2 – CONTENTS OF THE ENVIRONMENTAL IMPACT STATEMENT

2.1 INTRODUCTION AND BACKGROUND

Taseko Mines Limited (“Taseko”) of British Columbia proposes to develop the New Prosperity Gold-Copper Project, "The Project". The Project mine site is approximately 125 km southwest of Williams Lake on the Fraser Plateau in south central British Columbia. The Project deposit is located within the Fish Creek watershed.

Development of the mine site would occur on a 35 km^2 parcel of Provincial Crown land currently held by Taseko in the form of a lease (#787863) and 37 mineral claims. The Project consists of an open pit mine development and a 70,000 tonne per day concentrator facility with an average annual production of 108 million pounds of copper and 247 thousand ounces of gold production over a 20 year mine life. The Project also includes support infrastructure, associated tailings and waste rock areas, a 125 km long power transmission line, an existing concentrate load-out facility near Macalister, British Columbia and existing access from Williams Lake with construction of 2.8 km of new mine road.

The Project components are within the traditional territory of the Tsilhqot’in and Northern Seqwepemc people. The Tsilhqot’in people in seven communities are of consideration for this project include: Xeni Gwet’in (Nemiah), Yunesit’in (Stone), Tsi Del Del (Alexis Creek), Esdilagh (Alexandria), Tl’etinqox-t’in (Anaham), Tl’esqox (Toosey), and Ulkatcho. The Northern Seqwepemc people in five communities are of consideration for this project and include: Xat’sull/Cmetem (Soda Creek), Stswecem’c/Xgat’tem (Canoe Creek), T'exelcemc (Williams Lake), Esketemc (Alkali), and Llenlleney’ten (High Bar).

The purpose of the mine development is to utilize this proven mineral reserve to create value and opportunity for the people of British Columbia and Canada, and for the shareholders of Taseko. The Project is a needed component to help sustain the economic and social health of rural British Columbia communities. Average gold production from New Prosperity will not impact world markets, averaging 250,000 oz per year or 0.35% of world mine production. However new gold mine production in recent years has only replaced that of closed mines and future production is expected to be flat or declining. With the increasing difficulty in finding new deposits, increased costs of mine production, and the long lead times required to develop new mines, the gold from New Prosperity will help fill the gap between production and demand created by exhaustion of reserves at other mines.

A previously submitted project by Taseko, known as the Prosperity Gold-Copper Mine project was subject to an environmental assessment review under British Columbia’s Environmental Assessment Act (BC EAA) and a federal review panel under the CEAA in 2009-2010. Following that review, in January 2010 the Government of British Columbia issued an environmental assessment certificate for the previous project proposal and in July 2010 the federal panel concluded that the Prosperity Gold-Copper Mine project as proposed would result in significant adverse environmental effects.

In November 2010, in its response to the panel’s report, the Government of Canada indicated that it accepted the conclusions of the panel as presented, and determined that the significant adverse environmental effects could not be justified under the circumstances. In its response, the Government of Canada also noted that its decision did not preclude the Proponent from submitting a project proposal that addressed the factors considered by the panel.

Following the Government Response, Taseko undertook revisions to the mine development plan (MDP) and mine site layout to address the factors identified by the panel and submitted a project description for the New Prosperity Gold – Copper Project ("The Project") to the Canadian Environmental Assessment Agency (the Agency) for consideration. On August 9, 2011, the Agency accepted the project description, and on November 7, 2011, the Honourable Peter Kent, Minister of the Environment, announced that the Project will undergo a federal environmental assessment by way of an independent federal review panel (the Panel. In his referral of the Project to a federal review panel, the Minister of the Environment instructed the CEA Agency to design a process that will thoroughly assess whether the proposal addresses the environmental effects identified in the environmental assessment of the original Prosperity Gold-Copper Mine Project. He also directed the Agency to ensure that information obtained during the previous environmental assessment is used to the extent possible to ensure a timely decision and that the review take no more than 12 months.

Federally, the Project is subject to review under the *Canadian Environmental Assessment Act (CEAA)* given the potential requirement for Fisheries and Oceans Canada (DFO), Transport Canada and Natural Resources Canada to issue permits, approvals, authorizations and/or licences pursuant to the *Fisheries Act*, the Navigable Waters Protection Act (NWPA) and the Explosives Act respectively. Following completion of the federal panel review, their report is submitted to the Minister of the Environment. Once the Government of Canada decides whether or not to approve the Project the federal regulatory authorities "RAs" can then proceed to exercise their federal regulatory authority.

Guidelines for the preparation of an environmental impact assessment "EIS" pursuant to the Canadian Environmental Assessment Act for the New Prosperity Gold-Copper Mine Project "The Guidelines" were issued to Taseko in March 2012. Taseko has prepared this EIS in accordance with the Guidelines. The focus of the EIS is on aspects of the Project that have changed or are new from the previous project proposal and on corresponding changes to the environmental effects previously predicted. The EIS uses relevant information, submissions, testimony, findings and conclusions generated as part of the previous 2009/10 review and from the original EIS (2009) in support of the assessment of the Project. The EIS describes changes to previously predicted environmental effects that occur as a result of the implementation of the new mine development plan "MDP" and mitigation measures, describes how the Project as now proposed addresses the significant adverse environmental effects that were identified in the previous project review and documents how commitments, mitigation measures and recommendations made as part of the 200902010 provincial and federal review are incorporated into the Project design.

The EIS Guidelines Table of Contents was utilized as the basis for organizing and presenting the EIS. All information relevant to the Project in satisfying the Guidelines is included in the EIS.

2.1.1 The Proponent

Taseko Mines Limited ("Taseko") is a Canadian mining company, focused on mining operation and development in British Columbia. Headquartered in Vancouver Canada, Taseko is the 75% owner and operator of the Gibraltar Mine, the second largest copper-molybdenum mine in Canada. In addition, to this New Prosperity Project which is the 7th largest undeveloped gold-copper deposit in the world, Taseko is currently developing the Aley niobium project. Taseko was incorporated in 1966 and acquired the New Prosperity Project in 1969. Taseko understands the need for a company to operate in a responsible and sustainable manner and has developed corporate governance policies, a code of ethics, an environmental policy, health and safety and aboriginal policies the details of which may be found on the corporate website (www.tasekomines.com).

Taseko is committed to Towards Sustainable Mining standards for best practices and is on a path to reduce the operational impact at the Gibraltar Mine. Taseko has undertaken and completed energy efficient upgrades and developed guidelines for idling equipment and a new motor policy. Taseko are participating in the BC Power Smart Monitoring and Reporting and Process Control Initiative Assessment Program.

The Project is being designed and will be constructed and operated by Taseko's management team supported by leading edge development and technical service consultants and contractors. Taseko is committed to high standards of business practice, community participation and environmental conduct in all aspects of the work it undertakes, and has a proven track record of environmental and social responsibility at the Gibraltar Mine and with the City of Williams Lake and surrounding communities.

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Attention: Katherine Gizikoff
Director, Environment and Government Affairs

The preparation of the EIS for the proposed New Prosperity Gold-Copper Project has involved significant effort on the part of many contractors, leading consulting firms, specialists and supporting companies. Taseko Mines Limited wishes to acknowledge the contribution of the following organizations and individuals involved in the preparation of this EIS:

- Knight Piésold Ltd. – Surface Water Hydrology, Meteorology, Engineering and EIS
- BGC Engineering Inc. – Hydrogeology
- SRK Consulting (Canada) Inc. – ARD/ML
- Stantec Consulting Ltd. – Biophysical, Air Quality, Human Health and Ecological Risk
- Triton Environmental Consultants Ltd. – Fish and Fish Habitat, Fish Compensation and Water Quality
- Lions Gate Consulting Inc. – Socio-Economic

2.1.2 Legal Framework and Role of Government

The Project is subject to review under the *Canadian Environmental Assessment Act* (CEAA) given the potential requirement for Fisheries and Oceans Canada (DFO), Transport Canada and Natural Resources Canada to issue permits, approval, authorizations and/or licences pursuant to the *Fisheries Act*, the *Navigable Waters Protection Act* (NWPA) and the *Explosives Act* respectively. On November 7, 2011, the Honourable Peter Kent, Minister of the Environment, announced that the Project would undergo a federal environmental assessment by way of a review panel. At the time of writing this EIS, the Terms of Reference for the review panel have not been finalized nor has a panel been appointed. A Panel Secretariat has been appointed and will assist the panel with the discharge of their duties and responsibilities. The Canadian Environmental Assessment Agency (the Agency), responsible for coordinating the federal environmental assessment review process, was directed by the Minister of Environment to ensure that information obtained during the previous environmental assessment is used to the extent possible and that the review take no more than 12 months. The Project is also subject to the Major Resource Project Initiative of the federal government which provides a single window into the federal regulatory process.

Planning Context

The Project is located in the Cariboo-Chilcotin District, an area that contains a mix of rural agricultural lands, small acreage holdings and crown forest lands. Working directly with the people of the Cariboo-Chilcotin, the Government of British Columbia announced the Cariboo-Chilcotin Land Use Plan (“CCLUP”) on October 4, 1994. The CCLUP fulfills the need for a regional plan to provide “certainty and sustainability for the range of land and resource uses and values” (Government of British Columbia, 1995). It presents the overall framework for land use, conservation and economic development in the region. The CCLUP was developed to incorporate the interests and meet the needs of the community and builds on work conducted between January 1992 and July 1994 by the Commission on Resources and Environment, which allowed people a direct say over land use plans for their region (Government of British Columbia, 1995).

The mine site is located within a CCLUP development zone that states in part that, “the mineral and placer industries will have full access for exploration and mine development, subject to regulations of applicable statutes. Full access means that all (100%) of the land outside of protected areas is available to exploration and development, guided by the *Mineral Tenure Act* and the *Mines Act.* This respects the industries’ requirement for as large a land base as possible to explore for ‘hidden’ resources and recognises that the more intensive activities and impacts tend to be focused on the relatively small areas found to have potential for economically viable mineral occurrences.”

In respect to working with First Nations, the Government of British Columbia is committed to working on a government-to-government basis without limiting aboriginal rights or treaty negotiations. The province has carried out a policy that offers First Nations opportunities to be involved in the planning process. As well, the CCLUP encourages First Nations to have direct involvement in the implementation of the plan. While some First Nations participated in the consultation process to develop the land use plan; others declined and indicated their preference to address their issues through treaty negotiations (Government of British Columbia, 1995). The CCLUP contains seven sustainable resource management plans (“SRMP”) which provide spatial reference and detailed objectives needed to carry out the CCLUP, and are important elements in CCLUP implementation. In particular, the Williams Lake Sustainable Resource Management

Plan (Government of British Columbia, 2005) and the Chilcotin Sustainable Resource Management Plan (Government of British Columbia, 2007) address First Nations in the Project area.

These two SRMPs are literature reviews that are not based on interviews with First Nations; however, they reviewed archaeological overview assessments and the following Traditional Land Use Studies: *A Cultural Heritage Overview of the Cariboo Forest Region* (1997) and *A Cultural Heritage Overview of the Western Half of the Williams Lake Forest District* (1996). These two land use studies were conducted on behalf of the Ministry of Forests who wanted a cultural heritage overview in order to help them assess the potential existence of aboriginal rights in proposed management areas where the First Nations of concern have been unable or unwilling to provide requested traditional knowledge information. They extensively cover historical patterns of band membership, subsistence and settlement patterns, and cultural practices of aboriginal groups in the area.

The following First Nations have Traditional Territory within the Williams Lake SRMP: T'exelcemc (Williams Lake), Xat'sull/Cmetem (Soda Creek), Tsq'escen (Canim Lake) Stswecem'c/Xgat'tem (Canoe Creek) Lhtako (Red Bluff), Tl'esqox (Toosey), North Thompson Band, Tl'etinqox-t'in (Anaham), ?Esdilagh (Alexandria), Esketemc (Alkali) and Nazko First Nation.

The following First Nations have Traditional Territory within the Chilcotin SRMP: Tsi Del Del (Alexis Creek), Tl'etinqox-t'in (Anaham), Yunesit'in (Stone), Xeni Gwet'in (Nemiah), T'exelcemc (Williams Lake), Xat'sull/Cmetem (Soda Creek), Llenlleney'ten (High Bar), Esketemc (Alkali), Homalco, Laich-Kwil-Tach, and Nazko First Nation.

For the environmental assessment of the previous project the provincial and federal governments, determined that there were seven communities of Tsilhqot'in (Chilcotin) people and five communities of Secwepemc (Shuswap) people requiring consultation and engagement on the Project. They are the Tsilhqot'in communities of Xeni Gwet'in (Nemiah), Yunesit'in (Stone), Tsi Del Del (Alexis Creek), ?Esdilagh (Alexandria), Tl'etinqox-t'in (Anaham) and Tl'esqox (Toosey), and the Secwepemc communities of Xat'sull/Cmetem (Soda Creek), Stswecem'c/Xgat'tem (Canoe Creek), T'exelcemc (Williams Lake), Esketemc (Alkali), and Llenlleney'ten (High Bar). The Tsilhqot'in members of Ulkatcho are also entitled to consultation, since they form part of the Tsilhqot'in Nation with Aboriginal rights that may be affected by the Project.

The proposed mine site is within the Traditional Territories of the Xeni Gwet'in (Nemiah), the Tl'esqox (Toosey), the Yunesit'in (Stone), and the Esketemc (Alkali). The mine site is also within the area which is described in the recent William case as the "Eastern Trapline Territory" and in which the late Mr. Justice Vickers determined that the Tsilhqot'in people have Aboriginal rights to hunt and trap birds and animals as described in that judgment.

Legislation and Regulations

Following the completion of a review of the environmental effects of the proposed New Prosperity Project the federal Panel will prepare a report and submit their recommendations to the Minister of the Environment and the responsible authorities. Once the Government of Canada decides whether or not to approve the Project, if the decision is to approve the Project, federal regulators can then proceed to exercise their statutory decision making authority. Federal authorities required for the New Prosperity Project (Table 2.1.2-1) include authorizations from Fisheries and Oceans under the Fisheries Act. The Metal Mining Effluent Regulation under the Fisheries Act and administered by Environment Canada will require a Schedule II authorization to permit discharge of deleterious substances to the tailings impoundment area (TIA) because the site for the tailings impoundment contains fish. Approvals for water crossings will also be required from Transport Canada under the Navigable Waters Protection Act. An explosive factory license and explosives magazine license will be required from Natural Resources Canada under the Explosives Act, as will an approval for storage of explosives from Natural Resources Canada under the National Transportation Act. Other federal requirements such as those in respect of radio communication and aviation matters will need licenses.

Table 2.1.2-1 Federal Authorities

Federal Agency	Approval/License	Act
Fisheries and Oceans Canada	Section 35(2) **Authorization** Fish Habitat Compensation Agreement	*Fisheries Act*
Environment Canada	Section 35 (1) Schedule II **Amendment**	*Fisheries Act* Metal Mining Effluent Regulation
Canadian Coast Guard	Navigable Water: Stream Crossings **Authorization**	*Navigable Waters Protection Act*
Natural Resources Canada	**Explosives Factory License** **Explosives Magazine License**	*Explosives Act*
Transport Canada	**Approval** Ammonium Nitrate Storage Facilities	*National Transportation Act*
Industry Canada	**Radio Licenses**	*Radio Communication Act*
Canadian Nuclear Safety Commission (Natural Resources Canada)	**Radioisotope License** (Nuclear Density Gauges/X-ray analyzer)	*Atomic Energy Control Act*

2.2 PROJECT DESCRIPTION

2.2.1 Need for and Purpose of the Project

Metal mines operating in British Columbia have fallen from a peak of about 120 to the current level of 6. Over the past 10 years only one new mine has restarted while many have shut down. Currently, many operating mines are nearing the end of their active mine lives, which will leave British Columbia with very few operating metal mines in the near future. The current provincial government has indicated to the mining industry and the international finance community that British Columbia has enormous potential for mining and that mining in British Columbia is an emerging rather than a declining industry.

Despite being rich in resources, central British Columbia is relatively impoverished in terms of economic development and employment opportunities. Forestry has historically been a mainstay industry in BC but the devastating effects of the mountain pine beetle have put the future of the interior forest industry in jeopardy. The construction and operation of a long-term environmentally responsible and sustainable mine will contribute significantly to the economic well-being of this region.

Copper is a primary metal, used in industrial development worldwide and demand for the metal is growing. It has unique chemical and physical properties, including high electrical conductivity and resistance to corrosion, as well as excellent malleability and ductility, characteristics that make it an ideal material for use in the electrical energy, telecommunications, building construction, transportation and industrial machinery businesses, wire and cable products.

These uses account for as much as 75% of copper consumption. Copper is also an important metal in non-electrical applications such as plumbing, roofing and, when alloyed with zinc, it forms brass which is used in many industrial and consumer applications. The building and construction industry accounts for about 40% of worldwide copper usage.

Global economic development is the principal factor that creates demand for copper. This demand is driven by the increasing intensity of usage in traditional copper consuming products as well by the development of new products in which copper is incorporated. The demand for copper is forecast to continue to grow by 3 to 5% annually over the next number of years. The greatest overall increases in copper demand are expected to come from rapidly developing nations where economic growth is at a high level. Currently, China and India are the most dominant of these high industrial growth nations. Other Asian nations and some of the eastern European nations that have entered the European Union in recent years are also expected to provide demand in the future. The large populations of the developing nations create significant demand for consumer products such as access to electrical power and general improvements in living standards. Plumbing supplies, telecommunications, electrical appliances, automobiles, and air conditioners are typical consumer products that use significant amounts of copper and as nations develop the demand for these commodities will increase. Annual copper consumption per capita in the developing nations is very low by comparison to developed countries but, given their large populations, a modest increase in per capita consumption will inevitably result in a large increase in overall copper demand.

Global mine production is the principal source of world copper supply, with recycling of copper scrap accounting for less than 15% of total supply. Mine production in the Americas, Australia, and Indonesia produces about 75% of this copper with South America, especially Chile, being the largest contributor at about 40% of global production.

Copper prices in the mid-1990s resulted in the development of a significant number of large copper mines which, in the late 1990s materially increased the copper supply at a time of weakening demand resulting from a global economic slowdown. The resulting low copper prices caused a reduction in new mine development projects and therefore the global supply did not keep up with the resurgence in recent demand being driven by China and India’s strong economic growth. In 2011, the copper supply/demand deficit was estimated to be approximately 400-500,000 tonnes. Supply and demand is expected to be somewhat balanced over the next 2-3 years until demand out paces additional supply when the market is once again under-supplied.

Historically, the price of copper has been both volatile and cyclical, a reflection of economic conditions and expectations with respect to future supply and demand. During the 1980s and 1990s, the copper price averaged approx. US$1.00 per pound within a range of US$0.60 to $1.60. Since the late 1990s, when significant new mine capacity was developed, copper was in the lower portion of its normal price cycle until relatively recently. The copper price has averaged approximately $3.70 per pound in 2012 and $3.30 per pound over the past 5 years. With the exception of 2009, the price has remained very stable. The increasing demand for copper currently being experienced, particularly from Asia, together with the slowdown in new mine development, has resulted in a strong increase in the copper price. The copper price is expected to remain strong over at least the next few years. London Metal Exchange inventories have decreased from 350,000 tonnes in December 2002 to approximately 270,000 tonnes today and no new significant production is scheduled to come on stream in the near term to assist in rebalancing the supply/demand deficit.

In addition to meeting the demands for copper worldwide, Taseko believes that the Project will bring training, employment opportunities, and increased investment in services to the local population and all of British Columbia. On a national level, this project is timely given current copper and gold prices. Development of the New Prosperity project will contribute to Canada’s role as a producer of copper and gold in the world economy, and will help sustain Canada as a copper and gold producer. This purpose is consistent with Canada’s overall strategy of encouraging private corporations to generate national export commodities and tax revenues from natural resource development.

The Project would employ approximately 750 personnel per year for two years during construction and 407 personnel during operations. This will help offset job losses from recent mine closures and will provide employment for people affected by the closing down of forestry facilities locally.

The “no project” alternative would mean the loss of employment, business, and training opportunities, as well as taxes and royalties to all levels of government from Taseko and mine employees. The “no project” alternative would also mean that no environmental effects from the Project would occur. However, if the Project was to proceed, environmental effects of the Project are manageable with the designs described in this EIS and would not result in significant adverse effects on the natural environment. The mine would be constructed, operated, and closed using sustainable principles, which translate into transferable skills for mine employees and restoration of the natural environment when the mine closes. The environmental assessment process provides further opportunity to optimize and improve the overall project plan to the benefit of all stakeholders.

2.2.2 Project Setting

The New Prosperity property is 125 km southwest of Williams Lake, BC, in the Williams Lake Regional District. The deposit is 1 km north of Fish Lake and 10 km northeast of Lower Taseko Lake (51°28"N, 123°37"W; NTS Sheet 92-O/5E). Topography is subdued with elevations ranging from 1450 to 1600 masl.

Figure 2.2.2-1 shows the regional location of the New Prosperity Project located in the Cariboo-Chilcotin District.

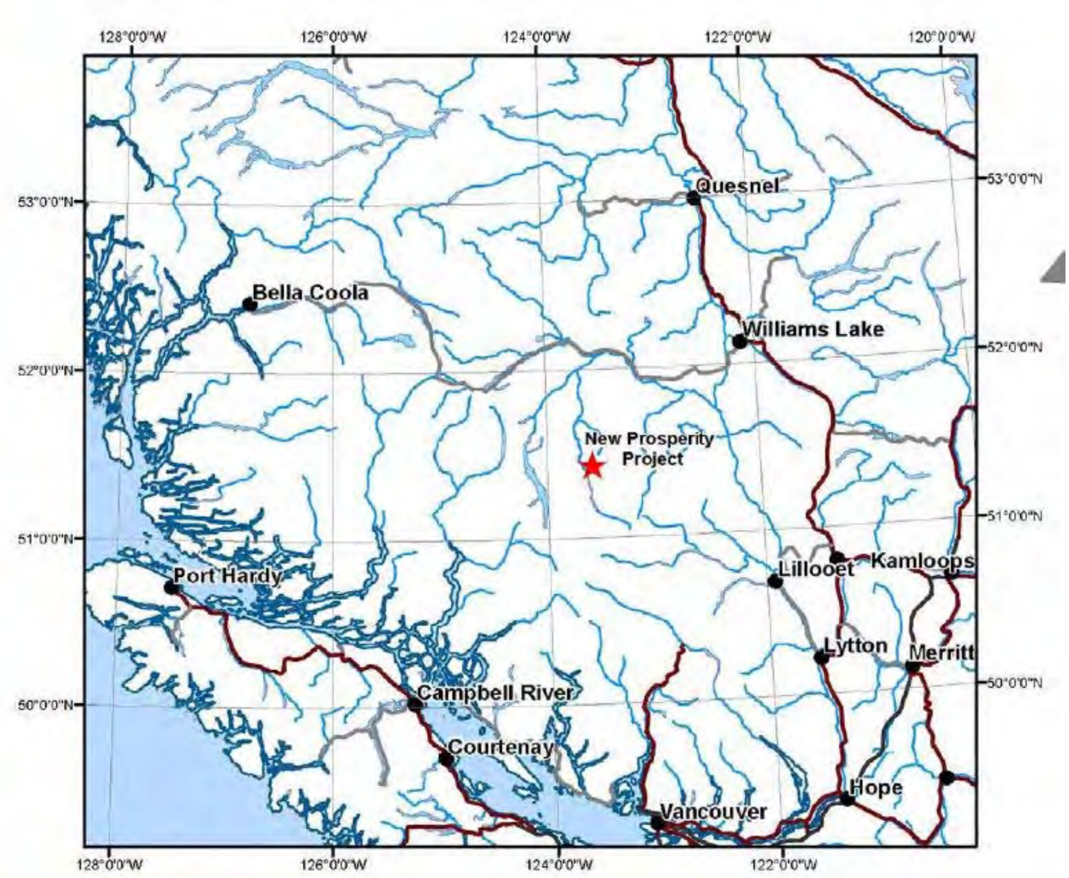


Figure 2.2.2-1 Project Location

Throughout this EIS additional maps including watershed, bathymetric and land use maps are provided to illustrate the geographic setting in which various aspect of the Project are located. Found within Section 2.6 (Existing Environment) and Section 2.7 (Impact Assessment) are maps and figures depicting among other things environmentally sensitive areas, regional and/or local planning or policy frameworks, and registered hunting, trapping and guiding areas. In Section 2.6.3 (Physical and Cultural Heritage Resources) figures showing the locations of protected archaeological sites have not been included at the request of the Archaeology Branch of the provincial government and First Nations in order to protect these historic sites.

2.2.3 Project Description

Introduction

The Project as proposed would involve a large open pit mine development with a 20 year operating life. Typical large-scale open pit mining equipment and conventional copper porphyry flotation processing would be used. In addition to the mine and associated tailings storage facility (TSF) and ore and waste rock storage areas, the Project includes development of an onsite mill and support infrastructure, a 125 km long power transmission line, a 2.8 km mine access road to connect to existing logging roads and highways and transport of concentrate to the existing Gibraltar Mine Concentrate Load-out Facility near Macalister, 54 km north of Williams Lake.

The following definitions will be used to describe the Project, which are consistent with the previous EIS application, as well as the Project Description of August 2011. The purpose of providing these definitions is to ensure clarity and consistency throughout the EIS. Furthermore, where possible, these terms will not be used in a manner other than described below.

Element

An Element is defined as one of the four (4) major parts of the Project:

- Mine
- Transmission Line
- Access Road and Transportation Corridor, and
- Concentrate Rail Load-Out Facility.

Components

Components are defined as the physical pieces that make up the Project. Each Element will be made up of various Components. For example, the Mine will be made of many components, such as the open pit, waste rock stockpiles, primary crusher, etc…

Features

A Feature is defined as a particular aspect of a given Component. For example, the Mine is made up of various Components, such as the Tailings Storage Facility (TSF). The TSF, in turn, is made up of various Features, such as the embankments and the seepage collection ponds.

Activities

Activities are defined as the actions that are performed to construct, operate or close the Project. For example, drilling and blasting are Activities that are performed in the open pit during pre-production and operations.

Mine Development Plan – Component Changes from Previous Project Proposal

The New Prosperity Project consists of four major elements, which are: (1) Mine; (2) Transmission Line; (3) Access Road and Transportation Corridor; and (4) Concentrate Rail Load-Out Facility. Elements #2, #3 & #4 remain unchanged from the previous project proposal as shown on Figure 2.2.3-1. Element #1 (the Mine) has many components, features and activities that remain identical from the previous project proposal. However, some have changed to address the conclusions and findings of the federal panel report on the Project previously assessed.

More specifically, the changes to the Project design for Element #1 (the Mine) address the previous panel findings regarding significant adverse effects on:

- Aboriginal rights or title
- Current use of lands and resources for traditional purposes by First Nations and on cultural heritage resources
- Fish and fish habitat in the Project area
- Users of the meadows within Teztan Yeqoz (Fish Creek) watershed
- Xeni Gwet'in / Sonny Lulua trapline
- Taseko Lake Outfitters tourism business
- Navigation, and
- Cumulative effects on the Southern Chilcotin grizzly bear population and on fish and fish habitat.

Through the relocation of the Tailings Storage Facility (TSF), the ore stockpile and the non-PAG waste rock and overburden stockpile, the mine site layout of New Prosperity preserves Fish Lake and the lower portions of Upper Fish Creek, including the island in Fish Lake and surrounding archaeology sites. It reduces hectares of disturbance and habitat fragmentation, and proposes two new mitigation measures to assist with the province's efforts in documenting and protecting the region's grizzly bear population.

In comparison to the previous project proposal, the development design for New Prosperity results in a direct increase in capital and operating costs of $300million in direct costs over the 20-year mine life to locate these three components away from Fish Lake. This is a design that was not deemed economically viable under long term commodity forecasts used during the review of the previous project proposal. Under current long term prices for both copper and gold the design is economically viable.

Components and Activities of the New Mine Development Plan

<u>Element #1 – Mine:</u>

The Project involves a conventional shovel/truck open pit mine with crushed ore conveyed 2 km to a concentrator at a plant site that includes standard industry infrastructure. The components considered as part of the Mine include the open pit, open pit dewatering, ore and waste rock/overburden stockpiles, primary crusher and overland conveyor, explosives manufacture and storage, coarse ore transfer, storage and reclaim, the plant site, the TSF, other infrastructure, water supply and distribution, communications and plant power distribution. Figure 2.2.3-2 illustrates the revised mine layout. Photographs of the project area and proposed location of mine components are provided in Appendix 2.2.3-A.

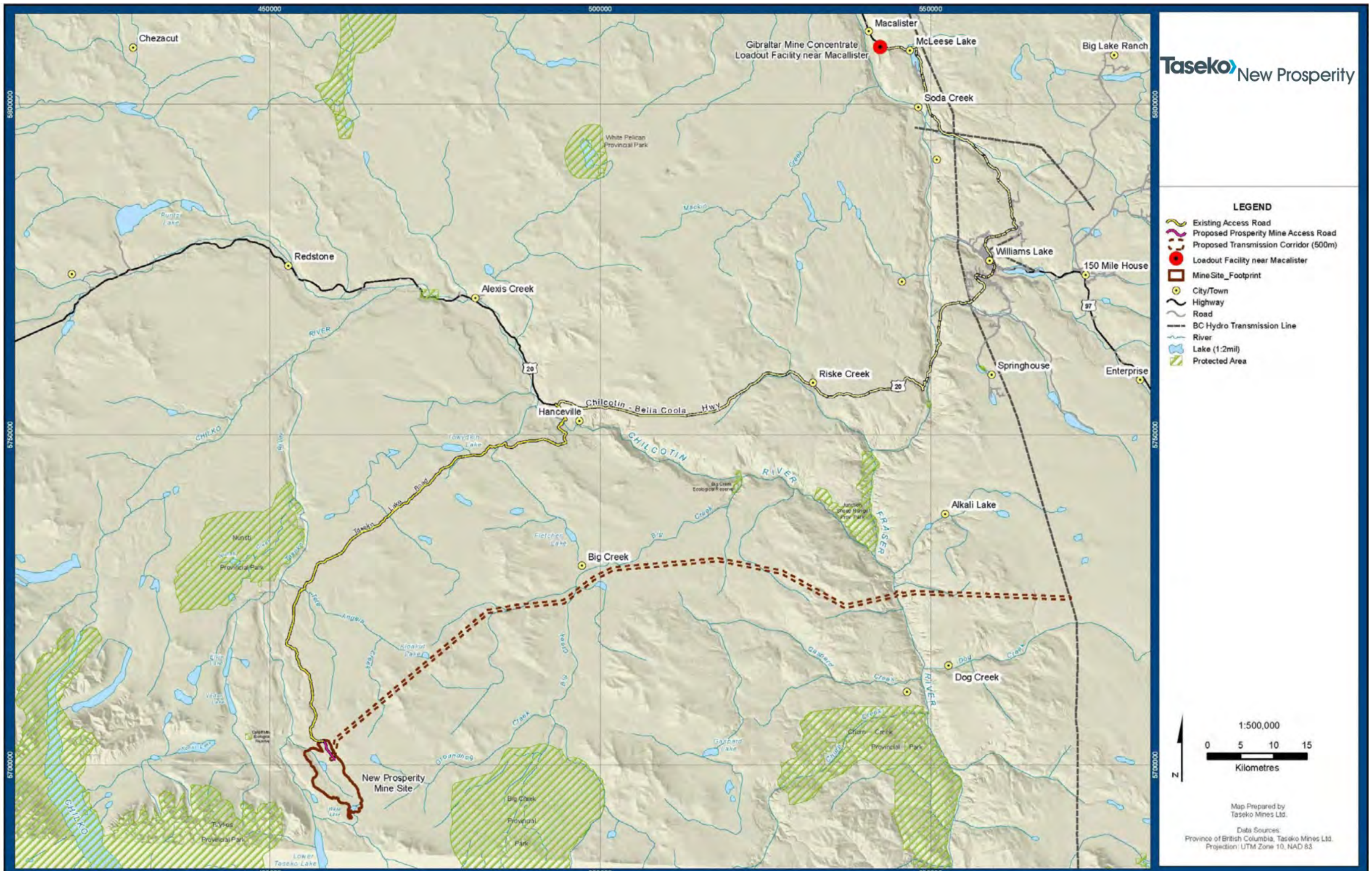
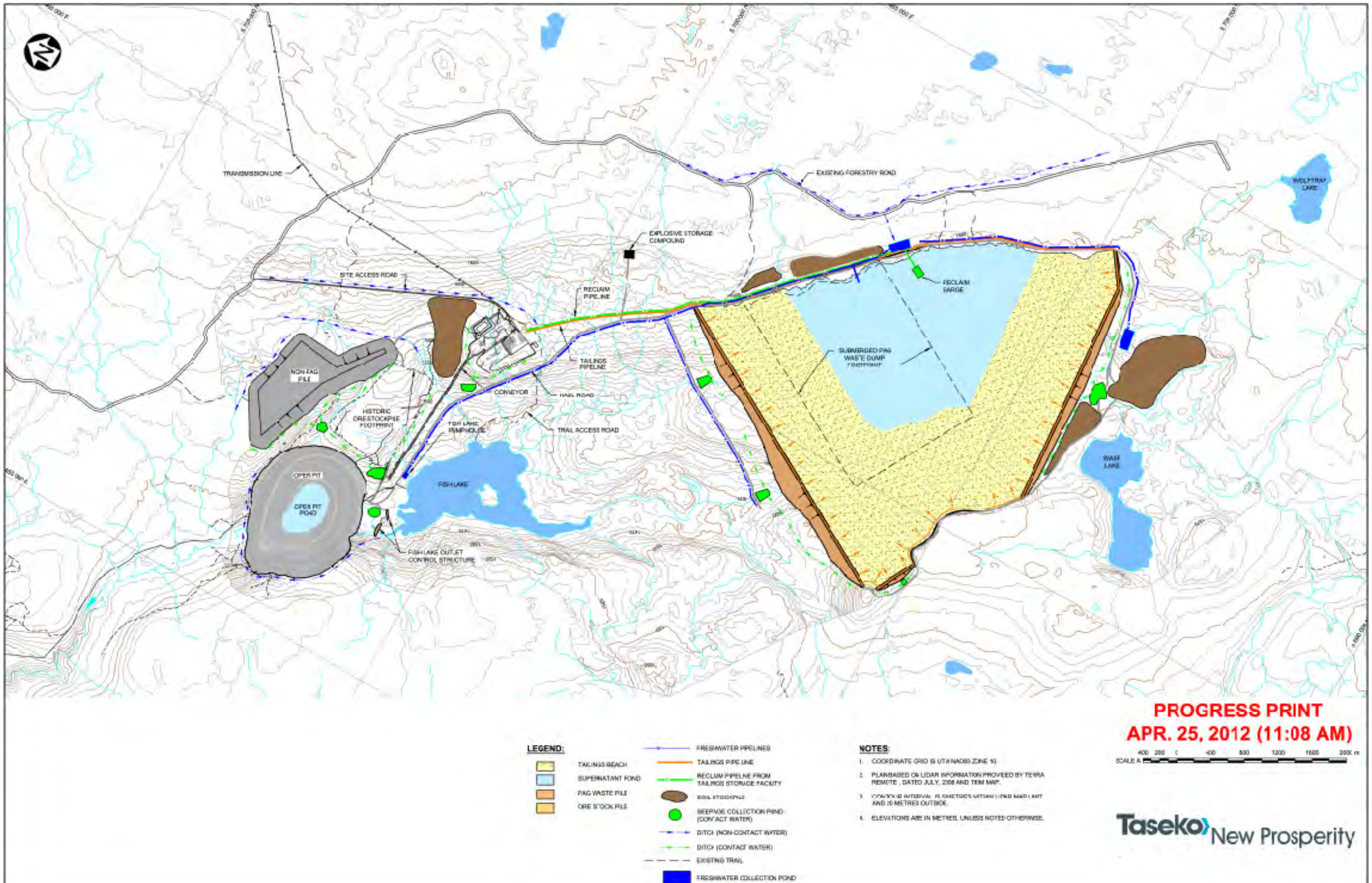


Figure 2.2.3-1 Regional Location of New Prosperity Mine Site, Access Road and Transmission Line



2.2.3-2 Mine Site General Location – End of Year 20 (Ultimate)

Open Pit

The open pit is located just north of Fish Lake. The nominal elevation of the pit rim is 1470 m. The ultimate open pit would be conical in shape, 1200–1600 m in diameter at the pit rim, and 525 m deep to an elevation of 945 m.

The open pit will provide 70,000 tpd mill throughput with an average mining rate of approximately 120,000 t of material per day over the active pit life of 17 years, stockpiling lower grade ore for processing in the latter three years of the Project. The open pit will yield 487 Mt of ore, 72 Mt of overburden stripping, and 328 Mt of waste rock. Non-potentially acid generating (non-PAG) open pit overburden and waste rock materials will be used to construct the tailings storage facility (TSF) which will impound tailings and potentially acid generating (PAG) waste materials. Non-PAG materials will also be used for road construction. Mill throughput, pit yields, volumes of non-PAG and PAG materials for the New Prosperity Project are exactly the same as those described in the previously assessed project.

Open Pit Dewatering

Pit water will go directly to the mill. When mill operations are temporarily disrupted the pit water will bypass the mill to the tailings line for discharge into the TSF. A combination of depressurization techniques including vertical wells, in-pit horizontal drains and collection systems will be implemented as a staged approach during pit development.

The QD and East fault zones require deep groundwater depressurization in order to minimize the potential for slope failure on the north and south walls. Shallow perimeter wells will be located outside the ultimate pit limit. The location of these wells will be determined based upon hydrologic monitoring information. Horizontal drain holes will be used within the pit based on hydrologic monitoring information collected during operations.

Water inflows to the open pit will include both groundwater and direct precipitation. The contribution of direct precipitation to in-pit pumping requirements will vary annually and seasonally. The open pit dewatering system has been designed to meet the combined requirements of the expected groundwater pit inflow rates and runoff from precipitation.

While the pit dewatering design must consider the change in the overall MDP, there is no change in the design of the dewatering system from the previously assessed project.

Ore and Waste Rock/Overburden Stockpiles

The total tonnage of waste material to be mined from the open pit is approximately 400Mt. The total waste material types are 12 Mt of PAG overburden, 60 Mt of non-PAG overburden, 225 Mt of PAG waste rock and 102 Mt of non-PAG waste rock. Non-PAG waste materials will be used to construct the TSF embankments and for road construction. The non-PAG waste, including overburden, not used in the TSF embankment or road construction will be deposited to the northeast of the open pit, and the ore stockpile will be located to the east of the pit.

The haul road from the open pit to the TSF is approximately 2 km longer that the previous project proposal, which will require a greater volume of non-PAG waste rock/overburden to construct. The specific non-PAG waste rock/overburden that will be used is identified in Section 2.7.2.1. The total volume of material used in construction of the embankments is similar to but somewhat less than the total volume required for the previous project proposal. As a result, there are differences in the relative volumes of each material for the construction of each embankment, as well as the timing of annual volumes required. Section 2.2.4 will identify the material volumes for construction of each of the three embankments.

PAG overburden and waste rock will be stored sub-aqueously in the TSF. The rate of placement of these PAG materials within the TSF remains unchanged from the previous project proposal. Furthermore, the criteria for where the PAG materials will be placed within the TSF remains unchanged as well.

Primary Crusher and Overland Conveyor

Ore will be hauled from the open pit mining operation to the primary crushing facilities close to the southeast rim of the open pit. The overland conveyor carries crushed ore directly from the primary crusher to the coarse ore stockpile at the plant site. It will generally follow existing topography on a prepared gravel bed on an upslope route to the coarse ore stockpile 1.9 km due east. A single lane service road will be provided along one side of the conveyor. The overhead conveyor, coarse ore stockpile and service road have not changed in any way from those components in the previously assessed project.

Explosives Manufacture and Storage

The mining process requires the use of explosives to break apart the rock in the open pit for recovery of the ore for processing and separation from the surrounding waste rock. Due to the large volumes of explosive required and the remote location of the mine site, explosives will be manufactured at the mine site. Taseko is responsible for the safe management of explosives on the site. This will include any tasks contracted out to a third party.

During the construction phase, Bulk Explosive products may be transported from existing explosive facilities at the Gibraltar Mine. The activity will continue until the permanent facility is constructed and commissioned at New Prosperity. The Explosives Storage compound at New Prosperity will include a number of buildings including a fully contained manufacturing plant, storage tanks and silos and plant services.

The location for the Explosives facility for the New Prosperity Project can be seen on Figure 2.3. The final configuration and detailed design of the structures on the compound site will be completed as part of the permitting process. The Explosives facility for the New Prosperity Project has been relocated relative to that described in the previously assessed project as a result of the revised stockpile locations but the features, activities and volumes of explosive material for the New Prosperity Project are the same as those described in the previously assessed project.

Coarse Ore Transfer, Storage and Reclaim

Ore will be dumped into the primary crusher located adjacent to the open pit. The crushed ore will then be conveyed to a coarse stockpile where it will subsequently be fed to the grinding circuit which consists of SAG and ball mills. The coarse ore conveyor is 1900 m long. The max slope of the conveyor will be 14° and there is single discharge onto the coarse ore stockpile. In order to reduce dust emissions, there will be a water suppression system at the discharge point of the coarse ore stockpile.

Reclaim from the coarse ore stockpile will be provided by inline apron feeders onto SAG mill feed conveyors. Dust collectors with pickups around the crusher, conveyors and ore transfer points will be installed to minimize fugitive dust in this area. All components, features and activities associated with coarse ore transfer, storage and reclaim are the same as those described in the previously assessed project.

Plant Site / Mineral Processing

The plant site will be located approximately 2 km east of the primary crusher at a nominal elevation of 1560 m on a relatively flat natural plateau on the east slope of the valley. Primary structures at the plant site will include coarse ore stockpile and reclaim facilities, concentrator building, main 230 kV substation, and assay laboratory.

Conventional crushing, grinding and flotation will be used to process ore. The concentrator utilizes industry standard unit processes and equipment with a nominal throughput of 70,000 dry tpd housed within an approximately 14,000 m^2 pre-engineered structure. The concentrator building is divided into three main sections: the grinding section, which houses the SAG and ball mills: the beneficiation section which houses the flotation cells and vertimills, the reagent storage and tailings handling; and, the concentrate handling section which houses the thickening, filtration and concentrate load out systems.

SAG mill product will be further ground in ball mills. Ball mill product will be directed to banks of rougher flotation cells giving a mass pull of about 8%. The rougher concentrate will be pumped to the regrind circuit while the tailings will report to the tailings pond. The rougher concentrate will be reground in regrind mills. The reground product will then feed the cleaner flotation circuit with final concentrate reporting to the dewatering circuit and cleaner circuit tailings reporting to the tailings pond.

The concentrator load-out area will be a slab on grade. A front end loader will load concentrate trucks positioned on a truck weight scale. The concentrate thickener and stock tanks will be located at grade inside the load-out section. Copper concentrate will be the final product. The plant will operate 24 hours per day, 365 days per year with scheduled downtime for equipment maintenance. As common with every flotation process, standard chemical reagents will be used to aid in achieving the optimal conditions for the recovery of the desired minerals. The specific chemical reagents have not yet been finalized. All components, features and activities associated with the Plant Site and Mineral Processing are the same as those described in the previously assessed project.

Tailings Storage Facility

The TSF will be located in the upper Fish Creek valley, starting approximately 2 km south of the mill site. The three embankments will be developed in stages throughout the life of the Project using low permeability glacial till, overburden and non-PAG waste rock materials from stripping operations at the open pit. The Main Embankment will be expanded in stages across the Fish Creek Valley. The South Embankment will begin construction after the Main Embankment beginning in Year 1 of operations, so as to confine tailings at the south end of the Fish Creek catchment. The West Embankment will be constructed later in the mine life (approximately Year 7 of operations) along the western ridge which separates the Fish Creek drainage basin from the Onion Lakes drainage basin.

All three embankments will be constructed as water-retaining structures for the entire life of the mine using the centreline method of construction. For the Main Embankment, this is a fundamental change in the design that was proposed previously. Namely, on-going raises for the Main Embankment will include a low-permeable glacial till core with centreline construction methodology, as opposed to downstream construction using a spiggoted sand zoned embankment. The Main Embankment will therefore have the same zoned features as the West and South Embankments throughout the life-of-mine. The primary purpose of this design feature is to minimize seepage as much as possible from the TSF through the Main Embankment.

The TSF has been designed to permanently store approximately 480 Mt of tailings and approximately 240 Mt of PAG waste rock and overburden materials and has the potential for increased storage capacity to accommodate substantial additional tonnes. This storage capacity remains identical as that for the previous project proposal.

Specific overall features of the TSF include:

- Three earth-rockfill, zoned embankments: Main, South and West
- Eastern TSF diversion ditch along the existing 4500 Forest Service Road (FSR)
- Seepage collection ditches downstream of each of the three embankments and four seepage collection ponds at the toes of each embankment (two at the Main, and one each at each of the West and South)
- Tailings distribution system, which will pump tailings from the plant site to the TSF and deposit along each of the three embankments
- Reclaim water system
- PAG waste rock stockpile
- Tailings beaches, and
- Supernatant water pond.

As a result of the embankment elevations relative to the concentrator, tailings will be pumped from the onset of operations.

Other Infrastructure

Administration and change house facilities will be located south of the Concentrator Building. The facilities will be contained in pre-fabricated units. Workers will reside in an on-site camp. The construction camp will be located adjacent to the south side of the mill site. The construction camp will be constructed in stages in order to accommodate the build-up of personnel from the early stage of construction activity to the estimated peak of 1000 during construction. The camp accommodation units and services will be expanded as additional beds are needed. The construction camp to house construction personnel will gradually be turned over to the mine operations as construction activities wind down.

The truck shop and maintenance facilities will be housed in a pre-engineered building located next to the Administration Building and south of the Concentrator Building. The assay and environmental laboratory will be located in a separate building near the service complex. The laboratory will be a pre-engineered single level building and will contain all the assaying and environmental sampling and testing facilities plus associated offices for the laboratory personnel. The warehouse will be located immediately south of the Concentrator Building in a stretch fabric structure. All components, features and activities associated with other infrastructure are the same as those described in the previously assessed project.

Water Supply and Distribution

The Process Water Pond, located adjacent to the concentrator, will have a total storage capacity of approximately 110,000 m^3 and will be supplied by three sources; pit dewatering, surface runoff from the ore and non-PAG waste rock/overburden stockpiles and the tailings supernatant pond reclaim.

Fresh water will be supplied by deep pit dewatering wells and surface run-off collection. Potable water will be supplied by wells.

Fish Lake will have a collection and distribution system to manage outflows from the lake, as well as capture non-contact water from the Fish Creek valley, directing flows to the inlet channels of the lake (see Figure 2.2.3-2). The lake outflows will be managed by a pumping system located at the northern end of the lake, with water conveyed in a pipeline and released to the inlet channels of the lake, immediately downstream of the TSF Main Embankment. Excess flows not needed for the inlet channels will be directed to the TSF. Two non-contact water ponds, located east and south of the TSF, will capture water in the undisturbed catchments surrounding the TSF. Pumping systems located in each pond will direct water to the inlet channels of the lake, immediately downstream of the TSF Main Embankment. Section 2.7.2.4 and Appendix 2.7.2.4-B provide detail about the Fish Lake water management for all phases of the Project, from construction through to post-closure.

Communications

Telephone and facsimile communications from the Project site will be via microwave. Radio and internal telephone communications system will be provided from the administration office area to all remote locations on the network. All components, features and activities associated with communications are the same as those described in the previously assessed project.

Plant Power Distribution

The plant substation is designed with a single 3-phase 100/133 MVA transformer (230/25 kV) and associated high voltage switch gear circuit breakers and isolation capable of meeting the peak plant power demand requirements. The secondary of the main step down transformer feeds a 25 kV switch gear line up which feeds the various plant areas. Each of the 25 kV breakers feed 7.5/10 MVA transformers which set the voltage down to 4160 V to feed plant motive loads at this voltage level and further step down transformer/switchgear unit substations at the 600 V level. Emergency power will be provided by standby diesel generators. . All components, features and activities associated with the plant power distribution are the same as those described in the previously assessed project.

Element #2 – Transmission Line

Electrical power to the mine site will be supplied from the existing BCTC 230 kV transmission line near Dog Creek through a new switching station to be designed and constructed by BCTC.

A 3-km wide, economically and technically feasible route for the transmission line was established following an assessment of a number of possible alternatives. Within this 3 km wide route, a 500 m wide corridor has been determined within which the centreline of the eventual 30 to 80 m wide right-of-way will be selected.

The route, 125 km in length, follows in a general westerly direction from the switching station at Dog Creek and follows access roads over easy terrain for the majority of its length before terminating at the proposed Prosperity development site. The transmission line will consist of wood or fiberglass pole H-Frame pole structures similar to standard BCTC/BC Hydro designs with average spans of 225 m.

Taseko will build a 230 kV substation at the mine site. The overall plant load demand is estimated to be an average operating load of 104 MW and peak load of 126 MW. All components, features and activities associated with the Transmission Line and the sub stations are the same as those described in the previously assessed project.

Element #3 – Access Road and Transportation Corridor

Existing road access for purposes of a permanent year-round transportation corridor is already established to within approximately 3 km of the plant site. Existing access from Williams Lake to the mine site for purposes of construction and operation consists of approximately 90 km of provincial highway and 90 km of gravel forest service roads. An additional 3 km of new gravel road construction will be required.

Concentrate transportation to the Gibraltar Mine Concentrate Load-out Facility near Macalister will occur through Williams Lake and continue on 54 km of provincial highway. All components, features and activities associated with the access road and transportation corridor are the same as those described in the previously assessed project.

Element #4 – Concentrate Rail Load-Out Facility

Concentrate will be trucked to the CN Rail mainline at the existing Gibraltar Mine Concentrate Load-out Facility near Macalister. Any capital improvements to the concentrate loading facility will occur within the existing yard, requiring no change to the overall footprint of the facility. Gibraltar Mines Ltd. is the current owner and operator of this facility. Gibraltar Mines Ltd. may decide to modify the current operating facility to accommodate additional concentrate from its current operations and other operations, and it will be their responsibility to undertake all necessary steps to secure regulatory authority to proceed with such modifications.

Phases and Scheduling of New Mine Development Plan

The four phases of the Project include construction, operation, closure, and post-closure. The following Section provides schedules and activities for each of the phases specific to the mine site.

The construction phase starts with the issuance of appropriate permits to start development and ends at that point at which the concentrator reaches commercial production. This spans a period of roughly two years. Figure 2.2.3-3 presents the activities and estimated durations of the Construction Phase schedule.

Figure 2.2.3-3 Construction Phase Schedule

The operations phase begins at this point and continues for approximately 20 years until no tailings are generated by the concentrator. Concurrent reclamation activities also begin during this operational period.

The closure phase begins at the cessation of tailings production and continues until the open pit begins to discharge water to Lower Fish Creek approximately 25 years later. Decommissioning of site infrastructure and reclamation are completed early in this period. Figure 2.2.3-4 presents the activities and estimated durations of the Operations Phase and Early Closure Phase schedule.

Figure 2.2.3-4 Operation and Decommissioning Phase Schedule

The post-closure phase begins when the open pit has filled with water and begins to discharge to Fish Creek. Activities in this period are all related to environmental monitoring and follow-up. This period will continue until all conditions of the Mines Act, Reclamation Code, and permits have been fulfilled and Taseko has been released from all obligations under the Mines Act. All phases, schedule and activities are the same as those described in the previously assessed project.

New or Changed Components, Features and Activities

Only Element #1 (the Mine) has new or changed components, features and activities compared to the previous project proposal. As stated earlier, there are no new or changed components, features or activities associated with Element #2 (Transmission Line), Element #3 (Access Road and Transportation Corridor) and Element #4 (Concentrate Rail Load-Out Facility.

A summary as to the new or changed components, features and activities by project phase is provided in Table 2.2.3-1.

Table 2.2.3-1 Project Components, Features and Activities Changed from Previous Project Proposal

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Construction and Commissioning		
Open Pit – Pre-production	N	
Non-PAG waste stockpile	Y	Location and timing only
PAG Stockpile	Y	Still subaqueous in TSF, just TSF location change
Non-PAG Overburden Stockpile	Y	Combined with Non-PAG (i.e. location and timing)
Ore Stockpile	Y	Location only
Primary Crusher	N	This is considered in 'Plant Site and other facilities'
Overland conveyor	N	This is considered in 'Plant Site and other facilities'
Fisheries compensation works construction	Y	Scope and Timing
Water Management Controls and Operation	Y	
Construction sediment control	Y	
Access road construction and upgrades	N	
Camp construction	N	This is considered in 'Plant Site and other facilities'
Site clearing (clearing and grubbing)	Y	Different areas related to moving of TSF, stockpiles, etc…
Soils handling and stockpiling	Y	Includes overburden removal
Plant Site and other facilities	N	
Explosives Plant	Y	Location only
Lake dewatering	Y	Fish Lake retained
Fish Lake Water Management	Y	Management of inflows and outflows
Starter dam construction	Y	Location and volume of material
Sourcing water supplies (potable, process and fresh)	Y	Fresh water sources and routing only as a result of reconfigured stockpiles

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Site waste management	N	
Clearing of transmission line ROW	N	
Construction/Installation of transmission line	N	
Vehicular traffic	Y	Additional haulage trucks and 2km of added haulage road as a result of TSF relocation.
Concentrate load-out facility near Macalister (upgrades to site)	N	
Operations		
Pit production	N	
Site clearing (clearing and grubbing)	Y	Area and relocation of TSF and stockpiles
Soils handling and stockpiling	Y	Area, volume, and relocation of TSF and stockpiles; revised soil stockpile locations
Crushing and conveyance	N	
Ore processing and dewatering	N	
Explosive handling & storage	Y	Location only
Tailing storage	Y	Location and embankments changed
Non-PAG waste stockpile	Y	Location and timing only
PAG Stockpile	Y	Still subaqueous in TSF, just TSF location change
Overburden Stockpile	Y	Combined with Non-PAG (i.e. location and timing)
Ore Stockpile management and processing	Y	Location only
Potable and non-potable water use	N	
Site drainage and seepage management	Y	
Water Management Controls and Operation	Y	Includes management of flows in and out of Fish Lake
Wastewater treatment and discharge (sewage, site water)	N	
Water release contingencies for extended shutdowns (treatment)	N	

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Solid waste management	N	
Maintenance and repairs	N	
Concentrate transport and handling	N	
Vehicle traffic	Y	Additional haulage trucks and 2km of added haulage road as a result of TSF relocation.
Transmission line (includes maintenance)	N	
Pit dewatering	N	
Fisheries Compensation works operations	Y	Scope and Timing
Concentrate load-out facility near Macalister	N	
Closure		
Water Management Controls and Operation	Y	
Fisheries Compensation operations	Y	Scope and Timing
Site drainage and seepage management	Y	
Reclamation of ore stockpile area	Y	Location only
Reclamation of Non-PAG waste rock stockpile	Y	Location only
Tailing impoundment reclamation	Y	
Pit lake, and TSF Lake filling	Y	
Plant and associated facility removal and reclamation	N	
Road decommissioning	N	
Transmission line decommissioning	N	
Post-closure		
Discharge of tailings storage facility water	Y	
Discharge of pit lake water	N	Into Lower Fish Creek
Seepage management and discharge	Y	

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Ongoing monitoring of reclamation	Y	

Following from Table 2.2.3-1, the new or changed components, features and activities compared to the previous project proposal are described below, by phase:

Construction and Commissioning Phase (inclusive of Site Preparation)

The non-PAG waste stockpile will be located northeast of the open pit. The non-PAG overburden will be placed with the non-PAG waste rock as it is released from the pit. Since the non-PAG waste rock and non-PAG overburden will be used for embankment and road construction during the construction and commissioning phase of the mine, the annual and total volumes of material that will be placed in this stockpile will differ from the previous project proposal. The mine plan detailing volume and timing of each material type (ore, PAG & non-PAG waste rock and overburden) will be shown in Section 2.2.3.

The PAG waste rock/overburden stockpile will be located within the TSF. Since the Main Embankment of the TSF has been relocated approximately 2 km south from where it was located in the previous project proposal, so too has the location of the PAG waste rock/overburden stockpile. The annual and total volume of PAG waste rock/overburden remains unchanged, but the overall dimension of the stockpile within the TSF has changed, commensurate with the modified geometry of the TSF.

The ore stockpile will be located to the east of the open pit and north of Fish Lake. The annual and total volume of ore remains unchanged from the previous project proposal. While the dimension of the ore stockpile is similar to that of the previous project proposal, the sequence of its construction will differ somewhat as result of changes in topography.

The construction of the Fisheries Compensation Works will differ in scope and timing from the previous project proposal, as the Fish Compensation Plan is substantially different now. This difference is directly related to the reduction in loss of fish habitat due to the new Mine Development Plan. As the Fish Compensation Plan is developed and discussed with DFO and MOE, the details around the construction will be developed.

The water management controls and operation during the construction phase will differ from the previous project proposal, as they are directly related to the construction of the relocated components of this Mine Development Plan. Namely, the relocated non-PAG waste rock/overburden stockpile, ore stockpile and TSF all have water management features associated with them. The collection/diversion ditches and seepage collection ponds function in the same manner as those in the previous project proposal, but their location, number and size differ.

Construction sediment control has been modified from the previous project proposal through the location and number of sediment control ponds. The Fish Lake basin was previously designated as a sediment control pond for the majority of the site, as the water in Fish Lake was to be pumped into the TSF once the Main Embankment starter dam had been constructed. The new Mine Development Plan will utilize construction sediment control ponds downstream of all construction activities, along with collection ditches, so as to manage sediment as required. A detailed construction sediment and erosion control plan will be developed as a requirement of the permitting process. Furthermore, Appendix 2.7.2.4-A presents details for conceptual sediment and erosion control for all phases of the Project.

Site clearing and grubbing will differ from the previous project proposal in extent and location, but the timing will remain the same. There is less overall footprint for all components in the Mine, which results in less overall clearing and grubbing. The primary difference is a large reduction in clearing and grubbing between Fish Lake and the TSF, with a modest increase in the area where the non-PAG waste rock/overburden and ore stockpiles will be situated.

Soil handling and stockpiling is similar to the previous project proposal, but differs in location and volume of the soil removal, as well as the location and size of the stockpiles. Overburden removal will occur as part of this activity. As discussed earlier, the non-PAG overburden will be placed with the non-PAG waste rock stockpile, while the PAG overburden will be placed in the TSF along with the PAG waste rock.

The explosives plant location differs from the previous project proposal, while the construction and operation of the plant remains the same. It will be located mid-way between the plant site and the TSF Main Embankment, northeast of the haul road that connects these two components.

Lake dewatering is no longer required as Fish Lake is being preserved.

Fish Lake water management is essentially a new activity compared to the previous project proposal. Under the new Mine Development Plan, the inflows and outflows to and from the lake will be managed in such a manner so as to maintain the ecological viability of the lake. Outflows will be managed through a pumping system, which will recirculate flows to the inlet streams at a point near to the TSF Main Embankment. Additionally, non-contact water from the Fish Creek catchment east and south of the TSF will be directed to the same inlet points. Flows have been defined based on the predicted needs to maintain velocity and volume of water throughout various times of the year. More details related to the management of water around Fish Lake can be found in Section 2.7.2.4 and Appendix 2.7.2.4-A.

Starter dam construction is similar compared to the previous project proposal in duration and timing, but the location and volume of material that must be placed will be different. The starter dam for the TSF is the Main Embankment, which is located approximately 2 km south from the location in the previous project proposal. Non-PAG waste rock and overburden will be used to construct the starter dam.

The sourcing of initial water for the site (potable, process and fresh water) will be similar to that described in the previous project proposal. Potable water will come from groundwater wells to supply water to the camp and mill. The volume of water required has not changed. Fresh water and process water needs are the same as well. Process water will be sourced from the TSF via the reclaim system. Fresh water, on the other hand, will be sourced from the open pit dewatering, as well as runoff from the non-PAG waste rock/overburden and ore stockpiles. Since the location of the stockpiles has changed, so too has the respective volume from these fresh water sources, compared to the previous project proposal.

The volume of vehicular traffic has changed somewhat compared to the previous project proposal. With the relocation of the non-PAG waste rock/overburden and ore stockpiles, as well as the TSF and PAG storage location, there will be a 30% increase in the number of haulage trucks required.

Operations Phase

Site clearing and grubbing will differ from the previous project proposal during the operations phase in extent and location, but the timing will remain the same. There is less overall footprint for all components in the Mine, which results in less overall clearing and grubbing. The primary difference is a large reduction in clearing and grubbing between Fish Lake and the TSF, with a modest increase in the area where the non-PAG waste rock/overburden and ore stockpiles will be situated. The footprints for the stockpiles will be cleared in stages as the stockpiles grow, rather than the entire footprint being cleared at once. The same will be true for the TSF, where clearing will occur as new features are required, such as the South and West Embankments in Years 1 and 7, respectively.

Soil handling and stockpiling is similar to the previous project proposal, but differs in location and volume of the soil removal, as well as the location and size of the stockpiles for the operations phase. Overburden removal will occur as part of this activity. As discussed earlier, the non-PAG overburden will be placed with the non-PAG waste rock stockpile, while the PAG overburden will be placed in the TSF along with the PAG waste rock. Much of the soil handling and stockpiling will occur in the construction and commissioning phase of the Project. However, as new footprints are expanded for the non-PAG waste rock/overburden and ore stockpiles, as well as the TSF, soil will be stripped from these areas as required, either for geotechnical purposes, or to provide the necessary soil volumes for reclamation.

Explosives handling and storage differs from the previous project proposal in location only. The explosives plant will be located mid-way between the plant site and the TSF Main Embankment, northeast of the haul road that connects these two components. The type of plant and method of storage remain the same.

Tailings storage method and volume remain the same compared to the previous project proposal, however the location of the tailings storage facility (TSF) component has changed, in addition to several features of the TSF. As discussed earlier, the TSF has been relocated approximately 2 km south of Fish Lake, but remains within the Fish Creek valley. Conventional slurry tailings, co-disposed with PAG waste rock/overburden, remains as the method to store tailings for the New Prosperity Project. New features of the TSF include a low-permeable core zone in all three embankments, whereas only the West and South Embankments included this previously. In addition, groundwater wells located downstream of the Main Embankment will be used to enhance seepage recovery from the TSF.

The non-PAG waste stockpile will be located northeast of the open pit. The non-PAG overburden will be placed with the non-PAG waste rock as it is released from the pit. Since the non-PAG waste rock and non-PAG overburden will be used for embankment and road construction during the construction and commissioning phase of the mine, the annual and total volumes of material that will be placed in this stockpile will differ from the previous project proposal.

The PAG waste rock/overburden stockpile will be located within the TSF. Since the Main Embankment of the TSF has been relocated approximately 2 km south from where it was located in the previous project proposal, so too has the location of the PAG waste rock/overburden stockpile. The annual and total volume of PAG waste rock/overburden remains unchanged, but the overall dimension of the stockpile within the TSF has changed, commensurate with the modified geometry of the TSF.

The ore stockpile will be located to the east of the open pit and north of Fish Lake. The annual and total volume of ore remains unchanged from the previous project proposal. While the dimension of the ore stockpile is similar to that of the previous project proposal, the sequence of its construction will differ somewhat due to changed topography.

Site drainage and seepage management has changed from the previous project proposal commensurate with the relocation of various components (non-PAG waste rock/overburden and ore stockpiles and the TSF). Contact water collection ditches are located downstream of each component in the Mine element, so as to capture as much contact water as possible and utilize this water in the milling process. Furthermore, seepage water (i.e. sub-surface water) management from the TSF differs in two manners. Firstly, the Main Embankment contains a low-permeable core zone, in order to minimize the volume of seepage that leaves the TSF northwards. Secondly, groundwater interception wells will be located downstream of the Main Embankment (~ 100 metres from the ultimate embankment toe) in order to enhance seepage recovery. Seepage and non-contact groundwater that is derived from these wells will report to the Main Embankment Seepage Collection Ponds and ultimately the TSF.

Water management controls and operations are somewhat different than those proposed in the project previously assessed, but there are many similarities. Components that generate contact water (open pit, TSF, waste rock/overburden stockpiles, etc…) are isolated from undisturbed areas that provide non-contact water. This philosophy remains the same, with the only difference being the location of these components and the destination of the non-contact water. The previous project proposal saw all non-contact water being directed to Prosperity Lake. Now it is being directed to Fish Lake. The timing and flows are different for the management of this water, which reflects the location of Fish Lake relative to the mine components, and the needs of the lake to function appropriately.

The volume of vehicular traffic has changed somewhat compared to the previous project proposal. With the relocation of the non-PAG waste rock/overburden and ore stockpiles, as well as the TSF and explosives site, there will be a 30% increase in the number of haulage trucks. Fisheries compensation works and operations will differ from the previous project proposal in that the location and scope of the works is substantially reduced, due to the reduction in loss of fish habitat as a result of the new Mine Development Plan. Once the Fish Habitat Compensation Plan is finalized and agreed to with DFO, the activities related to the works and operations can be defined.

Closure Phase

Water management controls and operations differ in the closure phase from the previous project proposal in direction of flows, volumes and timing. The primary objective continues to be to supply non-contact water to Fish Lake at the required flows each month. The Open Pit is filling, with excess flows from Fish Lake and the TSF being directed to the pit. Surface discharge from the TSF reports to Fish Lake once water quality is suitable for release. The southern-most sub-catchment of the TSF will begin reporting to Wasp Lake and ultimately Beece Creek. Fish Lake recirculation continues as required, up until the TSF begins releasing flows to Fish Lake. Groundwater pumpback wells and the Main Embankment seepage collection ponds direct flows to the open pit rather than back to the TSF.

Fisheries compensation operations will differ from the previous project proposal in that the location and scope of the works is substantially reduced, due to the reduction in loss of fish habitat as a result of the new Mine Development Plan. Once the Fish Habitat Compensation Plan is finalized and agreed to with DFO, the activities related to the works and operations can be defined.

Site drainage and seepage management in closure has changed from the previous project proposal commensurate with the relocation of various components (non-PAG waste rock/overburden and ore stockpiles and the TSF). Upon closure, each disturbance will be reclaimed, providing the opportunity to allow water from these facilities to return to their natural watercourses. Seepage water from the TSF Main

Embankment, as well as the groundwater seepage recovery wells will be directed to the pit, preventing these water sources from flowing into Fish Lake. Drainage from the reclaimed non-PAG waste rock/overburden stockpile will permanently be directed to the Open Pit, while the footprint of the ore stockpile and the plant site will return to their natural water courses.

The reclamation of the ore stockpile is the same as for the previous project proposal, with the exception that the location of the stockpile is in a new location. The processing of the ore in the final years of the mine life will deplete the stockpile, leaving only a footprint, which will then be covered with growth medium and reclaimed. Previously, the footprint of the ore stockpile consisted of non-PAG waste rock, while for this Mine Development Plan it will be natural ground, which will simplify the reclamation process somewhat.

The reclamation of the non-PAG waste rock/overburden stockpile is similar to the previous project proposal, but differs in location, extent and consistency of the stockpile. The reclamation approach will be the same, since the materials are the same, but there is an opportunity for concurrent reclamation of the stockpile by utilizing some of the overburden that will be placed with the waste rock in the stockpile throughout the active mining process.

The reclamation of the TSF will follow the same logic as that from the previous project proposal. A lake will remain, covering a portion of the tailings and ensuring a permanent subaqueous environment for the co-disposed PAG waste rock. Annual inflows to the TSF will create a surplus volume of water that will exit through a spillway along the eastern abutment of the Main Embankment. The flows from the west and south seepage collection ponds will report to their respective downstream environments once water quality is suitable for release. The beaches will be reclaimed in the same fashion as before, with a wetland being developed between the TSF Lake and the reclaimed beaches. The embankment slopes will also be reclaimed with growth medium and revegetated.

The TSF Lake may be drawn down in closure with water reporting to the open pit, which will speed up the improvement of water quality of the TSF Lake once it refills with annual influxes of fresh water. Once the TSF Lake has reached the spillway invert elevation, and the water quality is deemed suitable for release to Fish Lake, it will begin to spill in this fashion. The Open Pit Lake will begin to fill as soon as active mining is complete, assumed to begin in Year 17. It will begin to fill with direct precipitation and excess flows from Fish Lake. Upon closure, excess flows from the TSF and seepage collection ponds and groundwater pumpback wells below the Main Embankment will begin reporting to the Open Pit Lake. Once the Pit Lake is full, estimated to be about Year 45, it will mark the end of the Closure Phase and the beginning of the Post-Closure Phase. Since the catchment size upstream of the Open Pit is the same as the previous project proposal, the Open Pit Lake takes approximately the same time to fill and spill to Lower Fish Creek as in the project previously assessed.

Post-Closure Phase

The discharge of TSF water from the TSF Lake will exit via a spillway and report to Fish Lake in the Post-Closure Phase. The flow direction is the same from the previous project proposal, with the volume and potentially quality being somewhat different.

The management and discharge of seepage waters from the TSF in the Post-Closure Phase will differ from the previous project proposal in that the Main Embankment seepage collection ponds will be directed to the open pit, bypassing Fish Lake, until such time as water quality permits direct discharge to Fish Lake. Groundwater pumpback wells will also enhance the capture of seepage from the TSF and will be directed to the seepage collection ponds and ultimately the open pit until such time as water quality permits direct discharge to Fish Lake. The West Embankment seepage collection pond will report to Big Onion Lake, as was the case in the previous project proposal. The South Embankment seepage collection pond will report to Wasp Lake and Beece Creek.

On-going monitoring of reclamation at the New Prosperity project site will be similar in many respects to the previous project proposal. Placement of growth medium and revegetation of all upland areas will be monitored in the same manner as previously. A biological monitoring program of the Fish Lake system will be in place to ensure the implemented mitigation is suitable and determine if ongoing monitoring is required to ensure that the objectives of the reclaimed site are being achieved.

Components, Features and Activities that have not changed – All Phases

The development of the new site access road will start as soon as permitting is in place. The pilot road will be roughed into the plant site and access developed within the mine site footprint to allow Phase 1 timber harvesting and access for initial equipment for bulk earthworks.

The extent of harvesting, grubbing and clearing in Phase 1 will be sufficient to allow pit pre-production, site infrastructure development, tailings dam construction, stockpile development, and tailings deposition for several years. The limit of work completed in Phase 1 will be a balance between maximizing deteriorating forestry values due to Mountain Pine Beetle infestation, operational needs, minimizing premature disturbance, and compliance with an approved closure plan.

Upgrading of the new site access road, 4500 Road, and development of site infrastructure roads will start as soon as road construction material is accessed within the mine site area. Priority site infrastructure roads will include access to the Main Embankment site and to the open pit. All roads will be built in accordance with the Forest Practices Code, Forest Road Engineering Guidelines.

Priority site infrastructure development will be the plant site area to establish drainage and foundation preparation for the camp, followed by laydowns, an equipment maintenance area, and other infrastructure, including the construction of the crusher and conveyor. Waste water treatment for the camp and administrative building will be constructed at this time as well.

Initial pit pre-production activities will be limited to the higher ground east of Fish Creek.

The timing of the transmission line timber harvest will be based on optimizing contractor efficiency, mitigating any sensitive biophysical constraints and ensuring harvesting does not delay line construction. This may not be a continuous activity but staged to accommodate seasonal or environmental constraints. The Dog Creek switching station construction and line reinforcement will be completed by BC Hydro.

Upgrades to the load-out facility at Macalister will occur as part of the Gibraltar Mine permit for the facility, as Gibraltar owns the load-out facility, and is responsible for the operation and maintenance thereof.

The phasing of the open pit simply involves the sequential enlarging of the surface expression of the open pit in a radial fashion until completion of mining activities in the pit. Processing of ore continues into Year 20 with the introduction of remaining stockpiled ore in Year 17. Pit dewatering will begin with depressurization wells around the perimeter of the pit, and eventually evolve into an in-pit dewatering system.

There is the potential to delay logging and clearing within the ultimate disturbance area of the TSF dependant on the extent of harvesting, grubbing and clearing completed in Phase 1. The distribution of work between Phases 1 and 2 will be a balance between maximizing deteriorating forestry values due to

MPB infestation, operational needs, minimizing premature disturbance, and compliance with an approved closure plan.

The mill and crusher sites will be completely dismantled upon closure of the mine. All buildings not required for long-term closure will be removed and foundation footings broken down to ground level in preparation for soil cover and revegetation treatments.

Tailings and reclaim delivery systems and all pipelines, structures and equipment not required beyond mine closure will be dismantled and removed. All access roads, ponds, ditches and borrow areas not required beyond mine closure will be removed and regraded.

The roads, plant site facilities, and decommissioned water management structures will be reclaimed through replacement of windrowed soil. The transmission line will be decommissioned, dismantled, and reclaimed.

In the event of premature mine closure, pumping of TSF supernatant water directly to the open pit may be required as a temporary measure until water quality is suitable for direct discharge to Fish Lake.

Integral to the design of the tailings dam is the ability to address premature closure issues. In the event of premature mine closure, the PAG waste and ore stockpile are to be handled in the following manner. The PAG waste would be excavated to a level below the natural flood elevation of the TSF. This material would remain there in perpetuity. The ore stockpile would be processed.

Taseko will be responsible for all environmental monitoring and reclamation programs until such time as all conditions of the Mines Act, Health, Safety and Reclamation Code (BC MEMPR 2008), and permits have been fulfilled and Taseko has been released from all obligations under the Mines Act.

If any post closure activities are required they may include a continuation of environmental monitoring conducted during the history of the Project. These might include:

- Periodic inspection of the TSF embankments
- Evaluation of water quality and flow rates
- Fish and aquatic life monitoring, and
- Soil and vegetation monitoring.

2.2.4 Mine Plan

The basis for the reserves and resources are reported in the NI-43101 compliant technical report, “Technical Report on the 344 Million Tonne Increase in Mineral Reserves at the Prosperity Gold-Copper Project” dated December 17, 2009 posted on SEDAR. They remain unchanged from those of the project previously reviewed. The resource estimate for the New Prosperity Project Deposit is summarized in Table 2.2.4-1.

Table 2.2.4-1 Mineral Resource Inventory

Category	Cutoff Copper Grade (%)	Tonnes > Cutoff (000’s)	Cu Grade > Cutoff (%)	Au Grade > Cutoff (g/tonne)
Measured	0.14	547,100	0.273	0.461
Indicated	0.14	463,400	0.207	0.340
Total	**0.14**	**1,010,500**	**0.243**	**0.406**
Inferred	0.14	208,300	0.210	0.246

The Mineral Reserve contained within the stated resource is summarized in Table 2.2.4-2.

Table 2.2.4-2 Mineral Reserve Inventory

CDN$5.50 NSR/t Pit-Rim Cut-off					
Category	**Tonnes (millions)**	**Gold (gpt)**	**Copper (%)**	**Recoverable Gold Ounces (millions)**	**Recoverable Copper Pounds (billions)**
Proven	481	0.46	0.26	5.0	2.4
Probable	350	0.35	0.18	2.7	1.2
Total	831	0.41	0.23	7.7	3.6

The tonnes mined in the mine plan remain unchanged from those of the project previously reviewed and are summarized in Table 2.2.4-3.

Table 2.2.4-3 Tonnes Mined (Mine Production Forecast)

Open Pit Production - Tonnage	Year	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	*Total*
Ore Pit to Mill	(t x 1000)			9,135	25,560	25,560	25,560	25,560	25,560	25,560	25,560	25,560	25,560	25,560	25,560	25,560	25,560	25,560	25,560	6,822				**399,357**
Ore to Stockpile	(t x 1000)		1,372	4,480	7,006	9,046	7,027	9,180	9,641	5,161	4,348	3,371	4,037	10,267	6,770	5,028	697							**87,432**
Ore Stockpile to Mill	(t x 1000)			356																18,738	25,560	25,560	17,218	**87,432**
PAG Overburden	(t x 1000)		235	287	1,694	1,918	275	1,164	3,572	2,499	91													**11,736**
non-PAG Overburden	(t x 1000)	3,514	9,562	11,273	8,014	6,030	3,319	1,823	6,038	7,375	3,104	22												**60,074**
PAG Waste Rock	(t x 1000)	303	2,025	4,434	7,147	13,197	21,007	17,026	11,962	22,265	32,830	35,153	29,791	17,256	6,854	2,486	971	655	191					**225,553**
non-PAG Waste Rock	(t x 1000)	76	1,199	4,899	8,759	8,831	7,595	13,774	16,733	11,405	8,353	6,977	5,768	3,320	1,713	1,015	729	668	115					**101,928**
Total Mining	(t x 1000)	**3,893**	**14,393**	**34,508**	**58,181**	**64,582**	**64,783**	**68,526**	**73,506**	**74,266**	**74,286**	**71,083**	**65,156**	**56,404**	**40,896**	**34,089**	**27,957**	**26,884**	**25,866**	**6,822**				**886,080**
Total Material Moved	(t x 1000)	**3,893**	**14,393**	**34,864**	**58,181**	**64,582**	**64,783**	**68,526**	**73,506**	**74,266**	**74,286**	**71,083**	**65,156**	**56,404**	**40,896**	**34,089**	**27,957**	**26,884**	**25,866**	**25,560**	**25,560**	**25,560**	**17,218**	**973,512**
Open Pit Production - Volumes	**Year**		**-1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	
Ore Pit to Mill	(m^3 x 1000)			3,346	9,363	9,363	9,363	9,363	9,363	9,363	9,363	9,363	9,363	9,363	9,363	9,363	9,363	9,363	9,363	2,499				**146,285**
Ore to Stockpile	(m^3 x 1000)		503	1,641	2,566	3,313	2,574	3,363	3,532	1,891	1,593	1,235	1,479	3,761	2,480	1,842	255							**32,026**
Ore Stockpile to Mill	(m^3 x 1000)			130																6,864	9,363	9,363	6,307	**32,026**
PAG Overburden	(m^3 x 1000)		122	149	878	994	142	603	1,851	1,295	47													**6,081**
non-PAG Overburden	(m^3 x 1000)	1,821	4,954	5,841	4,152	3,124	1,720	944	3,128	3,821	1,608	12												**31,126**
PAG Waste Rock	(m^3 x 1000)	157	1,049	2,298	3,703	6,838	10,884	8,822	6,198	11,536	17,010	18,214	15,436	8,941	3,551	1,288	503	340	99					**116,867**
non-PAG Waste Rock	(m^3 x 1000)	39	621	2,538	4,538	4,576	3,935	7,137	8,670	5,909	4,328	3,615	2,988	1,720	887	526	378	346	60					**52,812**
Total Mining	(m^3 x 1000)	**2,017**	**7,249**	**15,813**	**25,201**	**28,208**	**28,619**	**30,231**	**32,741**	**33,815**	**33,949**	**32,438**	**29,266**	**23,785**	**16,281**	**13,018**	**10,499**	**10,048**	**9,521**	**2,499**				**385,198**
Total Material Moved	(m^3 x 1000)	**2,017**	**7,249**	**15,943**	**25,201**	**28,208**	**28,619**	**30,231**	**32,741**	**33,815**	**33,949**	**32,438**	**29,266**	**23,785**	**16,281**	**13,018**	**10,499**	**10,048**	**9,521**	**9,363**	**9,363**	**9,363**	**6,307**	**417,224**

Geotechnical Work

Geotechnical investigations, testing, and analysis for purposes of pit slope stability, waste dump stability, tailings dam construction, condemnation drilling and plant site characterization were undertaken by Knight Piésold over the period 1991 through 2012.

Pit and Waste Stockpiles

Knight Piésold Ltd. conducted a geotechnical review of the proposed 2011 open pit mine plan. All currently available drilling and discontinuity mapping data and stability analyses suggest the recommended pit slope design is reasonable and appropriate.

The complete test results, findings and recommendations for the pit wall slopes, waste dumps and results of hydrological investigations are contained in the KP reports, “Preliminary Pit Slope Design”, dated May 2012 (Appendix 2.2.4-A) and “Waste and Stockpiles Preliminary Design”, dated June 2012 (Appendix 2.2.4-B). A comprehensive geotechnical/hydrogeological database was developed during a previous pit slope study, “Feasibility Design of the Open Pit”, dated April 1999 (Appendix 3-6-E from the March 2009 EIS/Application).

Knight Piésold’s work consisted of site reconnaissance and mapping, oriented core diamond drilling and detailed logging of fracture data, in-situ permeability testing, point load testing, uniaxial compressive and tri-axial strength tests and direct shear tests on rock joints.

Geotechnical core logging data were used to develop a rock mass classification system and rock mass model for the deposit. Mapping data were used to determine structural discontinuities and to assess the potential for wedge and plane failures in the pit walls. These assessments were the basis for stability analyses of failure modes along structural discontinuities and for evaluation of deep-seated failure.

The existing geotechnical model incorporates five major geological domains: Overburden, Bedrock above Gypsum Line, Potassic Quartz Diorite, Propylitic Porphyritic Volcanic Rock and Potassic Volcanic Rock. The intact rock strengths were found to be generally strong. Combining the intact rock properties and characteristics of the observed discontinuities allowed the rock mass quality to be summarized as being generally fair. Two major faults have been identified to pass within the pit limits: the QD and the East Faults. These structures are sub-parallel, trend roughly North-South through the centre of the deposit, and are steeply dipping to vertical. The predominant jointing patterns are sub-vertical and coincident with main vein systems.

The water table is currently at or near the ground surface and slope depressurization measures are anticipated in order to facilitate the development of stable pit slopes.

Detailed geotechnical mapping of the rock mass will be completed once bedrock is exposed during pre-production and ongoing mining. Pit face mapping will be supplemented with monitoring of the slope deformations and hydrogeological conditions in and around the pit. Data collected during pit development will be used for ongoing pit slope optimization. Pit slope monitoring will also include regular inspections of benches and pit crests in order to identify any tension cracking or other indications of potential slope instability. Appropriate movement monitoring systems will be required for any potentially unstable areas of the pit.

Historical geotechnical reports related to the open pit include:

- Knight Piésold Ltd., March 1994. Report on Open Pit Design (Appendix 3-6-F from the March 2009 EIS/Application)
- Knight Piésold Ltd., March 1994. Open Pit Preliminary Hydrogeological Investigations (Appendix 3-6-G from the March 2009 EIS/Application)
- Knight Piésold Ltd., January 18, 1995. Report on 1994 Open Pit Investigation (Appendix 3-6-H from the March 2009 EIS/Application)
- Knight Piésold Ltd., June 6, 1997. Draft. 1996 Open Pit Geotechnical Investigation (Appendix 3-6-I from the March 2009 EIS/Application), and
- Knight Piésold Ltd., September 21, 2007. 2007 Feasibility Pit Slope Design (Appendix 3-6-C from the March 2009 EIS/Application).

Plant Site

A geotechnical report dated January 22, 2010 and entitled "*2009 Geotechnical Site Investigation Factual Data Report*" (Appendix 2.2.4-B) was prepared by Knight Piésold. This report is based on:

- A field investigation program in September and October 2009 which included 140 test pits, 9 geophysical survey lines, downhole seismic surveying in two drillholes and 13 geotechnical drillholes.
- Laboratory testing of samples.

The Knight Piésold reports include the following findings and recommendations:

- The Plant Site area is characterized by a thin layer of glacial till overlying a basaltic lava flow layer. The glacial till comprises a dense, well graded silty sand with varying amounts of clay and gravel and ranges in thickness from 1.5 to 7.5 m. The lava flow layer comprises medium strong, slightly fractured basalt ranging in thickness from 16.6 to 26.5 m. The soil underlying the basaltic lava flow layer was generally comprised of silty sand with a varying amount of gravel followed by very stiff sandy silt.
- The Primary Crusher area is characterized by a 7.9 m layer of glacial till overlying a basaltic lava flow layer. The glacial till comprises dense, well graded silty sand with varying amounts of clay and gravel.
- In general, conventional shallow spread footings may be used for foundations. Knight Piésold have made recommendations for allowable bearing capacities and predicted settlements based on type, depth, size and geometry of foundations bearing on native soil (glacial till), structural fill, and bedrock.
- The estimated depth of frost penetration for this area is 2.5 m. Footings will be located 2.5 m below grade and their excavations will be backfilled with non-frost susceptible material.
- The mine site is located at the north-eastern edge of the Coast Mountains source zone, an area with low seismic activity. Structures will be designed for a Design Basis Earthquake (DBE) for a conservatively chosen 1 in 475 year return period.
- Knight Piésold has made gradation recommendations for structural backfill materials and general yard fill material. Selective borrowing, blending, screening, crushing, and/or washing may be required to meet the gradation requirements for the structural backfill.

Additional technical reports related to foundation investigation and design includes:

- Knight Piésold Ltd., December 22, 1998. Report on Geotechnical Parameters for the Plant Site Foundation Design (Appendix 3-6-J from the March 2009 EIS/Application)
- Knight Piésold Ltd., January 22, 1999. Report on Geotechnical Parameters for the Plant Site Foundation Design (Appendix 3-6-K from the March 2009 EIS/Application), and
- Knight Piésold Ltd., January 11, 1995. Report on Plant and Crusher Site Foundation Investigations (Appendix 3-6-L from the March 2009 EIS/Application).

Tailings Storage Facility

Several geotechnical site investigation programs were conducted in the TSF area from 1991 to 2012. The programs included drill holes and test pits to investigate the geotechnical characteristics and foundation conditions, and to evaluate the geological factors affecting the design of the TSF.

Drill holes were logged, in situ permeability tests were conducted, representative overburden samples were retrieved for laboratory testing and point load testing was conducted on rock core samples. Groundwater monitoring wells were also installed in the drill holes. The geotechnical data has been used to evaluate the tailings basin and embankment foundations.

The site investigations conducted at the TSF by Knight Piésold Ltd. include the following:

- Initial overview in February 1991.
- A helicopter site visit and identification of alternate potential tailings storage sites was summarized in "*Report on Preliminary Geotechnical Evaluation*" (Appendix 3-6-M from the March 2009 EIS/Application).
- Geotechnical and hydrogeological investigations in the TSF site were completed during the late stages of the 1992 exploration season. Field work comprised general surface reconnaissance, five drill holes, in situ packer permeability testing and installation of groundwater quality monitoring wells. The results of the TSF investigations are included in "*Report on Preliminary Geotechnical Investigations*" (Appendix 3-6-N from the March 2009 EIS/Application).
- Geotechnical and hydrogeological investigations conducted in 1994 concentrated on the West Ridge between the West Embankment alignment and Big Onion Lake and consisted of six drill holes, in situ packer permeability testing, groundwater monitoring well installation and surficial mapping. The results are included in "*1994 Geotechnical and Hydrogeological Investigations for Proposed Tailings Storage Facility*" (Appendix 3-6-O from the March 2009 EIS/Application).
- Geotechnical site investigations were conducted in 1996 at the TSF site and an alternative site, as part of the final site selection program. A total of seven holes were drilled at the Fish Lake Valley site. In situ permeability testing was carried out and groundwater monitoring wells were installed. Laboratory testing was performed on overburden samples and point load testing was carried out on rock core. The details of the 1996 investigation are included in "*1996 Geotechnical Investigations for Tailings Management Options 2 and 5*" (Appendix 3-6-P from the March 2009 EIS/Application).
- Geotechnical and hydrogeological investigations conducted in 1998 resulted in nine drill holes on the floor of Fish Lake Valley. In situ packer permeability tests were conducted and groundwater monitoring wells were installed. Overburden samples were collected for laboratory testing and point load testing was conducted on rock core. The details of the 1998 investigation are included in "*Report on Feasibility Design of the Tailings Storage Facility*" (Appendix 3-6-U from the March 9, 1999 EIS/Application).

- Seismic refraction and reflection surveys were conducted in 1996 by Frontier Geosciences Inc. The results of the survey are included in "*Report on Seismic Refraction and Reflection Investigation*" (Appendix 3-6-Q from the March 2009 EIS/Application).
- Details of the site characteristics, geotechnical, hydrogeological and water management considerations for the tailings facility design, pipeworks, seepage collection and closure are contained in the Knight Piésold "*Report on Preliminary Design of the Tailings Storage Facility*", dated June 2012 (Appendix 2.2.4-C) as well as in the Knight Piésold report "*Water Management*", dated May 2012 (Appendix 2.2.4-D).

Additional geotechnical reports related to geotechnical considerations of the tailings storage facility are included in the following reports:

- Knight Piésold Ltd., March 1994. Report on Open Pit Design (Appendix 3-6-F from the March 2009 EIS/Application)
- Knight Piésold Ltd., February 10, 1994. Report on Materials for Embankment Construction and Concrete Aggregate (Appendix 3-6-S from the March 2009 EIS/Application)
- Knight Piésold Ltd., May 13, 1994. Site Geotechnical Considerations and Design of Tailings Storage Facility (Appendix 3-6-T from the March 2009 EIS/Application), and
- Knight Piésold Ltd., May 13, 1994. Report on 2007 Feasibility Design of the 70,000 tpd Tailings Storage Facility (Appendix 3-6-R from the March 2009 EIS/Application).

Condemnation Drilling

Condemnation drilling has occurred at the mine site as a component of the geotechnical drilling undertaken, the majority of which are shown on Figure 2.2.4-1. There are 8 holes drilled in the vicinity of the ore and non-PAG stockpiles, 18 holes drilled within the TSF area and 12 holes drilled in the vicinity of the plant site. There have also been more than 40 holes drilled at alternative TSF and waste rock locations no longer considered as components of the Project. In total, more than 80 geotechnical holes were drilled at the Project site totaling greater than 3000 m of drilling. Of this approximately 150 m from 8 holes were assayed in 80 samples. The maximum copper value returned from 80 assays is 0.009% Cu and the maximum gold value from 54 assays is 0.02 g/t Au.

Staged Mine Development

The staged mine development at Years 1, 3, 16 and 20 are shown in Figures 2.2.4-2 to 2.2.4-5. The proximity of the pit to Fish Lake as it expands can be seen, as well as the location of all major components, such as the ore stockpile, non-PAG waste rock/overburden stockpile, plant site, crusher and TSF.

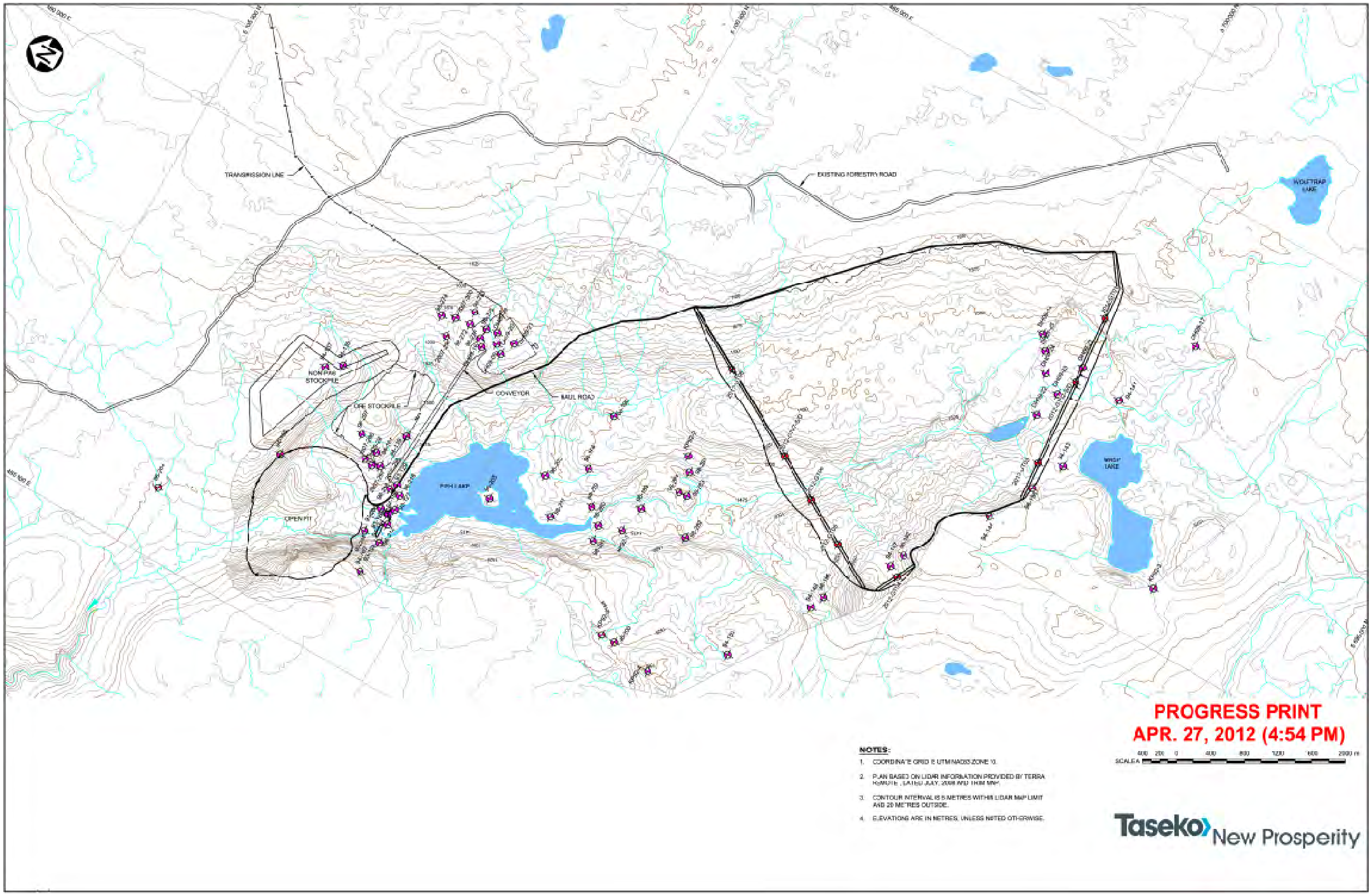


Figure 2.2.4-1 Condemnation Drilling

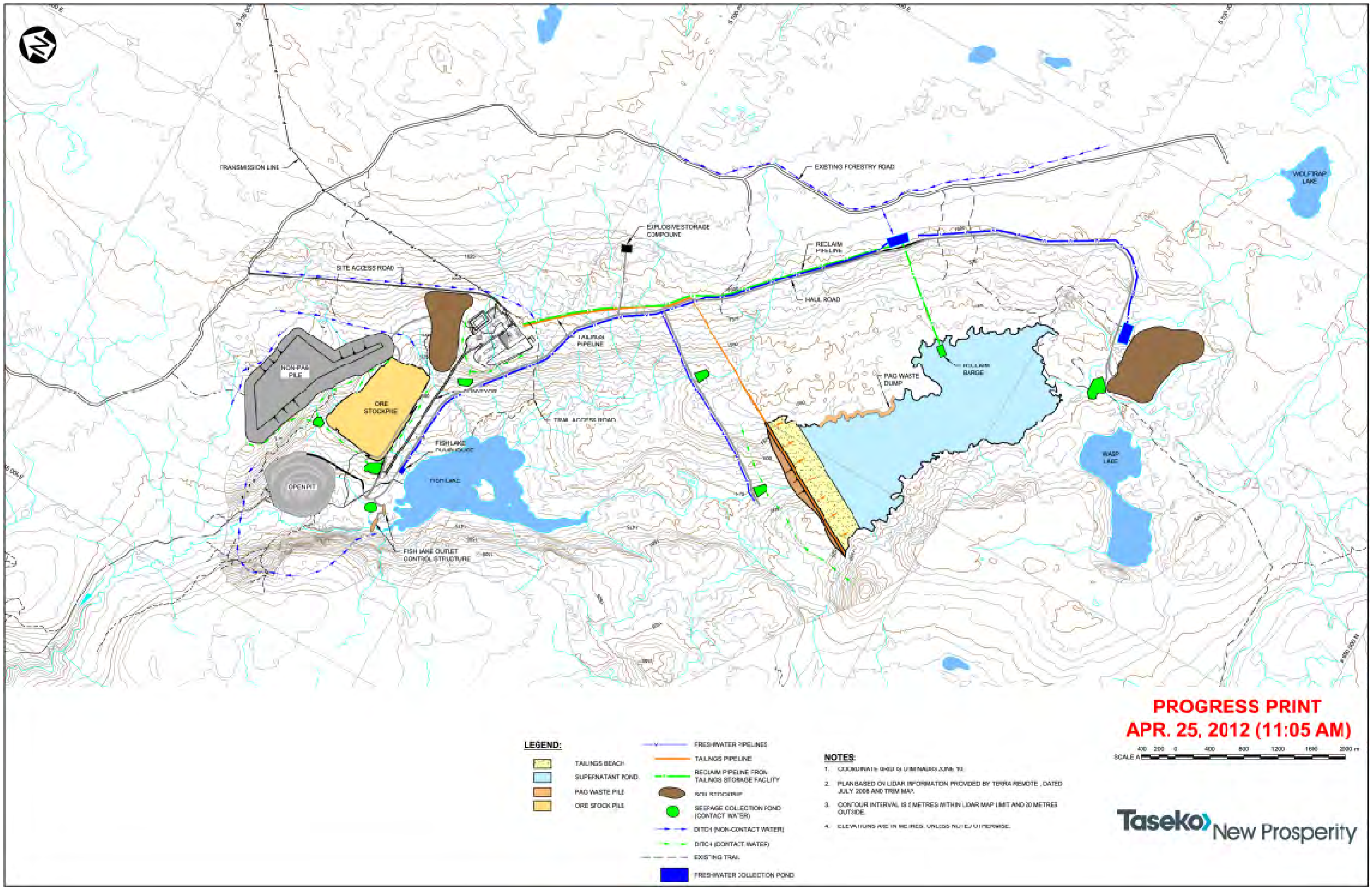


Figure 2.2.4-2 General Arrangement – End of Year 1

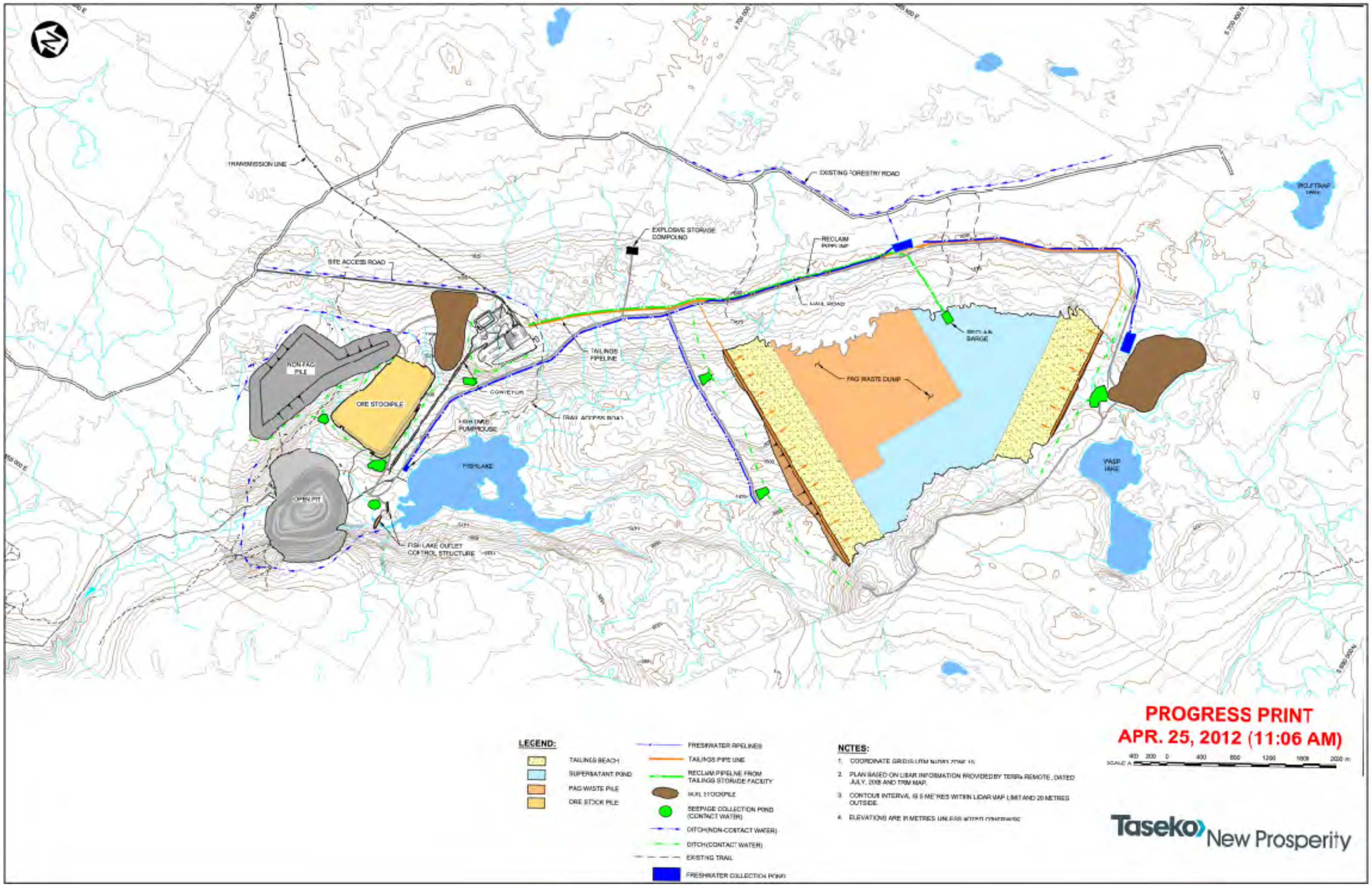


Figure 2.2.4-3 General Arrangement – End of Year 3

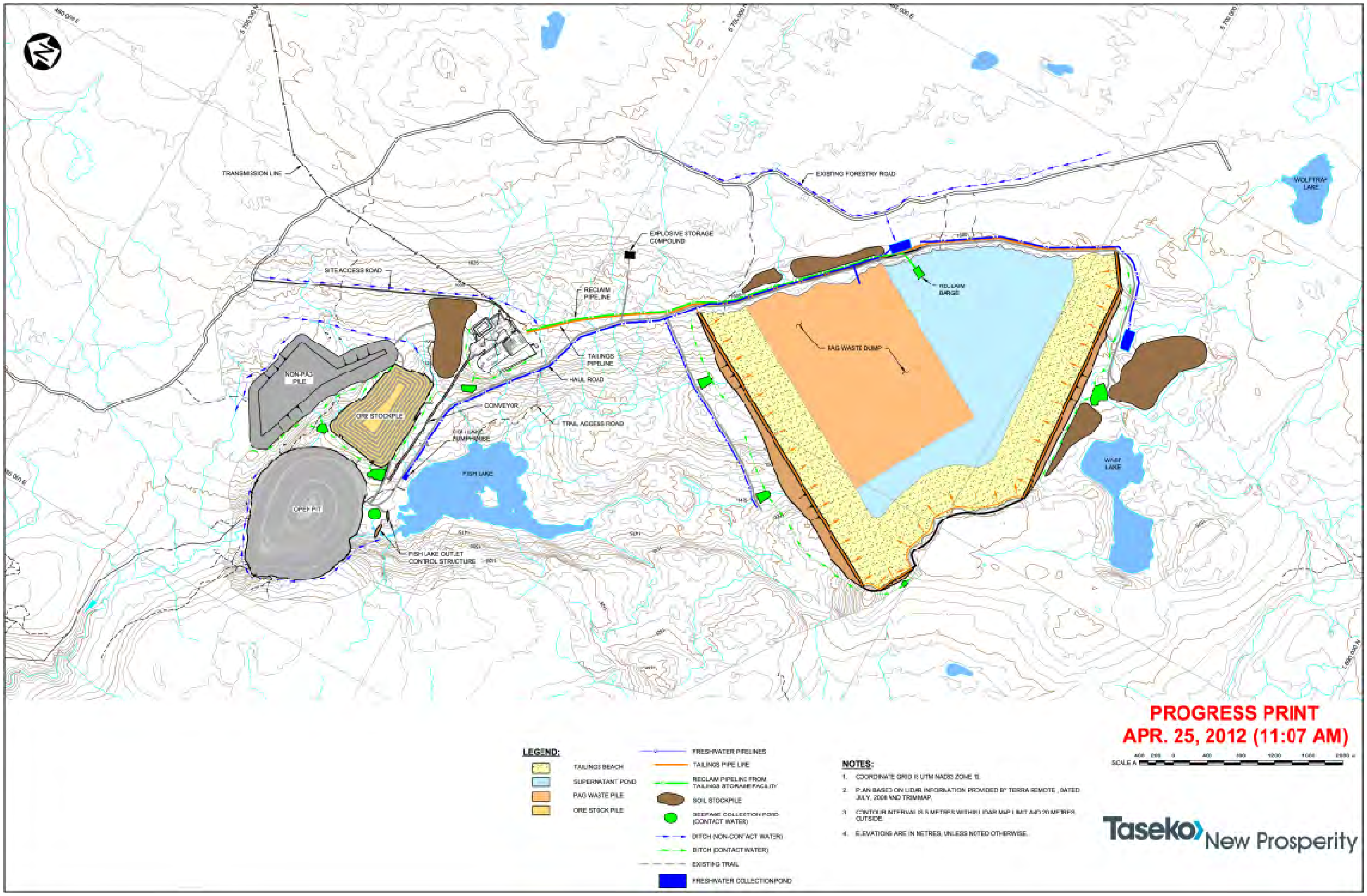


Figure 2.2.4-4 General Arrangement – End of Year 16

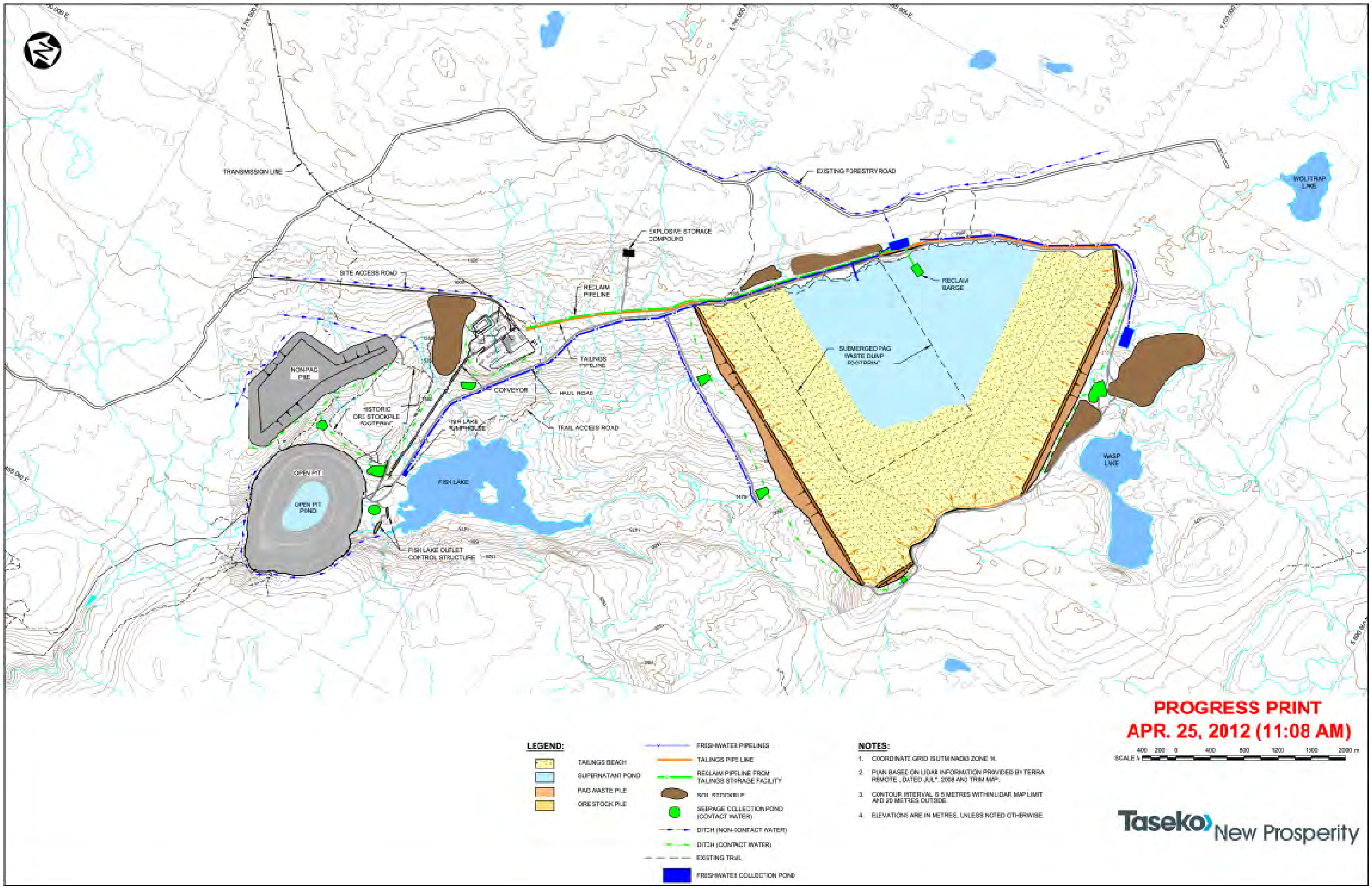


Figure 2.2.4-5 General Arrangement – End of Year 20 (Ultimate)

2.2.5 Mine Development

The general arrangement layout for the New Prosperity Project is shown on Figure 2.2.5-1.

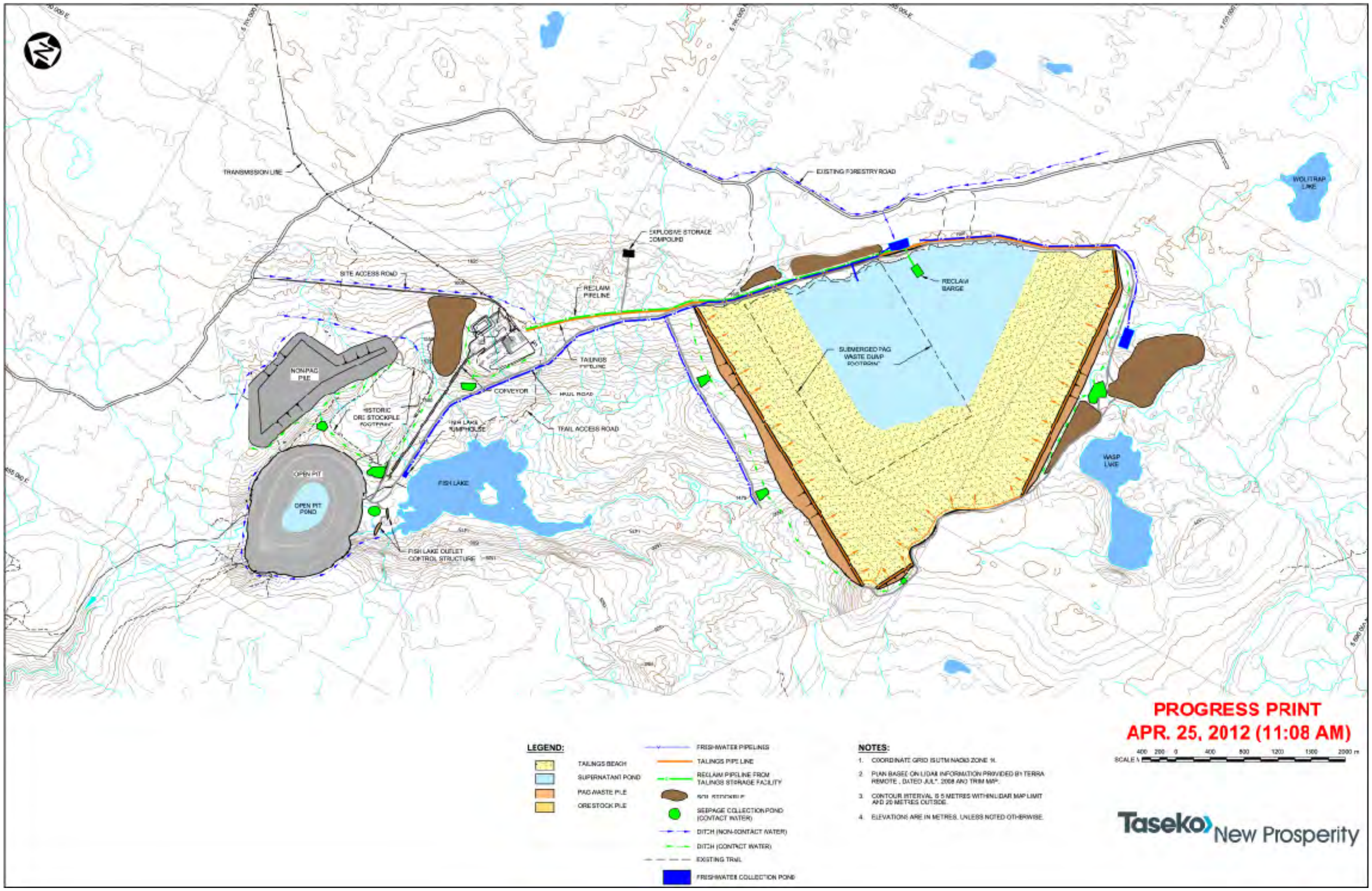


Figure 2.2.5-1 General Arrangement – End of Year 20 (Ultimate)

General Mine Design

The mining method proposed for the New Prosperity Project remains unchanged from the previous project proposal and is a conventional open pit shovel/truck operation. The mine will operate using industry standard large scale electric rotary drills, electric cable shovels, diesel electric trucks and a fleet of support equipment to maintain roads, dumps and stockpiles. The ore and waste will be drilled by rotary blast hole drills and blasted using ammonium nitrate and fuel oil or with emulsion as required.

Ore will be hauled to a gyratory crusher located southeast of the open pit and then conveyed overland to the coarse ore stockpile and subsequently to the concentrator for grinding and flotation. Waste rock and overburden will be segregated into non-PAG and PAG categories. Non-PAG waste rock and overburden will be hauled south from the open pit to either the tailings storage facility for dam construction or to the non-PAG waste rock/overburden stockpile east of the pit. It may also be used as general construction fill for haul roads or laydown areas. PAG waste rock and overburden will be hauled to the PAG stockpile located within the TSF.

Ore will be mined from the open pit for 17 years. The implementation of a declining cut-off grade strategy results in a stockpile of ore that will be used as supplemental mill feed during the first 16 years of operation with the balance processed at the end of the open pit mine life. This material will be reclaimed and processed as mining in the open pit is completed.

Open Pit Design

The open pit design remains unchanged from the previous project proposal and has been based upon the following key considerations:

- Geotechnical recommendations and design criteria for maximum pit slope and waste dump locations
- Operating constraints of the equipment selected for mining
- Minimum haulage road operating width and maximum effective grade within the operating limitations of the primary haulage units, and
- Logical and efficient scheduling of material movement from multiple phases of pit expansion to the crusher, the stockpiles and to final waste material placement sites.

The open pit will be mined in four phases commencing with the Phase 1 Starter Pit. The pit will be partially pre-stripped during the pre-production development period. Subsequent phases are radial expansions of the mine about the starter pit creating a progressively deeper pit.

The minimum pushback width is 80 m; however, in general the expansions are in excess of 100 m width. Haul road allowances have been provided at 35 m. Roads are designed at a maximum of 10% grade.

The benches will be mined at a 15 m height, double benched between berms. Wall slope design changes will be implemented by varying the berm widths and inter-berm slope angles.

The ultimate pit features are summarized as follows:

- 1650 m E-W by 1285 m N-S
- Total surface area 166 ha
- Final ramp exit elevation 1470 m
- Ultimate pit bottom elevation 945 m, and

- Maximum wall height–600 m in the SW quadrant with maximum crest elevation 1545 m.

Final overall wall slope angles in the following directions:

- North wall 45.5°
- East wall 45.2°
- South wall 43.6°, and
- West wall 42.4°.

Open pit wall slope stability is dependent upon the following site specific factors, and are discussed further below:

- Geological structure
- Rock alteration
- Intact rock strength
- Rock stress
- Groundwater conditions
- Discontinuity strength and orientation
- Pit geometry
- Blasting practices
- Climatic conditions, and
- Time.

Geological Structure

In general the rock mass quality at New Prosperity ranges from fair to good. There are two major faults within the pit limit. These are referred to as the QD and East Faults. These structures are near vertical, sub-parallel and trend North-South through the center of the deposit. There do not appear to be any major structures that will adversely influence the stability of the pit slopes.

Rock Alteration

The New Prosperity Deposit is centered about a diorite intrusive where potassic alteration is associated with the core of the mineralized zone. This central zone of mineralization is surrounded by a propylitic alteration zone. A retro-grade phyllic alteration is overprinted on the propylitic and potassic zones. Within the potassic zone there is a well-defined vertical zonation defined by dissolution of gypsum on joint surfaces. The “gypsum” line defines the change from generally competent rock to competent rock and is used to separate structural domains for the purposes of mine design.

Intact Rock Strength

Intact rock strength is an important consideration, as many potential failure surfaces are not completely developed and require some failure of intact rock. The moderate to high strength of the rock at New Prosperity site is beneficial due to the high stresses that are expected to develop in the pit slopes during later stages of mining. The uniaxial compressive strength, based on point load tests, varies but averages 112 mPa.

Rock Stress

The rock stress conditions within the rock mass are a significant factor for high slopes. Knight Piésold has used a sophisticated finite difference computer model (FLAC) to assess the potential overstressing of the rock in the proposed pit slopes.

Groundwater Conditions

The water table is currently at or near the ground surface and provisions have been made for a slope depressurization system. Groundwater dewatering wells and slope depressurization will be concentrated in North and South sectors as referred to in Figure 2.2.5-2 (Geotechnical Pit Slope Design Sectors Plan) and later in Figure 2.2.5-3 (Pit Slope Design–Pit Wall Depressurization Plan). The proximity of Fish Lake to the pit, as well as the interaction of Fish Lake with the groundwater table has been assessed with respect to the pit wall designs.

Discontinuity Strength and Orientation

The predominant jointing patterns are sub-vertical and coincident with the main vein systems. Secondary veins have also been identified dipping out of the East pit slopes. Knight Piésold has investigated the potential for adversely oriented structural features at depth at or near the final pit walls. The finding of this investigation was that there is a very low likelihood of adverse structures in the form of open joints. Structural features in close proximity to final walls will be primarily quartz and sulphide veins.

Pit Geometry

The ultimate pit geometry is roughly oval and the internal pit phases expand in all directions about the Phase 1–Starter Pit. As such during the life of the mine all internal walls are temporary and will be mined.

Blasting Practices

Drilling and blasting near both temporary and final walls will require buffer blasting. Knight Piésold have recommended overall wall slopes of 30° in overburden, 45° above the “gypsum line” and 50° below the “gypsum line”. The recommendations for bench and berm configuration were based upon single benching and achieving steep inter-berm face angles up to 75°. The designs incorporated in this study assume that double benching will be possible and that shallower inter-berm angles to 65° will be allowed resulting in berm widths from 10 to 15 m width.

Climatic Conditions

The climatic conditions at the New Prosperity Project are typical of the British Columbia Chilcotin District with an annual average of approximately 500 mm of rain equivalent precipitation. The seasons in this area are well defined with relatively predictable periods of “freeze up” in the fall and “break up” in the spring. The “break up” period is characterized by increased water flow from melting snow and cyclical thawing and freezing of the surface materials on pit slopes. This action results in decreased slope stability particularly at the smaller bench scale where there will be a marked increase in small face failures and ravelling of rock.

Time

As discussed in the earlier sections, final walls will occur only in the Phase 4 Pit that is active for a period of 10 years between Year 6 and Year 16 of the production schedule. Phase 1 and Phase 2 pit walls will typically be exposed for two years and the Phase 3 walls will be exposed for four years prior to excavation.

Design Sectors

Based upon three structural domains the open pit has been divided vertically into three major slope design sectors that correspond with:

- Sector I—Surface materials including overburden and basalt
- Sector II—Upper Zone located above the “gypsum line,” and
- Sector III—Lower Zone located below the “gypsum line.”

These major sectors have been further subdivided in greater detail; however, the actual design recommendations for each major sector are for the most part identical and are summarized in Table 2.2.5-1 (Recommended Wall Slopes) and shown on Figure 2.2.5-2. The overburden will be mined leaving a 30° inter-ramp slope. The basalt formation on surface will be mined leaving a 45° inter-ramp slope. The Middle Zone will be mined leaving a 45° inter-ramp slope and the Lower Zone inter-ramp slope will be increased to 50°.

The benches will be mined at a 15 m height, double benched between berms. Wall slope design changes will be implemented by varying the berm widths and inter-berm slope angles.

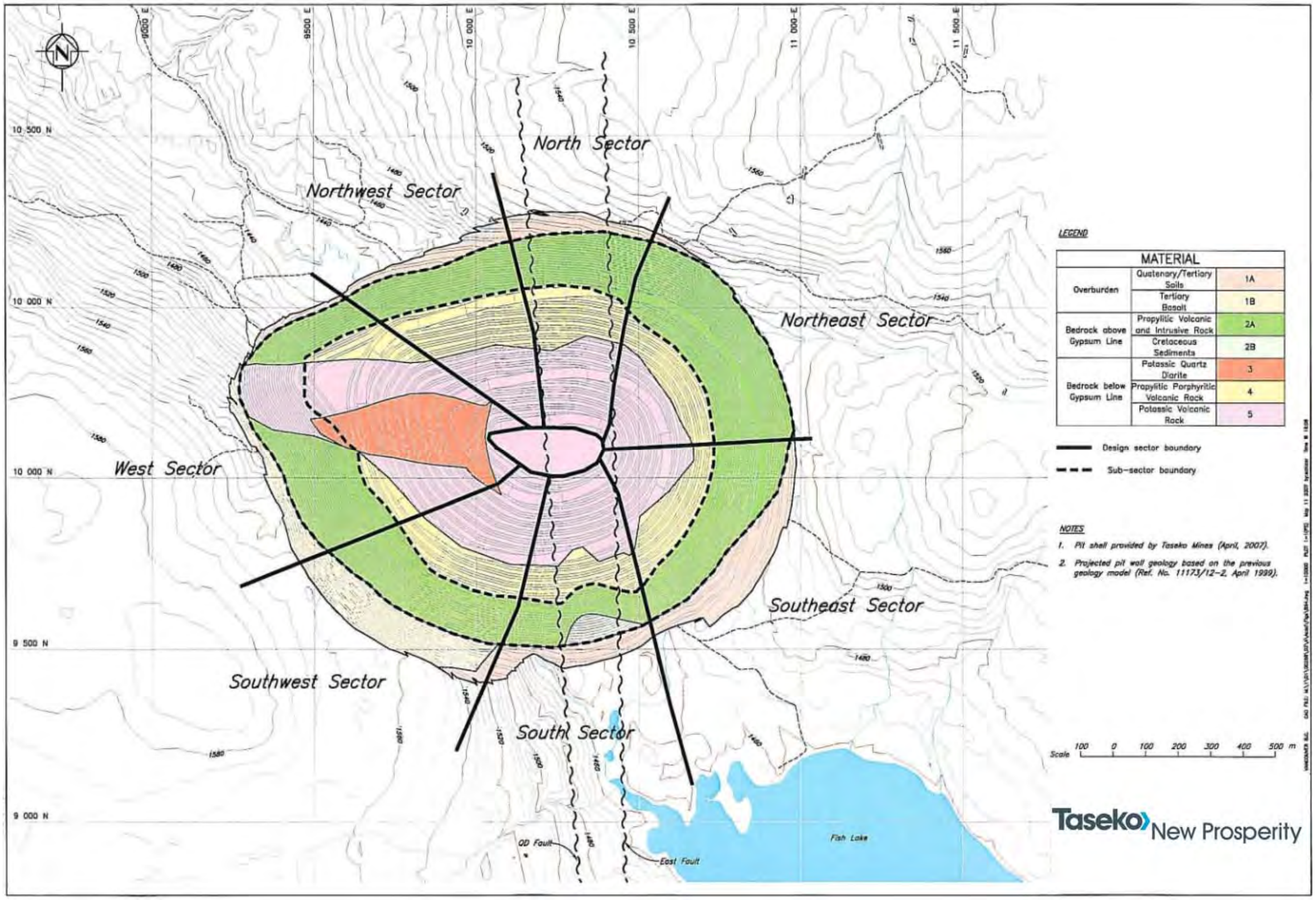
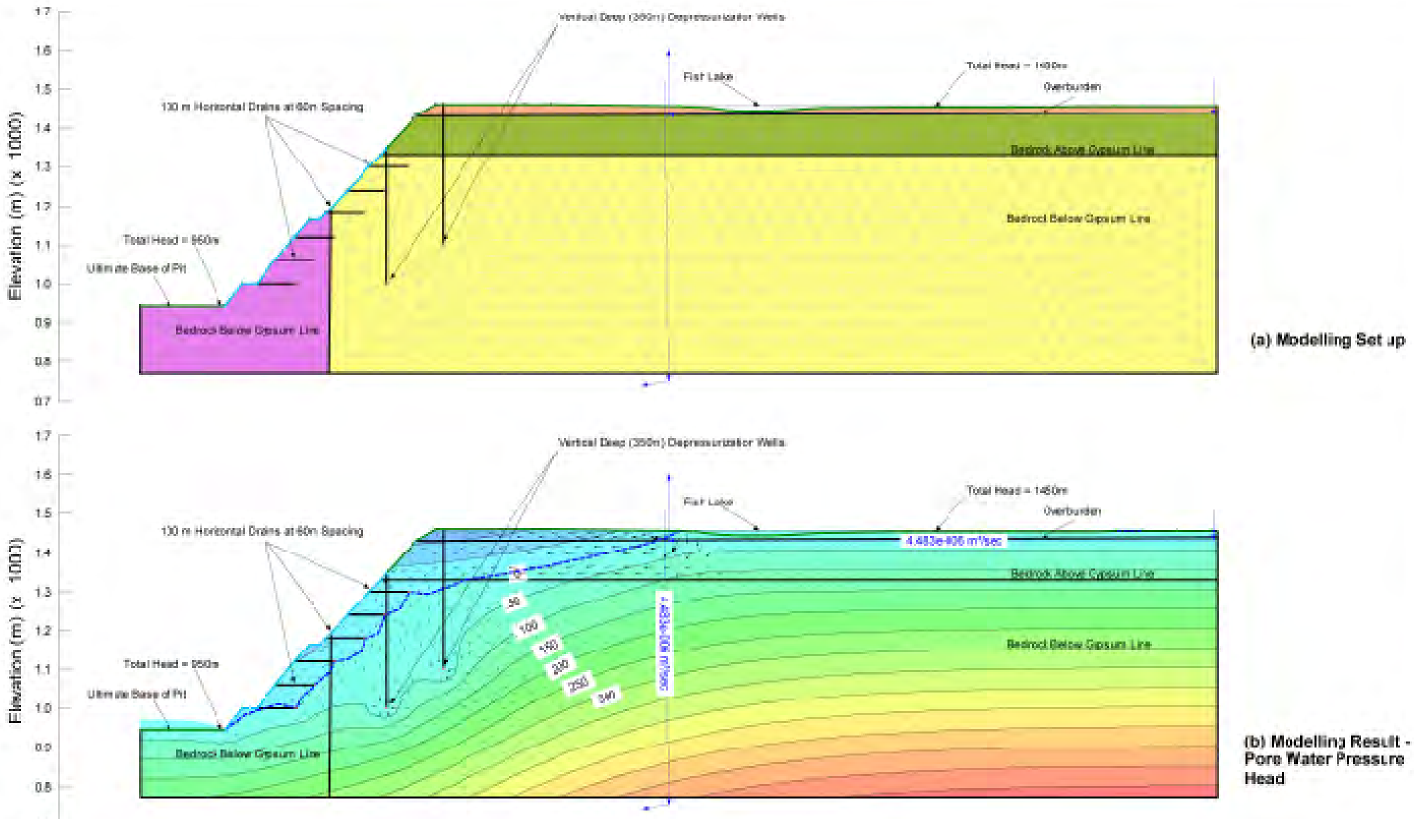


Figure 2.2.5-2 Geotechnical Pit Slope Design Sectors Plan



Notes:
1) Hydraulic Conductivities, geological domains, well locations and spacing of horizontal drains obtained from 1999 KP Report "Feasibility Design of the Open Pit" (KP Report, Ref. No. 11173/12-2, April 1999).
2) Pit Wall and Pit Slope angle obtained from 2007 KP Report "2007 Feasibility Pit Slope Design" (KP Report, Ref. No. VA101-00266/2-2, September 2007).
3) Bathymetry of Fish Lake obtained from Bathymetry Contour Drawing produced by TRITON Environmental Consultants on behalf of Taseko, August 2011.

Figure 2.2.5-3 Pit Slope Design–Pit Wall Depressurization Plan

Table 2.2.5-1 Recommended Wall Slopes

Design for Near Surface Materials						
Design Sector	**Geologic Domain**	**Inter-ramp Slope (degrees)**	**Bench Height (m)**	**Berm Interval (m)**	**Berm Width (m)**	**Interberm Slope (degrees)**
Ia	Overburden	30	15	15	8	40
Ib	Basalt	45	15	30	8	65
Design Above the Gypsum Line						
IIa	Upper west sector	45	15	15	8	65
IIb	Upper west sector–potassic	45	15	15	8	65
IIc	Upper northwest sector	45	15	15	8	65
IId	Upper north sector	30	15	15	8	65
IIe	Upper northeast sector	30	15	15	8	65
IIf	Upper east sector	45	15	15	8	65
IIg	Upper southeast sector	45	15	15	8	65
IIh	Upper south sector	45	15	15	8	65
Iii	Upper southwest sector	45	15	15	8	65
Design Below the Gypsum Line						
IIIa	Lower west sector	45	15	15	8	65
IIIb	Lower northwest sector	50	15	30	11	65
IIIc	Lower north sector	50	15	30	11	65
IIId	Lower northeast sector	45	15	15	8	65
IIIe	Lower southwest sector	50	15	30	11	65
IIIf	Lower south sector	50	15	30	11	65
IIIg	Lower southwest sector	50	15	30	11	65

Open Pit Dewatering

Pit water will go directly to the mill. When mill operations are temporarily disrupted the pit water will bypass the mill to the tailings line for discharge into the TSF.

Open pit development will have an impact on the local hydrogeologic regime, as the pit will become a groundwater discharge area. The groundwater table is at or near the surface and development of the open pit will result in a gradual lowering of the water table in the vicinity of the excavation.

Pit inflows will likely be dominated by localized confined aquifers in the southern area of the pit from zones of higher rock mass permeability related to major structures and from unconfined flow in the upper 150 to 300 m of fractured rock mass above the gypsum line. Inflows from good quality, low permeability rock below and peripheral to the gypsum line are expected to be low.

A combination of depressurization techniques including vertical wells, in-pit horizontal drains and collection systems will be implemented as a staged approach during pit development (Figure 2.2.5-3). The QD and East fault zones require deep groundwater depressurization in order to minimize the potential for slope failure on the north and south walls. Shallow perimeter wells will be located outside the ultimate pit limit. The location of these wells will be determined based upon hydrologic monitoring information.

Horizontal drain holes will be used within the pit based on hydrologic monitoring information collected during operations. Water inflows to the open pit will include both groundwater and direct precipitation. The contribution of direct precipitation to in-pit pumping requirements will vary annually and seasonally. The open pit dewatering system has been designed to meet the combined requirements of the expected groundwater pit inflow rates and runoff from precipitation.

Open Pit Operations

The open pit will be mined in four phases commencing with the Phase 1 starter pit. The pit will be partially pre-stripped during the pre-production development period. The Phase 2 through Phase 4 pits are radial expansions of the mine about the Starter Pit creating a progressively deeper pit.

The mine production forecast has been derived by scheduling ore to provide approximately 25 Mt of ore to the primary crusher annually. The mine will operate 24 hours per day, 365 days per year with a nominal crusher throughput of 70,000 tpd and a life of mine strip ratio of 0.8 tonnes of waste per tonne of ore. The production schedule is detailed in Section 2.2.4, Table 2.2.4-3.

Ore production from the open pit will cease in Year 17 of the current mine plan. Recovery of the ore from Ore Stockpile will sustain mill production through the middle of Year 20 of the mine plan.

The primary mining fleet in this conventional open pit shovel/truck operation will consist of large diesel electric haulage trucks, electric cable shovels and electric rotary blasthole drills. The surfaces of roads, dumps and operating benches will be maintained with a support equipment fleet including track dozers, graders, and excavators.

Haul roads will be required from the mine to the crusher, ore stockpile, waste storage areas, soil stockpiles, and the TSF for construction and waste storage. These roads will be constructed with non-PAG materials derived from mine operations. They will be built with an operating surface in compliance with the Health, Safety and Reclamation Code for Mines in British Columbia (the Code) with allowance for ditches and berms where required. The major haul roads are shown on Figure 2.2.5–1.

Concentrate, Ore, Waste Rock, Overburden, and Topsoil Storage

Concentrate that is generated from the milling process is stored within the confines of the concentrator building. Concentrate trucks will be loaded with a front end loader within this building, directly from the concentrate stockpile. Control measures such as a truck wash will be utilized to ensure that concentrate trucks are free of any uncontained concentrate prior to leaving the building.

The total tonnage of material to be mined from the open pit is approximately 886 Mt. The ore directly sent to the mill is approximately 400 Mt, while approximately 87 Mt is sent to the ore stockpile. The total waste material types are 12 Mt of PAG overburden, 60 Mt of non-PAG overburden, 225 Mt of PAG waste rock and 102 Mt of non-PAG waste rock. Table 2.2.4-3 provides an annual breakdown of each material type, presented as both tonnes and volume. PAG and non-PAG overburden will be excavated and stockpiled through the first nine years of operations, while PAG and non-PAG waste rock will be excavated for all sixteen years that active mining occurs.

The ore stockpile will be developed with 15 m high offset lifts at the angle of repose. Prior to placement of ore in the stockpile areas the vegetation will be cleared, and diversion and runoff collection ditches will be constructed. The segregation of material during dumping will cause coarser particles to collect along the base of each bench of the stockpile which will assist in promoting free draining conditions within the ore stockpile.

Non-PAG waste materials will be used to construct the TSF embankments. The non-PAG waste, including overburden, not used in the TSF embankment construction will be deposited on gently sloping topography to the northeast of the open pit, and the ore stockpile will be located to the east of the pit (Figure 2.2.5-1). The footprints of the non-PAG waste rock/overburden stockpile and ore stockpile are approximately 110 ha and 80 ha, respectively.

The non-PAG waste rock/overburden stockpile will be developed from the bottom up with 30 m high lifts at the angle of repose. The lifts will be offset to develop an overall dump slope angle of 26° (2H:1V). The crests will be contoured for reclamation. Prior to placement of overburden and waste rock in the stockpile, the vegetation will be cleared, and diversion and runoff collection ditches will be constructed. The segregation of waste rock and overburden materials during dumping will cause coarser particles to collect along the base of each bench of the stockpile which will assist in promoting free draining conditions within the waste rock and overburden materials.

PAG overburden and waste rock will be stored sub-aqueously. The PAG overburden contains weathered rock which includes oxidized or partially weathered sulphide minerals. PAG waste rock and overburden will be placed within the TSF in a sidehill fill arrangement along the eastern slopes of the Fish Lake Valley. The stockpile will be operated to maintain approximately 500 m minimum separation between the PAG waste materials and the TSF embankments. This separation will allow development of a tailings beach between the TSF embankments and the PAG waste rock/overburden stockpile. The continuous tailings deposit will provide a low permeability transition zone between the coarse, permeable PAG waste rock and the TSF embankment. This low permeability zone will function as a seepage limitation and control measure. The crest of the PAG waste rock/overburden stockpile will be covered with tailings and submerged by the supernatant pond in the later years of the mine life when stockpiled ore is being milled after open pit mining is complete.

The PAG stockpile has been designed in sequence with the mine production schedule. It will be developed with a similar rate of rise as the tailings. The stockpile crest will be maintained several metres higher than the tailings and supernatant pond to provide a dry, stable placement trafficking surface. At closure, the PAG stockpile will be submerged by tailings and the TSF supernatant pond. Based on the present mining schedule, tailings deposition will occur for a period of time after final placement of PAG materials sufficient to cover the placed PAG materials within tailings.

Three types of soil salvage will occur during the Project and the type selected is dependent on the infrastructure being developed:

- Windrowed soils: for linear features such as ditches, roads, and retention ponds, soil will be excavated and placed in linear piles or berms along the features. The depths of soil replaced for reclamation will be dependent on the amount of soil that was available to salvage from the sites. All linear features will have soil windrowed unless they are at risk of dust deposition which may impact soil quality; for example, the conveyor line and roads near the open pit area will have soil removed from the location for storage in stockpiles away from the operation.
- Two-lift operation of soils: In areas of buried services, a two-lift soil salvage operation will be used. For this salvage method the first lift would be for the soil and the second lift for the subsoil or overburden. When soil is placed back in a trench it is done in the reverse order thereby preventing admixing of lower quality material with soil that is used as a plant growth medium. No long-term soil storage is required as soils will be replaced once the infrastructure is in place.
- Soil stripping and storage in stockpiles: this is the removal of soil after vegetation has been cleared and the transportation of the soil to designated long-term storage sites. Areas proposed for this type of soil salvage include areas that will be covered by mine features such as the plant site, tailings beaches, tailings storage facility embankments, ore stockpile footprint and non-PAG waste rock/overburden stockpile. The storage locations take into consideration the volumes required for reclamation of disturbed areas such as the tailings storage facility beaches and embankments, plant site and conveyor line, and non-PAG waste rock/overburden stockpile. Salvage of sufficient soils for a replacement depth of 50 cm was selected to provide a sufficient rooting medium for plant growth. The soil cap will be replaced in one lift.

Appendix 2.2.4-B contains more information specific about the foundation conditions, preliminary designs and volumetrics of the non-PAG waste rock/overburden stockpile, the ore stockpile, the PAG waste rock/overburden stockpile and soil stockpiles.

ARD/ML Prevention and Mitigation

The ARD/ML Prevention and Mitigation Plan is designed around segregating and appropriately storing the PAG and non-PAG material found in four different classes. These four classes of material are:

- Mine area overburden
- Waste rock
- Tailings, and
- Ore.

Criteria for the classification of the PAG and non-PAG material will be determined based on standard industry tests on each of these four classes of material such as rinse pH, sulphide sulphur, modified neutralization potential and net acid generation test. PAG material will be stored in the TSF in a subaqueous manner. Non-PAG material will be stored in a sub aerial manner.

Waste delineation and segregation will occur in the following generalized process for Mine Area Overburden and waste rock:

Blast hole chips will be collected from surveyed drill holes.

These chip samples will be tested onsite for parameters specific to each waste rock type with regards to its PAG/non-PAG nature.

Dig limits will be calculated based on this information and used to determine the location of colour coded field stakes to indicate boundaries.

Material will be loaded into haul trucks. Shovel operators will use proven methodology to indicate the type of material loaded to the haul truck driver.

Material will be dumped at the appropriate stockpile with monitoring at the disposal locations to ensure that the wastes are appropriately dumped.

Existing data shows tailings material to be non-PAG. As such, no specific management criteria have been established. However, periodic sampling and testing will be conducted. Ore that is placed in the ore stockpile located east of the open pit will be processed in the final years of the mine life. Excess mill capacity in the early years of the New Prosperity Project will be used to process as much ore from this stockpile that is practicable, thereby reducing the volume of material to be stored. The Prediction, prevention, mitigation and management of metal leaching and acid rock drainage is further discussed in Section 2.7.2.1.

Condemnation Assessment

Section 2.2.4 describes condemnation drilling throughout the New Prosperity Project area. Specifically, geotechnical drilling has been conducted in the non-PAG waste rock/overburden stockpile, the ore stockpile, the plant site and the TSF, in addition to other areas that do not have permanent facilities proposed. Assays derived from approximately 150 m of drilling returned maximum values of 0.009% Cu from 80 samples and 0.02 g/t Au from 54 samples.

Surface and Groundwater Management

Water management for the New Prosperity Project has been divided into six phases, namely:

- Construction (Years -2 & -1)
- Operations Phase I (Years 1 through 16)
- Operations Phase II (Years 17 through 20)
- Closure Phase I (Years 21 through 30)
- Closure Phase II (Years 31 through 44), and
- Post-Closure (Years 45 onwards).

Management of water for all phases of the mine is focused on keeping contact water separate from non-contact water, so as to mitigate water quality impacts on the receiving environment.

During the construction phase, the primary objective for water management relates primarily to sediment control. Initial site development activities will be focused on road construction, vegetation clearing, stripping of surficial soils, and eventually construction of the plant site and TSF, among other components. Construction sediment control ditches will be developed immediately downstream of all components, so as to capture any sediment-laden water and direct it towards sediment control ponds, allowing for the management of sediment prior to release to lower Fish Creek.

During the second year of construction, a portion of the starter embankment of the TSF will be complete, allowing for storage of contact water at this point in time. Furthermore, the starter-pond in the TSF will need to begin to grow at this time, so that there will be sufficient water available for the commencement of operations. Sediment control ditches and ponds are shown downstream of the non-PAG waste rock/overburden stockpile, the ore stockpile, the TSF main embankment and the plant site on Figure 2.2.5-4 for the end of Year 1, which closely approximates the construction phase sediment control features. It is expected that a detailed construction sediment and erosion control plan will be developed for the permitting phase of the New Prosperity Project.

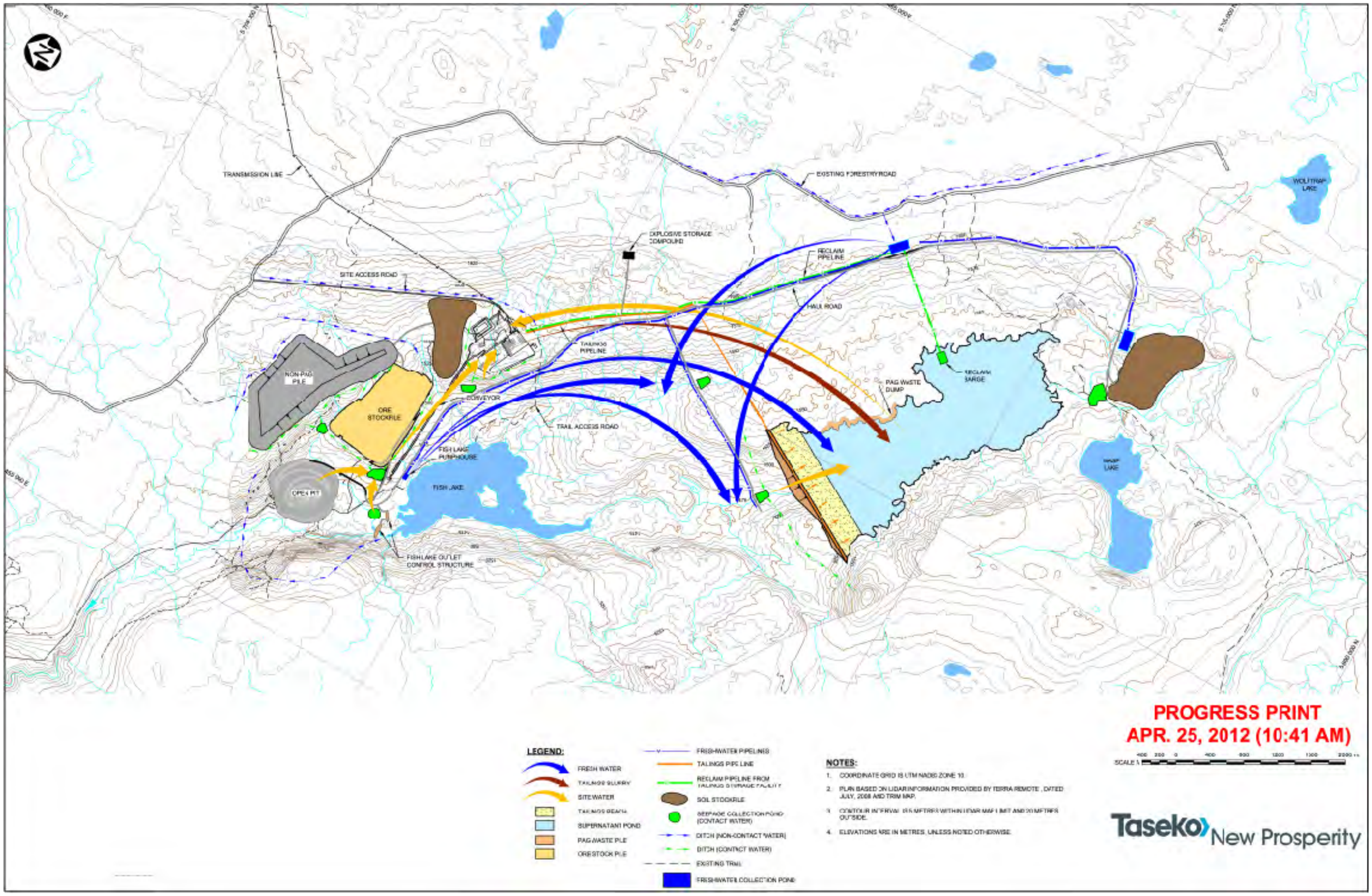


Figure 2.2.5-4 Water Management – End of Year 1

As the second year of construction commences, and storage of water begins in the TSF, natural flows will be reduced in Fish Lake. Some of the water management activities during the first year of construction will be focused on preparing for the capture and diversion of non-contact water towards Fish Lake, once the natural catchments are reduced. Furthermore, a pumping and recirculation system will be installed near the outlet of Fish Lake at this time, in addition to flood control dams in lower Fish Creek between Fish Lake and the open pit, so that flows entering Fish Lake can be managed and redirected to the inlets of Fish Lake and to the TSF, as required. Figure 2.2.5-4 shows the non-contact water collection systems to the east and south of the TSF, the flood control dams between Fish Lake and the open pit, as well as the Fish Lake recirculation system.

The flood control dams located between Fish Lake and the open pit have been sized considering a 1:1000 year 24-hour return period storm event. The catchment area that will generate this flood volume to Fish Lake is shown on Figure 2.2.5-5. Water from this unlikely storm event will be managed by either pumping the water to the TSF, or around the open pit and release it to lower Fish Creek. Appendix 2.2.5-A presents the full details surrounding the conceptual design of the Fish Lake Flood Control Dam.

Once active tailings deposition occurs in the TSF, the seepage collection ponds downstream of each embankment will begin to return collected seepage to the TSF. The main embankment will ultimately have two seepage collection ponds, located at topographic lows, while the south and west embankments will each have one seepage collection pond. The majority of seepage that will leave the TSF will flow through the embankment structures, with a smaller fraction reporting through the foundation of each embankment.

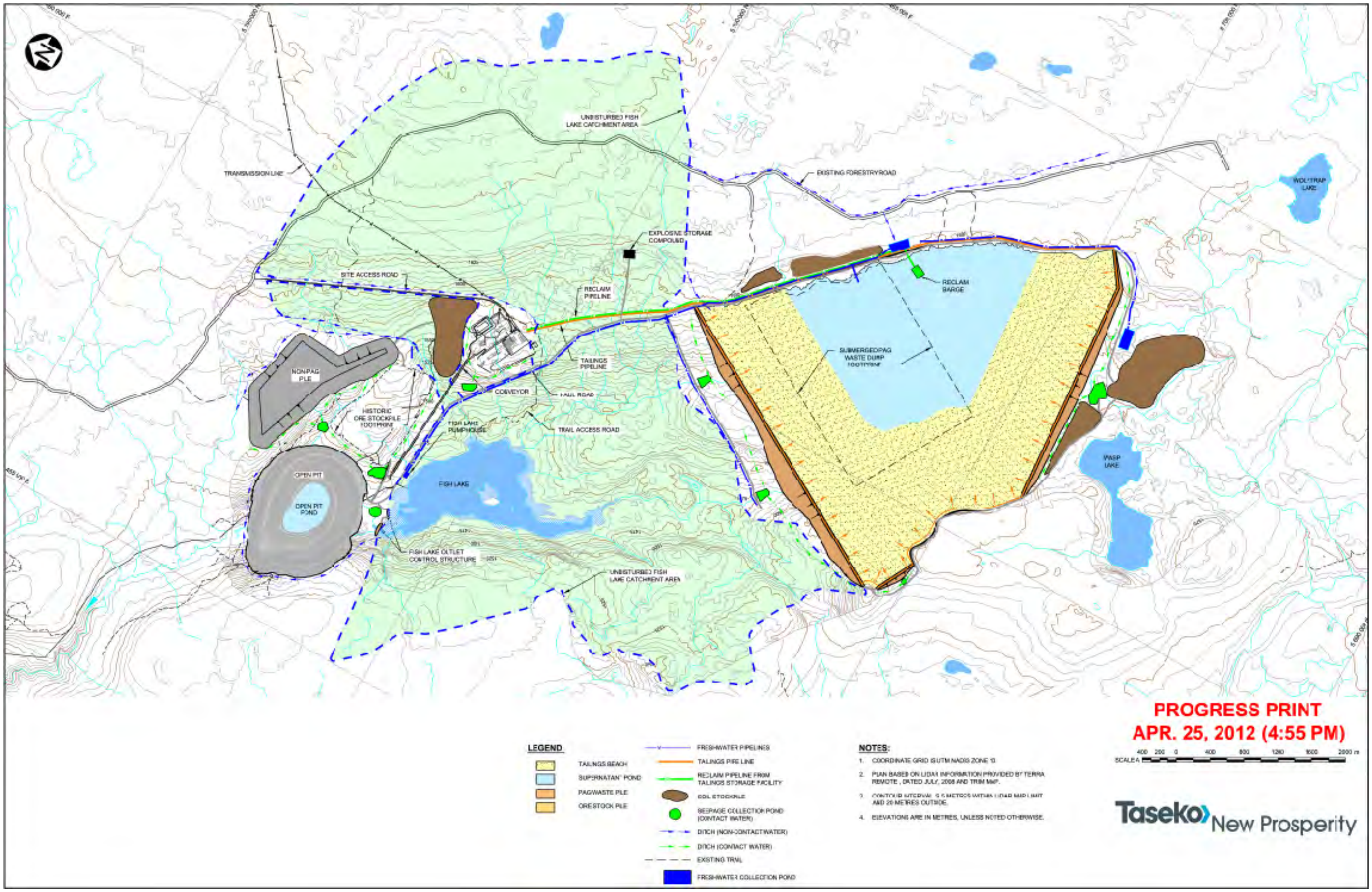


Figure 2.2.5-5 General Arrangement – Water Management Structures

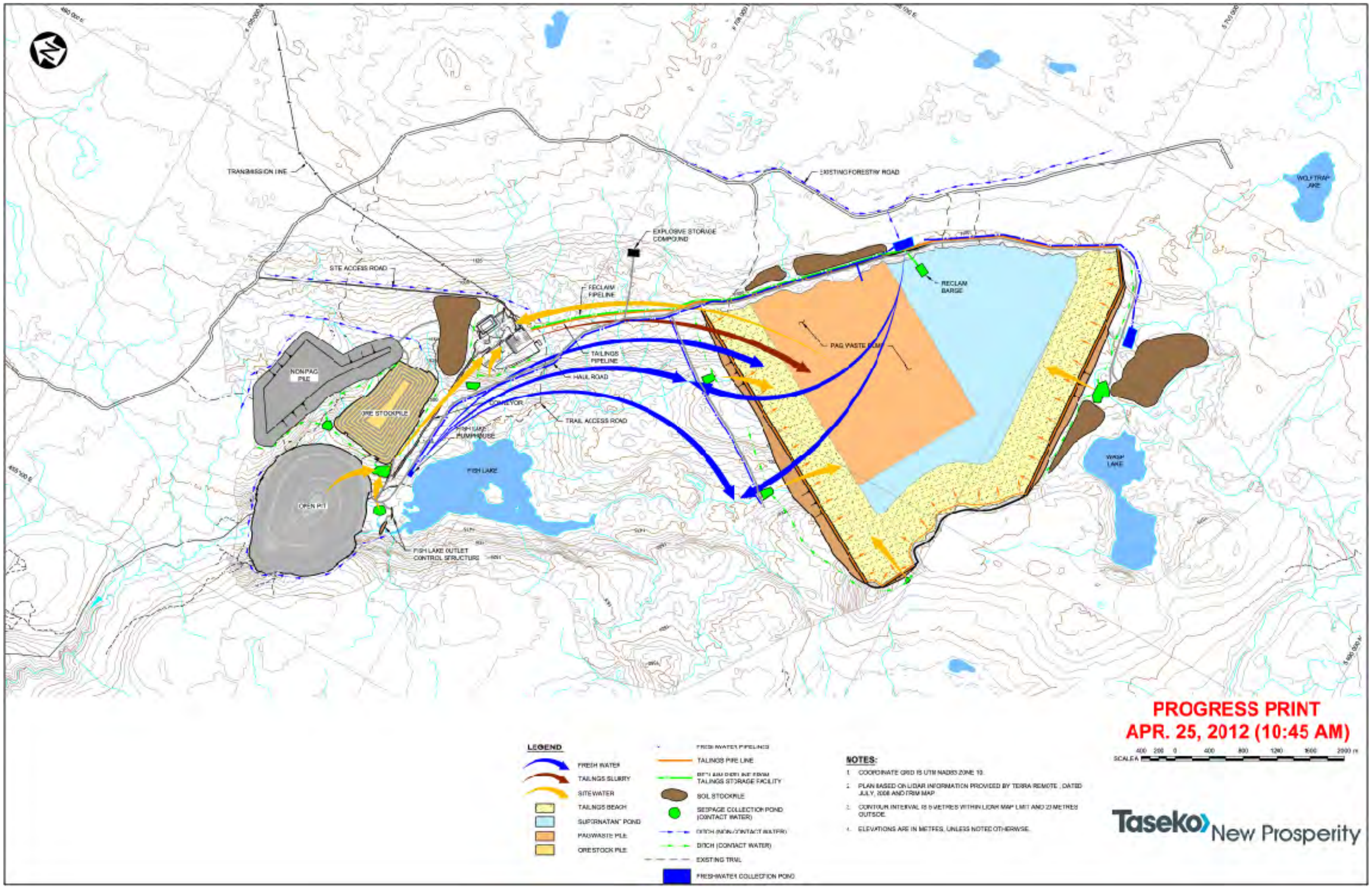


Figure 2.2.5-6 Water Management – End of Year 16

Downstream of the main embankment, further seepage collection measures will be installed in the form of groundwater pumpback wells, located within approximately 100 metres of the toe of the ultimate embankment. The main purpose of the additional seepage control measures at the main embankment is to minimize as much as practicable the volume of seepage reporting the inlets of Fish Lake from the TSF. These groundwater pumpback wells will report to the main embankment seepage collection ponds, which in turn will report to the TSF. Figure 2.2.5-6 presents the Year 16 Operations water management. Furthermore, Section 2.7.2.4 and Appendix 2.7.2.4-B describe all phases of water management in greater detail.

Tailings Storage Facility Design

The TSF is situated approximately 2 km south of Fish Lake. It is made up of three embankments (main, south and west), which will contain all tailings, PAG waste rock/overburden, the supernatant pond, and have freeboard sufficient for the Inflow Design Flood (IDF). A geotechnical site investigation program was conducted to support the design in March and April 2012. Drill holes, test pits and seismic lines along the embankment alignments made up the site investigation program. Appendix 2.2.4-E (2012 Site Investigation Factual Data Report, June 2012) contains all the details related to the 2012 site investigation program.

Previous site investigation programs provided a good basis for developing a preliminary design of the TSF, prior to conducting the 2012 program. Foundation conditions in the area of the south and west embankments were generally understood. Additionally, due to extensive geotechnical drilling in the Fish Creek Valley north of the main embankment, the foundation conditions for the main embankment were assumed to be similar to those of previous studies. However, in order to improve confidence in the parameters used for the design, drilling immediately under the embankments was performed.

Each embankment will be constructed using the centerline method of construction. A typical section through each embankment can be seen on Figures 2.2.5-7 (main embankment), 2.2.5-8 (south embankment) and 2.2.5-9 (west embankment).

Embankment material quantities for each staged raise are provided in Table 2.2.5-2. The table also compares the available construction materials in the open pit to the required volumes at the TSF, on a stage-by-stage basis. As can be seen, sufficient non-PAG waste rock and overburden is available to construct all three embankments throughout the entire life of mine. No additional borrow materials are required to be used to construct the three embankments. However, should suitable borrow materials be located within the TSF basin, they may be used for a portion of the starter embankment construction as a contingency.

The starter embankment will include only the main embankment. In Year 1, the south embankment will begin construction, along with a raise of the main embankment. By approximately Year 7, the west embankment will begin construction. Each staged raise thereafter will see all three embankments raised simultaneously. The filling schedule for the TSF is shown on Figure 2.2.5-10.

Appendix 2.2.4-C contains all information related to the preliminary design of the Tailings Storage Facility. Stability and seepage analyses were conducted for all three embankments, for the starter arrangement, as well as the final embankment heights, and can also be found within this appendix. Furthermore, all foundation preparation specifications, compaction requirements for each zone, and all other design aspects for the proper construction and operation of the TSF can be found in Appendix 2.2.4-C.

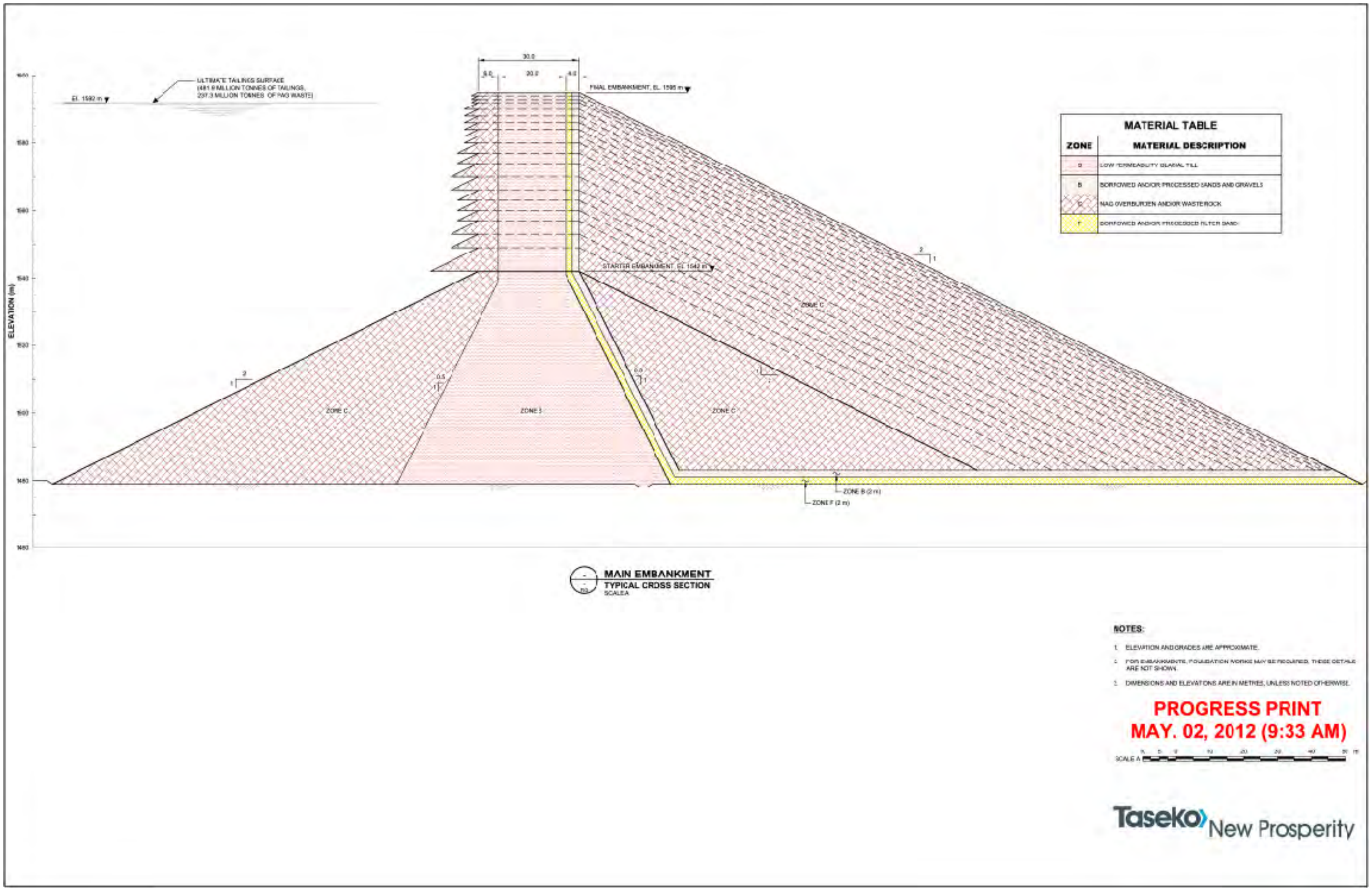


Figure 2.2.5-7 Main Embankment

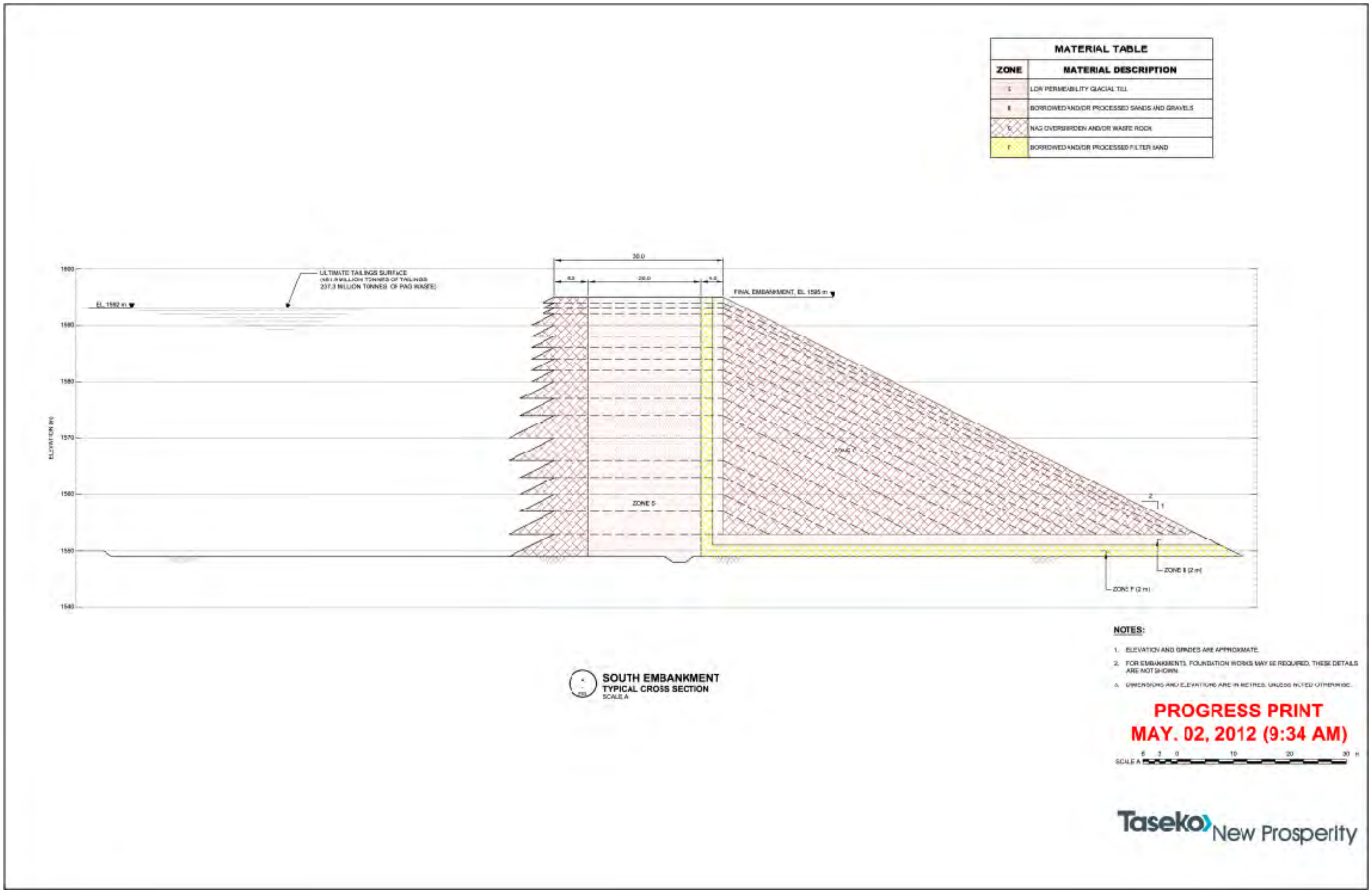


Figure 2.2.5-8 South Embankment

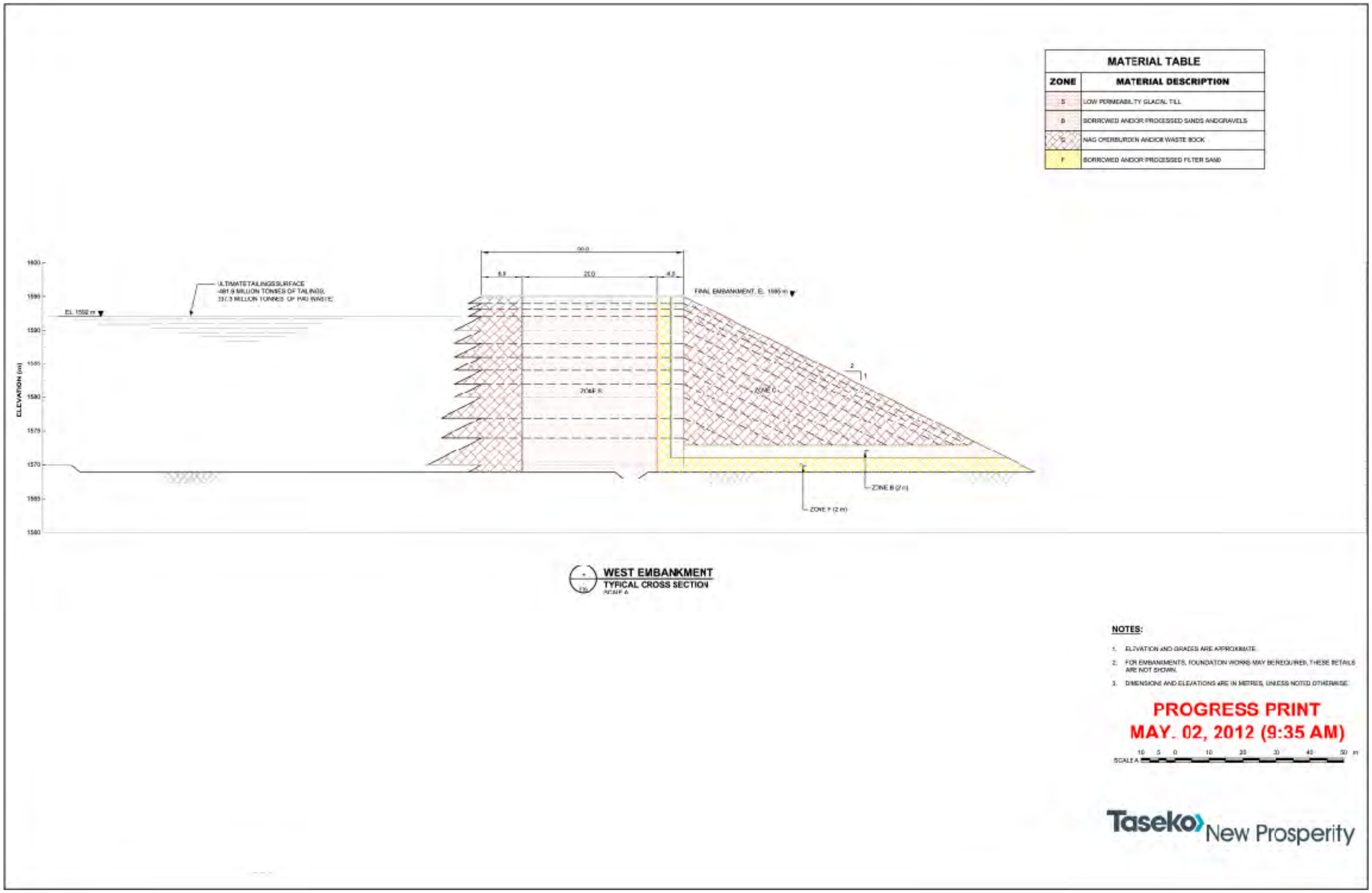


Figure 2.2.5-9 West Embankment

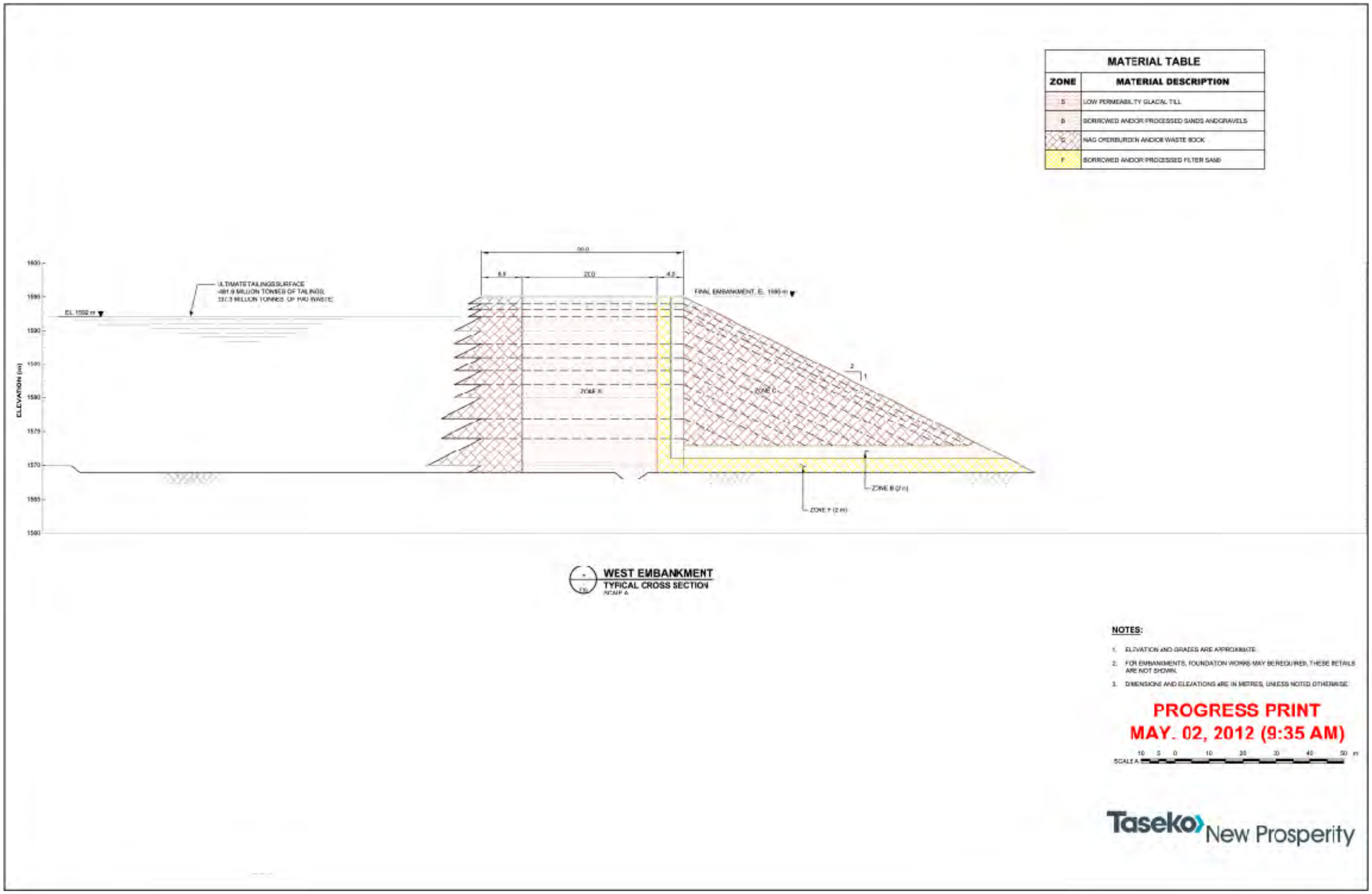


Figure 2.2.5-10 Filling Schedule

Reclamation and Decommissioning Plan –Temporary Closure

In the event of a short-term closure of less than one year, the following actions will be taken to maintain the site:

- Site environmental monitoring and management programs continue as per regular operations without interruption.
- A "care and maintenance" team is retained from the site operations and maintenance personnel which will maintain the site security program, maintain the equipment in an operationally ready state as well as monitor and maintain all site environmental systems.
- Pumping of tailings seepage water and runoff collected from the waste rock/overburden stockpile and ore stockpile will continue as per regular operations.
- Mining equipment will be relocated to the shop area (haul trucks and ancillary equipment) and a marshalling site near the pit rim (drills and shovels) for storage.
- Reagent inventories retained in their original packaging will be assessed to determine which, if any, will be adversely impacted by the expected storage term. Any reagents which will degrade during the shutdown period will be returned to the vendor, sold or disposed of in an approved facility. Any reagents which will remain active for the resumption of operations will be stored in a secure manner.
- Any reagent inventory which has entered the concentrator process and is stored in bulk tanks after cessation of operations will be removed and disposed of in an approved manner.
- Solvent, oil and fuel inventories at the site will be assessed to determine quantities to be retained and consumed during the site care and maintenance activities. The balance will be returned to the vendor or sold.
- Any waste oil and/or grease inventory will be disposed of offsite in an approved facility.
- Inventory of blasting supplies will be assessed and any supplies which will expire during the shutdown period will be returned to the vendor or disposed of in an approved manner. All retained inventory will continue to be held in a secure facility.
- Nuclear sources will be removed from the concentrator density gauges and stored in a secure facility on site as per Canadian Nuclear Safety Commission regulations.
- Any stockpiled ore will remain in stockpile and available as mill feed.
- All of the ore from the coarse ore stockpile will be processed through the mill prior to cessation of mill operations.
- Mill facilities and equipment (including concentrate sheds as well as concentrate and ore handling systems) will be washed down after operations cease. All concentrate will be shipped to market and any excess waste mineral from the cleanup will be impounded in the TSF.
- The TSF will continue to be maintained with required freeboard limits. If an embankment raise is underway at the time of closure and is required to maintain freeboard levels through the temporary closure period, then construction of the embankment raise will be completed.
- Dust from the TSF will be mitigated during dry periods by either wetting the tailings beach with supernatant pond water or implementing alternative methods effective for dust control.

In the event that the short-term closure extends beyond one year with no imminent foreseeable change, the following items in addition to those listed above will be scheduled for action as appropriate for the length of closure anticipated:

- Remaining reagents at site will be returned to suppliers, sold or disposed of in an approved facility.
- Remaining blasting supplies at site will be returned to the vendor or disposed of in an approved manner.
- Fuel and lubricating oil storage at site will be minimized with sufficient supplies maintained at site to support the on-going care and maintenance activities.
- Mobile and stationary equipment will be appropriately prepared and placed into long term storage.
- Freeboard at the TSF will be actively monitored and maintained at safe levels. This will be done either by embankment construction or through storage of excess tailings supernatant in the open pit; or a combination thereof.
- Exposed PAG waste rock/overburden in the TSF will be assessed and an action plan developed appropriate for the length of closure anticipated.
- Existing mitigation measures for dust control may be enhanced by seeding accessible areas of tailings beach.

A description of the conceptual permanent decommissioning and closure plan is located in Section 2.8.2.

2.2.5.1 Process Plant

Primary Crusher, Overland Conveyor and Ore Storage

Ore will be hauled from the open pit mining operation to the primary crushing facilities close to the southeast rim of the open pit. The crusher product will be discharged into a surge bin and withdrawn with an apron feeder onto the overland coarse ore conveyor. A fog system will also be employed at the transfer points below the gyratory crusher to reduce fugitive dust emissions and improve working conditions. A dedicated compressor and air receiver will be situated in the building to provide instrument air as well as air for the dust suppression system. Ore that is hauled from the open pit and will not be brought directly to the primary crusher will be stockpiled in the Ore Stockpile, located northeast of the overland conveyor.

The coarse ore conveyor will transport the ore to a coarse stockpile where it will subsequently be fed to the grinding circuit which consists of SAG and ball mills. It will generally follow existing topography on a prepared gravel bed on an upslope route to the coarse ore stockpile 1.9 km due east. A service road will be provided along one side of the conveyor. In order to reduce dust emissions, there will be a water suppression system at the discharge point of the coarse ore stockpile.

The layout of the Primary Crusher and Overland Conveyor remain unchanged from the previous project proposal. The Ore Stockpile has the same volume as the previous project proposal, but the location and configuration of the Ore Stockpile is different.

Mineral Processing and Concentrator

The plant site location, layout, and design remain unchanged from the previous project proposal. It will be located approximately 2 km east of the primary crusher at a nominal elevation of 1560 m on a relatively flat natural plateau on the east slope of the valley. Primary structures at the plant site will include coarse ore stockpile and reclaim facilities, a concentrator building, a main 230 kV substation, a service complex, and assay laboratory.

Conventional crushing, grinding and flotation will be used to process ore. The concentrator utilizes industry standard unit processes and equipment with a nominal throughput of 70,000 dry tpd housed within an approximately 14,000 m^2 pre-engineered structure. As common with every flotation process, standard chemical reagents will be used to aid in achieving the optimal conditions for the recovery of the desired minerals. The specific chemical reagents have not yet been finalized.

Copper concentrate will be the final product. The plant will operate 24 hours per day, 365 days per year with scheduled downtime for equipment maintenance. The concentrator load-out area will be a slab on grade within the concentrator building. A front end loader will load concentrate trucks positioned on a truck weight scale. The Mineral Processing area remains unchanged from the previously reviewed project.

The concentrator building (13,600 m^2) is a pre-engineered structure divided into three main sections: the grinding section, which houses the SAG and ball mills, the beneficiation section which houses the flotation cells and vertimills, the reagent storage and tailings handling and the concentrate handling section which houses the thickening, filtration and concentrate load out systems. Tailings will be pumped throughout the life of the mine. Reclaim water is pumped from the TSF and stored on site in a process water pond to be used for processing.

Tailings Characterization, Distribution and Impoundment

The tailings from the Project operation will be produced from conventional milling of copper and gold ore. The physical characteristics of the tailings have been obtained using samples from metallurgical test work on drill core assay rejects. The laboratory test work indicated that tailings products from the lower, middle and upper zones of the ore deposit have similar physical characteristics and will be non-PAG. Detailed laboratory testing and chemical analyses for the tailings solids and liquids were carried out as detailed in Section 2.7.2.1.

The TSF for impounding tailings and PAG waste rock/overburden will be located in the Upper Fish Creek valley approximately 2 km south of Fish Lake. The principle objectives of the TSF are to ensure protection of the regional groundwater and surface waters both during operations and in the long-term, and to achieve effective reclamation at mine closure.

The design of the TSF has taken into account the following aspects:

- Permanent, secure and total confinement of all solid waste materials within an engineered disposal facility
- Sufficient capacity and freeboard to store the Inflow Design Flood (IDF)
- Control, collection and removal of free draining liquids from the tailings during operations for recycling as process water to the maximum practical extent
- Collection and pumping of seepage water from each of the Main, South and West Embankments
- The inclusion of monitoring features for all aspects of the facility to ensure performance goals are achieved and design criteria and assumptions are met, and
- Staged development of the facility over the life of the Project.

The overall Project general arrangement is shown on Figure 2.2.5-1. The TSF will be an average of 4 km long by 3 km wide with a footprint of approximately 1200 ha.

PAG waste rock and overburden that is deemed to have the potential to generate acid drainage will be stored under water within the tailings storage facility. The TSF is designed to provide environmentally secure storage for co-disposal of approximately 477 Mt of tailings and 237 Mt of PAG waste rock/overburden.

As a result of the embankment elevations relative to the concentrator, tailings will be pumped from the onset of operations. Tailings pipelines will convey tailings along all three embankments, allowing the tailings to be spiggoted from the north, west and south parts of the TSF.

Non-PAG waste rock, glacial till and overburden will be used to build the TSF embankments in stages throughout the life of the Project from stripping operations at the open pit. The Main Embankment will be located in the Fish Creek Valley; the West Embankment will be constructed along the western ridge which separates the Fish Creek drainage basin from the Big Onion Lake drainage basin; and the South Embankment will be constructed across the Fish Creek Valley between Little Fish Lake and Wasp Lake. All three embankments will be constructed as water-retaining structures. Seepage losses will be returned to the TSF via a seepage collection and recycle system.

Much of the site is blanketed by surficial glacial till and a complex series of basalt flows, lacustrine units and lesser fluvial deposits. The glacial till is typically located within the valley bottom and lower valley slopes and ranges in thickness from 2 m to greater than 10 m. The surficial glacial till unit will provide a suitable, low permeability foundation for the tailings facility. All organics and soft, wet material will be removed from the tailings embankment footprints prior to fill placement.

In accordance with international and standard industry practice, stability analyses will be carried out to investigate the stability of the embankments under both static and seismic conditions as part of the permitting process. Analyses will be conducted to satisfy safety requirements and to indicate that the proposed design is adequate to maintain both short term (operational) and long term (post-closure) stability.

Process Water Supply and Distribution

The Process Water Pond will have a total storage capacity of 110,000 m^3 and will be supplied by three sources:

- Pit dewatering, depressurization wells, horizontal drains
- Surface runoff from the ore and non-PAG waste rock/overburden stockpiles, and
- The tailings supernatant pond reclaim.

A cast-in-place concrete outlet structure in the process water pond with a manually controlled sluice gate will discharge water by gravity through a buried HDPE pipe into the concentrator building. Process pumps will boost the pipeline pressure for distribution and use in the building.

Fresh Water will be supplied by:

- Deep Aquifers – As part of the pit dewatering system, depressurization wells in the deep water aquifer will be installed to intercept flows entering the pit. This water may also be used as potable water.
- Sediment Collection Ponds – Runoff from the plant site and open pit, as well as the non-PAG waste rock/overburden and ore stockpiles flow into a number of sediment collection ponds. These ponds can be used as a source for fresh water as the solids will settle.

These two fresh water sources will discharge into the fire/fresh water tank at the concentrator. The top 420 m^3 in this tank is available for fresh and gland water use. Pumps will draw water from the tank and distribute through gland and fresh water service loops in the concentrator building. A buried HDPE water main will convey freshwater to locations outside the concentrator building, where it is required. There have been no changes to process water supply and distribution since the previous project proposal with the exception of the location of the TSF and reclaim water line.

Potable Water Supply and Distribution

Potable water will be supplied by three proposed wells along the south perimeter of the ultimate open pit. The estimated capacity of each well is 12 m^3/hr. These wells will initially be the source of the project site potable water supply and will function to depressurize the open pit walls as the pit deepens.

The depressurization wells will be installed early in the Project so that they can provide potable water during the construction phase. The estimated daily potable water demand during construction will be 200 m^3 which is based on a maximum work force of 800 people. During operations, the estimated daily consumption will be 100 m^3, which is based on an average on-site work force of 400 people.

The wells will be connected to a common pipeline which will be buried below grade to the construction camp. The depth of burial will be sufficient to provide protection from freezing and vehicle traffic. Initially, this pipeline will be connected to the construction camp temporary water storage and distribution system.

A small demand for potable quality water will be required at the explosive manufacturing plant area. A stand-alone groundwater well will be installed at that location.

For overall operations, a permanent potable tank will be installed near the concentrator building. The vertical, field erected steel tank will have a nominal capacity of 150 m^3. Upon commissioning, the potable water well supply pipeline will be re-directed from the camp and connected to the permanent tank. Prior to discharging into the tank, the water will be treated by a calcium hypochlorite addition system with a small mix tank and a metering pump.

Potable water pumps in the concentrator building will draw water from the tank for distribution:

- Through a pipe loop in the concentrator, and
- Through an underground main to the outside structures on the mill site.

The main will be HDPE pipe and will be buried a minimum of 3 m for frost protection. The outside structures serviced by this buried network will be the operations camp, service complex, and assay laboratory.

Some areas requiring potable water will not be connected to this mill site underground system because their demand is small and remote from any potable water main. These areas include the primary crusher, the concrete batch plant and the gatehouse at the mill site entrance. They will have bottled potable water for drinking. There have been no changes to potable water supply and distribution since the previous project proposal

Plant Site Runoff and Sediment Control

The Plant Site will be graded to direct precipitation and snowmelt runoff towards ditches throughout the Plant Site area, and towards sediment control ponds located at low points throughout the site. A main sediment control pond will be located to the west of the Plant Site, where all collected runoff will ultimately be directed. Contact water from this pond will be directed to the process water pond for use in the concentrator. The objective of the runoff and sediment control features is to contain contact water and utilize it in the milling process. There have been no changes to management of runoff and sediment for the Plant Site since the previous project proposal.

Spill Prevention and Response

The objective of the Spill Prevention and Response Plan will be to promote the prevention of the accidental release of harmful substances into the receiving environment and, in the event of a spill, to provide adequate information to guide the response crew to safely, efficiently and effectively respond to and clean-up a spill. The Spill Prevention and Response Plan will be designed to prevent spills through the development of procedures in the transfer, handling and storage of fuel and other hazardous products and wastes, plus awareness training in these procedures. Prevention will be further supported by regular environmental site inspections and written assessments.

In the event of a spill, the Spill Prevention and Response Plan will incorporate a spill response action plan that will detail how to manage a spill, depending on the product that was spilled, the quantity spilled and the location of the spill. The Plan will maintain a list of products that are used at, and transported to and from, the mine site. For each product a data sheet will be available in the Plan that documents the physical and chemical properties of the product, safety measures related to that product such as personal protective equipment, and methods for containing and removing the product if spilled, plus the storage, transfer and disposal of the spilled product.

The Spill Prevention and Response Plan will also provide details related to the structure of the spill response team, and the duties and responsibilities of each individual on that team, including the responsibilities of the person who discovered the spill. Contact lists for persons/agencies to notify in the event of a spill, from corporate, to government, to clean up contractors and suppliers, to neighbouring dwellings/communities, will also be a component of the Plan.

Other components of the Plan will include an inventory of the location of spill response kits and their contents, the policy on reporting spills, and a spill response form that will form the written documentation and recording of spills.

Lastly, the Plan will dictate that emergency response personnel receive spill response and cleanup training from a qualified instructor. Greater detail of this plan, as well as all Environmental Management Plans, can be found in Section 2.8.1.

Site Water Balance

An operational water balance was completed to aid in water management, to estimate contingency process/supernatant pond water requirements, and to estimate when the TSF and Open Pit will begin to overflow in closure and post-closure, respectively. Section 2.7.2.4 provides a greater level of detail about the site water balance.

The water balance was completed on a monthly basis for a 100-year period using GoldSim®, a dynamic probabilistic simulation model used extensively for mine site water management applications. GoldSim® permits inputs to be entered as probability distributions rather than discrete values, performs Monte Carlo simulations, tracks outputs from those simulations and provides a graphic interface to facilitate the review and identification of interactions between components.

In order to address the potential variability of climatic conditions, a stochastic version of the water balance model was used, which involved Monte Carlo type simulation techniques and the modelling of monthly climatic parameters as probability distributions, rather than simply as mean values.

Model results were used to determine the likelihood of having a surplus and/or deficit of water in the TSF. Figure 2.7.2.4A-10 presents the range of possible cumulative pond volumes available in the TSF over the life of the mine, as defined by the 95th percentile values (5% chance of being equalled or exceeded in any year). This range of volumes can also be thought of as the required active, or “live”, storage capacity of the TSF pond for a reasonably large range of anticipated climatic conditions.

The system (including the TSF, Open Pit, water pumped from Fish Lake outflows and contributing catchments) is able to supply enough water to meet the process water mill requirements throughout the mine life, for all scenarios.

Waste Water (Sewage) Management

Sewage from the mill site and camp areas will be collected by a gravity sewer system, and will be conveyed to a sewage treatment plant. One sewage treatment plant (STP) will be used to service the mine during the construction phase and continue for operation. The maximum capacity of the plant will be based on a maximum workforce of 1000 during construction. Sewage treatment will be by a packaged Rotating Biological Contactor (RBC) unit, which will include:

- Flow equalization
- Primary settlement
- Sludge storage
- RBC unit
- Final clarifier
- Chlorine contact chamber, and
- Effluent pump chamber.

The STP will be located at the west end, low side, of the mill site, well away from the camp and other occupied areas. The STP will be partially buried to permit gravity feed of the influent and will include:

- Buried concrete slabs for anchoring tanks
- Easy accessibility from grade for inspection and maintenance of unit
- Heating and lighting, and
- An alarm to signal loss of rotation.

During construction, the treated effluent discharge will be pumped to a tile field or lagoon. Prior to any construction, tile field design and location will be verified by field percolation tests. The tile field has been proposed because it is regarded as a favourable method of disposal by permitting authorities.

Once the mine is operational, the treated STP effluent will be discharged to the TSF. A buried pipeline will discharge the effluent into the gravity section of the tailings pipeline near the concentrator building. At that time, the chlorine contact chamber will be activated because the effluent will become part of the reclaim water from the TSF.

Sewage from the washroom facilities that are remote from the mill site gravity sewer system will be directed to nearby sewage holding tanks. These tanks will be emptied at regular intervals and their contents treated at the mill site STP.

There have been no changes to waste water management since the previous project proposal

2.2.5.2 Maintenance, Administration and On-Site Support Facilities

There are a number of ancillary facilities that exist throughout the project site to support the mining of the ore body. A description of each facility or component is listed below:

Other Infrastructure

Administration and change house facilities will be located south of the Concentrator Building. The facilities will be contained in pre-fabricated units. Workers will reside in an on-site camp. The construction camp will be located adjacent to the south side of the mill site. The construction camp will be constructed in stages in order to accommodate the build-up of personnel from the early stage of construction activity to the estimated peak of 1000 during construction. The camp accommodation units and services will be expanded as additional beds are needed. The construction camp to house construction personnel will gradually be turned over to the mine operations as construction activities wind down.

The truck shop and maintenance facilities will be housed in a pre-engineered building located next to the Administration Building and south of the Concentrator Building. The assay and environmental laboratory will be located in a separate building near the service complex. The laboratory will be a pre-engineered single level building and will contain all the assaying and environmental sampling and testing facilities plus associated offices for the laboratory personnel. The warehouse will be located immediately south of the Concentrator Building in a stretch fabric structure. All components, features and activities associated with other infrastructure are the same as those described in the previously assessed project.

Explosives Manufacture and Storage

The mining process requires the use of explosives to break apart the rock in the open pit for recovery of the ore for processing and separation from the surrounding waste rock. Due to the large volumes of explosive required and the remote location of the mine site, explosives will be manufactured at the mine site. Taseko is responsible for the safe management of explosives on the site. This will include any tasks contracted out to a third party.

During the construction phase, Bulk Explosive products may be transported from existing explosive facilities at the Gibraltar Mine. The activity will continue until the permanent facility is constructed and commissioned at New Prosperity. The Explosives Storage compound at New Prosperity will include a number of buildings including a fully contained manufacturing plant, storage tanks and silos and plant services.

The location for the Explosives facility for the New Prosperity Project can be seen on Figure 2.3. The final configuration and detailed design of the structures on the compound site will be completed as part of the permitting process. The Explosives facility for the New Prosperity Project has been relocated relative to that described in the previously assessed project as a result of the revised stockpile locations but the features, activities and volumes of explosive material for the New Prosperity Project are the same as those described in the previously assessed project.

Communications

Telephone and facsimile communications from the Project site will be via microwave. Radio and internal telephone communications system will be provided from the administration office area to all remote locations on the network. All components, features and activities associated with communications are the same as those described in the previously assessed project.

Plant Power Distribution

The plant substation is designed with a single 3-phase 100/133 MVA transformer (230/25 kV) and associated high voltage switch gear circuit breakers and isolation capable of meeting the peak plant power demand requirements. The secondary of the main step down transformer feeds a 25 kV switch gear line up which feeds the various plant areas. Each of the 25 kV breakers feed 7.5/10 MVA transformers which set the voltage down to 4160 V to feed plant motive loads at this voltage level and further step down transformer/switchgear unit substations at the 600 V level. Emergency power will be provided by standby diesel generators. . All components, features and activities associated with the plant power distribution are the same as those described in the previously assessed project.

Fish Lake Water Supply and Distribution

Fish Lake will have a collection and distribution system to manage outflows from the lake, as well as capture non-contact water from the Fish Creek valley, directing flows to the inlet channels of the lake (see Figure 2.2.5.2-6). The lake outflows will be managed by a pumping system located at the northern end of the lake, with water conveyed in a pipeline and released to the inlet channels of the lake, immediately downstream of the TSF Main Embankment. Excess flows not needed for the inlet channels will be directed to the TSF. Two non-contact water ponds, located east and south of the TSF, will capture water in the undisturbed catchments surrounding the TSF. Pumping systems located in each pond will direct water to the inlet channels of the lake, immediately downstream of the TSF Main Embankment. Section 2.7.2.4 and Appendix 2.7.2.4-B provide detail about the Fish Lake water management for all phases of the Project, from construction through to post-closure, inclusive of volumes of water collected, diverted, pumped and recirculated for the Fish Lake Water Supply system.

2.2.6 Project Development Schedule

Development Schedule and Activities

The construction, operation, and reclamation aspects of the New Prosperity Project are divided into four main phases for purposes of the environmental assessment:

- Construction starts with the issuance of appropriate permits to start development and ends at that point at which the concentrator reaches commercial production. This spans a period of roughly two and a half years.
- Operations begin at this point and continue for approximately 20 years until no tailings are generated by the concentrator. Some reclamation activities begin during this operational period.
- Closure begins at the cessation of tailings production and continues until the open pit begins to discharge water to lower Fish Creek approximately 24 years later. Decommissioning of site infrastructure and reclamation are completed early in this time frame. Closure is further subdivided into two phases. Phase 1 starts with cessation of tailings discharge and lasts until water quality from the TSF is suitable for discharge to Fish Lake. For purposes of water quality modelling this has been assumed to occur approximately 10 years into closure but water management infrastructure inherent in the design can accommodate any changes in timing. Phase 2 begins when the TSF discharges to the Fish Lake tributaries and the south and west embankment seepage collection ponds discharge to the environment.
- Post-closure begins when the open pit has filled with water and begins to discharge to Fish Creek. Activities in this period are all related to environmental monitoring and follow-up. This period will continue until all conditions of the *Mines Act*, Reclamation Code, and permits have been fulfilled and Taseko has been released from all obligations under the *Mines Act*. Environmental monitoring is a key activity that occurs throughout the entire life of the Project as outlined in the Environmental Management Plan.

Construction Phase

The main activities in the construction schedule are summarized in Figure 2.2.6-1. The yellow bars in the figure represent continuous activities while the beige bars represent discontinuous activities or those activities which will be conducted at some time within the indicated time span. A brief description of these activities follows.

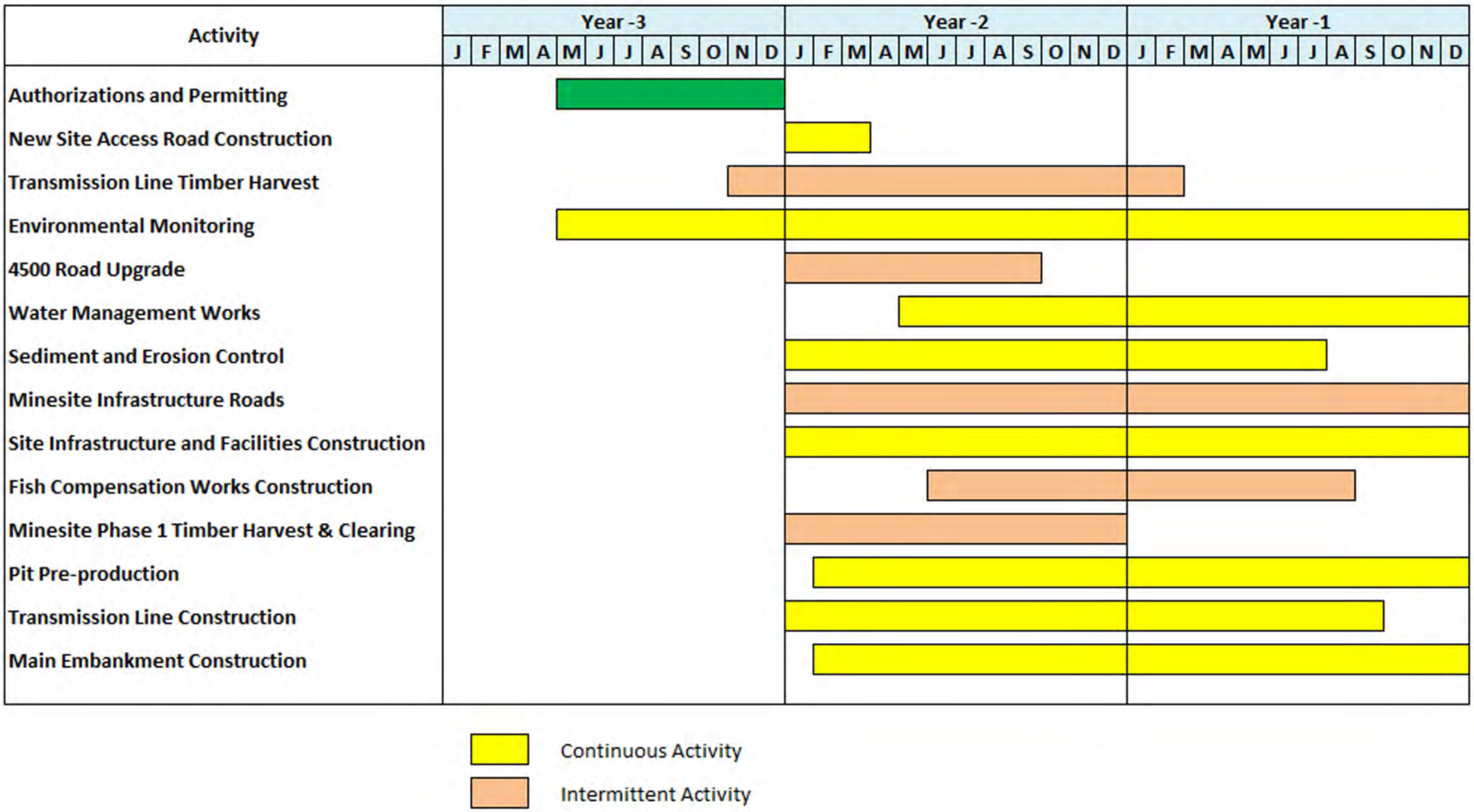


Figure 2.2.6-1 Construction Phase Schedule

The development of the new site access road will start as soon as permitting is in place. The pilot road will be roughed into the plant site and access developed within the mine site footprint to allow Phase 1 timber harvesting and access for initial equipment for bulk earthworks.

The extent of harvesting, grubbing and clearing in Phase 1 will be sufficient to allow water management works, pit pre-production, site infrastructure development, tailings main embankment construction, stockpile development, and tailings deposition for several years. The limit of work completed in Phase 1 will be a balance between maximizing deteriorating forestry values due to Mountain Pine Beetle infestation, operational needs, minimizing premature disturbance, and compliance with an approved closure plan.

Upgrading of the new site access road, 4500 Road, and development of site infrastructure roads will start as soon as road construction material is accessed within the mine site area.

Priority site infrastructure roads will include access to the main embankment site and to the open pit. All roads will be built in accordance with the Forest Practices Code, Forest Road Engineering Guidelines.

Priority site infrastructure development will be the plant site area to establish drainage and foundation preparation for the camp, followed by laydowns, an equipment maintenance area, and other infrastructure as outlined in Section 2.2.5.

Concurrent with bulk earthworks at the plant site and primary crusher will be the preparation of the water control structure and systems for the control of Fish Lake outflow and initial pit pre-production activities.

Two small earthfill flood control dams will be constructed at the outlet of the lake to enable controlled discharge around the pit pre-construction area and eventually pumping of Fish Lake outflow to the inlets of Fish Lake and the TSF.

Once the water flows are controlled around the main tailings embankment footprint construction of the main embankment can begin as outlined in Section 2.2.5. A borrow pit within the limits of the TSF may be used for initial construction materials, but the majority of construction materials are assumed to be derived from the pit pre-production.

Initial pit pre-production activities will be limited to the higher ground east of Fish Creek. An initial sediment control system will be established to protect Fish Lake and the creek. Pit pre-production activities will include development of initial pit benches in the starter pit, TSF haulage road, ore and waste rock/overburden haulage roads, waste rock/overburden and ore stockpiles, establishment of the pit dewatering system, and installation of the pit power distribution system.

The timing of the transmission line timber harvest will be based on optimizing contractor efficiency, mitigating any sensitive biophysical constraints and ensuring harvesting does not delay line construction. This may not be a continuous activity but staged to accommodate seasonal or environmental constraints.

Transmission line construction will be complete approximately 3 months before commissioning. The timeline allows for winter construction if required for any ecosystem constraints. The Dog Creek switching station construction and line reinforcement will be completed by BC Hydro prior to infrastructure commissioning.

Fish compensation works and activities will commence during the construction phase as well.

Operations Phase

The main activities in the operations phase are included in Figure 2.2.6-2. A brief description of these activities follows.

The phasing of the open pit simply involves the sequential enlarging of the surface expression of the open pit in a radial fashion until completion of mining activities in the pit. This is done in order to delay the removal of waste material until required to access ore at lower levels. There is no change in other surface mining activities beyond the timing and distribution of material to designated stockpiles and TSF construction.

Construction of the main embankment continues through Year 18. Construction of the south embankment begins in Year 1 and continues through Year 18. Construction of the west embankment begins in Year 7 and continues through Year 18. Construction is expected to be a seasonal activity as required to maintain the embankments at an elevation consistent with the design criteria.

Processing of ore continues into Year 20 with the introduction of remaining stockpiled ore in Year 17.

There is the potential to delay logging and clearing within the ultimate disturbance area of the tailings storage facility dependant on the extent of harvesting, grubbing and clearing completed in Phase 1 timber harvesting. The distribution of work between Phases 1 and 2 timber harvesting will be a balance between maximizing deteriorating forestry values due to MPB infestation, operational needs, minimizing premature disturbance, and compliance with an approved closure plan.

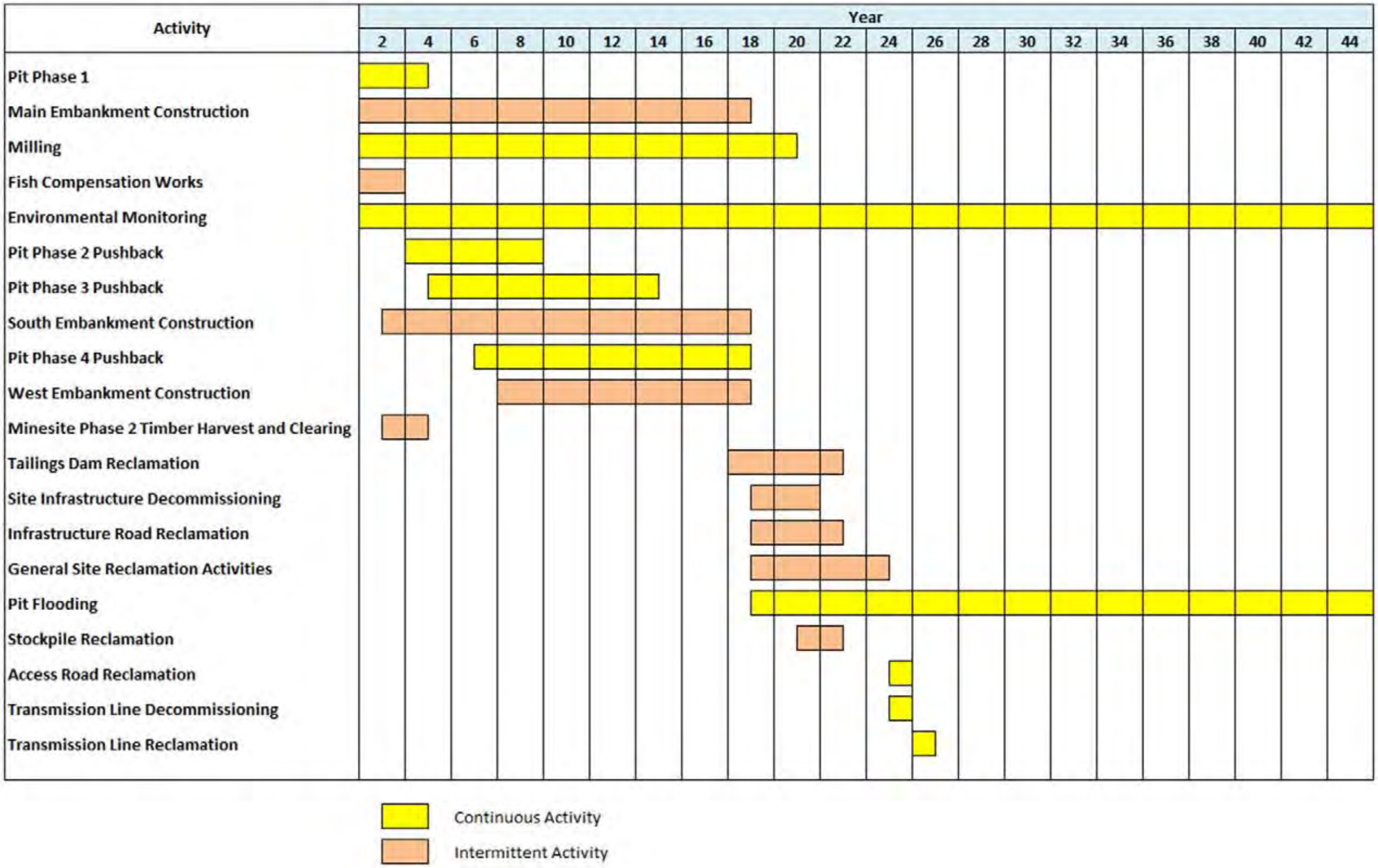


Figure 2.2.6-2 Operations and Closure Schedule

Closure Phase

Intent

The general concept applied to project reclamation and end land use is that reclamation will be conducted with the goal of establishing equivalent post-mine capability for a variety of end land uses. Ecosystem variety and vegetation dynamics will ensure that the post-closure landscape is capable of productively supporting a range of simultaneous uses similar to pre-development conditions, where primarily forested ecosystems provided a range of values from wildlife habitat to recreational fisheries. Thus, the primary focus of the reclamation program is to foster a return to appropriate and functional ecosystems, supported by soil salvage and replacement strategies that ensure this is possible. The focus of the reclamation program will be to establish self-sustaining vegetation and wildlife species habitat. The reclamation planning for the water features and riparian zones has been designed to create productive rainbow trout habitat for a potential recreational fishery.

Conceptual Closure Plan

The general sequence and timelines for closure activities are included on Figure 2.2.6-2. Conceptual mine site features at closure are depicted on Figure 2.2.6-3; however, boundaries of some features such as the tailings beach and the stockpiles may change during detailed design and permitting, and in consideration of avoiding significant archaeological sites. Site features at closure will include:

- The Pit Lake, which will fill the open pit
- The non-PAG waste rock/overburden stockpile and ore stockpile footprint
- The main, south, and west tailings embankments
- The tailings beach, and
- The TSF Lake with submerged PAG waste materials.

Estimated maximum depths of each of the water bodies are:

- Pit Lake at Open Pit – 500 m
- Fish Lake 13 m (no change from baseline conditions), and
- TSF Lake – 7 m.

Upon cessation of mining activities, the open pit will fill to its designed spill elevation over a period of approximately 28 years, releasing water into the lower Fish Creek in Year 45.

The mill and crusher sites will be completely dismantled upon closure of the mine. All buildings not required for long-term closure will be removed and foundation footings broken down to ground level in preparation for soil cover and revegetation treatments. Components of the buildings that have value will be sold, with the remainder of the materials either recycled or disposed of on-site using the designated dry landfill.

The transmission line will be decommissioned, dismantled, and reclaimed.

During the final months of operations, the supply and demand of chemicals and reagents used for the daily mining and milling activities will be monitored carefully, so that the smallest volume will remain when operations cease. Any residual products will be packaged appropriately and shipped back to the supplier. Alternatively, other mine operations that may be in closer proximity to the New Prosperity property could use these products for their continuing operations.

Used oil and oil filters will be collected and recycled off site as part of the operational phase. During the closure phase, trucks and other equipment will be required for reclamation, and this procedure of collecting and recycling will continue until all closure activities have been completed.

General aspects of the closure plan for the tailings storage facility include:

- Selective discharge of tailings around the facility during the final years of operations to establish a final tailings beach that will facilitate surface water management and reclamation.
- Pumping of the excess water from the supernatant pond to the pit for the duration of Closure Phase 1 . (until such time as water quality permits discharge to the environment).
- Pumping of the south and west seepage collection ponds to the TSF for the duration of Closure Phase 1 (until such time as water quality permits discharge to the environment).
- Pumping of the main embankment seepage collection ponds and wells to the pit until such time as water quality permits discharge to the environment.
- Dismantling and removal of the tailings and reclaim delivery systems and all pipelines, structures and equipment not required beyond mine closure.
- Construction of an outlet channel/spillway at the east abutment of the Main Embankment to enable discharge of surface water from the TSF to Fish Lake inlets at the start of Closure Phase 2.
- Removal of the seepage collection systems at such time that suitable water quality for direct release is achieved.
- Dismantling and removal of the water management infrastructure at the Fish Lake outflow at the start of Closure Phase 2.
- Removal and regrading of all access roads, ponds, ditches and borrow areas not required beyond mine closure.
- Long-term stabilization of all exposed erodible materials.

The roads, plant site facilities, and decommissioned water management structures will be reclaimed through replacement of windrowed soil. The overburden dump, tailings beach and tailings embankments will be reclaimed through placement of salvaged and stockpiled soil.

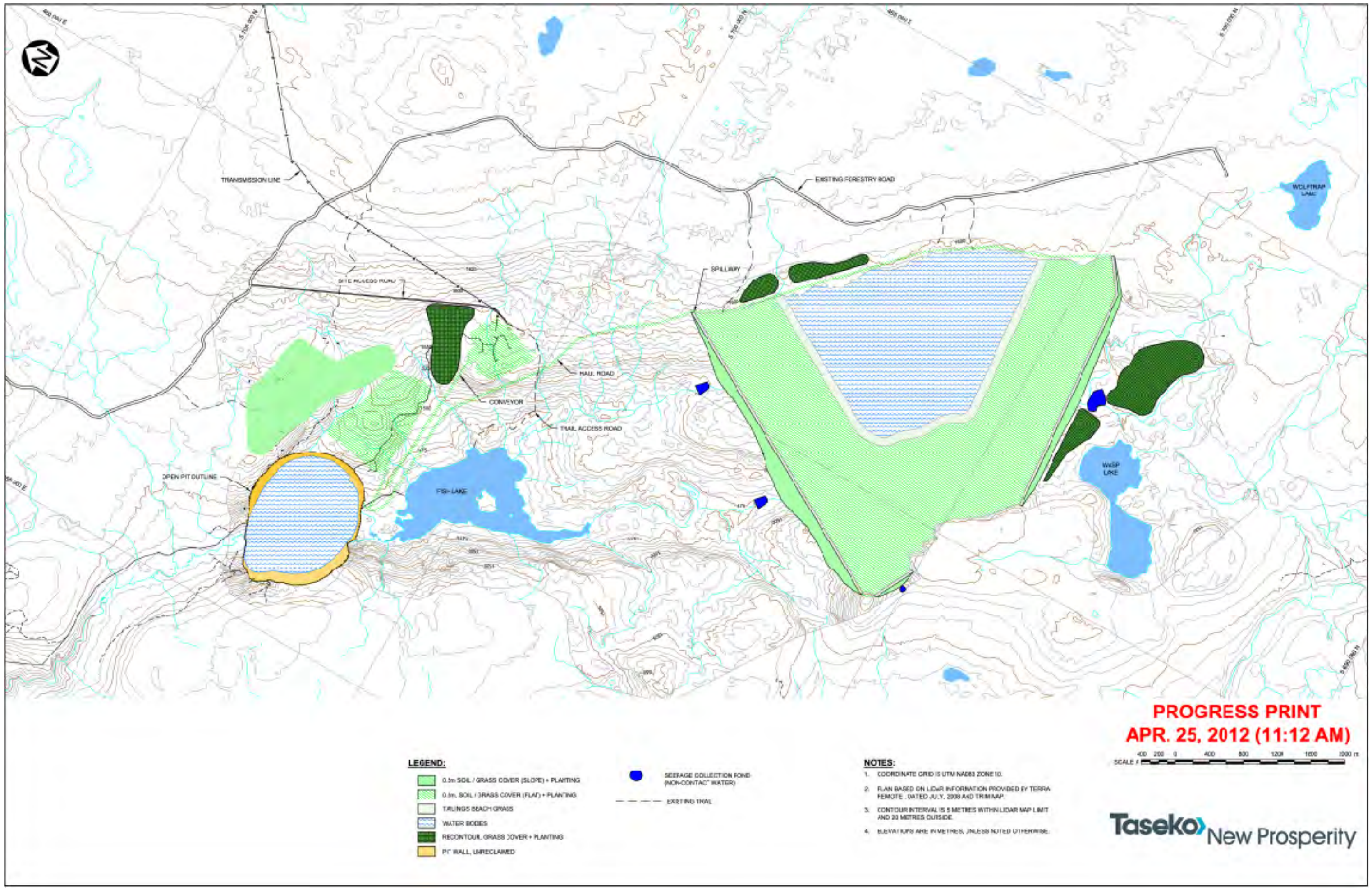


Figure 2.2.6-3 Conceptual Reclamation Plan

If any road access is required within the mine project areas after closure, these roads will be left in semi-permanent deactivated condition. Semi-permanent deactivation will allow the road to remain in place and be useable but also environmentally stable. Semi-permanent deactivation measures to be carried out include: removal of culverts and replacement with cross-ditches; installation of ditch blocks at cross ditch locations; installation of waterbars across the road to direct road surface water off the road; removal or breaching of windrows along the road edge; outsloping / insloping of the road surface as appropriate; and revegetation of exposed soil surfaces for erosion and weed establishment control. General reclamation practices and reclamation monitoring are described in Section 2.8.2.

Premature Closure

A discussion of premature closure is found in Section 2.2.5.

Post-closure Phase

Taseko will be responsible for all environmental monitoring and reclamation programs until such time as all conditions of the Mines Act, Reclamation Code, and permits have been fulfilled and Taseko has been released from all obligations under the Mines Act.

If any post closure activities are required they may include a continuation of environmental monitoring conducted during the history of the Project. These might include:

- Periodic inspection of the TSF embankments
- Evaluation of water quality and flow rates
- Fish and aquatic life monitoring, and
- Soil and vegetation monitoring.

2.3 PROJECT SCOPING

Overview of Approach

The Act defines the "Environment" as:

- The components of the Earth, and includes:
  1. Land, water and air, including all layers of the atmosphere
  2. All organic and inorganic matter and living organisms, and
  3. The interacting natural systems that include components referred to in paragraphs (a) and (b) (Section 2(1)).

The Act defines "environmental effect", in respect of a project, as:

a. Any change that the Project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act;*

b. Any effect of any change referred to in paragraph (a) on

   i. Health and socio-economic conditions

   ii. Physical and cultural heritage

   iii. The current use of lands and resources for traditional purposes by aboriginal persons

   iv. Any structure, site or thing that is of historical, archaeological, paleontological or architectural significance

c. Any change to the Project that may be caused by the environment whether any such change or effect occurs within or outside Canada.

The environmental assessment focuses on specific environmental components (called Valued Ecosystem Components) that are of particular value or interest to regulators and other stakeholders. Ecosystem components typically are selected for assessment on the basis of regulatory issues and guidelines, consultation with regulators and stakeholders, field reconnaissance, and professional judgement of the study team. Where a VEC has various components that may interact in different manners with the Project, the environmental assessment may consider the effects on individual Key Indicators (KIs), as well as VECs.

The term "impact" refers to the aspect of the Project infrastructure, action or activity that is likely to result in an environmental effect on the environment.

The environmental assessment methods address both project–related and cumulative environmental effects. Project-related environmental effects are changes to the environment that are caused by a project or activity arising solely as a result of the proposed principal works and activities, as defined by the scope of the Project. Cumulative environmental effects are changes to the environment that are caused by an action associated with the Project under review, in combination with other past, present and future projects and activities.

Project-related environmental effects and cumulative environmental effects are characterized sequentially. The Project-specific environmental effect is discussed first, having regard to mitigation measures proposed in this EIS or developed subsequently as a result of the EA process that help to reduce or avoid Project impacts that could result in this environmental effect. A cumulative environmental effects screening is then conducted for any residual environmental effect to determine if there is potential for a cumulative environmental effect as referenced in CEAA.

The significance of any residual adverse environmental effects for both project related and cumulative effects is then assessed having regard to the CEAA Reference Guide: Determining Whether A Project is Likely to Cause Significant Adverse Environmental Effects - The Requirements of the Canadian Environmental Assessment Act (http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=D213D286-1&offset=2&toc=show). In addressing what might constitute a significant adverse effect the following factors are considered: magnitude, likelihood, geographic extent, duration and frequency, reversibility, ecological context, and likelihood.

More specifically, the environmental effects assessment approach used in this assessment involves the following four steps.

1. Scoping of the overall assessment. This is discussed in greater detail in the balance of Section 2.3.,
2. Characterization of Project-related Environmental Effects. This is discussed in *Section 2.7.1.1.*
3. Characterization of Cumulative Environmental Effects. This is discussed in Section 2.7.1.4.
4. Assessment of Significance. This is discussed in Section 2.7.1.5.

2.3.1 Scope of Project

The Project as proposed would involve a large open pit mine development with a 20 year operating life. Typical large-scale open pit mining equipment and conventional copper porphyry flotation processing would be used. In addition to the mine and associated tailings storage facility (TSF) and ore and waste rock storage areas, the Project includes development of an onsite mill and support infrastructure, a 125 km long power transmission line, a 2.8 km mine access road to connect to existing logging roads and highways and transport of concentrate to the existing Gibraltar Mine Concentrate Load-out Facility near Macalister, 54 km north of Williams Lake. A complete description of the Project is provided in Section 2.2.3.

The scope of project includes all four elements (mine site, transmission line, access road and concentrate load-out), the components, features and activities described in Section 2.2.3. As detailed in the EIS Guidelines while this EIS will assess the potential environmental effects of the Project and identify the significance of any adverse residual effects, the focus of this assessment will be on environmental effects associated with those aspects of the Project that have changed or are new from the previous project proposal and on corresponding changes to the environmental effects previously predicted.

As stated in Section 2.2.3, there are no new or changed components, features or activities associated with the Transmission Line, Access Road and Transportation Corridor and the Gibraltar Mines Concentrate Rail Load-Out Facility. For those Project elements, this EIS makes use of existing relevant information generated as part of the 2009/2010 review process to provide a rationale stating why the previously predicted environmental effects remain the same.

Only at the mine site does the Project contain new or changed components, features and activities compared to the previously assessed project. Table 2.3.1-1 lists all the mine site components, features and activities for all Project phases and indicates whether or not there is a change from the previously reviewed project. Comments providing clarification are included where appropriate.

Table 2.3.1-1 Mine Site Components, Features and Activities Changed from Previous Project Proposal

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Construction and Commissioning		
Open Pit – Pre-production	N	
Non-PAG waste stockpile	Y	Location and timing only
PAG Stockpile	Y	Still subaqueous in TSF, just TSF location change
Non-PAG Overburden Stockpile	Y	Combined with Non-PAG (i.e. location and timing)
Ore Stockpile	Y	Location only
Primary Crusher	N	This is considered in Construction: plant site and other facilities
Overland conveyor	N	This is considered in Construction: plant site and other facilities
Fisheries compensation works construction	Y	Scope and Timing
Water Management Controls and Operation	Y	
Construction sediment control	Y	
Access road construction and upgrades	N	
Camp construction	N	This is considered in Construction: plant site and other facilities
Site clearing (clearing and grubbing)	Y	Different areas related to moving of TSF, stockpiles, etc…
Soils handling and stockpiling	Y	Includes overburden removal
Construction: plant site and other facilities	N	
Explosives Plant	Y	Location only
Lake dewatering	Y	Fish Lake retained
Fish Lake Water Management	Y	Management of inflows and outflows
Starter dam construction	Y	Location and volume of material

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Sourcing water supplies (potable, process and fresh)	Y	Fresh water sources and routing only as a result of reconfigured stockpiles
Site waste management	N	
Clearing of transmission line ROW	N	
Construction/Installation of transmission line	N	
Vehicular traffic	Y	Additional haulage trucks and 2 km of added haulage road as a result of TSF relocation.
Concentrate load-out facility near Macalister (upgrades to site)	N	
Operations		
Pit production	N	
Site clearing (clearing and grubbing)	Y	Area and relocation of TSF and stockpiles
Soils handling and stockpiling	Y	Area, volume, and relocation of TSF and stockpiles; revised soil stockpile locations
Crushing and conveyance	N	
Ore processing and dewatering	N	
Explosive handling & storage	Y	Location only
Tailing storage	Y	Location and embankments changed
Non-PAG waste stockpile	Y	Location and timing only
PAG Stockpile	Y	Still subaqueous in TSF, just TSF location change
Overburden Stockpile	Y	Combined with Non-PAG (i.e. location and timing)
Ore Stockpile management and processing	Y	Location only
Potable and non-potable water use	N	
Site drainage and seepage management	Y	
Water Management Controls and Operation	Y	Includes management of flows in and out of Fish Lake
Wastewater treatment and discharge (sewage, site water)	N	

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Water release contingencies for extended shutdowns (treatment)	N	
Solid waste management	N	
Maintenance and repairs	N	
Concentrate transport and handling	N	
Vehicle traffic	Y	Additional haulage trucks and 2km of added haulage road as a result of TSF relocation.
Transmission line (includes maintenance)	N	
Pit dewatering	N	
Fisheries Compensation works operations	Y	Scope and Timing
Concentrate load-out facility near Macalister	N	
Closure		
Water Management Controls and Operation	Y	
Fisheries Compensation operations	Y	Scope and Timing
Site drainage and seepage management	Y	
Reclamation of ore stockpile area	Y	Location only
Reclamation of Non-PAG waste rock stockpile	Y	Location only
Tailing impoundment reclamation	Y	
Pit lake, and TSF Lake filling	Y	
Plant and associated facility removal and reclamation	N	
Road decommissioning	N	
Transmission line decommissioning	N	
Post-closure		
Discharge of tailings storage facility water	Y	
Discharge of pit lake water	N	Into Lower Fish Creek

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Seepage management and discharge	Y	
Ongoing monitoring of reclamation	Y	

As with the other three Project elements, for those mine site components, features and activities for which there is no change, the EIS provides rationale and documentation as to why the environmental effects as previously determined remain the same. In instances where the implementation of the new MDP and mitigation measures leads to changes to previously predicted environmental effects they are described.

2.3.2 Scope of Assessment

This environmental assessment has been completed using a standard methodological framework to meet the requirements of CEAA. The scope of assessment focusses on changes to on-site and off-site components and activities associated with the new MDP and reconfiguration of the mine site layout. The EIS also considers those components and activities associated with the Project that have not changed but may result in changes to the environmental effects determinations from the 2009/2010 review of the previously assessed project.

The environmental effects assessment method used is based on a structured approach that:

- Considers that mandatory and discretionary factors required under Section 16 of CEAA
- Focusses on issues of greatest concern
- Affords consideration of key issues raised by the public, aboriginal people and public stakeholders
- Integrates engineering design and programs for mitigation and monitoring into a comprehensive environmental planning process, and
- Addresses project related and cumulative environmental effects (assessed sequentially).

For each of the components, features and activities listed in Table 2.3.1-1 for which there is a change indicated, interactions between key Project activities and the environment are ranked according to the potential for an activity to interact with one or more valued ecosystem components of the environment. Ranking of each interaction was assigned as follows:

"0" = Interaction is likely to decrease or stay the same (i.e. no changes to the significance conclusion) and there are no changes to previously proposed mitigation measures contemplated. No further assessment is warranted.

"1" = Interaction is likely to decrease or stay the same but some re-evaluation of effect is required due to changes in project design or proposed mitigation measures. All interactions listed as "1" are described and related information and justification is presented in the EIS.

"2" = Interaction is likely to increase therefore further assessment is warranted. All interactions listed as "2" are described and related information and assessment is presented in the EIS.

Ranking of the Project–environment interactions for each interaction is provided in the specific Section of the environmental assessment for that interaction.

2.3.3 Factors to be Considered

As detailed in the EIS Guidelines the factors considered in this EIS are those required under Section 16 of the CEAA. Consideration of the following factors is included:

- Environmental effects of the Project including environmental effects of malfunctions and accidents and any cumulative environmental effects that are likely to result from the Project in combination with other projects or activities that have been or will be carried out. See Section 2.7.
- The significance of the environmental effects referred to in the above paragraph. See Section 2.7.
- Comments from the public and Aboriginal groups that were received during this and the previously assessed project review. See Section 2.5.1.
- Measures that are technically and economically feasible that would mitigate any significant adverse environmental effects of the Project. See Section 2.7.2.
- The need for and purpose of the Project. See Section 2.2.1.
- Alternatives to the Project and alternative means of carrying out the Project that are technically and economically feasible and the environmental effects of any such alternative means. See Section 2.4.
- The need for and the requirements of any follow-up program in respect of the Project and the capacity of renewable resources which are likely to be significantly affected by the Project to meet the needs of the present and those of the future. See Sections 2.7.8 and 2.8.3.

2.3.4 Scope of the Factors

As stated in Sections 2.3.2, 2.3.6 and 2.3.7, the EIS focusses the assessment on relevant issues and concerns, and by defining both the temporal and spatial boundaries, a frame of reference for the assessment of significant environmental effects and cumulative effects has been established. As indicated in Section 2.7.2, different boundaries are appropriate for some of the VECs and KIs.

2.3.5 Valued Ecosystem Components

Based on the requirements of Section 2.3.5 of the EIS guidelines, a review of the prior panel report, and input obtained from interested parties since the prior panel review, the following valued ecosystem components are assessed in this EIS.

- Atmospheric Environment including climate change
- Acoustic Environment
- Aquatic Environment including:
  - Water quality and quantity
  - Hydrology and hydrogeology
  - Fish and fish habitat, and
  - Aquatic ecosystems including benthos and sediment quality, federally and provincially listed species at risk, and species of Aboriginal importance including salmon populations and rainbow trout.
- Terrestrial environment including:
  - Terrain and soils
  - Vegetation including country food, old growth forests and wetlands, and
  - Wildlife and wildlife habitat including avifauna, migratory birds, federally and provincially listed species at risk, red and blue listed ecological communities and species of Aboriginal importance with particular reference to Grizzly Bear.

For each valued ecosystem component, this document assesses whether the Project is likely to cause any significant adverse effects, having regard to the CEAA Reference Guide: Determining Whether A Project is Likely to Cause Significant Adverse Environmental Effects - The Requirements of the Canadian Environmental Assessment Act (http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=D213D286-1&offset=2&toc=show). That document states, in part:

The concept of significance is extremely important in the Act. One of the stated purposes of the Act is: “to ensure that projects that are to be carried out in Canada or on federal lands do not cause significant adverse environmental effects outside the jurisdictions in which the projects are carried out" (section 4 (c)).

The central test in the Act is whether a project is likely to cause significant adverse environmental effects. This determination is an objective test from a legal standpoint, which means that all decisions about whether or not projects are likely to cause adverse environmental effects must be supported by findings based on the requirements set out in the Act.

The definitions of "environment" and "environmental effect" are the starting point for this test. The Act defines the environment as:

- The components of the Earth, and includes

  1. Land, water and air, including all layers of the atmosphere,

  2. All organic and inorganic matter and living organisms, and

  3. The interacting natural systems that include components referred to in paragraphs (a) and (b) (section 2(1)).

Environmental effect means, in respect of a project,

1. Any change that the Project may cause in the environment, including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by aboriginal persons, or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, and

2. Any change to the Project that may be caused by the environment, whether any such change occurs within or outside Canada (section 2 (1)).

Only environmental effects as defined in the Act can be considered in determinations of significance and the related matters. It follows that the determination of significance and the related matters can consider only:

- Direct changes in the environment caused by the Project
- The effects of these environmental changes on:
  - o Health and socio-economic conditions
  - o Physical and cultural heritage
  - o Current use of lands and resources for traditional purposes by aboriginal persons
  - o Any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, or
- Changes to the Project caused by the environment.

For example, the socio-economic effects of a project may or may not be factors in determining significance and the related matters. If a socio-economic effect (such as job losses) is caused by a change in the environment (such as loss of fish habitat), which is in turn caused by the project, then the socio-economic effect is an environmental effect within the meaning of the Act and must be considered when determining significance and the related matters. If the socio-economic effect is not caused by a change in the environment, however, but by something else related to the Project (for example, reallocation of funding as a result of the Project), then the socio-economic effect is not an environmental effect within the meaning of the Act and cannot be considered in the determination of significance and the related matters.

For these reasons, impacts of the following valued ecosystem components in relation to socioeconomic matters, physical and cultural heritage resources, and aboriginal interests referenced in the Canadian environmental assessment act (other than established or asserted aboriginal rights and title) are assessed only to the extent that they are affected by a direct change to the environment caused by the Project.

- Socio-economic environment including:
  - o Community services, infrastructure and population
  - o Resource uses
  - o Navigable waters, and
  - o Human health.
- Physical and cultural heritage resources including:
  - o Archaeology
- Aboriginal interests including:
  - o Aboriginal communities
  - o Current uses of lands and resources for traditional purposes, and
  - o Archaeology resources.

Further, it should be noted that the analysis of potential social and economic impacts is divided into parts. The first assesses potential adverse social and economic impacts" in accordance with the framework described above. The second part describes expected social and economic benefits of the Project – and information in that part is not limited to benefits that are derived from a direct change to the environment. This is because that information is provided not for the purposes of assessing adverse impacts, but rather to help inform government's ultimate decision making as to whether to approve the Project even if the panel were to find it likely to cause any significant adverse effects.

With respect to potential or established Aboriginal rights or title, aboriginal rights and title are subject to constitutional protection and related legal duties and, as such are subject to a different framework of analysis than the one that applies to environmental effects. As such, issues related to the established or potential aboriginal rights or titles are addressed in Section 2.7.5 of the EIS, with cross referencing to other relevant sections as appropriate.

For each VEC or KI, one or more measurable parameters were selected to facilitate quantitative or qualitative measurement of potential project environmental effects and cumulative environmental effects. Measurable parameters provide a means to determine the level or amount of change to a VEC or KI as a result of an environmental effect. For example, a measure of total suspended solids might be chosen as the measurable parameter for change in habitat quality (the environmental effect) for the VEC Aquatic Environment or KI Fish and Fish Habitat. Other examples of measurable parameters include specific water quality measurements; changes in the seasonal distribution of fish, the presence of residential birds or terrestrial mammals; employment rates; demand for various land and resource uses; demand for infrastructure; and the number and type of archaeological sites.

The degree of change in these measurable parameters was used to characterize Project-related and cumulative environmental effects, and evaluate the significance of the potential environmental effects. Thresholds or standards were identified for each measurable parameter to assist, where possible, in determining the significance of a predicted environmental effect.

2.3.6 Spatial Boundaries

Spatial boundaries were primarily established based on the zone of the Project Influence, beyond which the potential environmental, cultural and socio-economic effects of the Project are expected to be non-detectable. They include a LSA, for project-specific effects, and a RSA, for cumulative effects. For most biophysical components of the environmental assessment, the LSA consists of the Project footprint called the Maximum Disturbance Area (MDA). This is the area within which the direct effects of the Project on the environment are detectable. For some disciplines, LSAs and RSAs were defined for the mine site, the transmission line, and the access road. Some disciplines also defined a study are for the load-our facility.

RSAs for cumulative effects assessment are defined by the furthest extent that measurable or demonstrable project-specific effects may act in combination with similar effects from other projects on VECs.

2.3.7 Temporal Boundaries

The temporal boundaries for the assessment were defined based on the timing and duration of Project environmental effects in relation to each VEC or KI. The purpose of a temporal boundary is to identify when an environmental effect may occur in relation to specific Project phases and activities. Temporal boundaries for most projects typically include:

- Baseline: the biophysical characteristics of the environment, at the time of the assessment, including all existing disturbances and past and present projects
- Construction and commissioning
- Operations (maximum active footprint[5]), and
- Decommissioning.

2.4 PROJECT ALTERNATIVES

2.4.1 Assessment of Alternatives and Selection of the Proposed Project

Section 16 of the Canadian Environmental Assessment Act requires that review panels consider the purpose of a project and alternative means of carrying out a project that are technically and economically feasible and the environmental effects of any such alternative means.

This EIS includes a consideration of the alternatives to the Project in Section 2.4.2 and an analysis of alternative means of carrying out the Project that are technically and economically feasible and the environmental effects of any alternative means in Section 2.4.3. Taseko has utilized the Agency guidance document Addressing 'Need for', 'Purpose of', 'Alternatives to' and 'Alternative Means' under the Canadian Environmental Assessment Act (CEAA 1998). Taseko has taken into account the relationships and interactions among various components of the ecosystem, including effects on local communities when assessing project alternatives.

2.4.2 Alternatives to the Project

The “need for” and “purpose of” the Project remain unchanged from that of the previously assessed project. The previous Panel concluded that Taseko had adequately outlined the purpose and need for the Project for the purposes of the environmental assessment.

The need for the Project is to respond to predicted world copper demand which is expected to exceed copper concentrate production from existing and permitted mines in the near future and to provide economic returns to Taseko’s shareholders while also creating value and opportunity for the people of British Columbia and Canada.

The purpose of the Project is to help fill the predicted global shortage of copper concentrate and help fill a current gap that exists between the production of, and demand for, gold.

The Project is expected to generate $11 billion in Real GDP over its anticipated 20 years of operation. The economic and social benefits for British Columbia and Canada will be significant, and especially for the Cariboo-Chilcotin region considering the current and future impact of the pine beetle infestation in this area of the province.

The only functionally different way to meet the Project need and achieve the Project purpose is to develop alternative copper, gold, or combined resources in Canada, preferably in British Columbia.

The nature of economic mineral resources is that they are very rare. Taseko is always looking for opportunities to acquire other potentially economic copper and gold deposits but currently does not have an economically viable alternative at the same advanced level of geological definition, engineering, and environmental assessment.

Taseko is already maximizing its copper production at Gibraltar through a $700 million investment to increase production capacity and to contribute to global copper supply and to provide economic returns to their shareholders while also creating value and opportunity for the people of British Columbia and Canada.

The only remaining alternatives are to economically extract the resource at New Prosperity or to do nothing, the “no project alternative”.

The “no project” alternative would obviously not meet the need for and purpose of the Project. The “no project” alternative would mean the loss of employment, business, and training opportunities, as well as taxes and royalties to all levels of government from Taseko and mine employees. The “no project” alternative would not provide economic returns to Taseko’s shareholders, nor would there be a contribution to global supply for copper and gold.

The alternatives of economic extraction and the development of criteria to identify the major environmental, social and cultural, economic and technical costs and benefits of those alternatives, and the criteria and process associated with choosing the preferred alternative are the subject of the alternative means of carrying out the project that follows.

2.4.3 Alternative Means of Carrying out the Project

In Taseko's August 1993 Pre-Application for a Mine Development Certificate were the results of alternative studies assessing potential waste rock storage options, tailings disposal sites and alternative routes for the transmission line. Environmental, design, operational and economic factors were considered. At the conclusions of these alternative assessments the pre-application filed in 1993 detailed a mine plan very similar to the project assessed by the previous panel.

From 1995 until April 1998 Taseko undertook a more thorough alternatives assessment process. Under the EAO lead environmental assessment process, discussions occurred between Taseko, the Project Committee and Technical Subcommittees to establish the Project Report Specifications (PRS). These discussions focused in part on defining and undertaking the requirements regarding the assessment of alternatives and selection of the proposed project development plan.

Between 1997 and 1999 Project Committee workshops and public open houses were held where the results of the alternatives assessment were presented and public input solicited. When the PRS was finalized and issued to Taseko in April 1998 it included a detailed description of the alternatives assessment process that had been followed thus far and to be followed in completing a transparent and defensible process of selecting the preferred project development plan.

Taseko, regulatory agencies and government departments undertook an iterative approach over two years in fulfilling the specific requirements of this process, consulting frequently with public stakeholders and First Nations. Participating regulatory agencies and ministries included:

- Environmental Assessment Office
- Ministry of Energy and Mines
- Ministry of Environment, Lands and Parks
- Ministry of Health
- Ministry of Small Business, Tourism and Culture
- Canadian Environmental Assessment Agency
- Department of Fisheries and Oceans
- Department of Environment, and
- Natural Resources Canada.

By mid-1999 provincial and federal agencies were satisfied that the alternatives assessment process lead to a conclusion that there was still only one economically and technically feasible alternative. For documentation of the development of the process framework, as well as the analysis and conclusions, the reader is referred to Appendix 2-6-A of the previous EIS submission as a compilation of the historical work completed on alternatives assessment including the MAE.

In its 2009 EIS submission to the British Columbia Environmental Assessment Office and the Panel, Taseko updated and expanded on the previously completed work on the alternatives assessment as documented in Volume 3, Section 6 of the 2009 EIS submission.

In response to deficiencies and concerns identified by the Panel, Environment Canada, the British Columbia Environmental Assessment Office and the provincial Ministry of Energy Mines and Petroleum Resources, Taseko also submitted a report entitled "Supplemental Report on the Assessment of Alternatives for Tailings and Waste Rock Storage" in August 2009.

The 2009/2010 review resulted in a comparison of three alternative Mine Development Plans (MDPs). All three alternatives were technically feasible, providing varying degrees of mitigation for Fish Lake and its immediate fish habitat values. The fundamental differences between the three MDPs were the waste rock and tailings storage methods and locations.

The selection of the project as previously proposed as the preferred alternative was based on the economics, technical issues and associated impacts to the physical environment; primarily the opinion that the alternative two options were flawed due to excessive economic risk.

The previous Panel concluded that Taseko's rationale for selecting its preferred alternative for the mine development plan and its approach to selecting the centreline for the transmission line were reasonable for the purposes of the environmental assessment.

Following the Government of Canada's decision in November, 2010 that the significant adverse environmental effects of the project proposed could not be justified under the circumstances, Taseko undertook revisions to the Project to address the factors identified by the panel.

In the economic modelling done in 2005 to 2008 leading up to the environmental assessment of Prosperity long term consensus pricing for copper and gold was $1.32/lb and $550/oz respectively. Taseko had a more optimistic view, using $1.50/lb copper and $575/oz gold in evaluating project alternatives but those commodity prices could not support the alternatives to the Prosperity project as proposed.

In a period between 2009/2010, while the Company was in the middle of the federal environmental assessment, long term metal price estimations were increasing to a point where a different configuration of the mine plan could be considered as an economically feasible option if the price outlook remained buoyant. In 2011 the long term outlook for higher metal prices was maintained and Taseko determined that the project could bear the additional cost and submitted a project description for New Prosperity to the Agency.

The New Prosperity Project as proposed presents a variation of one of the MDP options that was previously flawed as a result of excessive economic risk.

Taseko has determined that there are no new alternative means to carry out the various components and activities of the Project above and beyond those which have been previously assessed. For the purposes of this submission we have relied on the previous extensive body of work to identify and describe alternative means to carry out the various components and activities of the Project that are technically and economically feasible to arrive at alternative MDPs.

Taseko has relied on the previous methodology, regulatory and public participation, and consistent provincial and federal conclusions with respect to those aspects of the Project that have not changed and would suggest that previous conclusions with respect those aspects remain valid and correct.

With respect to those aspects of the Project that have changed, namely ore, waste rock and tailings storage locations, Section 2.4.3.1, Assessment of Alternatives for Mine Waste Disposal, provides an analysis of the assessment following Environment Canada's Guidelines for the Assessment of Alternatives for Mine Waste Disposal (September 2011).

2.4.3.1 Assessment of Alternatives for Mine Waste Disposal

In order to meet the requirements of the EIS Guidelines, Taseko has undertaken an assessment of the alternative means of disposing of mine waste. The assessment utilizes the methodology provided by Environment Canada as recommended by the Guidelines and found in Environment Canada's *Guidelines for the Assessment of Alternatives for Mine Waste Disposal* (September 2011).

The assessment is summarized in this Section and the detailed report may be found in Appendix 2.4.3.1-A.

OVERVIEW OF METHODOLOGY

The general approach consists of the identification of candidate alternatives, pre-screening to rapidly filter out infeasible options, multiple accounts evaluation to measure and score alternatives against a comprehensive list of subaccounts and indicators, value-based assessment to quantify the combined impact of each alternative, and sensitivity analyses to evaluate and eliminate bias and subjectivity.

<u>Identification of Candidate Alternatives</u>

A list of conceivable mine waste disposal alternatives was prepared using *threshold criteria* to provide boundary conditions to constrain the range of options to a manageable number that still provides a comprehensive list of options to be compared. These candidates are reasonable, conceivable, and realistic within the context of developing a modern mining venture. The options encompass a comprehensive selection of locations, waste disposal options, and waste disposal technologies.

The level of detail for the candidate identification stage is generally conceptual; however, candidates are developed to a point where meaningful evaluations of the concepts can be made.

<u>Pre-Screening</u>

The pre-screening procedure employs a means of filtering candidate options with successful candidates being carried on into the more detailed multiple accounts evaluation. This pre-screening assessment employs fatal flaw analysis (identification of factors or elements that are so severe or unfavourable that they would individually eliminate the site as a candidate waste disposal alternative) and exclusionary screens (e.g., undesirable environmental liability, unproven technology, etc.), to filter out alternatives that are unlikely to succeed. In general, candidates exhibiting a single flaw or two or more exclusionary factors were removed from further analysis.

<u>Multiple Accounts Analysis Method</u>

Alternative waste management strategies that pass through the initial pre-screening filter are then assessed using the multiple accounts analysis (MAA) method. The MAA employs a three-tiered approach, starting with generalized *accounts*, each broken down to specific *sub-accounts*, with each sub-account assessed using measurable *indicators*.

Accounts are basic elements that encompass and integrate comprehensive specific qualities developed through the scoring and evaluation of focused sub-accounts and measurable indicators.

Sub-accounts utilize factual characterization criteria and are developed independently of any consideration of the waste disposal alternatives that will be evaluated in the MAA process. Evaluation criteria consider the benefit or loss (material impact) associated with the evaluated alternatives.

Indicators allow for the qualitative or quantitative measurement of impact associated with any given sub-account. Indicators tend to be measureable; whereas sub-accounts cannot be measured directly. For this reason, indicators are focused, deconstructed components that inform their respective parent sub-account.

This process involves the evaluation of each option on the basis of environmental, economic, socio-cultural, and technical accounts using the following approach:

- Each general account is subdivided into sub-accounts that represent specific factors that the alternatives are rated against (evaluation criteria).
- Subjective weighting parameters are assigned to each account, sub-account, and indicator, implying the relative significance or importance associated with each indicator. The weighting factors have been bracketed to range from 1 (least important) to 6 (most important).
- Relative scoring is assigned to each indicator within each sub-account using a comparative 6-point ranking system. A score of 6 is considered the most favourable while a score of 1 is considered least favourable.
- Weighted sub-account scores are generated by multiplying relative indicator scores by the assigned weighting parameters.
- Account scores consist of the summation of all sub-account scores.
- The total alternative scores are then totalled by summing account scores. An option with a higher total score suggests a better option relative to an option that receives a lower total score.

In order to evaluate the effects of bias that may be introduced to the MAA process by the perceived relative importance of one account over another, a number of *cases* are evaluated in which the analysis places greater emphasis on various accounts and/or sub-accounts.

Sensitivity analysis is an important tool used to evaluate the effects of bias that may be introduced to the MAA process by sub account subjectivity (the perceived relative importance of one sub-account over another) and uncertainty.

Each case is evaluated using four sensitivity analyses to observe and limit the effect of bias within the MAA process. These sensitivity scenarios include the following:

1. Normalized Accounts – Scores for each account are normalized such that no one account carries more weight than another. Note that weighting is still applied within accounts, sub-accounts, and indicators.
2. Non-weighted Indicators – All indicators weightings are set to 1.
3. Non-weighted Sub-accounts – Each sub-account weighting is set to 1.
4. Non-weighted Sub-accounts and Indicators – All indicator and sub-account weightings are set to 1.

Normalized account scores are calculated by dividing scores by the maximum possible score for each account, multiplying by 25% giving a maximum possible score of 25 for each account. When summed, the maximum number of points that an option can received is 100 with each account contributing a maximum of 25 points.

The second sensitivity analysis allows comparison without bias introduced by indicator weighting factors. With all indicators being equal this option eliminates any reliance on perceived relative importance imparted by the subjective selection of weighting parameters.

The third sensitivity analysis allows comparison without bias introduced by sub-account weighting factors. With all sub-accounts being equal this option eliminates any reliance on perceived relative importance imparted by the subjective selection of weighting parameters.

The fourth sensitivity analysis allows comparison without bias introduced by sub-account and indicator weighting factors. With all sub-accounts and indicators being equal this option eliminates any reliance on perceived relative importance imparted by the subjective selection of weighting parameters.

IDENTIFICATION OF CANDIDATES

The candidate options were identified by employing a *threshold criterion* which was introduced to establish regional limits for selecting candidate alternatives. A boundary condition of 20 km from the open pit / plant site was selected as the logistical costs for transporting waste greater than this distance greatly reduces the likelihood of a positive economic outcome and increases the potential environmental liabilities that result from impacting a more widely dispersed area.

A total of 15 candidate TSF locations and configurations were developed to a conceptual level of detail sufficient to adequately and transparently review and screen the alternatives.

Potential Waste Management Sites

Eleven unique mine waste management sites were identified within the 20 km boundary condition (Figure 2.4.3.1-1). These locations are as follows:

- T1 – Fish Creek North
- T2 – Fish Creek South
- T3 – Tête Hill South
- T4 – Tête Hill North
- T5 – Cone Hill
- T6 – Tête Angela Creek
- T7 – Tête Angela Creek North
- T8 – Tête Hill East
- T9 – Beece Creek
- T10 – Groundhog Creek, and
- T11 – Big Lake.

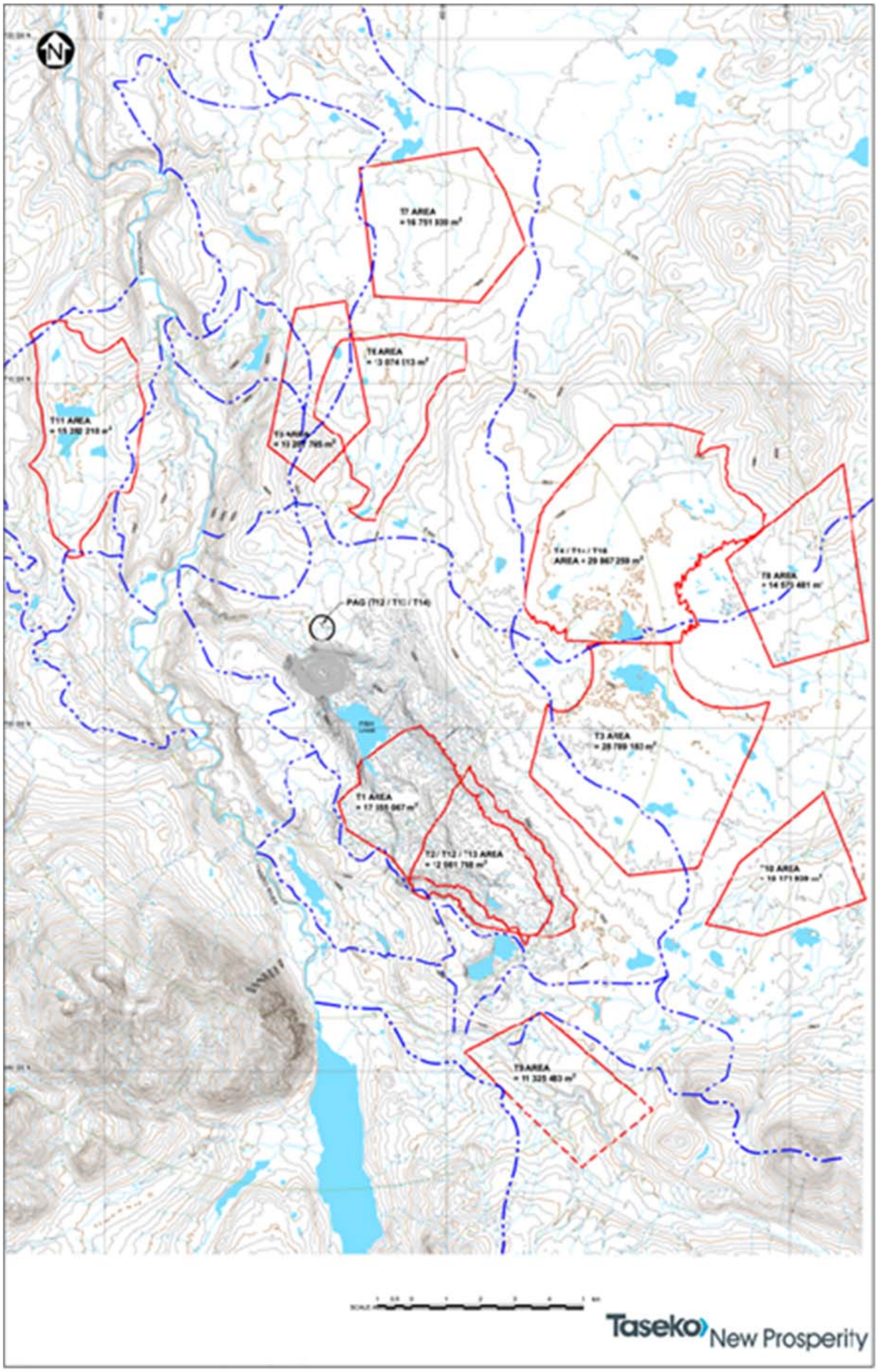


Figure 2.4.3.1-1 Tailings Storage Facility Sites

Potential PAG Waste Storage and Tailings Waste Disposal Options

Mine waste rock is commonly disposed of and stored sub-aerially (on the ground surface, exposed to the elements); provided that the waste rock is environmentally benign (e.g., it does not leach metals, generate acid rock drainage [ARD]).

Where the geochemical characteristics of the waste rock present an environmental liability such as metal leaching or ARD, that liability may be mitigated by employing engineered cover systems over the stored material, limiting exposure of the material to air.

A more robust, lower risk mitigation measure is to sub-aqueously store (fully submerged in water) such material, preventing oxidation and ARD. This can also present the additional benefit of minimizing the footprint of the Project (i.e. co-disposing waste rock and tailings within a common tailings storage facility).

Because of the potential for ARD associated with some of the waste material mined at New Prosperity, the potential alternatives developed consider the inclusion of both mitigation approaches.

A selection of mine tailings waste disposal technologies have been considered for use at the New Prosperity Project. As with waste rock disposal, tailings may be disposed of either sub-aerially or sub-aqueously. The general concepts, advantages, and disadvantages of each technology are discussed below.

Tailings are often transported and deposited in slurry form in combination with wet ore mineral processing. Tailings slurries can have solid contents ranging from 5% to 50%, but generally stay in the 20% - 40% range. Slurries are typically transferred to the TSF via pipeline or open channel. The slurries can be discharged at multiple locations into a body of water or flooded mine pit. Sub-aqueous slurries are deposited completely under water, while sub-aerial slurries are discharged overland and run downhill to the water. Sub-aqueous slurries are preferred when tailings have a high potential for ARD/ML production, while sub-aerial slurries are used when higher density tailings are preferred. The use of slurries is beneficial because supernatant water produced after deposition can be recycled and used within the mill.

Paste tailings are similar to thickened tailings except that they contain less water. This is achieved by using chemical additives to create a paste that will not separate. Alternatively, a combination of mechanical devices such as deep cone thickeners in conjunction with flocculants and hydrating agents can be used to achieve the same effect. Paste tailings generally range from 60% to 80% solids content. Paste tailings are typically used when backfilling underground mine workings, although they can be disposed above ground in a TSF. The advantage to above ground deposition of paste tailings is that their increased density and slope of deposition can lead to reduced footprint and height of the TSF in comparison to slurry disposal methods. In addition, water requirements are lower compared to conventional tailings disposal techniques. Paste tailings can also be transported using high pressure pipelines. Surface paste disposal may be susceptible to cold regions effects (i.e. freeze-thaw ground heaving).

Filtered tailings differ from the above mentioned types of tailings as they do not require pumped tailings deposition systems. Filtered tailings use mechanical devices such as high capacity vacuum and pressure belt filters in conjunction with chemical additives to dewater the tailings. Filtered tailings range from 50% to 70% solids content and are too thick to pump. As a result, they are transported by truck or conveyor and then dry stacked in the TSF. This involves placing, spreading, and compacting the tailings to form a dense, unsaturated mound. The benefit to this method is that no other containment structures are necessary for tailings storage, which leads to a smaller TSF footprint. Dry stack facilities require surface water runoff and seepage management systems to ensure that contamination does not occur.

Co-disposal occurs when tailings and waste rock are disposed of in a single facility. Co-disposal methods can vary greatly with respect to the degree of mixing, physical arrangement, and ratio of tailings to waste rock. In general, tailings are deposited into flow-through containment berms that are composed of waste rock, while the supernatant water is collected in ditches that surround the facility. It is beneficial to use thickened tailings in co-disposal scenarios as they require less water management. In co-disposal scenarios, waste rock production occurs mostly during open pit development, while tailings are generally produced at a constant rate. Thus, certain specific ratios of co-mingling cannot be achieved without significant effort and expense to re-handle waste rock later on in the life of the mine.

From the 11 possible sites and alternative waste disposal technologies, 15 potential waste disposal configurations were carried forward to a pre-screening assessment. The location of these configurations is shown on Figure 2.4.3.1-1.

Brief physical, operational, and closure descriptions of each of the options are provided below. Descriptions are developed to a greater level of detail in the report found in Appendix 2.4.3.1-A.

T1 – Fish Creek North, Subaqueous PAG in Slurry Tailings

Alternative T1 is situated 6,020 m away from the proposed open pit and is contained within a single catchment of the Fish Creek watershed. The TSF would consist of two dams with a total length of 6.5 km and a maximum height of 96 m. The overall footprint of the TSF would be 17.7 Mm2.

During construction, Fish Lake would be drawn down to dewater the areas of the proposed main tailings impoundment embankment. The main embankment would cross the Fish Creek valley just upstream of Fish Lake. A secondary embankment, located to the west, would be constructed on the ridge separating Fish Creek from the Big Onion watershed.

During operations, PAG waste would be transported and deposited by truck with tailings slurry being spigotted from varying locations along the embankment crests to manage beach and supernatant pond locations.

During closure, soil covers would be established on sub aerial tailings and waste rock while a permanent water cover would be maintained over the subaqueous tailings. The excess water from the TSF would be discharged to the open pit. The open pit would require approximately 30 years to fill prior to discharge to Fish Creek. This would allow for passive improvement of water quality prior to discharge. Active water treatment is assumed as a contingency only.

T2 – Fish Creek South, Subaqueous PAG in Slurry Tailings

Alternative T2 is situated 7,230 m away from the proposed open pit and is located within a single catchment of the Fish Creek watershed.

The main embankment would be constructed across upper Fish Creek with a secondary embankment located to the southwest which would be constructed as the TSF expands. The TSF would consist of three dams with a total length of 7 km and a maximum height of 120 m. The overall footprint of the TSF would be 13.0 Mm^2.

PAG waste would be transported and deposited by truck with tailings slurry being spigotted from varying locations on dam crests to manage beach and supernatant pond locations.

During closure, soil covers would be established on sub-aerial tailings and waste rock. There would be permanent water cover, vegetated beaches, and water routed to the open pit until water quality improves to allow discharge through the spillway to Fish Lake. Active water treatment from the open pit is assumed as a contingency.

T3 – Tete Hill South, Subaqueous PAG in Slurry Tailings

Alternative T3 is located 9,590 m away from the proposed open pit and is primarily located within the Groundhog Creek watershed with a portion within the Fish Creek watershed.

A long starter dam would be constructed along the south, east and west perimeter with a secondary embankment constructed to the north during later years. The TSF would consist of two dams with a total length of 12.8 km and a maximum height of 61 m. The overall footprint of the TSF would be 28.8 Mm^2.

During operations, PAG waste would be hauled and deposited by truck with tailings slurry being pumped and spigotted from varying locations along the dam crests to establish and maintain beach and supernatant pond locations. Due to the uncertainty of a self-sustaining water cover at closure an alternative approach to PAG waste disposal would be required in order to ensure that the PAG waste remains below the phreatic surface under post-closure conditions.

During closure, soil covers would be established on sub aerial tailings and waste rock, while vegetated beaches would be established at the TSF. Excess water from the TSF would be transferred to the open pit via pumps until water quality improves to a point where it may be freely discharged into the Groundhog system. Prolonged water management may be required and active water treatment from the open pit is considered as a contingency measure.

T4 – Tete Hill South, Subaqueous PAG in Slurry Tailings

Alternative T4 is located 9,230 m away from the proposed open pit and is within the Tête Angela Creek watershed.

A starter dam would be constructed along the north side. It would be raised and extended along the west ridge as the mine expands. A secondary dam, located to the south, would be constructed during the later years. The TSF would consist of two dams with a total length of 11.4 km and a maximum height of 82 m. The overall footprint of the TSF would be 29.9 Mm^2.

During operations, PAG waste would be hauled and deposited within the TSF by truck with tailings slurry being spigotted from varying locations along the dam crests to establish and maintain beach and supernatant pond locations. Due to the uncertainty of a self-sustaining water cover at closure an alternative approach to PAG waste disposal would be required in order to ensure that the PAG waste remains below the phreatic surface under post-closure conditions.

During closure, soil covers would be established on sub aerial tailings and waste rock while vegetated beaches would be established at the TSF. Excess water from the TSF would be transferred to the open pit via pumps until water quality improves to allow discharge through the spillway to Tête Angela system. Prolonged water management may be required and active water treatment from the open pit is considered as a contingency measure.

T5 – Cone Hill South, Subaqueous PAG in Slurry Tailings

Alternative T5 is located 8,170 m away from the proposed open pit. The TSF would be located within 4 different watersheds: Vick Lake, the Tête Angela Tributary, Slim Lake, and Cone Hill West.

The TSF would require that a starter dam be constructed along the west side with subsequent dam raises be raised, extending to the north and east. The TSF would consist of one dam with a total length of 9.9 km and a maximum height of 220 m. The overall footprint of the TSF would be 10.2 Mm2.

During operations, PAG waste would be transported and co-disposed in the TSF while tailings slurry would be spigotted from varying locations on dam crests to manage beach and supernatant pond locations. Due to the uncertainty of a self-sustaining water cover at closure an alternative approach to PAG waste disposal would be required in order to ensure that the PAG waste remains below the phreatic surface under post-closure conditions.

During closure, soil covers would be established on sub aerial tailings and waste rock. Vegetated beaches would be established at the TSF. Excess water from the TSF would be pumped to the open pit until water quality improves to a point where it may be discharged to the Taseko River. Prolonged water management may be required and active water treatment from the open pit is considered as a contingency measure.

<u>T6 – Tete Angela Creek, Subaqueous PAG in Slurry Tailings</u>

Alternative T6 is located 7,940 m away from the proposed open pit. The TSF would be located mostly within the Tête Angela tributary watershed with a small portion infringing on the Tête Angela Creek watershed.

The TSF would require that a starter dam be constructed across the north and west sides while a secondary embankment would be required to the south near the end of the mine's life. The TSF would consist of two dams with a total length of 6.2 km and a maximum height of 120 m. The overall footprint of the TSF would be 13.1 Mm2.

During operations, PAG waste would be transported by truck for co-disposal within the TSF. Tailings slurry would be pumped and spigotted from varying locations along the dam crests to establish and maintain beach and supernatant pond locations.

During closure soil covers would be constructed on sub aerial tailings and waste rock. A permanent water cover and vegetated beaches would be established at the TSF. Excess water from the TSF would be pumped to the open pit until a point in time when the water is of sufficient quality to discharge to the environment via the Tête Angela system. Prolonged water management may be required and active water treatment from the open pit is considered as a contingency measure.

<u>T7 – Tete Angela Creek North, Subaqueous PAG in Slurry Tailings</u>

Alternative T7 is located 13,200 m away from the proposed open pit. The open pit is situated within the Fish Creek watershed while the TSF would be located within the Tête Angela tributary watershed.

The TSF would require a starter dam to be constructed along the north and west perimeter with future expansion extending the dam along the northeast and southwest sides. The TSF would consist of one dam with a total length of 11.2 km and a maximum height of 120 m. The overall footprint of the TSF would be 16.8 Mm2.

During operations, PAG waste would be transported by trucks and co-disposed with tailings slurry that would be pumped and spigotted from varying locations along the dam crests to establish and maintain beach and supernatant pond locations. Due to the uncertainty of a self-sustaining water cover at closure an alternative approach to PAG waste disposal would be required in order to ensure that the PAG waste remains below the phreatic surface under post-closure conditions.

During closure, soil covers would be constructed on sub aerial tailings and waste rock. Vegetated beaches would be established at the TSF. Excess water from the TSF would be pumped to the open pit until water quality improves to a point where it may be discharged into the environment via the Tête

Angela system. Prolonged water management may be required and active water treatment from the open pit is considered as a contingency measure.

T8 – Tete Hill East, Subaqueous PAG in Slurry Tailings

Alternative T8 is located 14,020 m away from the proposed open pit. The open pit is situated within the Fish Creek watershed while the TSF would be located within both the Groundhog Creek and Tête Angela Creek watersheds.

The TSF would require that a starter dam be constructed on the east and south sides, extending along the west and northwest sides as the mine expands. The TSF would consist of one dam with a total length of 11.6 km and a maximum height of 120 m. The overall footprint of the TSF would be 14.6 Mm^2.

During operations, PAG waste would be hauled to the TSF and co-disposed with tailings slurry that is pumped and spigotted from varying locations along the dam crests to manage beach and supernatant pond locations. Due to the uncertainty of a self-sustaining water cover at closure an alternative approach to PAG waste disposal would be required in order to ensure that the PAG waste remains below the phreatic surface under post-closure conditions.

During closure, soil covers would be constructed on sub aerial tailings and waste rock. The beaches would be vegetated. Excess water from the TSF would be pumped to the open pit until the water is of sufficient quality to permit discharge into the environment via the Tête Angela or Groundhog systems. Prolonged water management may be required and active water treatment from the open pit is considered as a contingency measure.

T9 – Beece Creek, Subaqueous PAG in Slurry Tailings

Alternative T9 is located 13,940 m away from the proposed open pit. The open pit is within the Fish Creek watershed while the TSF would be located within the Beece Creek watershed.

The TSF would require the construction of a starter dam across the Beece Creek valley which would extend along the northwest and west sides as the mine expands. The TSF would consist of one dam with a total length of 6.8 km and a maximum height of 180 m. The overall footprint of the TSF would be 11.3 Mm^2.

During operations, PAG waste would be transported and co-deposited with tailings slurry that is pumped and spigotted from varying locations on dam crests to establish and maintain beach and supernatant pond locations.

During closure, soil covers would be constructed on sub aerial tailings and waste rock. A permanent water cover would be established on the TSF and the beaches would be vegetated. Excess water from the TSF would be pumped to the open pit until water has achieved a level of quality that is sufficient for discharge to the environment via Beece Creek. Water treatment from the TSF is not likely to be required as the inflow from the Beece Creek catchment allows for passive treatment of TSF lake water prior to discharge. Active water treatment has been assumed as a contingency measure.

T10 – Groundhog Creek, Subaqueous PAG in Slurry Tailings

Alternative T10 is located 14,720 m away from the proposed open pit. The open pit is within the Fish Creek watershed while the TSF would be located within the Groundhog Creek watershed.

The TSF would require the construction of a starter dam along the east and south sides, extending along the west side as the mine expands. The TSF would consist of one dam with a total length of 10 km and a maximum height of 120 m. The overall footprint of the TSF would be 10.2 Mm^2.

During operations, PAG waste would be hauled and co-deposited with tailing slurry that would be pumped and spigotted from varying locations along the dam crests to establish and maintain beach and supernatant pond locations. Due to the uncertainty of a self-sustaining water cover at closure an alternative approach to PAG waste disposal would be required in order to ensure that the PAG waste remains below the phreatic surface under post-closure conditions.

During closure, soil covers would be constructed on sub aerial tailings and waste rock. The beaches would be vegetated. Excess water from the TSF would be pumped to the open pit until the water has be determined to achieve discharge water quality objectives for eventual release to the environment through the Groundhog Creek system. Prolonged water management may be required and active water treatment from the open pit is considered as a contingency measure.

<u>T11 – Big Lake, Subaqueous PAG in Slurry Tailings</u>

Alternative T11 is located 10,260 m away from the proposed open pit. The open pit is within the Fish Creek watershed while the TSF would be located within the Big Lake watershed.

The TSF would require the construction of a primary starter dam across the valley at the discharge to the Taseko River with subsequent additional containment dams to be constructed to the north and south as the mine expands. The TSF would consist of three dams with a total length of 5.3 km and a maximum height of 100 m. The overall footprint of the TSF would be 15.3 Mm^2.

During operations, PAG waste would be conveyed across the Taseko River from the open pit and hauled to the TSF for co-disposal with tailings. Tailings pipelines would cross the Taseko River to transfer tailings to the TSF where they would be spigotted from varying locations along the dam crests to establish and maintain beach and supernatant pond locations. Due to the uncertainty of a self-sustaining water cover at closure an alternative approach to PAG waste disposal would be required in order to ensure that the PAG waste remains below the phreatic surface under post-closure conditions.

During closure, soil covers would be constructed on sub aerial tailings and waste rock. The beaches would be vegetated. Excess water from the TSF would be pumped to the open pit until the water has been determined to achieve discharge water quality objectives for eventual release to the environment via the Taseko River. Long term water management is anticipated, whereas active water treatment is considered as a contingency measure.

<u>T12 – Fish Creek South, Sub aerial PAG with Separate Slurry Tailings</u>

Alternative T12 is located 7,230 m away from the proposed open pit and is located within a single catchment within the Fish Creek watershed.

The TSF would require the construction of an embankment across the upper portion of Fish Creek. A second embankment, located to the southwest, would be constructed as the mine expands in order to keep the tailings storage within the Fish Creek catchment. The TSF would consist of three dams with a total length of 6.5 km and a maximum height of 110 m. The overall footprint of the TSF would be 13.0 Mm^2. A permanent PAG waste storage pad, water collection infrastructure, and water treatment facility would be developed to the north of the open pit.

During operations, tailings slurry would be pumped and spigotted from varying locations along the dam crests to establish and maintain the beach and supernatant pond locations. PAG waste rock would be managed in a separate facility and its drainage would be managed to ensure that no unacceptable discharge occurs.

During closure, soil covers would be established on sub aerial tailings and non-PAG waste rock. A permanent water cover would be established on the TSF and the beaches would be vegetated. Excess water from the TSF would be pumped to the open pit until the water has achieved a quality sufficient to allow discharge to the environment via Fish Lake. Prolonged water management may be required and active water treatment from the open pit is considered as a contingency measure. An engineered cover over the PAG waste rock would be required to minimize infiltration and volume of water requiring treatment. Active water treatment of PAG waste runoff is assumed to be required.

<u>T13 – Fish Creek South, Subaqueous PAG in Pit and Slurry Tailings</u>

Alternative T13 is located 7,230 m away from the proposed open pit and is located within a single catchment within the Fish Creek watershed.

The TSF would require the construction of an embankment across upper Fish Creek. A secondary embankment would be constructed to the southwest in order to keep the tailings storage within the Fish Creek catchment as the mine expands. The TSF would consist of three dams with a total length of 6.5 km and a maximum height of 110 m. The overall footprint of the TSF would be 13.0 Mm2.

During operations, tailings slurry would be pumped and spigotted from varying locations along the dam crests to establish and maintain the beach and supernatant pond locations. A temporary PAG waste storage pad and water collection system would be established to the north of the pit. Following the cessation of mining, the PAG waste rock would be placed into the pit below the natural flood level.

During closure, soil covers would be constructed on sub aerial tailings and non-PAG waste rock. A permanent water cover would be established on the TSF and the beaches would be vegetated. Excess water from the TSF would be pumped to the open pit until the water has achieved water quality objectives such that it may be discharged to the environment via Fish Lake and the open pit. Prolonged water management may be required and active water treatment from the open pit is considered as a contingency measure.

<u>T14 – Tëte Hill North, Subaqueous PAG in Pit and Dry-stack Tailings</u>

Alternative T14 is located 9,230 m away from the proposed open pit. The open pit is within the Fish Creek watershed while the TSF would be located within the Tête Angela Creek watershed.

A dry-stack tailings disposal site would be developed east of the mill site. The TSF would consist of two buttresses with a total length of 9 km and a maximum height of 85 m. The overall footprint of the TSF would be 29.9 Mm2. Buttresses would be constructed along the north, west and south sides of the dry-stack. A water storage reservoir would be constructed to the northeast of the mill site and west of the dry-stack. A temporary PAG waste storage pad would be constructed while water collection infrastructure would be established to the north of the pit. PAG waste rock would be placed back into the pit below the natural flood elevation after mining has ceased.

During operations, filtered tailings would be conveyed up to the dry-stack facility and spread in design lifts. Runoff would be directed to the water storage reservoir to the west. Management of runoff and snowfall would be required across the active depositional areas during the winter months, while dust management would be required in the spring, summer and fall periods.

During closure, soil covers would be constructed and vegetation would be established on the entire surface of the dry-stack tailings and waste rock. Water would be discharged to the open pit via pumps until water quality improves to allow discharge through to Tête Angela system. Prolonged water management may be required and active water treatment from the open pit is considered as a contingency measure.

T15 – Tëte Hill North, Comingled PAG and Paste Tailings

Alternative T15 is located 9,230 m away from the proposed open pit. The open pit is situated within the Fish Creek watershed while the TSF would be located within the Tête Angela Creek watershed.

The TSF would require the construction of a starter dam along the north side, which would be raised and extended along the west ridge. A secondary dam to the south would be constructed as the mine expands. The TSF would consist of two confining embankments with a total length of 9 km and a maximum height of 85 m. The overall footprint of the TSF would be 29.9 Mm^2. A separate water storage reservoir would be constructed to the northeast of the mill site and west of the paste facility.

During operations, a complex materials handling strategy would be required to appropriately source and blend paste tailings and PAG waste rock in order to ensure perpetual minimization of PAG waste rock oxidation. Management of runoff and snowmelt would be required during the winter months, while dust management may be required during the spring, summer and fall periods.

During closure, soil covers would be established on the NAG waste rock and the entire surface of the paste tailings. These surfaces would be vegetated as soon as practicable. Water would be pumped to the open pit until water quality is sufficient to allow discharge to the environment via the Tête Angela system. Prolonged water management may be required and active water treatment from the open pit is considered as a contingency measure.

PRE-SCREENING ASSESSMENT

The pre-screening assessment employs fatal flaw analysis and exclusionary screens to filter out candidates that are highly unlikely to succeed. In general, candidates exhibiting a single flaw or two or more exclusionary factors (constituting an effective fatal flaw) were removed from further analysis.

Each candidate was screened based on 9 general YES or NO criteria. The criteria were structured such that a YES response generally indicates that the alternative fails to pass one of the screens. Alternatives that receive a single fatal flaw (denoted by an 'F' in the Criteria Number in table below) YES response were immediately screened, whereas alternatives receiving 2 or more YES responses to exclusionary criteria (denoted by an 'E' in the Criteria Number in the table below) were also eliminated from more detailed analysis.

The criteria are described in Table 2.4.3.1-1.

Table 2.4.3.1-1 Pre-Screening Criteria

Criteria No.	Criteria	Explanation
1F	Does the life-of-mine waste production exceed the available storage of the Alternative?	If the Alternative does not have the capacity to allow for base case production it should be eliminated.
2E	Does the Alternative limit expansion due to ore reserve increase due to lack of waste storage?	The ore reserve is subject to refinement. If the Alternative does not have the flexibility to account for an ore reserve increase then it may be excluded if the alternative fails to pass additional screens.
3E	Is any part of the mine waste disposal system unproven technology at the proposed throughput and climate?	Placing reliance on unproven technologies could result in improper decision making and costly or ineffective redesigns. Alternatives that incorporate unproven technologies may be excluded if the alternative fails to pass additional screens.
4E	Does the disposal site exceed a practical distance to the open pit/mill site?	Greater distances increase the footprint of the Project may spread the impact over several watersheds. Alternatives with distances exceeding 10 km from the open pit/mill site may be excluded if the alternative fails to pass additional screens.
5F	Does the increased cost of an alternative exceed a reasonable threshold (>$500,000,000) above the cost of the Project proposed with no perceived environmental benefit?	The feasibility of any mining project is sensitive to the effect of cost. The higher the cost, the greater the risk that the Project will not proceed or that the Project will not be sustainable. While higher costs may be warranted to eliminate significant adverse effects there is no reason to investigate alternatives requiring significant additional cost unless there is a reasonable assumption of environmental gains. Taseko has determined that in the absence of the identification of significant potential environmental improvements at the pre-screening stage, an incremental cost of $500M over the cost of the Project proposed is a conservative threshold. $500M has been selected as a large enough cost to compensate for any estimation errors at this level of analysis. Any Alternative exceeding this threshold should be excluded at this stage unless it is determined in subsequent analysis of remaining alternatives that there is a significant environmental effect.
6F	Does the Alternative present an unacceptable environmental liability?	Taseko is a signatory to the Mining Association of Canada's *Toward Sustainable Mining* initiative. As such, it is their corporate policy to minimize the impact of operations on the environment and biodiversity through all stages of development from exploration through closure. If an alternatives presents an environmental liability that cannot be adequately resolved through mitigation or adaptation then the alternative should be eliminated.
7F	Does the Alternative present uncertainty in the ability to sustain permanent water cover?	The inability to provide and sustain a permanent water cover over potentially reactive tailings and waste presents a critical liability. Any Alternative that presents clear uncertainty that the ability to sustain a water cover cannot be achieved should be eliminated.
8F	Does the Alternative exceed the risk threshold for failure of engineered containment?	If the liquid waste containment facility exceeds the risk threshold for failure (CDA Guidelines) then the Alternative should be eliminated.
9F	Has the Alternative been eliminated due to previous regulatory rulings?	The Project has undergone previous multiple accounts analyses; however, some Alternatives have been deemed unacceptable based on regulatory rulings. While they may be technically-feasible Alternatives, they are eliminated based on the previous rulings.

RESULTS OF PRE-SCREENING

The pre-screening exercise reduced the number of alternatives from 15 to 2. Results are summarized in Table 2.4.3.1-2.

Table 2.4.3.1-2 Results of Pre-screening

	Pre-screening Criteria	Type of Criteria	T1 Fish Creek North	T2 Fish Creek South	T3 Tête Hill South	T4 Tête Hill North	T5 Cone Hill	T6 Tête Angela Creek	T7 Tête Angela Creek North	T8 Tête Hill East	T9 Beece Creek	T10 Groundhog Creek	T11 Big Lake	T12 Fish Creek South	T13 Fish Creek South	T14 Tête Hill North	T15 Tête Hill North
1	Does the life-of-mine waste production exceed the available storage of the Alternative?	Fatal Flaw	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
2	Does the Alternative limit expansion due to ore reserve increase due to lack of waste storage?	Exclusionary	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
3	Is any part of the mine waste disposal system unproven technology at the proposed throughput and climate?	Exclusionary	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
4	Does the disposal site exceed a practical distance to the open pit/mill site?	Exclusionary	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No
5	Does the Alternative exceed the threshold for financial liability (>$500,000,000 above the Proposed Project cost)?	Fatal Flaw	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes
6	Does the Alternative present an unacceptable environmental liability?	Fatal Flaw	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
7	Does the Alternative present uncertainty in the ability to sustain a permanent water cover?	Fatal Flaw	No	No	Yes	Yes	Yes	No	No	No	No	No	Yes	No	No	No	No
8	Does the Alternative exceed the risk threshold for failure of engineered containment?	Fatal Flaw	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
9	Has the Alternative been eliminated due to previous regulatory rulings?	Fatal Flaw	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No
	Should the Alternative be excluded from further consideration?		**Yes**	**No**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Alternative T1 (Fish Creek North) failed to pass screen 9. Alternative T1 was previously viewed as the favoured alternative based on the previous MAA; however, the results of the previous federal review of the proposed project concluded that the predicted environmental effects of the project were not justified.

Alternative T2 (Fish Creek South) passed all screens and was carried forward into detailed MAA.

Alternative T3 (Tête Hill South) failed to pass screen 7 due to a clear uncertainty in the ability to provide a permanent aqueous cover over PAG waste material.

Alternative T4 (Tête Hill North) failed to pass screen 7 due to a clear uncertainty in the ability to provide a permanent aqueous cover over PAG waste material.

Alternative T5 (Cone Hill) failed to pass screens 5 and 7 due to the cost differential between the cost of the project proposed and the cost of the Alternative ($918,000,000) exceeding the threshold and a clear uncertainty in the ability to provide a permanent aqueous cover over PAG waste material.

Alternative T6 (Tête Angela Creek) passed all screens and will be carried forward into detailed MAA.

Alternative T7 (Tête Angela Creek) failed to pass screens 4 and 5. The proximal distance from the open pit and mill site exceeds 10 km and the cost differential between the cost of the project proposed and the cost of the Alternative ($608,000,000) exceeds the threshold.

Alternative T8 (Tête Hill East) failed to pass screens 4 and 5. The proximal distance from the open pit and mill site exceeds 10 km and the cost differential between the cost of the project proposed and the cost of the Alternative ($1,483,000,000) exceeds the threshold.

Alternative T9 (Beece Creek) failed to pass screens 4 and 5. The proximal distance from the open pit and mill site exceeds 10 km and the cost differential between the cost of the project proposed and the cost of the Alternative ($960,000,000) exceeds the threshold.

Alternative T10 (Groundhog Creek) failed to pass screens 4 and 5. The proximal distance from the open pit and mill site exceeds 10 km and the cost differential between the cost of the project proposed and the cost of the Alternative ($591,000,000) exceeds the threshold.

Alternative T11 (Big Lake) failed to pass screens 4, 6, and 7. The proximal distance from the open pit and mill site exceeds 10 km, the requirement to pump tailings slurry via pipeline over the Taseko River is viewed as an unacceptable environmental risk, and the Alternative presents clear uncertainty in the ability to provide a permanent aqueous cover over PAG mine waste.

Alternative T12 (Fish Creek South with sub-aerial tailings disposal) failed to pass screen 6 as the sub-aerial disposal of PAG mine waste is viewed as an undesirable practice in British Columbia. This is considered a fatal flaw and thus this Alternative is eliminated.

Alternative T13 (Fish Creek South with subaqueous PAG in pit and slurry tailings) failed to pass screens 3, and 6 as the tailings disposal approach has not been proven at the proposed throughput and it present an unacceptable environmental liability.

Alternative T14 (Tete Hill North with subaqueous PAG in pit and dry stack tailings) failed to pass screens 3, 5, and 6 as the dry stack tailings disposal approach has not be proven at the proposed throughput and it presents an unacceptable environmental liability. Additionally, the cost differential between the cost of the project proposed and the cost of the Alternative ($719,000,000) exceeds the threshold.

Alternative T15 (Tete Hill North with comingled PAG and paste tailings) failed to pass screens 3, 5, and 6 as the paste tailings disposal approach has not be proven at the proposed throughput and it presents an unacceptable environmental liability. Additionally, the cost differential between the cost of the project proposed and the cost of the Alternative ($1,221,000,000) exceeds the threshold.

As a result, two alternatives have been put forward for further multiple accounts analysis:

- Alternative T2 (Fish Creek South) with subaqueous PAG waste co-disposal with tailings in the Upper (South) Fish Creek Drainage and NAG waste rock / ore storage located north of the pit.
- Alternative T6 (Tête Angela Creek) with subaqueous PAG waste co-disposal with tailings in the Tête Angela Drainage and NAG waste rock / ore storage located north of the pit.

MULTIPLE ACCOUNTS ANALYSIS

The two tailings and waste management options are described below.

T2 – Fish Creek South

Project Overview

Alternative T2 (see Figure 2.4.3.1-2) would involve a large open pit mine development and a 70,000 tonne per day concentrator facility with an average annual production of 108 million pounds of copper and 247 thousand ounces of gold production over a 20 year mine life. It involves a conventional shovel/truck open pit mine with crushed ore conveyed 2 km to a concentrator at a plant site that includes standard industry infrastructure. The works considered as part of the mine site include the open pit, ore and waste rock stockpiles, primary crusher and overland conveyor, the plant site, and the TSF. Figure 6.1 illustrates a mine layout including ore and waste rock storage location and the TSF. Non-PAG waste rock and overburden produced during active mining will be used in TSF embankment construction and road construction. Non-potentially acid generating (non-PAG) waste rock and overburden not used in TSF embankment construction, and road construction, will be located in the non-PAG stockpile to the east of the open pit. PAG waste rock and overburden will be stored sub-aqueously in the TSF. During mine closure, non-PAG waste stockpiles will be re-sloped to 2H:1V and a soil cover placed on sub-aerial tailings and waste rock.

Water Management Features

Alternative T2 directly impacts 2.1 ha of wetted streams and 0.3 ha of ephemeral streams. In terms of fish habitat, 14,000 ha of streams are impacted while 1 fish-bearing lake is directly impacted. Some diversion of excess water from freshet run-off will be required.

The TSF will have permanent self-sustaining water cover in the form of a flow through TSF lake with vegetated beaches. Excess water from the TSF will be pumped to the completed open pit until water quality improves to allow discharge through a spillway to upper Fish Creek, Fish Lake and ultimately the open pit. Prolonged water management may be required and active water treatment from the open pit is considered as a contingency measure.

Other Discriminating Features

T2 has a moderate operating cost which gives it a high likelihood of continuous operations. The Project would employ approximately 750 personnel per year for two years during construction and 407 personnel during operations. The potential for limited on-going post-closure personnel required for water management and periodic environmental monitoring are anticipated.

This alternative will cover a terrestrial footprint of 1,298 ha. No rare species of wildlife occur within T2 and the feeding habitats of moose, grizzly bears, and barrows golden eye are impacted from a low to moderate scale only. If a new access road were constructed off the east side of the 4500 Road, Fish Lake would be accessible for fishing during the life of the mine. This alternative falls within the commercial guide outfitter licensed area as well as the trap line area.

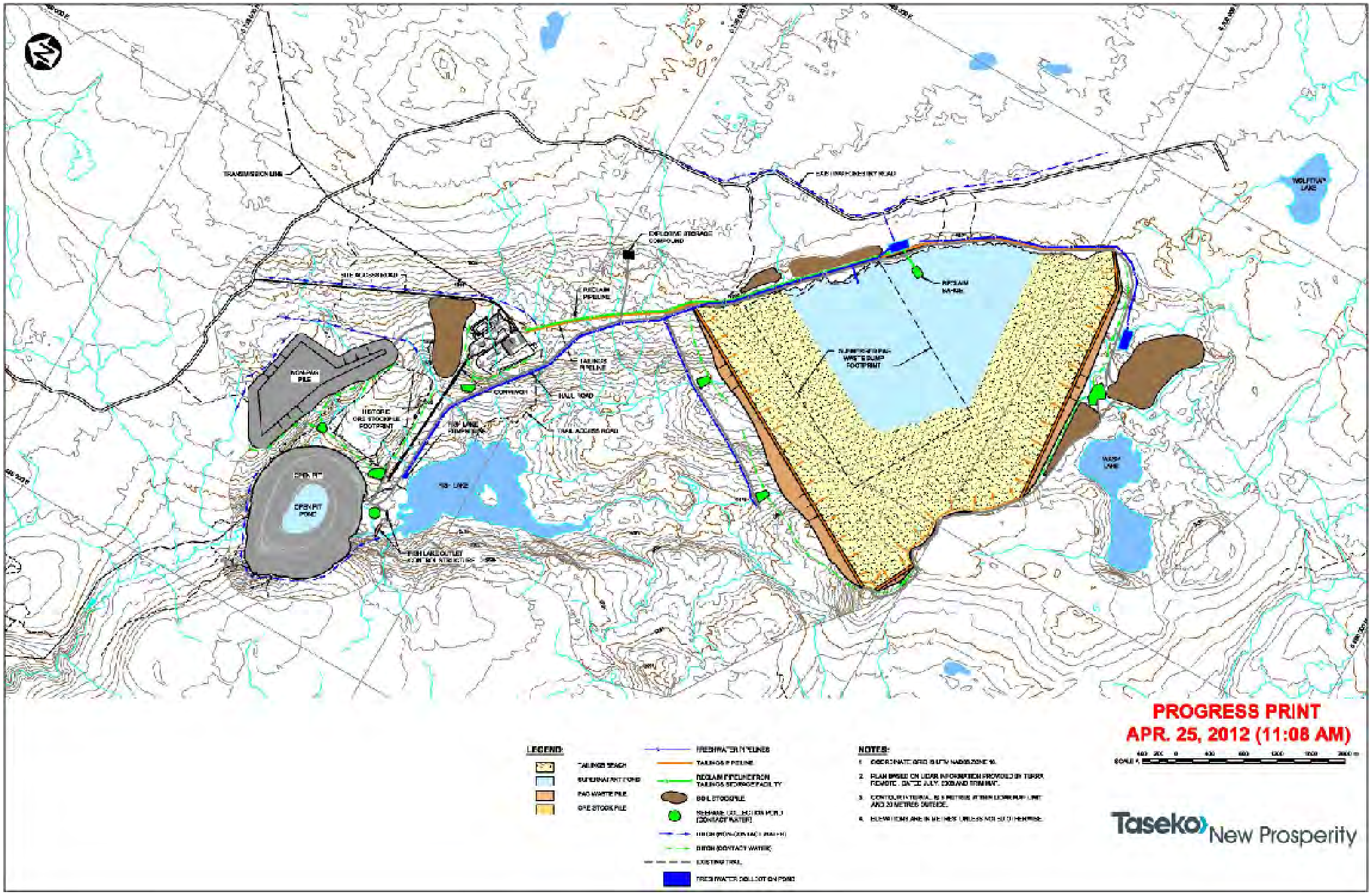


Figure 2.4.3.1-2 T2 - Fish Creek South – General Arrangement

T6 – Tête Angela Creek

Project Overview

Alternative T6 (see Figure 2.4.3.1-3) involves a large open pit mine development and a 70,000 tonne per day concentrator facility with an average annual production of 108 million pounds of copper and 247 thousand ounces of gold production over a 20 year mine life. This alternative involves a conventional shovel/truck open pit mine with crushed ore conveyed 2 km to a concentrator at a plant site that includes standard industry infrastructure. The works considered as part of the mine site include the open pit, ore and waste rock stockpiles, primary crusher and overland conveyor, the plant site, and the TSF. Figure 6.2 illustrates a mine layout including ore and waste rock storage location and the TSF. Non-PAG waste rock and overburden produced during active mining will be used in TSF embankment construction and road construction. Non-potentially acid generating (non-PAG) waste rock and overburden not used in TSF embankment construction, and road construction, will be located in the non-PAG stockpile to the east of the open pit. PAG waste rock and overburden will be stored sub-aqueously in the TSF. During mine closure, non-PAG waste stockpiles will be re-sloped to 2H:1V and a soil cover will be placed on sub-aerial tailings and waste rock.

Water Management Features

Alternative T6 directly impacts 2.0 ha of wetted streams and 2.6 ha of ephemeral streams. In terms of fish habitat, 47 ha of streams are impacted while four fish-bearing lakes are directly impacted. Some diversion of excess water from freshet run-off will be required, but water quality is not expected to change as a result of changing temperatures.

The TSF will have permanent self-sustaining water cover in the form of a flow-through TSF lake with vegetated beaches. Excess water from the TSF will be pumped to the completed open pit until water quality improves to allow discharge through a spillway to the Tête Angela system. Prolonged water management may be required and active water treatment from the open pit is considered as a contingency measure.

Other Discriminating Features

T6 has a high operating cost which gives it a smaller likelihood of continuous operations relative to T2. The Project would employ approximately 750 personnel per year for two years during construction and 414 personnel during operations. The potential for limited on-going post-closure personnel required for water management and periodic environmental monitoring are anticipated.

This alternative will cover a terrestrial footprint of 1,308 ha. No rare species of wildlife occur within the extent of this alternative and the feeding habitats of moose, grizzly bears, and barrows golden eye are impacted from a low to moderate scale only. Fishing in Vick Lake and Slim Lake would be lost permanently.

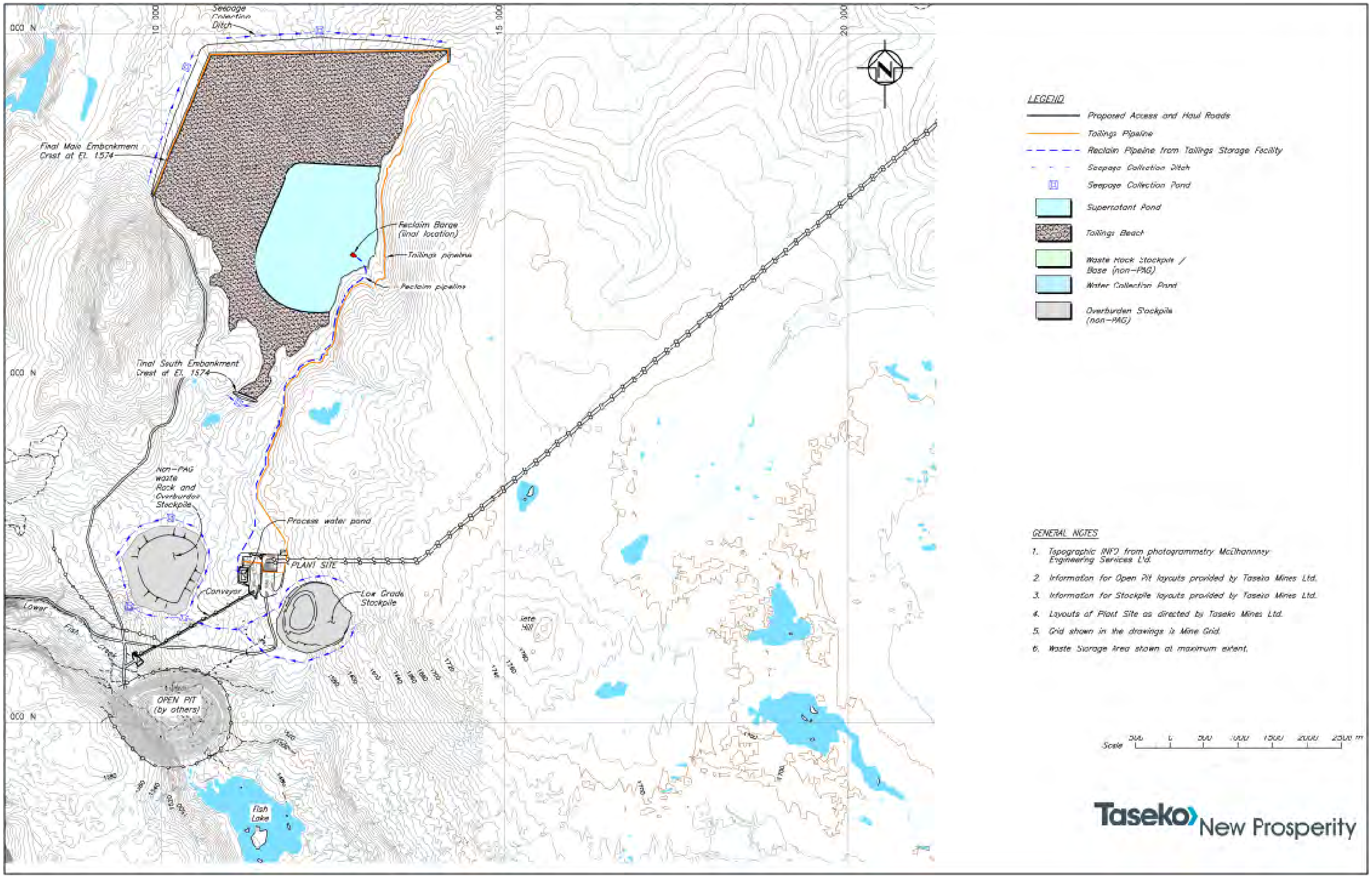


Figure 2.4.3.1-3 T6 - Tête Angela Creek – General Arrangement

Description of Accounts, Sub-accounts, and Indicators

Environmental Account

The environmental account encompasses a range of issues pertaining to the direct and indirect effects impacting the greater environment as a result of developing any given waste disposal option.

The environmental account is subdivided into a number of sub-accounts including land use, hydrology/hydrogeology, water quality, aquatic habitat, terrestrial environment, wildlife habitat, air quality, and watersheds. Each sub-account is evaluated on the basis of a series of indicators. Sub-accounts, indicators, and metrics for each indicator are summarized in Table 2.4.3.1-3.

Table 2.4.3.1-3 Environmental Account Sub-accounts, Indicators, and Metrics

Sub-account	Indicator	Metric
Land Use	**Haul Road Footprint**	Length of haul roads
	TSF Footprint	Area of direct impact
	Infrastructure Footprint	Tailings and reclaim pipe length
Surface Water	**Impact to Surface Water Availability**	Potential impact
	Ability to Prevent Mine Water Influence to Taseko River	Ability to prevent the migration of mine water
	Number of Watersheds Affected	Number of watersheds directly affected
Water Quality	**Potential Impact to Water Quality**	Level of mitigation required
	Potential for ARD Generation	Likelihood of ARD generation
	Potential for Metal Leaching	Likelihood of ML
	Seepage to Groundwater (Seepage Control)	Qualitative Rank
Aquatic Habitat	**Permanent Streams Impacted**	Based on area of direct impact
	Emphemeral Streams Impacted	Based on area of direct impact
	Indirect Impacts (Downstream Flow Reductions)	Based on area of indirect impact
	Number of Fish-Bearing Lakes Affected	Based on area of direct impact
Terrestrial Habitat	**Deer Winter Shelter Suitability**	Area of direct impact on varying capabilities
	Moose Winter Feeding Habitat Suitability	Area of direct impact on varying capabilities
	Loss of Grizzly Bear Habitat	Area of direct impact on varying capabilities
	Barrows Golden Eye Habitat Capability	Area of direct impact on varying capabilities
Terrestrial Ecology	**Wetlands**	Area of direct impact
	Rare Ecosystems	Area of direct impact
	Old Growth Forests: Spruce	Area of direct impact on spruce
	Old Growth Forests: Lodgepole Pine	Area of direct impact on lodgepole pine
	Grasslands	Area of direct impact
	Rare Plants	Occurrence, Field Counts
Air Quality	**Potential for Dust Emission**	Length of haul roads
	Potential for Greenhouse Gas Emission	Number of truck-hours
	Noise	Audible distance

Project Economics Account

The project economics account considers issues pertaining to the direct and indirect costs associated with the development of each alternative waste disposal option.

The project economics account is comprised on one sub-account; total costs. The sub-account is evaluated on the basis of a series of indicators. Sub-accounts, indicators, and metrics for each indicator are summarized in Table 2.4.3.1-4.

Table 2.4.3.1-4 Project Economics Account Sub-accounts, Indicators, and Metrics

Sub-account	Indicator	Metric
Total Costs	Capital Costs	$M, Life of Mine costs for differentaiting works and activities
	Operational Costs	$M, Life of Mine costs for differentaiting works and activities
	Closure and Reclamation Costs	$M, Life of Mine costs for differentaiting works and activities
	Fish Habitat Compensation Costs	$M, Life of Mine costs for differentaiting works and activities
	Financial Security Implications (Mines Act)	Project Area of Disturbance

Socio-economic Account

The socio-economic account addresses the social and cultural impacts of the alternatives.

The socio-economic account is subdivided into a number of sub-accounts including health and safety, socio-economic impacts, first nations impacts, public opinion, archaeological value, and recreation and commercial land use. Each sub-account is evaluated on the basis of a series of indicators. Sub-accounts, indicators, and metrics for each indicator are summarized in Table 2.4.3.1-5.

Table 2.4.3.1-5 Socio-economic Account Sub-accounts, Indicators, and Metrics

Sub-account	Indicator	Metric
Health and Safety	Risk to Human Health	Risk matrix
	Risk to Public Safety	Risk matrix
	Risk to Worker Safety	Risk matrix
Socio-economic Impacts	Economic Benefits to Regional Communities	Qualitative Rank
	Regional Job Creation and Diversity	Employment numbers
	Indirect Employment	Employment numbers x 2.5
	Impact on Community Services and Infrastructure	Employment Numbers
	Community Stability	Total Life-of-Mine Costs
First Nations Impacts	Aboriginal Rights	Qualitative Rank
	Extent of Traditional Land Use (No. of Individual Users)	Quantitative Rank
	Extent of Traditional Land Use (No. of Activities)	Quantitative Rank
Public Opinion	Regional Community Response	Taseko's Assumption
	Local First Nations Community Response	Taseko's Assumption
Archeological Value	Archeological Potential	Area of direct impact
Recreation and Commercial Land Use	Visual Impact	Area of direct impact
	Impact to Navigable Waters	Area of direct impact
	Extent of Recreational Land Use	Quantitative Rank
	Extent of Commercial Land Use	Quantitative Rank

Technical Account

The technical account assesses the technical merits of each of the alternatives. The account views the various life stages of the mine (construction, operations, closure, post-closure) and addresses issues specific to each.

The technical account is subdivided into a number of sub-accounts including construction, operations, closure, capacity, and water management. Sub-accounts, indicators, and metrics for each indicator are summarized in Table 2.4.3.1-6.

Table 2.4.3.1-6 Technical Account Sub-accounts, Indicators, and Metrics

Sub-account	Indicator	Metric
Construction	Topographic Complexity	Qualitative Rank
	Dam Complexity	Qualitative Rank
	Geotechnical and Seismic Concerns	Qualitative Rank
	Material Availability	Quantitative Rank
Operations	Distance Between TSF and Mill Site	Quantitative Rank
	Distance Between TSF and Pit	Quantitative Rank
	Operational Risks and Uncertainties	Risk Matrix
	Impact on Ability to Extract Known Resource	Constraints and Operating Cost
	Water Treatment Requirements (Operations)	Qualitative Rank
Closure	Ease of Decommissioning and Closure	Qualitative Rank
	Ability to Provide Suitable Water Cover	Qualitative Rank
	Potential Water Treatment Requirements (Closure)	Qualitative Rank
	Potential Water Treatment Requirements (Post-Closure)	Qualitative Rank
	Post-Closure Landform Stability	Qualitative Rank
	Post-Closure Chemical Stability	Qualitative Rank
Capacity	Tailings Storage Expansion Capacity	Qualitative Rank
	TSF Storage Efficiency	Qualitative Rank
Water Management	Sensitivity to Climate Variability	Storage capacity volume per construction material volume
	Dam Hazard Classification	CDA Dam Classification

<u>Scoring, Weighting, Cases Evaluated, and Sensitivity Analysis</u>

A relative scoring template has been developed for each indicator using a comparative 6-point ranking system based on the metrics identified in Table 2.4.3.1-2 through Table 2.4.3.1-5 above. A description and justification for scoring each indicator can be found in the detailed report in Appendix 2.4.3.1-A. A score of 6 is considered the most favourable while a score of 1 is considered least favourable.

Six-point weighting factors were applied to all accounts, sub-accounts, and indicators. The weighting factors have a multiplier effect such that a weighting factor of 6 magnifies the score of a given account, sub-account, or indicator 6 times relative to a parameter that is assigned a weighting factor of 1.

Changing the relative weights allows the analysis of alternatives from different value systems. Five cases are presented here.

Case 1: Taseko Values

This analysis was implemented by maintaining account weighting factors consistent with the recommendations suggested in the Guidelines (EC, 2011), as follows:

- Environment Account Weighting Factor: 6
- Socio-economic Account Weighting Factor: 3
- Technical Account Weighting Factor: 3, and
- Project Economics Weighting Factor: 1.5.

Sub-account and indicator weighting factors were established taking into account Taseko's corporate and environmental values with particular weightings adjusted to reflect valued components and key sub-accounts and indicators that are specific to the New Prosperity Project.

Case 2: Environment Canada Base case Analysis

The general account weighting factors for Case 2 are consistent with the base case account weighting recommendations suggested in the Guidelines (EC, 2011) but with all sub-accounts and indicators weighted equally.

Case 3: Economics Excluded

Case 3 removed all project economic influences by assigning the project economics account weight to zero while the remaining accounts are left consistent with the Environment Canada base case.

Case 4: Economics Excluded with Fisheries Bias Introduced

Case 4 removed all project economic influences by assigning the project economics account weight to zero and introduces a fisheries bias by setting the weighting of all sub-accounts related to water, water quality, and aquatic habitat to 6 and reducing all other sub-account weightings to 3.

Case 5: Technical Screening

Case 5 introduces a bias to technical aspects of the project by assigning zero weight to environmental and socio-economic accounts, a weight of 3 to the project economics account, and a weight of 6 to the technical account.

Sensitivity Analysis

A sensitivity analysis was applied to corroborate each case by an account normalization procedures and a series of three sensitivity analyses. The details of this analysis can be found in the detailed report in Appendix 2.4.3.1-A.

RESULTS AND CONCLUSIONS

The comparative overall results of each of the MAA cases are presented in Table 2.4.3.1-7. The analysis suggests that Alternative T2 (Fish Creek South) scores more favourably in each assessed case.

Table 2.4.3.1-7 Summary of Multiple Accounts Assessment by Case

Case	Account Weighting				Ranking		Notes
	Environment	Socio-economic	Technical	Project Economics	Fish Creek South	Tete Angela Creek	
1. Taseko Assumptions	6	3	3	1.5	1	2	Indicator weighting based on Taseko assumptions with Environment Canada recommended account weighing factors
2. Base Case	6	3	3	1.5	1	2	Environment Canada recommended account weighting factors
3. Economics Excluded	6	3	3	0	1	2	Project Economics is removed from the MAA, remaining account weighintg factors as for Case 2.
4. Economics Excluded with Fisheries Bias	6	3	3	0	1	2	Account weighting as for Case 2, with sub-account and indicator weighting favouring fish and fish habitat
5. Technical Screening	0	0	6	3	1	2	Places emphasis on technical merits of each alternative with moderate weighting applied to project economics

The comparative overall results of each of the MAA cases by account are presented in Table 2.4.1.3-8. The analysis suggests that Alternative T2 (*Fish Creek South*) scores more favourably with respect to environment, technical, and project economics in each assessed case. The two alternatives score equally with respect to the socio-economic account in all cases.

Table 2.4.3.1-8 Summary of Multiple Accounts Assessment by Account

Case	Candidate Alternative	Merit Rating by Accounts				Combined Account Merit Rating
		Environment	Socio-economic	Technical	Project Economics	
1. Taseko Case	T2 - Fish Creek South with subaqueous tailings disposal	**4.0**	**4.2**	**3.4**	**3.3**	**3.8**
	T6 - Tête Angela Creek with subaqueous tailings disposal	**3.5**	**4.2**	**2.9**	**2.8**	**3.5**
2. Base Case	T2 - Fish Creek South with subaqueous tailings disposal	**3.9**	**4.2**	**4.0**	**3.0**	**3.9**
	T6 - Tête Angela Creek with subaqueous tailings disposal	**3.6**	**4.2**	**3.6**	**2.8**	**3.6**
3. Economics Excluded	T2 - Fish Creek South with subaqueous tailings disposal	**3.9**	**4.2**	**3.6**		**3.9**
	T6 - Tête Angela Creek with subaqueous tailings disposal	**3.6**	**4.2**	**3.3**		**3.7**
4. Economics Excluded with Fisheries Bias	T2 - Fish Creek South with subaqueous tailings disposal	**4.0**	**4.2**	**3.6**		**4.0**
	T6 - Tête Angela Creek with subaqueous tailings disposal	**3.6**	**4.2**	**3.3**		**3.6**
5. Technical Screening	T2 - Fish Creek South with subaqueous tailings disposal			**3.6**	**3.0**	**3.4**
	T6 - Tête Angela Creek with subaqueous tailings disposal			**3.3**	**2.8**	**3.1**

A host of sensitivity analyses corroborate the results of the general cases. This analysis can be found in detailed report in Appendix 2.4.3.1-A.

It is recommended that the Fish Creek South waste management option is preferred and should be carried forward for the development of the Project.

2.5 CONSULTATION

The following sections describe the key consultation events and activities conducted for the development of the EIS. These consultation events and activities are divided into two major sections which include: Aboriginal Consultation and Public Consultation. A description of key consultation events as well as a summary of key issues discussed and presented at these events is provided below.

Consultation events and activities have been conducted since 1992. For the development of the Prosperity EA, events from 1992 to 2009 are summarized in Volume 2, Section 5 of the March 2009 EIS/Application in four sections: Government Agency Consultation, Public Consultation, First Nation Consultation and Stakeholder Consultation. The Public Consultation Report produced for the 2009 BC EAO review process and the First Nations Consultation Report produced for the 2009 BC EAO review process are provided in Appendices 2.5.1-A and 2.5.1-B, respectively.

During the federal review of the previous project, public hearings were conducted from March 22 to May 3, 2010 in the communities most affected by the Project. Transcripts that document the Panel hearings conducted in the spring of 2010 and that summarize issues and concerns raised by the public and First Nations are tabulated in Appendix 2.5.1-C.

The following sections illustrate how Taseko has engaged with, and continue to provide up-to-date information regarding the Project to the public and aboriginal groups, particularly those most likely to be affected by or interested in the Project. It also indicates how stakeholder considerations were incorporated into the MDP project design, and the steps that the proponent has taken to involve aboriginal groups and to take their advice as to how best to deliver this information.

2.5.1 Aboriginal Consultation

This section provides information required by the EIS guidelines, plus provides an overview of Taseko's aboriginal engagement and consultation strategy.

Taseko's engagement with Aboriginal groups and the methods used for obtaining Aboriginal traditional knowledge are documented in in subsection 2.5.1.1.

Changes that the Project may cause in the environment, which in turn may impact current use of lands and resources for traditional purposes by Aboriginal persons, physical and cultural heritage, and/or the capacity of renewable resources to meet the needs of the present and those of the future are discussed in Section 2.7.5.2.

An overview of aboriginal rights and title relative to this project is provided in Section 2.5.1.1. The reader is referred to Section 2.7.5.2 where potential impacts of the Project on potential or established Aboriginal rights or title are discussed.

Taseko's Engagement and Consultation Strategy was first implemented in the 1990s during the initial project planning period and was based on the following core values:

- First Nation engagement and consultation would provide input to assist the Project Team in effective project design, construction and post closure activities
- First Nation engagement and consultation would provide environmental and local cultural awareness key in developing a sound project
- A First Nation Consultation and Engagement Strategy would be determined in conjunction with each First Nation, and
- Funding to support capacity building within the First Nation to promote understanding of the Project would be available.

Since the early phases of project planning in the 1990s, engagement and consultation objectives have been to:

- Promote effective, proactive and responsive communications with concerned First Nations, Tribal Councils and agencies
- Build an understanding of the Taseko Prosperity Mine Plan and Environmental Assessment through continuous dialogue and information exchange
- Engage with First Nations in a timely, transparent consultation process designed to meet the needs of the local First Nations communities, determine the appropriate consultation program and engagement methods for each First Nation
- Accurately document all communications documented in the "Tables of First Nations Engagement and Consultation" (Appendix 8-2-A)
- Record communications between the Taseko's representatives and First Nations to ensure that concerns are included in the EA, and
- Develop and carry out appropriate Commitments to First Nations during all phases of the Project.

In 2011, Taseko established an Aboriginal Policy consistent with the Mining Association of Canada's *Towards Sustainable Mining* initiative that outlines Taseko's objectives with respect to Aboriginal people.

Taseko Mines is committed to developing mutually beneficial relationships with Aboriginal Peoples and with local communities that are affected by, or that affect, the company's various endeavors.

To fulfill this commitment the following principles will guide our decisions and the conduct of our employees. In accordance with the principles of Towards Sustainable Mining (TSM) we will:

- *Respect Aboriginal and Treaty rights and seek to understand local perspectives on those rights;*
- *Acknowledge and respect the social, economic, environmental and cultural interests of Aboriginal Peoples;*
- *Engage with Aboriginal Peoples, in accordance with the TSM Guiding Principles, to develop open and effective relationships throughout the mining lifecycle. This includes:*
  - *Building a cross-cultural understanding so that company personnel understand Aboriginal Peoples' culture, values and aspirations, and Aboriginal Peoples understand the company's principles, objectives, operations and practices*
  - *Undertaking early, timely and culturally appropriate engagement with Aboriginal peoples, including within the environmental assessment process, to ensure their interests in a project and its potential impacts are understood*
  - *Consideration of traditional knowledge to minimize or mitigate potential adverse environmental and social impacts, and enhance positive benefits of mining and related activities*
  - *Developing agreements for participation, where appropriate, either directly with local Aboriginal communities or in conjunction with governments*
  - *Working with governments and communities to support and encourage community development programs, which may include education, training, health, culture, employment and business development, or other community needs and priorities such as capacity building*
  - *Supporting and encouraging Aboriginal involvement in environmental monitoring, closure planning and reclamation and other environmental activities that may be of interest to them, and*
  - *Developing and implementing company policies and systems that support these commitments and encourage suppliers of goods and services to the industry to do the same.*

2.5.1.1 Engagement and Consultation

Consultations Undertaken with Aboriginal Groups Prior to the Submission of the EIS and Methods Used

Taseko believes First Nation engagement and consultation is integral to the EA process. Addressing First Nations concerns in the early stages of the EA provides direction for the Project Team and their studies. A variety of consultation and engagement mechanisms include: Project notifications, follow-up phone calls, letters and emails, presentations, and meetings with Chief and Council, Tribal Councils, Elders, individual members and staff.

The First Nations that have been / will be engaged in the previous project and on New Prosperity are identified in Table 2.5.1.1-1.

Table 2.5.1.1-1 First Nations Being Consulted on the New Prosperity Gold-Copper Project

Used in this Report	Full Name
Tsilhqot'in (Chilcotin)	
?Esdilagh (Alexandria)	?Esdilagh (Alexandria Indian Band)
Tl'esqox (Toosey)	Tl'esqox (Toosey Indian Band)
Tl'etinqox-t'in (Anaham)	Tl'etinqox-t'in Government Office (Anaham Indian Band)
Tsi Del Del (Alexis Creek)	Tsi Del Del (Alexis Creek Indian Band)
Ulkatcho	Ulkatcho First Nation
Xeni Gwet'in (Nemiah)	Xeni Gwet'in First Nations Gov't (Nemiah Valley Indian Band)
Yunesit'in (Stone)	Yunesit'in Government (Stone Indian Band)
Secwepemc (Shuswap)	
Esketemc (Alkali)	Esketemc First Nation (Alkali Lake Indian Band)
Llenlleney'ten (Llenlleney'ten)	Llenlleney'ten (Llenlleney'ten First Nation)
Stswecem'c/Xgat'tem (Canoe Creek)	Stswecem'c/Xgat'tem (Canoe Creek/Dog Creek Indian Band)
T'exelcemc (Williams Lake)	T'exelcemc (Williams Lake Indian Band)
Xat'sull/Cmetem (Soda Creek)	Xat'sull First Nation/Cmetem First Nation (Soda Creek/Deep Creek Indian Bands)

Taseko began implementing their First Nation Engagement and Consultation Strategy in 1993, with the First Nation communities in closest proximity to the proposed Project mine site, access roads and transaction corridor, and transmission line. These First Nation communities included: Xeni Gwet'in (Nemiah), Yunesit'in (Stone), Esketemc (Alkali) and Stswecem'c/Xgat'tem (Canoe Creek). Between 1993 and 1996, Taseko had a series of meetings with leadership within the Tsilhqot'in National Government (TNG), which, at that time, represented five First Nation communities: Xeni Gwet'in (Nemiah), Yunesit'in (Stone), Tsi Del Del (Alexis Creek), ?Esdilagh (Alexandria) and Tl'etinqox-t'in (Anaham). The TNG does not represent the Tl'esqox (Toosey), who are represented by the Carrier Chilcotin Tribal Council (CCTC);

however the Tl'esqox (Toosey) have worked closely with the TNG and participated in TNG meetings with Taseko.

As the engagement and consultation process evolved, Taseko held a series of meetings and distributed information booklets in the individual communities. During the late 1990s and from 2004 to 2008, nine Tsilhqot'in and Northern Secwepemc communities were engaged with Taseko on the Prosperity Project.

Engagement with the Ulkatcho, Llenlleney'ten (High Bar) and Xat'sull/Cmetem (Soda Creek) communities were initiated late in 2008 as the Provincial Government suggested these First Nations should also be consulted. There are now 12 First Nations included in Taseko's First Nation Engagement and Consultation Strategy.

The Taseko Mines Prosperity Project Table of First Nation Engagement and Consultation (Appendix 8-2-A) represents a compilation of issues by representative First Nations Governments or Tribal Councils as well as by individual First Nations communities. This table further documents the efforts undertaken to gather Aboriginal traditional knowledge, including through two ethnography studies conducted in the 1990s with participation from Aboriginal groups.

A report for the BC EAO was produced in August 2009 to summarize consultation conducted for the previous project during the Provincial EA review. This document is provided in Appendix 2.5.1-B.

During the federal review of the previous project, a public hearing was conducted from March 22 to May 3, 2010 in the communities most affected by the Project. The Panel held community hearing sessions in the First Nation communities of Xeni Gwet'in (Nemiah Band) (March 29 to April 1, 2010), Yunesit'in (Stone Band) (April 7-8, 2010), Tl'esqox (Toosey Band) (April 9-10, 2010), Tl'etinqox (Anaham Band) (April 12-13, 2010), Tsi Del Del (Redstone Band) (April 15-16, 2010), Stswecem'c/Xgat'tem (Canoe Creek Band) (April 16-17, 2010), and Esketemc (Alkali Lake Band) (April 19-21, 2010). Closing remarks were received in Williams Lake on May 1 and May 3. The Panel was in session for 30 hearing days, over 42 calendar days. The public hearing sessions were well attended; a listing of all people who appeared before the Panel can be found in Appendix 3 of the Federal Panel report.

Panel transcripts were reviewed from the 2010 hearings to further summarize issues and concerns, as well as traditional use and knowledge obtained from the community hearings. These summaries are provided in Appendix 2.5.1-C. A table for each session summarizes:

- First Nation Community Session and date
- Contributor
- Issue, and
- Use Information.

From December 2010 to present, Taseko has attempted to engage the Tsilhqot'in and Northern Secwepemc communities and leadership on the New Prosperity Project. Engagement efforts are document in Appendix 2.5.1-D.

Taseko has taken the following steps in attempts to gather and convey information in a manner that considered the views of aboriginal groups as to how to best achieve that objective:

- Offer to meet to discuss revisions to the project design (December 2010).
- Offer to meet leadership and/or community to hear issues/concerns with regard to a new mine development plan and/or concerns with Taseko (February 2011).
- Phone calls and hand delivery of a digital and hard copy of the draft Project Description provided to each community (June 2011).

- Offer to meet to explain the draft project description and new mine development plan (July 2011).
- Offer to meet to explain the New Prosperity Project Description and hand delivery of a digital and hard copy (August 2011).
- Letters to each Nation and Chiefs requesting a meeting to discuss, or alternatively, have their written responses, on their issues and concerns with New Prosperity, their views on potential significant adverse environmental effects, and/or their views of the proposed project's effect or impact on Aboriginal Rights or Title. In this letter (April 2012), a link to a website for digital copy of New Prosperity Project Description was provided, as was notification of public meetings being held in Williams Lake on April 16, 2012.

Taseko's engagement efforts since December 2010, including the various correspondences between Taseko and the TNG, or meetings with Esketemc (Alkali Lake Band) and Stswecem'c/Xgat'tem (Canoe Creek Band), are listed in Appendix A.

While meetings with leadership of Esketemc (Alkali Lake Band) and Stswecem'c/Xgat'tem (Canoe Creek Band) did occur in 2011, Taseko's offers to present New Prosperity information to the community members have not yet been accepted. Meetings have been held with the forest manager of Alkali Resources Ltd. to further the planning on the transmission alignment route through or near the Esketemc Community Forest. This proposed alignment requires further discussion with Esketemc leadership.

There has been no acceptance from Tsilhqot'in leadership to meet with Taseko; numerous offers to meet have been extended, initially in December 2010 to discuss an interest in revising the Project's design. Taseko has provided the TNG with extensive information about the New Prosperity Project over the last eighteen months. These steps have included sharing both the draft version and the final version of our detailed project description and Taseko has afforded a very substantial opportunity to consult.

Taseko, Tsilhqot'in leadership, and the Crown met in January 2012 and reached a settlement respecting the Tsilhqot'in's concerns with and Taseko's need for geotechnical investigations for the New Prosperity mine site layout, which resulted in discontinuance of related legal proceedings.

The TNG's publicized list of "10 facts why resubmitted Prosperity Mine Proposal cannot be approved" is documentation of their perception and concern with regard to New Prosperity. Taseko's response to these 10 items is provided in Section 2.7.5.3 of this EIS.

Formal letters from the TNG have been received by Taseko and the Federal government that outline their general concerns with New Prosperity, based on their understanding of the Project. The most recent letter from the TNG was received on May 14, 2012; the concerns itemized in this letter have been added to Taseko's documentation of key issues and concerns with the Project.

In setting out our understanding of aboriginal interests in the EIS, Taseko is relying upon an extensive body of information that has been assembled over the last 20 years; in particular that information which was assembled during the prior panel review of the original Prosperity project. While Taseko has been trying unsuccessfully to discuss the design modifications reflected in New Prosperity and how the resulting project may or may not affect aboriginal interests, it is important to acknowledge that those efforts build upon an extensive body of existing information, much of which remains relevant to the New Prosperity Project.

Summary of Ongoing and Future Consultation Activities with Aboriginal Groups

Over the many years leading up to the submission of the EIS, Taseko has undertaken extensive consultation with First Nations. The purposes of this consultation has been to seek to develop a working relationship with the First Nations; to identify potential opportunities for mutual benefit; to identify aboriginal concerns and consider options to mitigate or accommodate those concerns; and, to perform certain procedural aspects of the Crown's duty to consult.

Taseko intends to continue those efforts during the environmental assessment process, and as appropriate, beyond that phase.

It is Taseko's intent to work closely and cooperatively with participating First Nations throughout the environmental assessment to ensure that potential project-related impacts on identified interests are appropriately addressed.

Ongoing involvement and input from First Nations will be encouraged, facilitated and supported by the Company through the provision of Project-related information as well as in-house expertise to explain that information.

The nature of the consultation process for each First Nation will be determined to a considerable degree by the interest and willingness of that First Nation to participate in consultation with Taseko but generally, Taseko will:

- Seek suggestions from the First Nations as to how Taseko may be able to make the consultation process more meaningful for their community.
- Be available to answer any specific written or oral questions from First Nations relating to the Project, and will make appropriate in-house expertise available to attend at First Nation communities if that is their wish, to provide presentations on the EIS and on the Project, and to answer questions that may arise in the community.
- Work closely with the Crown and carry out any reasonable requests of the Crown with respect to consultation.
- Provide copies of the EIS and facilitate access to any relevant and reasonably available supporting documentation/studies that may be of interest to specific First Nations.
- Take reasonable steps to keep the First Nations informed in relation to the scope, potential impacts, timing and progress of the Project.
- Seek First Nations' input, through whatever form of communications, meetings or other forms of information sharing is appropriate to the particular First Nations, to reasonably address concerns regarding the potential for Project-related impacts on their interests, by identifying appropriate mitigation or accommodation measures and/or other appropriate means by which to address/resolve potential impacts identified by First Nations.

Key Issues and Concerns Identified

This section provides an outline of the issues identified by each First Nation. Through the consultations referred to above, a number of issues or concerns have been raised by aboriginal groups. Those issues fall within one or more of the following categories:

- Issues that are relevant to asserted or established aboriginal rights and title (which is relevant to the Crown's duty to consult and accommodate independent of the terms of the *Canadian Environmental Assessment Act*)
- Potential impacts regarding the current use of land and resources for traditional purposes by aboriginal people or impacts and physical and cultural heritage, where such impacts are derived from changes that the Project may cause in the environment (which is relevant to the panel's consideration given the definition of "environmental effect" in the *Canadian Environmental Assessment Act*, and

- Issues that may not fall within either of the above but which were raised during the course of consultations or submissions and which are noted here for completeness and transparency.

For the purposes of fulfilling the requirements of Section 2.5.1.1 of the EIS guidelines, we are presenting the full range of aboriginal issues and concerns identified through consultations to date, irrespective of which of the above three categories they may fall within. Taseko does, however, make further comment on the significance of such categorization of issues later in Section 2.7.5 of this EIS. Further, in the interest of completeness, we are also including issues and concerns related to the original Prosperity project proposal which would have involved the loss of Fish Lake, even though the New Prosperity project does not involve the loss of that lake. These concerns are noted with an asterisk.

Table 2.5.1.1-2 Key Issues and Concerns Identified by First Nations

Category	Concern
Environmental	
Wildlife	Dust and the air carry pollutants that will be absorbed by: • The plants and be ingested by animals and result in tainted home country foods, a key source of protein in traditional diets, and • Enter the water systems.
	There be a net loss of habitat for wildlife (such as grizzly bear) due to Project development and will the travel corridors for animals (like mule deer) be potentially affected
	The Project and its development will increase local hunting, specifically by employees, and contractors who will come and live in the local area
	Animal abundance and diversity will be affected from mortality (falling into the mine pit, being killed on the roads)
	Trappers will not be compensated for losses on the trap line as a result of the Project being developed
Fish and Fish Habitat	The impacts on fish habitat in the area will reduce opportunities for First Nations
	That fish living in the tailings ponds will not be suitable for eating
	That the genetic line of existing trout population that exists today will not be maintained
	Pollution from the mine effluent drainage system might devastate the salmon and sturgeon within the Chilko and Taseko Mines River system. Even if no effect, harvesting and consumption of salmon from the Dasiqox (Taseko River) would likely also be avoided, given the presence of the mine in the headwaters of that important salmon river.
	The loss of outlet spawning habitat and populations will eliminate this fish source and abundance of fish for First Nation harvest during operations.
	Fish might be larger (in Prosperity Lake) but less numerous than those currently in Teztan Biny and that it would take substantially more time and effort to catch the same amount of food.*
	Fish might be contaminated from the nearby mining activities, including Jidizay Biny (Big Onion Lake) as a result of seepage from the tailings storage facility, which would also lead to avoidance of that lake.
	Concern that if Teztan Biny (Fish Lake) was not available there would be increased competition for resources in those other lakes.*

Category	Concern
	Concern that Fish Lake would be contaminated from seepage from the TSF
Water Contamination	Groundwater/surface water interaction will not be monitored, or monitored long enough, when the operation period of the mine discontinues.
	Whether or not there is going to be water treatment and who will maintain it long-term
	How ARD is going to be managed, and what the risks are if water levels in pond drop after closure
	Whether or not toxic chemicals will be used (i.e. Cyanide), and concerns about metals such as Mercury and Arsenic
	Effects on aquifers and springs, long-term
	Prevention of groundwater impacts, and the blasting effects on the pit walls and the seepage loss from the pit
Gathering and Harvesting	Impact of dust on soils on medicinal plants, berries, and wildlife food sources
	As a result of logging and land disturbance increased in the region, First Nations would rely more heavily on the plants and berries growing in the Teztan Biny (Fish Lake) area as this area was considered one of the few remaining pristine areas east of Dasiqox (Taseko River).
	Medicines in the areas around their communities were contaminated, as a result, they would travel to Teztan Biny (Fish Lake) and the surrounding mountains where they felt the medicines were healthier and had more strength.
	Taseko did not provide any analysis on how accessible other areas were and what additional cost would be incurred by First Nations to access them.
	The construction and operation of an open pit mine would end the use of the Teztan Biny (Fish Lake) and Nabas area as a cultural hub for gathering.
Hazard and Nuisance Effects	Concern was raised that noise and lights will be seen and heard from Nemiah.
	Concern about hazards and risks such as the open pit after closure to people and animals, contribution of the Project on global warming and impacts on glacial fields, effects on the Project and infrastructure from earthquakes.
Increased Access	Concern was raised that the transmission corridor will result in increased access to hunting and trapping territories impacting wildlife populations, and increased access to important fishing sites. Concern that non-Aboriginal people will have new access to hunting areas.
	Concern that power into the region from the transmission corridor will result in further settlement.
	Expressed concerns regarding Transport Canada's initial recommendation that Taseko increase access to other fishing lakes as mitigation for navigation impacts and how that would further increase competition for fish and decrease the harvest.
Closure and Reclamation	Concern that reclamation is not clearly explained or reclamation is not as successful as described.
	Concern with the tailings pond being located above the lake as there will be disturbance to the lake's ecosystem.
	Criticism that multiple accounts analysis did not take indicators for environmental, social or cultural values into account, nor provide for monitoring to determine success.
Socio-economic	

Category	Concern
Culture	Concern was raised from Elders who were generally not accepting of the Project with perspectives that Prosperity is “destructive to the land and the animals; they don’t want to see the mine go in.” First Nations described themselves as “caretakers of the land; that they have a duty to their ancestors who fought for this land to protect it; that they are connected to the land.” The land is their most precious asset and “destroying” it is not something they will entertain
	Collection and distribution of First Nations cultural, burial and other archaeological sites is a concern.
	Concern was expressed about cremation sites on the island in the middle of Fish Lake.
	The loss of a heritage sites and archaeological burial ground around Fish Lake. Concerns regarding ancestors’ homestead sites in Nabas area.
	Concern that the Fraser River needs an 8 km wide corridor running on both sides to be protected.
	Concern that traditional knowledge areas will be potentially affected by the transmission line corridor.
	Questions were raised regarding medicinal food and wildlife, and if it will be infected; concern if the area is not fenced.
	The lack of access to the mine area is going to impact the traditional way of life.
	Concern was expressed that much of the TUS information is confidential and it will have to be scrutinized prior to publishing.
	Any infringement on the rights of First Nations is a serious issue and any impact on the Taseko River will be regarded as an infringement on First Nation rights.
Long-term Community Benefits	Concern that the Mine will have social impacts on people, such as increased drug and alcohol abuse and higher crime due to money from the mine in the community
	No assurance of long-term community benefits and environment protection for them to approve of development on their land.
	There is concern regarding the high unemployment rate (80%) in their communities but they will not have access to jobs at the mine.
	Impact of the mine and transmission line on emerging tourism strategy being developed with First Nations.
	Concern was raised that the favourable jobs would go to non-local residents.
	Employees’ onsite will go offsite and impact wildlife.
Employment, Contracts, Community Funding	Concern that there is a lack of ownership in First Nations communities but plenty of poverty, inadequate education, and poor government fiscal control of First Nation spending. First Nations are interested in revenue sharing.
Employment, Contracts, Community Funding	First Nations want tax revenues; some First Nations compared the conditions in their community to third world conditions. Since Project structures would be located on traditional territory, taxes should go to First Nations since resources belong 100% to the Chilcotin people.
	In regard to royalties, concern that it won’t be invested wisely such as going to other businesses that continue on after the operation of the mine so that grandchildren will benefit.
	If the Project proceeds, requests were made for training so that First Nations could obtain non-operating jobs.

Category	Concern
	Concern that the mine might not be economical and close during periods of low commodity prices.
Regulatory	
Consultation	Concern they are not being consulted by the province and requested that costs be covered for participating.
	Expressed concern of lack of access to information and lack capacity to provide effective input to the Working Group Meetings.
	Concern that they will be put into the position of having to make a quick decision regarding the Project.
	Community members, not the Chiefs, will be the decision makers and their concerns must be addressed or they will vote “no.”
Consultation	For further meetings to occur, legal council will need to be present to protect Rights and Title case.
	Concerned that they have little experience working with mining companies.

Potential Impact on Potential or Established Aboriginal Rights and Mitigation Measures

An aboriginal right is a custom, practice or tradition integral to the distinctive culture of aboriginal peoples at the time of contact with European settlers (generally regarded as 1793 in British Columbia). Aboriginal rights do not generally include an interest in land, but rather represent a right to undertake certain activities, such as fishing or hunting, on or in relation to land. Aboriginal title is a subset of aboriginal rights, which includes an interest in land and the right to choose the use to which land is put. Jurisprudence from the Supreme Court of Canada makes clear that the Crown has certain obligations to consult when considering applications by third parties to do things that may impact on potential aboriginal rights and title, and the Crown has an obligation to justify any infringements that occur in relation to established aboriginal rights or title.

In *Tsihlqot’in Nation v. British Columbia* 2007 BCSC 1700[1] the B.C. Supreme Court held that the Tsihlqot’in have aboriginal rights to hunt and trap (an aboriginal right to fish was not alleged)[2] in a broad claim area that includes, but is not limited to, the area of the proposed project area. The trial judge also expressed a non-binding opinion that the test for aboriginal title could likely be met in relation to a portion of the claimed area, but not the area of the proposed project. Rather, the Project falls within the area referred to in the decision as the “Eastern Trapline Territory” and the court stated, “I am not able to find that any portion of the Eastern Trapline Territory was occupied at the time of sovereignty assertion to the extent necessary to ground a finding of Tsihlqot’in aboriginal title”.[3]

Established or potential aboriginal rights or title represent one subset of aboriginal interests that are considered through the environmental assessment process. They attract a different form of assessment than that which the panel must apply in relation to environmental matters. Rather than determining whether there is a "significant adverse effect" in accordance with CEAA policy[4]the panel is mandated to

1 This decision was appealed to the BC Court of Appeal and has been heard but judgment had not been issued at the time of drafting of this EIS.

2 Paragraph 1054

3 Paragraph 893

4 For CEAA policy on determining what is a significant adverse effect, see: http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=D213D286-1&offset=1&toc=show

gather information regarding such potential or established aboriginal rights and title, and to provide the government with information about those interests as well as any mitigation measures that are made, without reference to the “significant adverse effect” test or related policy. This in turn will allow the Crown to ensure its consultation duties have been met, in accordance with the test established by the Supreme Court of Canada in *Haida Nation v. British Columbia (Minister of Forests)* [2004] 3 S.C.R. 550 and related case law.

The potential impacts of the Project on potential or established aboriginal rights or title, and the measures proposed to prevent or mitigate such impacts are discussed in considerable detail in Section 2.7.5 of this document.

Taseko will ensure that aboriginal groups have access to this EIS and other detailed information about the proposed project, in order to consider how it may impact their established or potential aboriginal rights or title. This will include providing aboriginal groups with hard copies and electronic copies of this EIS. Any comments provided by aboriginal groups on the EIS will be tracked and made available to aboriginal groups and the panel.

Where and How Aboriginal Traditional Knowledge is Incorporated into the Assessment

Substantial First Nations traditional knowledge and land use information was provided through working groups and consultation on the previous Prosperity Project; this information assisted in the refinement of the scope of assessments for Prosperity as described in the 2009 EIS/Application. Some additional traditional knowledge, such as vegetation and wildlife species present in the proposed mine site area based on accounts of harvesting and hunting, was presented through the Provincial EA review and Federal panel review and was considered in the Vegetation (Section 2.7.2.7) and Wildlife (Section 2.7.2.8) assessments in this EIS for New Prosperity.

2.5.2 Public Consultation

For the development of the Prosperity EA, government, public and stakeholder consultation events from 1992 to 2009 are summarized in Volume 2, Section 5 of the March 2009 EIS/Application. The Public Consultation Report produced for the 2009 BC EAO review process is provided in Appendix 2.5.1-A.

During the federal review of the previous project, public hearings were conducted from March 22 to May 3, 2010 in the communities most affected by the Project. Transcripts that document the Panel hearings conducted in the spring of 2010 and that summarize issues and concerns raised by the public and First Nations are tabulated in Appendix 2.5.1-C. A tabulated summary of the panel hearing transcripts are provided in Appendix 2.5.1-C.

The following summarizes public consultation conducted from December 2010 to date on New Prosperity.

PUBLIC CONSULTATION OPPORTUNITIES

Interactive New Prosperity Website

On June 6th, 2011, Taseko Mines Limited launched an interactive, public access website, www.newprosperityproject.ca. The website, which has been active and unrestricted in its accessibility since its launch, is a public access information and discussion portal related to the New Prosperity Gold-Copper Project.

The key objectives of the website are to:

1. *Inform the public.* The findings of scientific and economic research and analyses form part of the New Prosperity website content. This information is intended to give site users a thorough understanding of the impacts and projections of the New Prosperity Gold-Copper Project, to identify concerns related to the Project, and to understand measures being undertaken by Taseko Mines Limited to address these concerns.

Information accessible to all site users includes:

- A PDF of the New Prosperity *Project Description* in its entirety, as presented to the Canadian Environmental Assessment Agency (CEAA) in August of 2011
- A PDF of the *Executive Summary* of the Project Description
- Digital renderings of New Prosperity mine site representing the area before the commencement of operations, the area during mine operations, and the area following the closure of the mine
- A detailed third-party economic projections and impact report on the Project (developed by the Centre for Spatial Economics)
- A general overview of project proponent, Taseko Mines Limited, including a short video introduction
- A general overview of the history of mining in Canada, and
- Information and commentary supplied by other site users and site administrators (see item #2 below).

2. *Create an open, real-time platform for public discussion*. Taseko Mines Limited is committed to a program of transparent, fact-based dialogue around the New Prosperity Gold-Copper Project. Accordingly, the Project website (www.newprosperityproject.ca) is equipped with public discussion functionality with which site users may post questions, discuss project-related matters that are most relevant to their interests, and interact directly with members of the New Prosperity website team and/or other users of the website.

Categories for discussions have been created to assist users in receiving the most relevant and timely response to queries and comments. Each discussion category is formulated as a question and is populated with a response by Taseko Mines. In addition to these general responses, questions posed by site users within a category of discussion are answered within 24 hours, and typically sooner.

Public discussion topics hosted on the Project website include:

- Environmental impacts of the Project
- First Nations relations and other cultural considerations
- The preservation of Fish Lake and other differences between the original Prosperity plan and the New Prosperity plan
- The review process
- Employment and benefits, and
- Economic projections.

Moderation of comments submitted by site users is performed solely to mitigate the use of profane or defamatory language. All comments submitted to the site are otherwise approved and published for public viewing. Comments of support for the Project therefore coexist with comments of opposition; the goal of fostering frank and honest dialogue has been achieved.

All comments posted to the site remain accessible to the public and are archived by subject for easy retrieval at any time.

Website statistics to April xxx, 2012 include:

(These statistics will be updated for final submission)

Total Website Visits: **19,754**

Total Unique Website Visitors: **17,013**

Total Comments that have been "shared" on other Social Media Platforms: **1,124**

Average Time Spent by User on the Website: **3:24** (3 minutes, 24 seconds)

Website Comments by Sentiment (% of total):

Positive: **50.6%**

Neutral: **26.8%**

Negative: **22.5%**

Public Open Houses

The public was invited to attend open houses in Williams Lake on April 16, 2012 from 1:00 p.m. to 3:00 p.m. and 7:00 p.m. to 9:00 p.m. and in 100 Mile House on April 17, 2012 from 7:00 p.m. to 9:00 p.m. Individual letters were sent to all TNG and Secwepemc chiefs, informing them of these open houses. A historical overview of the company was presented and an update on the capital investment underway at Taseko's operating mine, citing the provincial and federal economic impacts. The rationalization of the company's decision to participate in a second environmental assessment was explained. A ten minute video of the New Prosperity Project illustrated the new design and construction plan. The public was invited to view poster boards set up on topic specific areas and to speak face to face with representatives from Taseko. This format provided the public with opportunity to ask questions, make comments, and discuss concerns about the Project with professionals knowledgeable in each area. Information tables consisted of, General and Economic Benefits, Water, Fish & Fish Lake, Reclamation, Land use, Terrestrial Assessments, Employment, Education & Training, Mining & Engineering, Camp, Infrastructure, and Mill and Tailings operation. In addition, comment cards were available to the public to submit written comments. These were collected and have been included in the summary provided in Section 2.5.2.4.

ONGOING PUBLIC CONSULTATION ACTIVITIES

Taseko is committed to maintaining an open dialogue about the Project throughout the environmental assessment process. Planned ongoing consultation plans for the public and stakeholders.

Taseko is planning to implement the following ongoing consultation activities:

- Website and newspaper advertisements and announcements would continue to be produced and distributed to keep the public aware of the Project and EA events and milestones.
- Make copies of the EIS available in local libraries and/or other suitable generally-accessible locations in Williams Lake, 100 Mile House, and Alexis Creek.
- Continue to update the Project website to reflect important Project and EA milestones.
- Present an overview of the EIS to key local organizations with information on how to obtain copies.
- Respond to Information Requests (IRs) received from the 33333Federal Panel and RAs.
- Meet with interested parties upon request.
- Host a round of open houses – Taseko is intending to hold open houses in the communities of Williams Lake and Alexis Creek, and 100 Mile House depending on community interest and requests for information. The open houses will provide an overview and visual presentation of the Project and environmental assessment as described in the EIS. Representatives from Taseko will be in attendance to describe the Project and the contents of the EIS and to identify any issues raised in the pre-EIS stage and how they have been addressed in the EIS. In addition, the open houses and review of the EIS will provide an opportunity for input to identify further issues or concerns.

COMMENTS MADE BY THE PUBLIC TO-DATE

Comments made and questions posed at New Prosperity Open Houses and through the Microsite are summarized in the table below:

Table 2.5.1.1-3 Comment and Questions

Subject Area	Key Themes
General Information and Economic Benefits	In support of the mine to sustain our economy and to create employment in the area.
	Open house and information presented was well done. Would like to see more open houses with question and answer before panel review hearings start and handout material about the Project.
	Concern about how the new Federal EA process may affect the Project and could First Nations hold up the Project through the courts should the government approve it.
	Has the company engaged with First Nations on agreements for opportunities for them?
	Conflict of interest by not using an independent contractor to complete the EA work.
	Why are the First Nations opposed to the Project?
	The tourism industry needs to better understand the positive impacts this mine will create for the local tourism businesses.
	Felt like a job fair, but with misleading displays and presentations. Company doesn't understand land, people, wildlife, and water.
	Many animals have become endangered due to First Nations slaughtering to make a point. They need to work and pay taxes as everyone else to earn respect.
	The company should speak respectful and engage with First Nations.
Water, Fish & Fish Lake	Concerns about the protection of wildlife in terms of their water supply.
	In support of the mine given the new design proposal.
	Is the fishing good in fish lake? Will the public be able to fish the lake during mine operation?
	How will the flow in and out of Fish Lake be managed and controlled?
	The water video should be made available to the public.
	Would like to learn more about Fish Lake in terms of size, depth, water quality, water flow, etc.
	What are the impacts to the lake with the pit only 500m away?
	Suggestion to advertise information on how the watershed and water table will be protected and preserved so the public's concerns are addressed.

	What are the toxin levels found in fish in other reclamation projects?
Reclamation, Land Use, Terrestrial Assessments	Concerns around transmission lines and road development
	What work has been done to learn about the grizzly bear population and how they will be protected around the Project area?
	What is the size of the area that will be disturbed?
	What measures will Taseko take in terms of ecosystem stability and reclamation?
	How will the lights affect the atmosphere and animals?
	What will the site look like once it has been reclaimed? Will there be enough soil to cap for reclamation?
	Suggest provide larger maps for easier reading.
	First Nations should be involved in reclamation planning.
	Concern regarding First Nation land base control and their food source.
Employment, Education and Training	Will Taseko be hiring contractors to build the roads and the mine?
	What specific training or skills do I need to get a job in the mine?
	What will be the shift schedule?
	Has Taseko started any training programs to assist the First Nations?
	Will the shift schedule be the same for the administration staff at the mine site?
	Will Taseko be hiring people from outside of Canada?
	Has hiring started yet for this project?
	What are the salaries/rate of pay for the jobs at the mine?
Mining & Engineering, Camp, Infrastructure	Will there be a camp at the mine site?
	Will Taseko provide transportation to people living in the communities in the Cariboo?
	Will there be a road built from 100 Mile House to the mine?
	Would the mine fly employees in and out of the mine site?
	Where is the load-out facility located?
	Will Taseko be building homes to sell to families moving into the communities?
	What is the expected mine life? What are the chances that it will exceed the initial expected mine

	life?
	Does the deposit go under the lake?
	Will there be further expansion of the mine after the mine is built?
	How large will the waste rock dump be?
	If the deposit is 800m deep, why is the pit only 500m deep?
Mill and Tailings Operation	Would like to learn more about the tailings dam in terms of location to the lake and other impacts it could have on the lakes and rivers during operation and after mine life.
	Will dust be an issue?
	Would like to know more about how dewatering works?
	Will there be fish living in the tailings pond?
	Why would the tailings pond be located in lower Fish Creek rather than Upper Fish Creek?
	What chemical are used in the process and where will they go?
	Is the tailings pond and pit location different compared to the old design?

KEY ISSUES OF CONCERN RAISED BY THE PUBLIC TO-DATE

The following are the key issues raised to-date on New Prosperity and Taseko's responses:

General Information and Economics

- Sharing of information on the Project – Public would like to see more open houses with question/answer opportunities prior start of panel review hearings
  - o Taseko is planning on another round of Open Houses, as well as stakeholder meetings where there is interest.
- General concern on the lack of a relationship with First Nations and that it could hold up the Project
  - o Taseko is open to communicating with First Nations on the issues of concern with the Project, potential impacts on asserted and established rights and title, mitigation measures, and benefits of the Project.
- Benefits of mining need to be communicated to the tourism industry, and others
  - o The benefits of this project will be communicated to stakeholder groups, and specifically to those in the tourism industry that have either concerns about the Project's impacts on their business, or those interested in benefitting from the Project.

Water, Fish and Fish Lake

- Concerns about the protection of the water supply for fish and wildlife, particularly Fish Lake
  - o Water management is detailed in Section 2.7.2.4 of this EIS and in 2.8.1, and is regulated by the BC Ministry of Forests Lands and Natural Resource Operations as well as Environment Canada
- Public access to Fish Lake during operations

  - Public access to Fish Lake during operations will be managed to be compliance with the Health, Safety and Reclamation Code of BC
- Impacts on Lake with pit only 500m away
  - The stability of the open pit walls is discussed in the KP report, "Preliminary Pit Slope Design", dated May 2012 (Appendix 2.2.4-A) and the effect on the lake is discussed in Section 2.7.2.4 (Hydrology and Hydrogeology) and in the BGC report, "Numerical Hydrogeologic Analysis", dated May 2012 (Appendix 2.7.2.4-A)
- Potential for contamination of fish, particularly from Tailings Storage Facility
  - Water management is detailed in Section 2.7.2.4 of this EIS and in Section 2.8.1; and regulated by the BC Ministry of Forests Lands and Natural Resource Operations as well as Environment Canada
  - Effects on fish are presented in Section 2.7.2.5 of this EIS
- Risk to Fish Lake from extended mine life
  - This EIS has been submitted seeking approval to issue permits enabling the execution of the mine plan outlined in the EIS. The open pit associated with that mine plan has a pit rim that is approximately 500 m away from Fish Lake. Under this application there is no risk to Fish Lake as a result of extending the mine life.

Reclamation, Land Use, Terrestrial Assessments

- Concern that the grizzly bear population will be protected
  - Grizzly bear mitigation measures new to New Prosperity are presented in Section 2.7.2.8 of this EIS
- Measures taken for reclamation
  - The reclamation plan is described in 2.8.2 of this EIS, and is governed by the BC Ministry of Energy and Mines
- Impact of lights and dust during operations on atmosphere and animals
  - Project effects on the atmospheric and acoustic environment are presented in Section 2.7.2.2 and Section 2.7.2.3 of this EIS

Employment, Education and Training

- Contractor opportunities; Employment opportunities, and skills required; Training programs for First Nations
  - Taseko's overview of contractor, employment and training programs are presented in 2.5.1; further engagement with the public through the EA and permitting with inform potential employees and contractors of opportunities

CONSULTATIONS WITH LOCAL GOVERNMENTS, STAKEHOLDER ORGANIZATIONS, AND FEDERAL AND PROVINCIAL ORGANIZATIONS

Meetings with governments, stakeholders and interested parties are ongoing; an interim summary is provided below:

Federal Agencies

<u>CEAA and Federal RA's</u>

- December 6, 2011 - An overview of the New Prosperity Project Description was provided to CEAA, Federal RAs as well as BC EAO and other BC Ministries.
- April 18, 2012 - A review of the contents and organization of the New Prosperity EIS was provided to CEAA and Federal RA's.

Fisheries and Oceans Canada

- January 26, 2012 - A review of Taseko's approach to Fish and Fish Habitat effects assessment was provided to Fisheries and Oceans Canada
- May 11, 2012 - Conference call with Fisheries and Oceans Canada to review Taseko's proposed approach on effects assessments and DFO's initial comments.

Stakeholders and Interested Parties

Chamber of Commerce, Williams Lake

Taseko was invited to attend the Williams Lake Chamber of Commerce meeting on March 29, 2012 to provide the business community with a company update. The approximately 120 attendees listened to a presentation on the company's history and a present day overview of the Company, capital investments and economic impacts, and the decision to proceed with a second environmental assessment. This was followed by a brief company video and one illustrating the new design and construction of the New Prosperity Project. The presentation was well received by the meeting attendees.

Chamber of Commerce, 100 Mile House

On April 4, 2012 the same presentation was delivered at a monthly general meeting of the 100 Mile House Chamber of Commerce. The meeting was attended by approximately 50 business representatives from the community. The majority of the attendees were encouraged by the new proposed mine plan, with the exception of one attendee who was opposed.

Alkali Resources Ltd

- August 1, 2010– To review options for transmission line through Community Forest
- July 9, 2011 (With Esketemc Chief and Council) – To review next steps on EA process relative to transmission line

Sigfried Reuter, Taseko Lakes Lodge

- August 2, 2011 – To deliver New Prosperity Project Description
- April 15, 2012 – To discuss effects of New Prosperity, and
- May 11, 2012 – To discuss effects of New Prosperity.

2.6 EXISTING ENVIRONMENT

2.6.1 Physical and Biological Environment

2.6.1.1 Geology and Geochemistry

GENERAL

The New Prosperity gold-copper deposit subcrops under a 5 to 65 m thick blanket of surficial cover at the north end of Fish Lake. It is predominantly hosted in volcanic rocks which have been intruded by a steeply dipping stock. The stock is surrounded by a swarm of dikes. The stock and dikes are spatially and genetically related to the deposit. The central portion of the deposit is cut by two prominent faults that strike north-south and dip steeply to the west. A central alteration zone is co-extensive with the copper/gold mineralization.

Pyrite and chalcopyrite are the principal sulphide minerals in the deposit. They are uniformly distributed as disseminations, fracture-fillings, veins and veinlets. Native gold occurs as inclusions in, and along microfractures with copper-bearing minerals and pyrite.

The deposit is oval in plan and is approximately 1500 m long, 800 m wide and extends to a maximum drilled depth of 880 m. It contains a total measured and indicated resources estimated at 1.01 billion tonnes with an average grade of 0.406 g/t Au and 0.243% Cu at a grade cut-off of 0.14% copper. Additionally, a total of 0.21 billion tonnes of inferred resources at an average grade of 0.246 g/t Au and 0.210% Cu were estimated above the same cut-off of 0.14% Cu.

A thorough treatment of the geology of the New Prosperity deposit may be found in Appendix 3-5-A of the March 2009 EIS/Application. The following sections provide a brief description for contextual purposes.

EXPLORATION HISTORY

Initial exploration activity in the vicinity of the New Prosperity deposit was undertaken in the early 1930s when prospectors located pyrite and chalcopyrite-bearing diorite and feldspar porphyritic dikes 1100 m northeast of the deposit.

In 1963–1964, Phelps Dodge Corporation conducted approximately 800 m of percussion (chip recovery) and diamond (core recovery) drilling proximal to the deposit. Results were not encouraging and the mineral claims were allowed to lapse.

In 1969, Taseko acquired the property and drilled 18 holes totalling approximately 2300 m immediately to the south of the area where Phelps Dodge had explored. Taseko discovered significant tonnage grading 0.25 to 0.30% copper.

Between 1970 and 1996, approximately 320 holes totalling 100,000 m were drilled by a number of companies under option agreements.

A scoping level metallurgical testwork program completed by Melis in the early 1990s indicated that acceptable gold and copper recoveries could be achieved by bulk sulphide flotation followed by regrinding and conventional copper flotation. A pre-feasibility study on the viability of a 60,000 t/day open pit gold-copper, mine-mill complex was completed by Kilborn in mid-1994.

Taseko commenced a drilling program in June of 1996 in order to advance the Project to feasibility level. By 1998, an additional 125 holes comprising over 50,000 m of NQ and HQ core had been drilled.

DEPOSIT SETTING

Interpretation of deposit geology is based on a drill hole database consisting of 384 diamond drill holes totalling 148,400 m and 68 percussion drill holes totalling 6300 m.

The deposit is predominantly hosted in andesitic volcaniclastic and volcanic rocks which are transitional to a sequence of sparsely mineralized, volcanically-derived sedimentary rocks to the south, as shown in Figure 2.6.1.1-1. The andesitic volcaniclastics are comprised of coarse-grained crystal tuff and ash tuff, and thinly bedded tuff with lesser lapilli tuff. The upper eastern portion of the deposit is hosted by sub-volcanic units of crowded feldspar porphyritic andesite and thick feldspar and hornblende porphyritic flows.

In the western portion of the deposit, the multi-phase Fish Creek Stock has intruded into a thick sequence of andesite flows which overlay volcaniclastic rocks. The steeply south-dipping, oval quartz diorite stock, which is approximately 265 m wide by 800 m long, is surrounded by an east-west trending swarm of sub-parallel quartz-feldspar porphyritic dikes which also dip steeply to the south. Together the stock and dikes comprise the Fish Lake Intrusive Complex that is spatially and genetically related to the deposit. Post mineralization (post-ore) porphyritic diorite occurs as narrow dikes that cross-cut all units within the deposit. They represent the final intrusive phase of the emplacement of the Fish Lake Intrusive Complex.

The deposit area is overlain by a variably thick overburden cover consisting of glacial till, basalt flows, and colluvium and lacustrine sediments. The depth of overburden is indicated on Figure 2.6.1.1-2.

The deposit is oval in plan and is approximately 1500 m long, 800 m wide and extends to a maximum drilled depth of 880 m. A central potassium silicate alteration zone is co-extensive with the copper-gold mineralization.

Pyrite and chalcopyrite are the principal sulphide minerals in the deposit. They are uniformly distributed as disseminations, fracture-fillings and sub-vertical veinlets and may be accompanied by bornite and lesser molybdenite and tetrahedrite-tennantite. Native gold occurs as inclusions in, and along microfractures with copper-bearing minerals and pyrite.

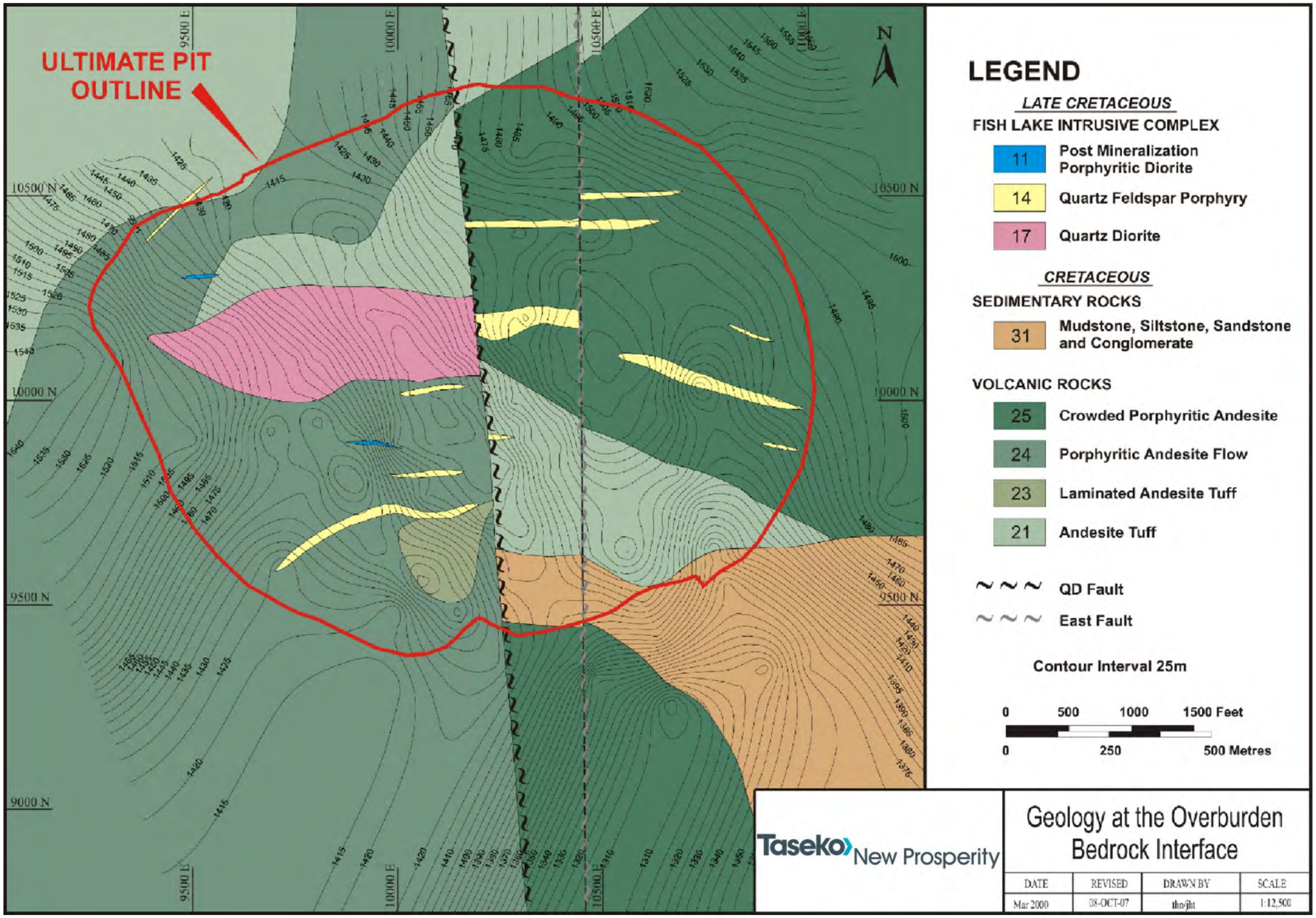


Figure 2.6.1.1-1 Geology at the Bedrock–Overburden Interface

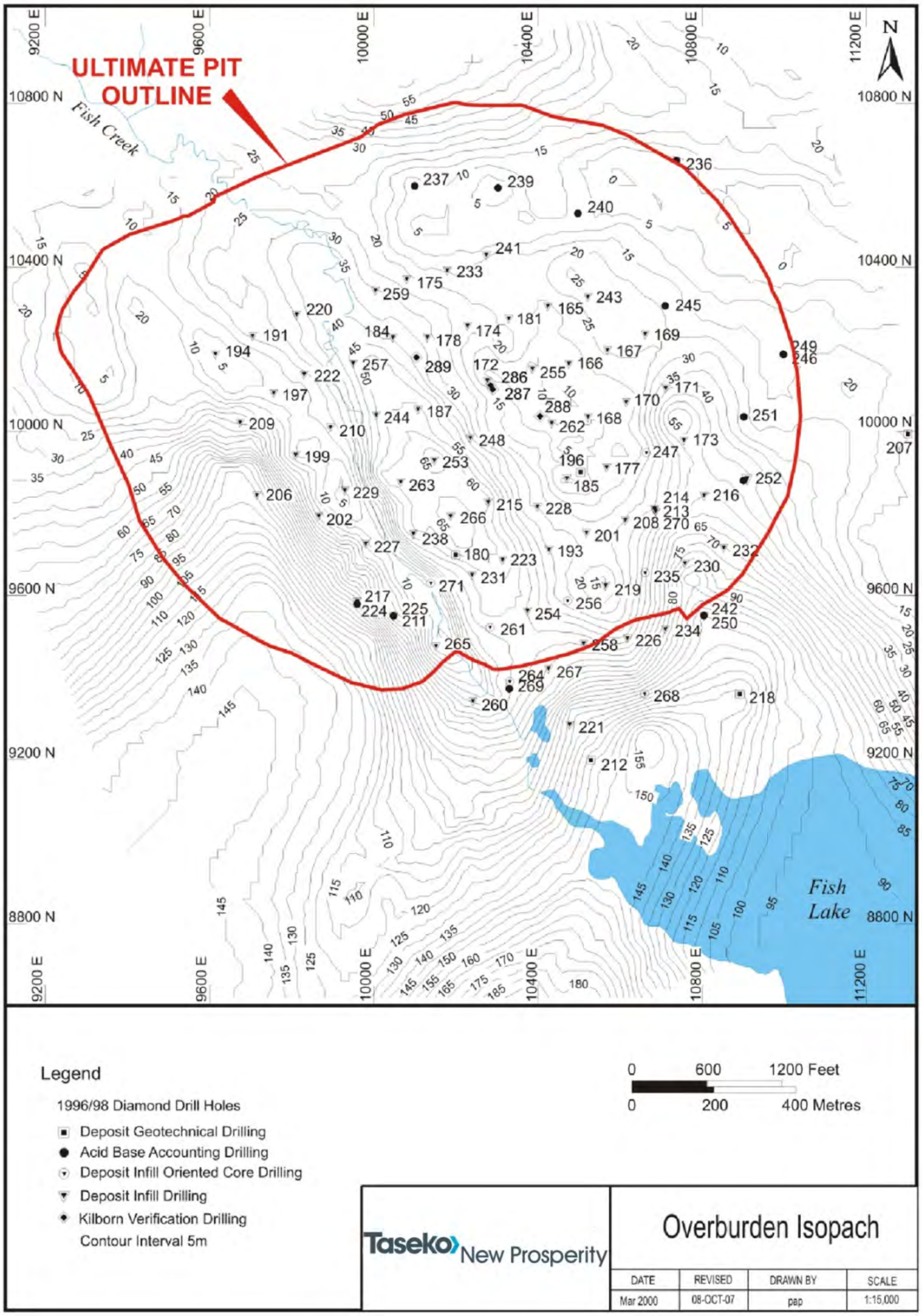


Figure 2.6.1.1-2 Overburden Isopach Plan

VOLCANIC AND SEDIMENTARY ROCKS

Five volcanic units and one sub-volcanic unit comprise the majority of the New Prosperity deposit host rocks. Sorted by quantity within the proposed pit, they are: andesite crystal, ash and lapilli tuff, porphyritic andesite flow, crowded porphyritic andesite and laminated andesite tuff. Andesite tuffs and flows are commonly interbedded.

A sparsely mineralized, volcanically-derived sedimentary unit occupies the upper south/southeast portion of the deposit.

FISH LAKE INTRUSIVE COMPLEX

The New Prosperity deposit is spatially and genetically related to the Fish Lake Intrusive Complex which is comprised of the Fish Creek Stock, quartz feldspar and lesser feldspar porphyry dikes and post-mineralization porphyritic diorite dikes.

The Fish Creek Stock is a lenticular east-west trending, steeply south-dipping body of porphyritic quartz diorite that has intruded a thick sequence of volcanic rocks.

Quartz feldspar porphyry and feldspar porphyry dikes occur as an east-west trending, steeply south-dipping swarm centered east of the Fish Creek Stock. The quartz feldspar porphyry units cross-cut all of the volcanic and sedimentary rocks identified in the deposit.

The entire suite of rocks (intrusive, volcanic and sedimentary) hosting the deposit is cross-cut by a series of barren, post-mineralization porphyritic diorite dikes. The post mineralization porphyritic diorite unit comprises less than 1% of the deposit rocks.

Figure 2.6.1.1-3 and Figure 2.6.1.1-4 provide typical plan and section views of the New Prosperity deposit.

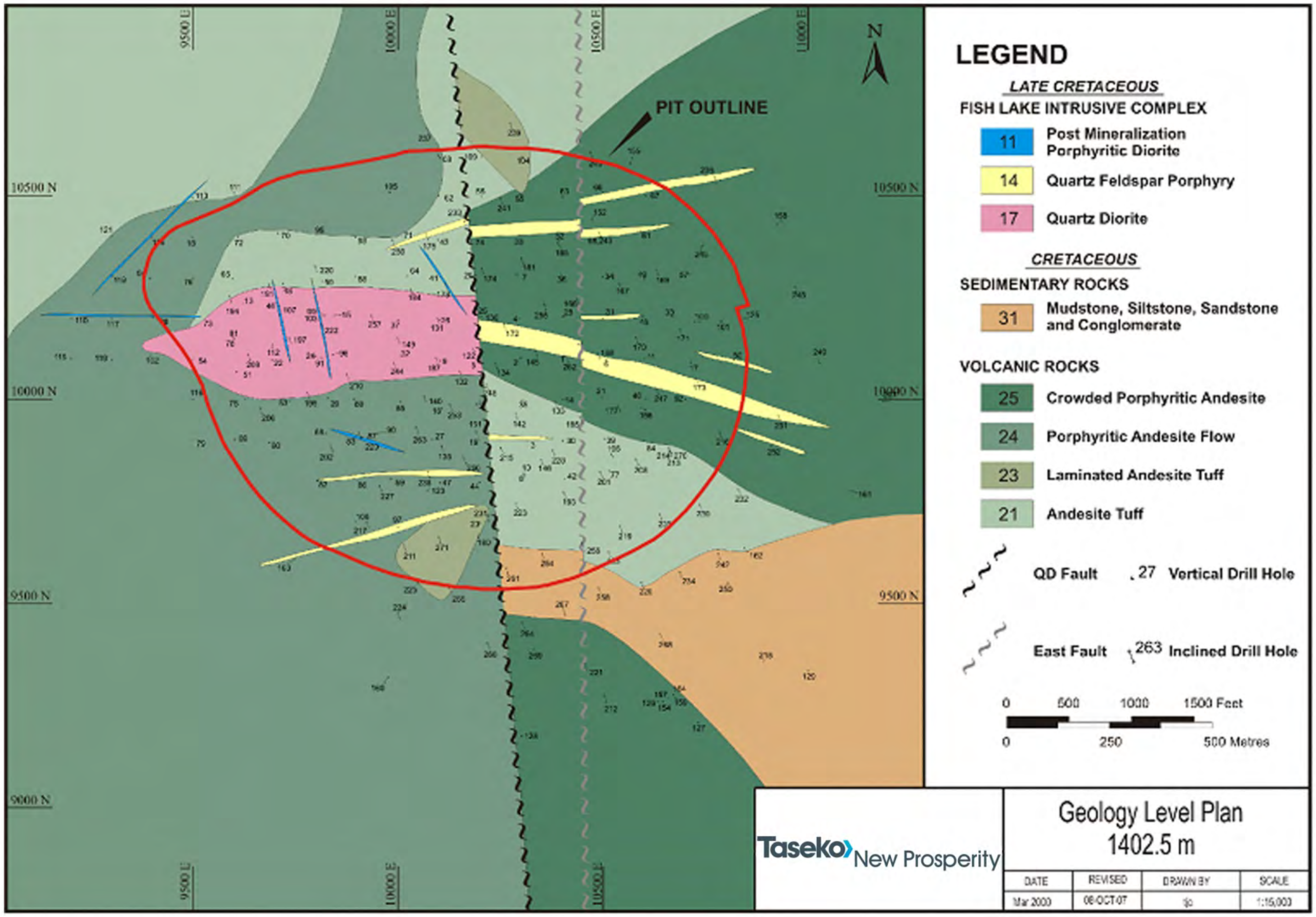


Figure 2.6.1.1-3 Geology Level Plan 1402.5 m

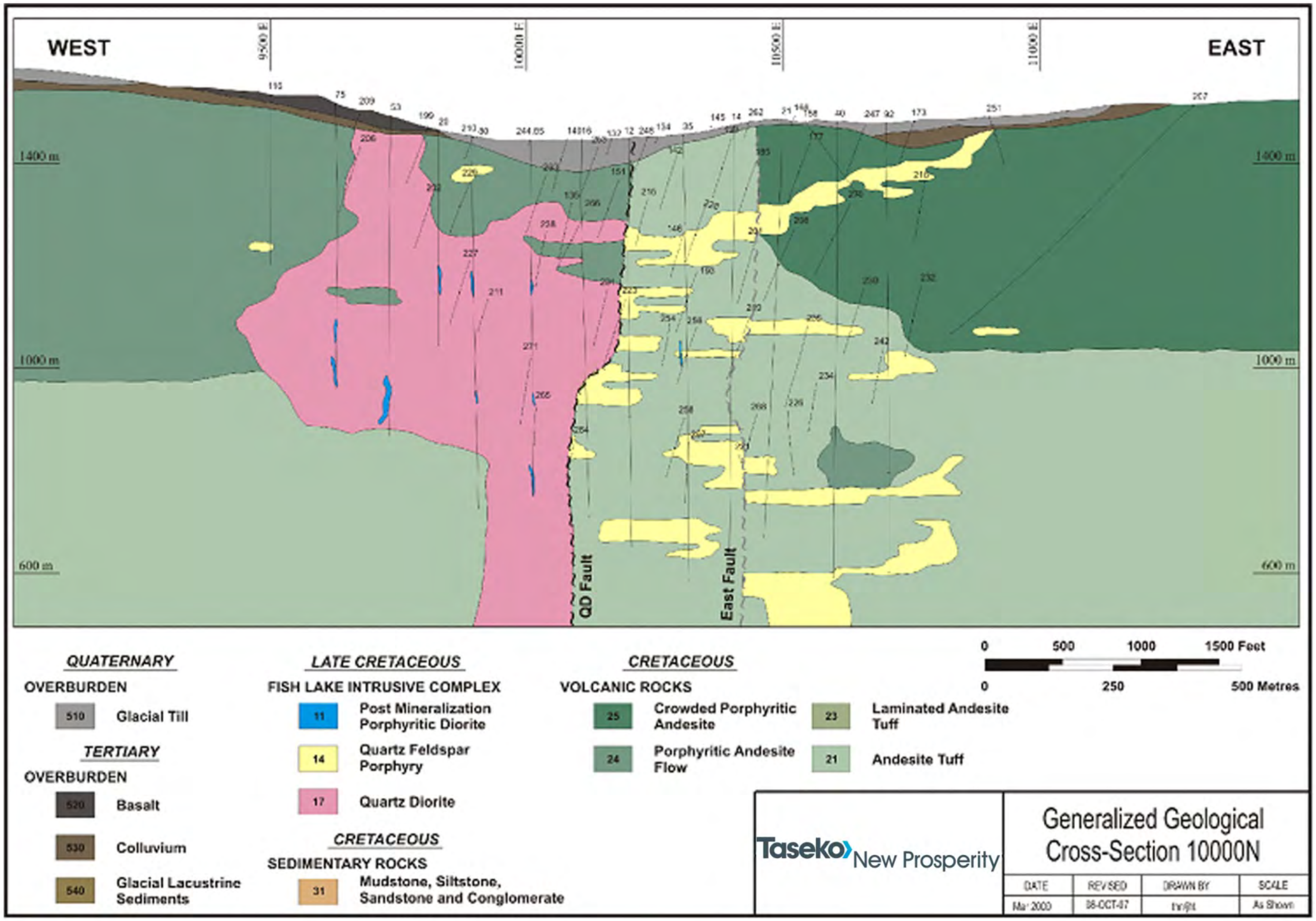


Figure 2.6.1.1-4 Generalized Geological Cross-Section 10000N

ALTERATION

Five main alteration styles have been identified at the New Prosperity deposit: potassium silicate, propylitic, sericite-iron carbonate, phyllic and argillic. Alteration styles do not occur singularly in discrete zones; they commonly overlap and/or overprint each other. However, one alteration style will typically dominate in any given area, hence the naming of a zone specific to the dominant alteration style.

Potassium silicate alteration predominates within the deposit area forming a central east-west trending ovoid zone intimately related to significant copper/gold mineralization (>0.20 g/Au t and >0.20% Cu). The zone of potassium silicate alteration is surrounded by propylitically altered rocks that extend outward for several hundred metres. Along the eastern margin of the deposit a discontinuous belt of phyllic alteration is developed in proximity to the transition between the potassium silicate and propylitically altered rocks. Late stage sericite-iron carbonate alteration forms irregular zones, particularly within the central zone of potassium silicate alteration. Argillic alteration is localized along fault zones and overprints earlier alteration assemblages.

Typical alteration distribution is shown on Figure 2.6.1.1-5.

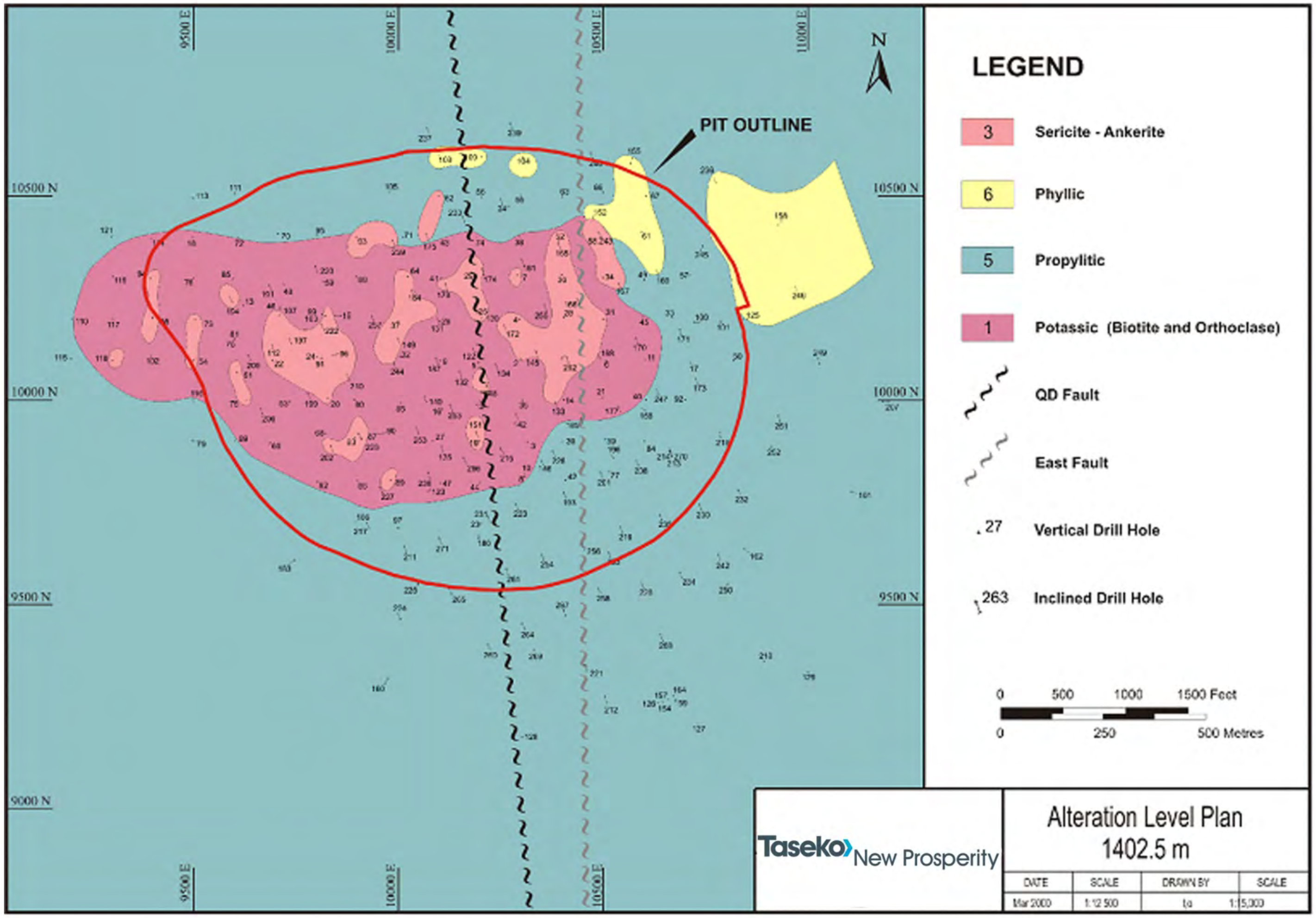


Figure 2.6.1.1-5 Alteration Level Plan 1402.5 m

STRUCTURE

Numerous faults were intersected in drill core throughout the deposit area. Faults are usually indicated by strongly broken core, gouge, shear, cataclastic and rarely mylonitic textures. All of the aforementioned features can occur across intervals of less than 1 cm to over 20 m. Utilizing all available data, two predominant faults (the QD and East Faults) have been delineated.

The QD and East Faults are sub-parallel, strike north-south and dip steeply to the west, becoming near vertical down-dip. They cut the central portion of the deposit and are approximately 230 m apart near surface and 330 m apart at depth.

MINERALIZATION

Copper/gold mineralization within the New Prosperity deposit is intimately related to potassium silicate alteration and a later, superimposed sericite-iron carbonate alteration. This is particularly true within a central, east-west trending ovoid zone that hosts the majority of the mineable reserve.

Chalcopyrite-pyrite mineralization and associated copper and gold concentrations are distributed relatively evenly throughout the host volcanic and intrusive units in the deposit. A sedimentary unit, located in the upper southeastern part of the mineralized zone, is sparsely mineralized. Post mineralization porphyritic dikes are essentially barren.

Pyrite and chalcopyrite are the principal sulphide minerals and are accompanied by: minor amounts of bornite and molybdenite; sparse tetrahedrite-tennantite, sphalerite and galena; and rare chalcocite-digenite, covellite, pyrrhotite, arsenopyrite and marcasite. Native gold generally occurs as inclusions in, and along microfractures with, copper sulphides and pyrite. Pyrite to chalcopyrite ratios throughout most of the proposed pit area range from 0.5:1 to 1:1 and rise to 3:1 or higher around the periphery of the deposit which coincides with the propylitic, and locally the phyllic, alteration zones.

Sulphide minerals show the thoroughly dispersed mode of occurrence characteristic of porphyry copper deposits. Sulphides occur in relatively equal concentrations as disseminations, blebs and aggregates in mafic sites, as fracture fillings and as veinlets.

Typical gold and copper distribution throughout the deposit is presented on Figure 2.6.1.1-6.

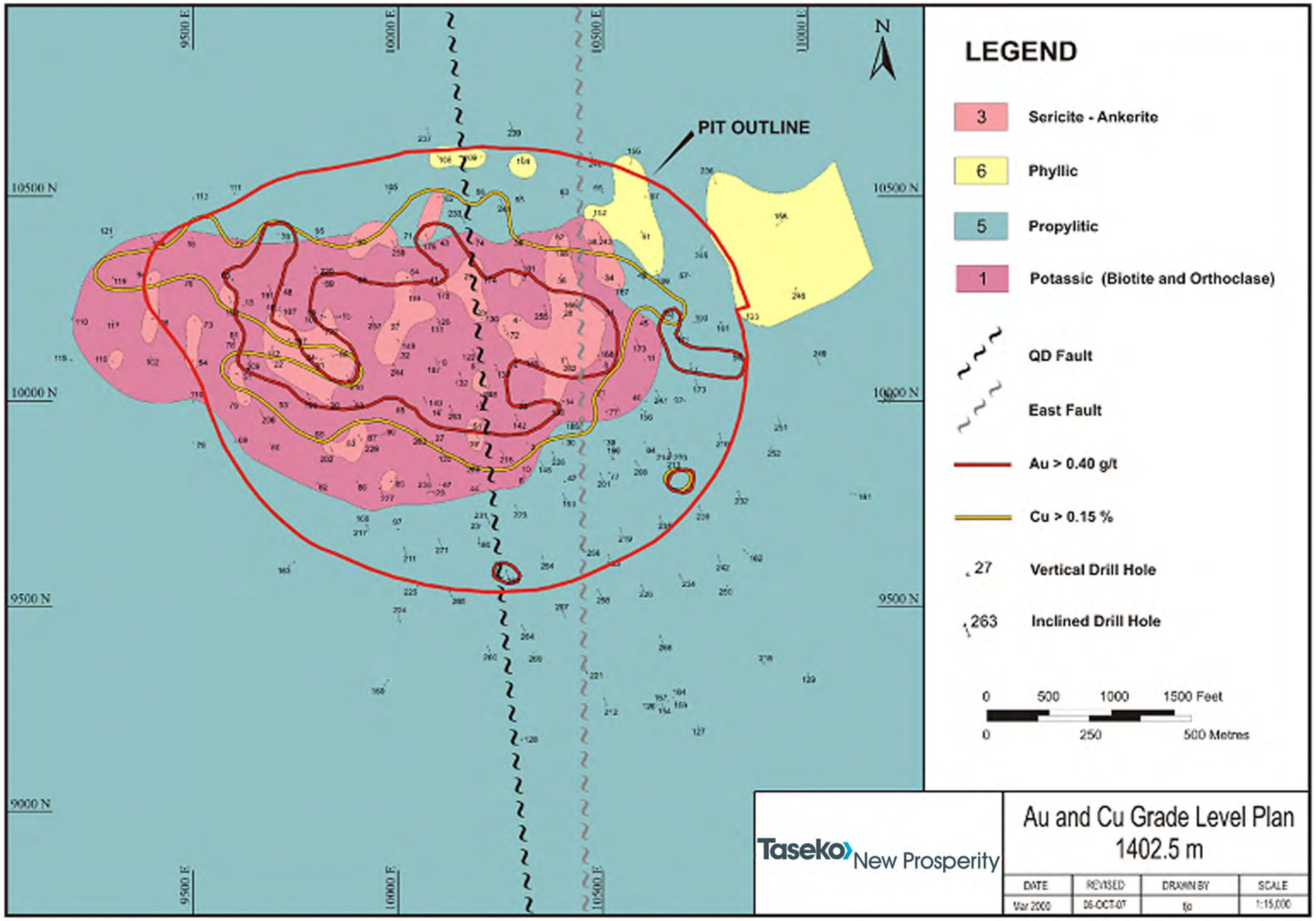


Figure 2.6.1.1-6 Au and Cu Grade Level Plan 1402.5 m

2.6.1.2 Atmospheric Environment

This section addresses the atmospheric environment baseline conditions, specifically Air Quality.

Some Project activities result in the release of substances that, owing to their physical and chemical properties, are classed as air contaminants. The atmosphere is an important pathway for the transport of contaminants to the freshwater, terrestrial, and human environments. Effects on Air Quality were assessed due to its intrinsic importance to the health and well-being of humans, wildlife, vegetation, and other biota.

Existing baseline Air Quality, Climate, and Noise conditions within the region surrounding the Project are presented in the Taseko Prosperity Gold-Copper Project Baseline Technical Data Report (TDR) (Appendix 4-2-A of the March 2009 EIS/Application). The information in the TDR serves as a reference describing baseline conditions before the start of the Project.

Effects of the Project on Air Quality are quantified using Project emission inventories and, in selected instances, dispersion modelling. These aspects are discussed later in this EIS. As well, the potential effects of changes in Climate on the Project are discussed.

CLIMATE OVERVIEW

An analysis of regional climate data was conducted for the region surrounding the Project. This analysis involved the acquisition and processing of temperature, precipitation, wind, visibility, relative humidity, solar radiation, and severe weather data from several Canadian Climate Normal Stations (CCNS)

Historical extreme temperatures at the selected monitoring stations range from -48ºC to 41.5°C. Historical mean daily temperatures range from 1.9 to 9.2ºC. The months of June and July are the wettest months of the year in the Project region and the recorded extreme maximum daily rainfall at the selected monitoring stations was 68.1 mm. The most snowfall occurs from November to February. The highest recorded extreme daily snowfall in the Project region was 48 cm.

Winds in the region are predominantly within the 0.5 to 2.1 m/s (1.8 to 7.6 km/h) range. On average for the three stations considered in this assessment, 49% of winds fall within this category. These wind speeds are relatively low and are believed to be representative of winds at the mine site.

Some climate parameters were measured by Taseko at several monitoring stations in the vicinity of the proposed mine site. This included measurements of temperature, precipitation, wind speed, and wind direction. There were no data available for the 2002 timeframe, and therefore site-specific measurements were not available to include in the dispersion modelling. A full calendar year of quality assured wind speed and direction data were not available at the time the baseline Technical Data Report was completed, however a summary of a one-year long interval (Station M05: October 1, 2006 to September 30, 2007) are presented in Appendix 4-2-D of the March 2009 EIS/Application.

The Station M05 meteorological data show that onsite winds are consistent with previous measures (52% are below 2.1 m/s). The average wind speed for that time period was 2.1 m/s. South is the most prevalent wind direction, followed by northerly winds. The maximum and minimum hourly temperatures in that time period were 29.5 and 38ºC respectively. The annual average temperature was 3.3ºC. For more details regarding historic climate monitoring, refer to the Taseko Prosperity Gold-Copper Project Baseline TDR for Climate, Air Quality, and Noise (Appendix 4-2-A of the March 2009 EIS/Application). Also, for an analysis of the 2006/2007 year-long interval of data collected at Station M05 data refer to Appendix 4-2-D of the March 2009 EIS/Application.

Some air quality parameters were measured by Taseko at several monitoring stations in the vicinity of the proposed mine site. This included measurements of inhalable particulate (PM_{10}) and DF. The PM_{10} data are summarized in Table 2.6.1.2-1. The Station locations are illustrated on Figure 2.6.1.2-1.

The maximum 24-hour average PM_{10} concentration observed at station M2 over the August 1997 to September 1998 period was 49.1 $\mu g/m^3$. It is marginally less than the Interim Level B 24-hour AAQO for PM_{10} of 50 $\mu g/m^3$. The average PM_{10} is very low (8.3 $\mu g/m^3$). It is very likely therefore that the annual average $PM_{2.5}$ is very low as well (<5 $\mu g/m^3$).

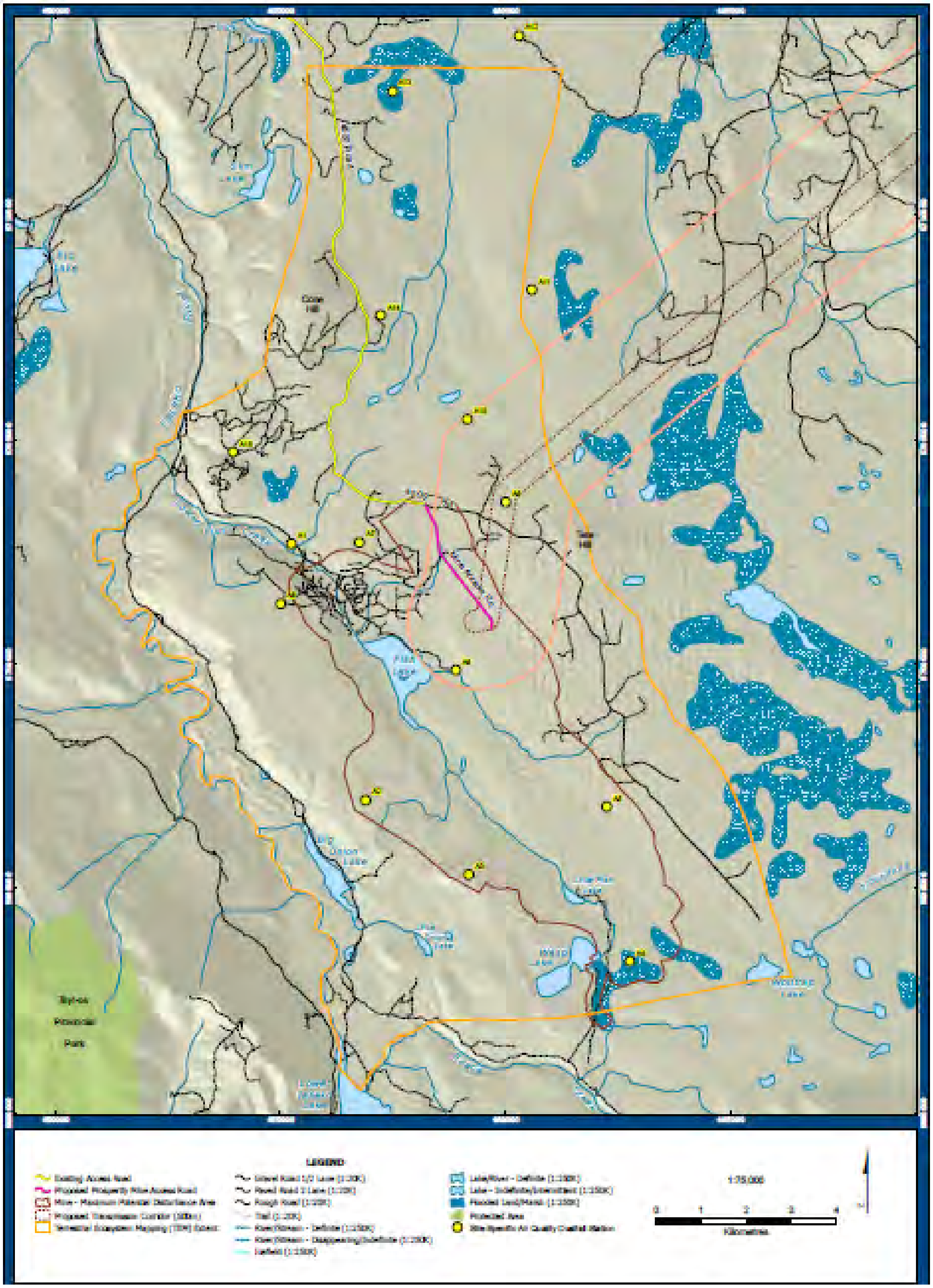


Figure 2.6.2.1-1 Location of Site-Specific Air Quality Dustfall Monitoring Stations

Table 2.6.1.2-1 Summary of Site-specific Ambient Air Quality Monitoring for PM_{10} at the Project Site

Station	Description	PM_{10} Concentration (µg/m^3)
Station M2	24-hour maximum	49.1
	98th percentile 24-hour	33.6
	90th percentile 24-hour	17.0
	75th percentile 24-hour	9.4
	Average 24-hour	8.3
	50th percentile 24-hour	5.3

Monthly ambient monitoring for dust fall was also carried out at a number of monitoring stations. These results are presented in Appendix 4-2-A of the March 2009 EIS/Application.

In the Project area the maximum rate of dust fall deposition ranged from 0.26 to 1.3 mg/dm^2/d. The annual average rate of dust fall deposition ranged from 0.033 to 0.2 mg/dm^2/d. The 30 day maximum rate of dust fall deposition is less than the BC Objectives for dust fall (1.7–2.9 mg/dm^2/d) (BC MOE 1979). This is consistent with the near-pristine nature of this rural-remote area.

A summary of regional air quality monitoring data for the relevant air contaminants is provided in Table 2.6.1.2-2 for the selected stations. The three selected Williams Lake stations are the closest continuous air quality monitoring stations within the region of the Project. The period represented is August 2001 through August 2006; however, not every parameter was measured at every station for the entire five year period.

These stations, while nearby, are not representative of the Project area due to urban land uses and forest products and other industrial activities in Williams Lake. Emissions sources associated with these activities can lead to occasional episodes of degraded air quality. Lower quartile (pristine) conditions at Williams Lake may be representative of background conditions at the Project site; however the upper quartile (degraded) conditions at Williams Lake cannot be compared to the Project site.

In Williams Lake the maximum one-hour average PM_{10} concentrations ranges from 301 to 602 µg/m^3 during this five year period. The maximum 24-hour average PM_{10} concentrations range from 82.6 to 168 µg/m^3. These values are greater than the Interim Level B 24-hour AAQO for PM_{10}. A brief investigation reveals that road dust may be responsible for many of the episodes of degraded air quality. The five-year annual average PM_{10} concentration ranges from 18.5 to 29 µg/m^3.

The maximum one-hour average $PM_{2.5}$ concentration ranges from 108 to 119 µg/m^3 during this five year period. The 98th percentile 24-hour average PM_{10} concentration (averaged over three consecutive years) ranges from 19.7 to 23.5 µg/m^3. These values are less than the Canada-wide Standard for $PM_{2.5}$. Industrial and domestic emissions, forest fires, and domestic burning activities may be responsible for many of the episodes of degraded air quality. The five-year annual average $PM_{2.5}$ concentration ranges from 6.14 to 7.02 µg/m^3.

In Williams Lake NO_2 concentrations are measured at only one station. The maximum 1-hour average NO_2 concentration for the five year period is 91.8 µg/m^3. The maximum 24-hour average NO_2 concentration is 57 µg/m^3. The five year annual average PM_{10} concentration is 17.1 µg/m^3. The hourly, 24-hour, and Annual average concentrations are all less than the NAAQO for NO_2.

There are no data available for CO and SO_2 in the Project region, however, it is expected that due to the remote nature of the site, existing concentrations of these substances will be very low.

Table 2.6.1.2-2 Summary of Regional Ambient Air Quality at Selected Continuous Monitoring Stations (August 2001–August 2006)

Species	Averaging Period	Concentration (μg/m³)[a]			BC or Canada AAQO or NAAQO[b]
		Cariboo Regional District Library, Williams Lake	Columneetza School, Williams Lake	Skyline School, Williams Lake	
PM_{10}	One-hour maximum	452	301	602	N/A
	24-hour maximum	102.1	82.6	168	50
	5-year annual average	22.9	18.5	29	N/A
$PM_{2.5}$	One-hour maximum	108	119	118	N/A
	98th percentile 24-hour[c]	19.7	23.5	21.6	30 [c]
	5-year annual average	6.14	7.02	6.67	N/A
NO_2	One-hour maximum	- -	91.8	- -	400 [d]
	75th percentile 1-hour	- -	26.8	- -	N/A
	24-hour maximum	- -	57.0	- -	200 [d]
	5-year annual average	- -	17.1	- -	60 [d]

NOTES:
[a] Based on all available data for the most recent five-year period from August 1, 2001 to August 1, 2006.
[b] BC Air Quality Objective Table (BC MOE, 2006b)
[c] Canada-Wide Standards (CWS) for Respirable Particulate Matter ($PM_{2.5}$), effective by 2010. This objective is referenced to the 98th percentile 24-hour average concentration over three consecutive years (CCME 2000). The data cited above is the maximum 3 year rolling average of the 98th percentile 24-hour average concentration observed between 2001 and 2006.
[d] National Ambient Air Quality Objectives, or NAAQO (Government of Canada 2004).
- Not Monitored.
N/A = Not Applicable.

"Background" is the concentration due to emissions from both natural and human caused sources (BC MOE 2006). Concentrations representative of background are typically added to the increment predicted through dispersion modelling.

In the Project mine site area there are very few human-caused sources, and a small amount of natural sources. Table 2.6.1.2-3 lists the year 2000 emissions for the 50 x 50 km modelling domain. These were obtained from the BC Ministry of Environments GIS-accessible database.

Table 2.6.1.2-3 Year 2000 Emissions for the Dispersion Modelling Domain

Source	$PM_{2.5}$	PM_{10}	TSP	NO_X	CO	SO_2
	(t/y)	(t/y)	(t/y)	(t/y)	(t/y)	(t/y)
Industrial	0.0	0.0	0.0	0.0	0.0	0.0
Residential Wood Heating	0.0	0.0	0.0	0.0	0.0	0.0
Wildfires	0.0	0.0	0.0	0.0	0.0	0.0
Prescribed Burning	0.0	0.0	0.0	0.0	0.0	0.0
Space Heating	0.8	0.8	0.8	0.2	4.6	0.0
Miscellaneous Burning	0.2	0.2	0.2	0.0	1.0	0.0
Mobile Sources	1.2	1.3	1.3	26.3	187.7	0.7
All Area Sources	0.4	3.2	7.3	0.0	0.0	0.0
Road Dust	21.1	117.9	435.3	0.0	0.0	0.0
TOTAL	23.6	123.4	445.0	26.5	193.3	0.7

The Project mine site area is undeveloped save for activities associated with the forest products industry and recreation. As such, emissions from traffic comprise the majority of the emissions (mobile sources and road dust). There is no industrial contribution in the 2500 km2 area, nor were there any wildfires or prescribed burning in that year.

Given this low intensity of activity it is expected that air quality will be unimpaired for much of the year. Exceptional circumstances such as the intrusion of regional wildfire smoke or long-range transport of particulate (e.g., Asian dust storms) may result in briefly elevated concentrations. Figures representative of local background are presented in Table 2.6.1.2-4.

Table 2.6.1.2-4 CAC Background Figures

Substance	Averaging Period	Background
$PM_{2.5}$	24-hour	7.0 µg/m^3
PM_{10}	24-hour	18.5 µg/m^3
TSP	24-hour	18.5 µg/m^3
	Annual	18.5 µg/m^3
DF	Monthly	0.2 mg/dm^2/d
NO_2	One-hour	26.8 µg/m^3
	24-hour	17.1 µg/m^3
	Annual	17.1 µg/m^3

Historically in BC, percentile background levels used in air quality assessments have ranged from the 100th to 98th percentile (BC MOE 2006). Given the Project mine site is a nearly pristine area, it is more realistic to use the Williams Lake 75th percentile 1-hour value for NO_2 (26.8 µg/m^3), and the 50th percentile 24-hour values as reference levels for $PM_{2.5}$, PM_{10}, and NO_2, (17.1, 18.5, and 7 µg/m^3 respectively). The 50th percentile value for NO_2 is also an appropriate background figure for the annual average period.

The background figure chosen for TSP (24-hour) is equal to that for PM_{10}. There are no measurements of TSP representative of background for this region. In the absence of local sources of coarse material, 18.5 µg/m^3 is a reasonably conservative figure. Representative background figures for CO, SO_2 and Pb are unavailable, but assumed to be very low.

CHANGES TO BASELINE CONDITIONS

Subsequent to the previous environmental assessment Taseko developed an Air Quality Emissions Monitoring and Management Plan (AQEMMP). Under the AQEMMP, Taseko conducted monitoring at the project site to develop additional baseline air quality and climate data. Under this monitoring plan, dustfall and other air quality data was collected between September 2010 and September 2011. A meteorological station was set up in 2006 to collect baseline climate data, and data was collected at that site up to May 2011. It collected data for the following meteorological parameters: temperature, wind speed, wind direction, precipitation (rainfall only), relative humidity, and solar radiation.

Four dustfall monitoring stations were set up either on the project site or in the vicinity of project site. Samples were collected once a month from each dustfall station. Three Minivol® Portable Air Sampler units (Air Metrics Rev 1.2) were set up to sample Total Suspended Particulate (TSP), inhalable particulate (PM_{10}) and respirable particulate ($PM_{2.5}$). These units were battery operated and programmed to collect samples over a 24-hour period (midnight to midnight) every 6 days coincident with the National Air Pollution Surveillance (NAPS) program schedule. These samplers were set up next to the meteorological station. For detailed analysis of 2010/2011 monitoring data, refer to Appendix 2.6.1.2-A.

Previous to this air quality monitoring study, ground level PM_{10} concentrations and dustfall data were collected for one year, from August 2, 1997 to September 2, 1998. PM_{10} data was collected on the six-day NAPS schedule using a Partisol® 2000 PM_{10} sampler. Dustfall samples were also collected at 15 dustfall monitoring sites set up around the project site and north of project site. Dustfall samples were collected every month. Precipitation and ambient temperature Climate data were also collected at 4 sites between 1992 and 1998. Wind speed and direction data were collected at 3 sites. For a detailed analysis of 1997/1998 monitoring data, refer to Appendix 4-2-A of the March 2009 EIS/Application.

The 2010/2011 air quality monitoring used Minivo® Portable Air Sampler units to measure TSP, PM_{10} and $PM_{2.5}$. Data analysis shows that detection limit for all 3 species were systematically high throughout the monitoring period. The percent of data that were above the detection limit for TSP, PM_{10} and $PM_{2.5}$ are 34%, 22% and 27%, respectively. In this pristine region this creates a strong bias towards high measured concentrations, and does not report low concentration data. These air quality data are of limited use and discounted in this work.

PM_{10} was measured in the previous 1997/1998 baseline monitoring study. The observed maximum PM_{10} concentration was 33.8 µg/m^3, which was below the provincial regulatory objective of 50 µg/m^3. The average PM_{10} concentration was 7.55 µg/m^3.

Maximum dustfall deposition at 4 dustfall stations during 2010/2011 study ranged from 0.38 mg/dm^2/day to 1.69 mg/dm2/day with average dustfall deposition ranging from 0.16 mg/dm2/day to 0.33 mg/ dm^2/day. In the previous dustfall monitoring study (1997/1998) at 15 dustfall stations, the maximum dustfall deposition ranged from 0.26 mg/ dm^2/day to 1.3 mg/ dm^2/day and average dustfall deposition ranged from 0.033 mg/ dm^2/day to 0.2 mg/ dm^2/day. The observed maximum and average dustfall deposition ranges were slightly higher in 2010/2011 study as compared to 1997/1998. This difference could be due to difference in location of dustfall monitors and/or human activity in the area.

Dustfall samples from both studies were also analyzed for metals in dust. For a substantial number of analyzed metals, metal deposition rates were below the detection limit or zero. The metal with the greatest number of guideline exceedance was copper (guideline is 0.00010 mg/ dm^2/day). The average copper deposition between the four stations ranged from 0.0001 mg/ dm^2/day to 0.0005 mg/ dm^2/day, with a maximum deposition of 0.006 mg/ dm^2/day. Comparably, in the 1997/1998 baseline study, the average deposition of copper ranged from 0.00035 to 0.0006 mg/ dm^2/day and the maximum deposition was 0.007 mg/ dm^2/day. This is likely naturally occurring copper from the country rock, which is strongly mineralized.

Site-specific climate data from October 2006 to September 2010 was analyzed. Wind speed and direction data from October 2006 to September 2010 were analyzed. Figure 2.6.1.2-2 presents a wind rose and wind speed frequency distribution diagram. Winds are generally from south and south-east directions. Approximately 50% of wind speeds were between 0.5 to 2.1 m/s with 2.1% calm winds. The average wind speed was 2.1 m/s. General wind directions in 1992/1998 wind data were from south-east with average wind speed of 2.1 m/s. These trends in the 1992/1998 study are therefore similar to 2010/2011 wind data.

Hourly temperature over 4 year period ranged from -38.3 °C to 29.5 °C, while daily mean temperature ranged from -29.8 °C to 21.3 °C. Annual average ambient temperature ranged from 2.4 °C to 6.3 °C. In the previous 1992/1998 climate data study, daily mean temperature ranged from -42.2 °C to 29.8 °C and annual mean temperature range of -0.08 °C to 1.22 °C. Precipitation data collected between 2006 and 2010 include only rainfall data and does not cover snow data. Maximum monthly rainfall recorded is 67.6 mm in June 2010. Summer season received the maximum rainfall. Season monthly average data for rainfall is provided in Table 2.6.1.2-5.

Table 2.6.1.2-5 Summary of Precipitation (Rainfall only) data between October 2006 and September 2010

Season	Monthly Maximum Rainfall (mm)	Monthly Average rainfall (mm)
Winter	22.4	9.3
Spring	56.8	19.2
Summer	67.6	32.9
Autumn	57.8	19.5

Note:
Winter: December, January, February
Spring: March, April, May
Summer: June, July, August
Autumn: September, October, November

Dustfall and metal deposition measurements similar range to the previous presented baseline monitoring results. A comparison of TSP, PM_{10} and $PM_{2.5}$ could not be made as the 2010/2011 data were not suited for analysis. It is expected that, given the relative stability of both the dustfall results and the baseline climate that other air quality parameters (e.g. TSP, PM_{10} and PM_{10}) have changed very little recently.

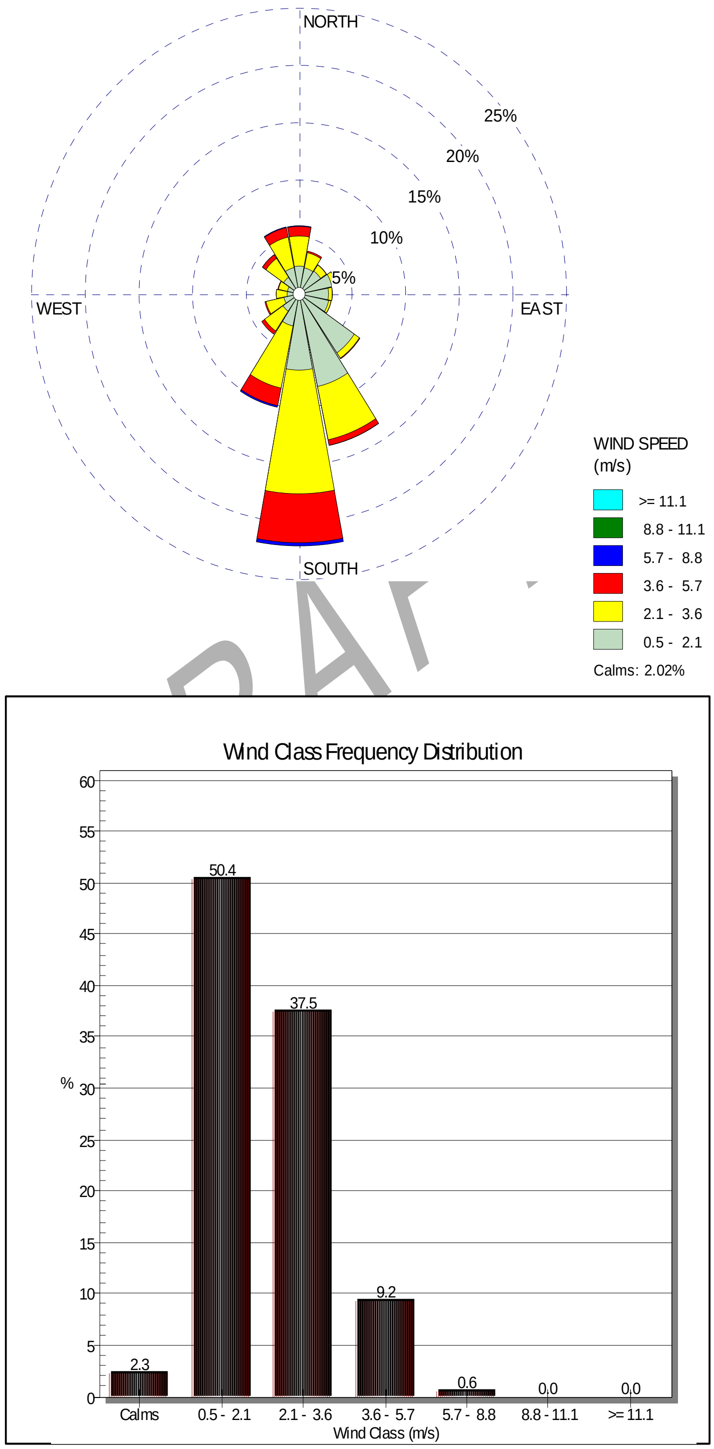


Figure 2.6.1.2-2 Summary of Wind Speed and Wind Direction Data based on Site-specific Climate Monitoring

2.6.1.3 Acoustic Environment

The existing acoustic environment for such remote rural areas is expected to be quiet and dominated by sounds of nature (e.g., wind noise, vegetation rustling, bird chirping, etc.). The location of the mine site is remote and the existing night-time acoustic environment (i.e., ambient conditions) is expected to be similar to the average night-time ambient sound level for remote rural area established by the Energy Resources Conservation Board (ERCB). In the absence of a similar average night-time ambient sound level value for British Columbia, the ERCB value is used for this assessment. Therefore an average night-time ambient sound level of 35 dBA Leq(9) has been used for this study. The ERCB Directive 38 recognizes that daytime ambient conditions are commonly 10 dB higher than night-time levels and as such an average daytime ambient sound level of 45 dBA Leq(15) has been used for this study.

2.6.1.4 Water Quality and Quantity

A. SURFACE WATER QUALITY

Water, sediment, periphyton, and benthic invertebrate characteristics of Fish Creek and other streams, as well as plankton communities of lakes, in the RSA, have been studied since 1992. In 2006, a gap analysis of previous published and unpublished Project reports was conducted to assess completeness of datasets, compliance with the PRS and relevance to conditions a decade after historic data collection (JWA, 2006). The following sources of information were reviewed, with methods and results for all work conducted since 1992 presented in a Technical Data Report (Appendix 5-2-A in the March 2009 EIS/Application):

- Programs conducted by Hallam Knight Piesold Ltd. between 1992 and 1997, and
- A program conducted by Triton Environmental Ltd. in 1997 and 1998.

The gap analysis identified the considerable amount of baseline water quality and sediment data already obtained for Fish Creek and surrounding water bodies, most of which is still relevant to current standards. The body of work was distinguished as pre-PRS (1992 to 1996) and post-PRS (1997 onward), as the PRS defined sampling sites and methods based on regulatory input. Methods used in 1997 and 1998, in particular, were consistent with the PRS and data quality (field and laboratory) was high, for the most part. Some gaps were identified, including:

- Differences in some data quality standards between the pre- and post-PRS work, with the earlier work having higher detection limits for many metals and periodic exceedance of recommended sample hold times for some nutrient parameters, and
- Minor differences such as analysis of total organic carbon rather than dissolved organic carbon, with the latter more relevant to assessment of metal toxicity.

Although the extensive database was considered to adequately reflect conditions up to 1998, there have been changes in the watershed related to logging of trees infested with mountain pine beetle. In addition, the selection of a preferred mine option and design have led to a more precise definition of sampling sites useful for assessing effects and for providing reference area data.

Recommendations were made for additional studies in 2006 to better define baseline conditions, given the potential for changes to hydrology and water quality related to logging. Methods, detection limits and endpoints were consistent with the PRS and 1997–1998 studies. The 2006 baseline assessment focused on four sites in Fish Creek, three in the Taseko River, one on the Big Onion lake system, and one on lower Tête Angela Creek (to provide a regional reference site for future monitoring programs). An additional year of data (water, biological communities) from Fish Lake prior to mine start-up, as required in the PRS, was also included.

Water quality in Fish Creek and the Taseko River upstream and downstream of the Fish Creek confluence was also assessed in April and May 2008 to provide additional baseline information. An additional season of water quality, sediment and aquatic biota data has been collected for Wasp Lake (north and south basins) and Big Onion Lake between May and October 2008, to better characterize these lakes.

Following the decision by the proponent to adjust the location of the TSF and thereby ensure the health and sustainability of the resident population of Rainbow Trout in Fish Lake, it was decided updated aquatic baseline data should be collected from Fish Lake and its tributaries. This most recent baseline data sampling program was carried out by Triton Environmental Consultants and includes data collected in July and October 2011, and February, 2012. A total of 35 water samples were collected and analysed.

OVERVIEW OF BASELINE

Details of the numerous baseline studies completed by Taseko on water and lake communities are summarized in Appendix 5-2-A in the March 2009 EIS/Application. The Appendix provides detailed information about methods, site locations, quality assurance/quality control measures and results. The approach and results are briefly summarized in this assessment to provide a general description of baseline conditions.

A total of 24 stream and 13 lake sites have been sampled at various times since 1992. Stream and lake sites are shown on Figure 2.6.1.4A-1 and described in Table 2.6.1.4A-1 and Table 2.6.1.4A-2. Most, if not all, of the streams and lakes are considered to be in undisturbed wilderness, with limited influence from human activities such as ranching, logging and recreation.

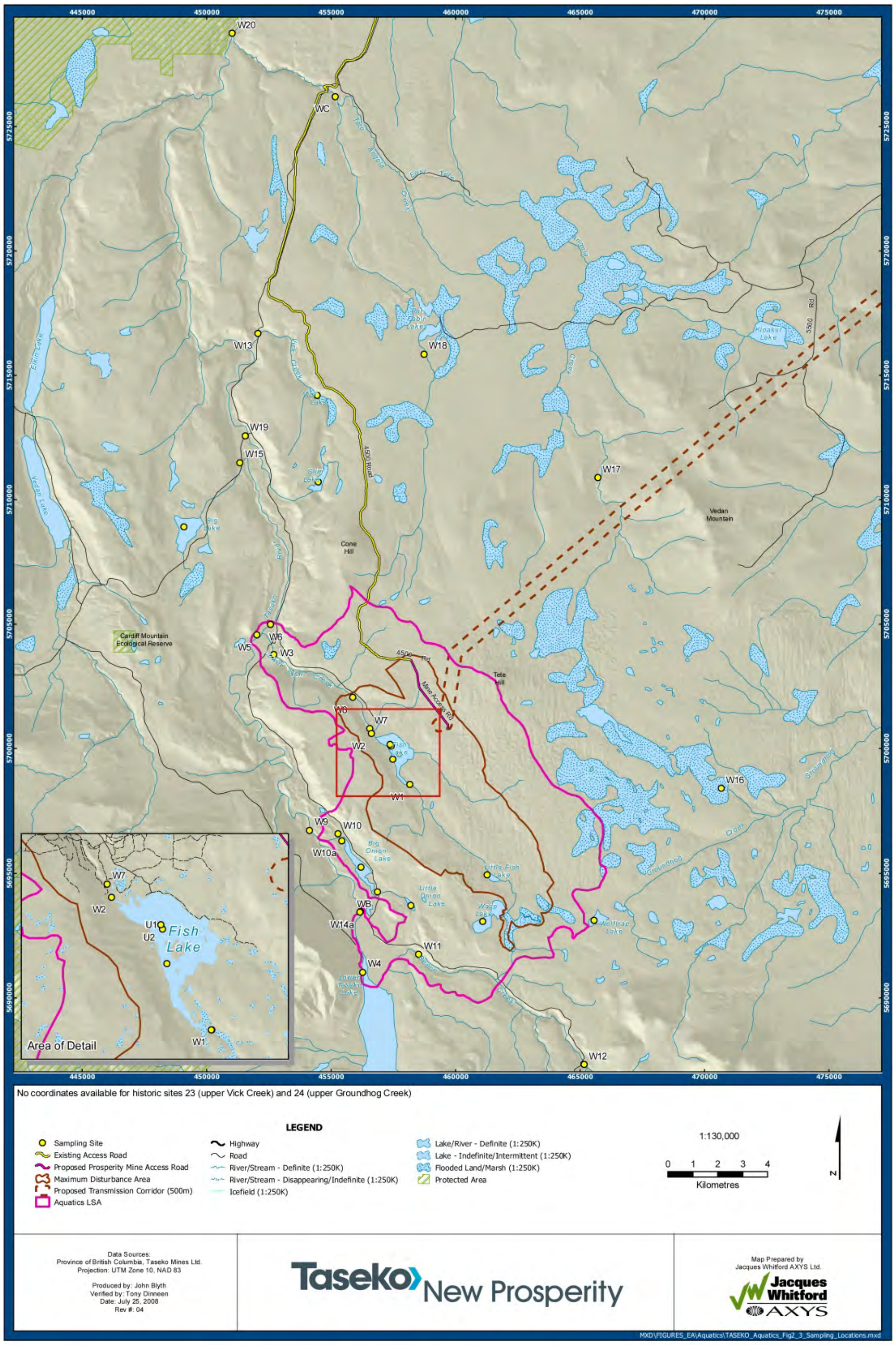


Figure 2.6.1.4A-1 Stream, River and Lake Sampling Sites in the New Prosperity Project Study Area (1992–2006)

At the time the PRS was finalized, the alternatives assessment process was underway and a final Project design had not been confirmed. As a result, the PRS included requirements for sampling at sites that would be directly or indirectly affected by Project activities using a number of Project designs, or provide regional reference information for long term monitoring. In the intervening years, the alternatives assessment has been completed, the mine plan defined and the EIS Guidelines issued. Consequently, the number of sites that need to be considered in this assessment has been reduced. Where helpful, reference to data from sites no longer relevant to the Project design has been made. For clarity, the figures and tables provide the reader with basic information about all the sites.

Table 2.6.1.4A-1 New Prosperity Project Sampling Program Outline–Streams and Rivers, 1992–2006

Sampling Location		Rationale	Number of Samples			
			Water	Sediment	Periphyton	Benthic Invertebrates
W1	Fish Creek at inlet to Fish L.	Directly affected by Project development	77	16	16	16
W2	Fish Creek at outlet of Fish L.	Directly affected by Project development	81	21	21	27
W3	Fish Creek, 1.2 km upstream of Taseko R.	Potential effects downstream of the Project	77	21	21	21
W4	Taseko River at outlet of Taseko L.	Regional reference upstream of Project influence	73	10	5	5
W5	Taseko River 250 m upstream of Fish Cr.	Reference upstream of confluence with Fish Creek,	88	21	15	21
W6	Taseko River 530 m downstream of Fish Cr.	Downstream of confluence with Fish Creek–potential effects assessment	88	21	10	16
W7	Fish Creek upstream of ore body	Affected by Project development (sampled pre-1997)	49	6	–	–
W8	Fish Creek downstream of ore body	Potential effects downstream of the pit	83	21	21	21
W9	Taseko River d/s of Big Onion L.	Potential effects–discharge of seepage post-closure	64	6	6	–
W10	Big Onion Lake outlet, 1990s	Potential effects	63	–	–	–
W10 a	Big Onion Lake foreshore near outlet	Potential effects	12	–	–	–
W11	Beece Creek upstream of Taseko River	Potential effects	63	16	10	16
W12	Beece Creek upstream of Project area	Reference site for activities in Beece watershed	63	16	10	16
W13	Vick Creek downstream of Vick L.	No longer applicable–regional reference	106	–	–	–

Sampling Location		Rationale	Number of Samples			
			Water	Sediment	Periphyton	Benthic Invertebrates
W14a	Taseko River, 2 km downstream of W4	Potential effects from groundwater seepage via Big Onion Lake	41	11	11	5
W15	Big Lake Cr. (Big Lake outlet)	Sampled once in 1994–regional reference	7	–	–	–
W16	Groundhog Creek (north arm)	No longer applicable–regional reference	24	6	–	–
W17	Tête Angela Creek East	No longer applicable–regional reference	24	16	16	16
W18	Tête Angela Creek West	No longer applicable–regional reference	20	16	11	11
W19	Taseko River d/s of Davidson Bridge	No longer applicable–regional reference	18	10	10	10
W20	Taseko River d/s of Tête Angela Cr.	No longer applicable–regional reference	18	10	10	10
W23	Vick Creek upstream of Vick Lake	No longer applicable–regional reference	9	–	–	–
W24	Upper Groundhog Creek	No longer applicable–regional reference	12	–	–	–
WC	Tête Angela Creek upstream of Taseko R	No longer applicable–regional reference	7	5	5	5
Total number of samples			**1084**	**249**	**198**	**216**

Table 2.6.1.4A-2 New Prosperity Project Sampling Program Outline–Lakes, 1992–2006

Sampling Location	Rationale	Number of Samples				
		Water	Sediment	Phytoplankton	Benthic Invertebrates	Zooplankton
Fish Lake	Potential effect of Project	28	11	19	11	16
Little Fish Lake	Direct effect of Project–Loss of the lake	7	5	11	11	11
Big Lake	No longer applicable - regional reference site	4	5	10	5	–
Big Onion Lake	Potential Project effects–seepage from mine area	5	11	11	11	17
Little Onion Lake	No longer applicable–regional reference	2	5	–	–	–
North Rat Cabin	No longer applicable–regional reference	2	5	–	–	–

Lake						
South Rat Cabin Lake	No longer applicable–regional reference	2	5	–	–	–
Slim Lake	No longer applicable–regional reference	6	5	11	11	11
Taseko Lake	No longer applicable–regional reference	–	5	10	5	–
Tête Angela Lake	No longer applicable–regional reference	3	–	–	–	5
Vick Lake	No longer applicable–regional reference	4	5	11	11	11
Wasp Lake	Direct effect of Project–Fish Creek watershed water diversion	7	11	12	11	6
Wolf Trap Lake	No longer applicable–regional reference	2	–	–	–	–
Total number of samples		**72**	**73**	**95**	**76**	**76**

A total of 1084 water, 249 sediment, 198 periphyton and 216 benthic invertebrate samples was collected from streams and rivers in the RSA (Table 2.6.1.4A-2). Sampling in lakes has also been extensive, with 72 water, 73 sediment, 95 phytoplankton, 76 zooplankton and 76 benthic invertebrate samples collected from lakes in the RSA. Three groundwater seepage locations on the northeast shore of Big Onion Lake were also sampled at various times, to characterize baseline groundwater quality that could be affected by seepage from the Fish Creek watershed. These include W21 and W22 (11 and 13 samples, respectively in 1997 and 1998) and WB (5 samples in 2006), which are not shown on Figure 2.6.1.4A-1.

Information about the Big Onion Lake system was obtained by sampling ephemeral inlet and outlet streams and at mid-lake. As a result, data for Big Onion Lake are discussed in relation to the other lakes, rather than streams of the area.

Appendix 5-2-A in the March 2009 EIS/Application provides information about sampling dates and locations for the stream, river and lake sampling programs. The timing and frequency of sample collection generally was as follows:

- Stream water samples were collected monthly and during two periods of intense sampling (five samples in a 30-day period during high and low flow seasons)
- Lake water samples were collected during the open water season (May through October) and occasionally under ice (March)
- Sediment samples were collected in August or September
- Benthic invertebrates and periphyton were collected in August or September
- Phytoplankton were collected at various times from May through October, and
- Zooplankton were collected in August.

Metals levels in all the streams studied were within BC and CCME WQG, with few or no exceedances. Exceptions included Fish Creek (iron, total aluminum), Taseko River (total and dissolved aluminum, copper and iron), Beece Creek (total and dissolved aluminum) and Groundhog Creek (iron). Evaluation of cadmium levels was hampered by the low detection limits needed to compare with the current WQG (range of 0.000017 to 0.00005 mg/L, depending on hardness), and historic analytical data with higher detection limits (0.0002 or 0.00005 mg/L).

Given the large dataset, with several correlated parameters, similarities and differences among the stream systems were explored using two statistical tools, Principal Components Analysis (PCA) and discriminant analysis, to assess water quality. PCA was used first to group correlated parameters. It explained 88% of the variability in water quality and identified three principal components (clusters of parameters). The first principal component correlated with alkalinity, total calcium, total dissolved solids, conductivity and hardness; the second, with turbidity, total copper and total aluminum; and the third, with ammonia-N and total nickel (Figure 2.6.1.4A-2). Once the redundancy related to correlated parameters was eliminated, a discriminant analysis was performed on the three principal components to examine similarities and differences among the systems. This analysis suggested three groups of streams:

- The Taseko River, which was related to higher levels of aluminum (from glacial silt), copper and turbidity, and lower alkalinity, hardness and concentration of major ions in general than the other streams
- Fish Creek, separated on the basis of higher levels of nutrients (ammonia and ortho-phosphate) and total nickel than the other streams, and
- The remaining streams (Vick, Groundhog, Tête Angela and Beece Creek).

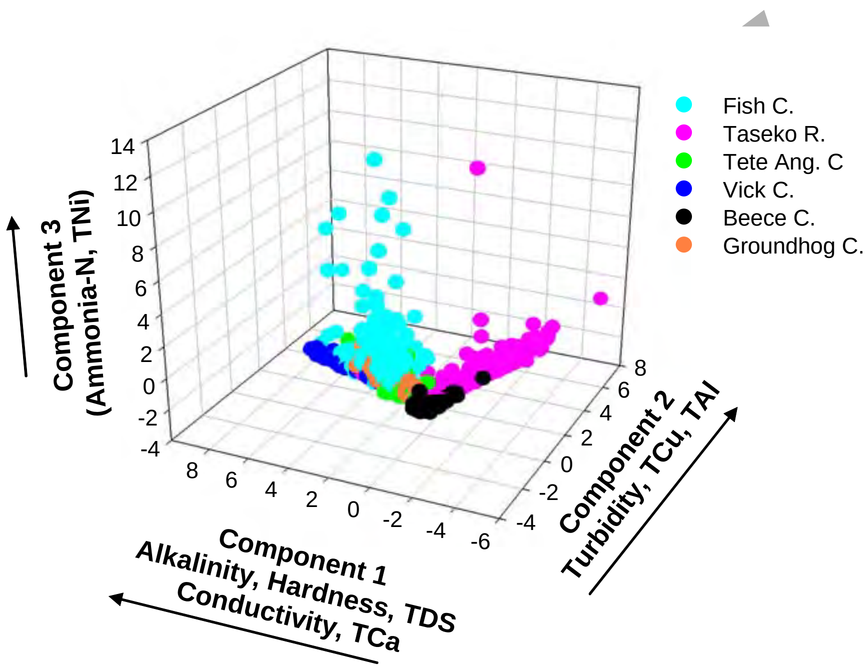


Figure 2.6.1.4A-2 Principal Components Analysis of Water Quality Data for Streams in the New Prosperity Project Area

Metals levels in sediment of Fish Creek and regional streams were generally within provincial SQG and a few were higher. In Fish Creek, mean levels of cadmium, copper, lead, mercury, selenium, silver and zinc were within BC Least Effect Level (LEL) SQG at all sites; however, levels of arsenic, chromium, iron, nickel, antimony and manganese were higher than LEL SQG. Of these, arsenic was particularly elevated, with more than 50% of measurements greater than the Probable Effects Level (PEL) SQG. Levels of antimony and manganese were elevated in most or all samples. There are no BC or CCME SQG at present for these metals; however, the PRS and the EIS provide guidelines. Concentrations of iron were also above the LEL guideline in almost all samples for Fish Creek. Trends generally were similar for sediment in the other streams and the Taseko River, with levels of arsenic, antimony, iron, nickel and manganese consistently exceeding guidelines in all streams surveyed except Beece Creek.

Multivariate analysis of sediment data was not done because of the wide range of values reported within a system and for sites within a system, making it difficult to distinguish trends. There was higher variability among sites than among habitat types (pool vs. riffle) at a site. Sediment samples from Fish Creek tended to have the highest concentrations of arsenic, chromium, manganese, mercury and TOC among all systems, and sediment from the Taseko River exhibited the highest levels of aluminum and copper.

Differences in metal concentrations between riffle and pool habitats varied from one system to another. In Fish Creek and Taseko River, metal levels tended to be higher in sediment from pool habitats that from riffle habitats. In Tête Angela Creek, metals levels tended to be higher in riffles and in Beece Creek no trend was observed.

Metals Levels in Fish Tissue

From 1993 through 1997, fish tissue samples (muscle and liver) were collected throughout the RSA to establish background levels of metals. Results for the RSA are presented in the TDR (JWA, 2007), with results for Fish Creek, Fish Lake, Little Fish Lake, and Taseko River presented here for Rainbow Trout, the most abundant species in these systems. In 2006, Rainbow Trout muscle tissue was collected from Fish Lake to augment the baseline data. Field and laboratory methods and equipment used in all programs were designed to prevent sample contamination and to assess natural and analytical variability.

Antimony, arsenic, cadmium, chromium, lead, mercury, nickel, and selenium levels were analyzed, as required in the PRS and the EIS. Results were compared with BC tissue guidelines (MoE, 2006), where available. Two of these guidelines apply to human consumption rather than fish health: lead (0.8 mg/kg wet weight, alert for human consumption, edible tissue) and mercury (0.1 to 0.5 mg/kg, varying with amount of human consumption, edible tissue). The selenium guideline of 1 mg/kg is an interim guideline for aquatic life. The PRS and the EIS Guidelines include these values (although in 1998, the selenium guideline was higher at 3 mg/kg), and a criterion for arsenic of 3.5 mg/kg. For other metals, comparisons were made with literature values, as shown in Table 2.6.1.4A-3:

- Arsenic and cadmium were compared with levels reported for fish tissue from uncontaminated BC lakes (Rieberger, 1992), and with EPA screening values for defining green areas (water bodies containing fish that are safe for “unrestricted consumption”) based on subsistence or recreational fish consumption (USEPA, 2000).
- Nickel was compared to levels reported for fish tissue from uncontaminated BC lakes (Rieberger, 1992).
- Chromium was compared to the range of concentrations in whole body fish observed nationwide in the USA (Bonn, 1999).

Table 2.6.1.4A-3 Values for Comparisons of Metal Concentrations in Fish Tissue

Variable	Concentration (mg/kg wet weight), Mean (SD)		
	Liver	Muscle	Whole Fish
Aluminum[1]	2.15 (2.67)	1.24 (1.55)	-
Arsenic[1]	0.18 (0.63)	0.15 (0.52)	-
Arsenic[2]	-	-	0.0039 (subsistence) 0.026 (recreation)
Arsenic[3]	3.5	3.5	
Cadmium[1]	0.31 (0.22)	0.23 (0.03)	-
Cadmium[2]	-	-	0.58 (subsistence) 4 (recreation)
Chromium[4]	-	-	0.22–25
Copper[1]	51.1 (46.8)	0.39 (0.29)	-
Iron[1]	318 (213)	7.50 (7.76)	-
Lead[5]	-	0.8	-
Manganese[1]	1.57 (1.19)	0.27 (0.13)	-
Mercury[5]	-	0.1 to 0.5	-
Nickel[1]	1.60 (1.05)	1.20 (0.40)	-
Selenium[5]	-	1	-
Zinc[1]	28.8 (16.8)	4.28 (1.35)	-

NOTES:
[1] Values from BC uncontaminated lakes (Rieberger, 1992)
[2] EPA (2000) screening values for defining green areas based on consumption
[3] Project Report Specifications (1998) only
[4] Values correspond to range of concentrations measured in fish whole body nationwide in the USA (Bonn, 1999)
[5] MOE (2006) approved tissue guidelines for BC

A total of 65 samples of Rainbow Trout tissue were analyzed: 39 fish from Fish Lake (includes three composites made from nine fish), 10 from Little Fish Lake, 10 from lower Fish Creek, and 12 from the Taseko River. Mean and maximum concentrations were estimated separately for muscle and liver tissue (Table 2.6.1.4A-4).

Table 2.6.1.4A-4 Baseline Metals Levels in Rainbow Trout Liver and Muscle Collected in Fish Creek, Fish Lake, Little Fish Lake and the Taseko River (n = 126 samples)

Metals	% Samples with Concentration Below DL	Mean Concentration (mg/kg fresh weight)			
		Maximum Muscle	Maximum Liver	Mean Muscle	Mean Liver
Antimony	100	<0.05	<0.05	<0.05	<0.05
Arsenic	81	0.11	0.46	0.03	0.05
Cadmium	87	<0.03	0.24	<0.03	0.04
Chromium	87	0.08	0.10	0.17	0.21

Lead	96	<0.05	0.20	<0.05	0.03
Mercury	0	0.34	0.53	0.08	0.10
Nickel	94	0.07	0.10	0.31	0.38
Selenium	30	0.90	5.90	0.16	2.13

Baseline metal levels in fish tissue from the lakes and streams sampled for the New Prosperity Project were low compared to the detection limits used and to other BC lakes (Rieberger, 1992). Antimony, arsenic, cadmium, chromium, lead, and nickel levels were below detection in 81 to 100% of the Rainbow Trout samples (Table 2.6.1.4A-4). Antimony, chromium, and nickel were below detection in 100% of samples from lower Fish Creek and the Taseko River as was lead in 100% of muscle samples from Fish Creek. Mercury was detectable in 100% of the samples and selenium in 70%.

Mean and maximum concentrations of arsenic and cadmium in liver and muscle of Rainbow Trout were generally lower than mean levels reported in fish from uncontaminated BC lakes (Rieberger, 1992). The only exception was arsenic in liver of fish from the Taseko River (maximum concentration of 0.46 mg/kg, three times higher than reported by Rieberger). The maximum arsenic concentrations in fish tissue were also higher than EPA screening levels (USEPA, 2000). Cadmium levels were below EPA screening values for defining green areas based on subsistence or recreational fish consumption (USEPA, 2000). Maximum chromium concentrations corresponded to the lower end of the range of USA concentrations (Bonn, 1999). Given that arsenic levels were higher than Probable Effects Levels in sediment from sites in the Taseko River and in Fish Creek upstream of the Taseko confluence, there may be links between exposure to and uptake of arsenic in Rainbow Trout.

Metals levels were compared with BC guidelines for fish tissue, with results as follows:

- Lead ranged from below detection levels to 0.20 mg/kg (no exceedance)
- Selenium ranged from below detection to 5.90 mg/kg (exceedance in 39% of analyzed samples), and
- Mercury ranged from 0.02 to 0.53 mg/kg (exceedance in 25% of analyzed samples).

In general, mercury levels in Rainbow Trout exceeded the 0.1 mg/kg guideline for mercury (the lowest criterion in the range of 0.1 to 0.5 mg/kg), corresponding to a recommendation for humans to consume no more than 1,050 g fish wet weight per week). In lower Fish Creek, however, 2 of the 10 individuals showed higher mercury concentrations in muscle (0.26 and 0.34 mg/kg) and liver (0.53 and 0.45 mg/kg). In Fish Lake, one fish with a mercury concentration of 0.31 mg/kg in liver was also reported. Mercury levels in liver and muscle were similar (Figure 2.6.1.4A-3), with guideline exceedances for both types of samples.

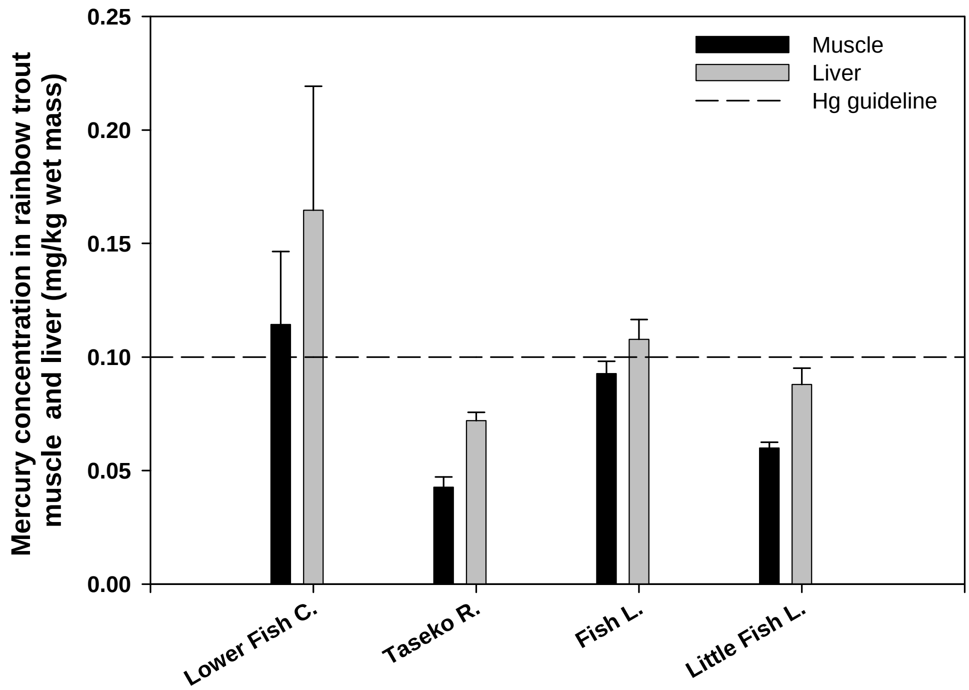


Figure 2.6.1.4A-3 Mercury Concentrations in Rainbow Trout Muscle and Liver Samples from the Taseko River, Fish Creek, Fish Lake and Little Fish Lake (mean and standard error)

Selenium concentrations in liver tended to be much higher than in muscle; most values exceeded the selenium guideline in liver tissue and were highest in fish from the Taseko River and Fish Lake (Figure 2.6.1.4A-4).

Baseline levels of mercury and selenium in fish tissue varied from one site to another. On average, mercury levels were highest in fish from lower Fish Creek and selenium levels were highest in fish from the Taseko River (ANOVA, $p < 0.05$). The percent of analyzed samples that exceeded either mercury or selenium guidelines varied as follows:

- Lower Fish Creek: 35% of muscle samples for mercury, with concentrations up to 0.53 mg/kg; 20% of muscle samples for selenium (40% of liver samples)
- Taseko River: no exceedance for mercury; 50% of muscle samples exceeded selenium guideline (100% of liver samples)
- Fish Lake: 35% of muscle samples for mercury, with concentrations up to 0.31 mg/kg; 37% of muscle samples for selenium (79% of liver samples), and
- Little Fish Lake: 10% of muscle samples for mercury, with all concentrations below 0.2 mg/kg; 40% of muscle samples for selenium (80% of liver samples).

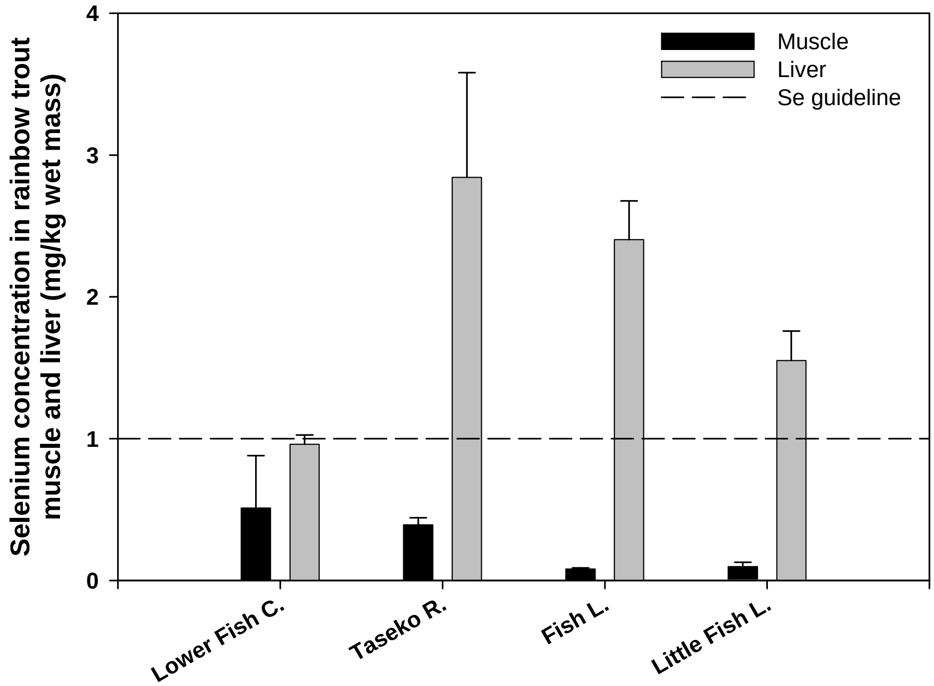


Figure 2.6.1.4A-4 Selenium Concentrations in Rainbow Trout Muscle and Liver Samples from the Taseko River, Fish Creek, Fish Lake and Little Fish Lake (mean and standard error)

Potential links between metals in sediment and fish tissue were examined. Levels of selenium were below applicable sediment quality guidelines (Least Effect Levels) in both Fish Creek and the Taseko River, which does not suggest an obvious link between sediment and fish liver levels, but does provide evidence in support of the bioaccumulation pathways discussed for the selenium guideline for fish tissue (MOE, 2006). Mercury levels were higher than sediment guidelines in some replicate samples from Fish Creek sites W8 and W3, although mean levels remained below the guidelines, similar to data for individual fish and averages, suggesting relationships between observed mercury levels in Fish Creek muscle tissue and sediment.

Metals such as mercury are known to accumulate in fish over time, with older larger fish having higher concentrations. Significant ($p < 0.05$) positive correlations between fish length and mercury concentration in muscle were observed for Rainbow Trout from Lower Fish Creek. A positive, but not significant trend was also observed for Rainbow Trout from Fish Lake, Little Fish Lake, and Taseko River. The poor correlation was probably due to small sample size and small range in size and age of fish sampled in each area.

Sediment Quality

The following sources of information were used for the sediment quality assessment, with methods and results presented in Appendix 5-2-A from the March 2009 EIS/Application for all work conducted for the Project since 1992:

- Studies conducted from 1992 through 1996 by Hallam Knight Piésold
- Studies conducted in 1997 and 1998 by Triton Environmental that were consistent with the PRS (1998)
- Studies conducted in 2006, based on a gap analysis conducted for historic data, also consistent with the PRS and EIS Guidelines, and
- Additional studies conducted in 2011 by Triton Environmental which were also consistent with the PRS and EIS Guidelines.

Since May 1997, sampling methods and sites have followed the PRS and the EIS Guidelines and were compatible with those described in the British Columbia Field Sampling Manual for Lake and Stream Sediment Sampling (MOE, 1996). Samples were also collected from 1994 to 1996 according to the standards of the time. Laboratory and field methods and equipment employed were designed to prevent sample contamination and to assess natural and analytical variability. Five or six replicates were collected at each site.

Samples were collected during the late summer low flow period from four sites in Fish Creek, four sites in Fish Lake, and one site in Wasp Lake. Samples were also collected from a number of other streams and lakes, and provide regional reference data. Since 1992, 326 samples have been collected from 23 stream sites and 13 lake sites in the RSA. Stream sites included Beece Creek (two sites), Tête Angela Creek (three sites), Groundhog Creek (one site), and Taseko River (eight sites). Lakes sampled included Little Fish, Big Onion, Little Onion, North Rat Cabin, South Rat Cabin, Slim, Taseko, and Vick Lakes. Both erosional and depositional habitats of streams were sampled by hand. Lake samples were collected using an Eckman dredge sampler.

Samples were sent either to ALS Environmental analytical laboratory (Vancouver, BC) or Maxxam Analytics (Burnaby, BC) and analyzed for metals, total organic carbon, and particle size, as indicated in Table 2.6.1.4A-5. The detection limits used were reported to be the lowest commercially available at the time. Since 1997, detection limits have been consistent with those outlined in the PRS and in the EIS Guidelines, with the exception of cadmium, nickel, and silver, for which the laboratory could not provide low limits. Detection limits varied for samples collected prior to 1997.

Table 2.6.1.4A-5 Sediment Parameters 1994 through 2012, New Prosperity Project

Parameters Measured in All Years	Additional Parameters Measured from 1997 to 2012
Particle Size	Total organic carbon
Percent moisture	Sediment accumulation rate
Antimony, total	Aluminum, total
Arsenic, total	Barium, total
Cadmium, total	Beryllium, total
Chromium, total	Boron, total
Cobalt, total	Calcium, total
Copper, total	Iron, total
Lead, total	Magnesium, total
Mercury, total	Manganese, total
Molybdenum, total	Potassium, total
Nickel, total	Sodium, total
Selenium, total	Tin, total
Silver, total	
Zinc, total	

The <63 µm (silt and clay) size fraction was analyzed from 1997 onward, as specified in the PRS and in the EIS Guidelines. The exception was some samples obtained in 2006, where the <63 to <250 µm fraction was analyzed due to difficulties obtaining sufficient fine sediment at some sites. The size fraction analyzed prior to 1997 was not specified; however, a fine fraction was collected and laboratory practice at that time was to analyze the entire sample (Andre Langlais, ALS Laboratory, pers. comm.).

Sediment Quality Guidelines

SQG were described in the PRS and the EIS Guidelines and have been updated with current British Columbia (Nagpal et al., 2006) and Canadian (CCME, 2006) SQGs for the protection of aquatic life. These guidelines are listed in Table 2.6.1.4A-6. SQGs represent total metal concentrations below which adverse biological effects are not expected, and are based on Least Effect Levels (LEL) derived from the literature. LEL represent the concentration below which adverse biological effects are expected to occur only rarely. Probable Effect Levels (PEL) describe levels at which effects are typically observed.

With three sources of SQG available, the most recently published value (BC and CCME, which are the same) was used. For arsenic, cadmium, manganese, mercury, nickel, and silver, the BC, CCME, and PRS and EIS Guidelines were relatively similar; however, for chromium, copper, lead, and zinc, the PRS SQG were lower than CCME or BC SQG, but were not used because of the publication of more recent SQG.

Where baseline conditions for a metal already exceed the SQG, effects levels will be developed as site-specific SQG (e.g., plus or minus 20% of mean baseline levels, a statistically and ecologically based approach used in federal environmental effects monitoring programs for mines to identify effects; EC, 2002). Elevated baseline metal concentrations will also be evaluated in relation to the higher PEL defined for BC (Nagpal et al., 2006).

Table 2.6.1.4A-6 Sediment Quality Guidelines, New Prosperity Project

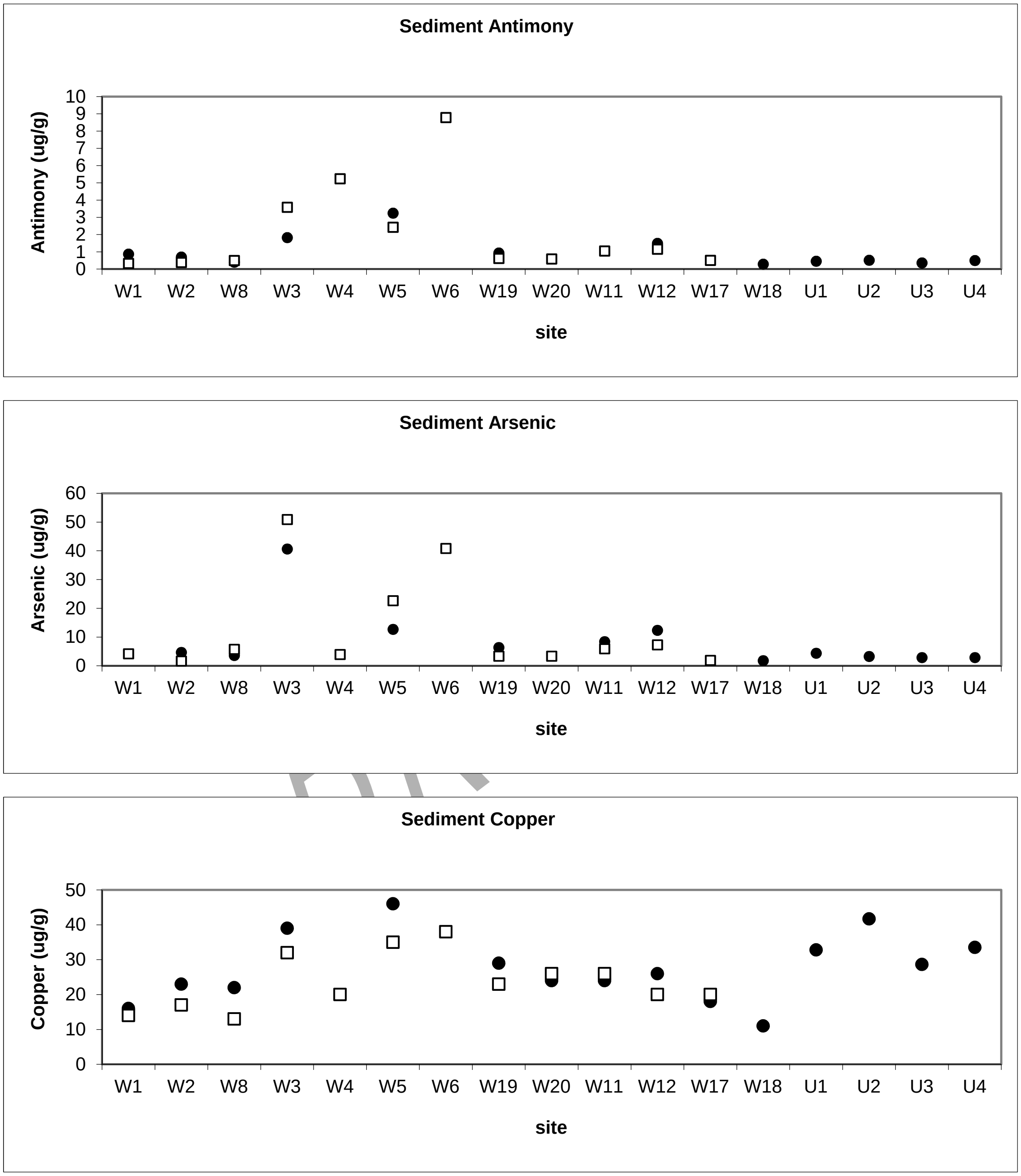
Variable	Concentration (µg/g dry weight)			
	Criteria listed in PRS	CCME Interim Sediment Quality Guidelines (2004)	BC Working Sediment Guidelines[1]	
			Least Effects Level (LEL)	Probable Effects Level (PEL)
Antimony, total	0.43	–	–	–
Arsenic, total	6	5.9	9.8	17
Cadmium, total	0.6	0.6	0.6	3.5
Chromium, total	26	37.3	37.3	90
Copper, total	16	35.7	35.7	197
Iron, total	–	–	21,200	43,766
Lead, total	31	35	35	91
Manganese, total	460	–	460	1100
Mercury, total	0.17	0.170	0.170	0.486
Nickel, total	16	–	16	75
Selenium, total	5	–	2	–
Silver, total	0.5	–	0.5	–
Zinc, total	120	123	123	315

NOTES:
[1] BC Working Guidelines are derived from CCME Guidelines

SOURCE:
PRS, Nagpal et al. (2006), CCME (2006) (interim sediment quality guidelines)

Streams

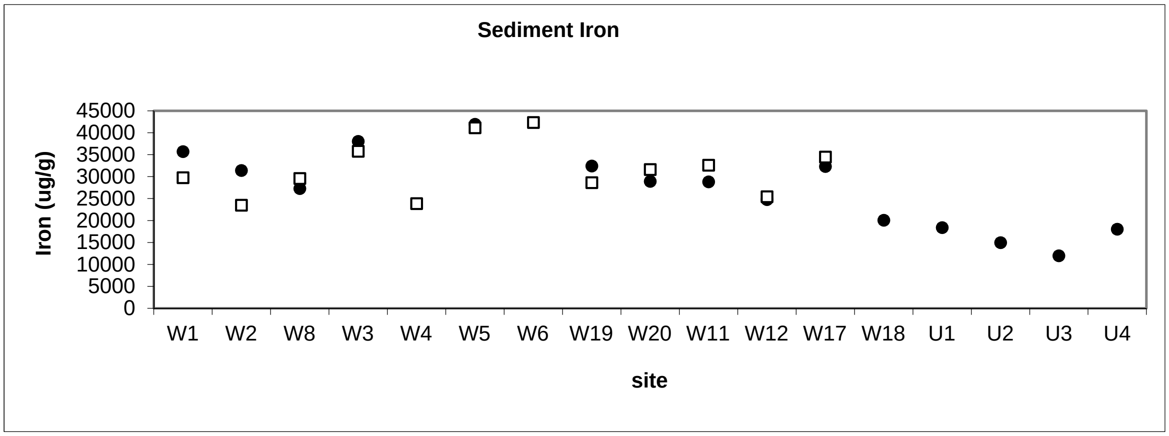
Data collected from streams and rivers in 1997 provide a general picture of metal levels in the RSA. Data for several metals are shown on Figure 2.6.1.4A-5 and Figure 2.6.1.4A-6 for Fish Creek (W1, W2, W8 and W3), Taseko River (W4, W5, W6, W19 and W20), Beece Creek (W11 and W12), and Tête Angela Creek (W17 and W18).

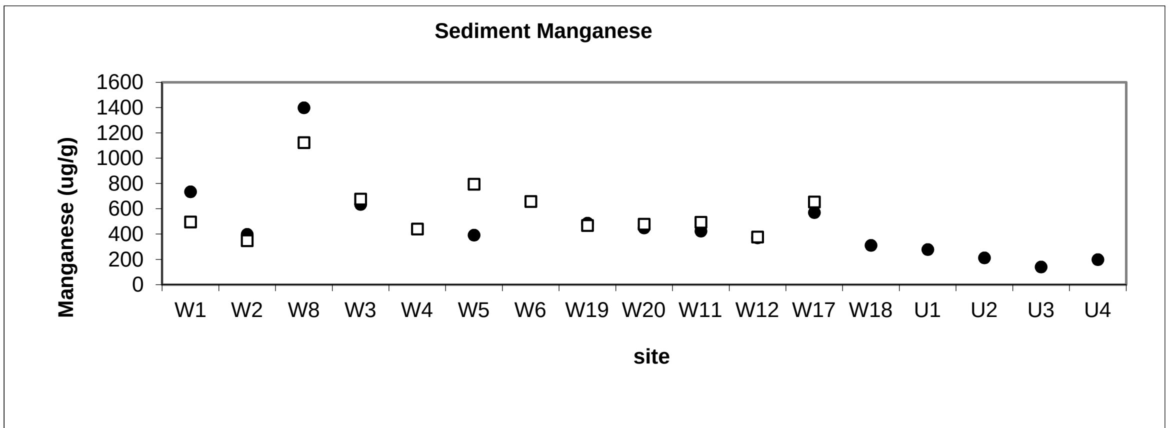


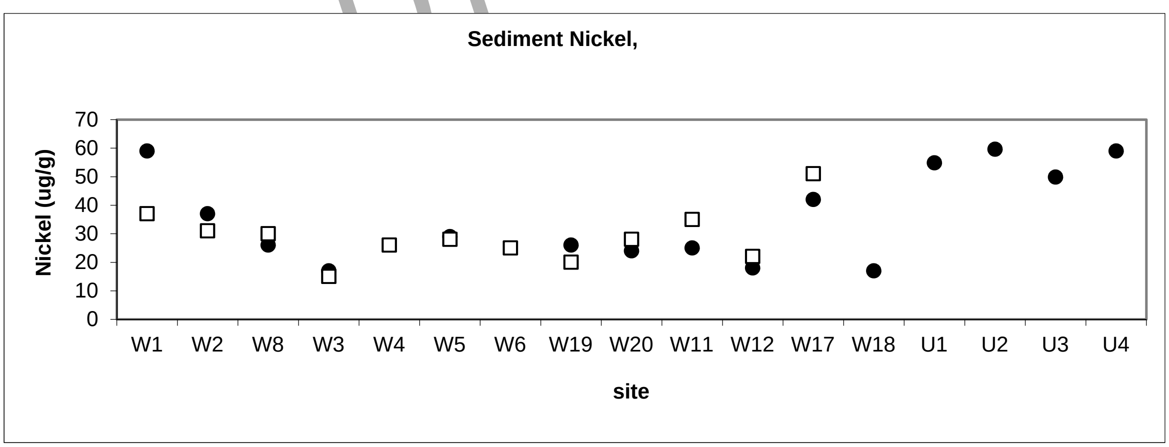
NOTES:

(closed symbol = pools; open symbol = riffle), Fish Creek (W1, W2, W8, W3), Taseko River (W4, W5, W6, W19, W20), Beece Creek (W11, W12), Tête Angela Creek (W17, W18), solid line indicates SQG

Figure 2.6.1.4A-5 Antimony, Arsenic and Copper Levels in New Prosperity Project Streams, 1997 (mean, n=5)







NOTES:

(closed symbol = pools; open symbol = riffle), Fish Creek (W1, W2, W8, W3), Taseko River (W4, W5, W6, W19, W20), Beece Creek (W11, W12), Tête Angela Creek (W17, W18), solid line indicates SQG

Figure 2.6.1.4A-6 Iron, Manganese and Nickel Levels in New Prosperity Project Streams, 1997 (mean, n=5)

Sediment of Fish Creek and other regional streams were similar in most respects, reflecting mineralization of the area:

- Cadmium, lead, selenium, and zinc levels were within BC SQG LEL at all sites.
- Chromium, copper, mercury, and silver levels seldom exceeded the SQG, LEL, and any exceedances were relatively small (up to 1.4 times higher).
- Levels of antimony, iron, and nickel exceeded the SQG LEL at all or most sites sampled (antimony up to 20 times, iron up to 2 times, nickel up to 3 times higher).
- Arsenic exceeded the PEL at sites near the Taseko River–Fish Creek confluence (W3, W5, W6) and exceeded the LEL at sites in Beece Creek (W11 and W12) and downstream on the Taseko River (W19), with the maximum arsenic level 8 times higher than the LEL.
- Manganese exceeded the BC SQG in some sites from Fish, Beece, and Tête Angela creeks and Taseko River (up to 3 times higher); highest at W8 in Fish Creek.
- Silver occurred at levels below or near detection limits, but interpretation of results for some sites is hindered by the use of detection limits greater than the SQG.
- Mercury levels were higher than SQG in some replicate samples from Fish Creek (Sites W8 and W3), although mean levels remained below the SQG.

Overall, concentrations of metals in most streams showed little variation between pool and riffle habitat. Significant differences (t test, $p < 0.05$) were observed in Tête Angela Creek, with levels of zinc, nickel, iron, copper, chromium, cobalt, and magnesium higher in riffles; other streams occasionally showed higher concentrations of metals in pools (Fish Creek for nickel and lead; Taseko River and Beece Creek for barium).

Precision of the analyses was calculated as coefficient of variability

$$CV = [\text{standard deviation}/\text{mean}]*100$$

with a target of <20%. CV was higher than the 20% target (more variable) for 22% of the analyses, all fraction sizes considered. Variability was greatest for samples from Fish Creek, for samples collected in both 1997 and 2006. At sites W1, W3, and W8, this included antimony, arsenic, barium, chromium, copper, manganese, and nickel, both in pool and riffle habitat. In the Taseko River, high variability among samples was only observed for arsenic, barium, and copper in pool habitat and manganese in riffle habitat (site W5, 1997) and for arsenic (site W6, 1997 and 2006).

High variability in the results may reflect the natural heterogeneity of the environment and the need for greater numbers of sample replicates per site when assessing statistical significance of differences among sites or as a result of Project activities. Prior to Project construction, another round of sampling will be completed at sites identified as potential effect sites (e.g., W3, W6, W8) and reference sites (e.g., W5) to ensure there is adequate baseline data from which to base future environmental effects monitoring. The number of replicate samples to be collected will be determined by power analysis.

Given the elevated background levels of some metals in sediments, the BC SQG LEL is exceeded for several metals in regional streams, including antimony, iron, manganese, and nickel and, to a lesser extent, copper, and chromium. Site-specific guidelines will be required for the Project area. These will be derived in consultation with regulators; however, the recommended approach will be to use plus or minus 20% of mean baseline conditions, a statistically and ecologically based approach commonly used in federal environmental effects monitoring programs for mines to identify effects (EC, 2002).

The consequences for aquatic life of elevated concentrations of antimony, copper, chromium, nickel, and manganese in sediments depend on bioavailability of these and other metals and on metal speciation. The effect of sediment metals on aquatic organisms is difficult to predict due to complex interactions with other constituents in solution, such as organic matter, other metals (iron and manganese complexes), hardness, and pH. To be bioavailable, a metal must be present in a form that can be readily taken up by algae or invertebrate organisms, typically by surface adsorption of ions onto aquatic plants and animals (Smock, 1983) or by ingestion. For adsorption to occur, metals must be available as non-bound forms (e.g., dissolved ions). Metals such as arsenic and mercury bind strongly to sediments, whereas others are weakly bound and are more readily released into the water (Branner et al., 1980). In addition to availability, metals must also have an affinity for adsorption onto biotic forms (Smock, 1983), and this capacity varies greatly (e.g., low for manganese and high for chromium).

Total concentrations of metals are likely not the most reliable measures of sediment quality, given the complex behaviour of metals in sediments, as total levels do not describe bioavailability (Tessier and Campbell, 1987). Biomonitoring of trace metals in tissues of various aquatic species has proven effective for determining the transference of metals to tissues (Power and Chapman, 1992; Hare and Tessier, 1998). Comparison of sediment levels with results of metal analysis in fish tissue will be useful in predicting potential effects of metals on aquatic life for the New Prosperity Project.

LAKES

Fish Lake and several lakes in the RSA (Little Fish, Wasp, Big Onion, and Taseko) were sampled in 1997 according to the methods described in the PRS (five replicates per lake), and also in 1995 (one or two samples per lake). Fish Lake was sampled again in 2011 according to the same methods, at four sites with five replicates per site. In 2012, sediment cores were taken from three sites in Fish Lake to provide data on sediment accumulation rates as well as particle size, metals, and total organic and inorganic carbon.

The entire data set is presented in Appendix 5-2-A from the March 2009 EIS/Application; however, only sites that may be affected by the Project (Fish Lake and Little Fish Lake) are discussed here. Little Fish Lake will be lost to the mine footprint. Data for the other lakes (Taseko, Big Onion, Wasp, North Rat Cabin, South Rat Cabin, Slim, and Vick) could provide reference data. The 1997 data set is the most complete, with the <63 µm fraction analyzed in five replicate samples per site.

Sediment data collected in 1997 and 2011 are summarized in Table 2.6.1.4A-7 and shown in Figure 2.6.1.4A-7 and Figure 2.6.1.4A-8. Total organic carbon levels were lower in Fish and Little Fish lakes (16.5 and 16.9%, respectively) than in Wasp Lake (30.1%). Antimony, chromium, copper, and nickel levels exceeded SQG in all three lakes (up to five times higher, for nickel), and iron levels exceeded SQG for Wasp Lake. Silver levels were close to the SQG. Arsenic, cadmium, lead, manganese, mercury, selenium, and zinc levels in these lakes were lower than the SQG. Metal levels in Taseko and Big Onion lakes are also shown on Figure 2.6.1.4A-9 for comparison and indicate higher levels of arsenic (Taseko and Big Onion), manganese (Taseko), and selenium (Big Onion) than are measured in the other lakes. Sediment accumulation rates were determined for Fish Lake in order to provide an indication of the long-term scavenging capacity of the sediments.

Table 2.6.1.4A-7 Metal and Organic Carbon Levels in Sediment of Fish, Little Fish and Wasp Lakes, 1997 and 2011 (mean, n = 5 replicates)

Parameter	Fish 1997	Fish 2011	Little Fish	Wasp	SQG1
Antimony, total	**0.6**	**0.46**	**0.8**	**0.7**	0.43
Arsenic, total	3.3	3.3	3.4	4.0	5.9
Cadmium, total	0.1	0.17	0.1	<0.5	0.6
Chromium, total	**52**	**42**	**50**	**38**	37.3
Copper, total	**41**	34.2	**49**	**45**	35.7
Iron, total	17,900	15,850	17,400	**28,200**	21,200
Lead, total	6	2.9	6	<20	35
Manganese, total	269	208	194	373	460
Mercury, total	0.110	**0.319**	0.106	0.018	0.170
Nickel, total	**66**	**56**	**87**	**48**	16
Selenium, total	1	1	1	1	5
Silver, total	**0.6**	0.1	0.1	**<1**	0.5
Zinc, total	71	61	76	61	123
TOC (%)	16.5	14.4	16.9	30.1	-
Lake volume (m^3)	4,438,000	4,438,000	133,000	1,611,000	

Sample precision for the five replicates per lake was calculated (CV) to assess variability. The target was 20% or less when values are within five times the detection limit. Arsenic levels consistently showed the highest variability. Samples from Fish and Little Fish Lakes showed lower variability (zero or two parameters) than those from Wasp Lake:

- Fish Lake—no parameters greater than 20% CV
- Little Fish Lake—antimony 26% and arsenic 58%, and
- Wasp Lake—antimony 26%, arsenic 69%, chromium 25%, iron 57%, manganese 29% and zinc 30%.

As noted above, Wasp Lake samples contained almost twice as much total organic carbon as those from Fish and Little Fish Lakes. High total organic carbon levels may contribute to high variability in metals levels as it includes living and non-living sources of organic matter.

Although total organic carbon levels in sediment were significantly higher in Wasp Lake than Fish Lake (*t = test*, p <0.05), there were few significant differences in metals levels (higher manganese levels in Wasp Lake, higher chromium and nickel levels in Fish Lake). The elevated chromium and nickel levels in Fish Lake are associated with the basalt deposits in that area. Both Fish Lake and Wasp Lake had antimony, chromium, copper, and nickel levels higher than PRS, EIS Guidelines, or BC SQG. Iron exceeded its SQG in Wasp Lake, as did silver in Fish Lake. Levels of cadmium, lead, mercury, selenium, and zinc were always lower than the SQG.

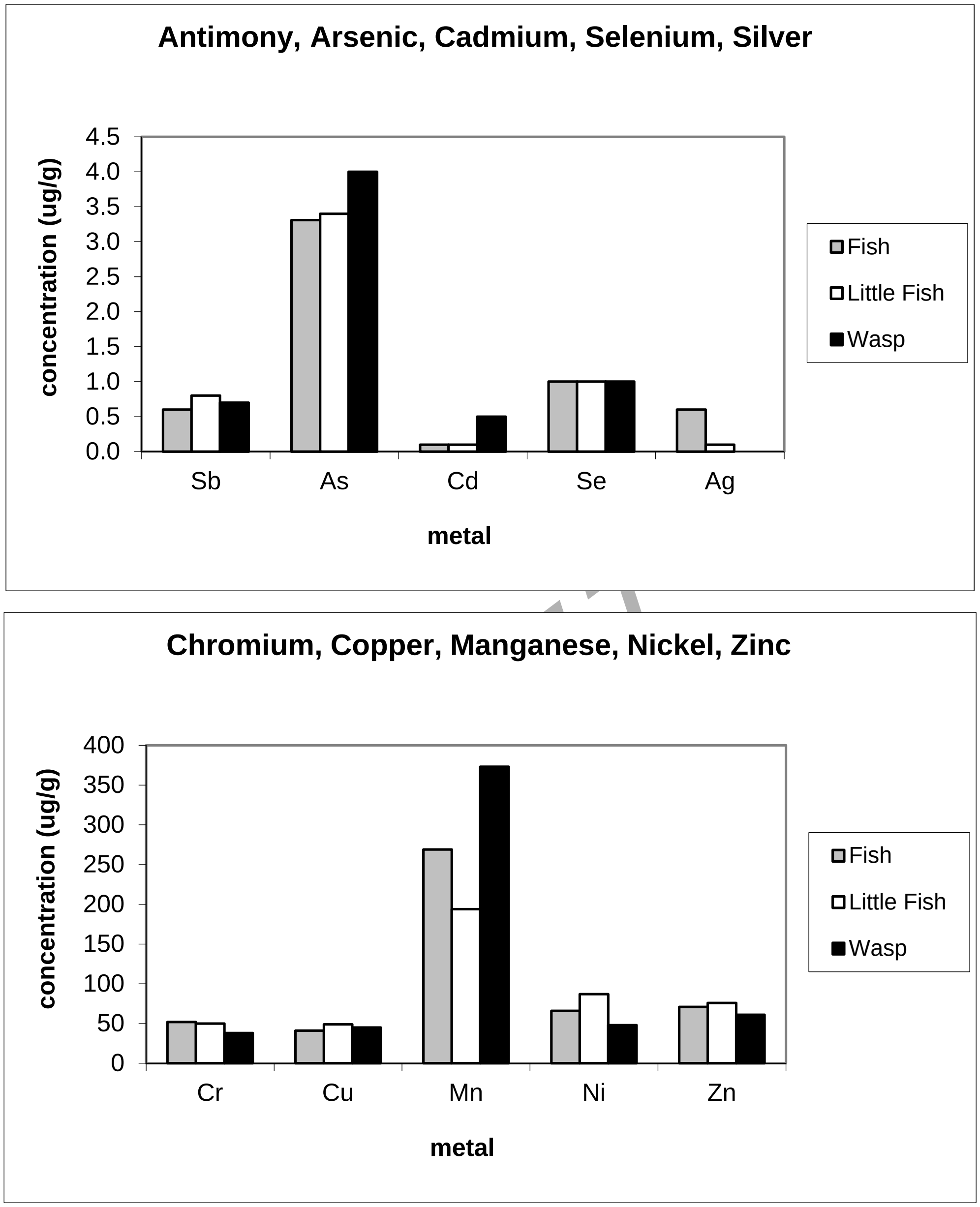


Figure 2.6.1.4A-7 Metal Levels in New Prosperity Project Lakes, 1997 (mean of five replicates)

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.6.1.4A-8 Metal Levels in New Prosperity Project Lakes, 2011 (mean of five replicates)

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.6.1.4A-9 Metal Levels in Taseko and Big Onion Lakes

Metals in Fish Creek and Fish Lake sediment

Data from Lower Fish Creek (W8 at the lower end of pit and W3 at the confluence with Taseko River) provide the baseline. Data from W8 and W3 are discussed below, using results from 1997, as these are the most complete for habitat type (pool and riffle) and fraction analyzed (<63 µm).

Samples from Fish Creek contained high proportions of gravel and sand, with a total of 1 to 10% silt and clay (Table 2.6.1.4A-8). There was 54% gravel and 42% sand in pool samples and 74% gravel and 25% sand in riffle samples, even with fine sediment targeted for collection. Total organic carbon content ranged from 0.3 to 1.3%. Metal levels were generally similar in pools and riffles of W8 and W3 (t = test, $p < 0.05$).

Table 2.6.1.4A-8 Sediment Quality in Fish Creek Sites W8 and W3, 1997 (mean ± s.d., n = 5 per habitat type)

Parameter (total metal µg/g)	W8 (downstream of pit)		# > SQG	W3 (upstream of Taseko River)		# > SQG	SQG
	pool	riffle		pool	riffle		
Antimony	0.40 ± 0.12	**0.50** ± 0.09	6/10	**1.83** ± 0.54	**3.59** ± 3.50	10/10	0.43
Arsenic	3.60 ± 0.97	5.72 ± 1.87	2/10	**40.6** ± 3.5	**50.9** ± 11.2	10/10	5.9
Cadmium	0.05 ± 0.00	0.05 ± 0.00	0/10	0.05 ± 0.00	0.05 ± 0.00	0/10	0.6
Chromium	28 ± 6	**40** ± 4	4/10	14 ± 1	13 ± 1	0/10	37.3
Copper	22 ± 5	13 ± 4	0/10	**39** ± 7	32 ± 5	4/10	35.7
Iron	**27,300** ± 1,670	**29,600** ± 5,700	10/10	**38,000** ± 1,500	**35,800** ± 4,500	10/10	21,200
Lead	2 ± 1	2 ± 1	0/10	8 ± 7	5 ± 1	0/10	35
Manganese	**1400** ± 510	**1120** ± 490	10/10	**635** ± 59	**677** ± 200	10/10	460
Mercury	0.030 ± 0.008	0.086 ± 0.082	1/10	0.129 ± 0.014	0.143 ± 0.022	0/10	0.17
Nickel	**26** ± 4	**30** ± 5	10/10	**17** ± 2	15 ± 2	6/10	16
Selenium	0.1 ± 0.0	0.2 ± 0.1	0/10	0.1 ± 0.0	0.1 ± 0.1	0/10	5
Silver	0.3 ± 0.1	0.3 ± 0.2	0/10	0.3 ± 0.1	0.2 ± 0.1	0/10	0.5
Zinc	45 ± 3	53 ± 8	0/10	75 ± 5	70 ± 7	0/10	123
% TOC	0.3 ± 0.2	1.3 ±0.7	–	0.4 ± 0.2	0.4 ± 0.2	–	–
% Gravel	74.2 ±19.6	28.4 ± 19.3	–	64.3 ± 17.1	78.0 ± 7.4	–	–
% Sand	25.1 ±18.8	59.2 ±14.4	–	34.3 ± 16.6	20.5 ± 6.3	–	–
% Silt	0.6 ± 0.6	5.2 ±3.6	–	0.7 ± 0.4	0.7 ± 0.3	–	–
% Clay	0.6 ± 0.5	5.2 ±3.3	–	1.1 ± 0.6	0.7 ± 0.2	–	–

NOTE:
> SQG = Number of times metals exceed BC SQG, or for antimony where there is no applicable BC SQG, number of times they exceed PRS criterion

Individual and mean values of cadmium, lead, selenium, silver, and zinc did not exceed BC SQG (least effects level, LEL) at W3 and W8. However, levels of other metals were higher than LEL SQG in one or more replicates, with arsenic exceeding the PEL:

- Antimony (PRS and EIS Guideline criteria) was at or near the guideline at W8, four to eight times higher at W3 (pool and riffle samples).
- Arsenic at W3 (all pool and riffle samples exceeded PEL, means were seven to nine times higher than LEL and two to three times higher than PEL).
- Chromium at W8 (mean is 1.1 times higher than LEL in riffle samples).
- Copper at W3 (mean is 1.1 times higher than LEL in pool samples).
- Iron at W8 and W3 (means are 1.3 to 1.8 times higher than LEL in pool and riffle samples).
- Manganese at W8 and W3 (means are 1.4 to 3 times higher than LEL in pool and riffle samples).
- Mercury at W8 (mean below LEL, 1 riffle sample 1.3 times higher than LEL).

- Nickel at W8 (means 1.6 to 1.9 times higher than LEL in pools and riffles) and W3 (1.1 times higher in pools).

There was a considerable range in concentrations for some metals within a site, reflecting the heterogeneity of the stream environment. The coefficient of variation was higher than the 20% target for antimony (19 to 98%), arsenic (9 to 33%), copper (15 to 31%), and manganese (9 to 44%).

The elevated chromium and nickel levels reported for W8 are likely associated with the basalt deposit in the pit area (Volume 3, Section 7.1 from the March 2009 EIS/Application).

The results of recent (2011) Fish Lake sediment chemistry is presented in Table 2.6.1.4A-9. In general, antimony, chromium, mercury, and nickel were frequently above guidelines. Mercury concentrations surpassed guidelines in three (3) out of five (5) sample replicates.

Table 2.6.1.4A-9 Summary of Sediment Chemistry Results from Fish Lake, July 2011 (n = 5 per station)

Parameter (total metal µg/g)	**U1**	**# > SQG**	**U2**	**# > SQG**	**U3**	**# > SQG**	**U4**	**# > SQG**	**SQG**
Antimony	**0.46** ± 0.02	3/5	**0.52** ± 0.02	5/5	0.36 ± 0.02	0/5	**0.5** ± 0.03	4/5	0.43
Arsenic	4.36 ± 0.31	0/5	3.24 ± 0.18	0/5	2.86 ± 0.16	0/5	2.88 ± 0.14	0/5	5.9
Cadmium	0.204 ± 0.01	0/5	0.228 ± 0.01	0/5	0.1 ± 0.01	0/5	0.134 ± 0.01	0/5	0.6
Chromium	**37.6** ± 1.60	4/5	**46.8** ± 1.72	5/5	35.2 ± 2.36	2/5	**48.4** ± 1.51	5/5	37.3
Copper	32.78 ± 1.70	1/5	**41.7** ± 1.32	5/5	28.64 ± 0.60	0/5	33.52 ± 0.99	1/5	35.7
Iron	18,400 ± 2448	1/5	14,980 ± 461	0/5	12,002 ± 1,145	0/5	18,020 ± 384	0/5	21,200
Lead	3.28 ± 0.20	0/5	3.1 ± 0.22	0/5	2.26 ± 0.19	0/5	2.78 ± 0.18	0/5	35
Manganese	278.4 ± 31.97	0/5	212.2 ± 6.77	0/5	140.8 ± 16.66	0/5	199.2 ± 4.65	0/5	460
Mercury	**0.178** ± 0.02	2/5	**0.196** ± 0.01	5/5	**0.742** ± 0.56	4/5	0.016 ± 0.01	3/5	0.17
Nickel	**54.86** ± 0.73	5/5	**59.6** ± 1.44	5/5	**49.84** ± 1.86	5/5	**58.96** ± 1.24	5/5	16
Selenium	0.9 ± 0.06	0/5	1.6 ± 0.07	0/5	0.86 ± 0.08	0/5	1.1 ± 1.12	0/5	5
Silver	0.104 ± 0.00	0/5	0.126 ± 0.01	0/5	0.094 ± 0.01	0/5	0.12	0/5	0.5
Zinc	67 ± 4.1	0/5	66 ± 2.3	0/5	46 ± 2.6	0/5	64 ± 1.3	0/5	123
% TOC	13.1 ± 0.9	–	14.8 ± 1.0	–	14.4 ± 0.9	–	12.6 ± 1.2	–	–
% Gravel	74.2 ±19.6	–	28.4 ± 19.3	–	64.3 ± 17.1	–	78.0 ± 7.4	–	–
% Sand	25.1 ±18.8	–	59.2 ±14.4	–	34.3 ± 16.6	–	20.5 ± 6.3	–	–
% Silt	0.6 ± 0.6	–	5.2 ±3.6	–	0.7 ± 0.4	–	0.7 ± 0.3	–	–

Parameter (total metal µg/g)	U1	# > SQG	U2	# > SQG	U3	# > SQG	U4	# > SQG	SQG
% Clay	0.6 ± 0.5	–	5.2 ±3.3	–	1.1 ± 0.6	–	0.7 ± 0.2	–	–
NOTE: # > SQG = Number of times metals exceed BC SQG, or for antimony where there is no applicable BC SQG, number of times they exceed PRS criterion									

B. SURFACE WATER HYDROLOGY

APPROACH AND METHODS

The creeks in the New Prosperity Project area are generally characterized by high flows in the spring, due to snowmelt, and rainfall combined with snowmelt, and low flows in the late summer/early fall and winter. All creeks are affected by ice formation during the winter and the smaller systems typically freeze over for extended periods, although minimal flows are often maintained under ice cover.

Streamflows within the Project area were monitored with manual staff gauge measurements and automated depth recordings. Flow data were collected at 17 different locations in and around the Project area. These installations were active for varying periods of time, and with varying degrees of success. Surface water hydrology baseline data collection programs were designed to meet the reporting requirements of the 2012 EIS Guidelines and the “Manual of Standard Operating Procedures for Hydrometric Surveys in British Columbia” Ministry of Environment, Lands and Parks 2009. Standards of data collection have changed since the initial data collection period (i.e. the introduction of the Resource Inventory Committee [RIC] standards). The historical site data records were reviewed and assessed and only data considered valid by today’s RIC standards were considered for this report.

SUMMARY OF PREVIOUS WORK AND GAP ANALYSIS

Regional hydrological data were obtained from the Water Survey of Canada (WSC) branches of Environment Canada, while site-specific data were collected by consultants working for Taseko. Beginning in 1992, hydrological data were collected by a number of consultants, including HKP and KP, in support of an environmental assessment and preliminary engineering studies for the proposed development of the Project. These data collection efforts continued until 2000 when the Project was temporarily halted.

Historical site-specific data and long-term regional data were used in conjunction for the assessment of hydrological baseline values for the Project. Historical site-specific data were collected from 17 manual staff gauge measurements and automated depth recordings. Regional data were predominately sourced from Big Creek as it was considered to be the most representative station due to its proximity to the site and long period of record.

Data collection at the site recommenced in May 2006 with the initiation of a more focused program that was confined to the Fish Lake watershed, as guided by the current Project development concept. The locations of all historical and current streamflow monitoring stations in the Project area are shown on Figure 2.6.1.4B-1 and Figure 2.6.1.4B-2, respectively.

The initial hydrological data collection program for the Project area evolved over a period of seven years, and grew substantially during that time. In 1992, HKP initiated the program and installed nine hydrology stations. In 1995, HKP expanded its program to include an additional hydrology station. In 1996, four additional hydrology stations were installed. In 1997, KP assumed responsibility of the hydrology program. At that time, KP conducted an extensive review and assessment of the data collected to that point. This resulted in a number of recommendations, including the involvement of Water Survey of Canada (WSC) in the installation and calibration of future hydrology gauging stations. Following this recommendation, WSC installed six additional hydrology stations and collected a series of stage-discharge measurements at all project stations.

Reports summarizing and analyzing the hydrological data collected for the Project were published in January 1998, January 1997, December 1996 and April 1999, as follows:

- Hydrometeorology Report (draft report Ref. No. 10173/11-2, Knight Piésold Ltd. 1998) (Appendix 4-4-F in the March 2009 EIS/Application)
- Hydrometeorology Report (Ref. No. 1731/12, Knight Piésold Ltd. 1997) (Appendix 4-4-G in the March 2009 EIS/Application)
- Hydrological Data from the Prosperity Project Area–April 1992 to March 1996 (Hallam Knight Piésold Ltd. 1996) (Appendix 4-4-H in the March 2009 EIS/Application)
- Meteorological Data from the Prosperity Project Area–April 1992 to March 1996 (Hallam Knight Piésold Ltd. 1997) (Appendix 4-4-I in the March 2009 EIS/Application), and
- Hydrometeorology Report (draft report Ref. No. 11173/13-8, Knight Piésold Ltd. 1999) (Appendix 4-4-J in the March 2009 EIS/Application).

Additional data were collected following the publication of the draft hydrometeorology report in January 1999, and the new information was incorporated into the analyses that were presented in the final hydrometeorology report published in December 2007:

- Hydrometeorology Report (draft report Ref. No. 101-266/1-2 Rev B, Knight Piésold Ltd. 2007) (Appendix 4-4-D in the March 2009 EIS/Application).

The final report confirmed long-term estimates presented in the April 1999 report. However, as a result of the addition of new data, certain estimates, such as long-term average annual precipitation and mean annual unit runoff values, differed slightly from previous estimates. These differences were not considered substantial, with the most notable change being a slight modification to the predicted stream flow distribution for the streams within the Fish Creek basin.

REGIONAL STREAMFLOW STATIONS

The RSA encompasses the Taseko River and Big Creek watersheds, which are located adjacent to the mine site area. Streamflow values have been recorded at a number of locations throughout these watersheds by the Water Survey of Canada (WSC), as indicated on Figure 2.6.1.4B-1. The regional stations considered most representative of the mine site area include Big Creek above Groundhog Creek, Big Creek below Graveyard Creek, Groundhog Creek above Big Creek, Lingfield Creek, and the Taseko River. These stations were selected on the basis of their basin size, elevation, surface cover, flow regulation and proximity to the site. These watersheds provided the basis for long-term flow estimates for LSA stations.

Big Creek above the Groundhog Creek drainage basin has an area of 1020 km^2 and ranges in elevation from 1370 to 2900 m, with an average elevation of 1850 m. Its topography varies from low lying bog areas to snow covered mountain peaks. Groundhog Creek above Big Creek drains a smaller and lower basin with an area of 246 km^2, an average elevation of 1550 m and an elevation range of 1370 to 2130 m.

Big Creek below Graveyard Creek has a similarly sized drainage area, at 232 km^2, but a higher average elevation at 2000 m, with a range of 1675 to 2750 m. The topography of this basin varies from mountain peaks in the upper reaches to foothills and rolling hills in the lower areas.

Lingfield Creek drains a basin with an area of 98.4 km^2, an average elevation of 1600 m and an elevation range of 1350 to 2100 m, making it similar to the basins in the mine site area, and Fish Creek in particular. However, it receives much more precipitation than the mine site area, which reduces its suitability for regional comparison.

Finally, the Taseko River drains a basin with an area of 1520 km^2, an average elevation of 1900 m and an elevation range of 1350 to 2750 m. The river drains directly from Taseko Lake, which has a great influence on the hydrograph. In addition, glaciers cover a sizeable portion of the watershed and contribute substantially to summer flows. Consequently, the recorded streamflows from the Taseko River cannot be considered to be regionally representative and are used only for generating estimates for the Taseko River.

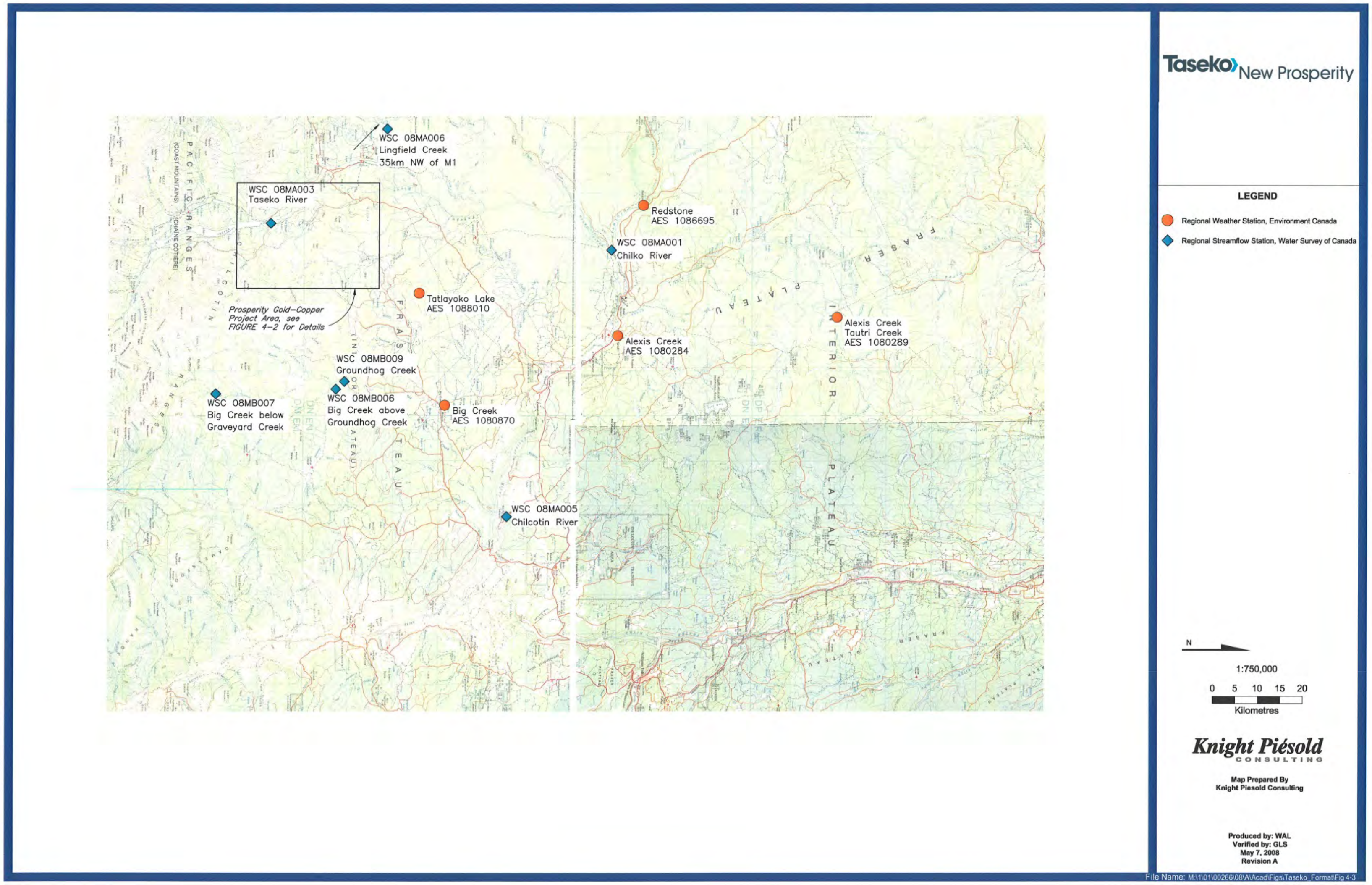


Figure 2.6.1.4B-1 Regional Streamflow and Weather Stations

PROJECT SITE STREAMFLOW STATIONS

In 2006, the majority of additional streamflow data were collected within the Fish Creek watershed. A regional approach to data collection had already been completed in the 1990s and therefore was not required for this investigation. In early May 2006, three stream data loggers were installed in the Fish Creek watershed, and one stream data logger was installed in the Big Onion watershed, as shown on Figure 2.6.1.4B-3. In October 2006, one additional stream data logger was installed in the Fish Creek watershed. All data loggers were removed in December 2006, re-installed in March and April 2007 and removed again in November 2007. In addition to the new stream data loggers, a new climate station was installed in September 2006 at site M5, also shown on Figure 2.6.1.4B-3. The installation and maintenance of this new climate station has been recorded in Appendix 4-4-E in the March 2009 EIS/Application.

Stream level data were recorded at all sites at fifteen minute intervals and to an accuracy of ± 2 mm. Records collected in 2006 and 2007 indicate that the relationship between stream level and discharge is consistent with previous data collection. However, it is expected that total flows and peak discharges may show an increase from previous baseline data as a result of a reduction in evapotranspiration and increased runoff due to the Mountain Pine Beetle epidemic.

Previous studies and generation of a long-term record through correlations with regional stations involved a study of not only Fish Creek, but also various other basins in the region, including Big Creek, Beece Creek and Vick Creek. However, because the current Project mine footprint mainly encompasses the Fish Creek watershed, previous references made to the regional watersheds are not directly applicable.

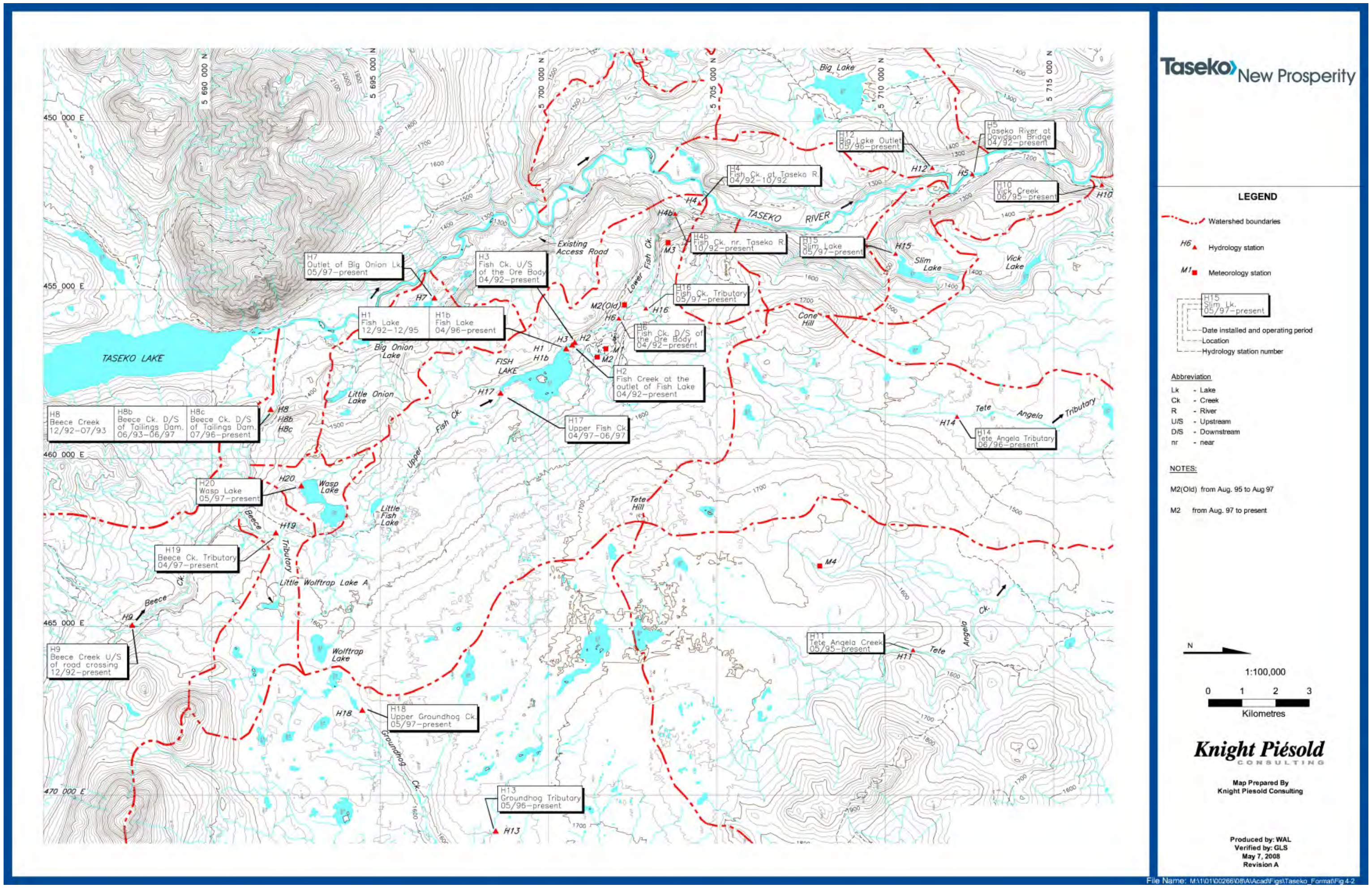


Figure 2.6.1.4B-2 Historic Project Area Streamflow and Meteorology Stations

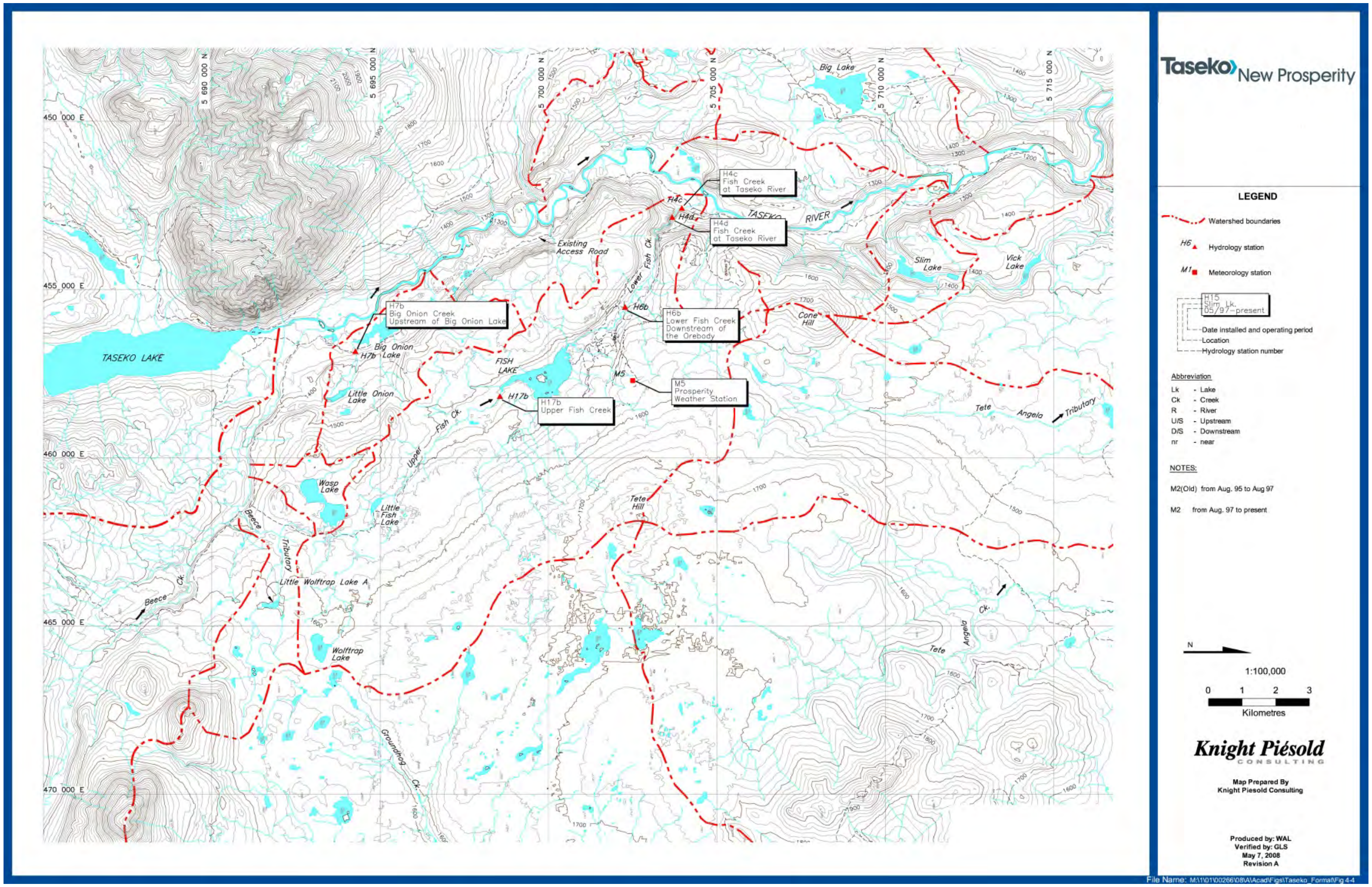


Figure 2.6.1.4B-1 Current Project Area Streamflow and New Meteorology Stations

OVERVIEW OF BASELINE CONDITIONS

There are many factors that influence runoff, and consequently, considerable uncertainty is associated with deriving runoff estimates. One basic set of hydrologic parameters, representing basin average conditions, is provided for the Fish Creek catchment. These parameters are used to estimate flows for basin average conditions, which are then modified as necessary according to localized conditions. A general flow estimating approach was developed, applicable to the greater Project area, through a comprehensive baseline (pre-mine) watershed model developed by KPL, and described further in Appendix 2.6.1.4B. The use of this estimating process provided flow estimates for relevant project drainages: Fish Creek, Big Onion Lake, and Wasp Lake.

The key findings of this study are summarized as follows:

- Spring melt of the winter snowpack typically occurs at a rate of approximately 40% in April, 50% in May and 10% in June.
- Runoff in the Project mine site area results from rainfall, snowmelt, or combined rainfall/snowmelt. This produces an annual hydrograph with two high flow seasons. The first peak generally occurs in April/May as a result of snowmelt, while the second peak occurs in August/September as a result of rainfall.
- The mean annual streamflow for the Project area site is highly variable as a result of the range in watershed characteristics within the Project area.
    - o Mean annual unit runoff in the Fish Creek basin ranges from 129 mm to 119 mm, at H17b in Upper Fish Creek and H4d in Lower Fish Creek, respectively.
    - o The catchment area contributing to Fish Lake (excluding Upper Fish Creek, H17b) was estimated to have a mean annual unit runoff of 125 mm.
    - o Mean annual unit runoff to Wasp Lake and Big Onion Lake, is 122 mm and 106 mm, respectively.
- Hydrologic patterns in the project area are highly variable and some unusual flow patterns have been noted in the available measured streamflow records for the Project site. However, after careful examination of measured streamflow records, it was concluded that some patterns are likely due to data measurement error. More details of this analysis are included in the KPL letter VA09-01164 (KPL 2009).

Measured Project Streamflow Records

The unit area runoff values at the three stations (H17b, H6b and H4c) were based on flow rate and stage measurements collected in 2007, which was the only year considered to have a complete record. No winter flows were observed at stations H17b and H6d and the unit runoff is estimated as zero during that period. Station H4c is on an alluvial fan and it is possible that some inter-gravel flow exists during the winter months. However, this flow is assumed unverifiable and inconsequential, and was not taken into account in unit area runoff calculations. The annual hydrograph for the data measured in 2007 for each of the stations is presented on Figure 2.6.1.4B-4. Please note that in Table 2.6.1.4B-1 the 2006-2007 values are for Station H4d, while the 2007 values are for Station H4c. These two stations are essentially in the same location. The monthly runoff values shown in Table 2.6.1.4B-1 were used as the basis for calibrating the baseline watershed model, as described below.

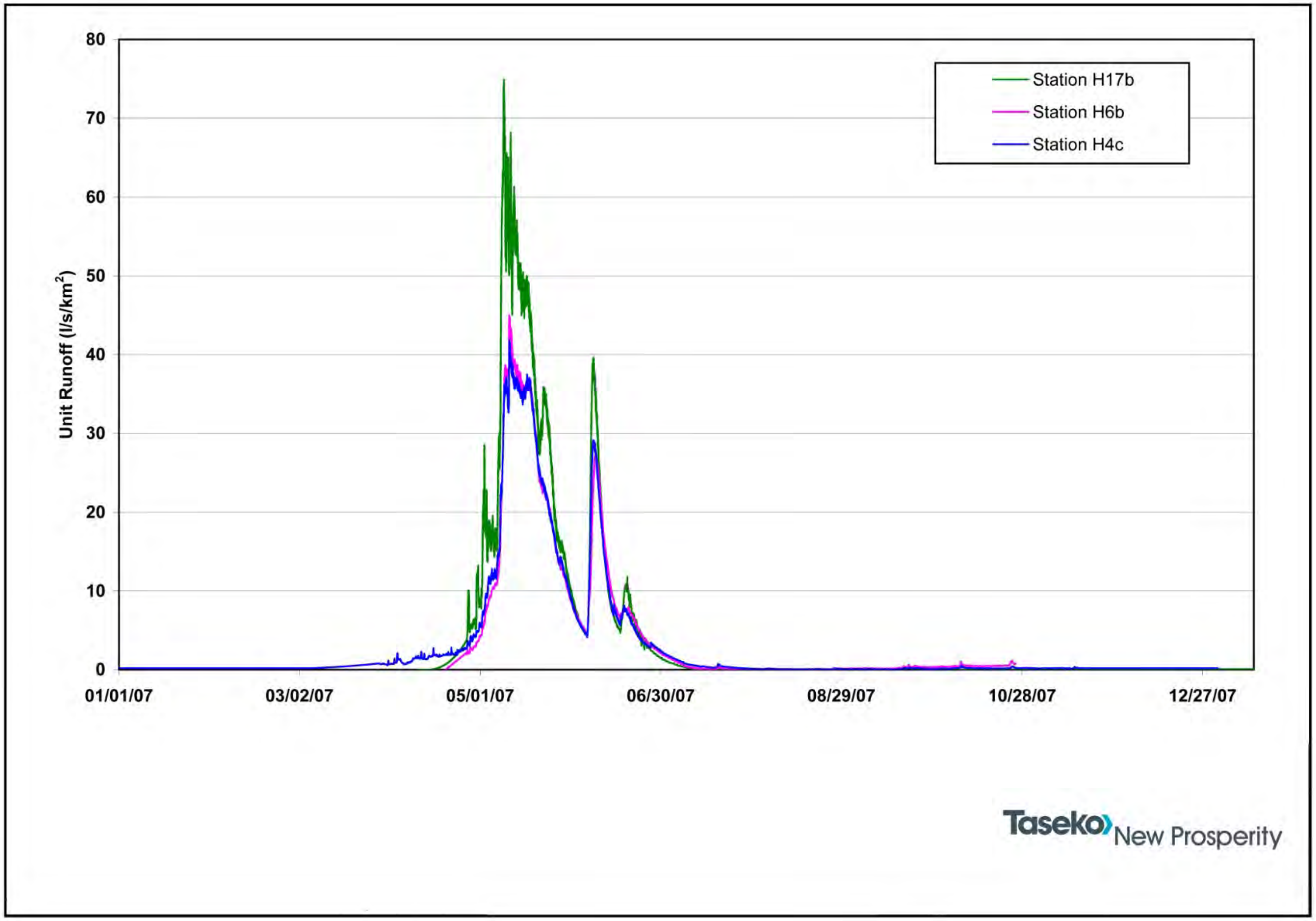


Figure 2.6.1.4B-4 2007 Unit Runoff Hydrograph H17B, H6B and H4C

Table 2.6.1.4B-1 Unit Runoff Streamflow Stations H17b, H6b and H4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station H17b - Unit Runoff (mm)													
2006					14.3	6.9	0.1	0.0	0.0	0.0	1.4	0.0	22.7
2007	0.0	0.0	0.0	2.6	82.1	23.7	0.7	0.0	0.0	0.1	0.3	0.0	109.5
AVERAGE	**0.0**	**0.0**	**0.0**	**2.6**	**48.2**	**15.3**	**0.4**	**0.0**	**0.0**	**0.0**	**0.9**	**0.0**	**67.4**
2007 revised	**0.0**	**0.0**	**0.0**	**3.7**	**82.8**	**24.3**	**0.6**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**111.4**
Station H6b - Unit Runoff (mm)													
2006					8.2	4.6	0.1	0.0	0.0	0.0	0.1	0.0	13.0
2007	0.0	0.0	0.0	0.7	54.6	15.6	0.1	0.0	0.0	0.0	0.0	0.0	71.0
AVERAGE	**0.0**	**0.0**	**0.0**	**0.7**	**31.4**	**10.1**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**42.3**
2007 revised	**0.0**	**0.0**	**0.0**	**1.8**	**59.9**	**22.5**	**1.0**	**0.2**	**0.6**	**1.1**	**0.0**	**0.0**	**87.1**
Station H4 - Unit Runoff (mm)													
2006										0.0	0.2	0.0	0.2
2007	0.0	0.0	0.2	5.1	64.8	24.1	0.9	0.0	0.1	0.1	0.3	0.0	95.6
AVERAGE	**0.0**	**0.0**	**0.2**	**5.1**	**64.8**	**24.1**	**0.9**	**0.0**	**0.1**	**0.1**	**0.2**	**0.0**	**95.5**
2007 revised	**0.0**	**0.0**	**0.2**	**5.2**	**60**	**21.8**	**1.6**	**0.2**	**0.3**	**0.0**	**0.0**	**0.0**	**89.3**

Estimated Long-term Streamflow

A baseline watershed model was developed for the Project area basins in order to assess the baseline surface and groundwater flow patterns in the area. Part of the model calibration process was to translate inputs of regional long-term precipitation into corresponding flow values recorded in the project area. Precipitation and temperature values measured at the regional climate station Williams Lake A were used to develop long-term (1979 through 2009) precipitation and temperature data sets for the project based on correlations with climate data collected from project site stations. Hydrologic inputs were adjusted to calibrate calculated stream flows to measured stream flows at the stream gauges. The calibrations were computed on the basis of monthly stream flow patterns and cumulative stream flow volumes for 2007. Once the model calibration was completed, estimates of long-term monthly historical flow were generated for each sub-catchment based on the calibrated hydrologic inputs and long-term precipitation and temperature data. The watershed model also calculated long term natural flow out of Fish Lake. The resulting long-term monthly flow values estimated for the Fish Creek, Wasp Lake and Big Onion Lake basins are summarized in Table 2.6.1.4B-2.

Table 2.6.1.4B-2 Average Estimated Monthly Flows

Average Monthly Flows (L/s)							
	Area 1	Area 2	Fish	Area 3	Area 4	Area 5	Area 6
	H4d	H6b	Lake	FL Catchment	H17b	Wasp	Big Onion
Pre-Mine Surface Water							
January	15	12	8	0	4	0.4	1.4
February	12	10	6	0	3	0.3	1.2
March	29	25	21	5	12	1.2	5.3
April	591	524	452	162	290	25.8	109.8
May	1,802	1,499	1,387	511	806	56.6	159.2
June	737	507	425	173	273	19.8	71.0
July	352	253	207	84	144	11.3	42.7
August	219	171	142	57	101	8.0	29.9
September	245	199	164	63	110	8.8	33.3
October	371	307	267	97	169	13.6	47.2
November	108	67	52	15	31	2.5	10.0
December	23	19	14	2	8	0.7	2.6
Annual	**375**	**299**	**262**	**97**	**163**	**12.4**	**42.8**
Minimum	**7**	**5**	**1**	**0**	**2**	**0.2**	**0.9**
Maximum	**2,002**	**1,703**	**1,565**	**564**	**294**	**70.8**	**226.8**
Groundwater							
January	3.0	0.1	0.0	3.1	0.8	0.01	0.2
February	3.0	0.1	0.0	2.6	0.8	0.01	0.2
March	2.9	0.1	0.0	2.4	0.8	0.01	0.2
April	3.0	0.1	0.0	3.2	0.8	0.01	0.2
May	3.0	0.1	0.0	4.5	0.8	0.01	0.2
June	3.0	0.1	0.0	5.3	0.8	0.01	0.2
July	3.0	0.1	0.0	5.2	0.8	0.01	0.2
August	3.0	0.1	0.0	4.8	0.8	0.01	0.2
September	3.0	0.1	0.0	4.5	0.8	0.01	0.2
October	3.0	0.1	0.0	4.5	0.8	0.01	0.2
November	3.0	0.1	0.0	4.4	0.8	0.01	0.2
December	3.0	0.1	0.0	3.8	0.8	0.01	0.2
Average	**3.0**	**0.12**	**0.0**	**4.0**	**0.8**	**0.01**	**0.2**
Minimum	**2.9**	**0.1**	**0.0**	**2.1**	**0.8**	**0.01**	**0.2**
Maximum	**3.0**	**0.1**	**0.0**	**5.6**	**0.8**	**0.01**	**0.2**
Area (km^2)	99.31	77.40	65.80	24.67	39.84	3.21	12.69
$L/s/km^2$	3.78	3.87	3.98	3.95	4.08	3.87	3.37
inc GW	3.81	3.87	3.98	4.11	4.10	3.87	3.38
mm	119.2	122.0	125.6	124.6	128.7	122.0	106.3

Inputs for Water Balance Modelling

This section defines additional hydrometeorological parameters required for engineering design and water balance modelling. These parameters help to quantify the climatic variability, as well as the monthly flow distribution appropriate for the Project area.

Precipitation and Streamflow Variability

The year-to-year variability of streamflow and precipitation conditions in the Project area are quantified by the coefficient of variation (Cv) values derived from regional data. The Cv values are required as input for stochastic water balance modelling. The Cv values for precipitation at the New Prosperity Project were estimated based on the long-term regional precipitation records at Tatlayoko Lake and Big Creek. In an effort to simulate the likely very high variability of streamflow in Fish Creek, but in a realistic manner, the Cv values from the WSC station at Groundhog Creek were used, as indicated in Table 2.6.1.4B-3. The Groundhog Creek Cv values are reasonably consistent with the Fish Creek values and serve as a reasonable mid-point between the lower general regional patterns and the higher Fish Creek values. A summary of the monthly Cv values used for water balance modeling for both streamflow and precipitation are summarized in Table 2.7.2.4A-4, in Section 2.7.2.4A.

Table 2.6.1.4B-3 Regional Streamflow Stations Coefficient of Variation

Regional Station	Drainage Area (km^2)	Years of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Big Creek above Groundhog Creek (08MB006)	1020	1975-2007	0.43	0.35	0.43	0.77	0.36	0.44	0.50	0.52	0.34	0.42	0.39	0.42
Big Creek below Graveyard Creek (08MB007)	232	1975-2007	0.34	0.31	0.29	0.65	0.39	0.37	0.35	0.39	0.31	0.51	0.51	0.34
Lingfield Creek (08MA006)	98.4	1975-2006	0.80	0.78	0.74	1.03	0.34	0.50	0.74	1.19	0.61	1.13	0.92	0.60
Groundhog Creek	-	-	-	-	-	0.61	0.68	1.08	0.80	0.70	0.46	0.24	0.23	
Model Values	-	-	-	-	**0.74**	**0.61**	**0.68**	**1.08**	**0.80**	-	-	-	-	-

Monthly Streamflow Distribution

In addition to resulting in a revision to the Cv values, the review of the regional and site flow data resulted in a change to how runoff is distributed on a monthly basis in the water balance model. Rather than only distributing the flow over the three months of April, May and June, as was done previously, it is now considered more realistic to distribute the annual flow over the five month period from March to July. The Fish Creek A2 distribution (Table 4-9 of Appendix 4-4-E in the March 2009 EIS/Application EIS), was used for the water balance model. This table presents flows for every month of the year, but as winter flows are believed not to occur in the upper watershed that feeds the TSF, the % flows from the winter months was divided amongst the three primary flow months of April, May and June, resulting in a distribution of:

Mar	April	May	June	July
3%	30%	42%	21%	4%

C. GROUNDWATER QUALITY

The groundwater quality data collection program involved the installation of groundwater wells and near-continuous quarterly sampling between 1992 and 1998. The program was initiated by HKP and remained under its management until 1996, at which time Triton Environmental Consultants Ltd. (Triton) became the primary environmental consultant on the Project, until 1998 when baseline studies were temporarily suspended. In 2006, KP was retained to conduct a gap analysis and undertake a supplemental groundwater sampling program to finalize the groundwater quality baseline study.

Over the course of the program, several reports have been compiled regarding the Project groundwater quality and the various tasks associated with this work. The following is a list of all of the previous documents that relate to this program, and that were used to compile the necessary information for this assessment:

- Sampling and Handling Guidelines of Groundwater Quality (Report No. 1732/1, Hallam Knight Piésold Ltd., 1992).
- Groundwater Quality Data from the Prosperity Project Area 1997 Data Report (Hallam Knight Piésold Ltd., 1997).
- 1998 Groundwater Well Evaluation Report (Ref. No. 10173/11-4, Knight Piésold Ltd., 1998).
- Hydrogeology Report—Draft (Ref. No. 11173/13-3, Knight Piésold Ltd., 2000).

The gap analysis included a review of the data for the groundwater samples collected between 1992 and 1998, documenting the locations of the wells, the sampling frequency and the QA/QC procedures that were implemented during that time. It was determined that sufficient data had been collected to meet the 1998 PRS over the course of the baseline groundwater data collection program, with at least one full year of samples representing the water quality for each groundwater well. As a follow up measure, a sub-set of the groundwater wells were sampled in August 2006 to confirm the data from previous sampling events.

Two wells from the Tête Angela basin (96–183 and 96–186) that were listed in the 1998 PRS had insufficient data and were not included in the final compilation of the baseline groundwater chemistry. It should be noted that the Tête Angela basin is not part of the area that may be affected by the New

Prosperity Project. Therefore, the lack of complete data in this basin is not relevant to this environmental impact assessment.

Groundwater is a component of the hydrologic cycle and it is protected under the BC *Water Act*. Alterations to groundwater quality could potentially impact surface waters and, as such, the groundwater quality data were assessed using the following provincial and federal guidelines and criteria for the protection of aquatic life:

“British Columbia Approved Water Quality Guidelines (Criteria)”, 2006 Edition, Fresh Water Aquatic Life and “A Compendium of Working Water Quality Guidelines for British Columbia (August 2006). For the purposes of the following discussion both the approved and working guidelines will be referred to as the British Columbia Water Quality Guidelines (BCWQG).

Canadian Water Quality Guidelines for the Protection of Aquatic Life, created by the Canadian Council of Ministers of the Environment (CCME), Canadian Environmental Quality Guidelines (CEQG). The freshwater parameter specific values were obtained from the “Canadian Water Quality Guidelines for the Protection of Aquatic Life–Summary Table”, updated in October 2005 (CCME, 2005).

Resources Inventory Committee (RIC)–Guidelines for Interpreting Water Quality Data. Prepared by the Ministry of Environment, Land and Parks, LandData BC, Geographic Data BC for the Land Use Task Force Resources Inventory Committee. Version 1.0 1998.

British Columbia Contaminated Sites Regulation (BC CSR), B.C. Reg. 375/96, (includes amendments up to BC Reg. 239/2007, July 1, 2007). Schedule 6–Generic Numerical Water Standards for protection of freshwater Aquatic Life.

Relevant guidelines and standards are summarized in Table 2.6.1.4C-1 and presented together with the summary statistics for the analytical groundwater chemistry results in Appendix 4-4-A of the March 2009 EIS/Application (Groundwater Quality Baseline Report).

Table 2.6.1.4C-1 Groundwater Quality Baseline Report–Guidelines for Comparison with Groundwater Quality Data

	BCWQG Limits	CCME Limits
Physical Parameters		
Conductivity (umhos/cm)	–	–
Total Dissolved Solids	500 (DW)	–
Hardness (mg/L $CaCO_3$)	200 (DW)	–
pH (pH units)	6.5–9	6.5–9
Total Suspended Solids	–	–
Turbidity (NTU)	1 (DW)	–
Dissolved Anions		
Alkalinity (mg/L $CaCO_3$)	–	–
Chloride	600	–
Fluoride	0.2/0.3	–
Sulphate	100	–
Nutrients		
Ammonia Nitrogen	0.6–28.3	0.05–184.8
Nitrate Nitrogen	200	13
Nitrite Nitrogen	0.06	0.06
Dissolved ortho-Phosphate	–	–
Total Dissolved Phosphate	–	–
Total Phosphate	–	–
Organic Compounds		
Dissolved Organic Carbon	–	–
Phenols	–	0.0040
Total Inorganic Carbon	–	–
Total Organic Carbon	–	–
Total Cyanide	–	0.005
WAD Cyanide	10	–
Total Metals and Dissolved Metals		
Aluminum	–	0.005–0.100
Antimony	0.006 (DW)	-
Arsenic	0.005	0.005
Barium	–	–
Beryllium	–	–
Bismuth	–	–
Boron	1.2	–
Cadmium	0.005 (DW)	$10^{(0.86(\log(\text{hardness}))-3.2)}/1000$
Calcium	–	–
Chromium	0.05 (DW)	–

Cobalt	0.11	
Copper	$^{(0.094(hardness)+2)}/1000$	0.002–0.004
Iron	0.3	0.3
Lead	$e^{(1.273 \ln(hardness) - 1.460)}$	0.001–0.007
Lithium	–	–
Magnesium	–	–
Manganese	0.01102(hardness) + 0.54	–
Mercury	0.0001	0.000026
Molybdenum	2	0.073
Nickel	–	0.025–0.150
Potassium	–	–
Selenium	0.0020	0.0010
Silicon	–	–
Silver	0.0001/0.0030	0.0001
Sodium	–	–
Strontium	–	–
Thallium	0.0003	0.0008
Tin	–	–
Titanium	–	–
Uranium	0.02 (DW)	
Vanadium	–	–
Zinc	$^{[33 + 0.75(hardness - 90)]}/1000$	0.03

NOTES:
Units are mg/L, unless otherwise stated.
BCWQG—British Columbia Water Quality Guidelines (2006 Edition), unless specified, the guidelines referred to are the Aquatic Life Limits, DW–refers to drinking water limits
CCME—Canadian Council of Ministers of the Environment (CCME), Canadian Environmental Guideline–Freshwater Guidelines for the Protection of Aquatic Life, Updated October 2005.
Fluoride BCWQG Limit–0.2 mg/L for hardness <50 mg/L $CaCO_3$, 0.3 mg/L for hardness >50 mg/L $CaCO_3$.
Ammonia Nitrogen BCWQG and CCME guideline–subject to in situ temperature and pH. More data needed to process this parameter.
Aluminum CCME Limit–0.005 mg/L for pH <6.5, 0.100 mg/L for pH > or = 6.5.
Aluminum BCWQG Limit (for dissolved aluminum only)- [diss Al] = e(1.209 - 2.426K + 0.286KK) mg/L for pH <6.5, 0.100 mg/L for pH > or = 6.5.
Copper CCME Limit–0.002 mg/L $CaCO_3$ 0-120 mg/L, 0.003 mg/L $CaCO_3$ 120-180 mg/L, 0.004 mg/L $CaCO_3$ >180 mg/L.
Lead CCME Limit–0.001 mg/L $CaCO_3$ 0-60 mg/L, 0.002 mg/L $CaCO_3$ 60-120 mg/L, 0.004 mg/L CaCO3 120-180 mg/L, 0.007 mg/L $CaCO_3$ >180 mg/L.
Nickel CCME Limit–0.025 mg/L $CaCO_3$ 0-60 mg/L, 0.065 mg/L $CaCO_3$ 60-120 mg/L, 0.110 mg/L $CaCO_3$ 120-180 mg/L, 0.150 mg/L $CaCO_3$ >180 mg/L.
Silver BCWQG Limit–0.0001 for hardness < or = 100 mg/L $CaCO_3$, 0.0030 for hardness > 100 mg/L $CaCO_3$.

APPROACH AND METHODS

The baseline groundwater quality assessment was conducted by compiling and reviewing the available groundwater quality data obtained between 1992 and 2006. The assessment focused on the monitoring wells specified in the 1998 PRS (Figure 8); these wells are shown on Figure 2.6.1.4C-1. In accordance with the 1998 PRS specific attention was given to the minimum time interval over which the samples were collected from each individual well, the required analysis parameters and the minimum analytical detection limits, and the quality assurance of the samples collected.

The in situ and analytical groundwater quality data were assessed using the current provincial and federal water quality guidelines. Summary information and statistics were tabulated for the data from each of the monitoring wells and consisted of the following: number of samples, minimum, maximum, mean, median, standard deviation, coefficient of variation, number of samples below the method detection limit (MDL), number of samples that exceeded the BCWQG limits (including the approved, working, and drinking water guidelines as specified in the 1998 PRS and the 2009 EIS), and number of samples that exceeded the CCME freshwater aquatic life guideline limits.

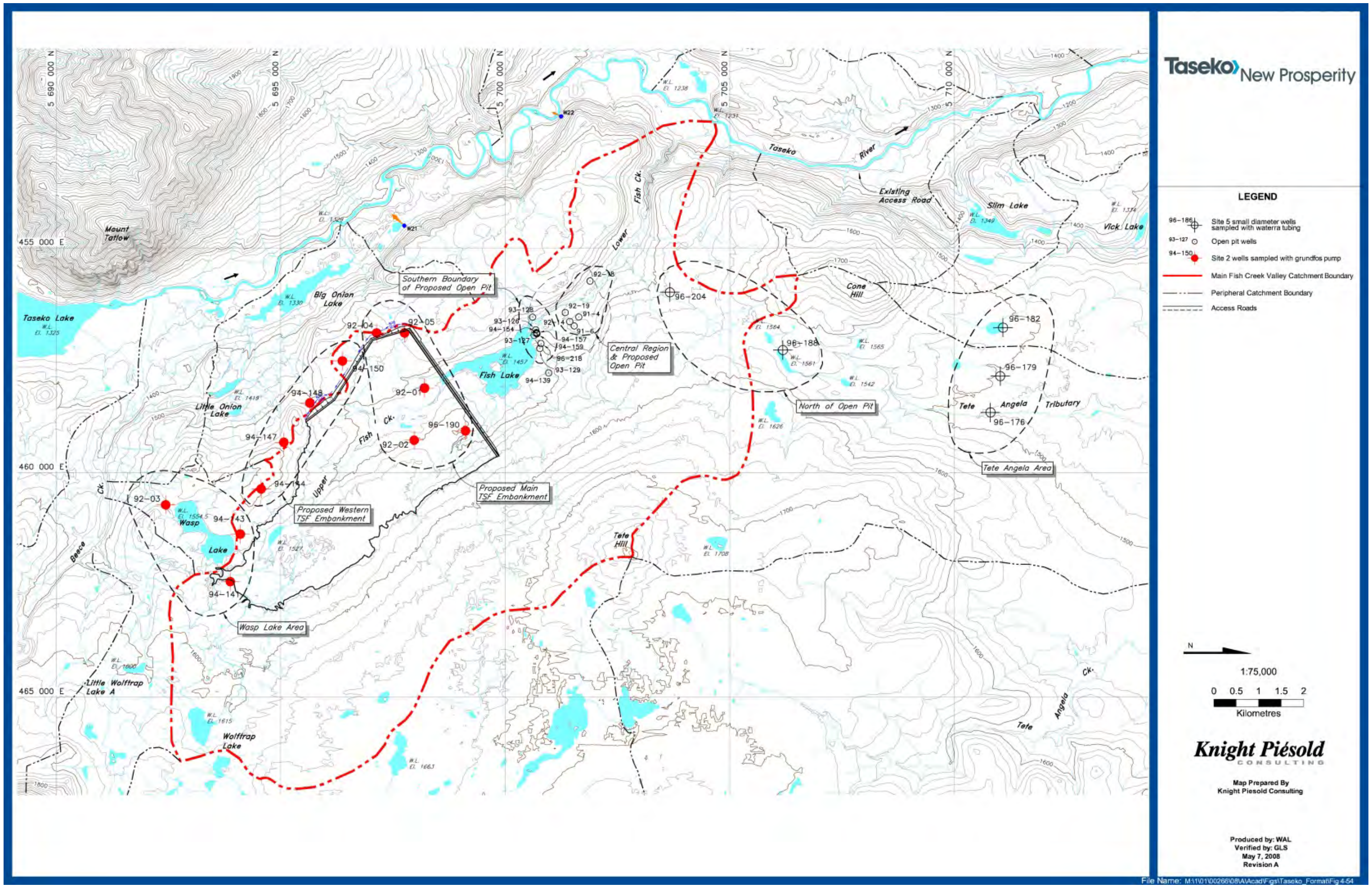


Figure 2.6.1.4C-1 Regional Hydrogeology Investigation Plan

For ease of assessment, the monitoring wells were grouped together based on their spatial/geographical distribution throughout the Project study area. These areas were generally defined by the future proposed land use and are summarized as follows:

- Proposed open pit area
- North of the proposed open pit
- Main embankment of the proposed TSF
- West boundary of the proposed TSF
- Wasp Lake area, and
- Tête Angela basin.

For further details of the baseline assessment process and the findings of the assessment refer to the Draft Groundwater Quality Baseline Report (Appendix 4-4-A of the March 2009 EIS/Application).

<u>Local Study Area</u>

Three general groundwater types were identified within the Fish Creek catchment, as determined in the baseline groundwater hydrology assessment (Appendix 4-4-B of the March 2009 EIS/Application), and they are as follows:

- Type I: Bicarbonate–calcium–magnesium type groundwater, indicative of fresh, shallow groundwater. This groundwater type is predominant in the upland recharge areas (ridgeline to the west and elevated areas to the east in the Fish Creek catchment).
- Type II: Calcium–magnesium–bicarbonate type groundwater with lesser but important concentrations of sodium, potassium, sulphate and chloride. This groundwater type is generally associated with wells in the proposed open pit area.
- Type III: Sodium–potassium–bicarbonate type groundwater. This groundwater type is generally associated with wells within the upland and valley floor areas of the Fish Creek catchment.

In situ groundwater values were recorded for temperature, conductivity, and pH during the 1997, 1998 and 2006 monitoring programs. During these time periods, groundwater temperatures within the LSA (Fish Creek, Wasp Lake and Tête Angela catchments) ranged from 2.2 to 11.2ºC, with a mean temperature of 6.1ºC. pH ranged from 6.54 to 11.37, with a median pH of 8.47, and in situ conductivity ranged from 140 to 891 µS/cm, with a median value of 441 µS/cm. The in situ parameters are summarized in Table 2.6.1.4C-2.

Table 2.6.1.4C-2 Groundwater Quality Baseline Report–Summary of In Situ Values

Well ID	Sample Date	Depth To Water (m)	Depth To Bottom of Well (m)	Conductivity (µS/cm)	pH pH unit	Temperature (°C)
91-04	27-Apr-97	13.69	25.48	719	7.59	6.0
	03-Aug-97	13.67	25.69	648	7.47	9.5
	30-Oct-97	13.57	25.06	625		5.0
	25-Jun-07	12.98	25.12			
91-06	26-Apr-97	22.11	38.70	574	7.13	6.0

	04-Aug-97	22.65	38.60	578	7.48	7.9
	06-Nov-97	22.90	38.40	546	7.80	5.5
	25-Jun-07	23.37	37.80			
KP92-01	02-May-97	9.64	59.40	460	9.13	6.5
	06-Aug-97	1.69	59.91	475	9.11	7.0
	31-Oct-97	1.79	59.90	410	11.37	7.1
	03-Nov-97	1.79	59.90	403	7.98	6.7
KP92-02	02-May-97	3.80	28.90	324	8.65	5.1
	01-Aug-97	5.32	28.09	308	8.13	5.8
	03-Nov-97	9.01	28.88	318	7.62	5.0
	26-Jun-07	5.08	28.50			
KP92-03	03-May-97	3.84	-	448	7.84	4.2
	06-Aug-97	3.86	-	650	7.66	4.7
	03-Nov-97	4.08	28.88	578	6.98	4.5
	26-Jun-07	3.93	28.66			
KP92-04	01-May-97	28.36	32.48	487	9.56	6.2
	01-Aug-97	28.42	32.52	284	9.92	6.5
	02-Nov-97	28.49	32.26	315		6.9
	26-Jun-07	28.88	32.11			
KP92-05	02-May-97	3.88	10.30	537	8.50	4.5
	01-Aug-97	4.09	10.31	312	7.68	5.6
	02-Nov-97	4.34	10.11	310	6.54	5.5
	17-Aug-06	4.63	10.10			
	26-Jun-07	4.04	9.65			
92-14	27-Apr-97	8.38	65.17	680	7.50	7.0
	04-Aug-97	8.52	65.87	807	7.22	6.6
	29-Oct-97	8.51	65.87	662	7.36	6.1
	25-Jun-07	8.66	65.53			
92-18	26-Apr-97	9.55	47.17	439	7.66	
	04-Aug-97	9.40	47.46	613	8.79	5.6
	30-Oct-97	9.53	46.66			5.5
	06-Nov-97	9.60	46.90	570	7.80	4.5
	25-Jun-07	8.08	-			
92-19	28-Apr-97	8.46	78.35	847	7.35	7.0
93-126	26-Apr-97	5.58	32.59	623	8.43	7.0
	02-Aug-97	3.40	32.65	518	8.04	6.9
	27-Oct-97	3.59	31.97	501	9.68	6.0
	25-Jun-07	3.78	32.00			
93-127	02-Aug-97	0.00	61.61	614	8.99	6.5
93-128	03-May-97	14.66	64.31		8.94	7.2

	04-Aug-97	15.05	64.31	459	8.33	7.7
	08-Nov-97	14.82	64.31	420	8.90	7.4
	25-Jun-07	13.84	15.06 (damaged)			
93-129	27-Apr-97	8.41	32.73	292		5.0
	04-Aug-97	8.29	32.77	325	9.94	5.6
	06-Nov-97	8.45	32.70	223	10.30	5.5
	25-Jun-07	8.69	32.39			
94-139	30-Apr-97	6.27	30.50	465	7.88	5.0
	05-Aug-97	6.51	31.52	520	8.12	5.7
	28-Oct-97	6.82	28.00			
	27-Jun-07	damaged	damaged			
94-141	02-May-97	-	-	369	9.23	4.6
	06-Aug-97	0.00	33.56	373	9.74	5.6
	04-Nov-97	0.00	33.50			
	16-Aug-06	0.00	33.02			
	26-Jun-07	0.00	32.20			
94-143	02-May-97	1.65	34.21	269	9.82	5.0
	06-Aug-97	1.70	34.30	296	9.96	6.3
	31-Oct-97	1.82	34.27	238	8.17	5.4
	25-May-98	1.77	34.20	200	9.90	6.5
	17-Aug-06	2.25	33.71	250	9.94	5.1
	26-Jun-07	4.84	33.96			
94-144	03-May-97	28.92	68.58		8.14	6.5
	01-Aug-97	29.03	68.58	322	7.65	6.9
	31-Oct-97	28.90	68.58	309	7.99	7.0
	26-Jun-07	31.37	68.58			
94-147	01-May-97	26.10	59.60	254	7.77	6.1
	01-Aug-97	26.15	59.61	240	7.71	7.0
	02-Nov-97	26.51	58.53	236	8.69	6.9
	27-May-98	26.97	60.18	150	8.20	7.0
	26-Jun-07	26.71	58.61			
94-148	03-May-97	5.73	23.20		8.34	5.1
	01-Aug-97	6.16	23.32	308	7.47	6.5
	03-Nov-97	6.28	23.36	277	8.27	5.4
	16-Aug-06	6.52	22.89	210	7.88	4.7
	26-Jun-07	6.30	23.01			
94-150	01-May-97	1.86	29.72	735	8.92	6.1
	06-Aug-97	2.10	29.70	741	8.87	5.9
	01-Nov-97	3.00	30.38	722	7.09	5.7

	27-May-98	2.34	30.85	540	8.90	7.0
	16-Aug-06	3.00	30.36	711	8.59	5.0
	26-Jun-07	2.24	30.58			
94-154	26-Apr-97	0.00	163.07	472	8.92	10.0
	02-Aug-97	0.00	163.07	399	8.71	9.4
	27-Oct-97	0.00	163.07	433	10.48	9.5
	25-Jun-07	0.00	>75			
94-157	28-Apr-97	0.00	182.27	479	8.96	11.0
	02-Aug-97	0.00	182.27	438	8.68	11.2
	29-Oct-97	0.00	182.27	442	8.44	10.8
	25-Jun-07	1.52	>75			
94-159	31-Jul-97	0.00	191.44	416	8.80	11.0
	29-Oct-97	0.00	191.44	426	8.12	10.6
	25-Jun-07	2.82	>75			
96-176 B	25-Apr-97	1.65	8.67	263	8.94	2.2
	27-Sep-97	1.65	-	273	8.17	5.4
	04-Nov-97	2.00	8.67	293		4.7
	21-May-98	1.48	8.88	210	8.20	4.0
96-179 A	25-Apr-97	2.32	47.96	510	6.97	2.4
96-179 B	27-Sep-97	2.26	11.20	235	7.04	4.7
	04-Nov-97	2.26	11.20	237		4.3
	20-May-98	1.45	11.19	140	7.60	3.0
96-182	24-Apr-97	2.44	42.91	460	9.68	4.0
	27-Sep-97	2.42	42.91	488	8.37	4.9
	04-Nov-97	2.44	42.91	536		5.2
	20-May-98	2.24	42.53	410	8.40	4.0
96-183	20-May-98	0.34	41.24	290	8.20	4.0
96-188 A	25-Apr-97	10.51	41.09	310	9.91	7.0
	16-Sep-97	34.65	41.09	366	9.55	4.0
	04-Nov-97	10.29	40.57	408		4.6
	21-May-98	10.50	40.92	220	9.70	5.0
96-190	02-May-97	4.38	18.60	385	8.53	4.8
	06-Aug-97	4.03	18.44	553	8.74	5.5
	02-Nov-97	4.17	17.92	515	11.03	5.0
	01-Nov-97	4.18	17.97	516	8.24	5.2
	25-May-98	4.39	17.94	430	8.90	6.0
	17-Aug-06	4.40	17.95	245	7.85	4.2
	25-Jun-07	4.09	16.87			
96-204	25-Apr-97	5.65	46.55	382	8.97	
	16-Sep-97	5.55	46.55	387	8.65	

	05-Nov-97	5.75	46.26	376	8.70	4.6
	25-May-98	8.72	46.40	310	9.00	5.0
	26-Jun-07	5.00	46.10			
96-218	28-Apr-97	5.80	59.04	795	9.78	8.0
	05-Aug-97	4.27	53.26	891	8.82	7.6
	08-Nov-97	5.54	58.87	890	9.00	7.2
	27-May-98	5.67	58.98	610	8.90	7.0

TDS concentrations within the study area ranged from 97 to 937 mg/L and generally concentrations were noted to increase with depth below grade in the wells located within the Fish Creek valley and to decrease with depth in the upland wells adjacent to groundwater flow divides (Appendix 4-4-A of the March 2009 EIS/Application).

The aquatic life water quality parameters that were most frequently exceeded were: aluminum, iron, arsenic, copper, lead, mercury, fluoride, and sulphate, presented in order of decreasing percentage of samples that exceeded the guidelines. The percentage exceedances for these parameters are summarized in Table 2.6.1.4C-3.

The percentage exceedances for all of the relevant parameters specified in the BCWQG and CCME guideline limits are summarized in Table 2.6.1.4C-4 and Table 2.6.1.5C-5, respectively.

Table 2.6.1.4C-3 Groundwater Quality Baseline Report–Summary Table of Primary Parameters that Exceed the BCWQG and CCME Aquatic Life Guideline Limits (Groundwater Quality Data–1992 to 2006)

Areas Where Exceedances Occurred	Number of Samples	Fluoride	Sulphate	Aluminum		Arsenic		Copper		Iron		Lead		Mercury
				Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
All Areas														
% of Total Samples that Exceeded the BCWQG Limits	352	17%	12%	na	19%	52%	43%	34%	3%	68%	22%	6%	1%	10%
% of Total Samples that Exceeded the CCME Limits	352	na	na	75%	19%	52%	43%	58%	11%	68%	22%	32%	5%	23%
Proposed Open Pit Area														
% of Total Samples that Exceeded the BCWQG Limits	154	54%	30%	na	18%	83%	79%	37%	17%	92%	27%	10%	3%	7%
% of Total Samples that Exceeded the CCME Limits	154	na	na	95%	18%	83%	79%	74%	21%	92%	27%	44%	16%	28%
North of Proposed Open Pit Area														
% of Total Samples that Exceeded the BCWQG Limits	10	0%	0%	na	10%	70%	60%	30%	0%	50%	10%	0%	0%	10%
% of Total Samples that Exceeded the CCME Limits	10	na	na	60%	10%	70%	60%	50%	10%	50%	10%	10%	0%	30%
Tête Angela Basin														
% of Total Samples that Exceeded the BCWQG Limits	15	7%	33%	na	40%	33%	0%	67%	0%	100%	20%	0%	0%	40%
% of Total Samples that Exceeded the CCME Limits	15	na	na	100%	40%	33%	0%	73%	7%	100%	20%	47%	0%	60%
Main Proposed TSF Embankment														
% of Total Samples that Exceeded the BCWQG Limits	76	37%	7%	na	7%	20%	17%	32%	1%	41%	4%	16%	0%	1%
% of Total Samples that Exceeded the CCME Limits	76	na	na	62%	7%	20%	17%	58%	12%	41%	4%	36%	7%	7%
Western Boundary of Proposed TSF														
% of Total Samples that Exceeded the BCWQG Limits	51	2%	0%	na	4%	8%	4%	20%	2%	45%	22%	0%	0%	0%
% of Total Samples that Exceeded the CCME Limits	51	na	na	65%	4%	8%	4%	57%	14%	45%	22%	29%	4%	6%
Wasp Lake Area														
% of Total Samples that Exceeded the BCWQG Limits	46	2%	0%	na	33%	98%	98%	17%	0%	80%	50%	11%	0%	0%
% of Total Samples that Exceeded the CCME Limits	46	na	na	67%	33%	98%	98%	37%	0%	80%	50%	26%	4%	9%

NOTES:
1) BCWQG—British Columbia Working and Approved Water Quality Guidelines—Aquatic Life.
2) CCME—Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines—Guidelines for the Protection of Aquatic Life.
3) na—Not Applicable—No guidelines exist for these parameters.

Table 2.6.1.4C-4 Groundwater Quality Baseline Report–Percentage of Samples that Exceeded the British Columbia Water Quality Guidelines (BCWQG)

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Rev'd: July 26/07

Parameter	Units	BCWQG Limits	Central Area of Proposed Open Pit					Southern Boundary Proposed Open Pit									North of Pit		Tete Angela Basin			Proposed Main Tailings Embankment					Proposed W Tailings Embankment				Wasp Lake Area		
			91-04	91-06	92-14	92-18	92-19	93-126	93-129	93-127	93-128	96-218	94-154	94-157	94-159	94-139	96-188	96-204	96-176	96-179	96-182	92-04	92-05	92-01	96-190	92-02	94-144	94-148	94-147	94-150	92-03	94-141	94-143
Relative Depth			deep	shallow	shallow	deep	deep	shallow	shallow	mid	mid	mid	deep	deep	deep	mid	mid	mid	shallow	shallow	deep	deep	shallow	deep	shallow	shallow	deep	shallow	deep	shallow	shallow	shallow	shallow
Number of Samples			18	21	20	21	17	14	14	8	13	6	10	10	5	8	5	5	5	5	5	9	20	20	8	19	11	13	13	14	19	13	14
General Parameters																																	
Conductivity	umhos/cm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	500 (DW)	13	21	22	10	53	0	0	0	0	83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42	0	0	0
Hardness	mg/L $CaCO_3$	200 (DW)	100	100	65	100	65	0	0	0	0	0	0	0	0	100	0	0	0	0	20	0	0	0	0	0	0	0	0	0	100	62	57
pH	pH units	6.5 - 9.0	0	0	22	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	75	0	0	0	0	0	0	0	0	0	83	100
Total Suspended Solids	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	1 (DW)	100	100	100	100	100	100	100	100	100	100	100	0	0	100	100	100	100	100	100	100	90	80	100	75	0	100	40	100	100	67	100
Dissolved Anions																																	
Alkalinity	mg/L $CaCO_3$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride	mg/L	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fluoride	mg/L	0.2/0.3	39	95	5	0	29	0	0	100	85	100	100	100	100	0	0	0	0	0	20	89	0	100	0	0	0	0	0	7	0	0	7
Sulphate	mg/L	100	28	38	95	5	65	0	0	0	0	33	0	0	0	0	0	100	0	0	100	0	0	0	63	0	0	0	0	0	0	0	0
Nutrients																																	
Ammonia Nitrogen	mg/L	0.6 - 28.3			Insufficient data							Insufficient data					Insufficient data			Insufficient data				Insufficient data				Insufficient data				Insufficient data	
Nitrate Nitrogen	mg/L	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrite Nitrogen	mg/L	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0
Dissolved ortho-Phosphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Phosphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Phosphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organic Compounds																																	
Dissolved Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenols	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Inorganic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Cyanide	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WAD Cyanide	mg/L	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Metals																																	
Aluminum	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	mg/L	0.020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arsenic	mg/L	0.005	11	95	85	100	94	79	100	100	100	100	0	0	0	0	100	40	60	40	0	89	0	0	88	0	0	0	0	29	100	100	93
Barium	mg/L	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beryllium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cadmium	mg/L	86(log(hardness))-3.2	11	10	10	0	0	0	0	25	8	33	0	0	0	13	0	20	60	60	0	0	5	30	13	0	27	8	15	7	5	8	7
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	0.05 (DW)	11	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cobalt	mg/L	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Copper	mg/L	4(hardness)+2)	17	33	0	19	0	21	43	100	92	83	80	10	20	0	0	60	100	100	0	78	20	50	13	11	18	8	31	21	0	23	36
Iron	mg/L	0.3	94	100	85	100	71	86	50	100	92	100	30	10	20	50	0	100	100	100	100	100	35	30	38	32	64	62	38	21	100	31	100
Lead	mg/L	1.273 ln(hardness) - 1.	0	0	0	0	0	0	21	50	69	0	0	0	0	0	0	0	0	0	0	11	0	25	0	0	0	0	0	0	0	15	21
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/L	02(hardness) +	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	20	40	20	0	0	0	0	0	0	0	0	0	0	0	0	0
Mercury	mg/L	0.0001	0	0	0	19	24	0	0	13	0	0	10	0	0	0	0	20	60	60	0	0	5	0	0	0	0	0	0	0	0	0	0
Molybdenum	mg/L	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nickel	mg/L	0.025 - 0.150	0	0	0	0	0	0	7	25	0	67	0	0	0	0	0	40	20	20	0	0	0	0	13	0	0	0	0	0	0	8	7
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.0020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	0.0001/0.0030	0	0	0	0	0	0	0	13	8	67	0	0	0	0	0	0	0	0	0	0	0	10	25	0	0	0	0	0	0	8	0
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	0	-	-	0	-	0	-	0	0
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vanadium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	75(hardness - 9	0	0	5	0	0	0	0	25	0	83	0	0	0	0	0	40	60	40	20	0	0	10	13	5	9	0	0	0	0	0	0

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Parameter	Units	BCWQG	Central Area of Proposed Open Pit					Southern Boundary Proposed Open Pit									North of Pit		Tete Angela Basin			Proposed Main Tailings Embankment					Proposed W Tailings Embankment				Wasp Lake Area		
		Limits	91-04	91-06	92-14	92-18	92-19	93-126	93-129	93-127	93-128	96-218	94-154	94-157	94-159	94-139	96-188	96-204	96-176	96-179	96-182	92-04	92-05	92-01	96-190	92-02	94-144	94-148	94-147	94-150	92-03	94-141	94-143
Dissolved Metals																																	
Aluminum	mg/L	0.1	6	5	0	0	0	14	29	63	46	100	10	10	0	0	0	20	40	80	0	11	11	5	0	5	0	0	0	14	0	8	100
Antimony	mg/L	0.020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arsenic	mg/L	0.005	6	86	80	86	88	86	100	100	100	100	0	0	0	0	100	20	0	0	0	89	0	0	63	0	0	0	0	14	100	100	93
Barium	mg/L	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beryllium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	1.2	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	0	-	-
Cadmium	mg/L	86(log(hardness))-3.2	0	0	0	0	6	0	0	13	8	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	8	0	0	0	0
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	0.05 (DW)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Copper	mg/L	4(hardness)+2)	0	5	0	0	0	0	0	75	77	67	50	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	8	0	0	0	0
Iron	mg/L	0.3	6	5	40	76	24	7	0	38	38	67	0	0	0	0	0	20	20	40	0	0	11	0	0	0	64	0	31	0	47	0	100
Lead	mg/L	1.273 ln(hardness) - 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manganese	mg/L	02(hardness) +	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mercury	mg/L	0.0001	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nickel	mg/L	0.025 - 0.150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.0020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	0.0001/0.0030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	0	-	-	0	-	0	-	0	0
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vanadium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	75(harness - 90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes:

BCWQG - British Columbia Water Quality Guidelines (2006 Edition), unless specified, the guidelines refered to are the Aquatic Life Limits, DW - refers to drinking water limits

Fluoride BCWQG Limit - 0.2 mg/L for hardness <50 mg/L CaCO3, 0.3 mg/L for hardness > 50 mg/L CaCO3.

Ammonia Nitrogen BCWQG and CCME guideline - subject to in situ temperature and pH. More data needed to process this parameter.

Aluminium BCWQG Limit (for dissolved aluminum only)- [diss Al] = $e^{(1.209 - 2.426K + 0.286KK)}$ mg/L for pH <6.5, 0.100 mg/L for pH > or = 6.5.

Silver BCWQG Limit - 0.0001 for hardness < or = 100 mg/L $CaCO_3$, 0.0030 for hardness > 100 mg/L $CaCO_3$.

Table 2.6.1.4C-5 Groundwater Quality Baseline Report–Percentage of Samples that Exceeded the Canadian Council of Ministers of the Environment (CCME), Freshwater Guidelines for the Protection of Aquatic Life

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Parameter	Units	CCME Limits	Central Area of Proposed Open Pit					Southern Boundary Proposed Open Pit									North of Pit		Tete Angela Basin			Proposed Main Tailings Embankment					Proposed W Tailings Embankment				Wasp Lake Area		
			91-04	91-06	92-14	92-18	92-19	93-126	93-129	93-127	93-128	96-218	94-154	94-157	94-159	94-139	96-188	96-204	96-176	96-179	96-182	92-04	92-05	92-01	96-190	92-02	94-144	94-148	94-147	94-150	92-03	94-141	94-143
General Parameters																																	
Conductivity	umhos/cm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hardness	mg/L $CaCO_3$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	pH units	6.5 - 9.0	0	0	22	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	75	0	0	0	0	0	0	0	0	0	83	100
Total Suspended Solids	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Anions																																	
Alkalinity	mg/L $CaCO_3$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nutrients																																	
Ammonia Nitrogen	mg/L	0.05 - 184.8			Insufficient data							Insufficient data					Insufficient data			Insufficient data				Insufficient data				Insufficient data				Insufficient data	
Nitrate Nitrogen	mg/L	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrite Nitrogen	mg/L	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0
Dissolved ortho-Phosphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Phosphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Phosphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organic Compounds																																	
Dissolved Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenols	mg/L	0.004	25	0	25	20	0	25	0	100	0	20	100	0	33	50	0	0	0	0	0	0	0	0	0	0	50	50	40	60	0	50	40
Total Inorganic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Cyanide	mg/L	0.005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	0	15	0	0	0	0
WAD Cyanide	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																																	
Aluminum	mg/L	0.005 - 0.100	94	100	65	90	53	100	93	100	100	100	40	30	20	75	20	100	100	100	100	100	65	65	63	37	73	85	54	50	68	31	100
Antimony	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	11	95	85	100	94	79	100	100	100	100	0	0	0	0	100	40	60	40	0	89	0	0	88	0	0	0	0	29	100	100	93
Barium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	$10^{(0.86(\log(\text{hardness}))-3.2}/1000$	11	10	10	0	0	0	0	25	8	33	0	0	0	13	0	20	60	60	0	0	5	30	13	0	27	8	15	7	5	8	7
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	0.002 - 0.004	72	86	35	52	47	79	64	100	92	83	80	10	20	25	20	80	100	100	20	100	55	75	38	32	64	46	69	50	32	23	57
Iron	mg/L	0.3	94	100	85	100	71	86	50	100	92	100	30	10	20	50	0	100	100	100	100	100	35	30	38	32	64	62	38	21	100	31	100
Lead	mg/L	0.001 - 0.007	17	24	30	10	6	43	71	100	100	83	40	30	0	13	0	20	80	60	0	56	25	75	13	11	64	23	23	14	0	23	64
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/L	0.000026	22	10	0	52	65	0	7	50	0	50	20	0	20	25	20	40	80	80	20	0	10	5	13	5	18	8	0	0	0	23	14
Molybdenum	mg/L	0.073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nickel	mg/L	0.025 - 0.150	0	0	0	0	0	0	7	25	0	67	0	0	0	0	0	40	20	20	0	0	0	0	13	0	0	0	0	0	0	8	7
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.0010	0	0	0	0	0	0	0	13	0	17	0	0	0	0	0	0	0	0	0	56	0	0	0	0	0	0	0	0	0	0	0
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	0.0001	11	0	0	5	0	0	0	13	8	67	0	0	0	13	0	0	60	60	0	0	0	10	25	0	0	0	0	0	0	8	0
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	0	-	-	0	-	0	-	0	0
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	0.03	22	33	15	24	12	0	0	25	0	83	0	0	0	13	0	60	80	40	40	0	5	10	13	11	9	0	0	7	5	8	0

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Parameter	Units	CCME Limits	Central Area of Proposed Open Pit					Southern Boundary Proposed Open Pit								
			91-04	91-06	92-14	92-18	92-19	93-126	93-129	93-127	93-128	96-218	94-154	94-157	94-159	94-139
Dissolved Metals																
Aluminum	mg/L	0.005 - 0.100	6	5	0	0	0	14	29	63	46	100	10	10	0	0
Antimony	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	6	86	80	86	88	86	100	100	100	100	0	0	0	0
Barium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	$10^{(0.86(\log(hardness))-3.2)}/1000$	0	0	0	0	6	0	0	13	8	0	0	0	0	0
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	0.002 - 0.004	0	10	0	5	0	14	0	75	77	67	50	20	0	0
Iron	mg/L	0.3	6	5	40	76	24	7	0	38	38	67	0	0	0	0
Lead	mg/L	0.001 - 0.007	0	0	0	0	0	0	0	50	100	67	20	10	0	0
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/L	0.000026	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.073	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nickel	mg/L	0.025 - 0.150	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.0010	0	0	0	0	0	0	0	0	8	0	10	0	0	0
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	0.0001	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Parameter	North of Pit		Tete Angela Basin			Proposed Main Tailings Embankment					Proposed W Tailings Embankment				Wasp Lake Area		
	96-188	96-204	96-176	96-179	96-182	92-04	92-05	92-01	96-190	92-02	94-144	94-148	94-147	94-150	92-03	94-141	94-143
Dissolved Metals																	
Aluminum	0	20	40	80	0	11	11	5	0	5	0	0	0	14	0	8	100
Antimony	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	100	20	0	0	0	89	0	0	63	0	0	0	0	14	100	100	93
Barium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	0	0	0	0	0	0	5	5	0	0	0	0	8	0	0	0	0
Calcium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	20	0	0	20	0	11	16	20	0	5	9	0	31	14	0	0	0
Iron	0	20	20	40	0	0	11	0	0	0	64	0	31	0	47	0	100
Lead	0	0	0	0	0	0	0	25	0	0	0	8	8	0	0	8	7
Lithium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nickel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potassium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	0	0	0	0	0	89	0	0	0	0	0	0	8	7	0	0	0
Silicon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0
Sodium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	0	-	0	-	-	0	-	0	-	0	0
Tin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes:

CCME -Canadian Council of Ministers of the Environment (CCME), Canadian Environmental Guideline - Freshwater Guidelines for the Protection of Aquatic Life, Updated October 2005.

Ammonia Nitrogen BCWQG and CCME guideline - subject to in situ temperature and pH. More data needed to process this parameter.

Aluminium CCME Limit - 0.005 mg/L for pH <6.5, 0.100 mg/L for pH > or = 6.5.

Copper CCME Limit - 0.002 mg/L $CaCO_3$ 0-120 mg/L, 0.003 mg/L $CaCO_3$ 120-180 mg/L, 0.004 mg/L $CaCO_3$ >180 mg/L.

Lead CCME Limit - 0.001 mg/L $CaCO_3$ 0-60 mg/L, 0.002 mg/L $CaCO_3$ 60-120 mg/L, 0.004 mg/L $CaCO_3$ 120-180 mg/L, 0.007 mg/L $CaCO_3$ >180 mg/L.

Nickel CCME Limit - 0.025 mg/L $CaCO_3$ 0-60 mg/L, 0.065 mg/L $CaCO_3$ 60-120 mg/L, 0.110 mg/L $CaCO_3$ 120-180 mg/L, 0.150 mg/L $CaCO_3$ >180 mg/L.

Dissolved aluminum concentrations ranged from below detection (<0.005 mg/L) to 1.57 mg/L (total aluminum concentrations ranged from below detection to 70.2 mg/L), with a mean concentration of 0.066 mg/L. Seventy-five percent of the samples from within the local study area exceeded the CCME guideline limit for total aluminum and 19% exceeded both the CCME and BCWQG limit for dissolved aluminum. Dissolved aluminum guideline exceedances were greatest in the Tête Angela Basin and Wasp Lake area, with 40 and 33% of the samples exceeding the CCME and BCWQG limits respectively. Total aluminum guideline exceedances were greatest in the Tête Angela basin and in the proposed open pit area (100 and 95% exceeded respectively).

Dissolved arsenic concentrations exceeded the 0.005 mg/L CCME and BCWQG limit in 43% of the samples and 52% of these samples also exceeded this limit for total arsenic concentrations. The greatest number of exceedances occurred in the Wasp Lake area (98% total and 98% dissolved), the proposed open pit area (79% dissolved and 83% total), and in the area to the north of the proposed open pit (60% dissolved and 70% total). Total arsenic concentrations ranged from below detection (<0.0001 mg/L) to 0.114 mg/L, with a mean concentration of 0.009 mg/L, which is just under two times greater than the guideline limit.

Dissolved iron concentrations exceeded the 0.3 mg/L CCME and BCWQG limit in 22% of the groundwater samples (38% exceeded for total iron), with concentrations ranging from below detection (<0.03 mg/L) to 2.79 mg/L (total iron concentrations ranged from below detection to 104 mg/L). Fifty percent of the samples from the Wasp Lake area exceeded the guideline limit for dissolved iron concentrations (80% for total) and 27% of the open pit area samples for dissolved iron exceeded this limit (92% for total iron).

Dissolved copper concentrations ranged from below detection (<0.001 mg/L) to 0.003 mg/L, with a mean concentration of 0.003 mg/L (total copper ranged from below detection to 0.475 mg/L) and the mean hardness concentration for the local study area was 127 mg/L $CaCO_3$. For dissolved copper concentrations, 3% of the samples exceeded the BCWQG limit, and 11% of the samples exceeded the CCME guideline limit. Total copper guideline exceedances were much greater, with the greatest percentage of exceedances occurring in the Tête Angela Basin (67% BCWQG and 73% CCME), the proposed open pit area (37% BCWQG and 74% CCME), along the main proposed TSF embankment (32% BCWQG and 58% CCME), and along the western boundary of the proposed TSF (20% BCWQG and 27% CCME).

Lead, mercury, fluoride and sulphate exceedances occurred at lower rates than the previously mentioned parameters, though they were still large enough to be noted. Total lead was highest in the proposed open pit area (mean 0.006 mg/L) and the Tête Angela basin (mean 0.005 mg/L), with the mean concentrations of the samples from those areas exceeding the CCME guideline limit. The mean total lead concentrations also exceeded the CCME limits in the area to the north of the proposed open pit and in the Wasp Lake area, though the mean total lead concentrations for these and the remaining areas were well below the BCWQG limit. Total mercury concentrations exceeded the BCWQG limit in 10% of the samples from the study area and 23% of the samples exceeded the CCME guideline limit, with the greatest rate of exceedance noted for the samples from the proposed open pit area, the area to the north of the proposed open pit, and in the Tête Angela basin. Seventeen percent of the samples exceeded the BCWQG limit for fluoride, with the greatest rate of exceedance noted for the proposed open pit area (54%) and along the proposed main TSF embankment (37%). Sulphate concentrations exceeded the BCWQG limit in 12% of the study area groundwater samples, with the bulk of the exceedances occurring in the proposed open pit area (30%) and in the Tête Angela basin (33%).

There were also guideline exceedances noted for pH, nickel, silver, and zinc, though the percentage of samples to exceed tended to be lower than those of the previously mentioned parameters.

Further details on the baseline groundwater quality assessment are provided in the Draft Groundwater Quality Baseline Report (Appendix 4-4-A of the March 2009 EIS/Application: Groundwater Quality Baseline Report).

Regional Study Area

Groundwater quality records reviewed by Foweraker (2001) were generally limited to the southeast portion of the Fraser Plateau between Clinton and Canim Lake. Groundwater was generally very hard, highly mineralized, of a calcium-magnesium-sodium-bicarbonate-sulphate type and some constituents, apart from hardness, were greater than the recommended guidelines for Canadian Drinking Water Quality (1989). For example, water quality data available for some relatively shallow wells located north of Clinton (46 m deep in sand and gravel) and in the 70 Mile House area (20 m deep completed in bedrock) showed hard water quality high in sodium, and hard water quality high in sodium and iron, respectively. Concentrations of iron and sodium in the latter well were sufficiently high to warrant treatment prior to use.

Hard, highly mineralized groundwater with mercury concentrations (0.005 mg/L) greater than the Canadian Drinking Water Quality Guidelines (0.001 mg/L), were reported for samples from two test wells completed in sands and gravels near Deadman River. Foweraker (2001) noted that the mercury concentrations were considered likely to be associated with the bedrock in the general area and also that concentrations increased with pumping duration.

D. GROUNDWATER QUANTITY

Detailed hydrogeological and geotechnical investigations were completed in 1992, 1993, 1994, 1996 and 1998 under the direction of Knight Piésold (Appendix 2.6.1.4D). These investigations comprised drilling, core orientation, geotechnical logging, in-situ permeability testing (including pumping, constant head and falling head packer, shut-in pressure and single well response (constant head and rising head) testing) installing long-term groundwater monitoring wells for the purposes of sampling groundwater quality and measuring groundwater levels.

Hydrogeological investigations completed to date were considered adequate to characterize baseline groundwater hydrology conditions within the Fish Creek catchment.

APPROACH AND METHODS

The baseline groundwater assessment was conducted by compiling and reviewing the available geological, geotechnical and groundwater quality data obtained from previous investigations of the property and available public information (e.g., BC Water Resources Atlas). Available data was supplemented by collecting additional groundwater level measurements from existing monitoring wells during the summer of 2006 and spring of 2007. Results of the baseline groundwater hydrology assessment are documented in Appendix 4-4-B of the March 2009 EIS/Application. A site visit was completed in February 2012 to collect additional groundwater level measurements in existing wells. Continuous groundwater level data collected since 2009 in four new wells installed at the south end of the

Fish Lake catchment were used to check the range of seasonal variation in water levels and to confirm the timing of recharge to the groundwater system in this area of the Fish Lake catchment.

A conceptual model of the hydrogeologic system was developed based on these available data. A 3D numerical model encompassing the key features identified in the conceptual model was constructed and calibrated to pre-development hydrogeologic conditions. MODFLOW, an industry standard 3D finite difference flow model developed by the U.S. Geological Survey, was selected as the numerical groundwater flow model for the site. The model was calibrated to baseline conditions, and used to predict the effects of the mining project on groundwater elevations, baseflow to the Taseko River, Lower Fish Creek and Beece Creek and groundwater inflow rates to Fish Lake, Big Onion Lake, Little Onion Lake and Wasp Lake. Results of the numerical hydrogeologic modelling are documented in Appendix 2.7.2.4-C.

OVERVIEW OF BASELINE

The elevation of the site ranges from approximately 1200 masl in the northwest along the Taseko River north of the confluence with Fish Creek to approximately 2000 masl at the ridge tops located in the south eastern corner of the study area. Groundwater enters the system as recharge from precipitation, runoff, and snow melt and leaves the system at discharge zones such as lakes, rivers, creeks, and low lying areas, and by evapotranspiration.

Estimated average annual precipitation for the local study area is 445 mm (uncorrected for orographic effect) based on data collected at meteorology station M1 (Appendix 4-4-D of the March 2009 EIS/Application). Precipitation and temperature normals for station M1, Williams Lake Airport and Big Creek are summarized in Table 2.6.1.4D-1.

Table 2.6.1.4D-1 Precipitation and Temperature Data for Station M1

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Williams Lake Airport													
Rain (mm)	4.5	2.2	4.2	13.3	37.4	55.3	53.5	47.3	36.9	27.3	12	1.8	295.7
Snow (cm)	42.4	22.7	19.8	9.8	2	0.4	0	0	0.9	8	36	50.8	192.8
Precip (mm)	37.	19.7	20.4	21.9	39.4	55.7	53.5	47.3	37.7	34.8	42.4	40.4	450.2
Temperature (°C)[1]	-8.3	-4.5	0	4.9	9.5	12.9	15.6	15.1	10.5	4.7	-2.6	-7.5	-
Big Creek													
Rain (mm)	1.7	0.8	1	8.4	25.5	51.1	51.4	43.6	24.3	14.3	1.9	1.9	225.9
Snow (cm)	21.6	15	11.8	5.8	1.5	0.1	0	0	2.7	6.3	19.8	27.2	111.8
Precip (mm)	23.3	15.7	12.8	14.2	27	51.2	51.4	43.6	27	20.6	21.7	29.1	337.6

Temperature (°C)[1]	-10.2	-6.4	-1.6	2.6	7.6	10.6	13.3	12.9	8.9	3	-4.1	-10.1	-
M1 Estimated Long-Term based on Comparison with Big Creek Data													
Rain (mm)	0	0	0	0	35.6	55.7	57.9	51.2	31.2	17.8	0	0	249.4
Snow (cm)	40.1	24.5	15.6	22.3	6.7	0	0	0	4.5	8.9	31.2	42.3	196.1
Precip (mm)	40.1	24.5	15.6	22.3	42.3	55.6	57.9	51.2	35.6	26.7	31.2	42.3	445.3
M1 Corrected to 1600m based on 12% orographic factor													
Precip (mm)	47.3	28.9	18.4	26.3	49.9	65.6	68.3	60.4	42	31.5	36.8	49.9	525.5
Temperature (°C)[1]	-10	-7	-3	1	6	10	13	13	7	3	-3	-10	-
NOTE: [1] T = mean monthly temperature (°C), from nearest meteorologic station													

During the period from November to April, 100% of the site precipitation comes from snowfall, typically occurring as 15 to 42 mm of equivalent rainfall. In transitional months (May, September, October) some snowfall occurs (less than 10 mm equivalent) and most of the precipitation occurs as rainfall. From June through August, 100% of precipitation occurs as rainfall. Infiltration of precipitation to groundwater, or “recharge”, is estimated to be in the range from 12 to 15% of annual average precipitation (Appendix 2.7.2.4-C).

Vegetation and wetlands cover the majority of the local study area. The maximum rate of evapotranspiration during the summer was assumed to be equal to potential evaporation at 2.6 mm/d (Appendix 4-4-D of the March 2009 EIS/Application). During the winter period, evapotranspiration is considered to be negligible (0 mm/d).

The hydrostratigraphy of the Project area is conceptualized in terms of three main hydrogeologic units: glacial till that blankets the majority of the site, fluvial deposits present along the extent of the Taseko River and Beece Creek, and a bedrock unit, consisting primarily of basalt flows, buried overburden, volcanics, and sedimentary rocks.

The glacial till varies in thickness from <5 m along ridge lines to >50 m in isolated areas in the vicinity of the open pit. The geometric mean hydraulic conductivity (K) of the glacial till, which is based on results of hydraulic tests, is approximately 5 x 10^{-8} m/s.

The presence of the fluvial deposits along the Taseko River and Beece Creek was interpreted based on terrain assessment completed by Jacques Whitford AXYS (Appendix 5-4-E of the March 2009 EIS/Application). The material type and thickness of the deposits were assumed to be silty sand approximately 10 m thick, respectively; but this was not confirmed in the field. No hydraulic conductivity test data are currently available for the fluvial deposits. For numerical implementation, a representative horizontal hydraulic conductivity value of 1 x 10^{-6} m/s and 5:1 horizontal to vertical anisotropy was selected based on typical values cited in the literature for fluvial materials (Maidment, 1992).

The hydraulic conductivity of the bedrock tends to decrease with depth, and is observed to vary over approximately three to four orders of magnitude at any given depth. Various analyses were carried out in an attempt to discern any spatial or geological trends with respect to the hydraulic conductivity of the bedrock; however, no substantial trends relating to these aspects were identified (Appendix 2.6.1.4D). Based on the available data, the primary control on hydraulic conductivity is depth. Therefore, for the purpose of this environmental assessment, the bedrock is assumed to behave spatially as a single hydrogeologic unit with hydraulic conductivity that decreases with depth.

The bedrock is cut by a number of faults (e.g., in the open pit area the QD Fault and East Fault; refer to Appendix 2.6.1.4D); however, limited available hydraulic data suggest that the permeability of these structures is similar to the bedrock hydraulic conductivity. To date there is no strong evidence to suggest any particular fault has a substantial control on the groundwater flow regime. Therefore, fault structures have not been explicitly included in the conceptual hydrogeologic model.

Groundwater elevation data are available for 94 locations at the site. Of these, 31 measurements were taken from installed piezometers and 63 were measured from shut-in tests performed during drilling. Measured groundwater elevations indicate that the water table is generally a subdued replica of the surface topography at the site.

In general, groundwater flow in the Fish Creek valley system is driven by recharge in upland areas to discharge in the network of streams and lakes that occupy the valley floor. The water table is near or above ground surface (i.e., artesian conditions) in low lying areas and is found at greater depths below ground surface along ridges. A groundwater divide is present within the study area underlying the ridge that forms the western edge of the Fish Creek watershed. The divide hydraulically separates the Fish Creek watershed from the Taseko River up to the confluence of the river and Lower Fish Creek.

Although available groundwater data are limited to wells installed within the Fish Creek valley, similar flow systems are expected in the peripheral smaller catchments for Wasp Lake and Big Onion/Little Onion Lakes.

2.6.1.5 Fish and Fish Habitat

Fish and fish habitat baseline conditions reflect existing conditions prior to development of the Project, and are used to predict potential changes related to construction and commissioning, operations (life-of-mine) and closure of the mine (closure and post-closure). This section summarizes the baseline data and information collection and assessment based on past (1993–1998), 2006 and 2007 creel survey and fish and fish habitat assessment at road crossing sites, and recent studies of Rainbow Trout distribution in selected Fish Lake tributaries (summer 2011 and winter 2012).

For the purposes of this baseline summary and to be consistent with previous studies, lower Fish Creek is defined as that section of stream from the confluence with the Taseko River upstream to the fish barrier (Reaches 1–3) and middle Fish Creek is defined as the section of stream from the barrier upstream to Fish Lake (Reaches 4–6). Upper Fish Creek (Reaches 7–10) includes Fish Lake, Little Fish Lake and their respective tributaries (Figure 2.6.1.5-1).

Table 2.6.1.5-1 lists the fish and fish habitat baseline studies that were conducted by Taseko between 1993 and 2012.

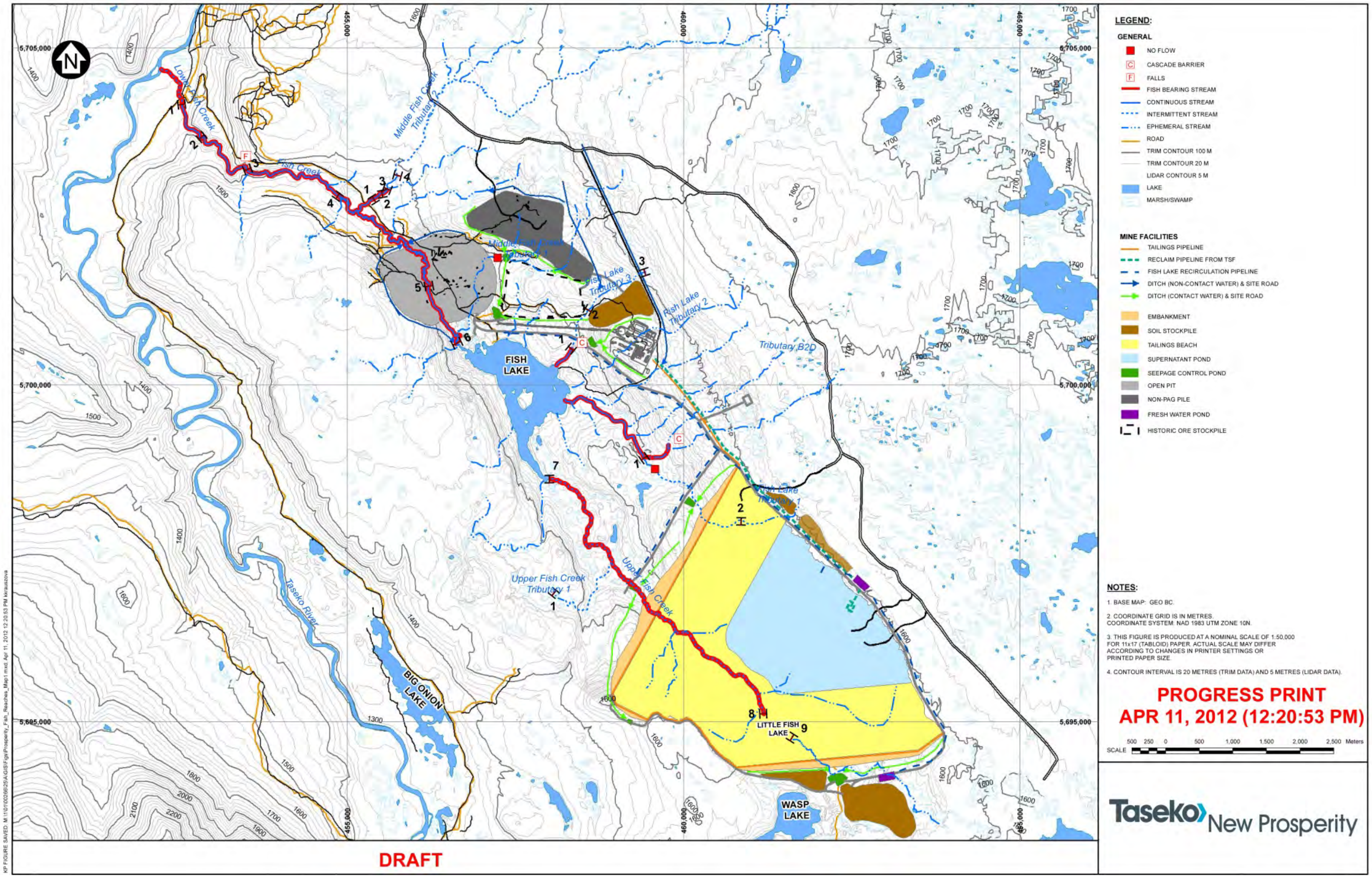


Figure 2.6.1.5-1 General Arrangement with Fish Reaches

Table 2.6.1.5-1 List of 1993–1998 Fish and Fish Habitat Studies

Study No.	Report Title	Location in March 2009 EIS/Application
1	Prosperity Gold-Copper Project: Fish Creek Fish and Fish Habitat Survey (conducted in late summer 1996 and 1997 and reported on in 1999)	Appendix 5-3-A
2	Prosperity Gold-Copper Project: Fish Creek Mark/Recapture Study	Appendix 5-3-B
3	Prosperity Gold-Copper Project: Lakes Physical Habitat	Appendix 5-3-C
4	Prosperity Gold-Copper Project: Fish Creek Spawner Enumeration Project	Appendix 5-3-D
5	Aquatic Resources of Fish Lake, Fish Creek and Related Fish Habitat Compensation Sites	Appendix 5-3-E (Part 1 and 2)
6	Sport Fishery Statistics from Fish Lake, British Columbia, June–October 1995	Appendix 5-3-F
7	Sport Fishery Statistics from Fish Lake, British Columbia, 1995 and 1996	Appendix 5-3-G
8	Fisheries Data from the Prosperity Project Area: 1996 Data Report	Appendix 5-3-H
9	Meteorological Data from the Prosperity Project Area, April 1992 to March 1996	Appendix 5-3-I
10	Visitor and Creel Survey, Fish Lake, BC, 1997	Appendix 5-3-J
11	Fish and Fish Habitat Surveys along Taseko Lake, Branch 4500 and the new Project Access Road (2006)	Volume 5, Section 3.2.2.1
12	Angler Effort and CPUE in Fish Lake (2006, 2007)	Volume 5, Section 3.2.2.2

FISH CREEK WATERSHED FISH HABITAT

Triton conducted baseline fish and fish habitat surveys of the Fish Creek watershed during August and September in 1996 and 1997 (Appendix 5-3-A from the March 2009 EIS/Application). The primary objectives of the fish survey were to determine fish species composition, distribution and density (site-specific population size[s]). The primary objective of the habitat survey was to quantify and qualify fish habitats within the Fish Creek watershed for assessment of environmental effects as a result of mine development. Stream attributes such as wetted width, depth and velocity had been previously collected (Appendix 5-3-E [Part 1 and 2] from the March 2009 EIS/Application).

Survey sites were distributed throughout lower, middle and upper Fish Creek to ensure survey representation of all habitat types present within the watershed. Procedures for fish and fish habitat sampling generally followed those described in the earliest version of the RIC Reconnaissance (1:20,000) Fish and Fish Habitat Inventory Standards and Procedures (RIC, 1997). Fish species composition and density (population) sampling was more intensive than required by RIC, which specifies only fish species presence, relative abundance and/or absence determinations.

In total, 44 sites were surveyed for habitat characteristics during low flow conditions over the two-year study. General site locations for the habitat surveys were initially identified through helicopter reconnaissance and observations of channel attributes (e.g., width, sinuosity, morphology), fish cover (e.g., deep pools, large woody debris [LWD]) and probability of fish occurrence. Specific site locations sites were selected to be representative of channel characteristics and morphology (hydraulic frequency) for the reach.

The habitat surveys determined the amount of fish-bearing habitat during maximum (bankful channel width) and late summer, low-flow (wetted width) water conditions. Data on habitat area were calculated and statistically analyzed using computer programs available from the SPSS library (Appendix 5-3-A from the March 2009 EIS/Application) and has been used in habitat compensation planning.

Characteristics of the Fish Creek watershed stream and lake habitats are described in detail in Appendix 5-3-A from the March 2009 EIS/Application and summarized in Tables 2.6.1.5-2 and 2.6.1.5-3.

The Fish Creek watershed comprises a total of 175,442 m^2 stream habitat of which 64,777 m^2 is fish bearing. The Fish Creek watershed also provides a total of 117.6 ha of lake habitat (Fish and Little Fish lakes) of which 904,230 m^2 is shoal area (<6 m).

Baseline riparian habitat, determined by methods described in the Riparian Management Area Guidebook (MoF, 1995) and Riparian Areas Regulations (MoE, 2004) is estimated at approximately 1.92 M m^2, most of which (93%) is associated with streams. Riparian habitat associated with lakes (Fish and Little Fish lakes) accounts for the remaining 7% of total riparian habitat.

Table 2.6.1.5-2 Summary of Baseline Stream Habitat Conditions in Fish Creek Watershed

Reach	Flow Type[1]	Fish Status[2]	Bankful Channel Dimensions[3] Lengt h (m)	Width (m)	Area (m^2)	Riparian RRZ Width (m)	Area (m^2)
Mainstem (Lower Fish Creek)							
1	intermittent	FB	744	7.2	5,357	30	44,640
2	continuous	FB	671	6.3	4,227	30	40,260
3	continuous	FB	1,212	5.6	6,787	30	72,720
Totals			**2,627**		**16,371**		**157,620**
Mainstem (Middle and Upper Fish Creek)							
4	continuous	FB	1,705	4.2	7,161	20	68,200
5	continuous	FB	3,221	4.5	14,495	20	128,840
6	continuous	FB	1,072	4.0	4,288	20	42,880
8	intermittent	FB	5,565	2.9	16,139	20	222,600
Totals			**11,563**		**42,082**		**462,520**
Middle Fish Creek Tributary No. 2							
1	continuous	FB	328	1.6	525	20	13,120
2	continuous	FB	154	1.5	231	20	6,160
3	continuous	FB	86	1.5	129	20	3,440
3	continuous	NFB	27	1.4	38	10	540
4	continuous	NFB	297	1.4	416	10	5,940
4	intermittent	NFB	3,483	1.2	4,180	10	69,660

Reach	Flow Type[1]	Fish Status[2]	Bankful Channel Dimensions[3]			Riparian	
			Length (m)	Width (m)	Area (m^2)	RRZ Width (m)	Area (m^2)
Tributaries	intermittent	NFB	1,167	1.2	1,400	10	23,340
mainstem tributaries	ephemeral	NFB	8,553	1.2	10,264	10	171,060
Totals			**14,095**		**17,183**		**293,260**
Middle Fish Creek Tributary No. 1							
	ephemeral	NFB	6,252	0.5	3,126	5	125,040
Totals			**6,252**		**3,126**		**125,040**
Fish Lake Tributary No. 1							
1	continuous	FB	1,761	2.5	4,403	20	70,440
Trib B2D	intermittent	FB	400	1.9	760	20	16,000
2	continuous	NFB	118	2.7	319	10	2,360
2	intermittent	NFB	2,371	1.6	3,794	5	23,710
3	ephemeral	NFB	557	1.4	780	5	5,570
Totals			**5,207**		**10,056**		**118,080**
Fish lake Tributary No. 3							
1	continuous	FB	345	0.8	276	20	13,800
2	intermittent	NFB	658	1.6	1,053	10	13,160
3	ephemeral	NFB	1,079	1.2	1,295	10	21,580
Totals			**2,082**		**2,624**		**48,540**
Upper Fish Creek Tributary No. 1							
1	intermittent	NFB	1,400	4.0	5,600	10	28,000
1	ephemeral	NFB	180	1.4	252	5	1,800
Totals			**1,580**		**5,852**		**29,800**
Ephemeral Streams							
All (includes reach 10)	ephemeral	NFB	55,820	1.4	78,148	5	558,200
Totals			**55,820**		**78,148**		**558,200**
Totals (Lower Fish Creek)			**2,627**		**16,371**		**157,620**
Totals (Middle and Upper Fish Creek)			**96,599**		**159,071**		**1,635,440**
Grand Totals			**99,226**		**175,442**		**1,793,060**

NOTES:

[1] **Ephemeral:** Ephemeral streams have well-defined, continuous channels but flow for only part of the year, usually in spring, early summer and the autumn in interior watersheds. Seasonal streams accessible to fish are important because they may provide overwinter shelter in coastal systems, and early spring spawning and rearing habitat in both interior and coastal drainages.

Intermittent: Intermittent streams do not dry up completely during seasonal periods of low rainfall, but retain water in

			Bankful Channel Dimensions[3]			Riparian	
Reach	Flow Type[1]	Fish Status[2]	Length (m)	Width (m)	Area (m^2)	RRZ Width (m)	Area (m^2)

separated pools along the channel. Intermittent tributaries that contain water all winter, but are reduced to isolated pools in summer, can support salmonids all year in both coastal and interior watersheds. These tributaries are commonly used by coho salmon juveniles, trout and char (adapted from *Fish Stream Identification Guidebook*, MOF 1998).

[2] **FB**: Fish-bearing; **NFB**: non fish-bearing

[3] **Bankful** channel width and area measurements reflect maximum values

SOURCE: Modified from Appendix 5-3-A from the March 2009 EIS/Application. Fish Creek Fish and Fish Habitat Surveys (summer 1996 and 1997)

Table 2.6.1.5-3 Summary of Baseline Lake Habitat Conditions for Fish and Little Fish Lakes

Property	Fish Lake	Little Fish Lake
Elevation (m)	1,457	1,527
Drainage area (ha)	6,490	1,470
Surface area (ha)	111	6.6
Volume (m^3)	4,438,446	133,280
Shoreline perimeter (m)	11,756	1,300
Shoal area (ha)	83.5	6.6
Maximum depth (m)	13	4.4
Mean depth (m)	4	2
Lake length (m)	2,050	560
Mean breadth (m)	541	118
Secchi depth (m)	>10	4
Shoreline development index[2]	3.15	1.43
No. of inlets	10	3
No. of outlets	1	1
No. of islands	5	0
Perimeter of islands	1,700	n/a
Riparian habitat (10 m RRZ for L1 lakes)	117,560	13,000
Fish presence	Rainbow Trout	Rainbow Trout

NOTES:

[1] Shoreline Development Index (DL): is a comparative figure relating the shoreline perimeter (L) to the circumference of a circle that has the same area (A) as the lake: $DL = L(m)/2\sqrt{\pi A(m^2)}$

SOURCE: Modified from Appendix 5-3-C from the March 2009 EIS/Application. Lakes Physical Habitat.

FISH RELATIVE ABUNDANCE AND DISTRIBUTION

Commensurate with the habitat survey (Appendix 5-3-A from the March 2009 EIS/Application), thirty sites were surveyed for fish species composition and density (fish/m^2) using an electrofisher and the multiple pass depletion method (Seber and Le Cren, 1967; Junge and Libosvarsky cited in Bohlin et al., 1989). Fish captures were identified to species, enumerated by life stage, subsampled for meristic information (fork length, weight, and age) and released at point of capture. The population of juvenile trout in the Fish Creek drainage was estimated based on available habitat in fish-bearing reaches. This was calculated as the product of wetted width during the summer low flow period and reach length (Appendix 5-3-A from the March 2009 EIS/Application) and mean, age-specific Rainbow Trout densities (fish/m2 and g/m2) for specific sites within sampled reaches.

Lower Fish Creek (Reaches 1, 2 and 3)

Rainbow Trout, Bull Trout and Chinook Salmon were captured by electrofishing effort in lower Fish Creek (Triton, 1996, 1997; Appendix 5-3-A from the March 2009 EIS/Application), as shown in Table 2.6.1.5-4. During fence operations in 1997, these species as well as Mountain Whitefish and White Suckers were also captured in lower Fish Creek.

Table 2.6.1.5-4 Summary of Fish Density (fish/m^2) by Reach, Species and Age in Lower Fish Creek

Reach	Rainbow Trout				Other Species		Reach Total
	Age 0+	Age 1+	Age 2+	Age 3+	Chinook	Bull Trout	
1	0.52	0.03	0.00	0.00	0.00	0.00	0.55
2	0.16	0.04	0.03	0.01	0.06	0.003	0.30
3	0.14	0.03	0.03	0.03	0.00	0.00	0.23

The Chinook juveniles and one Bull Trout captured from Reach 2 would have migrated into the creek from the Taseko River.

Middle and Upper Fish Creek

Rainbow Trout relative abundance and/or habitat surveys were conducted at 18 mainstem, seven creek tributary and nine lake tributary sites in the middle and upper Fish Creek drainage during the 1996 and 1997 July–September field seasons (Appendix 5-3-A from the March 2009 EIS/Application). Age-specific Rainbow Trout densities and relative abundances were calculated for fish-bearing mainstem reaches and Fish Lake Tributary No. 1 (Table 2.6.1.5-5). Relative abundances were also calculated for fish-bearing tributary reaches not sampled for fish presence during 1996 and 1997 studies. Those tributary reaches were determined to be fish-bearing based on accessibility to known mainstem or lake fish-bearing reaches and habitat availability during the summer critical flow period (CSFP). Fish abundance calculations for the non-sampled tributary reaches used the same density as that determined for the only tributary sampled for fish presence (Fish Lake Tributary No. 1; 1.58 age 0+ Rainbow Trout/m^2 habitat).

Table 2.6.1.5-5 Relative Abundance of In-stream Rainbow Trout in Middle and Upper Fish Creek

Reach	Rainbow Trout Density (fish/m^2)[1]				Wetted Channel Area During CSFP (m^2)	Rainbow Relative Abundance (fish)				
	Age 0+	Age 1+	Age 2+	Age 3+		Age 0+	Age 1+	Age 2+	Age 3+	Total (all ages)
4	1.75	0.05	0.01	0.00	4,876	8,533	244	49	0	8,826
5	2.34	0.19	0.03	0.01	11,274	26,381	2,142	338	113	28,974
6	0.74	0.14	0.00	0.00	3,141	2,324	440	0	0	2,764
8	4.78	0.05	0.00	0.00	5,387	25,750	269	0	0	26,019
Totals					**24,678**	62,988	3,095	387	113	**66,583**
Middle Fish Creek Trib. No. 2	1.58	-	-	-	761	1,202	N/A	N/A	N/A	1,202
Fish Lake Trib. No. 1	1.58	0.00	0.00	0.00	3,346	5,287	N/A	N/A	N/A	5,287
Fish Lake Trib. No. 3	1.58	-	-	-	345	545	N/A	N/A	N/A	545
Totals:	N/A	N/A	N/A	N/A	**4,452**	7,034	N/A	N/A	N/A	**7,034**
Grand Totals	N/A	N/A	N/A	N/A	**29,130**	70,023	3,095	387	113	**73,617**

NOTES:
[1] Densities represent multiple site capture averages

SOURCE:
Modified from Triton 1999a. Fish Creek Fish and Fish Habitat Surveys (summer 1996 and 1997)

Based on age-specific densities and available habitats during the critical stream flow periods, Rainbow Trout relative abundance in the middle and upper Fish Creek watershed was roughly estimated at 73,600 fish, the majority of which (96%) are young-of-the year (age 0+ years). Ages 2 and 3+ Rainbow Trout were found to be most abundant in mainstem Reach 5. Collectively, Reaches 5 and 6 support the majority (75%) of Rainbow Trout stream production in the Fish Creek watershed.

FISH POPULATIONS AND MARK-RECAPTURE AND SPAWNER ENUMERATION STUDIES

Fish Lake

Results from a hydroacoustic survey of Fish Lake conducted by BioSonics Inc. during August 1995 were determined by review agencies to be biased and likely underestimated the Rainbow Trout population in Fish Lake, due in part to the inadequacy of using sonar over shallow shoal areas consequently the results from this study are not reported in this EIS. Triton conducted a review of alternative methods for estimating the Fish Lake Rainbow Trout population and selected the single-census, Petersen mark-recapture methodology (Chapman's version; Ricker, 1975) as appropriate.

The mark-recapture method was used in 1997 to estimate the number of sub-adult (2–3 year old) and adult (4–6 years old) Rainbow Trout in the lake. Juvenile (1–2 year old) trout were not captured due to the mesh size of fish traps used to capture fish and the associated escape potential. As such, the total population was estimated by combining the sub-adult and adult populations estimated during the study with inlet and outlet fence counts of one-year old stream emigrants determined in previous studies conducted by Triton in 1996 and 1997 (Appendix 5-3-B from the March 2009 EIS/Application).

Two recapture phases were conducted: one in late July and August and one in September. A higher ratio of marked to unmarked fish during the first recapture phase was due to the reduced activity of the trout following marking, making them harder to recapture. Triton based the population estimate on the second recapture phase to eliminate a biased population estimate. The adult and sub-adult population in Fish Lake was estimated to be 49,057 with 95% confidence limits of 32,097 (-35%) and 82,014 (+67%) (Table 2.6.1.5-6). The wide range in confidence limits is largely the result of the decision to use only the second recapture phase.

Table 2.6.1.5-6 Life Stage-specific Population Estimates of Rainbow Trout in Fish Lake 1997

Sub-population	Juveniles	Sub-adults	Adults	Combined
Length Range (mm)	**(70–139)**	**(140–229)**	**(230–330)**	**(140–330)**
Initial number marked (M)	441	757	861	1,618
Marked after 24 hours (M)[a]	406	696	792	1,489
Length Range (mm)	**(70–139)**	**(140–229)**	**(230–330)**	**(140–330)**
Total number examined in second recapture phase (C)	397	319	235	554
Recaptured in second recapture phase (R)	0	9	6	15
R/C ratio	–	0.028	0.026	0.027
Population (N)	–	22,318	26,739	49,057
Lower 95% confidence limits	–	12,318	13,270	32,097
Upper 95% confidence limits	–	39,004	50,123	82,014

NOTE:
[a] Based on 92% survival; losses due to angling were assumed to be negligible.

SOURCE: Appendix 5-3-B from the March 2009 EIS/Application.

Based on juvenile trout captures during fence operations and adult and sub-adult mark-recapture efforts, the Fish Lake Rainbow Trout population was estimated at 85,178 individuals consisting of 36,121 juveniles, 22,318 sub-adults and 26,739 adults.

As part of the Project's baseline assessment of Fish Lake, Triton also conducted a Rainbow Trout spawner enumeration and migration study during the ice free periods of 1996 and 1997 (Appendix 5-3-D from the March 2009 EIS/Application). During the 1996 study, problems with maintaining the integrity of the fish fences occurred, and there was an absence of data for early Rainbow Trout migrants prior to ice break up (Appendix 5-3-B from the March 2009 EIS/Application).

These issues were addressed and rectified in the 1997 study (Appendix 5-3-D from the March 2009 EIS/Application). Fish capture methods for the 1997 study were similar to those used in 1996. An enumeration fence was installed and operated by Triton during the ice-free period of 1997 (May to August) at the inlet and outlet of Fish Lake. The primary objective of the fences was to determine the timing and magnitude of the Rainbow Trout spawning migration, as well as juvenile recruitment into Fish Lake. Meristic data (age, weight, length and fecundity) were also collected from individuals captured at the fences. The fish fence at the inlet operated from May 13 to August 15, 1997, and the outlet enumeration fence was in place from May 12 to August 29, 1997.

Prior to ice break-up in 1997, underwater video cameras were installed at both the inlet and outlet to Fish Lake near the eventual locations of each fence to enumerate early Rainbow Trout migrants. The cameras were left in place for a short period after the installation of the fences as a means of verifying the accuracy of fence counts. The camera at the inlet to Fish Lake was in operation from May 3 to 14, 1997. The camera at the outlet operated from April 20 to May 14, 2007 (Appendix 5-3-D from the March 2009 EIS/Application).

In total, 4,593 Rainbow Trout spawners were recorded migrating through the inlet into upper Fish Creek. Most of the migration took place between May 6 and June 6, 1997. A total of 10,148 adult Rainbow Trout was observed migrating through the outlet into Fish Creek during the 1997 study period. Most of the downstream migration occurred between May 7 and 29, 1997. The rate of migration was strongly and positively correlated with increased discharge and water temperature between 10 and 13°C.

In total, 5,562 juvenile Rainbow Trout were recorded moving into Fish Lake at the inlet fence and 12,624 at the outlet fence during the 1997 study period. Eighty percent of the juvenile migration at the inlet took place between June 11 and July 10, 1997 and between June 9 and July 22, 1997 at the outlet. Detailed descriptions of study methods and results are provided in the original reports.

Fish Creek Watershed Rainbow Trout Population Characteristics

The Fish Lake and Fish Creek Rainbow Trout population was estimated at 164,945 individuals of which about 85,000 reside in Fish Lake (Table 2.6.1.5-7). The total population consists of age classes 0 to 6+ year old fish. Based on this population estimate, mean fish weight (mass) by life-stage (juvenile, sub-adult and adult fish) and Fish Lake surface area, fish production is estimated in Fish Lake at 24.1 kg/ha/y.

Table 2.6.1.5-7 Summary of Fish Creek Watershed Lake and Stream Rainbow Trout Population Characteristics during the 1996–1997 Period

Population Characteristic	Fish Lake	Little Fish Lake[1]	Fish Creek and Lake Tributaries[2]
Rainbow Trout population	85,000	5000	74,945
Age distribution	2+–6 yrs	2+–6 yrs	0+–3 yrs
Size distribution	140–345 mm	130–274 mm	24–210 mm
Mean fish density (biomass)	41.6 kg/ha	41.6 kg/ha	1.18–5.90 g/m^2
Productivity	24.1 kg/ha/y	24.1 kg/ha/y	
Fence Captures of adults (>100 mm) RB (1997)			
Fish Lake inlet spawners			4,422
Fish Lake outlet spawners			10,317

NOTES: [1] Little Fish Lake values are estimated based on Fish Lake population characteristics. [2]Fish Creek and Fish Lake tributary populations include 73,617 Rainbow Trout from upper and middle Fish Creek and 1328 Rainbow Trout from lower Fish Creek; (6 bull trout and 120 chinook juveniles were also captured from lower Fish Creek (not included in table).
SOURCES: Appendices 5-3-A, 5-3-B and 5-3-D from the March 2009 EIS/Application.

Additional Lake Studies

As part of the 1993–1998 baseline fish and fish habitat studies, lake surveys and limnological studies were completed in Fish, Little Fish, Big Onion, Little Onion, Wasp, Slim, Vick, Rat Cabin North and Rat Cabin South lakes (Appendix 5-3-C from the March 2009 EIS/Application). Basic limnology studies were also carried out by Hallam Knight Piésold Ltd. (HKP) between 1993 and 1995. Details of these studies are provided in the original reports (refer to Table 2.6.1.5-1).

Fish sampling methods included the deployment of gill nets, baited minnow traps and lake traps, and angling (Appendix 5-3-C from the March 2009 EIS/Application). Gill net and minnow trap sampling methods followed those outlined in the British Columbia Field Sampling Manual (Clark, 1996). The results of the lakes physical habitat study are summarized in Table 2.6.1.5-8.

The collected baseline data characterizes Fish Lake in the context of other lakes in the RSA, both in terms of fish species present and water quality parameters. Baseline data was also used to determine the potential of these lakes as opportunities for compensation or mitigative purposes.

Table 2.6.1.5-8 Summary of Physical Habitat Data from the Prosperity Gold-Copper Project: Lakes Physical Habitat Study

Property	Fish Lake	Little Fish Lake	Big Onion Lake	Little Onion Lake	Wasp Lake	Slim Lake	Vick Lake	Rat Cabin Lake (south)	Rat Cabin Lake (north)
BGC zone	SBPSxc	SBPSxc/MSxv	SBPSxc	SBPSxc	MSxv	SBPSxc	SBPSxc	SBPSxc	SBPSxc
Elevation (m)	1,457	1,527	1,327	1,417	1,557	1,347	1,332	1,425	1,427
Drainage area (ha)	6,490	1,470	1,410	380	310	500	1,000	5,462	5,190
Surface area (ha)	111	6.6	63.4	7.5	67.9	28.7	12.1	28.4	30.4
Volume (m^3)	4,438,446	133,280	1,493,375	160,090	1,611,120	1,611,000	237,000	276,800	491,267
Shoreline perimeter (m)	11,756	1,300	9,115	1,729	6,907	3,704	2,346	4,144	2,856
Shoal area (ha)	83.5	6.6	57.8	7.4	67.9	1.3	12.1	28.4	30.4
Max. depth (m)	13	4.4	12	6.2	5.4	14	4.3	2.7	5.5
Mean depth (m)	4	2	2.4	2.1	2.4	5.6	2	1	1.6
Lake length (m)	2,050	560	2,590	685	1,600	775	800	1,160	1,060
Mean breadth (m)	541	118	245	110	424	370	152	245	287
Secchi depth (m)	>10	4	–	–	5	NA	NA	3	3
Shoreline development index	3.15	1.43	3.23	1.78	2.36	1.95	1.90	2.19	1.46
No. of inlets	10	3	3	1	1	2	2	1	1
No. of outlets	1	1	1	1	1	1	1	1	1
No. of islands	5	0	0	0	0	0	0	1	0
Perimeter of islands (m)	1,700	NA	NA	NA	NA	NA	NA	NA	NA
Estimated annual water fluctuation (m)	–	–	0.3	0.4	0	–	–	0.3	0.3
Fish presence	Rainbow Trout	Rainbow Trout	stocked with Rainbow Trout in	no	no	stocked with Rainbow Trout in	stocked with Rainbow Trout in	Rainbow Trout	Rainbow Trout

Property	Fish Lake	Little Fish Lake	Big Onion Lake	Little Onion Lake	Wasp Lake	Slim Lake	Vick Lake	Rat Cabin Lake (south)	Rat Cabin Lake (north)
			1996 and 1998			1996 and 1998	1996 and 1998		
NOTE: NA—data not available									
SOURCE: Appendix 5-3-C from the March 2009 EIS/Application.									

Fish Lake Rainbow Trout Fishery

Fish Lake supports recreational and Aboriginal fisheries (Triton, 1998; J. Lulua, Nemiah Band, 2006, pers. comm.). Data for the Fish Lake Rainbow Trout recreational fishery are summarized in Table 2.6.1.5-9. Annual recreational fishing effort ranged from 388 to 548 angler-days with a total annual harvest of 4100–4900 Rainbow Trout. Table 2.6.1.5-10 provides a summary of the creel surveys and aerial boat counts conducted in 2006.

Table 2.6.1.5-9 Summary of the Fish Lake Rainbow Trout Recreational Fishery during 1993–1997

Fishery	Fish Lake	Little Fish Lake	Fish Creek and Lake Tributaries
Recreation site/road access	Yes/4x4	No/ATV	No/ATV
Annual angler-days	388–548	NA	NA
Annual mean catch/h	2.7–2.9	NA	NA
Annual total fish captured	4100–4900	NA	NA
Size range (FL [mm])	200–300[a]		
NOTE: [a] Retained by anglers.			
SOURCE: Appendix 5-3-J from the March 2009 EIS/Application.			

Table 2.6.1.5-10 Summary of the Modified Fish Lake Creel Survey and Aerial Boat Counts during 2006

Date	Interview No.	No. of Anglers	No. of Rods	Hours Fished	Rod-Hours	Trout Kept	Trout Released	Total CPUE (fish/rod-hour)	Boat Count
May 13	survey not completed								0
May 20	survey completed (no anglers)								0
May 27	survey not completed								3
Jun 3	survey not completed								1
Jun 10	survey not completed								1
Jun 17	survey not completed								1
Jun 18	1	2	2	8	16	5	22	1.69	0
Jun 18	1	2	2	2	4	0	11	2.75	
Jun 18	2	5	5	8	40	33	10	1.08	
Jun 24	survey not completed								2
Jul 1	survey not completed								4
Jul 2	survey not completed								3
Jul 15	survey completed (no anglers)								0

Date	Interview No.	No. of Anglers	No. of Rods	Hours Fished	Rod-Hours	Trout Kept	Trout Released	Total CPUE (fish/rod-hour)	Boat Count
Aug 6	1	1	1	1.5	1.5	0	10	6.67	2
Aug 6	2	2	2	3	6	7	30	6.17	
Aug 6	3	1	1	1	1	0	0	0.00	
Aug 6	4	2	2	1.5	3	7	10	5.67	
Aug 12	survey not completed								0
Aug 19	survey completed (no anglers)								0
Aug 26	survey not completed								3
Sept 3	1	2	2	4	8	10	4	1.75	2
Sept 3	2	2	1	4	4	1	1	0.50	
Sep 16	survey not completed								0
Totals/ Mean			18	33	83.5	63	98	1.93	22

NOTE:
Boat counts were conducted between 10:30 and 11:30 on survey dates.
SOURCE: Appendix 5-3-L from the March 2009 EIS/Application.

Angler catch per unit effort (CPUE) effort included 161 Rainbow Trout caught in 83.5 rod-hours or 1.93 trout/rod-hour. Mean catch-per-unit-effort was approximately 30% lower than the mean annual catch rates determined during previous studies (2.7 to 2.9 trout/rod-hour). This finding may be the result of the relatively small sample size.

Aerial boat counts of Chilcotin Region lakes were conducted during 2007 by White Saddle Air Service Ltd. The maximum number of boats (all types) observed at Fish Lake during the 2007 overflights occurred on June 30 (four boats), similar to the maximum observed on the July 1 weekend in 2006 (four boats). However, while 22 boats were observed for the total survey time on Fish Lake in 2006 (ranked eighth highest), only nine boats were counted over the same study period May 13 to September 16 in 2007 (ranked seventh highest).

A comparison of boats enumerated on the Region 5 Chilko Circuit lakes during 2006 and 2007 is shown in Figure 2.6.1.5-2. Overall, fishing effort on the survey lakes declined by 36% between 2006 (479 boats observed) and 2007 (308 boats observed; Appendix 5-3-L from the March 2009 EIS/Application). During both years, Horn, Chaunigan, Bluff, Cochin, Sapeye and Big Onion lakes supported the most boats. The general decrease in the number of boats on survey lakes between 2006 and 2007 may be related to a decline in angler interest in those lakes, and/or the cold, wet spring-summer weather during 2007 acted as a deterrent (S. Rimmer, MOE pers. comm., 2007).

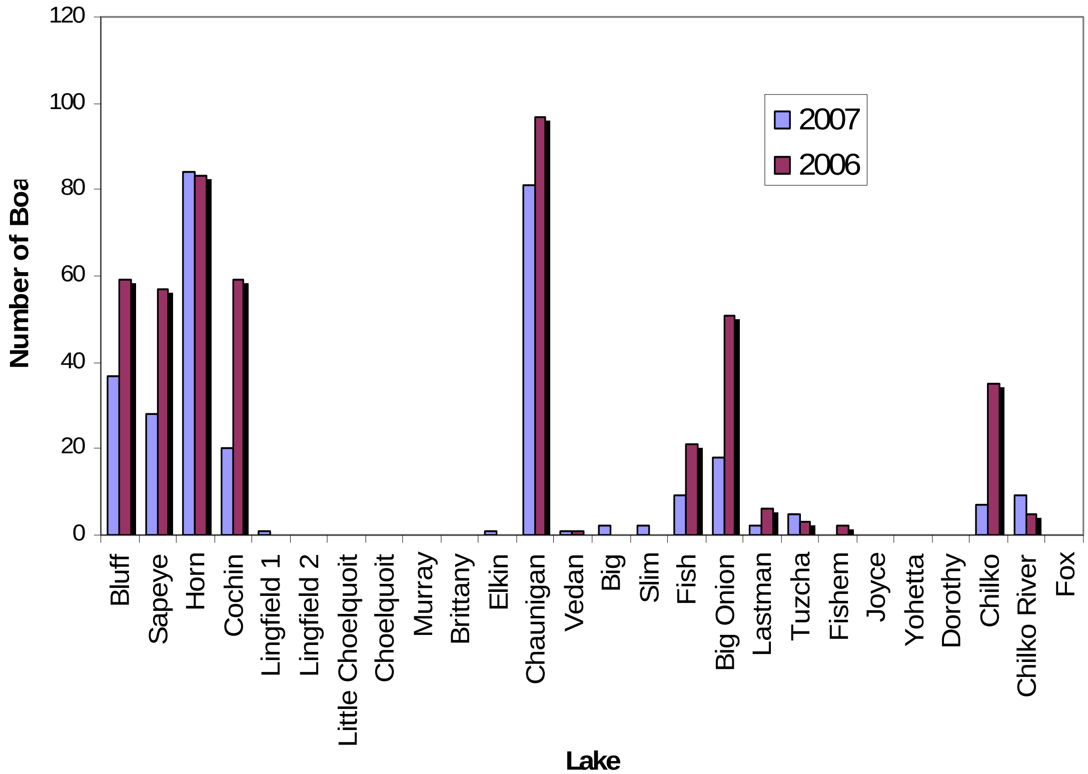


Figure 2.6.1.5-2 Chilko Circuit Boat Counts, 2006 and 2007

Fish and Fish Habitat Inventory at Road Stream Crossings (Appendix 5-3-K)

Fish and fish habitat surveys were conducted at 64 sites associated with the existing Taseko Lake and Branch 4500 roads and the proposed new 2.8 km access road stream crossing sites between July 16 and July 21, 2006. Thirty-three sites (52%) were located in the Haines Creek drainage and 31 sites in the Tête Angela drainage (48%).

Forty-seven of the 64 mapped stream crossings associated with the existing roads, new road construction or upgrading in Fish, Tête Angela, Haines and Minton creek watersheds are classified as no visible channel (NVC) or non-classified drainages (NCD) as defined in the *Fish Stream Identification Guidebook* (MOF, 1998 v.2.1). Nine stream crossings were classified as fish-bearing (S1–S4) as confirmed in-field or inferred by direct connectivity to downstream fish-bearing reaches (Table 2.6.1.5-11). In many cases, streams with inferred fish presence contained fragmented habitat in which rearing, spawning and overwintering habitats were isolated during the late summer low flow period.

Table 2.6.1.5-11 Summary of Stream Habitat Quality and Species Presence (Confirmed and Inferred) at Existing and Proposed Fish-Bearing Road Stream Crossings 2006

Site No.	UTM Zone	Easting	Northing	Creek Name	Species Captured (Inferred)	Stream Class	Habitat Comments
275	10	457788	5704281	Unnamed	Inferred fish presence due to unobstructed connectivity with fish-bearing areas downstream	S4	Poor; limited flows at centerline; better habitat downstream; good cover
271	10	457198	5706014	Unnamed	Inferred fish presence due to unobstructed connectivity with fish-bearing lake downstream	S4	Poor; intermittent flows at time of survey; large channel morphology with good cover at higher water levels
267	10	456809	5707957	Unnamed	Inferred fish presence due to unobstructed connectivity with fish-bearing areas downstream	S4	Moderate; deeply incised channel in mossy forest floor; intermittent flows at time of survey; good cover
265	10	456354	5711432	Unnamed	Inferred fish presence due to unobstructed connectivity with fish-bearing areas downstream	S4	Poor; Creek consists of intermittent pools and scoured channel separated by mossy sections of forest floor; intermittent and dry creek with low fish value

Site No.	UTM Zone	Easting	Northing	Creek Name	Species Captured (Inferred)	Stream Class	Habitat Comments
262	10	454425	5715098	Unnamed	Dry channel; no barriers observed downstream though high gradients may inhibit fish passage; inferred fish presence	S4	Poor; creek becomes much steeper downstream from road centre line (15–20%); in a steep ravine upstream from road centre line (approximately 50 m) channel becomes dendritic and discontinuous in a small wetland
217	10	454774	5726384	Tête Angela Creek	Rainbow Trout captured	S1	Good; good spawning substrates; cover in slower moving back channels and side channels
213	10	459912	5731635	Haines Creek	Rainbow Trout captured	S2	Good; fish captured; numerous fish congregated near culvert; replacement of culvert with a bridge would enhance habitat
200	10	483402	5748221	Minton Creek	Rainbow Trout captured	S2	Good; excellent flows for summer low period; spawning substrates and good cover in slow moving edgewater
183		493905	5751428	Unnamed	Inferred fish presence; no known barriers downstream	S4	Moderate; marshy area at centerline; no discernible channel; channel becomes defined DS of centerline; appears to drain agricultural area US of crossing

Haines Creek

An existing dam on Tête Angela Creek re-directs the majority of Tête Angela Creek flows into the Haines Creek watershed through a diversion channel and a series of berms. This diversion system, originally developed for downstream irrigation purposes, is currently under MOE management for downstream recreational lake fisheries enhancement purposes via a Water License under the Water Act. The lakes and mainstem areas downstream from this diversion currently contain monoculture, self-sustaining populations of Rainbow Trout which are connected only during periods of high flow or spring freshet.

One stream site sampled immediately upstream from the culvert crossing at the Taseko Lake Road in the upper reaches of Haines Creek found numerous Rainbow Trout ranging in size from 40 to 55 mm. A channelized wetland area upstream from the road crossing provides good rearing and overwintering opportunities for young Rainbow Trout. Some suitable substrates and adequate low summer flows provide moderate spawning potential and rearing habitat.

Minton Creek

Minton Creek provides spawning habitat for Chinook Salmon in the lower 2.5 km of the mainstem and an abundance of spawning, rearing and overwintering habitat for Rainbow Trout (MOE, 2007). Most unobstructed, low-to-moderate gradient tributaries to Minton Creek likely support Rainbow Trout. Fletcher Lake, in the upper areas of the Minton Creek watershed which receives enhanced flows from Big Creek, supports a confirmed population of Rainbow Trout. Five impoundments with fish ladders, established to provide downstream irrigation flows, are distributed throughout a 10-km section immediately downstream from Fetcher Lake. Although Chinook Salmon were historically known to frequent this section of the Fletcher Creek watershed, the current wetland/shallow lake impoundments would likely not contain preferred habitat for juveniles of this species.

One site sampled at the Taseko Lake Road concrete bridge spanning the creek approximately 7 km upstream from its confluence with the Chilcotin River had Rainbow Trout present and good rearing habitat with excellent cover downstream of the bridge and upstream in a channelized wetland. Good spawning habitat was also observed at the road crossing site. The stream flows were very good for the late fall dry season, representing the highest water flows observed of all road sites visited in July 2006.

Tête Angela Creek

A percentage of flow from Tête Angela Creek is diverted to augment flows in the upper reaches of Haines Creek watershed. Rainbow Trout have been observed throughout the Tête Angela watershed, which provides abundant spawning, rearing and overwintering habitat throughout.

Rainbow Trout were observed at the Taseko Lake road site crossing, as well as in the Tête Angela headwater lake. Good rearing habitat was observed in back and side channels downstream from the road crossing. Moderate spawning habitat exists, though reduced flows due to the upstream diversion may limit spawning potential.

Recent Studies

Triton recently undertook two studies to gather additional baseline data regarding Rainbow Trout distribution and location of fish migration barriers in tributaries to Fish Lake, and to collect preliminary data for the Rainbow Trout habitat suitability index (HSI) study component in Upper Fish Creek. Data were collected during a summer high flow period in July 2011 to assess habitat and discharge conditions in upper Fish Creek (Reach 8) and in Fish Lake Tributary 1 that would roughly equal that which is typically available during the May-June Rainbow Trout spawning period. These data were intended to supplement/support the September 2011 companion study that assessed Rainbow Trout spawning habitat suitability in Reach 8 of Upper Fish Creek. The results of this study are described in the Triton Report (Appendix 2.6.1.5-A) and are summarized below.

The summer, 2011 field program was completed during a high flow period in July to determine the maximum possible extent of fish distribution in upper Fish Creek (Reach 8), Fish Lake Tributaries 1, 2 and 3, and in Middle Fish Creek Tributary 1 (Appendix 2.6.1.5-A). Fish presence sampling was conducted in these tributaries upstream and downstream from known or suspected barriers to fish passage. Fish Lake Tributary 1 and Tributary 3 were determined to be fish bearing for 2.1 km and 400 m respectively, upstream from Fish Lake. Tributary 2 was determined to be non-fish bearing as this drainage is comprised of isolated marsh areas only and sampling efforts did not produce any fish. Middle Fish Creek Tributary 1 drains into a swamp with no continuous connecting channel to Fish Creek. Fish were not captured nor observed in this tributary and as such are considered non-fish bearing above the wetland area.

Due to the lack of surface flow in Tributary 1 upstream from Tributary B2B confluence, during the high water period the Notice of Work (NoW) site which is located about 2.7 km upstream from the confluence, is considered non-fish bearing. No permanent fish passage barriers were observed in the initial 1.5 km upstream from Fish Lake. The Notice of Work (NoW) site on a small unnamed tributary to upper Fish Creek was not sampled but is considered non-fish bearing due to its small catchment area compared to the larger catchment areas of other non-fish bearing reaches in Fish Lake watershed.

In early February, 2012, Triton conducted a fisheries assessment in upper Fish Creek, Fish Lake Tributary 1 and at the outlet to Fish Lake to determine fish use and habitat availability during winter (Appendix 2.6.1.5-B). Water depth and basic water quality parameters were also measured at each site. Fish sampling methods consisted of the use of overnight sets of baited minnow traps set in ice-auger holes at potentially deep pool habitats in those tributaries.

As shown in Appendix 2.6.1.5-B, upper Fish Creek (Reach 8) is predominantly dry throughout the winter and does not support an overwintering population of Rainbow Trout. The largest of the beaver ponds in Reach 8 (upper Fish Creek) was frozen surface-to-substrate. At several other locations where water depth was sufficient to set a minnow trap, (e.g. greater than 30 cm), no fish were captured. Other sites were less than 30 cm and could not accommodate a minnow trap. These shallow water sites were often associated with fines/organic substrates with hydrogen sulphide odor.

Rainbow Trout were captured in Fish Lake Tributary 1, at the confluence B2B tributary, indicating some overwintering in the lower reaches of this tributary. The channel, including the major beaver impoundment upstream from the B2D confluence was frozen surface-to-substrate or dry at the time of investigation.

SUMMARY OF EXISTING CONDITIONS

Lower Fish Creek (anadromous section) provides 16,371 m^2 of intermittent (Reach 1) and continuous flow habitat (Reaches 2 – 3) and supports small populations of Rainbow Trout, Chinook Salmon, Bull Trout, Mountain Whitefish and White Sucker. Middle and Upper Fish Creek (non-anadromous; Reaches 4 – 10, tributaries Fish and Little Fish Lake) provides 159,071 m^2 of ephemeral, intermittent and continuous stream habitat and 117 ha of lake habitat. Middle and Upper Fish Creek supports a self-sustaining monoculture population of Rainbow Trout with about 85,000 residing in Fish Lake, 5,000 in Little Fish Lake and 73,600 individuals utilizing available stream mainstem and tributary habitats. Rainbow Trout utilizing lake habitats range in age from 2+ to 6 years; age 0+ to 3+ year old Rainbow Trout utilize stream habitats.

Fish Lake supports up to 548 recreational angling days with up to 4,900 fish caught annually ranging in size from 20 to 34 cm. The LSA also includes portions of the Beece Creek watershed (including the non-fish bearing Wasp Lake), and Big Onion Lake which historically supported a quality Rainbow Trout fishery.

The RSA has a large number of large and small lakes with both self-sustaining monoculture Rainbow Trout and multi-species populations, and lakes containing hatchery-released Rainbow Trout. Collectively, these lakes provide a range of recreational fishing opportunities based on access, stocking rates and recreational experience. The Taseko and Chilcotin rivers contain valuable stocks of commercially important salmon and resident populations of recreationally important fish species.

Sixty-four stream crossing sites associated with the existing Taseko Lake and Branch 4500 roads and the proposed new 2.8 km access road stream were assessed for fish bearing status. Nine stream crossings were classified as fish-bearing (S1–S4) as confirmed or inferred by direct connectivity to downstream fish-bearing reaches.

Rainbow Trout distribution studies conducted in Fish Lake tributaries in summer 2011 and winter 2012 confirmed previously identified fish migration barriers (Appendix 5-3-A from the March 2009 EIS/Application). Upper Fish Creek (Reach 8) does not support overwintering Rainbow Trout, while Reach 1 in Fish Lake Tributary 1 does.

BASELINE CONDITIONS FOR AQUATIC ECOLOGY

Sediment, periphyton, and benthic invertebrate characteristics of Fish Creek and other streams, as well as plankton communities of lakes, in the RSA have been studied since 1992. In 2006, a gap analysis of previous published and unpublished Project reports was conducted to assess completeness of datasets, compliance with the PRS and relevance to conditions a decade after historic data collection (JWA, 2006). The following sources of information were reviewed, with methods and results for all work conducted since 1992 presented in a Technical Data Report (Appendix 5-2-A from the March 2009 EIS/Application):

- Programs conducted by Hallam Knight Piesold Ltd. between 1992 and 1997, and
- A program conducted by Triton Environmental Ltd. in 1997 and 1998.

The gap analysis identified the considerable amount of baseline sediment and aquatic community data already obtained for Fish Creek and surrounding water bodies, most of which is still relevant to current standards. The body of work was distinguished as pre-PRS (1992 to 1996) and post-PRS (1997 onward), as the PRS defined sampling sites and methods based on regulatory input. Methods used in 1997 and 1998, in particular, were consistent with the PRS and data quality (field and laboratory) was high, for the most part. Some gaps were identified, including:

- Differences in some data quality standards between the pre- and post-PRS work, with the earlier work having higher detection limits for many metals and periodic exceedance of recommended sample hold times for some nutrient parameters, and
- Minor differences such as analysis of total organic carbon rather than dissolved organic carbon, with the latter more relevant to assessment of metal toxicity.

Although the extensive database was considered to adequately reflect conditions up to 1998, there have been changes in the watershed related to logging of trees infested with mountain pine beetle. In addition, the selection of a preferred mine option and design have led to a more precise definition of sampling sites useful for assessing effects and for providing reference area data.

Methods, detection limits and endpoints were consistent with the PRS and 1997–1998 studies. The 2006 baseline assessment focused on four sites in Fish Creek, three in the Taseko River, one on the Big Onion lake system, and one on lower Tête Angela Creek (to provide a regional reference site for future monitoring programs). An additional year of data (water, biological communities) from Fish Lake prior to mine start-up, as required in the PRS, was also included.

An additional season of sediment and aquatic biota data has been collected for Wasp Lake (north and south basins) and Big Onion Lake between May and October 2008, to better characterize these lakes.

OVERVIEW OF BASELINE

Details of the numerous baseline studies completed by Taseko on sediment, periphyton, benthic invertebrates and lake communities are summarized in Appendix 5-2-A from the March 2009 EIS/Application. The Appendix provides detailed information about methods, site locations, quality assurance/quality control measures and results. The approach and results are briefly summarized in this assessment to provide a general description of baseline conditions.

A total of 24 stream and 13 lake sites have been sampled at various times since 1992. Stream and lake sites are shown on Figure 2.6.1.5-3 and described in Table 2.6.1.5-11 and Table 2.6.1.5-12. Most, if not all, of the streams and lakes are considered to be in undisturbed wilderness, with limited influence from human activities such as ranching, logging and recreation.

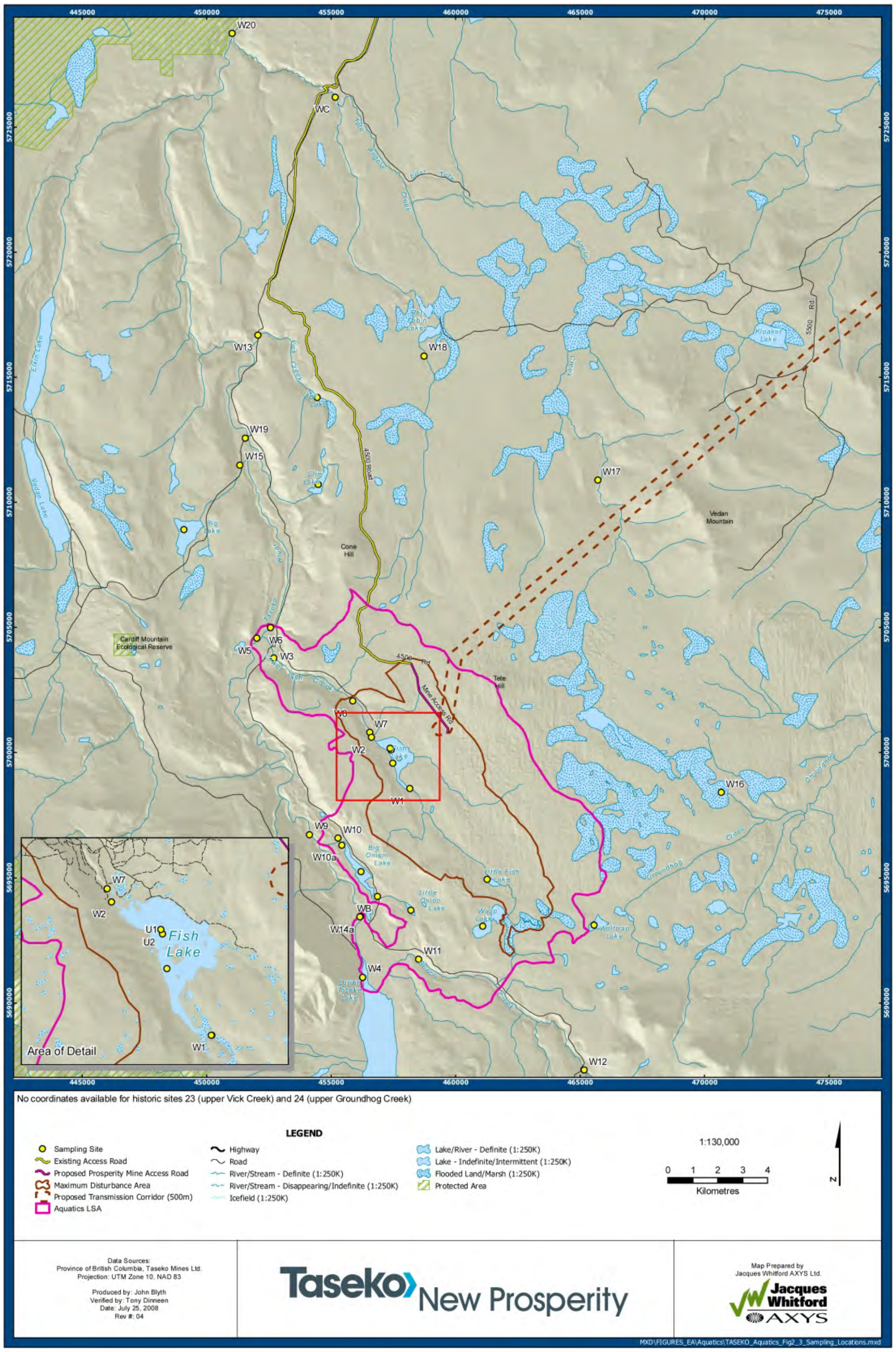


Figure 2.6.1.5-3 Stream, River and Lake Sampling Sites in the Project Study Area (1992–2006)

At the time the PRS was finalized, the alternatives assessment process was underway and a final Project design had not been confirmed. As a result, the PRS included requirements for sampling at sites that would be directly or indirectly affected by Project activities using a number of Project designs, or provide regional reference information for long term monitoring. In the intervening years, the alternatives assessment has been completed, the mine plan defined and the EIS Guidelines issued. Consequently, the number of sites that need to be considered in this assessment has been reduced. Where helpful, reference to data from sites no longer relevant to the Project design has been made. For clarity, the figures and tables provide the reader with basic information about all the sites.

Table 2.6.1.5-12 New Prosperity Project Sampling Program Outline–Streams and Rivers, 1992–2006

Sampling Location		Rationale	Number of Samples		
			Sediment	Periphyton	Benthic Invertebrates
W1	Fish Creek at inlet to Fish L.	Directly affected by Project development	16	16	16
W2	Fish Creek at outlet of Fish L.	Directly affected by Project development	21	21	27
W3	Fish Creek, 1.2 km upstream of Taseko R.	Potential effects downstream of the Project	21	21	21
W4	Taseko River at outlet of Taseko L.	Regional reference upstream of Project influence	10	5	5
W5	Taseko River 250 m upstream of Fish Cr.	Reference upstream of confluence with Fish Creek,	21	15	21
W6	Taseko River 530 m downstream of Fish Cr.	Downstream of confluence with Fish Creek–potential effects assessment	21	10	16
W7	Fish Creek upstream of ore body	Affected by Project development (sampled pre-1997)	6	–	–
W8	Fish Creek downstream of ore body	Potential effects downstream of the pit	21	21	21
W9	Taseko River d/s of Big Onion L.	Potential effects–discharge of seepage post-closure	6	6	–
W10	Big Onion Lake outlet, 1990s	Potential effects	–	–	–
W10a	Big Onion Lake foreshore near outlet	Potential effects	–	–	–
W11	Beece Creek upstream of Taseko River	Potential effects	16	10	16
W12	Beece Creek upstream of Project area	Reference site for activities in Beece watershed	16	10	16
W13	Vick Creek downstream of Vick L.	No longer applicable–regional reference	–	–	–
W14a	Taseko River, 2 km downstream of W4	Potential effects from groundwater seepage via Big Onion Lake	11	11	5
W15	Big Lake Cr. (Big Lake outlet)	Sampled once in 1994–regional reference	–	–	–
W16	Groundhog Creek (north arm)	No longer applicable–regional reference	6	–	–
W17	Tête Angela Creek East	No longer applicable–regional reference	16	16	16
W18	Tête Angela Creek West	No longer applicable–regional reference	16	11	11

Sampling Location		Rationale	Number of Samples		
			Sediment	Periphyton	Benthic Invertebrates
W19	Taseko River d/s of Davidson Bridge	No longer applicable–regional reference	10	10	10
W20	Taseko River d/s of Tête Angela Cr.	No longer applicable–regional reference	10	10	10
W23	Vick Creek upstream of Vick Lake	No longer applicable–regional reference	–	–	–
W24	Upper Groundhog Creek	No longer applicable–regional reference	–	–	–
WC	Tête Angela Creek upstream of Taseko R	No longer applicable–regional reference	5	5	5
Total number of samples			**249**	**198**	**216**

Table 2.6.1.5-13 New Prosperity Project Sampling Program Outline–Lakes, 1992–2006

Sampling Location	Rationale	Number of Samples			
		Sediment	Phytoplankton	Benthic Invertebrates	Zooplankton
Fish Lake	Potential effect of Project	11	19	11	16
Little Fish Lake	Direct effect of Project–Loss of the lake	5	11	11	11
Big Lake	No longer applicable - regional reference site	5	10	5	–
Big Onion Lake	Potential Project effects–seepage from mine area	11	11	11	17
Little Onion Lake	No longer applicable–regional reference	5	–	–	–
North Rat Cabin Lake	No longer applicable–regional reference	5	–	–	–
South Rat Cabin Lake	No longer applicable–regional reference	5	–	–	–
Slim Lake	No longer applicable–regional reference	5	11	11	11
Taseko Lake	No longer applicable–regional reference	5	10	5	–
Tête Angela Lake	No longer applicable–regional reference	–	–	–	5
Vick Lake	No longer applicable–regional reference	5	11	11	11
Wasp Lake	Direct effect of Project–Fish Creek watershed water diversion	11	12	11	6
Wolf Trap Lake	No longer applicable–regional reference	–	–	–	–
Total number of samples		**73**	**95**	**76**	**76**

A total of 249 sediment, 198 periphyton and 216 benthic invertebrate samples was collected from streams and rivers in the RSA (Table 2.6.1.5-12). Sampling in lakes has also been extensive, with 73 sediment, 95 phytoplankton, 76 zooplankton and 76 benthic invertebrate samples collected from lakes in the RSA (Table 2.6.1.5-13).

Information about the Big Onion Lake system was obtained by sampling ephemeral inlet and outlet streams and at mid-lake. As a result, data for Big Onion Lake are discussed in relation to the other lakes, rather than streams of the area.

Appendix 5-2-A from the March 2009 EIS/Application provides information about sampling dates and locations for the stream, river and lake sampling programs. The timing and frequency of sample collection generally was as follows:

- Sediment samples were collected in August or September
- Benthic invertebrates and periphyton were collected in August or September
- Phytoplanktons were collected at various times from May through October , and
- Zooplanktons were collected in August.

Baseline conditions for sediment, stream periphyton, stream benthic invertebrates and lake communities are discussed below. Results indicated a range of conditions for streams and lakes within the local and regional study areas.

Metals levels in all the streams studied were within BC and CCME WQG, with few or no exceedances. Exceptions included Fish Creek (iron, total aluminum), Taseko River (total and dissolved aluminum, copper and iron), Beece Creek (total and dissolved aluminum) and Groundhog Creek (iron). Evaluation of cadmium levels was hampered by the low detection limits needed to compare with the current WQG (range of 0.000017 to 0.00005 mg/L, depending on hardness), and historic analytical data with higher detection limits (0.0002 or 0.00005 mg/L).

Nutrient levels and aquatic productivity tended to be higher in Fish Creek and Tête Angela Creek, reflecting the low stream gradients and topography, and lower in Taseko River, influenced by glacier melt, and Beece Creek, reflecting more mountainous terrain.

Given the large dataset, with several correlated parameters, similarities and differences among the stream systems were explored using two statistical tools, Principal Components Analysis (PCA) and discriminant analysis, to assess water quality. PCA was used first to group correlated parameters. It explained 88% of the variability in water quality and identified three principal components (clusters of parameters). The first principal component correlated with alkalinity, total calcium, total dissolved solids, conductivity and hardness; the second, with turbidity, total copper and total aluminum; and the third, with ammonia-N and total nickel (Figure 2.6.1.5-4). Once the redundancy related to correlated parameters was eliminated, a discriminant analysis was performed on the three principal components to examine similarities and differences among the systems. This analysis suggested three groups of streams:

- The Taseko River, which was related to higher levels of aluminum (from glacial silt), copper and turbidity, and lower alkalinity, hardness and concentration of major ions in general than the other streams
- Fish Creek, separated on the basis of higher levels of nutrients (ammonia and ortho-phosphate) and total nickel than the other streams, and
- The remaining streams (Vick, Groundhog, Tête Angela and Beece Creek).

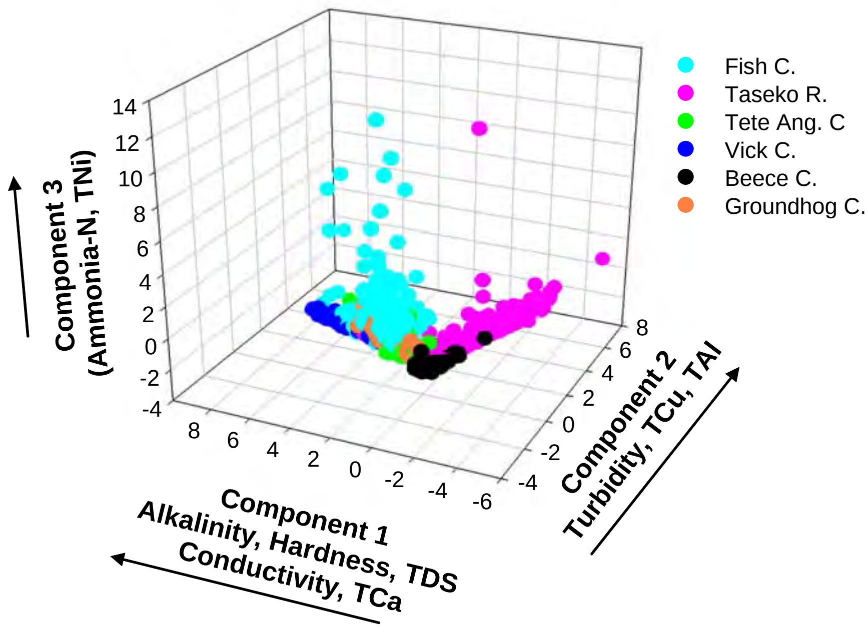


Figure 2.6.1.5-4 **Principal Components Analysis of Water Quality Data for Streams in the New Prosperity Project Area**

Metals levels in sediment of Fish Creek and regional streams were generally within provincial SQG and a few were higher. In Fish Creek, mean levels of cadmium, copper, lead, mercury, selenium, silver and zinc were within BC Least Effect Level (LEL) SQG at all sites; however, levels of arsenic, chromium, iron, nickel, antimony and manganese were higher than LEL SQG. Of these, arsenic was particularly elevated, with more than 50% of measurements greater than the Probable Effects Level (PEL) SQG. Levels of antimony and manganese were elevated in most or all samples. There is no BC or CCME SQG at present for these metals; however, the PRS and the EIS provide guidelines. Concentrations of iron were also above the LEL guideline in almost all samples for Fish Creek. Trends generally were similar for sediment in the other streams and the Taseko River, with levels of arsenic, antimony, iron, nickel and manganese consistently exceeding guidelines in all streams surveyed except Beece Creek.

Multivariate analysis of sediment data was not done because of the wide range of values reported within a system and for sites within a system, making it difficult to distinguish trends. There was higher variability among sites than among habitat types (pool vs. riffle) at a site. Sediment samples from Fish Creek tended to have the highest concentrations of arsenic, chromium, manganese, mercury and TOC among all systems, and sediment from the Taseko River exhibited the highest levels of aluminum and copper.

Differences in metal concentrations between riffle and pool habitats varied from one system to another. In Fish Creek and Taseko River, metal levels tended to be higher in sediment from pool habitats that from riffle habitats. In Tête Angela Creek, metals levels tended to be higher in riffles and in Beece Creek no trend was observed.

Periphyton and benthic invertebrates have been sampled in Fish Creek and area streams over the years. Results indicate moderate to high productivity and diversity, presence of pollution sensitive as well as tolerant species, and the presence of many organisms that provide prey for fish. There are differences from one stream to another, as expected for the range of habitat types and variations in water chemistry. Periphyton samples contained a variety of diatom, green algal and blue-green algal species. Benthic invertebrate samples had high numbers and diversity of species, including insects that provide food for fish (Chironomidae or midges, Ephemeroptera or mayflies, Plecoptera or stoneflies and Trichoptera or caddisflies). Abundance of both periphyton and benthic invertebrates tended to be lower in the Taseko River than in the streams.

2.6.1.6 Terrain and Soil

The proposed Project will result in changes to terrain and soil resources within the immediate area of the Project. This section describes the existing conditions of terrain and soil resources in the Project area.

SCOPE OF ASSESSMENT FOR TERRAIN

This section outlines the scope of the assessment of potential environmental effects of the New Prosperity Project on terrain resources. Terrain is defined by Allaby and Allaby (1999) as “an area of the ground with a particular physical character; an area or region with characteristic geology”. For the purpose of this study, terrain includes landforms, surficial materials, material texture, surface expression, slope and geomorphic processes (as defined by Howes and Kenk 1997).

This assessment has been prepared in accordance with the EIS Guidelines (March 2012), and more general direction provided in the BC Environmental Assessment Office publication, *Mine Proponent’s Guide: How to Prepare Terms of Reference and an Application for an Environmental Assessment Certificate* (EAO 2006). The assessment scope and methods for the Project build on the environmental work completed by Talisman Land Resource Consultants Inc. (Appendices 5-4-A, 5-4-B and 5-4-C in the March 2009 EIS/Application) and by Madrone Consultants Limited (Appendix 5-4-D in the March 2009 EIS/Application).

REGULATORY SETTING

- Applicable regulatory objectives and practice requirements that specifically address terrain resources are found in the following acts:
- *BC Mines Act*—Section 9.7.1 of the *Mines Act* addresses terrain issues and Section 10.1.4(g) identifies terrain-related information that is required for the mine plan and reclamation program, including baseline information requirements. Section 10.7.9 applies to terrain-related reclamation and closure objectives. The *Mines Act* also outlines best management practices for mining activities and outlines the risks to terrain stability. It also provides the necessary steps and information required in the event of slope failures.
- The *Forest and Range Practices Act* (FRPA) provides a legal framework and guiding principles that govern best management practices which may be applicable for mitigating Project-related effects on terrain resources. The main aspect of the FRPA that applies to the Project is the assessment of potential landslide risks. Landslides, following timber removal and road construction, can adversely affect human life and property, water, fish, soil, timber and visual values. In recognition of this risk, the *BC Forest Practices Code* (the Code) established an elaborate system of professional landslide hazard mapping, site assessment and road engineering procedures. Under the new FRPA, the low tolerance for landslide risk continues; specifically the stated objective is the prevention of landslides that will have a material adverse effect on resources and values. The FRPA indicates the primary method of predicting the likelihood of landslides is to conduct geologic investigations of areas proposed for development and complete assessments of the likelihood of post-harvest or road construction related landslides. These investigations, referred to as Terrain Stability Field Assessments (TSFAs), are used to modify and adjust preliminary harvesting and road construction plans to reduce the potential for landslide activity. The general standard of practice for TSFAs is outlined in the Mapping and Assessing Terrain Stability Guidebook (1995/1998).

- EIS Guidelines (March 2012) — the specifications for terrain were established with involvement from federal and provincial agencies, local governments and First Nations.

SELECTION OF KEY INDICATORS

The measurable parameters of the key indicator of terrain stability are:

- Evidence of mass wasting as noted by geomorphic processes, and
- Potentially unstable slopes as measured by slopes over 60%.

BASELINE CONDITIONS FOR TERRAIN

The following section summarizes terrain conditions for the Project area which includes the mine site, transmission corridor and access road. Detailed data generated from the field is included in the descriptions of the mine site and access road. Detailed baseline terrain information on the transmission line collected in 2006 is included in Appendix 5-4-E in the March 2009 EIS/Application, as it was not considered in this assessment. Similarly, no information is provided for the rail load-out facility as Project-related activities will not contribute to mass wasting. All terrain work for this assessment followed the standards set in the Terrain Classification System for British Columbia (Howes and Kenk 1997). Appendix 5-4-G in the March 2009 EIS/Application contains the legend describing the bioterrain symbols used in mapping. All baseline data underwent quality control and the details of the measures in place are outlined in Appendix 5-4-H of the March 2009 EIS/Application.

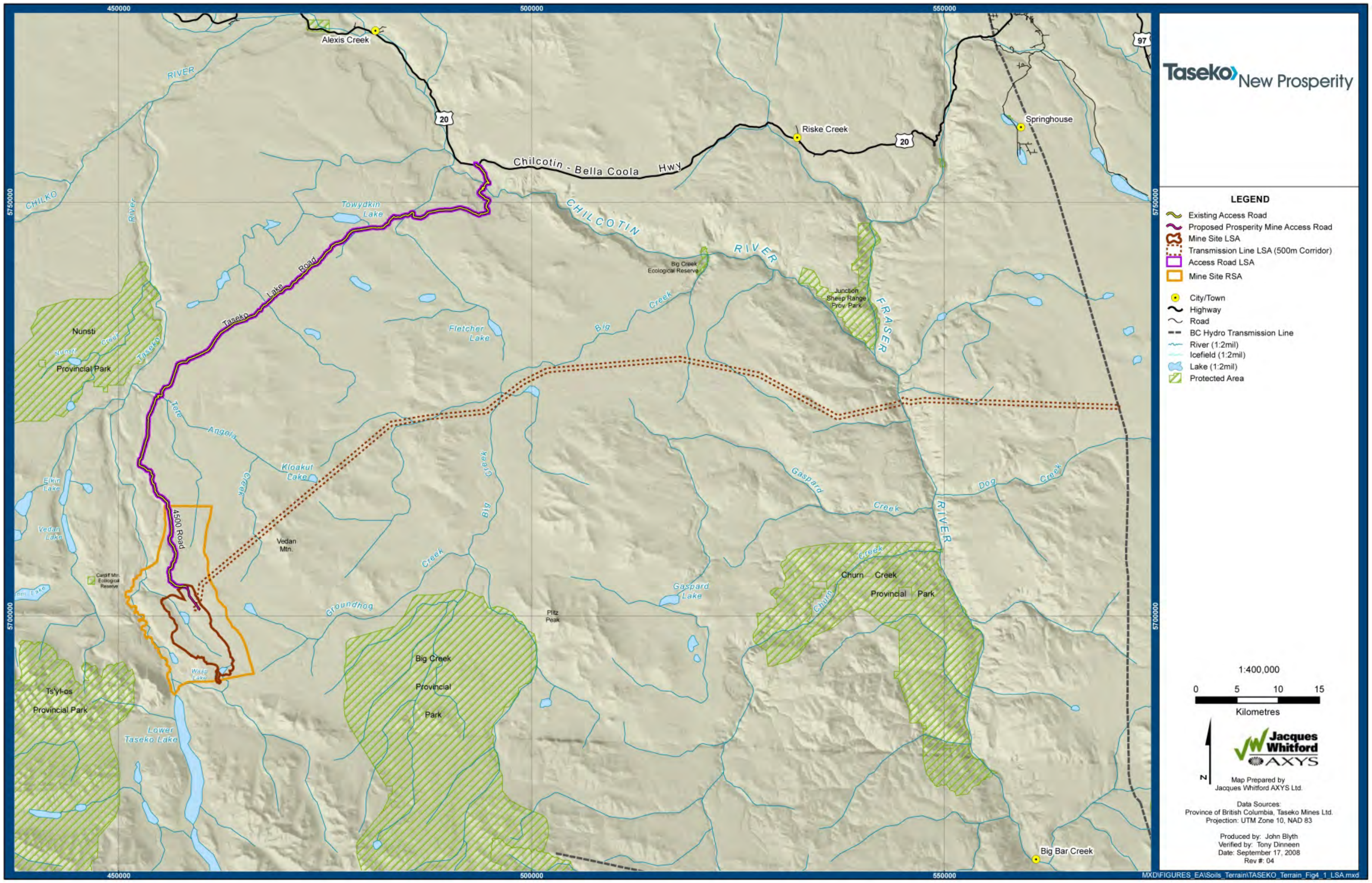


Figure 2.6.1.6-1 Local Study Areas and Regional Study Area for Terrain and Soils

PREVIOUS WORK AND GAP ANALYSIS

A number of relevant studies have been completed in the past decade within or immediately adjacent to the proposed mine site, including work by Brommeland and Wober (1997), Talisman Land Resource Consultants Inc. (Appendices 5-4-A to 5-4-C in the March 2009 EIS/Application) and Madrone Consultants Ltd. (Appendix 5-4-D in the March 2009 EIS/Application); each of these studies is discussed in more detail below and associated data contained in Appendix 5-4-E in the March 2009 EIS/Application.

Several exploration studies were conducted in the vicinity of the Project area. One of them, (Brommeland and Wober 1997) addressed geological, engineering and mine design parameters. The report provides valuable information on the surficial geology of the mine site area.

The Talisman study (Appendix 5-4-A in the March 2009 EIS/Application) consists of a preliminary overburden assessment and provides information on surficial deposits. This terrain assessment was carried out along the transmission corridor and was documented in an unpublished draft report in 1998. The assessment describes and maps at a 1:50,000 scale, important landform features within the 3 km wide transmission corridor, as well as terrain hazards and constraints that could potentially affect transmission line construction and maintenance. This report was prepared based on published maps and written reports—most notably 1:100,000 CLI maps—as well as data from the 1997 field program and air photo assessment. Although the terrain assessment covers the entire transmission corridor, only areas of potential hazards or constraints related to terrain were identified on the 1:50,000 scale map produced with this report.

Madrone (Appendix 5-4-D in the March 2009 EIS/Application) produced a TEM map for the mine site area at a representative scale of 1:20,000; this study used 1993 1:15,000 colour photography. Mapping was completed directly from hardcopy aerial photographs. The TEM program sampled over 410 sites or 33% of the 1252 polygons mapped, meeting the standards outlined by the Province for Survey Intensity Level (SIL) 3 work. These data are incorporated into this report.

The Talisman reports (Appendices 5-4-A to 5-4-C in the March 2009 EIS/Application) for New Prosperity Gold-Copper Mine Environmental Assessment were reviewed and compared with requirements for surficial geology and terrain data. These specifications were issued under the harmonized British Columbia *Environmental Assessment Act* (BCEAA) and Canadian *Environmental Assessment Act* (CEAA) in 1998. This historic information was also reviewed in light of current requirements and practice for proposed projects (e.g., Kemess North Mine) and existing regulations (e.g., BC *Mines Act* Permit Application requirements) pertaining to mining operations in British Columbia. The aim of this review was to anticipate current regulatory requirements that must be met for this EA and to facilitate the gathering of information necessary for an eventual permit application.

The Kemess North Mine Panel Review documentation and the Panel Terms of Reference (2012) were used as additional guidance on baseline data collection and interpretation of baseline data.

Additional studies were recommended for 2006 and were conducted in the summer and fall of 2006 to better define baseline conditions, address new data collection standards and meet current regulatory requirements for both the EA and regulatory requirements under *Mines Act* Permit Application (MAPA).

Other considerations include:

- A requirement for baseline TEM mapping of the access road corridor to support effects assessment for all terrestrial disciplines
- Requirements for more detailed mapping (larger map compilation scale and higher survey intensity level) to meet MAPA requirements in the mine site area

APPROACH AND METHODS

Data accumulated between 1995 and 1998 by Talisman, along with data collected for the TEM program by Madrone (Appendix 5-4-D in the March 2009 EIS/Application) during 1993 and 1995 was used in conjunction with data collected during the summer of 2006 to meet current mine permitting and EA regulations.

Every effort was made to preserve as much of the previous data as possible; the 2006 data collection methods were matched to the previous studies to ensure that data was compatible. The data sources were combined into a single database and were used to develop the associated map products.

Terrain field data were collected as part of the overall TEM and soils field programs conducted between June to August 2006, and again in October 2006 for terrain mapping of the transmission line corridor. The field programs recorded information on surficial sediment types (e.g., till, colluvium, organic, etc.), surface expression, slope, drainage and geologic modifying processes (including mass wasting). The mine site and transmission line areas were accessed mainly by helicopter, while the existing road was used to study the access road area.

The terrain field data was used both to verify preliminary terrain linework, and provide classification data for individual terrain units. At each detailed ground site, the following attribute data were recorded on a standard data sheet:

- Slope gradient (percent)
- Topographic position
- Parent material (surficial sediment type)
- Surface expression
- Texture of surface material
- Texture of unaltered parent material
- Percentage of coarse fragments
- Coarse fragment description
- Drainage, and
- Geomorphic modifying processes, including rapid and slow mass movements.

Visual site inspections were also carried out while in the field, primarily during helicopter flights over the study area; however, terrain field data collection was limited to that information which could be collected with confidence. Heavily forested areas were not considered suitable for visual inspection.

Terrain field plots for the mine site, transmission line corridor, and access road LSA are identified on Figures 2.6.1.6-2, 2.6.1.6-3, and 2.6.1.6-4 respectively. Table 2.6.1.6-1 summarizes field sites by LSA.

Table 2.6.1.6-1 Terrain Field Sites by Local Study Area

Local Study Area	Talisman/Madrone Field Programs		JWA Summer-Fall 2006 Field Program		Total Sites	Hectares per Plot
	Detailed Ground Sites	Visual Sites	Detailed Ground Sites	Visual Sites		
Mine Site (4419 ha)	253	unknown	136	0	389	11.4
Access Road (3495 ha)	4	0	59	0	63	55.5
Transmission Line Corridor (6264 ha)	1	unknown	16	7	24	261.0

All mapping completed by JWA for the Project was completed using JWA's HD-MAPP system; this system incorporates the PurVIEW™ softcopy mapping tools. The use of this PurVIEW™ has been accepted by both the BC Ministry of Forests and Range and the BC Ministry of Environment.

To develop a better understanding of the terrain within the Project area and address the information requirements identified in the Gap Analysis, detailed terrain mapping of the mine site and access road was completed at 1:10,000. Terrain mapping was not carried out for the transmission corridor because it was determined during the Gap Analysis and scoping process that existing mapping by Valentine et al. (1987) and Talisman (Appendix 5-4-B in the March 2009 EIS/Application) was sufficient for the EA.

Mapping of the mine site was completed at an approximate scale of 1:7500 using a combination of 1997–1:15,000 color and 1:20,000–2005 colour aerial photographs; final map scale production was at 1:10,000. The intent of this mapping was to use the existing mapping completed by Madrone (Appendix 5-4-D in the March 2009 EIS/Application) and subdivide the polygons to better reflect the terrain conditions within the mine site and access road areas. Revisions were completed by subdividing, redrawing and reclassifying individual map units where necessary.

Terrain maps identifying terrain hazard and constraints (rapid or slow mass movement) were produced at 1:50,000 for the transmission line corridor and buffer area by Talisman (Appendix 5-4-B in the March 2009 EIS/Application). Any polygons with terrain hazards were field checked either by helicopter or on-site inspections in 2006 to confirm terrain and hazard assessments. Terrain information for the transmission corridor was supplemented from soils maps produced by Valentine et al. (1987) at 1:100,000 scale.

No previous mapping was available for the new section of the access road; hence new mapping was undertaken for this area along the original LSA (a 1-km wide corridor centred on the road). Mapping was completed at a scale of 1:20,000 using 1999 black and white 1:35,000 scale air photos using the PurVIEW™ softcopy mapping system.

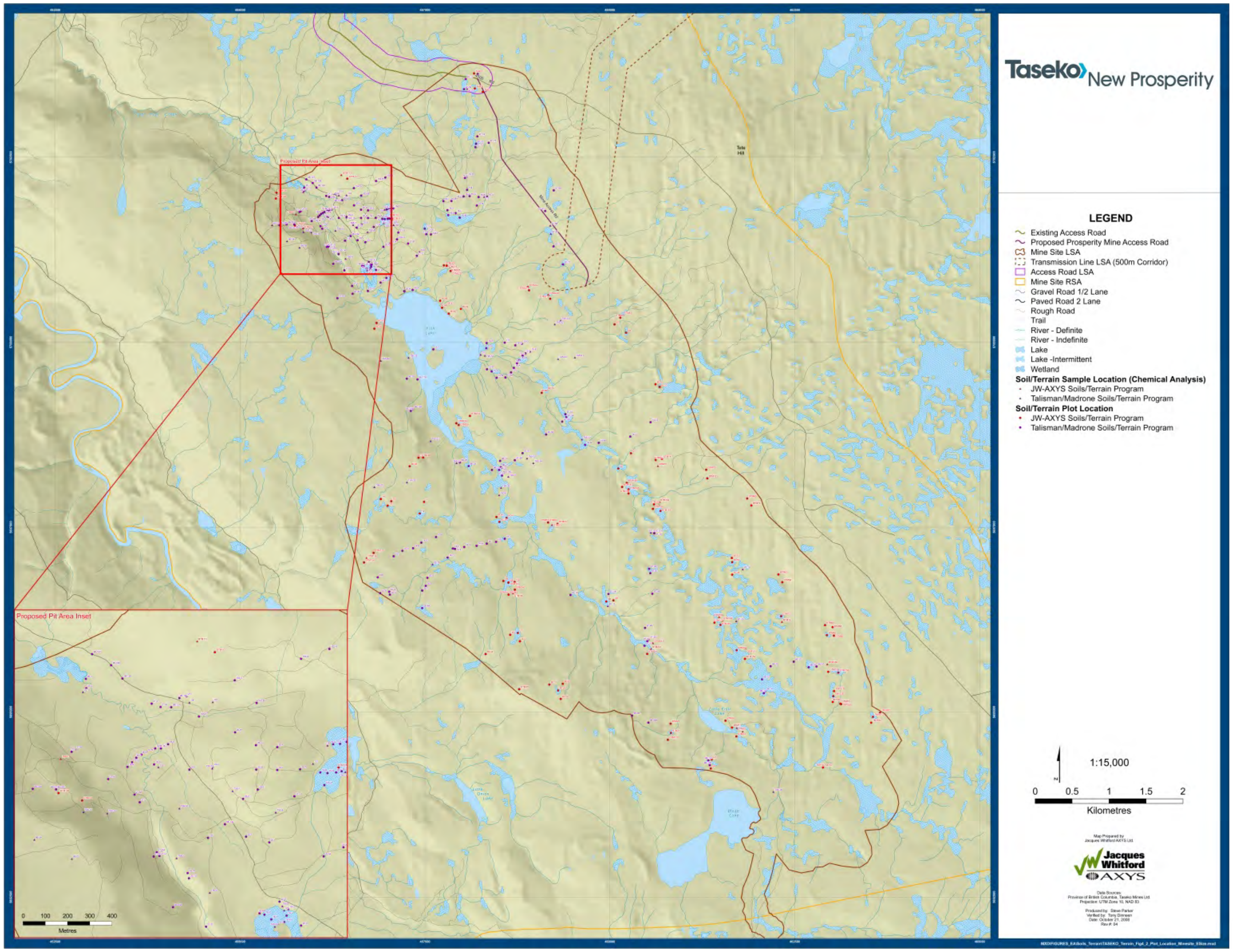


Figure 2.6.1.6-2 **Terrain and Soils Field Plot Locations of the Mine Site**

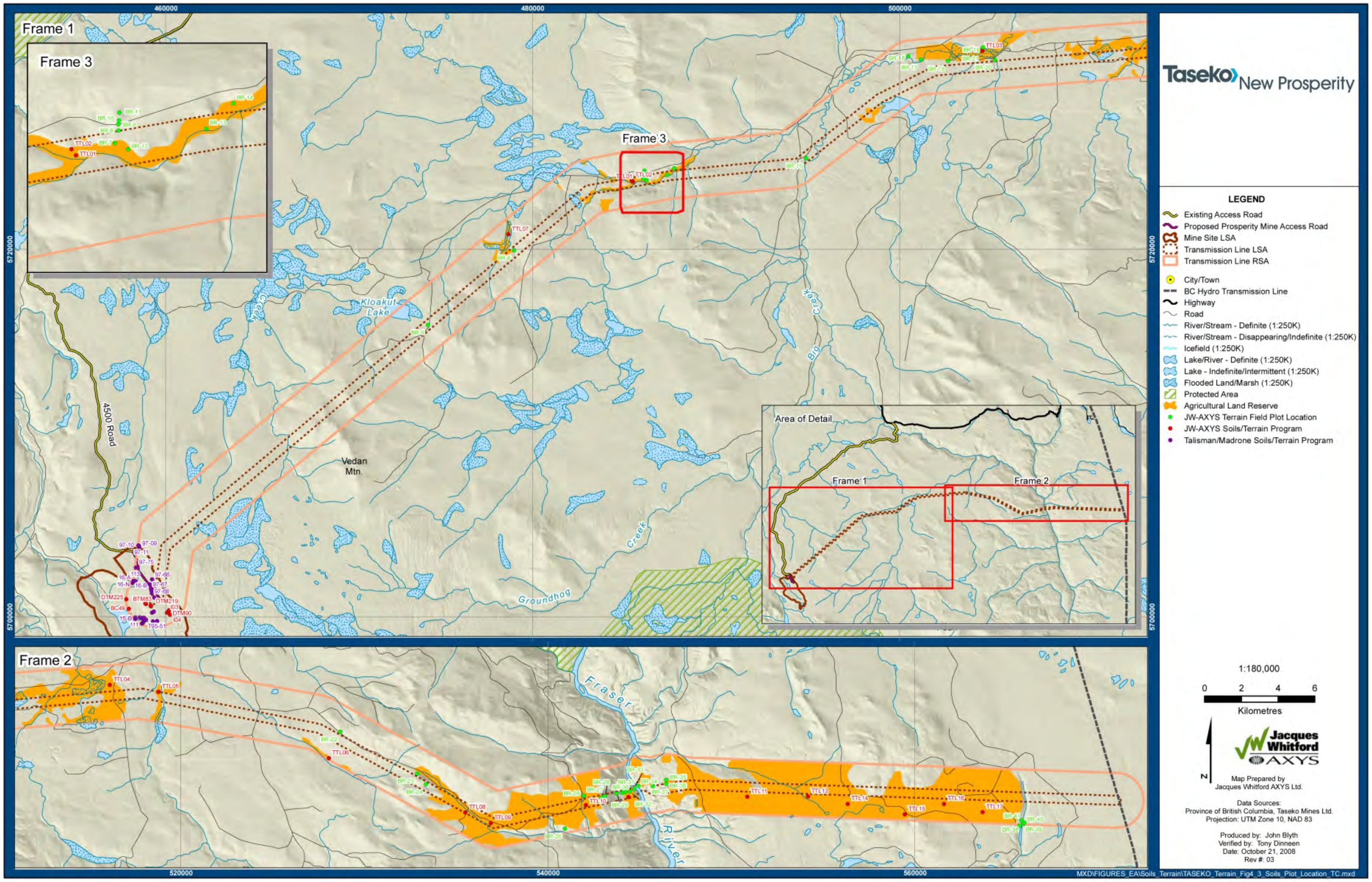


Figure 2.6.1.6-3 Terrain and Soils Field Plot Locations of the Transmission Line Corridor

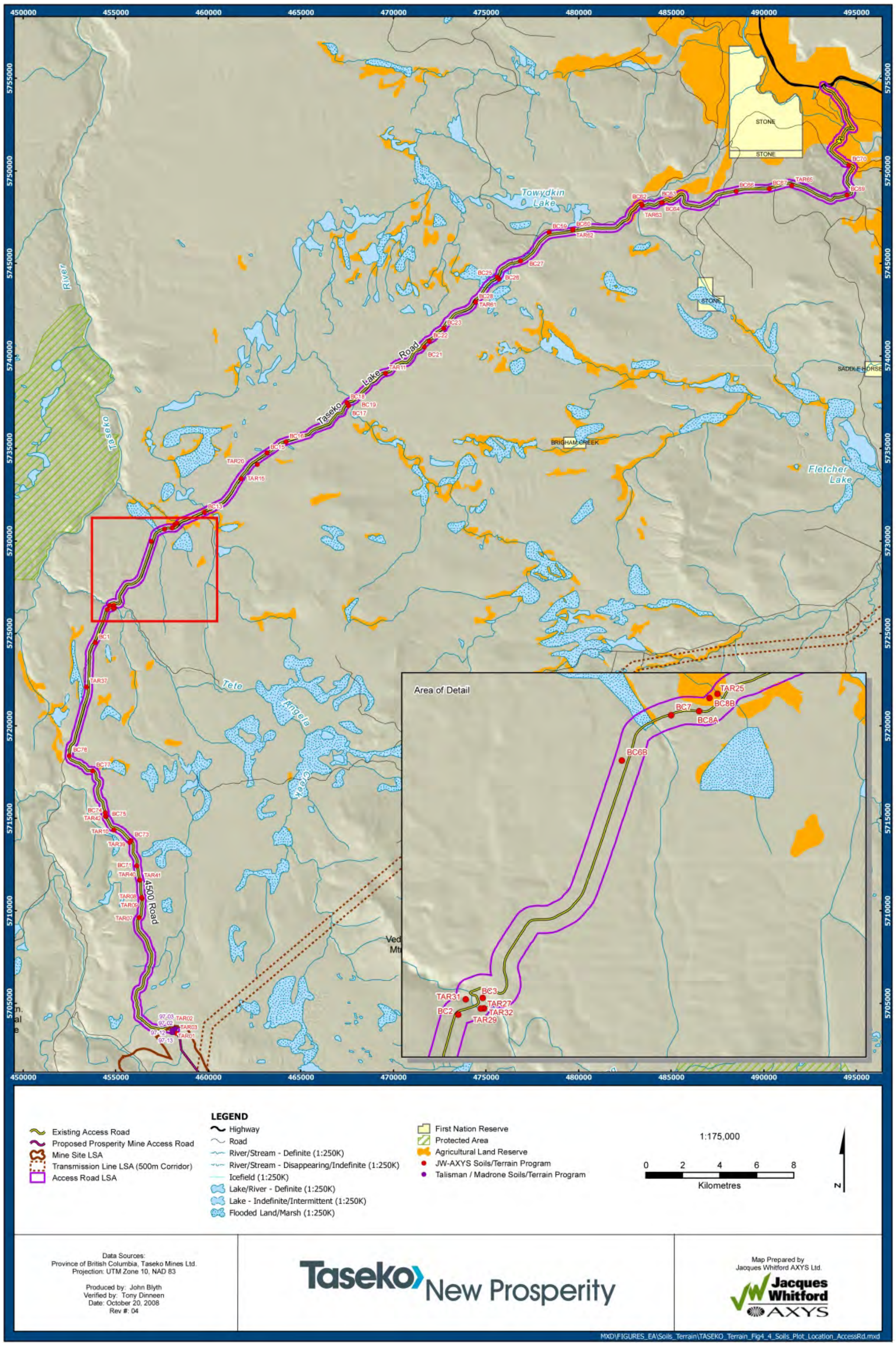


Figure 2.6.1.6-4 Terrain and Soils Field Plot Locations of the Access Road Local Study Area

For the most part, all terrain mapping conformed to standards outlined in Howes and Kenk (1997), Resources Inventory Committee (1996) and British Columbia Ministry of Environment and British Columbia Ministry of Forests (1998). The only exception to these standards dealt with slope classes. Slope classes were broken into seven classes versus the standard five classes to allow for an erosion hazard assessment which requires lower slopes to be broken out into finer detail. Table 2.6.1.6-2 lists the slope classes and ranges used in the mapping process. Slope values were first generated by applying the Digital Elevation Model (DEM) to assign a slope to each polygon and the dominant slope in each polygon was verified by the terrain interpreter.

Table 2.6.1.6-2 Slope Classes and Ranges

Slope Class	Slope Range[1] (%)	Description
1	0–2	Plain (planar)
2	>2-5	very gently undulating
3	>5-15	Gentle slope
4	>15-26	Undulating
5	>26–49	Moderate slope, inclined
6	50–70	Moderately steep slope, inclined
7	>70+	Steep slope, inclined

[1] Modified from Howes and Kenk (1997) to assist in erosion hazard modeling

OVERVIEW OF BASELINE

The New Prosperity Gold-Copper Project is situated in the Fraser Plateau Section of the Interior Plateau; this flat to gently rolling plateau forms a major part of the Interior physiographic system (Demarchi 1995; Holland 1976). The geologic (dominantly level or gently dipping lava flows) and physiographic history (e.g., extensive Pleistocene glaciation) is similar across the Interior Physiographic System, which extends from the Coast Mountains in the west to the Rocky Mountains in the east.

The extensive Interior Plateau is of low to moderate relief underlain by Tertiary age basaltic flows within the southern Interior Physiographic System. The southern Interior Plateau is drained by the Fraser River. Holland (1976) characterized the area as being the “remnants of the very widespread late Tertiary erosion surface which was uplifted and dissected”. Subsequently, extensive Miocene and early Pliocene basalt lava flows resulted in the development of plains of low relief throughout this area.

The topography is characterized by an undulating to rolling plateau dissected by a few valleys and associated rivers. Stream erosion was rejuvenated following the uplift of the plains created in early Pliocene time. The general surface of the Fraser Plateau was raised to 1525 metres above sea level (masl) and resulted in deep incisions in the main valleys (e.g., Fraser River) and much less so at the valley heads which were created in pre-Pleistocene times. Very little dissection or incision of the uplands had occurred on the western Fraser Plateau by the end of the Tertiary period. The main river system is the Taseko River; its main tributary is Fish Creek.

The transmission line corridor for the proposed Project extends across the Fraser Plateau section of the Interior Plateau; it crosses the Fraser River Valley between Meason and Word creeks. Slopes are generally low in plateau areas, and steeper on valley walls.

The elevation of the open pit and plant site ranges from about 1457 masl at Fish Lake to 1570 masl at the maximum elevation of the crest along the west side of the open pit.

The transmission line corridor generally falls between 1050 and 1250 masl but adjacent to the Fraser River elevations decline quickly to less than 500 masl. Near the mine site, the route gains elevation relatively quickly to a maximum of just over 1600 masl where the transmission line enters the mine site.

The access road begins at just over 1600 masl where the road leaves the mine site area. It quickly loses elevation to between 1350 and 1400 masl approximately 15 km from the mine site. Thirty kilometres from the mine site boundary the elevation drops to about 1250 masl. The next 25 km see a further elevation decrease of only about 100 to 1150 masl. As the road nears the Chilcotin River valley the elevations decrease quickly. The last point sampled north along the road corridor measured 722 masl. This point was still above the valley floor.

Slopes ranging between 5 and 15% dominate both the LSA and the RSA of the mine site (Table 2.6.1.6-3). There are extensive areas within the mine site with slopes between 2 and 5% (very gentle) (Figure 2.6.1.6-5). Slopes greater than 15% are relatively rare in the mine site LSA, and are only slightly more common in the RSA. Slopes between 15 and 50% are generally associated with hummocky morainal deposits.

Slopes ranging between 5 and 15% are the most common slope for the access road LSA (Table 2.6.1.6-4). The nearly level to gentle slopes comprise nearly 40% of the LSA (Figure 2.6.1.6-6). There are no slopes greater than 70% in the LSA of the access road, and less than 1% are over 50%, indicating that very few potentially unstable slopes are likely to occur along the access road.

Table 2.6.1.6-1 Slope Classes for the Mine Site

Class	Slope (%)	Regional Study Area (ha)	Regional Study Area (%)	Local Study Area (ha)	Local Study Area (%)
1	0–2	751.8	4.1	202.7	4.6
2	2–5	3,321.7	18.2	612.8	13.9
3	5–15	11,708.8	64.1	3,243.0	73.6
4	15–26	1,073.1	5.9	246.5	5.6
5	26–50	905.6	5.0	30.5	0.7
6	50–70	66.4	0.4	1.3	0.0
7	>70	18.1	0.1	0.0	0.0
Disturbed Land	Not classified	421.4	2.3	70.2	1.6
Total		**18,266.9**	**100**	**4,407.1**	**100**

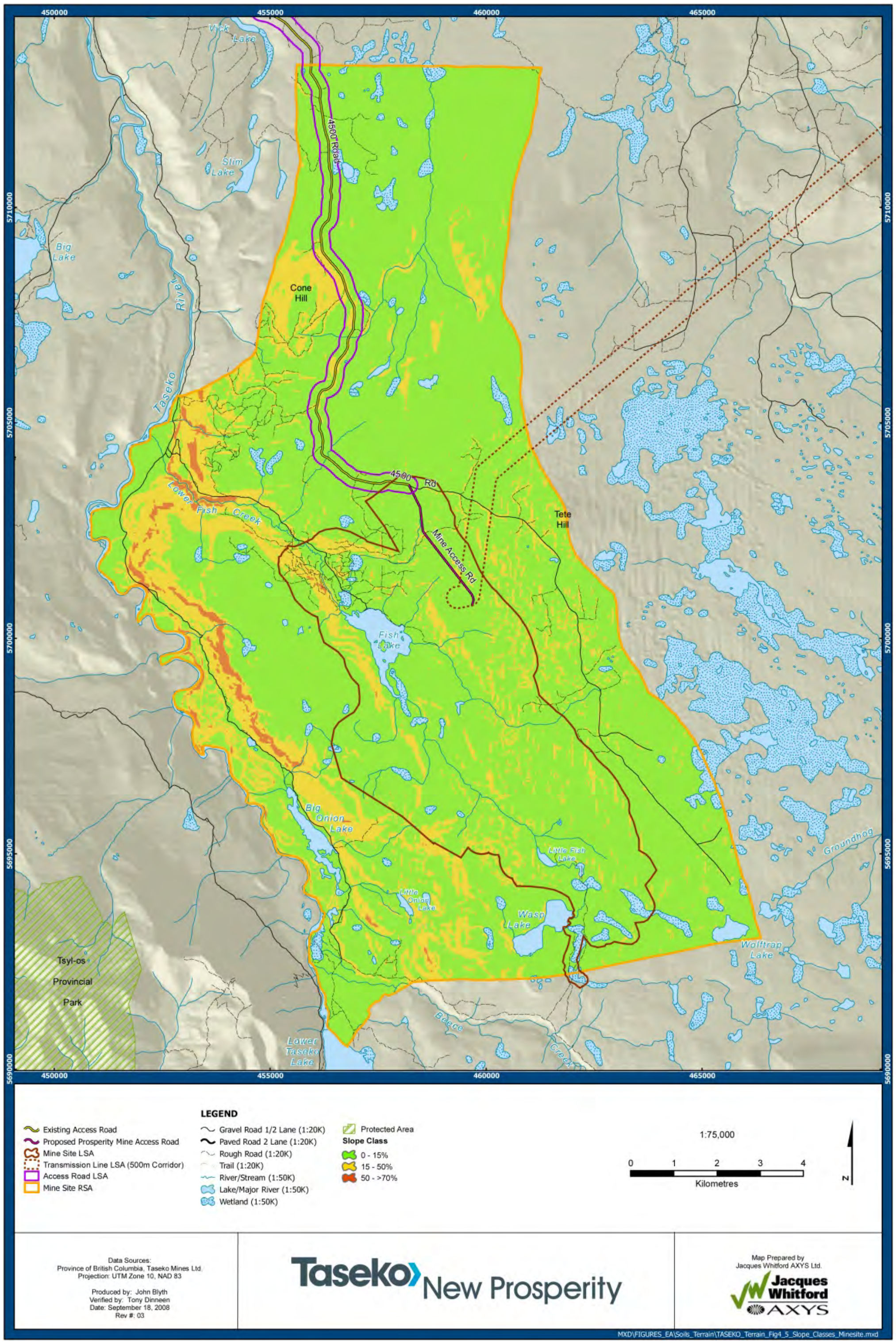


Figure 2.6.1.6-5 Slopes for the Regional Study Area of the Mine Site

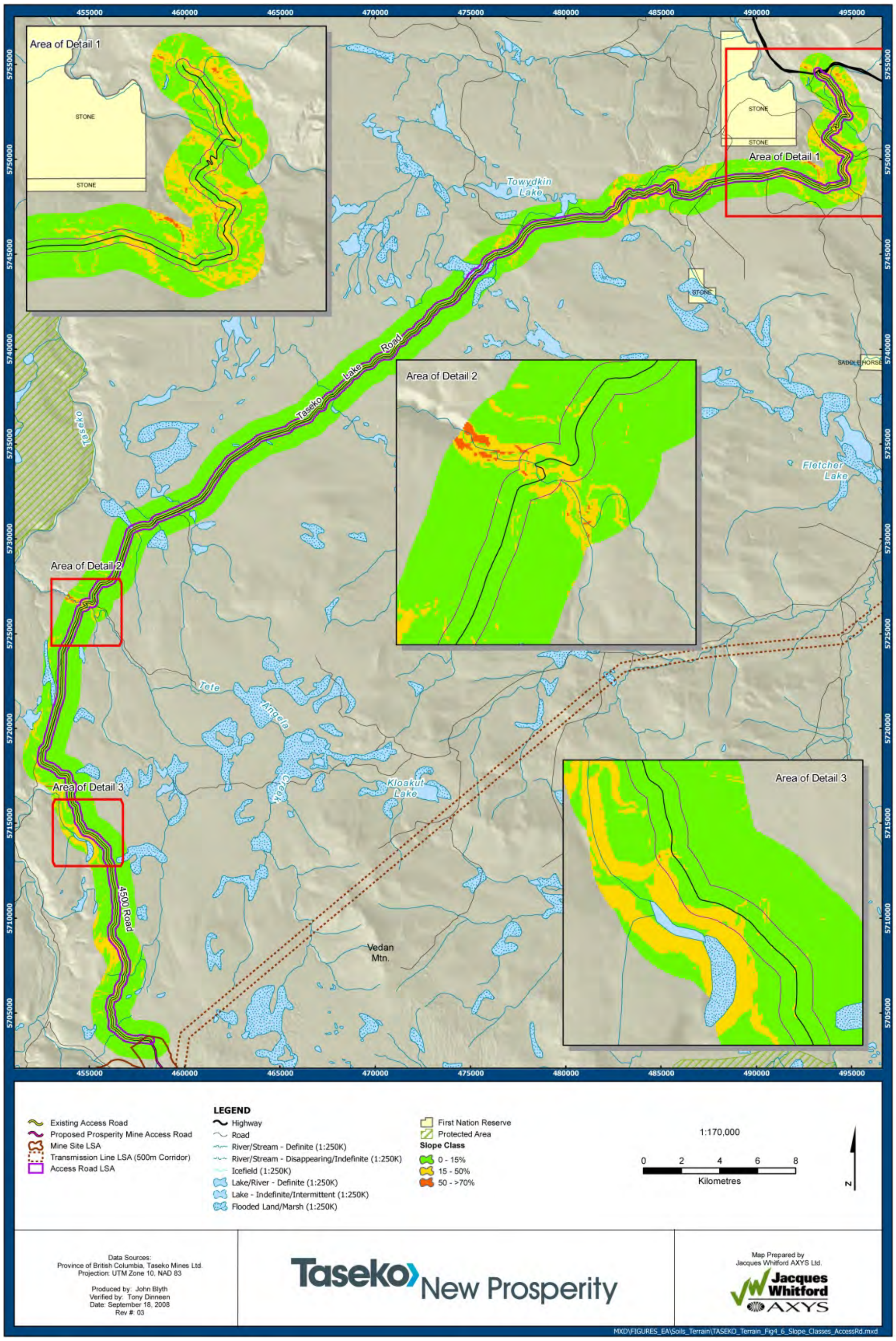


Figure 2.6.1.6-6 Slopes for the Access Road Local Study Area

Table 2.6.1.6 4 Slope Classes for the Access Road Local Study Area

Class	Slope (%)	Local Study Area (ha)	Local Study Area (%)
1	0–2	312.0	8.9
2	2–5	830.6	23.8
3	5–15	1,608.1	46.0
4	15–26	130.7	3.7
5	26–50	36.1	1.0
6	50–70	21.3	0.6
7	>70	0.0	0.0
Disturbed Land		555.7	15.9
Total		**3,494.7**	**100.0**

This section provides a general overview of the bedrock geology of the study area. The mine, transmission line and access road LSAs fall within the westernmost portion of the Intermontane Belt, about 50 km northeast of the Coast Plutonic Complex boundary. Most of the area is underlain by late Palaeozoic to Cretaceous lithotectonic assemblages intruded by Mid-Cretaceous to early Tertiary plutons (Brommeland et al. 1998).

The Yalakom Fault lies southwest of the LSAs. Northeast of the fault, the majority of exposed rocks are composed of feldspathic sandstones, conglomerates and shales. Andesitic volcaniclastic and volcanic rocks that are thought to correlate with andesites, tuffaceous sandstones, argillite and siltstones are exposed near the mouth of Fish Creek. Fossils from shale deposits between the volcanic rocks at Fish Creek suggest an early Cretaceous (Hauterivian) age. Flat to gently dipping Miocene plateau basalts and non-marine sedimentary rocks are associated with the Chilcotin Group (Brommeland et al. 1998).

The geological details of the New Prosperity Gold-Copper deposit are also discussed by Brommeland et al. (1998) and the interpretation is based on 379 diamond drill holes and 68 percussion holes. The New Prosperity deposit is mainly within Cretaceous andesitic volcaniclastic and volcanic rocks, although rocks of the Late Cretaceous Fish Lake Intrusive Complex can be found in the western portion of the deposit (Brommeland et al. 1998).

Physiography, landforms and surficial deposits of the area are associated with the Late Wisconsinan glaciation which occurred between approximately 10,000 and 25,000 years ago. During this glacial period, ice from the Chilcotin and Pacific ranges moved north and north-eastward in a radial pattern over the Fraser Plateau (Appendix 5-4-A in the March 2009 EIS/Application).

During the Pleistocene glaciation, the upper surface of the ice sheet was in excess of 2450 m. The main effect of this period was the deposition of glacial drift over the plateau surfaces and the resultant rolling, drumlinized till plain configuration. During the subsequent warmer period of ice wasting, approximately 10,000 years ago, meltwater channels were occupied by large streams, resulting in numerous glaciofluvial landforms. Many of these former channels are drainage ways occupied by much smaller modern streams. Many lakes and organic filled depressions were formed as a result of the ice movement and subsequent melting and development of enclosed depressions.

Preliminary baseline reports by Talisman (Appendices 5-4-A and 5-4-B in the March 2009 EIS/Application), Brommeland and Wober (1997) and Brommeland et al. (1998) discuss the surficial sediments in the area. Compact basal till is the most common glacial deposit within the Project area. In general, these tills are described as a heterogeneous mix of subrounded to subangular boulders, cobbles, and pebbles in a sandy to sandy loam matrix. However, the texture varies depending on the bedrock the material is derived from and the distance it has been transported. Results from drilling assessment reports (Brommeland and Wober 1997, Brommeland et al. 1998) identified a till with a gray clay-rich matrix with up to 60% clasts of various lithologies, including some that are not typical of the area. The thickness of glacial till ranges from less than one meter on steep valley side-slopes (e.g., along the west and north sides of the open pit) to more than five meters in the valley bottoms (Appendix 5-4-C in the March 2009 EIS/Application).

Extensive glaciolacustrine deposits were identified in cores drilled in the southern part of the future open pit (Appendix 5-4-A in the March 2009 EIS/Application; Brommeland et al. 1998). The deposits consist primarily of horizontal, varved clay and silt beds up to 30 cm thick, which often contain interbeds of coarse sand and gravel. At the base of some of the beds there is a layer of black organic debris which commonly contains leaf fossils and woody debris (Brommeland et al. 1998). Extensive glaciolacustrine deposits are also found within the transmission line corridor LSA, most prominently on the terraced and gullied east slopes of the Fraser River.

Glaciofluvial deposits commonly occur as sinuous ridges (eskers) or irregular mounds (kames) and are generally formed of abundant round to subrounded pebble- to cobble-sized coarse fragments set in a sand or silty sand matrix. Eskers and kames are most prominently found in valley bottoms and tend to be coarse-textured, with well-rounded to subrounded gravel- to cobble-sized clasts (Appendix 5-4-A in the March 2009 EIS/Application). Extensive glaciofluvial terraces are located along the Fraser River above modern fluvial deposits.

Recent fluvial deposits are also present throughout the area, primarily along valley bottoms and floodplains. Fluvial deposits range from silts to gravels and are typically finer in texture than glaciofluvial sediments (Appendix 5-4-A in the March 2009 EIS/Application) with sandy pebble/cobble gravel being the most common. A cap of finer sediments (overbank deposits) is common in the upper 10–50 cm.

Overburden and soil reports from Talisman (Appendices 5-4-A and 5-4-C in the March 2009 EIS/Application) describe colluvial materials located on the mid and upper slopes of steep areas. The deposits range from coarse, angular, stony talus derived from basalt with little or no fines, to medium-grained, moderately coarse-textured deposits that may have been reworked by water.

Organic accumulations are present in many areas of the mine site, particularly in areas to the east and south. The organic accumulations have developed in poorly drained depressions in the southern and eastern portions of the pit area and vary in thickness from 15 to 300 cm (Appendix 5-4-A in the March 2009 EIS/Application). Fibre contents generally reflect moderately well to well decomposed materials and are dominated by Mesisols and Humisols.

The area has been subjected to volcanic activity: thin to very thick (0.5–48 m) basalt flows are found next to and within the surficial deposits (Brommeland et al. 1998, Talisman Appendices 5-4-A and 5-4-C in the March 2009 EIS/Application).

The following is an overview of the surficial deposits identified during 2006 field investigations. An overview description of the Project (i.e., the broad area that encompasses the mine site, transmission line, access road and load-out facility LSAs) is provided along with more detailed descriptions for the mine site and access road corridor.

The majority of the area is covered with thick deposits of till; bedrock exposures are relatively rare. Well drained morainal (glacial till) deposits are extremely abundant. The thickness of these deposits ranges from veneers (less than a meter) on steep slopes and valley walls to several meters or more in the more widespread low-lying, low-gradient areas. Several drumlinized till plains are found in the access road area. Till deposits are characterized by subrounded and subangular pebbles and cobbles in a silty sand or sandy silt matrix. Clast percentages average 30 to 50% with a notable increase in coarse fragment content below 40 cm. Boulders are also present and tend to be more angular than pebbles and cobbles. Glaciofluvial sediments are the second most common sediment type. Large quantities of glaciofluvial sediments were deposited in meltwater channels, either in subglacial environments (e.g., ice tunnels) that ultimately produced eskers, or subaerial rivers issuing from the top and front of melting glaciers during the final stages of the last glaciation. These deposits generally consist of pebbles and cobbles and commonly form large terraces adjacent to the Taseko River. Sinuous esker ridges are found in a number of places, including the northern access road area, the Taseko River Valley, and in scattered locations within the mine site LSA. Collectively, they make up a much smaller component of the glaciofluvial deposits than the terraces. The eskers within Taseko valley are esker complexes and are much larger in size than those found elsewhere. Large glaciofluvial terrace features capped by relic fans are prominent along the Fraser River at the transmission corridor crossing.

Glaciolacustrine deposits are rare within the LSAs, with a notable exception observed in the transmission line corridor on the east side of the Fraser River. While none were identified at the surface in the mine site or access road LSAs during the 2006 field study, Talisman (Appendix 5-4-A in the March 2009 EIS/Application) identified them from drilling information as fine sand, silt and clay; these sediments were deposited in ice-dammed lakes by glacial meltwater streams.

Colluvial deposits such as talus aprons and fans, colluvial veneers and colluviated glacial deposits are the product of weathering and gravity and transported primarily through erosion and mass wasting. These deposits are more common in areas of rugged topography, so they are relatively uncommon within the LSAs; this is particularly true of the mine site and access road LSAs. Colluvium is present on the steep slopes of major valleys and in localized areas of steeply sloping bedrock and till deposits. Coarse, angular clasts (cobbles and boulders) with little or no fine-grained matrix are the most common type of deposit; however, in areas where glacial deposits have become colluviated, both smaller clast sizes and fine-grained matrices may be present. Colluvial deposits found in gully systems and on moderately steep slopes tend to be finer-grained, and can contain clay, silt, sand and gravel depending on the composition of the parent material. Rockfall deposits consist generally of angular to very angular blocks, boulders and cobbles, with very small amounts of fine sediment.

Fluvial deposits are associated with the streams and creeks that flow through the area, most notably the Taseko River, Fish Creek, Tête Angela Creek, and the larger Chilcotin and Fraser Rivers. They are present along valley floors and at the bottom of a few gully systems. The texture of fluvial sediments is directly linked with the energy level of each stream: coarser-grained deposits are associated with faster flowing streams. Fluvial fans have developed at the confluence of some tributaries with major valleys; these can be quite large in the Taseko River valley and are subject to both flooding and debris flow activity.

Organic accumulations are shallow and occur in topographic depressions. These bogs and fens are characterized by very poor drainage.

The New Prosperity gold-copper porphyry deposit is located at the northern limit of Fish Lake. The proposed mine site maximum disturbance area covers an area of 4419 ha of which 4407 ha had bioterrain mapping completed. Table 2.6.1.6-5 summarizes the surficial materials for the mine site LSA and they are spatially presented in Figure 2.6.1.6-7.

Table 2.6.1.6-5 Surficial Materials of the Access Road Local Study Area

	Mine Site	
Parent Material	**Area (ha)**	**Portion of Local Study Area (%)**
Anthropogenic	70.2	1.6
Colluvium	22.8	0.5
Weathered Bedrock	16.8	0.4
Fluvial	22.9	0.5
Glaciofluvial	118.5	2.7
Lacustrine	1.4	0.0
Moraine	3,428.8	77.8
Not Mapped (includes water bodies)	124.9	2.8
Organic	594.2	13.5
Bedrock	6.6	0.1
Total	**4,407.1**	100
NOTE: Statistics based on 1:7500 scale mapping using HD-MAPP		

Till is the most common surficial sediment; it accounts for approximately 78% of all deposits mapped within the mine site. Till thickness ranges from less than 1 m on steep to moderately steep slopes (e.g., western edge of the pit and hill crests) to several meters in flat areas and valley floors. Topography in these till-dominated areas varies from mainly level to gently and moderately undulating (0–26% slopes) with minor areas of higher relief (e.g., 26–49%). Till matrices range from silty sand to silty clay, but silty sand and sandy silt are most common. Clasts make up 10 to 80% of the deposits, averaging approximately 40%. Most clasts are subrounded and in the pebble to cobble size range, but all clast sizes are represented and angularity ranges from angular to rounded. Boulders are generally more angular and subrounded than the smaller clast sizes. Most tills are well drained, however tills near or adjacent to the numerous wetlands in the mine site are moderately and imperfectly drained.

Organic accumulations (bogs and fens) are present in many parts of the mine site accounting for almost 14% of materials in this area. They have developed in topographic depressions and have very poor drainage. Bogs and fens are particularly evident in the eastern and southern parts of the mine site. Thicknesses can range from less than one meter to several meters, with fine to very fine textured sediment commonly underlying these materials. Textures are equally divided among fibric, mesic and humic.

Approximately 3% of the mine site is characterized by glaciofluvial deposits. These deposits are generally planar to gently undulating and are found in low-lying areas. They are poorly to moderately sorted with abundant rounded to subrounded pebble- to cobble-sized clasts set in a sand or silty sand matrix. Clast content is 20–50% and the deposits are generally well to rapidly drained.

Shallow to deep colluvial materials are limited within the mine site, accounting for only 0.5% of all materials. These well to rapidly drained deposits are found most commonly on slopes exceeding 35%; they consist mainly of debris slide deposits derived from glacial sediments and rockfall deposits. The former can span all grain sizes, while the latter are most commonly composed of cobbles and boulders. Clast content is quite high, ranging from 60–80%, and clasts are dominantly angular. Small debris flows can be expected in gullies that receive rockfall or debris slide sediment and on the fluvial fans that they flow out onto.

Present day fluvial sediments are found in small streams and creeks; these recent sediments account for only 0.5% of all materials within the mine site. Fluvial fans have developed at the mouth of a few minor tributaries and gullies. Drainage in these sediments is highly variable, ranging from poorly to well drained. Grain sizes range from silt to gravel with sandy pebble/cobble gravel being the most common. A cap of finer overbank sediments is common in the upper 10–50 cm.

Bedrock and weathered bedrock together make up less than 0.4% of the materials identified within the mine site. Weathered bedrock is most common in upland areas. Drainage varies from rapidly drained to poorly drained depending on topography, bedrock porosity and degree of fracturing.

Modern lacustrine deposits are extremely rare (0.03%). They include beach deposits at the margins of larger lakes, including Fish Lake and lakes that have become in-filled over time with very fine grained sediment. The latter may be covered by organic accumulations.

Anthropogenic materials (areas where human disturbance is the most prominent terrain feature) and water bodies make up the remainder of the materials identified within the mine site (1.2%).

Eolian deposits were not identified during the recent field surveys or by Talisman (Appendix 5-4-A in the March 2009 EIS/Application). However, southwest of the mine site, Madrone (Appendix 5-4-D in the March 2009 EIS/Application) mapped eolian deposits.

Glaciolacustrine deposits were not found nor mapped within the mine site. However, extensive glaciolacustrine deposits (up to 70 m thick), which can be interbedded with glaciofluvial sediments, were identified in cores drilled in the southern part of the mine site adjacent to Fish Lake (Brommeland and Wober 1997; Talisman Appendix 5-4-A in the March 2009 EIS/Application). These deposits are only found below 20 m depth and are overlain by till deposits up to 59 m thick.

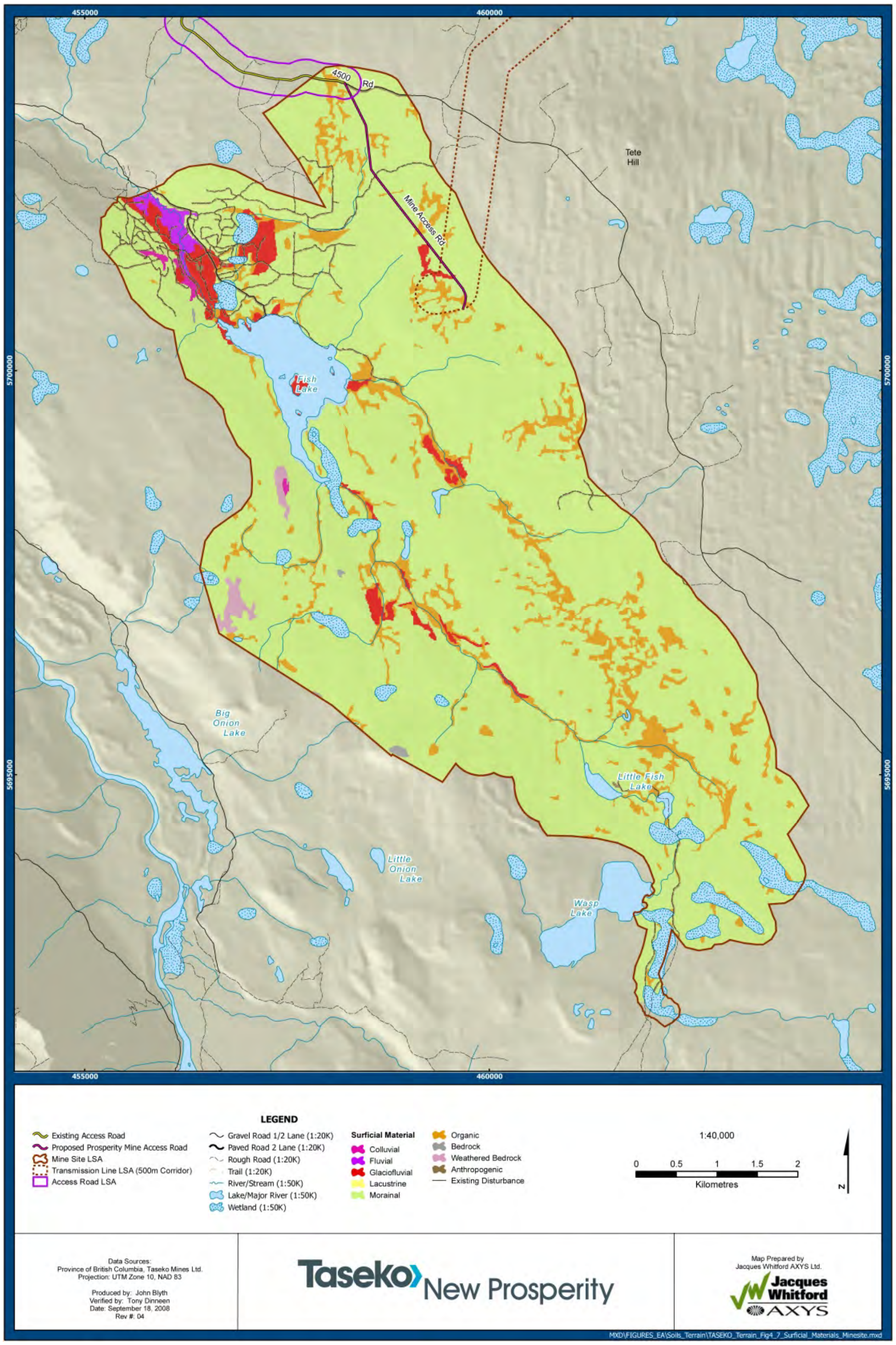


Figure 2.6.1.6-7 Dominant Surficial Materials and Existing Disturbed Areas of the Mine Site

The proposed access road to the mine site follows an existing logging road south from Lees Corner to the mine site. The access road LSA is approximately 88 km long with a 200 m buffer on either side, and covers an area of 3495 ha. It includes a small area of overlap between the access road and mine site.

Table 2.6.1.6-6 summarizes the surficial materials for the access road, excluding the area of overlap with the mine site. Due to the length of the access road, the southern section of the access road is visually presented on Figure 2.6.1.6-8, the central section on Figure 2.6.1.6-9 and the northern section on Figure 2.6.1.6-10.

Table 2.6.1.6-6 Surficial Materials of the Access Road Local Study Area

	Access Road	
Parent Material	**Area (ha)**	**Percentage of Local Study Area (%)**
Anthropogenic	555.7	15.9
Colluvium	83.1	2.4
Fluvial	47.6	1.4
Glaciofluvial	246.9	7.1
Lacustrine	0.9	0.0
Moraine	2,429.5	69.5
Not Mapped	6.4	0.2
Organic	123.9	3.5
Bedrock	0.7	>0.1
Total	**3,494.7**	**100**
NOTE: Statistics based on 1:7500 scale mapping using HD-MAPP		

The access road LSA is mainly underlain by thick deposits of till; these account for approximately 70% of all materials identified along the access road LSA. The topography in these till-dominated areas is undulating, with slopes ranging from level to gently and moderately undulating (0–26%). The till is poorly to very poorly sorted, and consists of pebble, cobble and boulder gravel set in a matrix that ranges from silty clay to silty sand. Clasts are mainly pebbles and cobbles and are subrounded to angular, with subrounded fragments dominant. Boulders tend to be more angular and the coarse fraction usually makes up 10 to 35% of the upper 40 cm of the deposit, increasing to as much as 70% with depth.

The second largest area is composed of anthropogenic materials consisting primarily of the access road itself. These materials make up nearly 16% of the access road LSA.

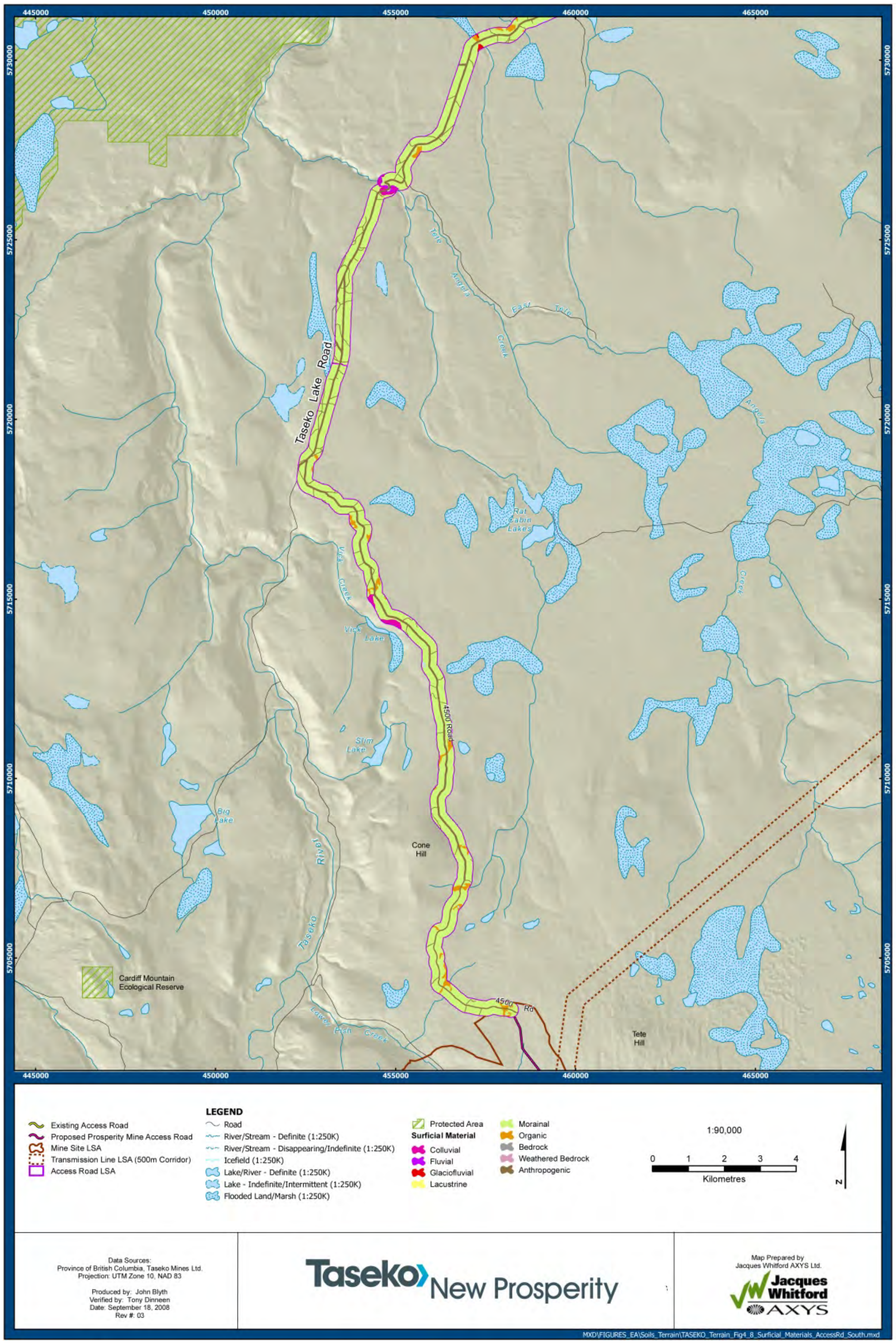


Figure 2.6.1.6-8 Dominant Surficial Materials of the Access Road Local Study Area (Southern Section)

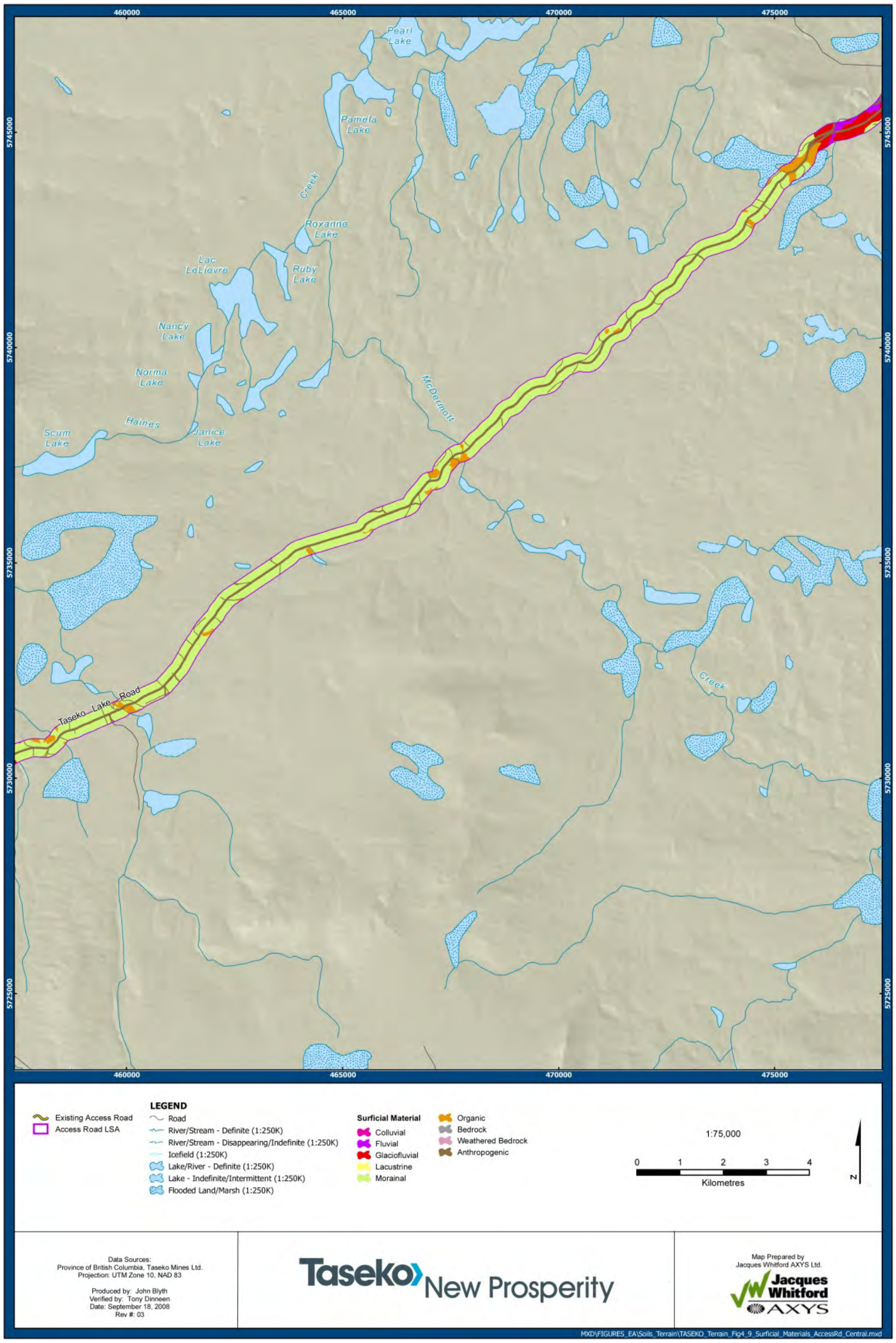


Figure 2.6.1.6-9 Dominant Surficial Materials of the Access Road Local Study Area (Central Section)

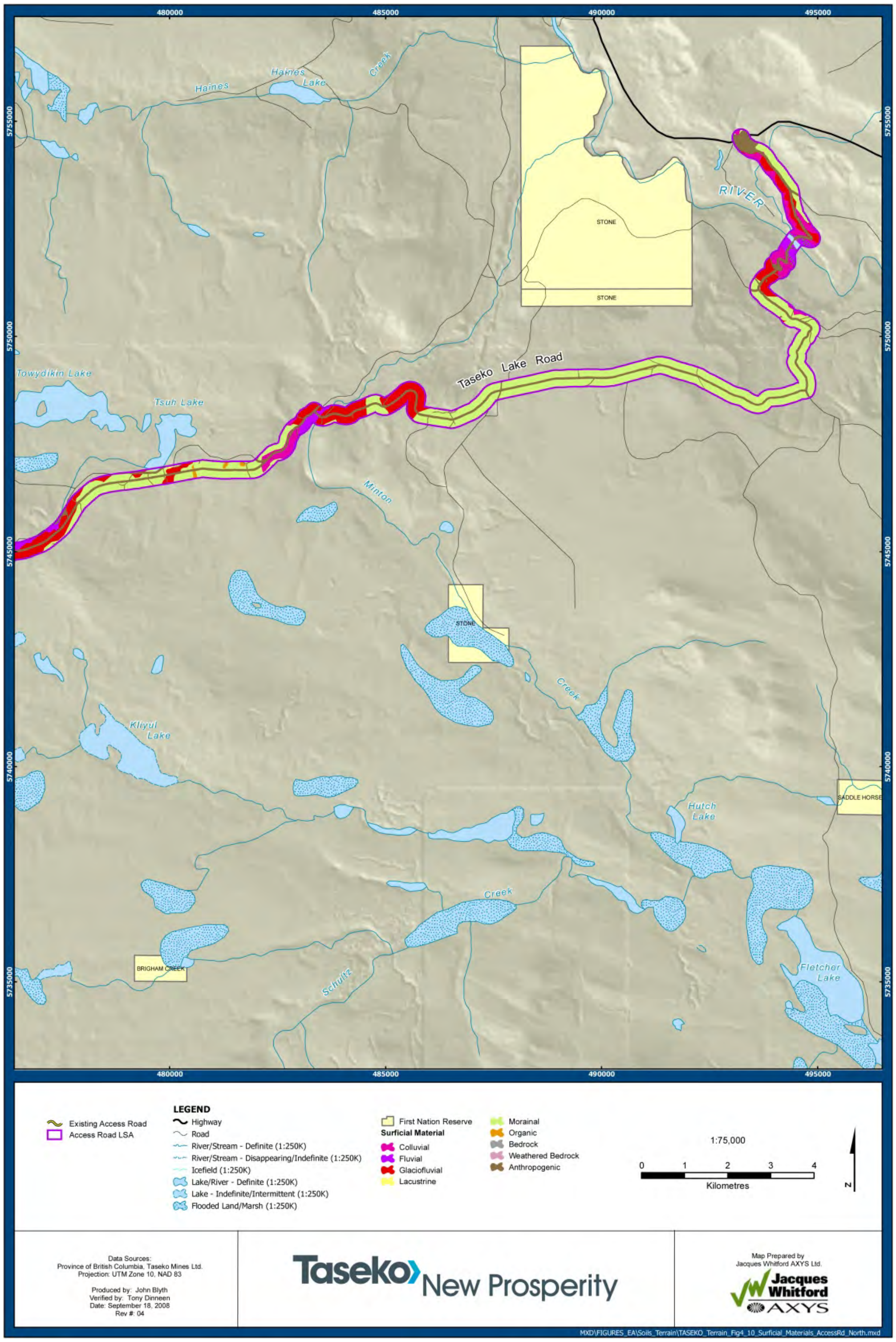


Figure 2.6.1.6-10 Dominant Surficial Materials of the Access Road Local Study Area (Northern Section)

Glaciofluvial sediments are much less extensive. They account for about 7% of all materials within the access road LSA. Subglacial glaciofluvial deposits form long, narrow, linear eskers, which in many cases are found overlying till, line the northern part of the LSA. Subaerial glaciofluvial deposits include thick terraces along the Taseko River; the access road crosses these deposits at its northern end. The terraces are subject to riverbank erosion in many areas; retrogressive slumping on the outer banks of the river is an important terrain stability issue. Glaciofluvial deposits consist predominantly of pebbles, cobbles and minor boulder gravel with a sand or silty sand matrix. Clasts generally make up 20–50% of the deposit and are subrounded to rounded with a minor subangular component. Glaciofluvial deposits are well to rapidly drained.

Organic accumulations (bogs and fens) are the next most common terrain type in this area; they are associated with depressional topography and are very poorly drained. They represent about 4% of materials found along the access road LSA and generally overlie till, recent lacustrine sediments and fluvial deposits. The thickness of organic deposits ranges from less than a meter to up to 2 m. Bogs and fens are fibric, mesic and/or humic.

Colluvial deposits along the access road LSA are rare, but include debris slides and slumps on steep river banks and valley slopes, rockfalls from steep bedrock cliffs (e.g., basalt cliffs exposed in the northern extremity of the access road) and materials eroded from gullies. Colluvial materials account for some 2.4% of all materials within the LSA. Thickness of colluvial deposits can range from thin veneers in areas of shallow bedrock, to a few meters at the base of a slope. Clasts are angular and are generally in the cobble to boulder size range. They make up 60 to 80% of the deposit. Matrix, where present, consists of silty sand or sandy silt.

Modern fluvial deposits are found in small streams and creeks and at the margins of Taseko River; they account for less than 1.4% of materials within the LSA. Fluvial fans are found where small tributaries, creeks and gullies enter larger valleys. Fluvial sediments are commonly made up of pebble and cobble gravel with a sandy matrix; however, a finer-grained cap of silt, sand and/or clay is common in the upper 10–50 cm (these are likely over bank deposits). The drainage of smaller streams is mainly imperfect, but ranges from poorly to well drained; Taseko River deposits are well drained. Flooding, slumping and riverbank erosion affect fluvial deposits along Taseko River.

Recent lacustrine sediments are present around a few lakes and ponds (or drained lakes) within the access road corridor. They mainly consist of planar deposits of silty clay, which are moderately drained. They account for only 0.03% of the materials within the LSA. The remainder of the access road LSA consists of bedrock and unmapped water bodies each of which cover approximately 0.2% or the total area.

SCOPE OF ASSESSMENT FOR SOILS

The assessment of the environmental effects of the New Prosperity Gold-Copper Mine Project on soils focuses on the direct effects of the Project on soil distribution, quantity and quality.

The assessment has been prepared in accordance with the EIS Guidelines (March 2012) and more general direction provided in the BC Environmental Assessment Office publication, *Mine Proponent’s Guide: How to Prepare Terms of Reference and an Application for an Environmental Assessment Certificate* (EAO 2006).

REGULATORY SETTING

In British Columbia there are a number of land use planning, regulatory and policy instruments used by federal, provincial and local governments to support conservation of soil and agricultural resources. Applicable regulatory requirements are found in the following acts and regulations:

- BC Mines Act (1996) Section 9.6.1 of the Mines Act addresses soil conservation. Section 10.1.4 (h) identifies soil-related information that is required for the mine plan and reclamation program, including baseline information requirements. Section 10.7.8 outlines reclamation standards for soils. The regulations and associated appendices provide guidance on baseline data to gather for the Environmental Assessment, recommendations on soil characterization, soil survey, mapping standards, in addition to land capability, soil salvage and stockpile requirements.
- BC Agricultural Land Commission Act (2002) "repealed the Agricultural Land Reserve Act, the Land Reserve Commission Act and the Soil Conservation Act and replaced them with a new Act that incorporates some of the provisions from the repealed Acts, and established the Provincial Agricultural Land Commission" (Provincial Land Commission webpage). The Act governs the use and development of agricultural land. Land designated as Agricultural Land Reserve is found in portions of both the Access Road and Transmission Line Corridor.
- Agricultural Land Reserve Use, Subdivision and Procedure Regulation (2002) identifies farm activities and other, non-farm uses permitted in the ALR, notification requirements for soil removal and placement of fill, procedures for submitting applications and identifies filing requirements for development related to the Project. This regulation will need to be referenced as portions of the transmission line will be constructed in the Agricultural Land Reserve, where pole placement will involve soil disturbance and gravel fill for posts.
- The BC Forest and Range Practices Act (2004) governs best management practices for the management of soils that may be applicable for guiding Project activities. The objectives of soil conservation under the British Columbia Government's new Forest and Range Practices Act are to limit the extent of soil disturbance that negatively affects the physical, chemical, and biological properties of the soil.
- Soil Disturbance Hazard Ratings for Compaction, Displacement, and Surface Soil Erosion (BCMOF 1999). This guidebook, developed under the former Forest Practices Code and adopted under the more current FRPA, was used as the basis to assess compaction and erosion:
- EIS Guidelines (March 2012). The Guidelines were developed with input from federal and provincial agencies, local governments and First Nations. Following a public comment period where additional comments were received and changes to the Guidelines were made they were finalized by the Minister of Environment.

KEY INDICATORS

Two Key Indicators were considered for the soil resources in this assessment:

- Reclamation suitability in non-Agricultural Land Reserve Areas, and
- Agricultural capability in Agricultural Land Reserve Areas.

Rational for selection of these Key Indicators are provided in Table 2.6.1.6-7.

Reclamation suitability can be defined as the ability of soil to be utilized as reclamation material enabling a site to return to its former or other productive uses following a disturbance and subsequent reclamation.

Soils rated as “good” or “fair” are generally suitable for reclamation with a minimal amount of management or inputs. Soils rated as poor can be used for reclamation, but generally only under more intensive management.

Characteristics which affect the suitability of materials for reclamation purposes include: soil texture, coarse fragment content, soil structure, soil available water storage capacity, soil nutrient holding capacity, soil organic matter content, soil salt and sodium content, and soil reaction (pH). These soil properties influence the productivity of the soil and the ability of the soil to support vegetative growth.

The reclamation suitability rating system originally developed by Alberta Agriculture, Food and Rural Development in the *Soil Quality Criteria Relative to Disturbance and Reclamation* document for the Eastern Slopes (AAFRD 1987) was applied. This rating system is applicable in both Alberta and in British Columbia to assess reclamation suitability. The reclamation suitability ratings described in Appendix 1, Table 2.6.2-1 of the Application Requirements for a Permit Approving the Mine Plan and Reclamation Program pursuant to the *Mines Act* (1996) is based on the AAFRD (1987) rating system for the Eastern Slopes (Ministry of Energy and Mines 1998).

The importance of Reclamation Suitability in relation to Project Activities is that it provides a quantitative measure to determine Project effects on soil quality in forested areas. Reclamation suitability ratings are based on soil physical and chemical properties, so if environmental effects occur, the end result is a change in reclamation suitability. Reclamation efforts are supported by reclamation suitability ratings as they identify the location of suitable and unsuitable material prior to soil salvage and, in conjunction with topsoil depth, provides estimates of the amount of material that may be used at post-closure.

Table 2.6.1.6-7 Key Indicators for Soils

Key Indicator	Rationale for Selection	Linkage to EA Guidelines, Other Regulatory Drivers, Policies and Programs	Baseline Data for EA
Reclamation Suitability	Soil reclamation suitability was chosen as the KI for all land not within the Agricultural land reserve affected by the mine development because it can be used as a measure to assess the ability of land to sustain non-agricultural uses such as forest and wildlife production. Land outside the agricultural land reserve comprises the majority of area along the access road and the transmission line, and within the mine site.	Project Report Specifications (1998) Environmental Impact Statement Guidelines (2008) BC *Mines Act (1996)*—Section 9.6.1 of the *Mines Act*	Soil Mapping Reclamation Ratings Field data Lab Analyses (refer to Appendices 5-4-G, 5-4-H, 5-4-I and 5-4-J in the March 2009 EIS/Application)
Agricultural Capability	Agricultural capability was chosen as a KI for Land designated as Agricultural Land Reserves because of its importance in the determination of land suitability for agricultural production. Project-related activities have the potential to affect soil resources on land designated as Agricultural Land Reserve that occurs along the transmission line corridor. No land designated as Agricultural Land Reserve is found within the mine site.	Project Report Specifications (1998) Environmental Impact Statement Guidelines (2008) BC *Agricultural Land Commission Act* (2002) *Agricultural Land Reserve Use, Subdivision and Procedure Regulation (2002)* BC *Forest and Range Practices Act (2004)* (*Forest and Range Practices Act*)	CLI map Agricultural Capability Ratings Field data Lab Analyses (refer to Appendix 5-4-G in the March 2009 EIS/Application)

Agricultural capability is defined as the suitability of land for sustained production of cultivated crops based on soil, climate and landscape characteristics. In British Columbia, seven classes have been developed to rate agricultural land capability. Class 1 lands have the highest and Class 7 lands the lowest capability to support agricultural land use activities.

Agricultural capability ratings assess soil physical and chemical factors such as texture, salinity, fertility, stoniness, and rooting restrictions in addition to site characteristics such as slope class and drainage pattern (Canada Land Inventory 1969). Soil capability in agricultural areas is assessed by evaluating surface soil degradation potential and loss.

The Land Capability Classification of Agriculture in British Columbia (Kenk and Cotic 1983) was not used since specific areas of ground disturbance have not been defined along the transmission line and, as a result, a detailed soil sampling at these sites could not be undertaken.

The Canada Land Inventory (CLI) soil capability classification database was used to assess agricultural capability. The CLI rating system has been applied to agricultural lands throughout Canada to assess the suitability of land to sustain agricultural crops.

The importance of Agricultural capability in relation to Project activities is that it provides a quantitative measure to determine if Project activities result in changes in soil quality for agricultural areas.

BASELINE CONDITIONS FOR SOIL

The following sections summarize previous work and baseline soil conditions which include soil map units for the mine site and soil orders for the transmission line corridor. Soil associations for the mine site and transmission line are presented in Appendix 5-4-J in the March 2009 EIS/Application. Baseline conditions for the access road are included in this section as an assessment will be required once road engineering plans are confirmed.

For the mine site, additional information is presented in support of the soil stripping and salvage operation that are associated with Project construction, including topsoil depths, compaction and rutting risk, erosion risk of topsoil, and concentrations of metal for soils within the mine site.

PREVIOUS WORK

A number of relevant studies have been completed in the past decade within or immediately adjacent to the proposed mine site, including work by Talisman Land Resource Consultants Inc. (Appendices 5-4-A to 5-4-C in the March 2009 EIS/Application) and Madrone Consultants Ltd. (Appendix 5-4-D in the March 2009 EIS/Application); each of these is discussed in more detail below.

A TEM was developed by Madrone for the mine site area. This study used 1993 1:15,000 scale colour photography. The final map products were issued at 1:20,000. Mapping was completed directly from hardcopy air photos. The TEM program sampled over 410 sites or 33% of the 1252 polygons mapped, meeting the standards outlined by the Province for SIL3 work. These data are also incorporated into this report (Appendix 5-4-K in the March 2009 EIS/Application).

The Talisman study consists of a preliminary overburden assessment and suitability for reclamation assessment for the open pit area. The study also includes a surficial deposit sampling program and laboratory analysis of background trace metal concentrations. General soil parameters, including texture, percent coarse fragments, pH, and nutrient levels, are used to characterize the different types of surficial deposits. Overall results have been used to evaluate the suitability of surficial deposits for use in soil reconstruction. This data is incorporated in the soil mapping. The field data are listed in Appendix 5-4-K in the March 2009 EIS/Application and chemical data is in Appendix 5-4-L in the March 2009 EIS/Application.

The transmission line and access road assessment used existing data, which included 1:250,000 CLI maps and a broad reconnaissance level soil survey conducted by Valentine et al. (1987) to determine soil associations.

GAP ANALYSIS

The Talisman reports (Appendices 5-4-A to 5-4-C in the March 2009 EIS/Application) were reviewed and compared with requirements for soils described in the Project Report Specifications. These specifications were issued under the harmonized BCEAA and CEAA in 1998. This historic information was also reviewed in light of current requirements and practice for proposed projects (e.g., Kemess North Mine) and existing regulations (e.g., BC *Mines Act* Permit Application requirements) pertaining to mining operation in British Columbia. The aim of this review was to anticipate current regulatory requirements that must be met for the EA and to facilitate the gathering of information necessary for an eventual permit application.

The documentation and Panel Review process for the Kemess North Mine were reviewed for further guidance on matters related to the collection and interpretation of baseline soils data.

Overview level results of the review of historic data and reports are as follows:

- Methods, site selection, sampling frequency and reporting followed the PRS
- Methods and reporting were in accordance with standards in effect at the time, and
- Additional studies were recommended for 2006 to better define baseline conditions, address new data collection standards and meet current regulatory requirements for both the EA and regulatory requirements under MAPA.

Other considerations include:

1. Examination of Land designated as ALR along the Access Road corridor
2. Higher survey intensity from a SIL3 to 2 to meet MAPA requirements in the mine site area
3. Requirements for more detailed mapping from 1:20,000 scale to 1:10,000
4. Reclamation requirements to map soil depth by horizon within the mine site area to support soil salvage and reclamation efforts

APPROACH AND METHODS

Data accumulated between 1995 and 1998 by Talisman, along with data collected for the TEM program by Madrone during 1993 and 1995, were used in conjunction with data collected during the summer of 2006, to meet current regulations applicable to mine permitting and EA. Every effort was made to preserve as much of the previous data as possible. The 2006 data collection methods were matched to the previous studies to ensure that data was compatible.

The data sources were combined into a single database and were used to develop the updated soil map and associated map products. A similar approach to development of the Talisman soil map units was employed; however, the increased level of detail available following the 2006 field season led to modifications of the map units developed for the 2006 report. In addition, the 2006 terrain mapping, upon which the soil map was developed, was completed at a finer scale (within most of the mine site LSA).

Data was incorporated from three primary sources for the soils component of this report:

- 2006: JWA soil and terrain field program
- 1995–1998: Talisman field program, and
- 1993–1995: TEM field program (Madrone).

The field survey was carried out in the summer and early fall of 2006. There were a total of 223 soil inspections completed at representative sites in and around the mine site LSA, and along the access road and transmission line corridors. Soil field plots for each field program are listed in Table 2.6.1.6-8 and presented on Figures 2.6.1.6-2, 2.6.1.6–3, and 2.6.1.6–4.

A SIL 2 soil survey was carried out on the mine site LSA.

All soil inspections were conducted using a shovel and Dutch auger to a depth of 1.2 m or shallower if bedrock or high coarse fragment content (>70%) were encountered. In areas of deep organics, using an auger extension, depths of 1.6 m were reached.

For each soil inspection, the following site conditions were recorded:

- GPS coordinates
- Surface expression
- Slope
- Slope position
- Aspect
- Gradient
- Slope length
- Drainage
- Surface stoniness, and
- Parent materials.

Table 2.6.1.6-8 Summary of Soil Field Plots

Survey Area/Survey Period	Plots	Hectares/Plot
Mine Site Local Study Area		
Jacques Whitford AXYS (2006)	136	32.4
Talisman (1995-1998)	223	19.8
TEM (1993-1995)	30	146.9
Total	389	11.3
Transmission Line Local Study Area		
Jacques Whitford AXYS (2006)	18	n/a
Access Road Local Study Area		
Jacques Whitford AXYS (2006)	78	n/a

For each soil pit, soil horizons were described using the Canadian System of Soil Classification criteria established by the Soil Classification Working Group (1998) and according to national standards established by the Expert Committee on Soil Survey (1983; 1987).

Each soil profile was classified to the subgroup level according to the Canadian System of Soil Classification (Soil Classification Working Group 1998). A general soil and site description for each soil inspection site is provided in Appendix 5-4-K in the March 2009 EIS/Application.

Chemical analyses were completed for inspection sites established during three separate programs (Table 2.6.1.6-9):

- 2006: JWA field program
- 1995 to 1997: Talisman field program, and
- 1993 and 1995: TEM field program (Madrone).

The chemistry and physical property data collected assisted in proper soil classification to the subgroup level and provided information necessary for calculating reclamation suitability ratings. Soil chemical and physical properties from the three field campaigns are summarized in Appendix 5-4-L in the March 2009 EIS/Application.

Table 2.6.1.6-9 Soil Sample Program for the Prosperity Project

Field Programs	Soil Sample Sites
Talisman 1995-1998	25
TEM 1993–1995 (Madrone)	33
Jacques Whitford AXYS 2006	15

A soil map unit is a "defined and named repetitive grouping of soil bodies occurring together in an individual and characteristic pattern over the soil landscape" (Gregorich et al. 2001). A soil map unit may consist of a single soil type, but more commonly consists of a dominant soil type and inclusions of other soil types.

Soil map units were developed for the mine site regional study area and for the access road local study area. Soil mapping was based on the TEM mapping and was verified by a field inventory program. The map unit symbols used were modified from those used by Madrone

Soil map units were not delineated for the transmission line corridor since:

- The soil disturbance created during transmission line construction is generally confined to pole locations and to roads related to construction and maintenance.
- The level of soil disturbance is typically minimal for this type of activity relative to mine and road construction.

CLI maps were used as a basis to quantify broad soil orders within the transmission line LSA. A limited number of soil inspections were undertaken on the proposed transmission corridor in 2006 to verify the broad scale CLI Maps. The inspection points were focused on areas designated as Agricultural Land Reserve. When the extent and location of potential soil disturbances have been determined, a decision can be made whether further soil inspections are appropriate.

The description of a map symbol is based on the proportions of different soil types in specific landscape types. With the scale of mapping completed, often more than one main soil type occurred within a single mapped polygon. Therefore, where more than one soil type was present, the map symbol consisted of complexes. These complexes consisted of a dominant soil type with up to two additional differing soil types, which together account for the entire map symbol (Figure 2.6.1.6-11).

The soil map symbol has two components:

- Soil map unit(s) and decile extents, and
- Slope class(es).

Soil Map Symbol

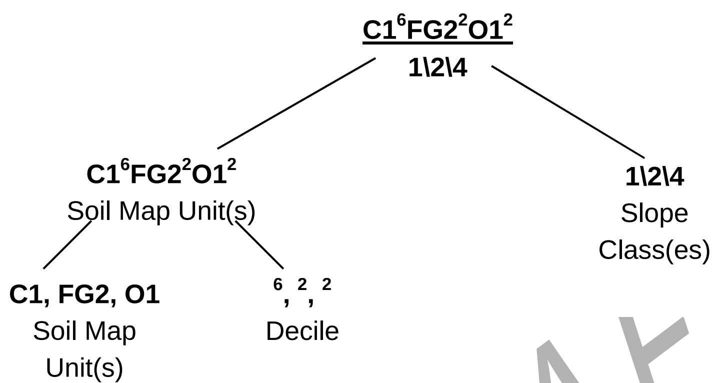


Figure 2.6.1.6-11 Map Symbol Description

OVERVIEW OF BASELINES FOR SOIL

Mineral soils of the mine site are typically moderately well to well drained Brunisols or Luvisols developed on morainal parent materials. There are occurrences of organic soils which have developed in depressions and along drainages. These are primarily concentrated in the southern region of the mine site LSA. A soil model matrix was developed for the mine site LSA based on plot data and information contained in the Talisman soil survey and the Valentine et al. (1987) soil report. The soil model matrix was used to populate a soil map.

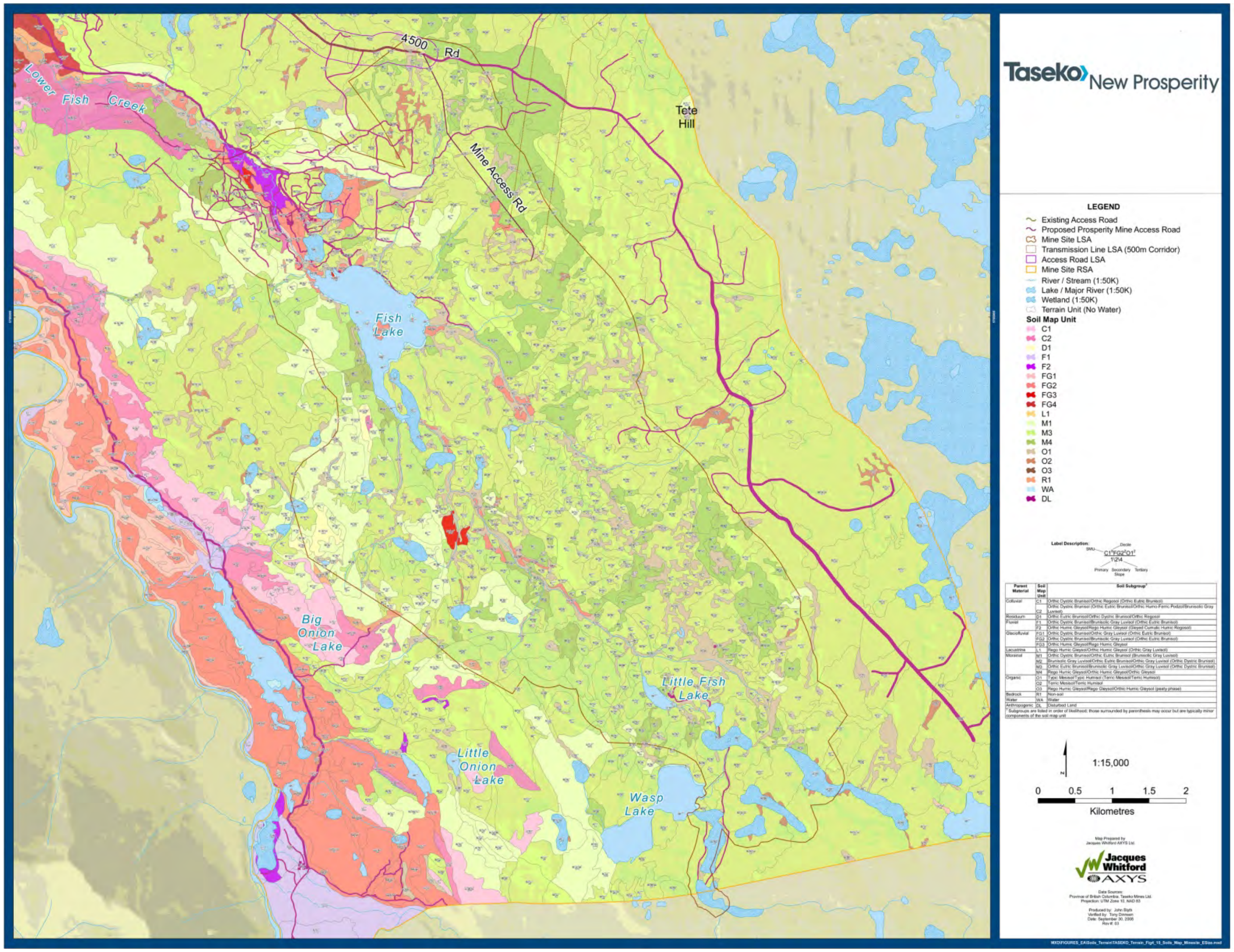


Figure 2.6.1.6-12 Soils of the Mine Site Local Study Area and Regional Study Area

A total of 14 soil map units SMUs were developed for the mine site area, excluding bedrock outcrops, water bodies and disturbed land (Table 2.6.1.6-10). A soils map of the mine site LSA is provided on Figure 2.6.1.6-12.

Table 2.6.1.6-10 Soil Map Unit Symbol Descriptions for the Mine Site Local Study Area

Parent Material	Soil Map Unit	Surface Expression[1]	Drainage[2]							Soil Subgroup[3]
			VR	R	W	MW	I	P	V	
Colluvial	C1	x,v,w	x	x	x	x	-	-	-	Orthic Dystric Brunisol/Orthic Regosol (Orthic Eutric Brunisol)
	C2	a,b,j,k	x	x	x	-	-	-	-	Orthic Dystric Brunisol (Orthic Eutric Brunisol/Orthic Humo-Ferric Podzol/Brunisolic Gray Luvisol)
Residuum	D1	all	x	x	x	-	-	-	-	Orthic Eutric Brunisol/Orthic Dystric Brunisol/Orthic Regosol
Fluvial	F1	f,t,v	-	x	x	x	-	-	-	Orthic Dystric Brunisol/Brunisolic Gray Luvisol (Orthic Eutric Brunisol)
	F2	j,p,v	-	-	-	-	x	x	-	Orthic Humic Gleysol/Rego Humic Gleysol (Gleyed Cumulic Humic Regosol)
Glaciofluvial	FG1	a,k,r	-	x	x	x	-	-	-	Orthic Dystric Brunisol/Orthic Gray Luvisol (Orthic Eutric Brunisol)
	FG2	b,j,m,p,t,u	-	x	x	x	-	-	-	Orthic Dystric Brunisol/Brunisolic Gray Luvisol (Orthic Eutric Brunisol)
	FG3	b,j,p,u	-	-	-	-	x	x	-	Orthic Humic Gleysol/Rego Humic Gleysol
Lacustrine	L1	p	-	-	x	x	x	x	-	Rego Humic Gleysol/Orthic Humic Gleysol (Orthic Gray Luvisol)
Morainal	M1	v,w,x	-	x	x	x	-	-	-	Orthic Dystric Brunisol/Orthic Eutric Brunisol (Brunisolic Gray Luvisol)
	M2	k,r	-	x	x	x	-	-	-	Brunisolic Gray Luvisol/Orthic Eutric Brunisol/Orthic Gray Luvisol (Orthic Dystric Brunisol)
	M3	a,b,j,m,p,u	-	x	x	x	-	-	-	Orthic Eutric Brunisol/Brunisolic Gray Luvisol/Orthic Gray Luvisol (Orthic Dystric Brunisol)
	M4	b,j,p,t,u	-	-	-	-	x	x	-	Rego Humic Gleysol/Orthic Humic Gleysol/Orthic Gleysol
Organic	O1	b,j,p	-	-	-	-	-	-	x	Typic Mesisol/Typic Humisol (Terric Mesisol/Terric Humisol)
	O2	v (b,p with poor drainage)	-	-	-	-	-	x	x	Terric Mesisol/Terric Humisol
	O3	x	-	-	-	-	-	x	x	Rego Humic Gleysol/Rego Gleysol/Orthic Humic Gleysol (peaty phase)
Bedrock	R1	all	-	-	-	-	-	-	-	Non-soil
Water	WA	not applicable	-	-	-	-	-	-	-	Water
Anthropogenic	DL	all	-	-	-	-	-	-	-	Disturbed Land

NOTES:
[1, 2] Surface expression codes and Drainage codes are defined in Appendix 5-4-E in the March 2009 EIS/Application.
[3] Subgroups are listed in order of likelihood; those surrounded by parenthesis may occur but are typically minor components of the soil map unit

The types of parent material observed in the Project area and the corresponding SMUs include:

- Shallow to deep, very gravelly, coarse to moderately coarse-textured colluvial or mixed colluvial and morainal material (C1, C2)
- Medium textured, gravelly to very gravelly residuum (D1)
- Slightly gravelly to very gravelly, moderately coarse to moderately fine-textured recent fluvial material (F2)
- Very gravelly, sandy glaciofluvial material (FG1, FG2, FG3)
- Fine textured, non-stony lacustrine material (L1), and
- Shallow to deep, slightly gravelly to very gravelly, coarse to moderately fine-textured till (M1, M3, M4)
- Deep to shallow organic over mineral material (O1, O2, O3).

Most of the map units within the mine site footprint occur on either morainal or organic parent materials (77.8 and 13.4% respectively). All of the remaining parent material types add up to only 8.8% of the total area, including non-soil units such as water (WA), disturbed land (DL) and bedrock (R1). Of the morainal units, M3 occurs most often, at 54.1% of the total land area. M1 and M4 occupy 10 and 13.7% respectively. Of the organic based units, O1 and O2 dominate with 10.5 and 2.9% respectively. Colluvial based SMUs occupy 0.5% of the area, residual SMUs occupy 0.4% and lacustrine SMUs occupy less than 0.1% of the mine site LSA. Together, fluvial and glaciofluvial units account for about 3% of the total aerial extent.

Table 2.6.1.6-11 Soil Map Unit Areas for the Mine Site Local Study Area

Soil Map Unit	Mine Site Footprint	
	ha	%
C1	6.6	0.1
C2	16.2	0.4
Total Colluvial	22.8	0.5
D1	16.8	0.4
Total Residual	16.8	0.4
F2	22.9	0.5
Total Fluvial	22.9	0.5
FG1	4.9	0.1
FG2	102.8	2.3
FG3	10.8	0.2
Total Glaciofluvial	118.5	2.6
L1	1.4	0.0
Total Lacustrine	1.4	0.0
M1	439.1	10.0
M3	2,385.9	54.1
M4	603.8	13.7
Total Morainal	3,428.8	77.8
O1	463.6	10.5
O2	129.7	2.9
O3	0.9	<0.1
Total Organic	594.2	13.4
DL	70.2	1.6
R1	6.6	0.1
WA	124.9	2.8
Total Miscellaneous	201.7	4.5
Total	**4,407.1**	**100.0**

In general, soils along the road corridor are well drained, morainal in origin, and similar to those found at the mine site. Soils tend to be better developed along the road corridor and fewer Brunisols are present. When interpreting the soil maps it is important to remember that as the distance from the mine increases, Orthic Gray Luvisols tend to replace Brunisolic Gray Luvisols in similar landscape positions and Orthic Eutric Brunisols tend to replace Orthic Dystric Brunisols. This shift occurs rapidly as the elevations decrease moving north along the access road. In addition, at the most northerly section of the road corridor, there are fluvial and glaciofluvial parent materials associated with the Chilcotin River valley with characteristics unlike any near the mine site.

A soil model matrix was developed for the proposed access road corridor based on the access road plot data, the mine site plot data and the findings of the Valentine et al. (1987) report. The Valentine report and mine site data was used as a general guideline to fill gaps in inspection points. The soil model matrix was used in conjunction with detailed terrain mapping to populate a soil map (Figures 2.6.1.6–13, 2.6.1.6–14 and 2.6.1.6–15). The primary difference between the mine site and access road models is in the subgroups populating the matrix, rather than in the combination of parent materials, surface expressions, and drainages which form the basis of the soil map units.

A total of 16 soil map units were developed for the access road area, excluding bedrock outcrops, water and disturbed land (Table 2.6.1.6-12). The types of parent material observed in the Project area include:

- Shallow to deep, gravelly, coarse to moderately coarse-textured colluvial or mixed colluvial and morainal material (C1, C2)
- Slightly gravelly to very gravelly, finely-textured to moderately coarse recent fluvial material (F1, F2)
- Gravelly to very gravelly, moderately fine to sandy glaciofluvial material (FG1, FG2, FG3, FG4)
- Silty to silty clay loam lacustrine material (L1)
- Shallow to deep, slightly gravelly to very gravelly, coarse to moderately fine-textured till (M1, M2, M3, M4), and
- Deep to shallow organic over mineral material (O1, O2, O3).

Table 2.6.1.6-12 Soil Map Unit Symbol Descriptions for the Access Road Local Study Area

Parent Material	Soil Map Unit	Surface Expression[1]	Drainage[2]							Soil Subgroup(s)[3]
			VR	R	W	MW	I	P	V	
Colluvial	C1	v	x	x	x	x	-	-	-	Orthic Eutric Brunisol (Brunisolic Gray Luvisol/)
	C2	a,b,j,k	-	x	x	x	-	-	-	Orthic Eutric Brunisol/Brunisolic Gray Luvisol (Orthic Gray Luvisol)
Fluvial	F1	f,j,p,t,v	-	x	x	x	-	-	-	Brunisolic Gray Luvisol/Rego Dark Brown Chernozem (Orthic Gray Luvisol/Orthic Eutric Brunisol)
	F2	f,j,p,v	-	-	-	-	x	x	-	Orthic Humic Gleysol/Rego Humic Gleysol (Gleyed Cumulic Humic Regosol)
Glaciofluvial	FG1	a,h,k,r,s	-	x	x	x	-	-	-	Orthic Eutric Brunisol (Orthic Gray Luvisol)
	FG2	b,f,j,m,p,t,u	-	x	x	x	-	-	-	Orthic Gray Luvisol/Orthic Eutric Brunisol (Eluviated Eutric Brunisol)
	FG3	j,p,u	-	-	-	-	x	x	-	Orthic Humic Gleysol/Rego Humic Gleysol
	FG4	v	-	x	x	-	-	-	-	Orthic Eutric Brunisol/Brunisolic Gray Luvisol (Orthic Gray Luvisol)
Lacustrine	L1	p,v	-	-	-	x	x	x	-	Orthic Gray Luvisol/Orthic Dark Brown Chernozem (Rego Humic Gleysol/Orthic Humic Gleysol)
Morainal	M1	v,w	-	x	x	x	x	-	-	Orthic Eutric Brunisol (Brunisolic Gray Luvisol/Orthic Gray Luvisol)
	M2	h,k,r	-	x	x	x	-	-	-	Orthic Gray Luvisol/Orthic Eutric Brunisol (Brunisolic Gray Luvisol)
	M3	a,b,j,m,p,u	-	x	x	x	-	-	-	Orthic Gray Luvisol (Orthic Eutric Brunisol/Brunisolic Gray Luvisol/Eluviated Dark Brown Chernozem)
	M4	b,j,p,u	-	-	-	-	x	x	-	Rego Humic Gleysol/Orthic Humic Gleysol/Rego Gleysol
Organic	O1	b,p	-	-	-	-	-	-	x	Typic Mesisol/Typic Humisol (Terric Mesisol/Terric Humisol)
	O2	v,w (b with poor drain)	-	-	-	-	-	x	x	Terric Mesisol/Terric Humisol
	O3	x	-	-	-	-	-	x	x	Rego Humic Gleysol/Rego Gleysol/Orthic Humic Gleysol (peaty phase)
Bedrock	R1	all	-	-	-	-	-	-	-	Non-soil
Water	WA	not applicable	-	-	-	-	-	-	-	Water
Anthropogenic	DL	all	-	-	-	-	-	-	-	Disturbed Land

NOTES:
[1, 2] Surface expression codes and Drainage codes are defined in Appendix 5-4-E in the March 2009 EIS/Application.
Subgroups are listed in order of likelihood; those surrounded by parenthesis may occur but are generally minor components of the soil map unit

The majority of map units along the road corridor occur on morainal parent material (69.5%) as shown in Table 2.6.1.6-13. Soil map unit M3 occurs most often, at 62.9% of the total land area. M1 and M4 occupy 3.6 and 2.8% respectively. Of the remaining parent materials, organic and glaciofluvial are the most significant at 3.5 and 7.1% respectively. Within the glaciofluvial category, FG2 occupies the most area at 6.4%. The organics are dominated by the O1 and O2 SMUs at 1.3 and 2% respectively. The remaining parent material categories add up to a total of 19.9%. This includes non-soil units such as water (WA), disturbed land (DL) and bedrock (R1), which total 16.1% of the total area. Colluvial based SMUs occupy 2.4% of the area, fluvial SMUs occupy 1.4% and lacustrine SMUs occupy less than 0.1% of the buffered access road.

Table 2.6.1.6-13 Soil Map Unit Areas for the Access Road Local Study Area

Soil Map Unit	Road Corridor	
	ha	**%**
C1	37.9	1.1
C2	45.2	1.3
Total Colluvial	83.1	2.4
F1	18.9	0.5
F2	28.8	0.8
Total Fluvial	47.6	1.4
FG1	15.9	0.5
FG2	222.6	6.4
FG3	3.8	0.1
FG4	4.6	0.1
Total Glaciofluvial	246.9	7.1
L1	0.9	<0.1
Total Lacustrine	0.9	<0.1
M1	125.0	3.6
M2	9.4	0.3
M3	2,198.2	62.9
M4	96.8	2.8
Total Morainal	2,429.5	69.5
O1	46.2	1.3
O2	68.9	2.0
O3	8.8	0.3
Total Organic	123.9	3.5
DL	555.7	15.9
R1	0.7	<0.1
WA	6.4	0.2
Total Miscellaneous	562.8	16.1
Total	**3,494.7**	**100.0**

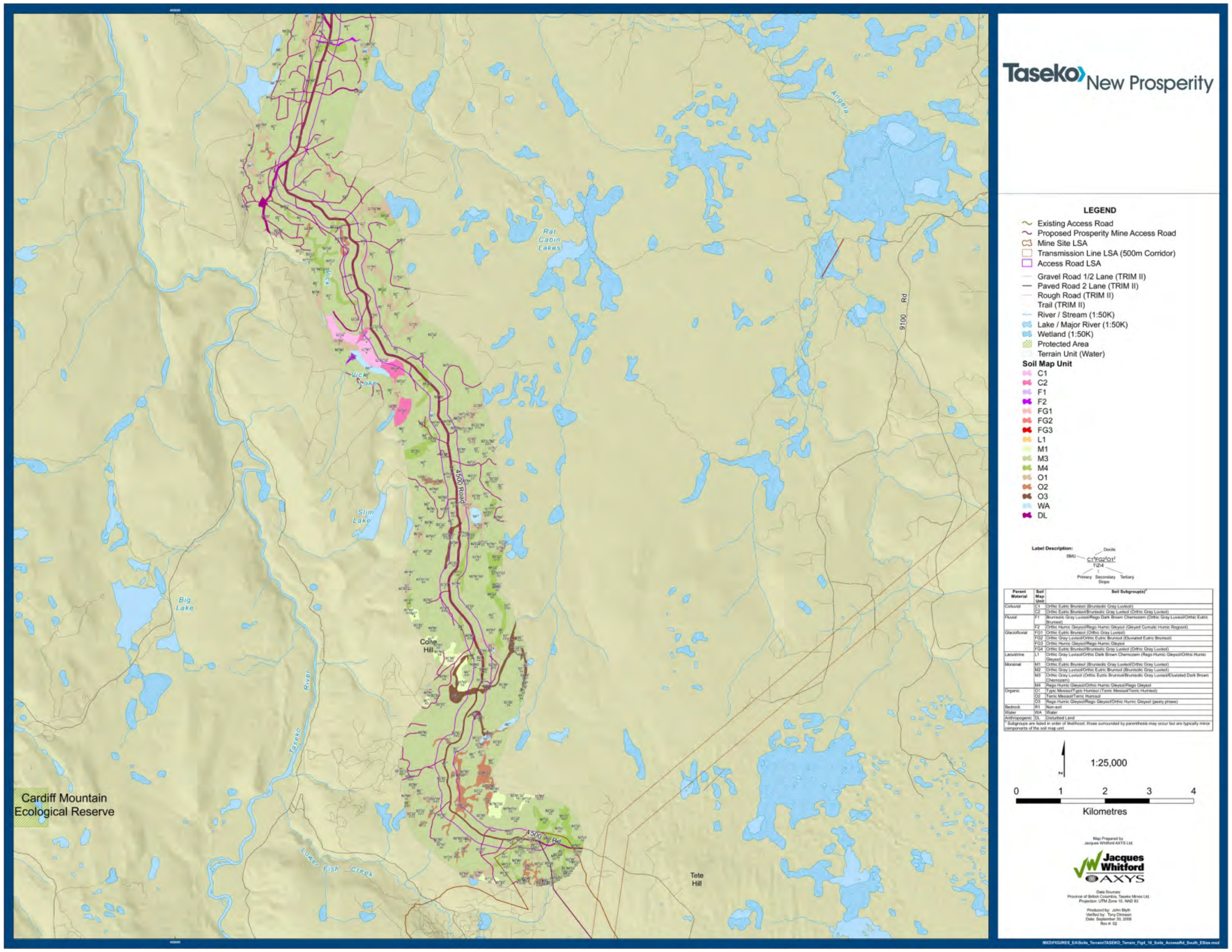


Figure 2.6.1.6-13 Soils of the Access Road Local Study Area (Southern Section)

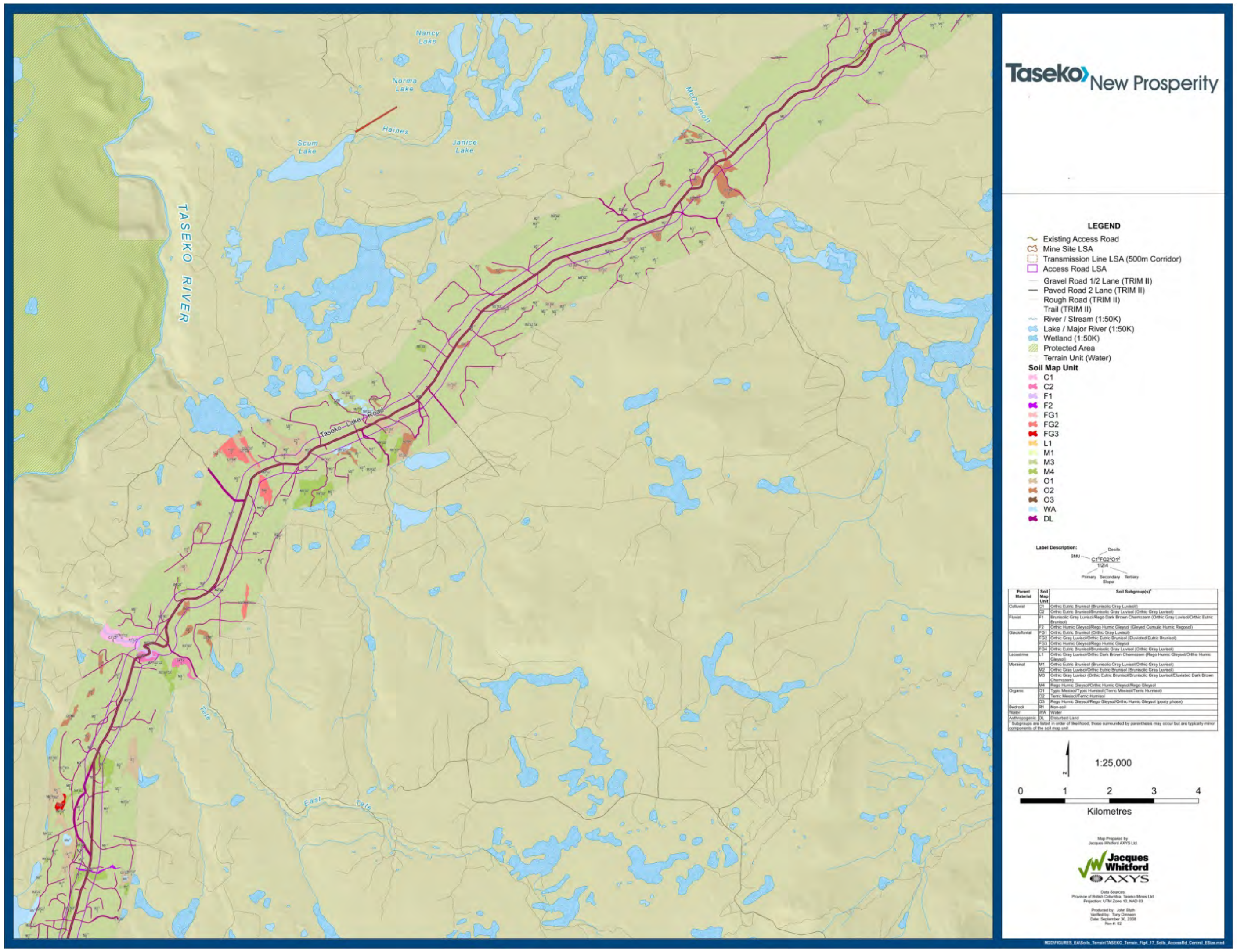


Figure 2.6.1.6-14 Soils of the Access Road Local Study Area (Central Section)

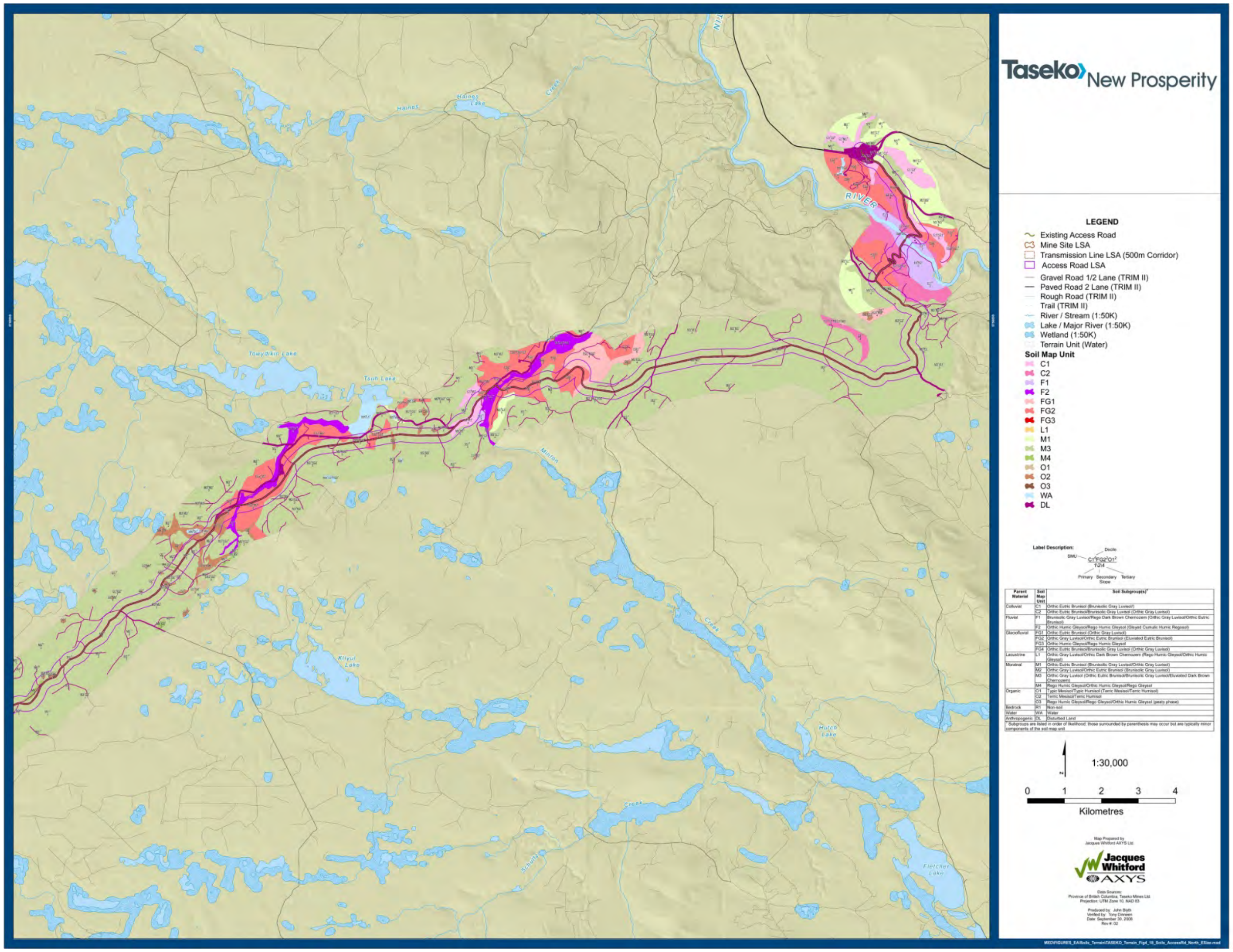


Figure 2.6.1.6-15 Soils of the Access Road Local Study Area (Northern Section)

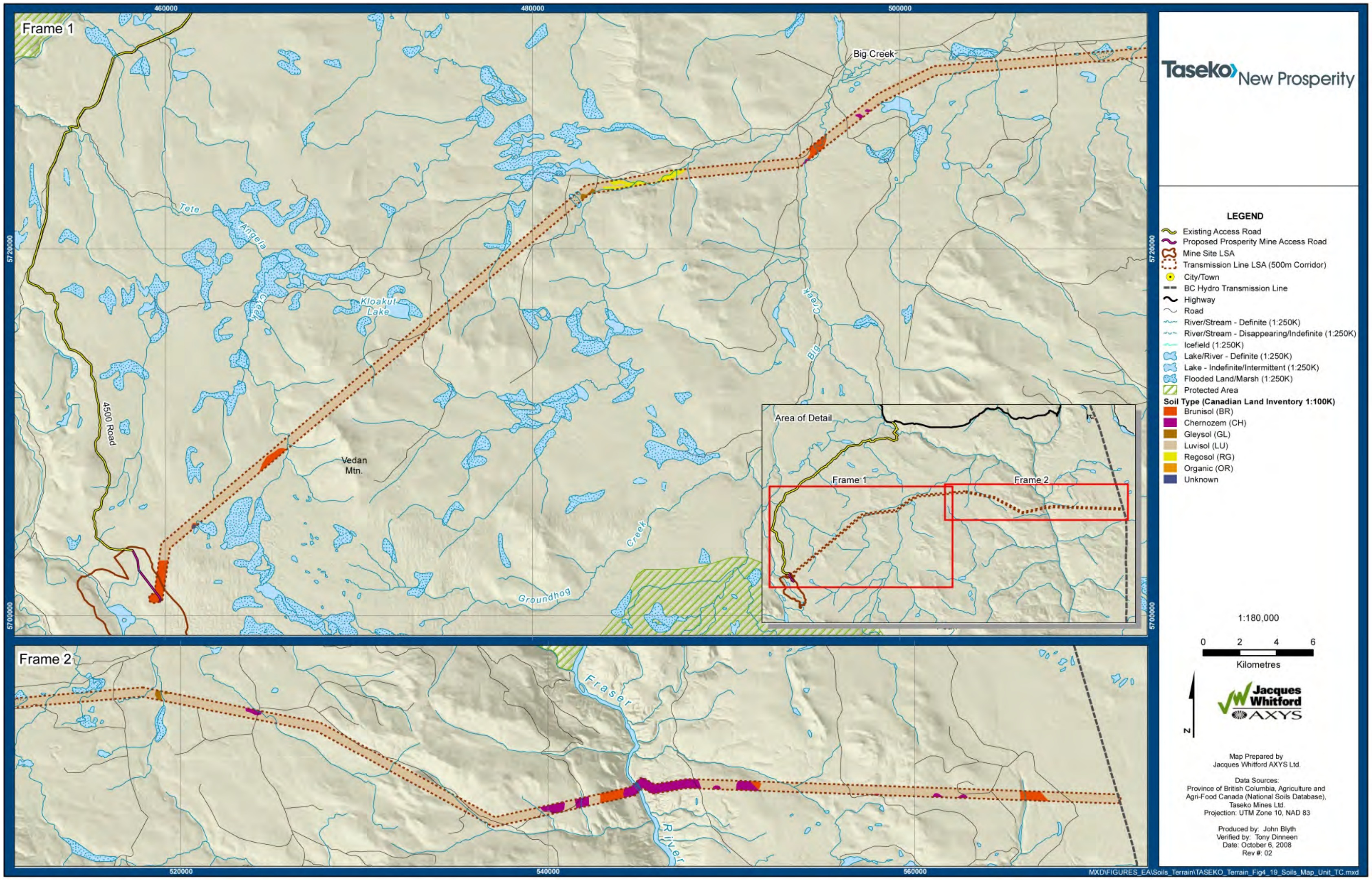


Figure 2.6.1.6-16 Canadian Land Inventory Soils of the Transmission Line Local Study Area

A soil map based on Canada Land Inventory (CLI) data is included in this report to illustrate which broad soil types occur along the transmission line LSA (Figure 2.6.1.6-16). A summary of the areas of each soil order is contained in Table 2.6.1.6-14. The majority of the transmission line (85%) is dominated by Luvisols, which are characterized by the eluviation of clay and humic material into the B horizon or subsoil.

Areas closest to the mine site that fell within the Agricultural Land Reserve tended to be associated with wetland soils. Wetter soils included an organic veneer on morainal material (peaty Rego Gleysol), and gleyed or humic variants of Regosols. Brunisolic Gray Luvisols or Orthic Eutric Brunisols occurred on drier sites. Parent materials were either morainal or fluvial. The non-ALR soils in this section of the transmission line route appeared to be Orthic Gray Luvisols and Brunisolic Gray Luvisols similar to those found on the mine site.

West of the Fraser River the ALR lands tended to occur on, or adjacent to fluvial plains or terraces, some of which had been utilized as forage for livestock. It appeared that several of the fields had been planted to tame species. Fluvial soils included Cumulic and Orthic Humic Regosols. Soils forming on morainal parent materials included Brunisolic Gray Luvisols, Orthic Gray Luvisols, and Orthic Dark Gray Chernozems. A weakly formed Orthic Dark Gray Chernozem was sampled just west of, and above the Fraser River on a fluvial fan. Coarse fragment content was generally lower than that of the mine site or access road.

East of the Fraser River was a complex of coniferous forests, deciduous forests and grassland plains. The grasslands and deciduous forests tended to be composed of Orthic Dark Gray Chernozems on compacted till. The soils under coniferous forests were mostly Orthic Gray Luvisols; however an Orthic Eutric Brunisol was also sampled. These soils were also formed on compacted till. Coarse fragment content was generally lower than that associated with morainal materials on the mine site or the access road corridor.

Table 2.6.1.6-14 Soils Orders of the Transmission Corridor Local Study Area

Soil Order	ha	%
Unknown	12.6	0.2
Brunisol	387.5	6.2
Chernozem	411.3	6.6
Gleysol	33.9	0.5
Luvisol	5,309.9	84.8
Organic	1.3	0.0
Regosol	107.4	1.7
Totals	**6,263.9**	**100.0**

SOURCE:
Canada Land Inventory. 1972. Reprint. Soil Capability Classification for Agriculture. Report No. 2. Department of the Environment. Ottawa, Ontario.

Within the mine site, As, Cu, Ni, Se and Zn were found in certain existing topsoil and subsoil samples to exceed recommended guidelines (CCME 1999). A full listing of the sites with elevated metals and associated values are contained in Appendix 5-4-O in the March 2009 EIS/Application. The naturally occurring elevated metals in the soil were not reflected in the vegetation samples taken in 2006 and 2007.

Overall the elevated metals in soils do not correlate well with plant metal exceedances at baseline conditions and, therefore, the elevated metals in the soil do not appear to limit the reclamation suitability of the soil (Figure 2.6.1.6-17).

Elevated metals in the soil do not necessarily indicate that vegetation will take up the metals in concentrations that may be detrimental to plant growth or harmful if consumed. A full discussion on trace elements in soils and uptake in vegetation is found in the Conceptual Reclamation Plan.

Overburden at the mine site occurs approximately 1 m below mineral soil and may be at greater depth for organic soils. A preliminary overburden assessment of the mine site was completed by Talisman Land Resource Consultants Inc. in 1997 to assess reclamation suitability. The overburden material was deemed unsuitable for reclamation due to high pH values (8.1 to 8.8), with additional limitations of fine textures (silt loam to heavy clay) in the glaciolacustrine parent material and high coarse fragment content in the glaciofluvial materials. Certain samples show that sodicity limits reclamation suitability at depths ranging from 25 to 39 m. As in the soil samples, certain overburden samples had existing As, Cr, and Ni concentrations higher than the recommended guidelines (CCME 1999). Guidance on overburden handling is outlined in the section on the Conceptual Reclamation Plan.

Soil chemical data was collected in support of characterizing the soil fertility conditions at the site. The levels measured provide an indication of baseline conditions for soils and can assist in land use restoration during reclamation activities.

General Parameters measured during the 1993 sampling by Talisman included:

- Moisture in sample (%)
- pH
- Total sulphur (%)
- Electrical conductivity (salts) (mmho/cm)
- Organic matter (%)
- Total nitrogen (%)
- Phosphorus, P
- Potassium, K
- Cation exchange capacity
- Exchangeable calcium
- Exchangeable magnesium, and
- Exchangeable potassium.

General parameters measured for 1995 and 1996 soil samples:

- Moisture in sample (%)
- pH
- Electrical conductivity (salts) (µmhos/cm)
- Total sulphur (%)
- Total organic carbon, C (%)
- Total nitrogen, N, (%)
- Total phosphorus, P
- Potassium T-K, ppm
- Carbon/nitrogen ratio, and
- Cation exchange capacity.

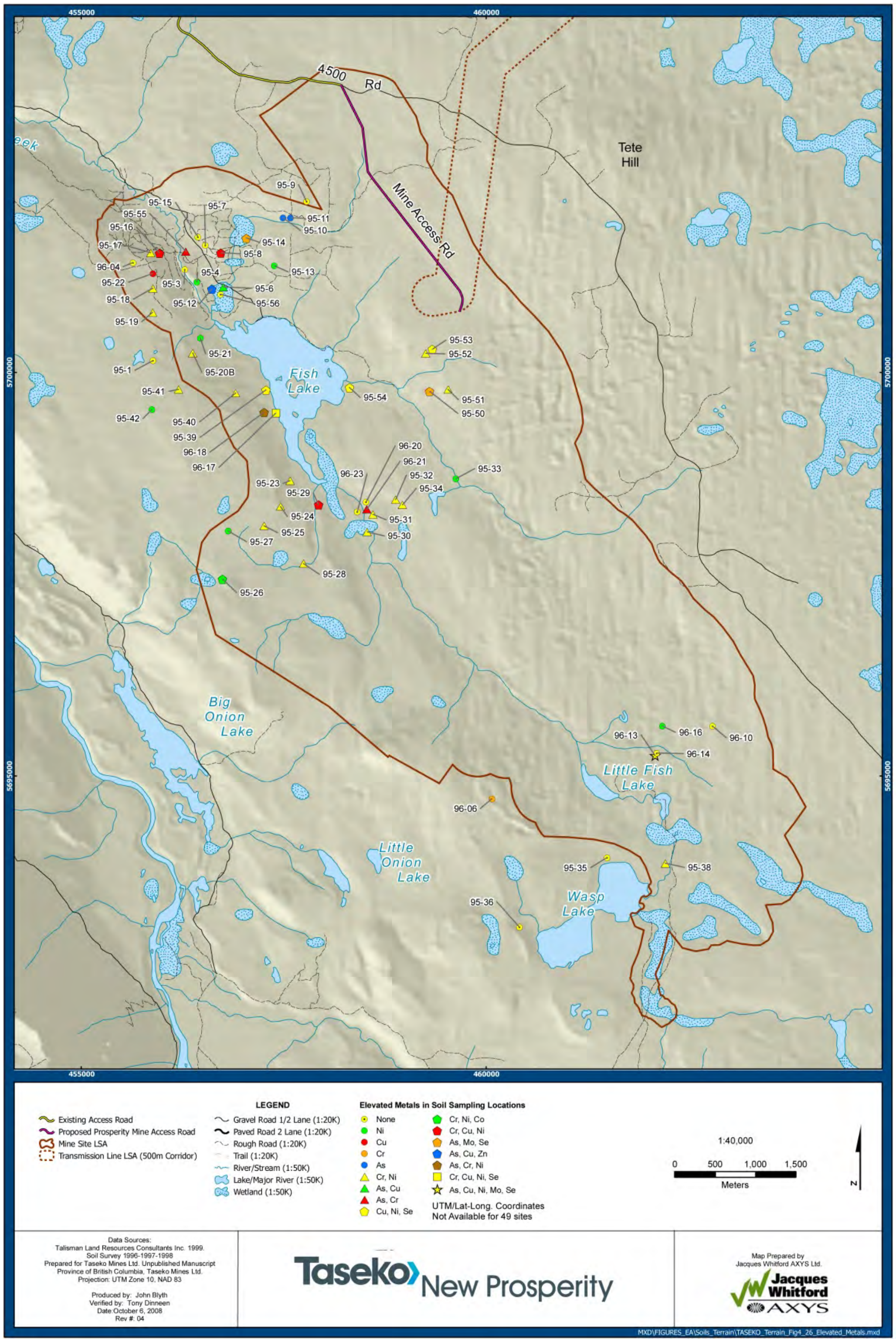


Figure 2.6.1.6-17 Locations of Elevated Metals in Soil within the Mine Site for Baseline

All data related to soil chemical properties are contained in Appendix 5-4-P in the March 2009 EIS/Application. Generally, the mine site soil has relatively low nutrient and carbon content. The soil status is reflected in forest productivity which, for the mine site LSA, ranges from moderate to low.

2.6.1.7 Vegetation

Vegetation baseline conditions were presented in Volume 5, Section 5.2 of the March 2009 EIS/Application. The transmission corridor and access road study areas remain unchanged for New Prosperity; see section 5.2.4.2 of Volume 5 in the March 2009 EIS/Application for a summary of the ecosystems mapped in these areas.

As discussed in Section 2.3.6, there have been small changes to the mine site LSA as a result of changes to project design and maximum disturbance area, including a minor deviation at the north end of the 2009 Prosperity LSA, and the removal of the portion of the 2009 Prosperity LSA directly east of Wasp Lake. No new field data has been collected to update the baseline mapping. As such, baseline vegetation conditions are re-summarized in Table 2.6.1.7-1 using Prosperity Project data and the New Prosperity LSA.

Table 2.6.1.7-1 Terrestrial Ecosystem Mapping Summary–Mine Site

BEC Unit	TEM Map Code	Ecosystem Description	Mine Site RSA (ha)	Prosperity Mine Site LSA (ha)	New Prosperity Mine Site LSA (ha)
MSxv	BF	Water sedge–Beaked sedge	546.0	137.0	133.6
	DT	Dandelion–Timber oatgrass	1.2	1.2	1.2
	GK	Pl–Grouseberry–Kinnikinnick	341.3	34.1	24.5
	JK	Juniper–Kinnikinnick	2.6	1.9	0.4
	LG	Pl–Grouseberry–Feathermoss	7,776.1	1,771.1	1,489.0
	LK	Pl–Kinnikinnick–Cladonia	140.6	43.0	37.9
	LT	Pl–Trapper's tea–Crowberry	342.3	6.7	4.4
	SC	Sxw–Crowberry–Knight's plume	343.9	225.0	132.1
	SG	Sxw–Crowberry–Glow moss	320.4	61.6	55.7
	SH	Sxw–Horsetail–Crowberry	243.2	85.2	73.9
	ST	Sxw–Labrador tea–Willow	2.9	2.9	2.9
	WJ	Bluebunch wheatgrass–Junegrass	10.7	0.0	0.0
	WM	Grey-leaved willow–Glow moss shrub carr	49.2	24.1	12.4
	WS	Willow–Scrub birch–Sedge fen	337.8	113.6	91.3
	YL	Yellow pond-lily	3.0	0.8	0.2
SBPSxc	BF	Water sedge–Beaked sedge fen	204.6	83.4	14.6
	DS	Drummond's willow–Sedge swamp	4.1	3.0	3.0
	DT	Dandelion–Timber oatgrass	32.7	0.0	0.0
	GA	Grass–Large-leaved avens	5.1	0.0	0.0
	JK	Juniper–Kinnikinnick	367.4	19.9	3.7
	LC	Pl–Kinnikinnick–Cladonia	1,107.5	159.9	7.3
	LG	Pl–Grouseberry–Feathermoss	24.2	23.4	0.0
	LK	Pl–Kinnikinnick–Feathermoss	4,759.1	1,491.3	372.8

BEC Unit	TEM Map Code	Ecosystem Description	Mine Site RSA (ha)	Prosperity Mine Site LSA (ha)	New Prosperity Mine Site LSA (ha)
	SB	Sxw–Scrub birch–Fen moss	124.5	61.6	9.2
	SF	Sxw–Scrub birch–Feathermoss	135.8	88.7	36.9
	SH	Sxw–Horsetail–Glow moss	102.1	29.2	14.5
	SM	Sxw–Horsetail–Meadowrue	96.5	0.0	0.0
	ST	Sxw–Labrador tea–Willow	0.6	0.0	0.0
	WJ	Bluebunch wheatgrass–Junegrass	11.4	7.5	0.0
	WM	Grey-leaved willow–Glow moss shrub carr	127.0	70.4	27.4
	WW	Willow–Scrub birch–Sedge fen	308.5	106.4	38.6
	YL	Yellow pond-lily	15.6	15.2	0.0
Unvegetated, Sparsely Vegetated or Anthropogenic Units					
MSxv	BE	Beach	0.4	0.4	0.0
	LA	Lake	109.7	28.8	6.2
	OW	Open Water	26.9	0.9	0.3
	RO	Rock Outcrop	0.4	0.0	0.0
	RZ	Road Surface	0.2	0.2	0.2
	TA	Talus	0.2	0.0	0.0
SBPSxc	ES	Exposed Soil	25.8	2.4	2.4
	LA	Lake	178.5	102.4	0.0
	TA	Talus	2.2	1.1	1.1
	OW	Open Water	14.3	1.5	0.6
	RO	Rock Outcrop	12.9	3.1	0.0
	RW	Rural	3.8	0.0	0.0
	RZ	Road Surface	3.8	3.3	3.1
Total			**18,267**	**4,812**	**2,601**

The summary of previous work and gap analysis for vegetation can be found in Volume 5, Section 5.2.1 of the March 2009 EIS/Application. Baseline data to support the description of vegetation can be found in Appendices 5.5-A through 5.5-L of the March 2009 EIS/Application.

Baseline data on ambient concentrations of trace elements in vegetation is provided in Appendices 5.5-D, 6-6-A and 6-6-B of the March 2009 EIS/Application. As noted in Section 2.6.1.6 of this assessment, there are no updates to the baseline conditions for trace elements in vegetation.

The Invasive Plant Management Plan presents updated baseline information on weeds and invasive plants.

Through review of current literature and guidelines the baseline conditions for individual vegetation KIs have been updated in Section 2.7.2.7.

2.6.1.8 Wildlife

The proposed Project is anticipated to interact with wildlife and wildlife habitat. For the purposes of this assessment wildlife refers to all species of wildlife that potentially occur in the Project area. This includes mammals, birds, amphibians, reptiles, and terrestrial invertebrates. Aquatic invertebrates and fish are addressed elsewhere in this Environmental Impact Statement (EIS). This section describes the existing (baseline) wildlife and wildlife habitat conditions in the Project area.

In 1998, a list of wildlife species to be assessed with respect to the potential effects of the Project previously assessed was selected through consultation with BC Ministry of Environment, Lands and Parks (now FLNRO) Region 5 staff, with input from the Canadian Wildlife Service (Appendix 5-6-A in the March 2009 EIS/Application). The selection of species was also informed by the results of the ecosystem mapping and baseline wildlife inventories. The selected species were referred to as “focal species”, but for the purpose of this assessment are referred to as Key Indicators (KIs).

The 1998 list was reviewed and approved by agency representatives at a Technical Working Group meeting held in May 2006, with two changes—the American badger (*Taxidea taxus jeffersonii*) was added as a KI (based on increasing number of known occurrences along the Fraser River, south of the Junction), and the upland sandpiper (*Bartramia longicauda*) was removed as a KI (occurrences appear to be a very rare event). Thus, 20 species and 1 wildlife group were confirmed as KIs. These species are listed in Table 2.6.1.8-1, and the rationale for their selection and the linkages between each KI and the regulatory setting described above are also presented.

All 21 KIs were assessed with respect to the environmental effects of the transmission line corridor and access road. Twelve of the KIs were assessed with respect to the environmental effects of the mine development area—great blue heron, sandhill crane, Barrow’s goldeneye, mallard, prairie falcon, short-eared owl, fisher, black bear, grizzly bear, moose, mule deer, and amphibians.

There is strong regional interest in provincially-listed and SARA-listed species. Available information suggests that 47 listed vertebrate wildlife species may occur in the Project area—15 of these were selected as KIs (Table 2.6.1.8-1).

Table 2.6.1.8-1 Wildlife Key Indicators: Selection Rationale and Regulatory Setting

Key Indicator	Species Name	Provincial Conservation Status (CDC, 2007)	Federal Conservation Status (COSEWIC, 2007)	Rationale for Selection	Regulatory Setting
California bighorn sheep	*Ovis canadensis*	blue	--	Conservation status, strong regional interest	*Wildlife Act, Weed Control Act, Forest and Range Practices Act*, Identified Wildlife Management Strategy[5], Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy, Cariboo-Chilcotin Grassland Strategy and Grassland Restoration Plan, Fraser Basin California Bighorn Sheep Management Plan, Churn Creek Sheep Migration Corridor Ecosystem Restoration Plan
Mule deer	*Odocoileus hemionus*	yellow	--	Socio-economic value as hunted and subsistence species, strong regional interest	*Wildlife Act, Weed Control Act, Mines Act, Forest and Range Practices Act*, Category of Ungulate Species[6], General Wildlife Measures for Ungulate Winter Range, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy, Cariboo-Chilcotin Grassland Strategy and Grassland Restoration Plan, Regional Mule Deer Winter Range Strategy
Moose	*Alces americanus*	yellow	--	Socio-economic value as hunted and subsistence species, strong regional interest	Federal Wetland Policy, *Wildlife Act, Weed Control Act, Mines Act, Forest and Range Practices Act*, Category of Ungulate Species, General Wildlife Measures for Ungulate Winter Range, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy
Grizzly bear	*Ursus arctos*	blue	Special Concern	Conservation status, strong regional and provincial interest, sensitivity to human disturbance	*Species at Risk Act, Wildlife Act, Mines Act, Forest and Range Practices Act*, Identified Wildlife Management Strategy, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy
Black bear	*Ursus americanus*	yellow	--	Traditional and socio-economic value as hunted species	*Wildlife Act, Mines Act, Forest and Range Practices Act*, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy
Fisher	*Martes pennanti*	blue	--	Conservation status, socio-economic value as trapped species, strong regional interest	*Wildlife Act, Mines Act, Forest and Range Practices Act*, Identified Wildlife Management Strategy, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy
American badger	*Taxidea taxus jeffersonii*	red	Endangered	Conservation status, strong regional interest	*Species at Risk Act, Wildlife Act, Forest and Range Practices Act*, Identified Wildlife Management Strategy, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy, Cariboo-Chilcotin Grassland Strategy and Grassland Restoration Plan
Townsend's big-eared bat	*Corynorhinus townsendii*	blue	--	Conservation status, strong regional interest	*Wildlife Act, Forest and Range Practices Act*, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy, Cariboo-Chilcotin Grassland Strategy and Grassland Restoration Plan
Great blue heron (interior subspecies)	*Ardea herodias herodias*	blue	--	Conservation status, strong regional interest	*Migratory Birds Convention Act*, Federal Wetland Policy, *Wildlife Act, Weed Control Act, Mines Act, Forest and Range Practices Act*, Identified Wildlife Management Strategy, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy
Mallard	*Anas platyrhynchos*	yellow	--	Socio-economic value as hunted species[7], strong regional interest	*Migratory Birds Convention Act*, Federal Wetland Policy, *Wildlife Act, Weed Control Act, Mines Act*, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy
Barrow's goldeneye (western population)	*Bucephala islandica*	yellow	--	Socio-economic value as hunted species[8], strong regional interest	*Migratory Birds Convention Act*, Federal Wetland Policy, *Wildlife Act, Weed Control Act, Mines Act, Forest and Range Practices Act*, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy, Cariboo-Chilcotin Grassland Strategy and Grassland Restoration Plan
Sandhill crane	*Grus canadensis*	blue[9]	Not at Risk	Conservation status, strong regional interest	*Migratory Birds Convention Act*, Federal Wetland Policy, *Wildlife Act, Weed Control Act, Mines Act, Forest and Range Practices Act*, Identified Wildlife Management Strategy, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy, Cariboo-Chilcotin Grassland Strategy and Grassland Restoration Plan

[5] Species on the Identified Wildlife list are those included in the Category of Species at Risk, established by provincial order under FRPA (http://www.env.gov.bc.ca/wld/frpa/species.html)
[6] Ungulates for which "ungulate winter range" may be required for winter survival are included in this category, established by provincial order under the *Forest and Range Practices Act* (http://www.env.gov.bc.ca/wld/frpa/species.html)
[7] The average annual mallard harvest (1974-2005) was 61.3% of the harvest of all dabbling ducks for that period (CWS, 2007).
[8] The average annual Barrow's goldeneye harvest (1974-2005) is 17.3% of the harvest of all diving ducks for that period (CWS, 2007).
[9] Three subspecies occur in the province: greater sandhill crane (*G. c. tabida*), lesser sandhill crane (*G. c. canadensis*), and Canadian sandhill crane (*G. c. rowani*). However, given the limited information on the status of these subspecies, the CDC listing applies to the species as a whole (BCWLAP, 2004l). The *tabida* subspecies is believed to be the most common breeder in the Central Interior, although some *rowani* birds may also breed there (Cooper, 1996).

Key Indicator	Species Name	Provincial Conservation Status (CDC, 2007)	Federal Conservation Status (COSEWIC, 2007)	Rationale for Selection	Regulatory Setting
Long-billed curlew	*Numenius americanus*	blue	Special Concern	Conservation status, strong regional interest	*Species at Risk Act, Migratory Birds Convention Act, Wildlife Act, Weed Control Act, Forest and Range Practices Act*, Identified Wildlife Management Strategy, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy, Cariboo-Chilcotin Grassland Strategy and Grassland Restoration Plan
Lewis's woodpecker	*Melanerpes lewis*	red	Special Concern	Conservation status, strong regional interest	*Species at Risk Act, Migratory Birds Convention Act, Wildlife Act, Weed Control Act, Forest and Range Practices Act*, Identified Wildlife Management Strategy, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy, Cariboo-Chilcotin Grassland Strategy and Grassland Restoration Plan
Yellow-breasted chat	*Icteria virens*	red	Endangered	Conservation status, strong regional interest	*Species at Risk Act, Migratory Birds Convention Act, Wildlife Act, Weed Control Act, Forest and Range Practices Act*, Identified Wildlife Management Strategy, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy, Cariboo-Chilcotin Grassland Strategy and Grassland Restoration Plan
Sagebrush Brewer's sparrow	*Spizella breweri breweri*[10]	red	--	Conservation status, strong regional interest	*Species at Risk Act, Migratory Birds Convention Act, Wildlife Act, Weed Control Act, Forest and Range Practices Act*, Identified Wildlife Management Strategy, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy, Cariboo-Chilcotin Grassland Strategy and Grassland Restoration Plan
Sharp-tailed grouse (*columbianus* subspecies)	*Tympanuchus phasianellus columbianus*	blue	--	Conservation status, strong regional interest	*Wildlife Act, Weed Control Act, Forest and Range Practices Act*, Identified Wildlife Management Strategy, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy, Cariboo-Chilcotin Grassland Strategy and Grassland Restoration Plan
Prairie falcon	*Falco mexicanus*	red	Not at Risk	Conservation status, strong regional interest	*Species at Risk Act, Migratory Birds Convention Act, Wildlife Act, Forest and Range Practices Act*, Identified Wildlife Management Strategy, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy, Cariboo-Chilcotin Grassland Strategy and Grassland Restoration Plan
Short-eared owl	*Asio flammeus*	blue	Special Concern	Conservation status, strong regional interest	*Species at Risk Act, Migratory Birds Convention Act*, Federal Wetland Policy*, Wildlife Act, Weed Control Act, Mines Act, Forest and Range Practices Act*, Identified Wildlife Management Strategy, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy, Cariboo-Chilcotin Grassland Strategy and Grassland Restoration Plan
Flammulated owl	*Otus flammeolus*	blue	Special Concern	Conservation status, strong regional interest	*Species at Risk Act, Migratory Birds Convention Act, Wildlife Act, Forest and Range Practices Act*, Identified Wildlife Management Strategy, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy, Cariboo-Chilcotin Grassland Strategy and Grassland Restoration Plan
Amphibians	--	One is blue	One is Special Concern; one is Threatened	Conservation status, potential vulnerability to Project effects, strong regional interest	*Species at Risk Act*, Federal Wetland Policy*, Wildlife Act*, *Weed Control Act, Fisheries Act, Mines Act , Forest and Range Practices Act*, Identified Wildlife Management Strategy, Sustainable Resource Management Plans, Cariboo-Chilcotin Land Use Plan Regional Biodiversity Conservation Strategy, Cariboo-Chilcotin Grassland Strategy and Grassland Restoration Plan

[10] Two Brewer's sparrow subspecies occur in BC—the other subspecies, the timberline Brewer's sparrow (*S.b.taverneri*), occurs in extreme northwest corners of the province in the Northern Boreal Mountains ecoprovince (Campbell et al., 2001)

OVERVIEW OF BASELINE CONDITIONS

A number of wildlife inventories and research studies have been completed in the Project area, with grasslands being the best-studied ecosystem. Among the earlier projects were a reconnaissance level survey of the biodiversity in the Cariboo-Chilcotin grasslands conducted in 1992 and 1993 (Roberts and Roberts, 1993); research on long-billed curlews (e.g., Hooper and Pitt, 1996); multiple waterfowl projects (e.g., Boyd et al. 1989; Savard 1991); a water-strider study (Spence, 1983); and radio-telemetry studies of bighorn sheep at the Junction (Ashcroft, 1986; Harrison, 1990). Since then, a large number of other studies have taken place in the area (e.g., Hooper and Pitt, 1996 [grassland bird communities]; Fischer et al. 2000 [moths]; Wiebe 2001 [northern flickers]; Cullen, 1998; Boyd et al., 2000 [eared grebes]; Evans et al., 2002 [Barrow's goldeneyes, buffleheads]; Cooke, 2001 [riparian systems in interior forests]).

Information is more limited in the western section of the Project area. With the exception of the field programs conducted in the late 1990s specifically for this Project (i.e., Appendix 5-6-J and Appendix 5-6-A in the March 2009 EIS/Application), little additional data is available for the mine site LSA. However, there are past and ongoing studies in adjacent areas that are generally applicable (e.g., in the same biogeoclimatic units, specific information on KI species) including Sopuck et al. 1997 (listed species); McCrory 2002 (grizzly bear, feral horses); and several fisher studies (L. Davis, pers. comm., January 2007).

There has also been multiple habitat mapping projects completed in and around the Project area. These include a biophysical habitat mapping inventory for the Chilcotin Lake and Marsh area (Kowall and Steciw 1992), and several TEM projects with wildlife interpretations: Ts'yl-os Provincial Park (McKenzie et al. 1996); the Churn Creek area (JMJ 1999), and the Chilcotin West area north of Alexis Creek (JMJ 2000).

The Project area includes provincial Management Units (MU) 5–2, 5–3, 5–4 and 5–14. There is an open hunting season for mule deer, white-tailed deer, black bear, coyote, wolf, cougar, lynx, bobcat, snowshoe hare, Columbian ground squirrel, grouse, ptarmigan (5–3 and 5–4 only), chukar (5–3 only), common raven, and various waterfowl within these units. The area of Management Unit 5–4 bounded by Chilko River to the west, Highway 20 to the north, Big Creek to the east, and Groundhog and Nemala creeks to the south, is the only area of Management Unit 5–4 open to bighorn sheep hunting. There is a limited entry hunt for moose in all four of the MUs, and for mountain goat in Management Unit 5–4.

There are two Ducks Unlimited Canada projects that fall within the transmission line RSA—Willan Lake and Sugar Cane Jack (see Figure 7 in Appendix 5-6-C in the March 2009 EIS/Application). Ducks Unlimited Canada has census data on file for these projects (B. Harrison, pers. comm., April 2007).

Trapping also occurs within the Project area. The provincial trapper harvest records for Management Units 5–2, 5–3, 5–4 and 5–14 from 1985–2003 (BCMOE, unpublished data) indicate that beaver (*Castor canadensis*), marten (*Martes americana*), muskrat (*Ondatra zibethicus*), and red squirrel (*Tamiasciurus hudsonicus*) are the most frequently trapped species.

No parks or protected areas overlap with the general mine and transmission line; however, within the surrounding area there are three provincial parks and a small ecological reserve. In addition, an area known as the Brittany Triangle marginally overlaps the access road (where the route follows the Taseko River). The Brittany Triangle is sometimes referred to as the Rainshadow Wild Horse Ecosystem (as per McCrory, 2002). This area is not recognized as a protected area under any current legislation. The proposed transmission line runs through the Gaspard–Churn Creek ATV and Snowmobile Closed Area on the west side of the Fraser River.

There are 353.5 ha designated as permanent Old Growth Management Areas within the mine site LSA and 563.2 ha within the transmission line area. Old Growth Management Areas that are designated as permanent will not be logged, even if they are pine-dominated (J. Youds, pers. comm., October 2007; R. Hoffos, pers. comm., April 2008).

Incidental mammal observations recorded by field personnel in 2006 were: white-tailed deer (*Odocoileus virginianus*), mule deer, moose, California bighorn sheep, grizzly bear, black bear, wolf (*Canis lupus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), fisher, yellow-bellied marmot (*Marmota flaviventris*), bushy-tailed woodrat (*Neotoma cinerea*), muskrat, beaver, American pika (*Ochotona princeps*), snowshoe hare, yellow-pine chipmunk (*Tamias amoenus*), and red squirrel (Appendix 5-6-E in the March 2009 EIS/Application).

The following sections provide an overview of baseline conditions for nine wildlife groups (ungulates, large and medium-sized mammals, small mammals, bats, birds, amphibians, reptiles, terrestrial invertebrates, and threatened and endangered species). More detailed baseline information relevant to the assessment of specific environmental effects for each KI is provided elsewhere.

Moose and mule deer are common in the Project area; while white-tailed deer are relatively uncommon (two were observed near Farwell Creek in May 2006, Appendix 5-6-E in the March 2009 EIS/Application). California bighorn sheep are common along the Fraser River, in particular at its confluence with the Chilcotin River, and are present in the Coast Range Mountains south and west of the mine area (Fraser River Bighorn Sheep Advisory Committee 2004).

Woodland caribou (northern ecotype) do not currently occur in the Project area, although there are historical records for the Taseko and Chilko rivers, and upper Big Creek (MCTAC, 2002). The northern ecotype is blue-listed in BC (BCCDC, 2007) and federally designated as Threatened (COSEWIC, 2007). It is also on the provincial Identified Wildlife list. The Chilcotin Plateau and Western Chilcotin Upland ecosections, northwest of the Project area, support one of the largest caribou herds in the province (Young and Roorda, 1999; Apps et al., 2001). Winter habitat use is predominately within mature forests of the Montane Spruce and Sub-boreal Pine Spruce biogeoclimatic zones (Young and Roorda, 1999). These zones extend into the mine site RSA and caribou are capable of crossing the Chilcotin River (into the Project area), although to date, no telemetry records have confirmed this (J. Young, pers. comm., November 2006).

Mountain goats are known from the mountains south and southwest of the mine site, that is, Taseko and Tatlow mountains, with smaller populations inhabiting the Mt. Olsen and Tuzcha Lake areas (P. Dielman, pers. comm., October 2006). The Fish Creek Canyon is the only area within the mine site that has suitable goat escape terrain. There is one confirmed hunting record from 1993 in Fish Creek Canyon (Appendix 5-6-J in the March 2009 EIS/Application), and goats are still occasionally observed in this area (P. Dielman, pers. comm., October 2006.). However, no mountain goats were observed on the August 2006 aerial survey through Fish Creek Canyon, and along the cliffs above Taseko River, nor were they observed during any of the earlier Project-related field programs (Appendix 5-6-J and 5-6-A in the March 2009 EIS/Application).

The only species for which there is designated Ungulate Winter Range that overlaps with the Project-related study areas is mule deer. The areas of overlap will be discussed in detail in the assessment for this species.

Three ungulate species (moose, mule deer and bighorn sheep) were selected as KIs. Additional details on baseline conditions for these KIs are provided later to support their environmental effects assessments. Additionally, feral horses were considered generally in the assessment.

Grizzly and black bears, fisher, coyote, wolf, fox, beaver and muskrat were observed in the Project area in 2006 (Appendix 5-6-E in the March 2009 EIS/Application).

Cougars have occasionally been sighted in the mine site RSA, and lynx sign has been observed in the mine site RSA (Appendix 5-6-J in the March 2009 EIS/Application). There is a single record for a wolverine in the Fish Lake area (Appendix 5-6-J in the March 2009 EIS/Application). The American badger is very likely to occur in the eastern portion of the transmission line although the only observation recorded during Project-related activities was in the mine site (Appendix 5-6-J in the March 2009 EIS/Application). Porcupine sign has been recorded occasionally in the mine site (Appendix 5-6-J in the March 2009 EIS/Application).

Beavers are relatively common in the Project area. Beaver activity has been recorded in the Fish Lake drainage and throughout the mine site area (Appendices 5-6-A and 5-6-J in the March 2009 EIS/Application), and within the transmission line area (Appendix 5-6-E in the March 2009 EIS/Application). Muskrats appear to be less common and widespread than beavers, but are known from Fish Creek and Fish Lake (Appendix 5-6-A in the March 2009 EIS/Application), and were also observed within the transmission line area (Appendix 5-6-E in the March 2009 EIS/Application). Beaver and muskrat were the most commonly trapped species in the registered trapline area that includes Fish Lake (BC MOE, unpublished data, 1985-2003). Otters have been recorded in the mine site area along Fish Creek (Appendix 5-6-J in the March 2009 EIS/Application), and in Fish Lake (a family of five were observed there in August 2006 [R. Sunderman, pers. comm., October 2007]).

Four large and medium-sized mammal species (grizzly bear, black bear, fisher and American badger) were selected as KIs. Additional details on the baseline conditions for these KIs are provided later in this section to support their environmental effects assessments.

Within the mine site area small mammal trapping was conducted in 1996 and winter track surveys were conducted in 1996 and 1998 (Appendices 5-6-J and 5-6-A in the March 2009 EIS/Application). Small mammals confirmed for this study area are: red squirrel, yellow-pine chipmunk, southern red-backed vole (*Clethrionomys gapperi*), deer mouse (*Peromyscus maniculatus*), snowshoe hare, long-tailed weasel (*Mustela frenata*), mink (*M. vison*), ermine (*M. erminea*), marten, meadow vole (*Microtus pennsylvanicus*), bushy-tailed woodrat, American pika, western jumping mouse (*Zapus princeps*), cinereus shrew, and dusky shrew (*S. monticolus*) (Appendices 5-6-A and 5-6-E in the March 2009 EIS/Application). It is expected that the northern water shrew (S. palustris) is likely present in the area as well (Madrone, 1999). The most frequently recorded small mammals within the mine site areawere red squirrel and yellow pine chipmunk. Snowshoe hare are also abundant in some years. There were no small mammal surveys along the transmission line area. The only species observed were the bushy-tailed woodrat, yellow-pine chipmunk, and snowshoe hare. However, a species assemblage similar to that found in the mine site area would be expected.

No small mammals of conservation concern have been documented in the Project area.

No small mammals (other than bats, see below) were selected as KIs, although they are considered generally in the assessment and KIs such as old forest, riparian ecosystems, and grasslands provide an indication of potential environmental effects on habitat availability for this diverse group.

Of the 16 bat species found in British Columbia, 12 have confirmed distributions that overlap with the Project area: little brown myotis (*Myotis lucifugus*), Yuma myotis (*M. yumanensis*), California myotis (*M. californicus*), long-legged bat (*M. volans*), western long-eared myotis (*M. evotis*), western small-footed myotis (*M. ciliolabrum*), fringed myotis (*M. thysanodes*), big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), Townsend's big-eared bat, and spotted bat (Nagorsen, 1993; Roberts and Roberts, 1993; Holroyd et al., 1994). Four of these species are provincially blue-listed (western small-footed myotis, fringed myotis, Townsend's big-eared bat and spotted bat), and one of these (spotted bat) is on Schedule 1 of SARA.

In 1997, a bat inventory in the Fish Lake area identified *Myotis* spp., little brown bat, long-legged bat, silver-haired bat, long-eared myotis, and big brown bat through mist net capture and echolocation detection (Appendix 5-6-K in the March 2009 EIS/Application).

A more expansive bat inventory program was undertaken in the Project area in July 2006, with the objective being to inventory species presence, in particular listed species, using mist net capture and echolocation detection (details in Appendix 5-6-B in the March 2009 EIS/Application). Eight bat species were confirmed in the transmission line LSA (big brown bat, little brown myotis, silver-haired bat, California myotis, long-legged bat, western long-eared myotis, fringed myotis, and hoary bat). Of these species, only the fringed myotis is considered a conservation concern (blue-listed). No bats were captured in the mine site area although there were some detected (i.e., *Myotis* spp., long-eared myotis, and a larger species [either big brown bat or silver-haired bat]) (Appendix 5-6-B in the March 2009 EIS/Application). Over the eight sampling nights (July 19–27), 56 bats of 7 species were captured. All were adults—10 males and 46 females (10 lactating and 5 post-lactating) (Appendix 5-6-B in the March 2009 EIS/Application). The highest echolocation detection rates were in the Interior Douglas-fir Very Dry Mild subzone and Interior Douglas-fir Dry Cold Chilcotin variant; and the lowest detection rates were in the Bunchgrass Very Hot Dry Fraser variant and Montane Spruce Very Dry Very Cold subzone (Appendix 5-6-B in the March 2009 EIS/Application).

One bat species (Townsend's big-eared bat) was selected as a KI for further description of baseline conditions and detailed assessment. Additionally, the spotted bat was considered more generally in the assessment for Small Mammals.

More than 250 bird species may occur in the Project area (Appendix 5-6-L in the March 2009 EIS/Application)—a total of 151 species were recorded during surveys related to this Project (or incidentally) from 1993 to 2006 (Appendices 5-6-C and 5-6-L in the March 2009 EIS/Application).

Eighty-six waterbird (includes ducks, geese, wading birds, shorebirds, and seabirds) and 137 passerines species may occur in the Project area—a total of 47 and 91 species, respectively, were recorded during Project-related field programs (Appendices 5-6-C and 5-6-L in the March 2009 EIS/Application). Five gamebirds may occur in the Project area—willow ptarmigan, spruce grouse (*Falcipennis canadensis*), dusky grouse (*Dendragapus obscurus*), ruffed grouse (*Bonasa umbellus*), and sharp-tailed grouse. All but the sharp-tailed grouse were recorded during Project-related field programs (Appendices 5-6-C and 5-6-L in the March 2009 EIS/Application). Twenty-eight raptor species may occur in the Project area—19 species were recorded during Project-related field programs (Appendices 5-6-C and 5-6-L in the March 2009 EIS/Application). The burrowing owl record reported in 2006 for the Dog Creek area (Appendix 5-6-C in the March 2009 EIS/Application) is ~200 km north of any recent confirmed sightings of this species.

During the 2006 breeding bird surveys 75 species were detected (Appendix 5-6-C in the March 2009 EIS/Application). The most common species in the mine site area were the American robin (*Turdus migratorius*), chipping sparrow (*Spizella passerine*), dark-eyed junco (*Junco hyemalis*), ruby-crowned kinglet (*Regulus calendula*), and Swainson's thrush (*Catharus ustulatus*) (Appendix 5-6-C in the March 2009 EIS/Application). The most common species along the transmission line were the American robin, dark-eyed junco, ruby-crowned kinglet, song sparrow (*Melospiza melodia*), and yellow-rumped warbler (*Dendroica coronate*) (Appendix 5-6-C in the March 2009 EIS/Application). The largest number of species (67) was recorded along the transmission line; however, species composition was similar between all Project components (i.e., mine site, transmission line and access road).

During the 2006 aerial surveys of migratory waterfowl along the proposed transmission corridor and in and around the mine site, 2071 individuals from 15 species were recorded (Appendix 5-6-C in the March 2009 EIS/Application). Mallard was the most commonly observed species followed by lesser scaup (*Aythya affinis*), bufflehead (*Bucephala albeola*), and American coot (*Fulica americana*). Late season moulters were observed on several of the wetlands throughout the Project area suggesting that these wetlands are used in all stages of the life cycle (breeding, moulting/pre-migratory staging and migration). In addition, these data suggest that there may be limiting factors in terms of energetics (e.g., inadequate or poor food), as these birds are not likely to migrate successfully.

During the 2006 migration stand watch surveys, 12 species (140 individuals) of non-passerine birds were observed including two small flocks of sandhill cranes (Appendix 5-6-C in the March 2009 EIS/Application). In addition, 13 species (49 individuals) of passerines were noted as incidental observations (Appendix 5-6-C in the March 2009 EIS/Application). The passage rates for non-passerine birds ranged from 0.5 birds/hour (September 26 and 27) to 19.2 birds/hour (September 14). Radar surveys for nocturnal activity did not detect any birds.

Thirty-two provincially and/or federally listed bird species may occur in the Project area (Tables 6–3 and 6–4, Appendix 5-6-L in the March 2009 EIS/Application). Fifteen of these were detected during Project-related field programs: barn swallow (*Hirundo rustica*), common nighthawk (*Chordeiles minor*), Lewis's woodpecker, olive-sided flycatcher (*Contopus cooperi*), bobolink (*Dolichonyx oryzivorus*), long-billed curlew, prairie falcon, burrowing owl, double-crested cormorant (*Phalacrocorax auritus*), western grebe (*Aechmorphorus occidentalis*), American bittern (*Botaurus lentiginosus*), surf scoter (*Melanitta perspicillata*), red-necked phalarope (*Phalaropus lobatus*), sandhill crane, and great blue heron (Appendix 5-6-A; Appendices 5-6-C and 5-6-L in the March 2009 EIS/Application).

Twelve bird species were selected as KIs for further description of baseline conditions and detailed assessment: three passerines (Lewis's woodpecker, yellow-breasted chat, and sagebrush Brewer's sparrow); five water birds (great blue heron, mallard, Barrow's goldeneye, sandhill crane, and long-billed curlew); one gamebird (sharp-tailed grouse); and three raptors (short-eared owl, flammulated owl, and prairie falcon).

Amphibians as a group were chosen as a KI since the species most likely to be affected by the Project (i.e., species which are primarily aquatic) have similar life history characteristics (e.g., breeding timing, habitat conditions) and responses to disturbance (e.g., limited avoidance capabilities). A description of baseline conditions and a detailed assessment for this group are presented later on.

Eight reptile species may occur in the Project area: racer (*Coluber constrictor*), rubber boa (*Charina bottae*), Great Basin gopher snake (*Pituophis catenifer deserticola*), painted turtle (*Chrysemys picta*), northern alligator lizard (*Elgaria coerulea*), and three garter snake species (common garter snake [*Thamnophis sirtalis*], western garter snake [*T. elegans*] and northwestern garter snake [*T. ordinoides*]). Only the garter snakes are likely to occur within the mine site area. Three of these species are provincially blue-listed (racer, painted turtle, Great Basin gopher snake), and three are on Schedule 1 of SARA (rubber boa, racer, Great Basin gopher snake)—the boa and racer are listed as Special Concern and the gopher snake is listed as Threatened.

Northwestern garter snakes were observed twice near Fish Lake in the mid-1990s (Appendix 5-6-J in the March 2009 EIS/Application). The presence of the common garter snake was confirmed in the mine site area by Madrone (Appendix 5-6-A in the March 2009 EIS/Application) and the study in 2006 (Appendix 5-6-D in the March 2009 EIS/Application). No other reptiles have been observed during any Project-related activities.

No reptile species were selected as KIs; however, reptiles as a group and the Great Basin gopher snake specifically, are considered generally in the assessment.

No terrestrial invertebrates were selected as KIs for detailed effects assessment because of the lack of detailed information on their habitat requirements, and distribution and abundance in the province.

Within the Cariboo-Chilcotin region, one provincially listed damselfly species may occur in the Project area: Hagen's bluet (*Enallagma hageni*). This blue-listed species inhabits lacustrine areas (marshy lakes and ponds) within the Cariboo region and its flight period lasts from late May to early September (CDC, 2007). Limited knowledge on this species is available and many aspects of its ecology have not yet been assessed (CDC, 2007).

No provincially listed terrestrial invertebrate species were observed in the Project area from May to September of 2006; however, no specific surveys were conducted for this group. Madrone conducted a butterfly survey in the Fish Lake area in 1998 and identified 26 species (none of conservation concern) (Appendix 5-6-M in the March 2009 EIS/Application) between June and September (Appendix 5-6-A in the March 2009 EIS/Application).

No terrestrial invertebrates were selected as KIs, although they are considered generally in the assessment, and KIs such as old forest, wetlands, riparian ecosystems and grasslands provide an indication of potential environmental effects on habitat availability for this diverse group.

Five KIs are listed under Schedule 1 of SARA—the American badger and yellow-breasted chat are considered Endangered, and the long-billed curlew, Lewis's woodpecker, and the flammulated owl are of Special Concern (COSEWIC, 2007). Two amphibians are also on Schedule 1—the western toad (*Bufo boreas*), which is designated as Special Concern, and the Great Basin spadefoot toad, which is designated as Threatened (COSEWIC, 2007). In addition, the spotted bat (Schedule 1, Special Concern [COSEWIC 2007]) and the Great Basin gopher snake (Schedule 1, Threatened [COSEWIC, 2007]) have been considered generally in this assessment, under Small Mammals and Reptiles, respectively.

Two other KIs, the grizzly bear and short-eared owl, are listed as Special Concern but are not on Schedule 1—the short-eared owl is on Schedule 3 and the grizzly bear is on Schedule 2b (COSEWIC, 2007).

With respect to provincial conservation status, 10 KIs are blue-listed (California bighorn sheep, grizzly bear, fisher, Townsend's big-eared bat, short-eared owl, flammulated owl, sharp-tailed grouse, great blue heron, sandhill crane, and long-billed curlew), and five are red-listed (American badger, prairie falcon, Lewis's woodpecker, yellow-breasted chat, and sagebrush Brewer's sparrow). One amphibian is also listed—the Great Basin spadefoot toad is on the Blue List.

In addition to the KIs of conservation concern, there are a number of other wildlife species that are listed provincially and/or federally and may occur in the Project area. As discussed, the assessment of Project effects for these listed species was either addressed directly but qualitatively; or not specifically addressed, but inferable from the results of the effects assessment for an appropriate umbrella KI or for a KI that is related or similar in behaviour and habitat use pattern or for an appropriate vegetation KI (i.e., “habitat type”)

Recovery strategies are in progress for two of the COSEWIC-listed species known or likely to occur (and breed) in the Project area—American badger (*jeffersonii* subspecies) and Great Basin gopher snake. No finalized recovery strategies are available for any of the species of concern in the Project area.

CHANGES TO BASELINE CONDITIONS

The assessment for the New Prosperity Gold-Copper Mine Project uses the same baseline habitat conditions as the Prosperity EIS (2009). These conditions are current to May 2006 with respect to incorporation of existing disturbances such as cutblocks and roads, and air photo coverage for the ecosystem mapping (see Volume 5, Section 6.2 of the March 2009 EIS/Application). However, there have certainly been changes to baseline vegetation conditions within the mine site and transmission line RSAs since that date which may affect current wildlife habitat availability. For example, within the mine site RSA there has been a 15.2 percent reduction in old forest due to recent logging and effects related to the mountain pine beetle. Changes such as this will be discussed qualitatively where applicable in the key indicator-specific assessments presented in Section 2.7. In general, the most likely changes to baseline habitat conditions (i.e., cutblocks, beetle kill) will be most likely to affect species that rely on mature forest for some or all of their life history requirements. Most of the recent logging and beetle kill of old forest has occurred outside of the MDA.

With respect to other wildlife baseline information such species occurrence records, no new field data has been collected specific to the New Prosperity Gold-Copper Mine Project. However, information sources that have become available since the March 2009 EIS/Application were reviewed for anything that would substantively change wildlife baseline conditions from what was originally described. These included:

- BC Conservation Data Center (BC CDC) Internet Mapping Service to confirm any new sightings within the Project area (accessed April, 2012)
- Grizzly Bear Population Abundance, Distribution & Connectivity Across British Columbia’s Southern Coast Ranges (Apps, 2009)
- Grizzly Bear Population Inventory & Monitoring Strategy for British Columbia (Apps, 2010)
- BC MOE Management Plan for the Flammulated Owl (*Otus flammeolus*) in British Columbia (Provincial Flammulated Owl Working Group, 2011)
- BC MOE Management Plan for the Mountain Goat (*Oreamnos americanus*) in British Columbia (Mountain Goat Management Team, 2010), and
- The Land Use Objectives for the Cariboo-Chilcotin Land Use Plan (CCLUP) Area (Ministry of Agriculture and Lands Integrated Land Management Bureau Ministerial Order, 2010).

2.6.2 Socioeconomics, Culture and Human Health

2.6.2.1 Resource Uses

Resource uses include a large number of diverse activities. Several are primary industries, which involve the harvest or extraction of a raw material such as timber, livestock, trapping and minerals. Materials from these activities are typically sold or transferred for further processing. Other inputs are enjoyed or consumed by the final user, such as public recreation, tourism, hunting and fishing.

All the resource uses are sensitive to changes in supply and demand conditions for their respective product. For example, in recent years, conditions have been broadly favourable for forest products and less favourable for trapping. Given the dynamic nature of most resource uses, the “baseline” for each is described in terms of recent and expected average conditions. Descriptions of baseline conditions for each resource use are provided in the baseline sections for each KI. Further information on each resource use is provided in Volume 6, Section 5 of the March 2009 EIS/Application as follows: (Appendix 5-B (Land Use), Appendix 5-C (Forestry), Appendix 5-D (Agriculture/Ranching), Appendix 5-E (Fishing), Appendix 5-F (Hunting), Appendix 5-G (Public Recreation), Appendix 5-H (Tourism) and Appendix 5-I (Trapping).

Land Use

The Cariboo-Chilcotin Land Resource Management Plan (CCLRMP) established 17 new protected areas covering about 460,000 ha. Outside the protected zone, the CCLRMP defined three resource development zones covering about 80% of the plan area. The zones are:

Enhanced Resource Development Zone (ERD)—land units where economic benefits and jobs will be increased through intensive resource management and development. In this zone, the plan challenges all local resource users and government to set targets for increased sustainable resource development.

Integrated Resource Management Zone (IRM)—land units that will be dedicated for sustained integrated resource use.

Special Resource Development Zone (SRD)—land units where significant fish, wildlife, ecosystem, back country recreation and tourism values exist. Timber harvesting, mining and grazing will take place in this zone in a manner that respects these values.

The CCLUP states that mineral development is an accepted land use in the three zones.

The plan defines land units which were assigned to one of the three management zones noted above. The Project footprint overlaps six of these land units. These are identified in Table 2.6.2.1-1.

Table 2.6.2.1-1 Distribution of Project Lands by Cariboo-Chilcotin Land Use Plan Land Units

Land Unit	Designation (CCLUP)	Total Area (ha)	Mine Footprint (ha)	Mine Buffer (ha)	Transmission Buffer (ha)	Access Road Buffer (ha)
Eagle	IRM	19,133	2,531	13,802	1,928	872
Gaspard	ERD	25,013		25	24,365	623
Grasslands	IRM	8,927			8,660	267
Gustafson	ERD	1,247			1,247	
Taseko	SRD	5,847	1,005	4,439	403	

Lake						
Williams Lake	ERD	1,448			1,448	
Total		61,615	3,536	18,266	38,051	1,762
SOURCE: Jacques Whitford AXYS Ltd. GIS Analysis (<u>Note</u>: Values to be updated for Final EIS)						

A key component of the implementation of the CCLUP is the completion of sub-regional plans, termed sustainable resource management plans (SRMPs). Eight SRMP areas have been designated, and the Project falls within two, the Chilcotin and Williams Lake. The SRMPs provide detailed objectives and strategies for the management of the Cariboo’s resources and the maintenance of environmental values consistent with the strategies and targets set out in the CCLUP. The Williams Lake SRMP is complete and the Chilcotin is in draft at the time of writing (ILMB, 2005).

The management of forest harvesting is one of the tools used to attain a wide range of timber and non-timber values. Broadly, three zones are defined in the SRMP’s by the following:

- No harvest zone
- Extended harvest zone, and
- Harvest in one rotation.

These zones are addressed in the main report.

Forestry

There is no community forest tenure (an area based forest licence) in the mine site area.

The timber lands in the area are managed as part of the Williams Lake timber supply area (TSA) on a long term sustainable harvest basis. Williams Lake is one of the largest TSA’s in BC. Its allowable annual cut (AAC) is presently 5.7 million cubic metres, which is a temporary uplift to salvage timber attacked by the mountain pine beetle. The pre-uplift AAC was 2.81 million cubic metres.

The characteristics of the forest and timber lands in the Project area are summarized in Table 2.6.2.1-2 below. Eighty-three percent of the mine site area is considered capable of producing merchantable timber within a defined time period (termed productive forest land). All of the forest land in the mine site area has relatively poor growth potential, which is reflected in slow annual growth rates and low stand volumes. The standing volume is estimated at about 220,000 cubic metres.[11] Lodgepole pine is the dominant species, accounting for 74% of the forested area with spruce and black cottonwood common in the riparian areas. The age profile is comprised of stands approaching harvest age (age class 4) and old growth (age class 8).

11 The productive land base of the New Prosperity MDA covers 2,600 ha. of productive forest land, or 58.8% of the previous project assessment. The New Prosperity project effects on forestry have been scaled accordingly. The standing inventory of the previously proposed MDA was 372,000 cubic metres.

Table 2.6.2.1-2 Forest Tenures in the Project Area

Forest Licences	Licence Volume	Holds Road Permit in Footprint
Replaceable		
Tolko Industries Ltd.	1,042,968	✓
West Fraser Mills Ltd.	659,222	✓
Non-replaceable		
Yun ka whu'ten Holdings Ltd.	190,000	
Tsi del del Enterprises Ltd.	60,000	
Esketemc First Nation	59,663	✓
Amabilis Contracting Ltd.; Maheca Timber Co. Ltd.; Kodiak b	110,000	
Waddington Charter & Contracting	10,000	
Tolko Industries Ltd.	300,000	
West Fraser Mills Ltd.	150,000	✓
Sigurdson Bros. Logging Company Ltd.	290,000	✓
Klatassine Resources Ltd	73,459	
Pal lumber Co. Ltd.	15,000	✓
Tl'etinqox Logging Ltd.	15,000	
Amabilis Contracting Ltd.	60,000	
BIG 6 Contracting Ltd.	135,000	
Area Based Licences in Footprint (ha)	Form of Tenure	Transmission Line ROW
Esketemc First Nation	Community Forest	47
Hodgson	Wood Lot	20.5
SOURCE: Ministry of Forest Apportionment System (2006-06-16) Jacques Whitford AXYS Ltd. GIS Analysis		

Given the preponderance of old growth lodgepole pine stands, the mine site area is highly susceptible to attack by the mountain pine beetle that has spread throughout the TSA. Surveys dating back to 1983 indicate the continuing presence of the pest in the MDA footprint (Table 2.6.2.1-3). In 2007, nearly the entire MDA was subject to low to moderate levels of beetle infestation.

A province-wide survey rated the general region of the Project at the most severely impacted (i.e. "overrun") (Ministry of Forests and Range, 2007). It is not known how much of the pine in the MDA is dead and how much might have salvage value within a limited period of time.

Table 2.6.2.1-3 Summary of MPB Surveys of MDL

Year	Rating	Hectares rated
2010	Low	35.9
2010	Trace	769.7
2007	Moderate	1,093.2
2007	Low	1,003.4
2006	Trace	705.6
2006	Moderate	61.9
2006	Low	1,335.3
2005	Trace	1,974.0
2004	Trace	335.8
2003	Low	23.7
1987	Severe	1.3
1984	Severe	46.8
1983	Severe	26.9

Source: Hillcrest Geographics (2012)

Commercial timber harvesting in the MDA has been infrequent and limited in size. The site's relatively low timber values and long haul distance limit its economic value (Gatenby, 2012, pers. comm.). The cutting authorities are summarized in Table 2.6.2.1-4.

Tolko Industries operates in the general area and holds a cutting authority that extends over the eastern boundary covering a small portion of the MDA polygon. Harvest under the permit is attributed to the company's replaceable forest licence. No harvesting has occurred in recent years because of weak market conditions.

Taseko Mines Limited holds two conditional tenures, termed occupant licence to cut. This allows for the clearing in the pit and surrounding area totalling some 520 ha. The other licence allows for clearing of road rights-of-way. The licence volume is taken from the Forest Service Reserve and does not affect the TSA's total harvest quota. It is general practice that such licenses are not constrained to satisfy biodiversity objectives that would apply to forest industry operators.

Table 2.6.2.1-4 Cutting Authorizations in the MDL

Holder	Tenure Type	Status	Area (ha)
Taseko Mines Ltd.	Occupant Licence To Cut	Active	518.22
Taseko Mines Ltd..	Occupant Licence To Cut	Active	18.16
Tolko Industries Ltd.	Forest Licence	Retired	12.31
Tolko Industries Ltd.	Forest Licence	Active	45.24

Hillcrest Geographics (2012)

Agriculture and Ranching

Agriculture plays a central role in the history, culture and economy of the Cariboo-Chilcotin. As an economic activity, agriculture makes an important contribution to the region's economic base. ALR land accounts for 7.5% of all the land area within the Project components, although the mine site does not include any ALR at all. The capability of the land base within Project components is primarily in forage crops. The mine site and mine buffer are suitable for forage crops but improvement practices are not feasible. Approximately 17% of the transmission line buffer and over two thirds of the access road are considered suitable for forage crop improvement practices.

The CCLUP specifies that all lands within the plan area can be considered for the expansion of existing agricultural holdings, and includes a CCLUP objective of providing for the future growth and development of agriculture. The land use plan also recognizes the needs of industry to enhance its access to Crown land and water in support of agricultural economic opportunities.

The Cariboo-Chilcotin Grasslands Strategy has noted that the biggest threat to grasslands in the region, and associated livestock grazing and biodiversity, is from forest encroachment. "Cattle herd size, or animal unit month (AUM) allocations set in the 1960s, cannot be maintained at current levels for much longer" (Cariboo-Chilcotin Grasslands Strategy Working Group 2001, p 4). An open range benchmark has been established for the Ministry of Forests and Range and will result in the long term expansion of range lands and grazing capacity to 1965 levels[12.] The MOFR is contracting to clear selected small diameter forest stands across the District as part of the strategy.

The Cariboo Regional District (CRD) is an important beef cattle producing area, representing 10% of cattle farms and 16.5% of the cattle/calve inventory in the province in 2001 (Table 2.6.2.1-5). The cattle industry accounts for 64% of farms in the CRD and contributes approximately 30% of total provincial production (Cariboo Geographic Systems, 2003). Average herd size is 178 head. Other agricultural industries include dairy, sheep, game farming, horse, poultry, horticultural crops and forage production. Some organic production is occurring. There are many small hobby farms where the residents raise animals and crops for their own consumption.

[12] Personal communication, Chris Armes, District Agrologist, Cariboo-Chilcotin Forest District, 250-398-4362.

Table 2.6.2.1-5 Selected Agriculture Statistics for the Cariboo Regional District, Electoral Areas K and E, BC, 2001

	Electoral Area K	Electoral Area E	Cariboo Regional District	BC
Total farms – number	77	50	1,188	20,290
Total farms – number reporting receipts greater than $2,500 annually	71	48	1,046	17382
Total area of farms (ha)	216,486	41,856	400,177	2,587,118
Average area per farm (ha)	2,811	837	220	127
Livestock production:				
Cattle and calves – number of farms	61	34	758	7,726
Cattle and calves – number of animals	38,231	11,042	135,435	814,949
Average herd size	626	325	178	105
Crop production:				
Alfalfa & alf mixtures (ha)	4,392	2,076	26,395	195,516
All other tame hay and fodder (ha)	2,104	314	28,502	205,475
Total farm capital ($ ‘000)	81,000	161,000	935,000	15,831,000
Average farm capital ($)	2,090,000	1,620,000	787,000	780,000
Total gross farm receipts ($ ‘000)	14,000	6,000	102,000	2,308,000
Average farm receipts ($)	182,000	120,000	56,000	114,000
SOURCE: Statistics Canada (2001)				

Ranches are highly dependent on Crown range for grazing, which is administered under a tenure system by the MOFR. Two tenure types are used, the permit and the licence[13]. The former is rarely used and can be any interval from one to five years. It expires at the end of the permit and renewal is discretionary. The licence is a 10-year evergreen document, which means the licence is replaced before expiry. The licence offers greater security for the ranch; it is also the favoured administrative tenure for the MOFR. Both permit and licence rights may be transferred in a ranch sale or lease. They are rarely cancelled.

The range tenure system is based on large geographical areas called Stock Ranges, which normally have an association of grazing tenure holders (e.g., the Big Creek Stock Association). They are a society and hold spring and fall meetings. Within most stock ranges are smaller geographical management areas called “units”. These units are for the most part separated from other units by geographical barriers such as rivers, creeks, rock, height of land, large areas of barren forest and by fences where such barriers are absent. Similarly Stock Ranges are separated from adjacent ranges usually by firmer barriers such as the Fraser River, Chilcotin River and Taseko River where stock drift is impossible. The range unit forms the basic management unit for individual ranch herds. Grazing rights are based on legal boundaries specified in the tenure document and are confined to dates of use, stock numbers and types, within the boundaries

[13] The term “lease” is sometimes used to describe range tenure, but the usage is incorrect. Lease is another tenure type and is distinct from Ministry of Forest and Range grazing tenures, which are either permits or licenses. The latter authorizes only the use of forage; a lease authorizes control of the land base including access.

of a range unit. Occasionally a unit maybe further divided between two or more users. This might arise where a unit has only a few isolated areas of suitable grazing separated by large areas of non-productive waste ground. In essence there are pastures within one unit. In other cases the range is divided with users attempting to manage their herds separately. This is often for convenience where the ranches enter and exit the unit from different directions and therefore attempt to eliminate costly separating of mixed herds, or to keep breeding programs (i.e., one ranch uses Hereford bulls, another Angus).

Ranches with tenures along the Fraser and Chilcotin Rivers usually turnout onto Crown Range in mid-April and move onto higher elevation summer ranges in early June where they typically graze until early winter snowfalls start cattle moving towards their lower elevation grazing areas and home. Most tenures authorize grazing in the upper elevation areas until mid- to late-October. Gang Ranch and the Big Creek Stock Association tenures of Weetman and Anvil Mountain Ranch have the longest grazing period and the longest herd movements from spring range along the Chilcotin River to summer-fall range at the headwaters of Relay, Vic and Anvil Mountains.

Ranches are highly dependent on Crown range. Winter feeding of livestock, lasting anywhere from four to six months, relies primarily upon hay and silage stores produced in the region or imported. From the spring to the early fall, livestock are pastured on Crown and private rangelands, after which most calves are sold and shipped out of the region.

The Project components intersect a total of 22 grazing tenures, approximately 9% of all tenures in the area. The licence area covered by mine components is negligible for the majority of tenures (less than 6% in total), while productivity in terms of AUMs that those areas represent cannot be determined with the available data14. The largest lease area for an individual tenure is 251,000 ha, while the average tenure is 60,000 ha.

Fishing

There are over 31 lakes within the Chilko and Taseko River watersheds suitable for fishing and boating, with important sport fisheries in both rivers and in over a dozen lakes that include Chaunigan, Chilko, Fishem, Konni, Taseko, Tsuniah and Vedan. Fish species such as Bull Trout, Chinook salmon, Dolly Varden, Steelhead, Sockeye salmon and native Rainbow trout attract fishers from the region and beyond. Lodges and other tourism operations promote fishing as one of the primary activities and many are dependent on this resource.

Baseline conditions for fishing as a resource use have remained consistent with those presented for the previous project assessment (Volume 6, Section 5.3.4 of the March 2009 EIS/Application). Fish Lake ranked 55 out of the Cariboo-Chilcotin's 116 fishing lakes in terms of total annual angling effort during the late 1980s and early 1990s, when Creel surveys and boat counts were regularly undertaken (MOE 2006a). Aerial boat counts for the 2006 (21 boats) and 2007 (9 boats) summer seasons indicated Fish Lake to be the seventh busiest of the 32 lakes on the Chilcotin flight circuit with regular but low use levels. Horn, Chaunigan, Bluff, Cochin, Sapeye and Big Onion lakes supported the most boats.

Hunting

Baseline conditions for hunting and guide outfitting are comparable to those documented for the previous project, where data was presented up to and including the 2005 season. Data for the 2008 season shows the number of resident hunters active in the LSA (management unit 5-4) rose slightly from 572 to 600, while the number of non-resident hunters increased from 111 to 122. However, the number of hunter days

[14] Personal communication, Chris Armes, District Agrologist, Cariboo-Chilcotin Forest District, 250 398-4362.

actually declined 6% so expenditures and the total value of hunting was less than in 2005. (MOE 2010). As noted in the previous project assessment, according to local rod and gun clubs, the use of the Fish Lake area is very low because there are other areas in the region that provide better opportunities, more options and closer proximity for the principle species of moose and Mule deer.

Public Recreation and Tourism

Baseline conditions for outdoor recreation and tourism are consistent with those presented for the previous project. Recreation and tourism infrastructure, including parks, recreation sites and trails and travel routes are unchanged in the last five years. Recreation use at and around Fish Lake remains negligible due to the remote conditions and lack of compelling recreational features. No records are kept on recreation site use, but the majority is believed to be by anglers and hunters. Few winter activities occur at the MDA.

In terms of tourism, the number of accommodation facilities in the Cariboo Regional District is less today than in 2007, with fewer properties, lower room inventories and lower revenues (BC Stats, 2012). Visitor attendance at the Williams Lake and 100 Mile House visitor centres peaked in 2007 and 2006 respectively, with 2011 visitation at both facilities below those peak levels (Tourism BC, 2012). No major tourism attractions, facilities or resorts have been developed in the Central Cariboo over the last five years, while the number of tourism businesses has remained virtually unchanged (Tourism BC, 2012b). However, there have been more recent investments in hospitality capacity in Williams Lake with the announced development of a Best Western hotel and upgrades to the Overlander Hotel (Madrigga, 2012, pers. comm.). Lodge and resort operators are reporting high booking levels for the upcoming season and the Cariboo Chilcotin Coast Tourism Association is predicting a favourable season due to strong domestic travel trends and a rebound in visitation from key US regional markets (Thacker 2012, pers. comm.). The above factors indicate that the value of tourism and its contribution to the regional economy, while experiencing a downturn in the 2008 to 2011 period, is comparable today to the baseline presented in the previous project assessment (Volume 6, Section 5.3.7 of the March 2009 EIS/Application).

Trapping

Registered trapping activity is administered by the BC Ministry of Environment. The registered trap line system is the primary system for setting harvest guidelines and managing furbearing animals. In 1926, the province was divided into registered trap lines, giving the trap line owner the exclusive right to trap furbearing animals inside the trap line area (BC Trappers Association www.bctrappers.bc.ca). Harvest levels are guided by species management strategies, with furbearers being divided into three classes:

Class 1—Species managed on individual trap lines including beaver, fox, marten, mink, muskrat, raccoon, skunk, squirrel, weasel.

Class 2—Species move between and among trap lines and are managed regionally in consultation with local trappers and includes lynx, bobcat, wolverine, fisher, and otter.

Class 3—Species also move between and among trap lines, but generally are not vulnerable to over-trapping. This class includes the wolf and coyote (BC Ministry of Environment www.env.gov.bc.ca/fw).

In general, appropriate trapping seasons have been developed by considering a variety of criteria including pelt primeness, relative vulnerability of age and sex classes to harvesting, abundance, and capture technology.

The New Prosperity Gold-Copper Mine Project falls within Region 5 of the BC Ministry of Environment's Cariboo Management Region. This Region is further broken down into Wildlife Management Units with the study area including eight separate Management Units: 5-3, 5-4, 5-5, 5-6, 5-10, 5-12 and 5-13 (these MUs are considered the RSA for trapping). There are no trap lines registered in Wildlife Management Unit 5-3.

The Ministry of Environment records fur harvest returns for all registered trap lines in the province. Trapping activity and the number of animals harvested can vary greatly from year to year.

Baseline conditions for trapping are similar to those documented for the pervious project, where data was presented for the period between 1999 and 2005. In the most recent period from 2006 to 2010 slightly more animals were trapped than in the previous period (Table 2.6.2.1-6).

Table 2.6.2.1-6 Trap Lines with Territory in the MDL Area

	TR0504T003		**TR0504T005**	
	1999-2005	**2006-2010**	**1999-2005**	**2006-2010**
Black Bear	0	1	0	0
Marten	0	0	0	9
Squirrel	0	0	95	95
Weasel	0	0	2	5
Total	0	1	97	111

Source: Ministry of Environment (2012)

2.6.2.2 Navigable Waters

The *Navigable Waters Protection Act* (NWPA) regulates the construction of works in navigable waters. Section 5 provides that no work shall be built or placed in, on, over, under, through or across any navigable water unless the work and the site and plans thereof have been approved by the Minister (Transport Canada). The Environmental Impact Statement (EIS) Guidelines (March 2012) outlines specific information that must be included in this EIS in order that an assessment of the potential effects of the Project on navigable waters may be completed. The specific information includes the following:

- Identify any Project components, including a description of any activities (e.g., dredging, alteration of water bed and/or water banks) that may affect waterways and water bodies and that fall outside the scope of the Minor Works and Water Order. For those components and activities that meet the Order, no NWPA approvals are required
- Describe any ancillary and temporary works (e.g., cofferdams, detours, fencing, temporary bridges, or bridge replacements along existing and proposed road alignments) including, where available, approximate dimensions
- Describe the anticipated direct and indirect effects on the waterways and water bodies, including, but not limited to, changes in water level and flow
- Provide information on current and/or historic usage of all waterways and water bodies that will be directly affected by the Project, including current Aboriginal uses, where available
- Describe the manner in which the tailings impoundment area may affect downstream surface water flows and water levels in all water bodies that could be impacted, and how this may impact navigation, and
- Provide hydrology studies to determine if water levels in all water bodies that could be impacted will remain unaffected; and describe how affected navigation will be restored.

A discussion of that information follows.

Waterways and Water Bodies at the Mine Site

Fish Creek Watershed

The Fish Creek watershed covers 95.4 km^2 with an average elevation of 1540 m. The headwaters of the watershed are indistinct because the land is a complex of marshes and morainal depositions that have created hummocks. The creek flows approximately 14 km in a northerly direction to its confluence with the Taseko River. Approximately 3.2 km upstream of that confluence is an 8 m high waterfall that is impassable to fish. Stream flow and precipitation data have been collected from the Fish Creek area between the years 1992 and 1998 and again between 2006 and 2007. Average monthly flows are estimated to reach a maximum of 1.67 m^3/s in April during spring freshet, after which they decrease to a minimum of 0.02 m^3/s in September and October. The mean annual flow is 0.36 m^3/s. The watershed drainage is as follows:

Fish Creek

(150-335700-13400-47700)

↓

Little Fish Lake

↓

Fish Creek

(150-335700-13400-47700)

↓

Fish Lake

(01093TASR[15])

↓

Fish Creek

(150-335700-13400-47700)

↓

Taseko River

(150-335700-13400)

↓

Chilko River

(150-335700)

↓

Chilcotin River

(150-000000)

↓

Fraser River

(100-00000-00000-00000)

Little Fish Lake

Little Fish Lake is located at an elevation of 1527 masl and has a drainage of 1470 ha. The lake has a volume of 133,280 m^3, a surface area of 6.6 ha, a mean depth of 2 m and a maximum depth of 4.4 m. The lake is 560 m long and 118 m wide with water levels being maintained by a beaver dam at the mouth of the lake. Little Fish Lake has five ephemeral inlets and one permanent outlet stream.

[15] The numbers shown in brackets are the unique watershed codes (for streams and rivers) and the unique water body identifiers (for lakes) assigned by the BC Government.

Fish Lake

Fish Lake is at an elevation of 1457 metres above sea level (masl). The lake has a drainage area of 6490 ha. The lake is 2050 m long and 541 m wide. Fish Lake has one large island and four small islands and a narrow gravel beach at the Forest Recreation Site at the north end of the lake. The volume of Fish Lake is 4,438,446 m^3, the surface area is 111 ha, the maximum depth is 13 m and the mean depth is 4 m. Fish Lake has three permanent inlet streams, seven ephemeral inlet tributaries and one permanent outlet stream.

Fish Creek Mainstem

Fish Creek has been broken down into 10 reaches. Reaches 1 to 3 are situated between the confluence with the Taseko River and the impassable falls 3.2 km upstream. Reach 1 is ephemeral and during the summer and low-flow periods there is no surface flow. Reaches 4, 5 and 6 situated between the upstream end of the falls and Fish Lake consist of run/riffle and pool habitats and rainbow trout from Fish Lake are known to utilize portions of these reaches. There is considerable beaver activity and their dams have considerable influence over the reach characteristics. Reach 7 and 9 are Fish and Little Fish Lake respectfully. Reaches 8 and 10 are characterized as meandering, with beaver dams and activity evident throughout. Reach 10 only exists as a defined continuous channel for 800 to 1000 m upstream of Little Fish Lake above which the channel becomes discontinuous and difficult to follow during low flow period as there is no flow.

Fish Creek Tributaries

Although 1:20,000 TRIM maps of the Fish Creek watershed show a number of tributary streams, stream surveys conducted in spring and late-summer found that only three of the tributaries were used by rainbow trout. The remaining streams were ephemeral and went dry soon after snowmelt in both 1996 and 1997.

Transmission Line River and Stream Crossings

Following an extensive assessment of alternatives a preferred 3 km wide transmission line corridor has been selected. Connecting to the British Columbia Transmission Corporation (BCTC) grid near Dog Creek on the east side of the Fraser River, the 125 km transmission line will cross the Fraser River and Big Creek before reaching the mine site at Fish Lake. Although the final alignment of the centre line for the 30-80 m right-of-way has not been determined, a review of the TRIM II dataset (Volume 6 of the March 2009 EIS/Application) confirms that in addition to the 142 m wide Fraser River and the 20 m wide Big Creek crossing sites, approximately 125 additional definite or indefinite streams will be crossed by the transmission line.

CURRENT AND HISTORICAL USE OF FISH LAKE

Information concerning visitor and sport fishery use of Fish Lake has been collected annually for the period 1995 to 1997 and again in 2006 and 2007. This information is included in Volume 6 of the March 2009 EIS/Application. Surveys revealed that the site is used by generally small user groups (average 2.9 to 3.5 people) and for generally short visits (recorded average length of stay was 1.7 to 2.3 days). “Fishing” was the most frequently provided reasons for coming to Fish Lake. The estimated number of fish caught is shown in Table 2.6.1.5-9.

Table 2.6.2.2-1 Summary of the Fish Lake Rainbow Trout Recreational Fishery during 1994–1997

Fishery	Fish Lake	Little Fish Lake	Fish Creek and Lake Tributaries
Recreation site/road access	Yes/4x4	No/ATV	No/ATV
Annual angler-days	388–548	NA	NA
Annual mean catch/h	2.7–2.9	NA	NA
Annual total fish captured	4100–4900	NA	NA
Size range (FL [mm])	200–300[a]		

NOTE:
[a] Retained by anglers

SOURCE:
Appendix 5-3-J of the March 2009 EIS/Application (Visitor and Creel Survey Fish Lake, 1997)

During the Panel Review of the previous project proposal, Transport Canada noted the unique aspects of Teztan Biny (Fish Lake) having created a strong link between boating and navigation, and between fishing and recreation.

The Panel stated that it heard that Teztan Biny (Fish Lake) was valued by First Nations as a food fishery. Taseko's understanding of current use information from previous studies is that the Tsilhqot'in fished opportunistically for rainbow trout at Teztan Biny (Fish Lake), Y'anah Biny (Little Fish Lake) and Wasp Lake, though the bulk of their annual catch likely came from salmon fishing elsewhere in the Daisqox (Taseko River) and Tsilhqox (Chilko River) drainages. The Y'anah Biny (Little Fish Lake) area was reported by First Nations as being used heavily by individuals at the cabin sites. Taseko noted that fishing in the Project area occurred year round in various locations. Teztan Biny (Fish Lake) was noted as a historic winter fishing site for the Tsilhqot'in since pre-crown sovereignty.

During the panel hearings, many Tsilhqot'in people indicated that they had gone, and continue to go to Teztan Biny (Fish Lake) to fish. The Tsilhqot'in submitted that Teztan Biny as well as Y'anah Biny (Little Fish Lake) and upper and lower reaches of Teztan Yeqox (Fish Creek) were important fishing locations. Fisheries and Oceans Canada noted the use of Teztan Biny (Fish Lake) by the Tsilhqot'in as a reserve food supply in the event of poor salmon runs. The department noted that the Tsilhqot'in could net large numbers of fish on an annual basis and that the lake could support food requirements for at least two to three years without impacting the long-term population success in the lake.

The Panel stated that it heard that Teztan Biny (Fish Lake) was also valued by First Nations as a location for teaching and the transfer of cultural knowledge between generations. The Panel heard from educators in many of the communities that Teztan Biny (Fish Lake) was identified as an important teaching environment and that many trips were made to the area to teach the Tsilhqot'in language and cultural practices to Tsilhqot'in youth. Access to the island in Teztan Biny (Fish Lake) by boat was valued by First Nations.

2.6.2.3 Human Health

All information on Human Health (including baseline data and impact assessment) can be found in Section 2.7.3.3.

2.6.3 Physical and Cultural Heritage Resources

2.6.3.1 Archaeology

Quantitative archaeological data has been collected for the Chilcotin Forest District in which the mine development area falls and provides baseline archaeological data for the area. In 1998, Arcas Consulting Archaeologists prepared a report entitled *GIS Modeling of Archaeological Potential: Chilcotin Forest District*, which outlined the archaeological and ethnographical background of the area (Arcas Consulting Archaeologists, 1998). The GIS-based Archaeological Overview Assessment (AOA) study resulted in the development of a model of archaeological potential and provides a reasonable understanding of the regional context for the number and types of sites identified within the mine development area.

In 1998, when these data were compiled, 811 sites had been identified within the Forest District. Of these sites approximately 56% were lithic scatters, approximately 19% were pit house habitations, approximately 31% contained pit roasting features and approximately 12% contained cache pit features. Other types of sites located with the Chilcotin Forest District include quarries, hunting and fishing sites, burials, trails, rock art and culturally modified trees (CMTs).

Nine years after the production of the AOA report (as of November of 2007), the Remote Access to Archaeological Data (RAAD) site inventory system listed 1139 registered archaeological sites within the Chilcotin Forest District.

As outlined in Volume 7 and Appendix 7-2-D of the March 2009 EIS/Application, a detailed Archeological Impact Assessment (AIA) was completed for the mine site of the previously proposed project in accordance with both provincial guidelines and the terms and conditions of the Inspection Permit issued under the authority of the *Heritage Conservation Act* (HCA). The objectives of the assessment, as noted in Volume 7 were to: identify and evaluate archaeological resources within the project area; identify and assess all impacts on archaeological resources subject to provisions of the HCA which would result from the Project: and recommend viable measures to manage identified adverse impacts to those values. Prior to this study, two previous archaeological field studies recording 16 archaeological sites had been completed.

The AIA conducted over the Fish Lake area was considered to be of a comprehensive nature rarely seen over so large an area. A total of 3476.5 ha were assessed resulting in the confirmation of 79 protected (pre-1846) archaeological sites. A lithic component was identified at 73 of the sites; subsistence or habitation features were identified at 21 sites; a faunal component identified at 10 sites; and, a single potential human burial (believed to be historic) was identified at one site. Historic resources identified included 34 post-1846 CMTs, nine cabins, four corrals and one fence.

The bulk of the archaeological sites identified within the area were indicative of temporary or seasonal land use. The wide range of dates obtained through cross-dating of diagnostic artifacts, the presence of historic resources including CMTs and cabins, as well as information provided by First Nations communities, suggest the use of the Fish Lake locality from approximately 5500 BP to present. The artifact and feature assemblage identified indicates that the area was used for a range of activities including, hunting, fishing, plant gathering and processing.

2.6.4 Aboriginal Interests

This section provides an overview of First Nations communities, cultural use of lands and resources for traditional purposes, an overview of established or asserted Aboriginal rights and title that overlap with components of the Project, and Aboriginal archaeological interests.

2.6.4.1 Aboriginal Communities

Aboriginal Territories and Project Components

Seven Tsilhqot'in (Chilcotin) communities and five Secwepemc (Shuswap) communities are identified for consultation and engagement on the Project. These include the Tsilhqot'in communities of Xeni Gwet'in (Nemiah), Yunesit'in (Stone), Tsi Del Del (Alexis Creek), ?Esdilagh (Alexandria), Tl'etinqox-t'in (Anaham) and Tl'esqox (Toosey), and the Secwepemc communities of Xat'sull/Cmetem (Soda Creek), Stswecem'c/Xgat'tem (Canoe Creek), T'exelcemc (Williams Lake), Esketemc (Alkali), and Llenlleney'ten (High Bar). The Tsilhqot'in members of Ulkatcho are also entitled to consultation, since they form part of the Tsilhqot'in Nation with Aboriginal rights that may be affected by the Project.

Project infrastructure in relation to First Nations Traditional Territories is shown on Figure 2.6.4.1-1

The Tsilhqot'in National Government ("TNG") was established in 1969, and represents five of the seven communities of the Tsilhqot'in people. The TNG does not represent either the Tl'esqox (Toosey) or the Ulkatcho communities, who are represented by the Carrier Chilcotin Tribal Council (CCTC), although it appears that the Tl'esqox (Toosey) may work closely with the TNG.

The Xat'sull/Cmetem (Soda Creek), Stswecem'c/Xgat'tem (Canoe Creek) and T'exelcemc (Williams Lake), are part of the Northern Shuswap Tribal Council ("NSTC"), a non-profit organization which is an association of autonomous member First Nations. This organization is also known as the Northern Secwepemc te Qelmucw ("NStQ"). The Esketemc (Alkali) and Llenlleney'ten (High Bar) are each considered independent, as they are not associated with the NSTC or the other main Secwepemc organization, the Shuswap Nation Tribal Council ("SNTC").

The RSA Project components consist of the proposed mine site; electric transmission line; access roads and transportation corridor; and, a concentrate loading facility.

The scope of project includes all four elements (mine site, transmission line, access road and concentrate load-out), the components, features and activities described in Section 2.2.3. As detailed in the EIS Guidelines while this EIS will assess the potential environmental effects of the Project and identify the significance of any adverse residual effects, the focus of this assessment will be on environmental effects associated with those aspects of the Project that have changed or are new from the previous project proposal and on corresponding changes to the environmental effects previously predicted.

Mine Site

The mine development includes an open pit mine with a 20 year operating life, waste rock stockpiles, primary crusher and overland conveyor, the plant site, the tailings storage facility and maintenance, administrative and onsite support facilities. The mine site will be within the Traditional Territories of the Xeni Gwet'in (Nemiah), the Tl'esqox (Toosey), the Yunesit'in (Stone), and the Esketemc (Alkali) First Nations.

The mine site is also within the area which is described in the recent William case as the "Eastern Trapline Territory" and in which Mr. Justice Vickers determined that the Tsilhqot'in people have Aboriginal rights to hunt and trap birds and animals as described in that judgment.

Electric Transmission Line

The proposed 230 kV electric transmission line servicing the New Prosperity Mine is 125 km long, with a 230 kV switching station at Dog Creek and at the mine site. It traverses Traditional Territories of four Secwepemc First Nations—the Stswecem'c/Xgat'tem (Canoe Creek), the T'exelcemc (Williams Lake), the Esketemc (Alkali) and the Llenlleney'ten (High Bar)—as well as the Traditional Territories of three Tsilhqot'in First Nations—the (Xeni Gwet'in First Nations Government (Nemiah), the Tl'esqox (Toosey) and the Yunesit'in (Stone).

Access Road and Transportation Corridor

An existing road currently provides access to the mine site, with the exception of approximately 2.8 km of new road construction that would be required. The existing access road crosses Traditional Territories of Xeni Gwet'in (Nemiah), Yunesit'in (Stone), Tl'esqox (Toosey), Tsi Del Del (Alexis Creek), Tl'etinqox-t'in Government Office (Anaham), and ?Esdilagh (Alexandria) First Nations. The 2.8 km of new access appears to cross Traditional Territories of the Xeni Gwet'in (Nemiah), the Yunesit'in (Stone), and the Esketemc (Alkali) First Nations.

Concentrate Loading Facility

The concentrate loading facility is the existing Gibraltar Mine concentrate load-out facility near Macalister. The concentrate loading facility falls within the Traditional Territories of the Xat'sull/Cmetem (Soda Creek), the ?Esdilagh (Alexandria) and the T'exelcemc (Williams Lake) First Nations.

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.6.4.1-1 Proposed New Prosperity Gold-Copper Project Mine Site and Offsite Infrastructure in Relation to First Nations Traditional Territories, Rights and Title Area and Communities—Regional Context

Table 2.6.4.1-1 Taseko's Four Main Project Elements within Assumed Traditional Territories

First Nation	Mine Site	Transmission Line	Access Road & Transportation Corridor	Concentrate Loading Facility
Tsilhqot'in				
Xeni Gwet'in (Nemiah) (TNG)	**X**	X	X	
Yunesit'in (Stone) (TNG)	**X**	X	X	
Tsi Del Del (Alexis Creek) (TNG)				
Tl'etinqox-t'in (Anaham) (formerly TNG)			X	
?Esdilagh (Alexandria) (TNG)			X	X
Tl'esqox (Toosey) (CCTC)		X	X	
Ulkatcho (CCTC)*				
Secwepemc				
Xat'sull/Cmetem (Soda Creek) (NSTC)			X	X
Esketemc (Alkali) (Independent)	**X**	X	X	
Llenlleney'ten (High Bar) (Independent)		X		
Stswecem'c/Xgat'tem (Canoe Creek) (NSTC)		X		
T'exelcemc (Williams Lake) (NSTC)		X	X	

As stated in Section 2.2.3 there are no new or changed components, features or activities associated with the Transmission Line, Access Road and Transportation Corridor and the Gibraltar Mines Concentrate Rail Load-Out Facility. For those Project elements, this EIS makes use of existing relevant information generated as part of the 2009/2010 review process to provide a rationale stating why the previously predicted environmental effects remain the same.

Only at the mine site does the Project contain new or changed components, features and activities compared to the previously assessed project. For the purposes of the effects assessment, the communities whose Traditional Territories overlap the mine site components of the Project that have changed are Xeni Gwe'tin (Nemiah), Yunesit'in (Stone) and Esktemc (Alkali). However, for purposes of completeness, descriptions of all communities are provided below.

Overview of Aboriginal Communities

The information below is reflective of statistics held by Aboriginal Affairs and Northern Development, Canada (previously Indian and Northern Affairs, Canada). Please note that the aboriginal communities may have differing data that is different from that presented below.

Tsilhqot'in

As noted earlier, the seven Tsilhqot'in communities of interest to this Project are Xeni Gwet'in (Nemiah), ?Esdilagh (Alexandria), Tsi Del Del (Alexis Creek), Yunesit'in (Stone), Tl'etinqox-t'in Government Office (Anaham), Tl'esqox (Toosey), and Ulkatcho. The TNG is generally recognized as a tribal council representing four or five of the member communities, with Tl'etinqox-t'in (Anaham) being independent at the time of this report submission. The TNG does not represent either the Tl'esqox (Toosey) or the Ulkatcho communities, who are represented by the Carrier Chilcotin Tribal Council (CCTC), although it appears that the Tl'esqox (Toosey) may work closely with the TNG.

Member communities are primarily located throughout the Chilcotin Plateau, west of the Fraser River, between Riske Creek (20 km west of Williams Lake) and the Coast Mountains, except ?Esdilagh (Alexandria) which is north of Williams Lake on the east side of the Fraser River (British Columbia Government 2008).

Xeni Gwet'in (Nemiah)

The Xeni Gwet'in (Nemiah) First Nation is located in the Nemiah Valley which is 150 km southwest of Williams Lake on Chilko Lake. The main community (most populous reserve) is the Chilko Lake Reserve No. 1A on the east shore of Chilko Lake at the mouth of the Nemiah River. The Xeni Gwet'in (Nemiah) First Nation has eight reserves on 1200 hectares of land (INAC, 2008). The modern Xeni Gwet'in (Nemiah) community includes descendants from a number of bands and families that occupied lands around Tatla Lake and Chilko Lake (Alexander, 1996).

As of March 2012, the Xeni Gwet'in (Nemiah) had a total registered population of 419 members (AAMDC, 2012). A total of 204 members resided on the Xeni Gwet'in (Nemiah) reserve lands compared with 207 on reserve in 2008 (INAC, 2008 and AANDC, 2012).

Yunesit'in (Stone)

The Yunesit'in (Stone) First Nation is located near Hanceville which is 90 km west of the City of Williams Lake. The main community (most populous reserve) is the Stone No. 1 Reserve located 7 km west of Hanceville on the Chilcotin River. Yunesit'in (Stone) territory consists of five reserves on 2146.4 ha of land. The modern Yunesit'in (Stone) community is comprised primarily of descendants from the pre-contact Stone Chilcotin (Alexander, 1996). In 2012, the Yunesit'in (Stone) had a registered population of 428 members (AANDC 2012). A total of 228 members currently reside on the Stone First Nation reserves compared with 210 in 2008 (INAC, 2008 and AANDC, 2012).

Tl'etinqox-t'in (Anaham)

Tl'etinqox-t'in (Anaham) is located 100 km west of the City of Williams Lake near Alexis Creek. The main community (most populous reserve) is at the Anaham Flat's No. 1 on the banks of the Chilcotin River. The Tl'etinqox-t'in (Anaham) have 19 reserves on approximately 11,300 ha of land. The Tl'etinqox-t'in (Anaham) tribal council affiliation was the TNG, but at the time of the preparation of this report they appeared to be independent.

In 2012, the Tl'etinqox-t'in (Anaham) had a total registered population of 1510 (AANDC, 2012). A total of 562 members currently reside on the Tl'etinqox-t'in reserve lands compared to 592 in 2008 (INAC, 2008 and AANDC, 2012).

?Esdilagh (Alexandria)

?Esdilagh (Alexandria) is located near the town of Alexandria between the cities of Williams Lake and Quesnel. The main community is Alexandria Reserve No. 3 located on the banks of the Fraser River, 7 km south of the town of Alexandria. The reserve lands consist of a total of 14 individual reserves comprising 1304.1 ha. The modern ?Esdilagh (Alexandria) community is a mixture of people which includes descendants from a number of pre-contact Anahim Lake Chilcotin bands, and some Secwepemc and Lhtakot'en Carrier bands (Alexander 1996).

In 2012, ?Esdilagh (Alexandria) had a total registered population of 182 people. A total of 51 members reside on the ?Esdilagh (Alexandria) main reserve compared to 49 in 2008 (INAC, 2008 and AANCD, 2012).

Tl'esqox (Toosey)

The Tl'esqox (Toosey) First Nation is recognized by the federal government as a member of the Carrier Chilcotin Tribal Council. The Tl'esqox (Toosey) is Tsilhqot'in but is not part of the TNG. However, the TNG works closely with the Tl'esqox (Toosey). The Carrier Chilcotin Tribal Council consists mainly of the Southern Carrier Nations and the Tsilhqot'in Nation (CCTC, 2008).The modern Tl'esqox (Toosey) community is comprised primarily of descendants from the pre-contact Anahim Lake Chilcotin (Alexander 1996).

Tl'esqox (Toosey) is located about 40 km south of the City of Williams Lake. Tl'esqox (Toosey) has four reserves on 2582.5 ha of land.

In 2012, the Tl'esqox (Toosey) had a total registered population of 313 members (AANDC, 2012). A total of 145 members currently reside on Tl'esqox (Toosey) reserve lands compared to 148 in 2008 (INAC, 2008 and AANDC, 2012).

Ulkatcho

The Ulkatcho are affiliated with the Carrier Chilcotin Tribal Council. Ulkatcho consists of 14 reserves, located on approximately 3245.7 ha of land (INAC, 2008).

The main community (most populous reserve) is at the Squinas Reserve No. 2 at the southeast end of Anahim Lake (AANCD, 2012).

As of 2012, the registered population for Ulkatcho was 1007 (AANCD, 2012). A total of 653 members currently reside on Ulkatcho reserve lands compared to 663 in 2008 (INAC, 2008 and AANDC, 2012).

Secwepemc

The five Secwepemc First Nations communities of interest to the New Prosperity Project are: Xat'sull/Cmetem (Soda Creek), T'exelcemc (Williams Lake), Esketemc (Alkali), Stswecem'c/Xgat'tem (Canoe Creek), and Llenlleney'ten (High Bar). Three of the communities are represented by the NSTC with Esketemc and Llenlleney'ten being independent.

Stswecem'c /Xgat'tem (Canoe Creek)

The Stswecem'c /Xgat'tem (Canoe Creek) First Nation is located in a semi remote area southwest of the city of Williams Lake on the east side of the Fraser River. Stswecem'c /Xgat'tem (Canoe Creek) consists of two communities, Dog Creek and Canoe Creek and is on 5880.4 ha of land. Each of the main communities of Dog Creek and Canoe Creek are situated on approximately 50 ha of land.

In 2012, the Stswecem'c/Xgat'tem (Canoe Creek) had a total registered population of 716 (AANDC, 2012). A total of 264 members currently reside on the Stswecem'c/Xgat'tem (Canoe Creek) reserve lands compared to 242 in 2008 (INAC, 2008 and AANDC, 2012).

T'exelcemc (Williams Lake)

The main T’exelcemc (Williams Lake) reserve is located about 12 km south of the City of Williams Lake at Sugarcane, just off of Highway 97. The T'exelcemc (Williams Lake) lands consist of eight reserves on 1927.3 ha.

In 2012, the Williams Lake First Nation had a total registered population of 703 members with a total of 231 members residing on Williams Lake First Nation reserve lands (AANDC, 2012). In 2008, 212 registered members resided on reserve lands (AANDC, 2008).

Xat’sull/Cmetem (Soda Creek)

The Xat’sull/Cmetem (Soda Creek) First Nation is located north of the City of Williams Lake on Highway 97. Xat’sull/Cmetem (Soda Creek) consists of two reserves on approximately 2048 ha. The two reserves are at Deep Creek, 30 km north of Williams Lake and Soda Creek, 45 km north of Williams Lake. Both reserves are located on Highway 97. Xat’sull/Cmetem (Soda Creek) was once nearly half Carrier but is now primarily a Secwepemc band (Haagen, 2008).

Xat’sull/Cmetem (Soda Creek) is a member of the Great Secwepemc Nation, once known as the people of Xat'sull. Xat'sull/Cmetem (Soda Creek) is the northernmost Secwepemc tribe of the Secwepemc Nation, which is the largest Nation within the interior of British Columbia. Xat’sull/Cmetem (Soda Creek) is one of four Northern Secwepemc Nation Bands making up the NSTC. Xat’sull/Cmetem (Soda Creek) was originally a combination of two groups of Secwepemc peoples—Soda Creek and Deep Creek.

In 2012, Xat’sull/Cmetem (Soda Creek) had a total registered population of 397 (AANDC, 2012). A total of 154 members currently reside on Xat’sull/Cmetem (Soda Creek) reserve lands compared to 150 in 2008 (INAC, 2008 and AANDC, 2012).

Esketemc (Alkali)

The Esketemc (Alkali) First Nation Traditional Territory spans the Alkali Lake area, which is southwest of the City of Williams Lake. Esketemc (Alkali) holds 19 reserves on 3960.1 ha. The main community (most populous reserve) is Alkali Lake No. 1, at the Lillooet District at Alkali Lake (INAC, 2008). Esketemc (Alkali) is a First Nations government of the Secwepemc people but is not a member of the NSTC or the Shuswap Nation Tribal Council, and has no tribal council affiliation.

In 2012, Esketemc (Alkali) had a population of 841 members (AANCD, 2012). A total of 416 members currently reside on Esketemc (Alkali) reserve lands compared to 403 in 2008 (INAC, 2008 and AANDC, 2012).

Llenlleney’ten (High Bar)

Llenlleney’ten (High Bar) Traditional Territory spans the Alkali Lake area, which is southwest of the City of Williams Lake. Llenlleney’ten (High Bar) holds three reserves on 1546.3 ha. The main community (most populous reserve) is High Bar No. 1, located in the Lillooet District on the Fraser River, 17 km northwest of Kelly Lake. The total registered population in 2012 is 101. All individuals but one are registered as living off-reserve (AANDC, 2012).

2.6.4.2 Cultural Use of Lands and Resources for Traditional Purposes

Sources of Information

For the 2009/2010 EIS/Application information on traditional knowledge and traditional use of land and resources, and current use of land and resources for traditional purposes for the Project Area was gathered from three primary sources:

- **William (*Tsilhqot'in Nation*) case documents (Tsilhqot'in Nation)** - The case documents of William (*Tsilhqot'in Nation vs. British Columbia), 2007 BCSC 1700*, (Government of British Columbia, 2007a) including the appendices, maps, and case testimonies were reviewed for relevant Traditional Knowledge information within the LSA.
- **The Heritage Significance of the Fish Lake Study Area: Ethnography -** (Ehrhart-English) (Appendix 2.6.4.2-A). Taseko commissioned this study in 1993 and it provides a comprehensive assessment of the historical and traditional land use of the (Xeni Gwet'in [Nemiah] and Yunesit'in [Stone].
- **Existing sources review** - For the Tsilhqot'in people the review included:
    - Alexander, Diana, 1997. A Cultural Heritage Overview of the Cariboo Forest Region
    - Alexander, Diana, 1996. A Cultural Heritage Overview of the Western Half of the Williams Lake Forest District
    - Farrand, Livingston, 1900. Traditions of the Chilcotin Indians. Memoirs of the American Museum of Natural History
    - Friends of the Nemiah Valley Website, 2008
    - Glavin, Terry and the People of the Nemiah Valley, 1992. Nemiah The Conquered Country
    - Lane, Robert, 1981 Chilcotin
    - Littlemore, Richard, 2000. Nemiah: Home of the Xeni Gwet'in Pacific Salmon Forests Project
    - Matson, R.G. and Magne, Martin, 2007. Athapaskan Migrations: The Archaeology of Eagle Lake, British Columbia
    - Rothenburger, Mel, 1978. The Chilcotin War
    - Tsilhqot'in National Government Website, 2008
    - Tsi Del Del Website, 2008
    - Unknown Author, 2008. We do not know his name: Klatassen and the Chilcotin War website, and
    - Xeni Gwet'in: People of Nemiah Website, 2008.

Two frequently cited sources on the Tsilhqot'in people include:

- Lane, Robert, 1953. Cultural Relations of the Chilcotin of West Central British Columbia. Unpublished Ph.D., and
- Tyhurst, Robert, 1984. The Chilcotin: An Ethnographic History. Unpublished M.A.

These documents were not obtainable for this review, however, are included as sources in the work of Alexander (1996), Ehrhart-English (1994), Matson and Magne (2007), and in the case of Tsilhqot'in Nation vs. British Columbia (Government of British Columbia, 2007a). A final source that was not obtainable in this review was the letters and memoirs of James Teit from 1895–1930. Teit was the first anthropologist to make notes on the Tsilhqot'in people, however, the majority of his observations are from time spent with other First Nation bands, and his only concentrated contact with the Tsilhqot'in was over a two week period (Matson and Magne, 2007).

For the Secwepemc people the review included:

- Alexander, Diana, 1997. A Cultural Heritage Overview of the Cariboo Forest Region
- Alexander, Diana, 1996. A Cultural Heritage Overview of the Western Half of The Williams Lake Forest District
- Bouchard, Randy and Kennedy, Dorothy, 1979. Shuswap Stories
- Brow, James, 1972. Shuswap of Canada
- Dawson, George, 1891. Notes on the Shuswap People of British Columbia
- Ignace, Marianne Boelscher, 1998. Shuswap
- Jack, Rita; Matthew, Marie; and, Matthew, Robert, 1993. Shuswap Community Handbook
- Palmer, Andie, 2005. Maps of Experience: The Anchoring of Land to Story in Secwepemc Discourse,
- Secwepemc Cultural Education Society and Simon Fraser University, 1999. Re tsuwet.s re Secwepemc: The Things We Do, and
- Wolf, Annabel Cropped Eared and Matthew, Robert, 1996. Shuswap History: A Century of Change.

Since the 2009/2010 EIS submission, additional current and traditional use information was made available:

- Written submissions to the panel by Esketemc (Alkali) entitled Esketemc First Nation Traditional Use Research and Comments on the Taseko Prosperity Proposal, 2009 (Appendix 2.6.4.2-B).
- Written submission from Tsilhqot'in National Government entitled Tsilhqot'in Current Use of Land and Resources for Traditional Purposes: Submission to the Prosperity CEAA Panel, November 2009 (Appendix 2.6.4.2-C).
- Written submission to the Federal Review Panel from Catherine Haller, and elder from Xeni Gwet'in.
- Oral presentations provided by numerous individuals and consultants during the 2010 Federal Review Panel hearings, and documented in the hearing transcripts (http://www.ceaa.gc.ca/050/05/documents-eng.cfm?evaluation=44811&type=2). Summary tables referencing communities, speakers and traditional knowledge and current use information are provided in Appendix 2.6.4.2-D).

Summary of Current Use of Land and Resources for Traditional Purposes

A summary of current use by the Tsilhqot'in for traditional purposes relative to the Project, and more specifically use of the proposed mine site where components have changes, is provided in the following section. No specific information is available on the current use of the Fish Lake area for traditional purposes by Secwepemc people.

The Canadian Environmental Assessment Act does not define the term current use of land for traditional purposes and there does not appear to be any CEAA policy concerning this term. In the Voisey's Bay Mine and Mill Environmental Assessment Panel Report, the panel stated as follows:

> Although project-caused changes to Aboriginal people's current use of lands and resources for traditional purposes is part of the definition of "environmental effect" under the Canadian Environmental Assessment Act, the Canadian Environmental Assessment Agency provides no guidance on how to define or document such use. The Panel is aware that "current use" can have a range of meanings. At a minimum, it means use during the last few years, because land use patterns vary and no single year can be considered fully representative. In its broadest sense, it means land use within "living memory" as recorded by the map biography method typically used to establish Aboriginal title or site-specific Aboriginal rights. This method produces a comprehensive record of the last 30 to 40 years and, for more limited purposes, a record as long

as 60 to 70 years. The Panel indicated in its guidelines that it would consider land claims documentation for the purposes of establishing current use of lands and resources in the context of this review. To determine possible adverse effects of the Project and ways to remediate them, the Panel decided to focus on land and resource use patterns over approximately the last 20 years, and also on possible future uses.

In their presentation to the original Panel on the previous Prosperity project, the Tsilhqot'in identified traditional use to include hunting, fishing and gathering (page 14, Appendix 2.6.4.-E). They further identify they graze cattle for income purposes (page 4, Appendix 2.6.4-E); therefore, ranching and haying are not included in the assessment of current use for traditional purposes.

Contextual Setting

In the 1960s, the Chilcotin area became popular with hunters, fishermen, home seekers and ranchers (Alexander 1997; Lane 1981). Subsistence and economic activities were largely carried out on the public lands that the Tsilhqot'in assumed were available to them by right (Alexander, 1997). Continued development in the 1950s and 1960s led to a decrease in the resources that the Tsilhqot'in depended upon and to a decline in the economic opportunities available to them (Lane, 1981).

In 1973 a road was built into the Nemiah Valley, which has significantly impacted traditional land use, culture, and the way of life for the Xeni Gwet'in (Nemiah) (Glavin, 1992). Prior to the completion of the road, life for the Xeni Gwet'in (Nemiah) continued as it had for essentially the past 100 years. The community members ran cattle and trapped through the winter, and harvested vegetation, hunted, and fished in the summer months (Littlemore, 2000). Once a year community members would load their horse and wagons and make the trip to Williams Lake to sell cattle and buy seeds and dry goods for coming year (Littlemore, 2000). The trip took one week each way.

Now, most people have vehicles and travel to and from Williams Lake once a week (Littlemore, 2000). The road has impacted the culture of the Xeni Gwet'in (Nemiah) community and the traditional land use patterns as subsistence livelihoods are no longer a matter of survival. People focus less on intensive subsistence livelihoods, as there is now the option of the supermarket in town. Prior to 1973, 90% of community members were fluent speakers of the Tsilhqot'in language, making the Tsilhqot'in language the most preserved in British Columbia (Littlemore, 2000). As of 2000, less than half of the population under 20 year olds spoke the language (Littlemore, 2000). The traditional land use of the Tsilhqot'in people has changed since pre-contact times with the establishment of reserves and the adoption of ranching, the building of a road into the Xeni Gwet'in (Nemiah) community, and the increasing levels of industry activity in the area. As ranches developed, haying became important and Tsilhqot'in families often took on this chore until the 1950s when this became a mechanized activity (Alexander, 1997; Lane, 1981).

Current Use of the Fish Creek Watershed for Traditional Purposes

Participants of the previous review and excerpts of the Ehrhart-English report, indicate that Amelia William's family (Xeni Gwet'in elder) used the Fish Lake area for trapping and fishing, while raising cattle and horses, and harvesting hay.

Within a few years of the death of Jimmy William in 1971, continuous habitation at Little Fish Lake ceased. However, information collected during the panel review for the previously reviewed project, indicates that the Solomon family lived in the eastern trap line area year round in the 1980's to 1990's and continues to visit the area each year.

In the recent past (last 20 – 30 years) the Tsilhqot'in have actively hunted and trapped in the Fish Lake area, which is reported as a site of cultural activities for the Xeni Gwet'in (Nemiah). Information collected during the previous review indicates that the Fish Lake area is used for camping, hunting, fishing, berry and medicine gathering, and groundhogs. The importance of fishing in the mine development area seems to have originated from the amount of trapping or overwintering cattle in the Little Fish Lake area; if these two activities were eliminated, then fishing would have taken place at another location (Ehrhart-English, 1994).

Wildlife trapped by the Tsilhqot'in in the Fish Lake study area has been defined in Ehrhart-English's study (1994), Lane (1981), and Alexander (1997).

During the previous panel review, the TNG indicated that of the species identified in the Ehrhart-English study, trapping areas for cougar, bobcat, fisher, wolverine, rabbit, squirrel, weasel, lynx and marten and hunting of squirrel are the most abundant in the mine site footprint. In addition, participants of the previous review identified moose, deer, caribou, elk, fisher, swans, and wild chickens as species hunted for sustenance.

Many of the Tsilhqot'in have indicated that they had gone, and continue to go to Teztan Biny (Fish Lake) to fish. The Tsilhqot'in submitted to the previous panel that Teztan Biny as well as Y'anah Biny (Little Fish Lake) and upper and lower reaches of Teztan Yeqox (Fish Creek) are important fishing locations. Sean Nixon, legal counsel for the Tsilhqot'in, submitted to the previous panel that members from all Tsilhqot'in communities had identified past and current fishing activities within the Project area. In winter, ice fishing occurs in the rivers and lakes in the region for whitefish, suckers, trout and sturgeon (Alexander, 1996) and trout fishing may occur on Fish Lake; in spring, the Tsilhqot'in fish for rainbow trout in a number of water bodies in the region, including Fish Lake. During the late summer, salmon are caught in the larger rivers and lakes in the region; however, no salmon are present in the proposed mine area.

While fishing for food purposes in the lake was identified as an important activity, it was also stated that other cultural practices occur there, such as gatherings of Elders and youth. Teztan Biny (Fish Lake) was also noted as being an important "fall-back" resource for the Tsilhqot'in, should the salmon runs be low or insufficient. During the panel hearing sessions, fishing was also identified as an important cultural activity. Lake fishing was repeatedly identified as a method to teach the youth how to fish and practice traditional net and gaff fishing techniques before children were ready to fish for salmon in the rivers. The Panel heard from educators in many of the communities that Teztan Biny (Fish Lake) was identified as an important teaching environment and that many trips were made to the area to teach the Tsilhqot'in language and cultural practices to Tsilhqot'in youth.

In early summer the regional landscape begins to bloom and many plants are available for harvesting**.** Plants gathered by the Tsilhqot'in in the Fish Lake Study area as defined in Ehrhart-English's study and that berry-picking areas for thimbleberry, blueberry, strawberry and crowberry, and the harvesting areas for Labrador tea, balsam and cottonwood are the most abundant species harvested in the mine site area. Throughout the year, particularly in winter, fire wood of various tree species is collected. During the previous panel's community sessions, numerous participants from the Tsilhqot'in and Nations confirmed past and current plant gathering activities in or around the Project area and identified a list of 52 plant species of importance to the Tsilhqot'in likely present within the Project area. Gathering activities identified in the Project area includes: berry picking (blueberries, chokecherries, crowberries, frog berries, huckleberries, raspberries, Saskatoon berries, soap berries, strawberries); medicine gathering (Indian

Hellebore, Pine pitch, Dark willow, scrub birch or dwarf birch, alder, juniper and aspen, Fireweed root); and, other harvesting (Balsam fir, bear tooth, kinnikinnick, Labrador tea, pine mushrooms, wild onion and wild potatoes).

2.6.4.3 Potential or Established Aboriginal Rights or Title

An overview of rights and title claims by First Nations in the area that overlap with components of the Project is presented in Section 2.7.5 (Aboriginal Interests).

2.6.4.4 Archaeological Resources

Section 2.6.3.2 of this report discusses the archaeological resources identified in the Project Area through archaeological impact assessments and archaeological overview assessments completed by Taseko. In general, the following were the types of interests raised by aboriginal groups that are potentially related to archaeological resources.

Participants of the panel hearings spoke of a strong connection to the Teztan Biny (Fish Lake) and Nabas area. This connection was, in some part, due to the belief that many of their ancestors have been buried or cremated there. One potential burial site has been reported and is referred to in the Archaeological Impact Assessment conducted by Terra Archaeology Consultants on behalf of Taseko. The cabins in a Little Fish Lake represent ties to the past and the land, and this area is considered home to certain families of the Xeni Gwet'in (Nemiah). During the previous panel review, the Tsilhqot'in Nation repeatedly referred to the presence of a pit house that was located on the island in Teztan Biny (Fish Lake), which had not been recorded in the archaeological impact assessment of the area even though it was intensively investigated during the archaeological study.

Many Tsilhqot'in described during the previous panel hearings the importance of the Teztan Biny (Fish Lake) area for cultural gatherings, including elders' gatherings, and how adults would work with the youth to teach values, culture and language. Family and social gatherings, including camping trips, fishing trips and recreational use were also identified. Catherine Haller noted that Elders Gatherings, food gathering ceremonies, youth ceremonies, and bathing ceremonies all occurred at Teztan Biny.

The Tsilhqot'in noted that in his decision, Justice Vickers on the Williams Case, found that ancestral trails in the area were still used and indicated that this illustrated a strong historical and cultural connection to the Nabas area.

2.7 IMPACT ASSESSMENT

Overview of Approach

The Act defines the “Environment" as:

- The components of the Earth, and includes:
    4. Land, water and air, including all layers of the atmosphere
    5. All organic and inorganic matter and living organisms, and
    6. The interacting natural systems that include components referred to in paragraphs (a) and (b) (section 2(1)).

The Act defines “environmental effect”, in respect of a project, as:

d. Any change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act*

e. Any effect of any change referred to in paragraph (a) on:

   v. Health and socio-economic conditions

   vi. Physical and cultural heritage

   vii. The current use of lands and resources for traditional purposes by aboriginal persons, and

   viii. Any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

f. Any change to the project that may be caused by the environment whether any such change or effect occurs within or outside Canada.

The environmental assessment focuses on specific environmental components (called Valued Ecosystem Components) that are of particular value or interest to regulators and other stakeholders. Environmental ecosystem components typically are selected for assessment on the basis of regulatory issues and guidelines, consultation with regulators and stakeholders, field reconnaissance, and professional judgement of the study team. Where a VEC has various components that may interact in different manners with the Project, the environmental assessment may consider the effects on individual Key Indicators (KIs), as well as VECs.

The term “impact” refers to the aspect of the Project infrastructure, action or activity that is likely to result in an environmental effect on the environment.

The environmental assessment methods address both project–related and cumulative environmental effects. Project-related environmental effects are changes to the environment that are caused by a project or activity arising solely as a result of the proposed principal works and activities, as defined by the scope of the project. Cumulative environmental effects are changes to the environment that are caused by an action associated with the project under review, in combination with other past, present and future projects and activities.

Project-related environmental effects and cumulative environmental effects are characterized sequentially. The Project-specific environmental effect is discussed first, having regard to mitigation measures proposed in this EIS or developed subsequently as a result of the EA process that help to reduce or avoid Project impacts that could result in this environmental effect. A cumulative environmental effects screening is then conducted for any residual environmental effect to determine if there is potential for a cumulative environmental effect as defined in CEAA.

The significance of any residual adverse environmental effects for both project related and cumulative effects is then assessed having regard to the CEAA Reference Guide: Determining Whether A Project is Likely to Cause Significant Adverse Environmental Effects - The Requirements of the Canadian Environmental Assessment Act (http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=D213D286-1&offset=2&toc=show). In addressing what might constitute a significant adverse effect the following factors are considered: magnitude, likelihood, geographic extent, duration and frequency, reversibility, ecological context, and likelihood.

More specifically, the environmental effects assessment approach used in this assessment involves the following four steps.

1. Scoping of the overall assessment. This is discussed in Section 2.3.
2. Characterization of Project-related Environmental Effects. This is discussed in *Section 2.7.1.1.*
3. Characterization of Cumulative Environmental Effects. This is discussed in Section 2.7.1.4.
4. Assessment of Significance. This is discussed in Section 2.7.1.5

2.7.1 Approach to the Effects Prediction, Mitigation Measures and Significance of Residual Effects

2.7.1.1 Effects Prediction

This environmental assessment has been completed using a standard methodological framework to meet the requirements of the Canadian Environmental Assessment Act (CEAA) and the British Columbia Environmental Assessment Act (BCEAA). The environmental effects assessment method is based on a structured approach that:

- Considers that mandatory and discretionary factors required under Section 16 of CEAA
- Focuses on issues of greatest concern
- Affords consideration of all federal and provincial regulatory requirements for the assessment of environmental effects
- Considers all issues raised by the public, aboriginal people, and public stakeholders, and
- Integrates engineering design and programs for mitigation and monitoring into a comprehensive environmental planning process.

For the purpose of this environmental assessment, the term "environment" as defined by CEAA means the components of the Earth, and includes:

- Land, water and air, including all layers of the atmosphere
- All organic and inorganic matter and living organisms, and
- The interacting natural systems that include components referred to in the first two bullets.

Characterization of Project-related Environmental Effects are assessed, including descriptions of how an environmental effect will occur, mitigation and environmental protection measures proposed to reduce or eliminate the environmental effect, and evaluation and characterization of the residual environmental effects of the Project (i.e., environmental effects remaining after application of mitigation measures) on the environment for each development phase.

Where possible, threshold criteria or standards were identified for each VEC, beyond which a residual environmental effect would be considered adverse. In some cases, standards or thresholds were also defined for specific effects for a VEC or KI.

Standards are recognized government or industry regulations or objectives for physical aspects such as air quality, water quality, effluent release, or in-stream flows. Thresholds reflect the limits of an acceptable state for an environmental component based on resource management objectives, community standards, scientific literature, or ecological processes (e.g., desired states for fish or wildlife habitats or populations).

Where they exist and are applicable, guidelines are considered in the assessment of effects, keeping in mind that while in some instances they may provide a helpful benchmark against which to consider the significance of any residual adverse effects, by themselves they are often not determinative of a finding of significance. By their very nature, guidelines often incorporate order of magnitude margins of safety, are determined based on theoretical grounds, aspects of which are often contradicted and exceeded in the natural environment and they often are developed in specific jurisdictions or with specific intended application only then to be considered for general application.

Potential changes in a measurable parameter, KI, or VEC resulting from the Project and/or cumulative environmental effects were evaluated against these standards or thresholds. Where possible, the following characteristics for an environmental effect were described quantitatively to assist in the assessment of the residual environmental effect. Where these residual environmental effects characteristics could not be expressed quantitatively, at minimum, they were described using qualitative terms.

2.7.1.2 Mitigation Measures

Mitigation, defined as changes in the temporal or spatial aspects of the Project and/or the means in which the Project will be constructed, operated or decommissioned, over and above aspects of the Project design are described throughout the EIS. Where possible, the effectiveness of the proposed mitigation measure(s) was expressed in terms of the expected change in the measurable parameter(s) for the environmental effect.

2.7.1.3 Compensation

Compensation for VECs other than for fish and fish habitat, as well as for wetland habitat and on wetlands associated with migratory birds and species at risk, will be identified where adverse residual effects are anticipated and are unavoidable. If compensation is proposed for a particular VEC, it will be identified in association with each VEC in Sections 2.7.2, 2.7.3 and 2.7.4.

Effects on fish and fish habitat have been quantified in Section 2.7.2.5, including residual effects once mitigation measures are implemented. Two Fish Habitat Compensation Plans will be developed, one that characterizes habitat loss related to the Tailings Impoundment Area (TIA), and another that characterizes habitat loss related to the balance of the MDP, excluding the TIA. Both Habitat Compensation Plans will be developed in consultation with regulatory agencies and be consistent with existing legislation and policies. The extent to which fish population and fish habitat, the productive capacity of water bodies, recreation values, wildlife, wildlife habitat and the habitat of species at risk values has been affected is identified, including a discussion of how these effects are avoided, reduced or mitigated.

Consistent with the Table of Commitments from the previously reviewed project a habitat compensation framework has been developed to guide the development and implementation of a Habitat Compensation Plan. As indicated in this Framework, the details of any compensation plan cannot meaningfully be developed or implemented until the implementation of planned mitigation measures has been completed, the effects assessment predictions confirmed and the criteria defining and the justification for need developed. This habitat compensation framework can be found in Appendix 2.7.1.3-A.

2.7.1.4 Cumulative Effects Assessment

Characterization of Cumulative Environmental Effects of other projects and activities that overlap with those of the Project is identified. An assessment of potential interactions is completed to determine if an assessment of cumulative effects is required for that specific Project effect. Cumulative environmental effects are only assessed if all three of the following conditions are met for the environmental effect under consideration (CEAA Cumulative Effects Assessment Practitioners Guide, Feb 1999). A series of three questions are used to screen cumulative environmental effects:

- The Project will result in a measurable, demonstrable or reasonably-expected residual environmental effect on a component of the environment (i.e., Is there an environmental effect that can be measured or that can reasonably be expected to occur?)
- The project-specific residual environmental effect on that component does, or is likely to, act in a cumulative fashion with the environmental effects of other past or future projects and activities that

are likely to occur (i.e., is there overlap of environmental effects–i.e., A cumulative environmental effect?), and

- There is a reasonable expectation that the Project's contribution to cumulative environmental effects will affect the viability or sustainability of the resource or value.

Project Inclusion List

A Project Inclusion List including all past, present and reasonably foreseeable projects (those that are likely to occur), activities and actions with potential residual environmental effects that could overlap spatially and temporally with the potential residual environmental project effects being assessed was prepared. The inclusion list was developed through consultation with a wide variety of information sources. Projects currently listed with the BC EAO and CEAA were evaluated for relevance to the New Prosperity project, and where the potential existed for these projects to have some environmental interaction (cumulative effect) with the Project, they were included in the Project Inclusion List.

Additional information sources consulted to determine existing and foreseeable projects included municipal, regional, provincial and federal governmental agencies and other stakeholders (e.g. developers and companies). The following organizations and agencies were contacted for information on relevant projects near the Project area:

- City of Williams Lake
- Quesnel Community and Economic Development Corporation
- Cariboo Regional District
- BC EAO
- Ministry of Energy and Mines
- Front Counter BC, and
- Canadian Environmental Assessment Agency.

In addition, a number of companies and businesses currently operating or with proposed projects within the regional study areas (RSAs) were contacted or their websites were searched for additional information to determine if potential cumulative effects existed. Table 2.7.1.4-1 contains the 22 projects and activities determined to be relevant to the New Prosperity project. It summarizes the nature of the project, the proponent, project dates and provides a current status according to available information. The location of these projects within the RSAs is found on Figure 2.7.1.4-1. A project being on the list does not imply there is a cumulative effect; rather, it indicates that the project has sufficient merit for further review of its effects relative to New Prosperity to be evaluated.

The results of the cumulative effects assessments are discussed for each VEC in Sections 2.7.2, 2.7.3 and 2.7.4.

Table 2.7.1.4-1 Inclusion List

Project Name	Company/ Organization	Project Type	Major Components	Start Date (yr)	End Date (yr)	Footprint Size	Project Description	Status
Cariboo Gold Project	Barkerville Gold Mines Ltd	Mining	Open pit, mill, waste storage facility, access roads, power line right-of-way, diversion ditches, topsoil stockpiles			2,463 ha	The Cariboo Gold Quartz Project ("Gold Quartz") is situated within the Cariboo Gold Fields, a world-class producer of gold with a history of mining that dates back to the Cariboo gold rush of the 1860's. In excess of 2.5 million ounces of placer gold and over 1 million ounces of load gold has been produced from the region. The Gold Quartz is a proposed open pit mine on Cow Mountain within the Rainbow, Sanders and Pinkerton zones, which are centered on a large knoll on Cow Mountain. http://www.barkervillegold.com/s/Cariboo_Gold.asp http://www.barkervillegold.com/s/Operations.asp http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_project_home_69.html	Terminated/ Past Project
Bonanza Ledge Project	Barkerville Gold Mines Ltd	Mining	Exploration and Drilling	2008	2013	78 ha	The Bonanza Ledge deposit is on the southwest flank of Barkerville Mountain, about 2 km northwest of the Barkerville Historic Town site. Based on the successes of these previous drill programs, the company has expanded its planned drilling program through to 2013. Initially the program will consist of 20,000 meters of diamond drilling to further explore at depth, along strike and within the Bonanza Ledge deposit area. http://www.barkervillegold.com/s/Bonanza_Ledge.asp	Approval Under the BC Mines Act
Cariboo Mineral Gold	Noble Metal Group	Mining	Exploration and Drilling	2005	Ongoing	10,950 ha	The property is located approximately 21 kilometres north-northeast of the community of Likely, in the Cariboo Mining Division of British Columbia, Canada. The property consists of 22 four post located claims containing 388 units and 50 located two post claims for a total of 438 units. The claims are contiguous and have not been surveyed. http://aris.empr.gov.bc.ca/ArisReports/28443.PDF	Ongoing Exploration
QR Mine	Barkerville Gold Mines Ltd.	Mining	Underground mine	2007	2011	120 ha	This project involves the reopening and expansion of a mine. Underground operations were suspended in February of 1998 and milling was suspended in April after processing stockpiled ore. The initial operations on the QR Mine will develop the Northwest, West and Midwest Zones all defined and or developed by Kinross. Ongoing operations will develop the extension of the Midwest Zone at depth, the North Zone and the balance of the QR Intrusive contact that has not to date been evaluated. The QR Mill is rated to operate at 900 tonnes per day with feed from three zones http://www.barkervillegold.com/i/pdf/reports/qrmine/qrmine_43101.pdf http://www.empr.gov.bc.ca/Mining/Geoscience/PublicationsCatalogue/ExplorationinBC/Documents/2011/BCEx-Mining2011_Thomp_Ok_Cariboo.pdf	Past Project
Gold Creek Project	Tiex Inc.	Mining	Exploration and Drilling	2008	Ongoing	79,379 ha	TIEX Inc.'s currently is focusing its exploration efforts on the Gold Creek Zone, located just north of the town of Likely, B. C., where prospecting and some recently acquired historical data have demonstrated the presence of gold values. http://www.tiexinc.com/r47.389.a367.shtml http://www.tiexinc.com/p48.423.405.shtml	Ongoing Exploration
Spanish Mountain	Spanish Mountain Gold Ltd.	Mining	Exploration and drilling Construction and operation	2007 2014	Ongoing 2025	170 mineral claim units totalling 10,500 acres (4,249 ha)	The completion of a $13M financing in 2006 kick started an aggressive exploration campaign to build a larger NI43-101 compliant gold resource. A 135-hole drill program (30,000 m) was completed in 2006 with the results being compiled to guide an even more aggressive drill program for 2007. This project offers potential for a significant near-surface gold deposit, located near existing infrastructure and amenable to low cost open pit, bulk mining methods. Projects NPV/IRR/Cashflow are highly leveraged to gold price. Preliminary Economic Assessment completed in 2010. Feasibility Study underway. Project Description accepted by both Federal and Provincial Environmental Assessment Agency. Projected timeline: construction in 2014 & production in 2015. http://www.ceaa.gc.ca/050/details-eng.cfm?evaluation=63917&ForceNOC=Y http://www.spanishmountaingold.com/s/SpanishMountain.asp?ReportID=486421	Past Project/ Ongoing Exploration

Project Name	Company/ Organization	Project Type	Major Components	Start Date (yr)	End Date (yr)	Footprint Size	Project Description	Status
Mt. Polley Mine	Imperial Metals Corporation	Mining	Open pits, processing plant, water supply, tailings pond and a power transmission line	2005	2023	18,321 ha	Mount Polley mine is located eight kilometres southwest of Likely and 100 kilometres (by road) northeast of Williams Lake, British Columbia. Mount Polley is an open pit copper/gold mine producing an average of 20,000 tonnes per day. Ongoing exploration at Mount Polley in 2011 will continue to focus on defining underground higher grade mineralization, and further testing of the mineralized zones: Boundary, WX, C2 and Cariboo, which are in the vicinity of the Springer pit. http://www.imperialmetals.com/i/pdf/2012-imperial-metals-annual-information-form.pdf http://www.imperialmetals.com/s/MountPolley_new.asp Map at: http://www.imperialmetals.com/i/pdf/zone-map-mount-polley-zone-map.pdf	Completed
Gibraltar Mine	Taseko Mines Ltd. (250) 684-6365	Mining	Open pit, water supply, tailings pond, power transmission line, processing plant, instream diffuser Upgrade and expansion of concentrator facility	2006 2011	2038 2012	10,900 ha	Gibraltar Mine has started construction for an upgrade and expansion of the concentrator facility to increase production from 60 to 180 million pounds of copper per year by 2012 at the mine. In the Spring of 2011, construction commenced for Gibraltar Development Plan 3 (GDP3). GDP3 will include the construction of a 55,000 ton per day concentrator, which will initially have an installed capacity of 30,000 ton per day, to complement the existing 55,000 ton per day facility currently in operation. Commissioning of the new concentrator is anticipated in Q4 2012.http://www.tasekomines.com/our-properties/gibraltar/current-status/88/	Started
Horsefly	Tiex Inc.	Mining	Exploration and Drilling	Ongoing		109,442 ha	Located 150 km east-northeast of Williams Lake, British Columbia. Tiex identified at least five potential areas (Bullion, Viewland, Magnetic, Horsefly Mountain, and Jamboree) of Au/Cu Porphyry targets. http://www.tiexinc.com/g48.414.0.shtml#	Ongoing Exploration
Woodjam North/South	Gold Fields Horsefly Exploration Corp.	Mining	Exploration and Drilling	Ongoing		56,150 ha	Woodjam gold-copper-molybdenum property comprises the Woodjam North (42,343 ha) and the Woodjam South (13,827 ha) properties. Both properties are a joint venture with Cariboo Rose Resources Ltd (40%) and have been optioned under separate agreements to Gold Fields Ltd (NYSE:GFI). In 2010, Gold Fields completed the 3rd largest exploration drilling program in British Columbia at Woodjam. The property is owned 60:40 by Fjordland Exploration Inc and Cariboo Rose Resources Ltd respectively making up the Woodjam Joint Venture.On 28 May 2009 Gold Fields Horsefly Exploration Corp, a member of the Gold Fields Ltd. group of companies, was awarded an option to earn an initial 51% interest in a portion of the property referred to as "Woodjam North" http://www.fjordlandex.com/woodjam_property.html http://www.empr.gov.bc.ca/Mining/Geoscience/PublicationsCatalogue/ExplorationinBC/Documents/2011/BCEx-Mining2011_Thomp_Ok_Cariboo.pdf	Ongoing Exploration
Tak (Moffat)	Fjordland	Mining	Exploration and Drilling	Ongoing		55,654 ha	The Tak properties consist of seven (Tak) gold-copper-molybdenum prospects located adjoining and southeast of the company's Woodjam property, and adjacent to Newmont's new holdings. Capstone Mining Corp (TSX:CS) optioned the Tak properties and can earn up to a 70% interest through $6 million of exploration expenditures by December 31, 2016. http://www.fjordlandex.com/cariboo_properties.htm	Ongoing Exploration
Fox	Happy Creek Minerals Ltd.	Mining	Exploration and Drilling	Ongoing		13,790 ha	The Fox property is located approximately 25 kilometres east of the former Boss Mountain molybdenum mine, and approximately 70 kilometres northeast of 100 Mile House in the south Cariboo region of British Columbia, Canada. The Company has had excellent success in advancing the Fox tungsten-molybdenum property. It is now thought to be at the early stage of a significant new tungsten discovery in western Canada. http://www.happycreekminerals.com/s/Fox.asp?ReportID=177367	Ongoing Exploration
Lac La Hache (Spout)	GWR Resources Inc.	Mining	Exploration and Drilling	Ongoing		5,000 ha	The Lac La Hache Property is situated between producing mines at Imperial Metals' Mt. Polley Copper-Gold Mine and New Gold Inc.'s New Afton Copper-Gold project (Teck-Cominco's legendary Afton mine), and is well-served by rail, road and power infrastructure. Drilling of the Lac La Hache Property is ongoing. http://www.gwrresources.com/s/LacLaHache.asp	Ongoing Exploration
Newton Mountain	Amarc Resources Ltd.	Mining	Exploration and Drilling	1972	Ongoing	4100 ha	In 2010, Amarc made an important new bulk-tonnage gold discovery at Newton within an eight square kilometre mineralized system. The Company's 2011 drill program confirmed the Newton discovery zone extends under shallow cover. An 18,000 metre delineation drill program is underway at Newton in 2012, and will continue to determine the full extent of the gold mineralization. http://www.amarcresources.com/ahr/Newton.asp?ReportID=419336	Ongoing Exploration

Project Name	Company/ Organization	Project Type	Major Components	Start Date (yr)	End Date (yr)	Footprint Size	Project Description	Status
							http://www.highridgeresources.ca/i/pdf/highridge-ppt.pdf	
Blackdome Mine	Sona Resources Corp.	Mining	Past producer Exploration	Late 1980's On-going	1999	34,794 ha	The Blackdome Gold Mine is a permitted mine and milling facility located in southwestern British Columbia, approximately 230 kilometres north of Vancouver and 100 kilometres south of Williams Lake. Since acquiring the mine in 1995, Sona Resources (then Claimstaker Resources) has carried out geotechnical surveys, exploration drilling and small-scale mining. Project milestones: Preliminary assessment study of Blackdome and Elizabeth by Micon International Review of inferred resource by SRK Consulting Inc. Planning underway for exploration drilling of Giant and Redbird veins http://www.sonaresources.com/properties/blackdome_bc/http://www.sonaresources.com/_resources/news/SONA_NR%2010_2010.pdf	Past Project/ Ongoing Exploration
Taseko Project (exploration)	Galore Resources Inc.	Mining	Exploration and drilling	2007	On-going	Claims encompas s 48,081 ha	The Taseko Project is located south and west of Upper Taseko Lake, 160 km southwest of Williams Lake, BC. Galore Resources Inc. owns and has options to acquire 100% interest in mineral titles to over 48,000 ha of highly prospective exploration targets for copper, molybdenum, gold and silver in the Taseko Lakes region, south of the Prosperity Project site. The company is currently conducting exploration at this point including airborne surveys of the whole property, ground geological prospecting/sampling and 2400 m of planned drilling (June to September 2007 - all helicopter supported). http://www.galoreresources.com/assets/downloads/galore_Project_Summary.pdf map can be found at: http://www.galoreresources.com/Projects/Properties/	Ongoing - Exploration Only
Pellaire Mine	Galore Resources Inc.	Mining	73 km of road, underground mine (200 m of raise, crosscut and sub-drift slope)	1936	Ongoing	3,882 ha	Since the original discovery of gold-silver bearing quartz veins on the Pellaire property in 1936, the area immediately west of the Lord River and Upper Taseko Lake has been continuously prospected and explored for precious metal vein deposits up to the 1950's and since that time for porphyry copper-molybdenum-gold deposits. Approximately 1270 tonnes of ore were extracted and about 848 tonnes of ore were shipped to the Cominco smelter in Trail. The mine still had estimated reserves of 90 000 tonnes of 0.79 oz./ton gold and has produced 2000 oz in 2002. It is currently considered a past producer. http://minfile.gov.bc.ca/report.aspx?f=PDF&r=Minfile_Detail.rpt&minfilno=092O++045	Past Project/ Ongoing Exploration
Taylor Windfall Mine	Galore Resources Inc.	Mining	Underground Mine	1920s	Ongoing		Taylor Windfall mine property is included in Galore Resources Inc. Taseko Project's exploration program. Mining for gold and silver at the Taylor Windfall Mine started in the 1920s. Production records show that 555 tonnes of ore were mined in five years between 1932 and 1953. http://www.galoreresources.com/assets/downloads/galore_Project_Summary.pdf	Past Project/ Ongoing Exploration
Nazko Lava Quarry	Lightweight Advanced Volcanic Aggregates Inc. "Lava Inc." Brian C. Wear: 604-852-2710	Quarry (mining)	Open pit	1996 (year of EA certificate) Site mined since ~1990	Mine current life reserves estimated at 200 years	405 ha	The project quarries a deposit of volcanic ash around the cone of an extinct volcano (open pit) 3 kilometres east of Fishpot Lake and about 10 km west of the village of Nazko. http://minfile.gov.bc.ca/Summary.aspx?minfilno=093B++060	Ongoing
Diatomaceous Earth Mining	Dialite Industries Ltd.	Mining	re-establishment and reopening of former mine, stock piling and processing facility	2006 to 2009	~2080	~100 ha	Dialite Industries Ltd. will establish a new business enterprise to extract diatomaceous earth, which is composed of fossilized skeletal remains of algae used for its high absorbency. The project involves the re-establishment of a processing facility in the former processing area at the site, rehabilitation of site services and infrastructure, and re-opening of the mine. The mining involves diatomite production in winter months (~ 2 weeks per year) using a loader and dump truck(s) to establish a production stockpile adjoining the processing facility and processing of diatomite products year round. This earth can be processed to manufacture a range of absorbent products	Ongoing

Project Name	Company/ Organization	Project Type	Major Components	Start Date (yr)	End Date (yr)	Footprint Size	Project Description	Status
Tsilhqot'in Power Development Project	-Western Biomass and -Tsilhqot'in National Government	Power Generation	The proposed Tsilhqot'in Power Development Project consists of three main components; a forest-based biomass-fired, thermal electric power generating plant, log-chipping and wood fibre fuel handling and sorting facilities, and a 230-kV transmission line.	Ongoing (Life of Biomass plant 30-40 years)		NA	The proposed Tsilhqot'in Power Development Project consists of: a 60 MW forest-based biomass-fired, thermal electric power generating plant; associated wood fibre and log-chipping, sorting and handling facility and an approximately 70 km transmission line. The proposed power plant site is 85 km west of Williams Lake, BC, adjacent to Highway 20 (the Chilcotin Highway) at 51° 56' 03" north latitude and 122° 57' 45" west longitude (UTM 5753775N 502598 E). The project will include approximately 70 km of 230-kV electric transmission line to connect the power plant with the BC Hydro provincial electric transmission grid. The proposed power plant and transmission line would be outside of the municipality of Hanceville and within the CRD, and would include: A 60 MW (53 MW net basis) biomass-fired thermal electric generating plant Approximately 70 km of 230-kV transmission line Log sorting yard and chipping area Hog fuel storage and fuel conveyance system Boiler ash disposal area Office building and control room Ancillary equipment including equipment maintenance facility and diesel fuel storage for mobile equipment http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_project_home_330.html	Pre-application
Forestry (Licences)	-690361 BC Limited (Tl'esqox Band and Esk'etemc Band) -BC Timber Sales -Community Forests (Likely – Xatsull,Tsi Del Del Band, City of Williams Lake and Williams Lake Indian Band) -Esk'etemc Indian Band -Pioneer Biomass -West Fraser Mills Ltd. -Williams Lake Indian Band -Tolko Industries -Tsilhqot'in National Government -Ulkatcho Indian Band						Mountain Pine Beetle fiber and timber salvage and general forestry practices in the vicinity of the New Prosperity Mine develop pose the potential for increased road access to beetle-killed areas and other forest license areas. Standard Forest Practices Code logging practices will be followed for all logging activities.	Ongoing

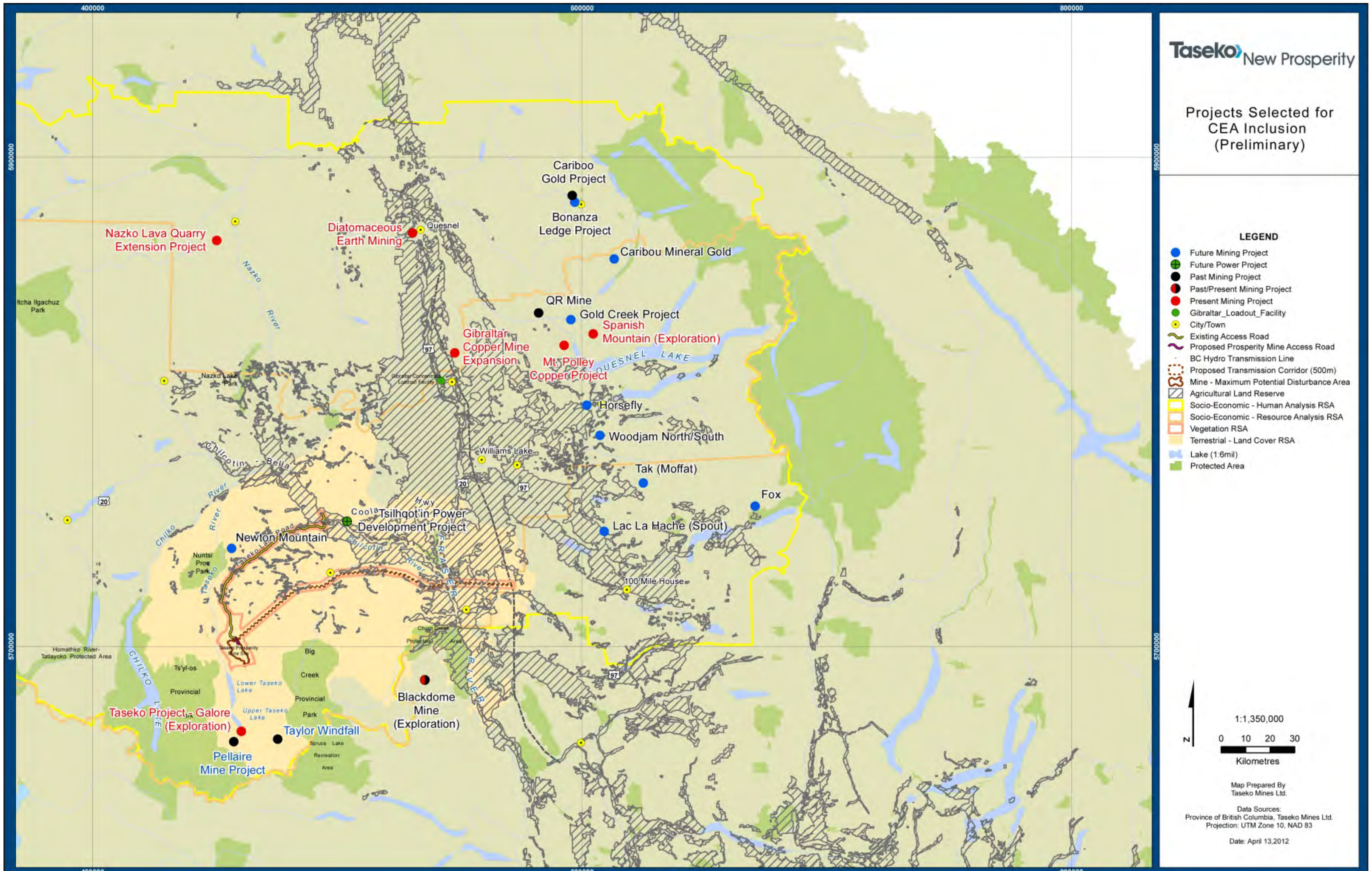


Figure 2.7.1.4–1 Location of Inclusion List Projects or Activities

2.7.1.5 Determination of the Significance of Residual Effects

Assessment of Significance for any residual Project-related and cumulative adverse environmental effects are determined. Under the CEAA Reference Guide: Determining Whether A Project is Likely to Cause Significant Adverse Environmental Effects - The Requirements of the Canadian Environmental Assessment Act (http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=D213D286-1&offset=2&toc=show), the environmental assessment must include a determination of the significance of environmental effects. In order to address what might constitute a significant adverse environmental effect the following factors are considered:

Direction: The ultimate long-term trend of the environmental effect (e.g., positive or adverse)

Magnitude: The amount of change in a measurable parameter or variable relative to baseline case (i.e., low, moderate, high)

Geographical Extent: The geographic area within which an environmental effect of a defined magnitude occurs (site-specific, local, regional, provincial, national, international)

Frequency: The number of times during a project or a specific project phase that an environmental effect may occur (i.e., once, sporadically, regular, continuous)

Duration: This is typically defined in terms of the period of time that is required until the VEC or KI returns to its baseline condition or the environmental effect can no longer be measured or otherwise perceived (i.e., short-term, medium-term, long-term, permanent)

Reversibility: The likelihood that a measurable parameter or KI will recover from an environmental effect (i.e., reversible, irreversible)

Ecological or Socio-economic Context*:* The general characteristics of the area in which the Project is located (i.e., undisturbed, disturbed, urban setting)

Likelihood*:* The likelihood or probability of occurrence of an environmental effect (e.g. high or low probability)

The determinations also included a discussion of the prediction confidence based on:

- Scientific certainty relative to quantifying or estimating the environmental effect, including the quality and/or quantity of data and the understanding of the effect mechanisms, and
- Scientific certainty relative to the effectiveness of the proposed mitigation measures.

Residual effects are discussed for each VEC in Sections 2.7.2, 2.7.3 and 2.7.4.

2.7.1.6 Summary of Effects Assessment

Table 2.11-1 summarizes the following key information:

- A concise summary of the Project's beneficial and adverse effects
- A summary of mitigation and compensation measures
- A brief description of any potential residual effects
- A brief description of cumulative effects
- A determination of the significance of residual effects, and
- For those adverse effects found to be significant, a determination of whether the effect is likely to occur.

2.7.2 Physical and Biological Environment

2.7.2.1 Geology and Geochemistry

TERMS OF REFERENCE

The EIS guidelines stipulate that “The EIS shall identify how the Project as proposed has changed from the previous project proposal and whether changes will result in environmental effects on geology and geochemistry” (Section 2.7.2.1 in the EIS Guidelines).

However, geology and geochemistry themselves are not Valued Ecosystem Components (VECs). The primary relationship between geology/geochemistry and the assessment of environmental effects is one in which geochemical changes arising from excavation, processing, and disposal of geological materials have the potential to causes changes to VECs (typically, VECs relating to water quality or affected by water quality). For this reason, Section 2.7.2.1 Geology and Geochemistry has been structured in a parallel manner to the equivalent section in the previous project proposal (Volume 3, Section 7: Acid Rock Drainage and Metal Leaching, in the March 2009 EIS/Application).

In this document, the focus of Section 2.7.2.1 is both the assessment of the potential for metal leaching (ML) and acid rock drainage (ARD) (together, ML/ARD) for the New Prosperity project, and the related prediction of site-wide water quality.

CHANGES FROM THE PREVIOUS PROJECT PROPOSAL

From the perspective of geology and geochemistry, the Project as proposed is different from the previous project proposal only in the location of the project components and the timing of construction of those components. These changes have been described elsewhere in this application, and are not repeated here.

The greatest material change in the new project is the reconfiguration of the project components within the Mine Element such that Fish Lake is maintained. The effects of this reconfiguration on the process of prediction of future site water quality are complex in both space and over time. As a result, this section has been prepared to address the Project as a whole rather than to attempt to address only those aspects that have changed from the previous proposal

PROJECT SETTING AND GENERAL ARRANGEMENT

Figures showing the Project setting and the general arrangement of the mine site for the various periods of the Project are provided in earlier sections of the application. For the purposes of Section 2.7.2.1, the following figures are provided for ease of reference:

- Figure 2.7.2.1-1 provides an overview of the Fish Creek watershed, showing the ultimate outline of the open pit
- Figure 2.7.2.1-2 provides the site plan at maximum disturbance (end of milling). Figure 2.7.2.1-3 provides the site plan for the post-closure period
- Figure 2.7.2.1-4 provides a long section of the Fish Creek valley through the post closure plan of arrangement
- Figure 2.7.2.1-5 and Figure 2.7.2.1-6 provide the plan locations of the exploration drillholes that defined the New Prosperity ore body and which provided the geological materials for the geochemical testing which supports the ML/ARD assessment and related water quality predictions which are the subject of Section 2.7.2.1.

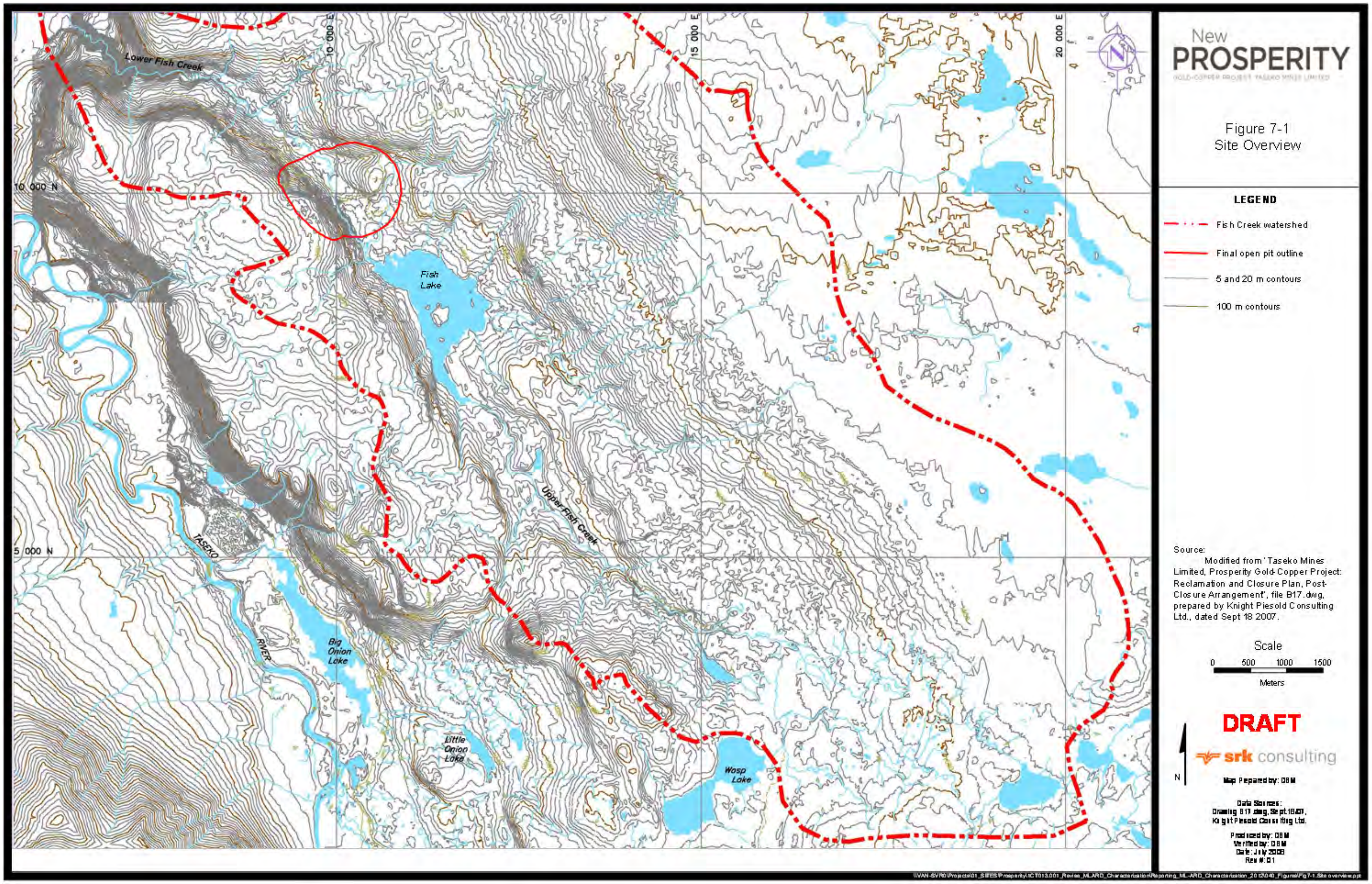


Figure 2.7.2.1-1 Site Overview

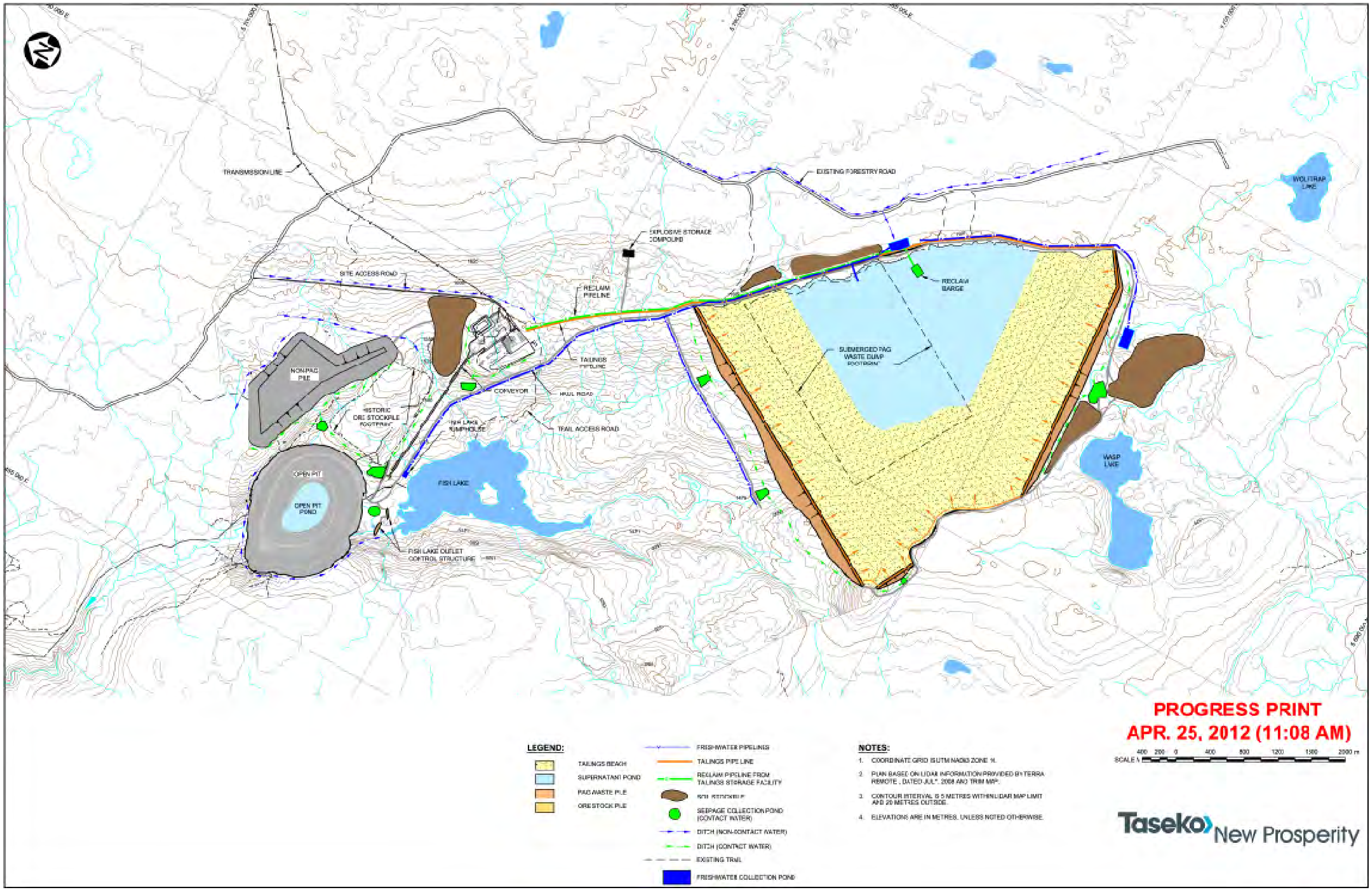


Figure 2.7.2.1-2 Site Plan at Maximum Disturbance Arrangement

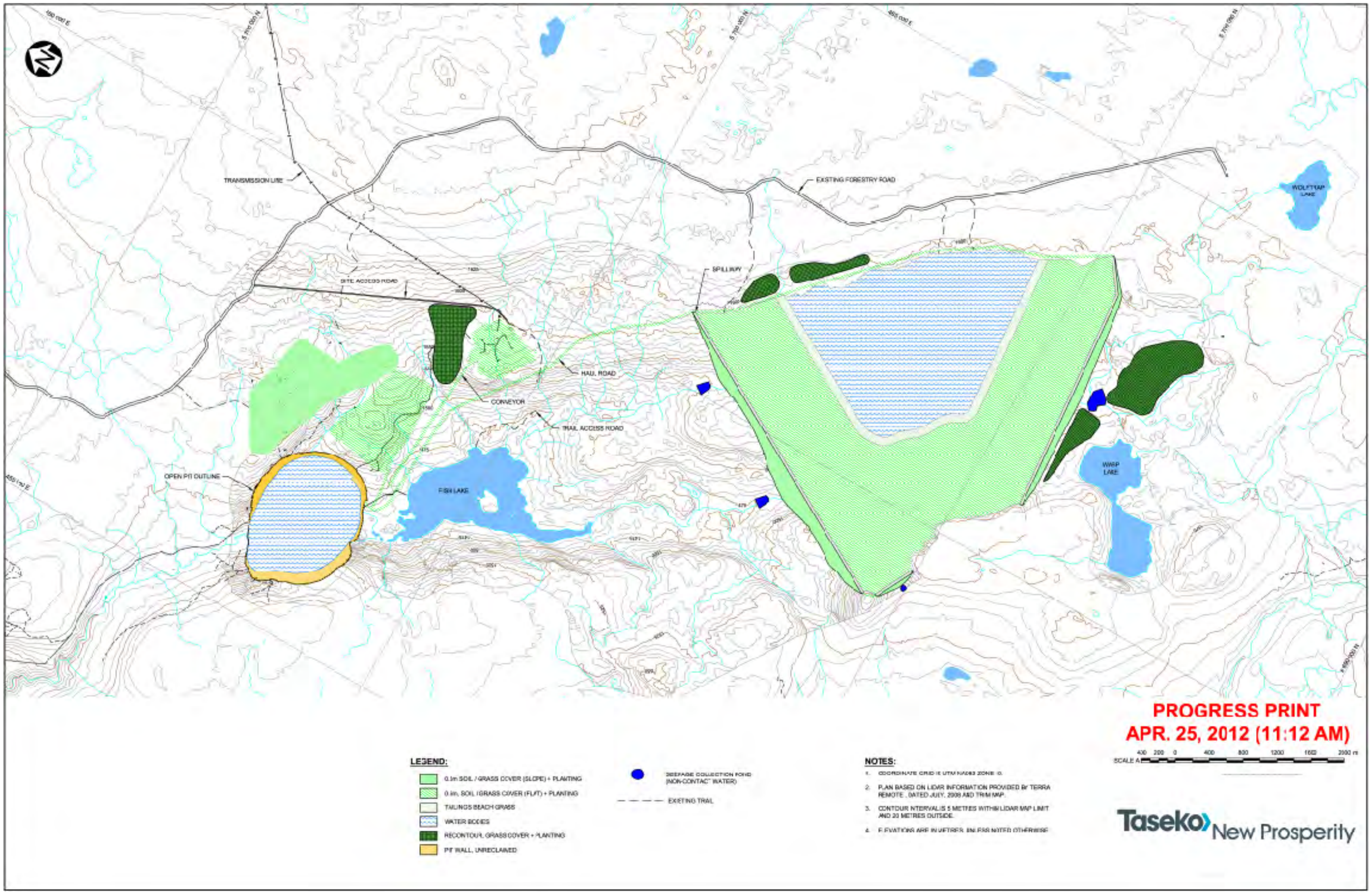


Figure 2.7.2.1-3 Post-Closure Site Plan

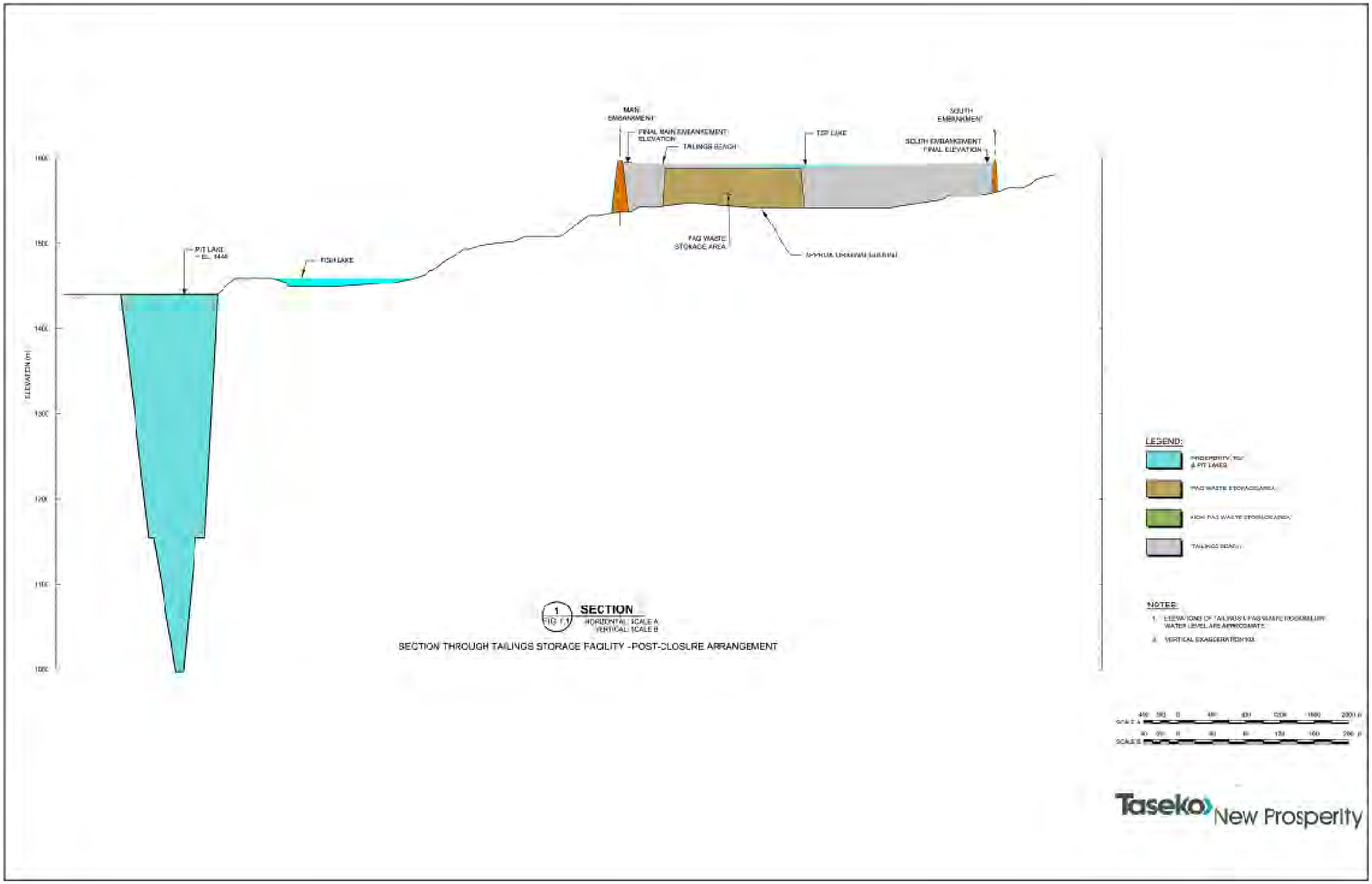


Figure 2.7.2.1-4 Long Section of Fish Creek Valley

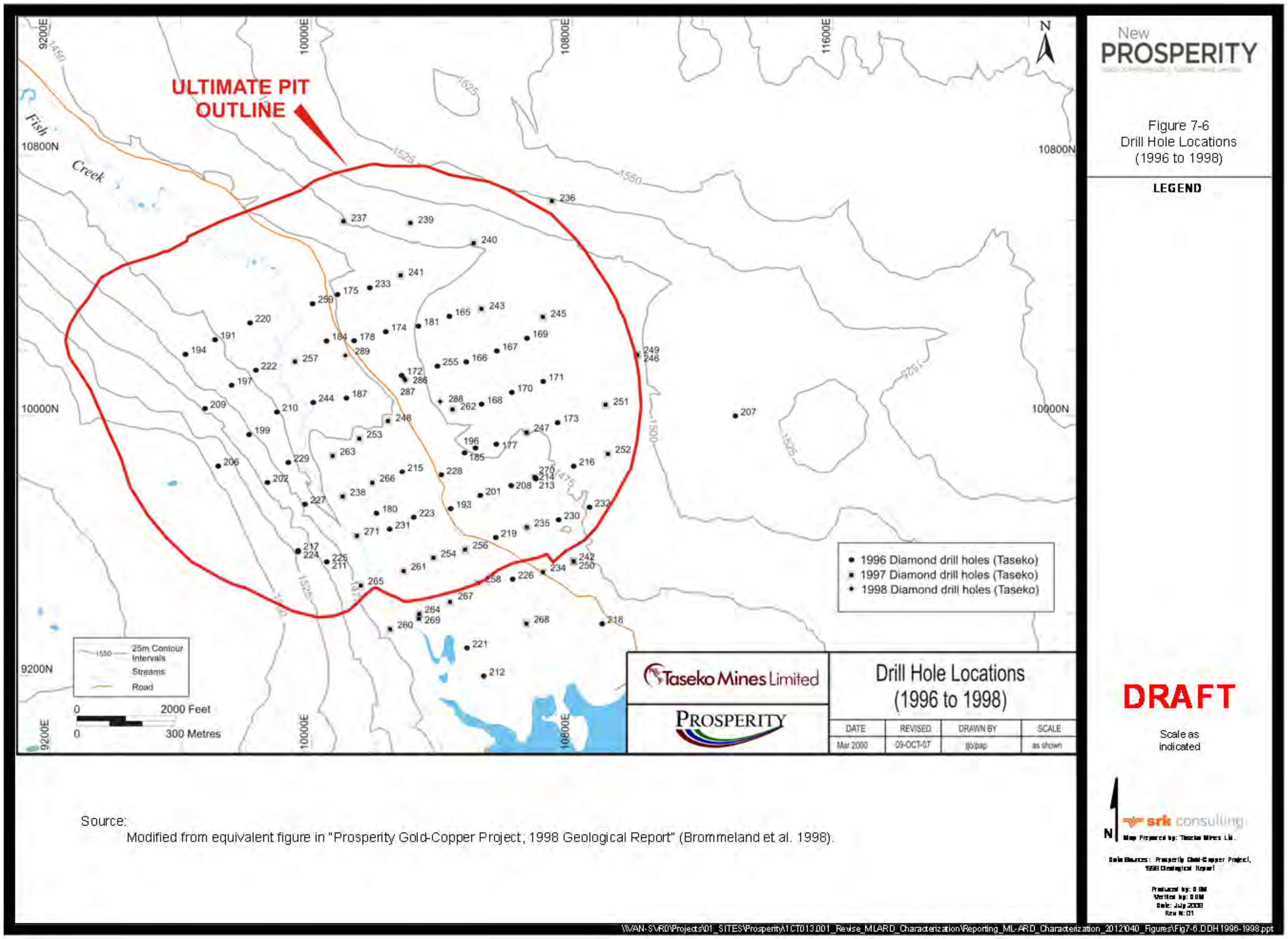


Figure 2.7.2.1-5 Drill Hole Locations (1969-1994)

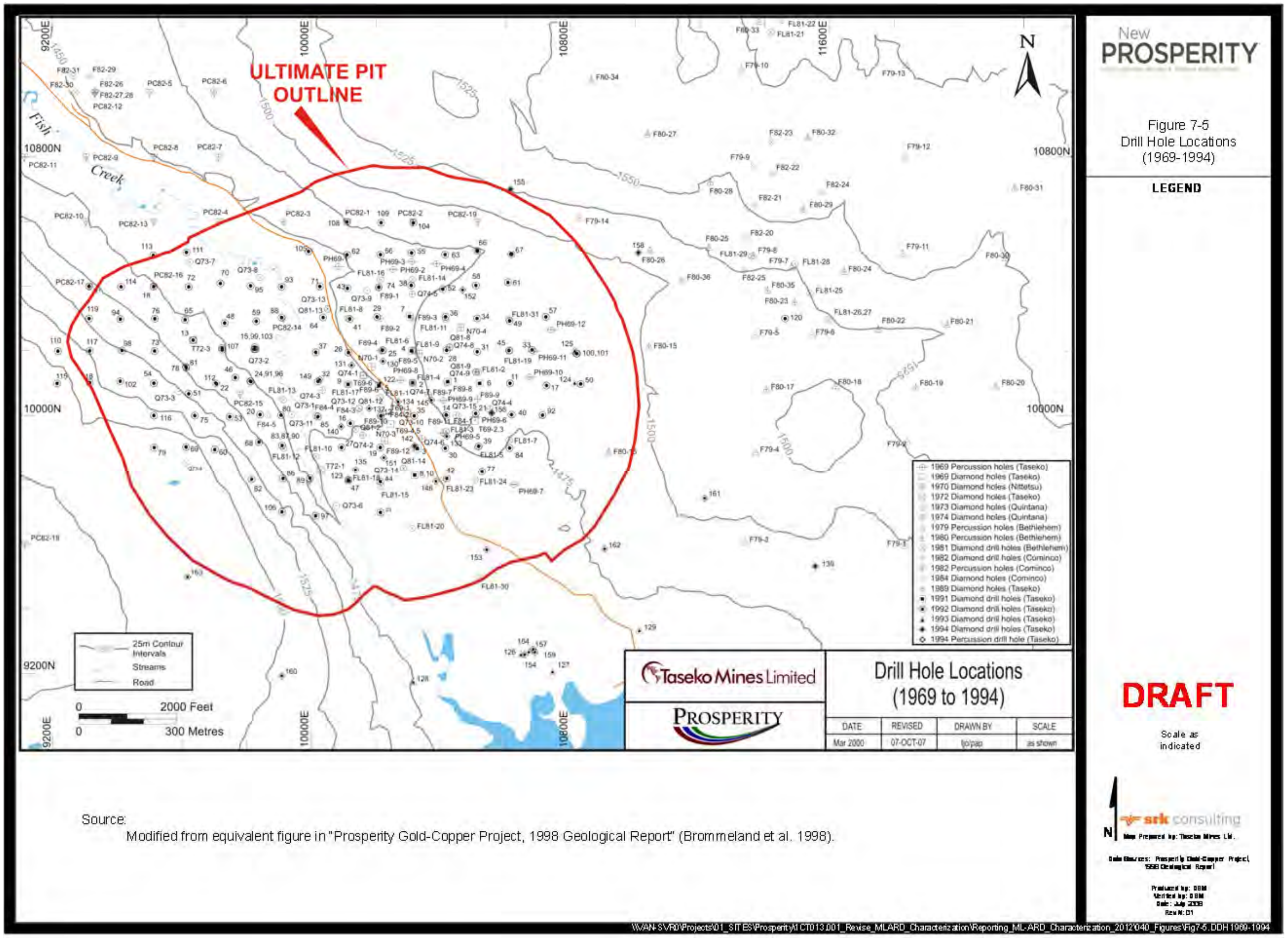


Figure 2.7.2.1-6 Drill Hole Locations (1996 to 1998)

GEOLOGICAL CONTEXT

The following sections summarize the geological description prepared by Taseko (Appendix 3-5-A of the March 2009 EIS/Application). Additional background information on the geology of the New Prosperity deposit can be found in MINFILE (record 092O 041), Caira et al. (1995), and Brommeland et al. (1998).

REGIONAL SETTING

The New Prosperity Project is located within the western-most portion of the Intermontane Belt, about 50 km northeast of the Coast Plutonic Complex boundary. The surrounding area is underlain by poorly exposed, late Palaeozoic to Cretaceous sedimentary and volcanic rocks which have been intruded by plutons of mid Cretaceous to early Tertiary age. Sub-horizontal Miocene plateau basalts and non-marine sedimentary rocks of the Chilcotin Group form a discontinuous and locally extensive post-mineral cover in the immediate project area. The regional Yalakom Fault, which lies to the southwest of New Prosperity, may have imparted some related structural controls which were important to the localization of mineralization at the deposit (Figure 2.7.2.1-7).

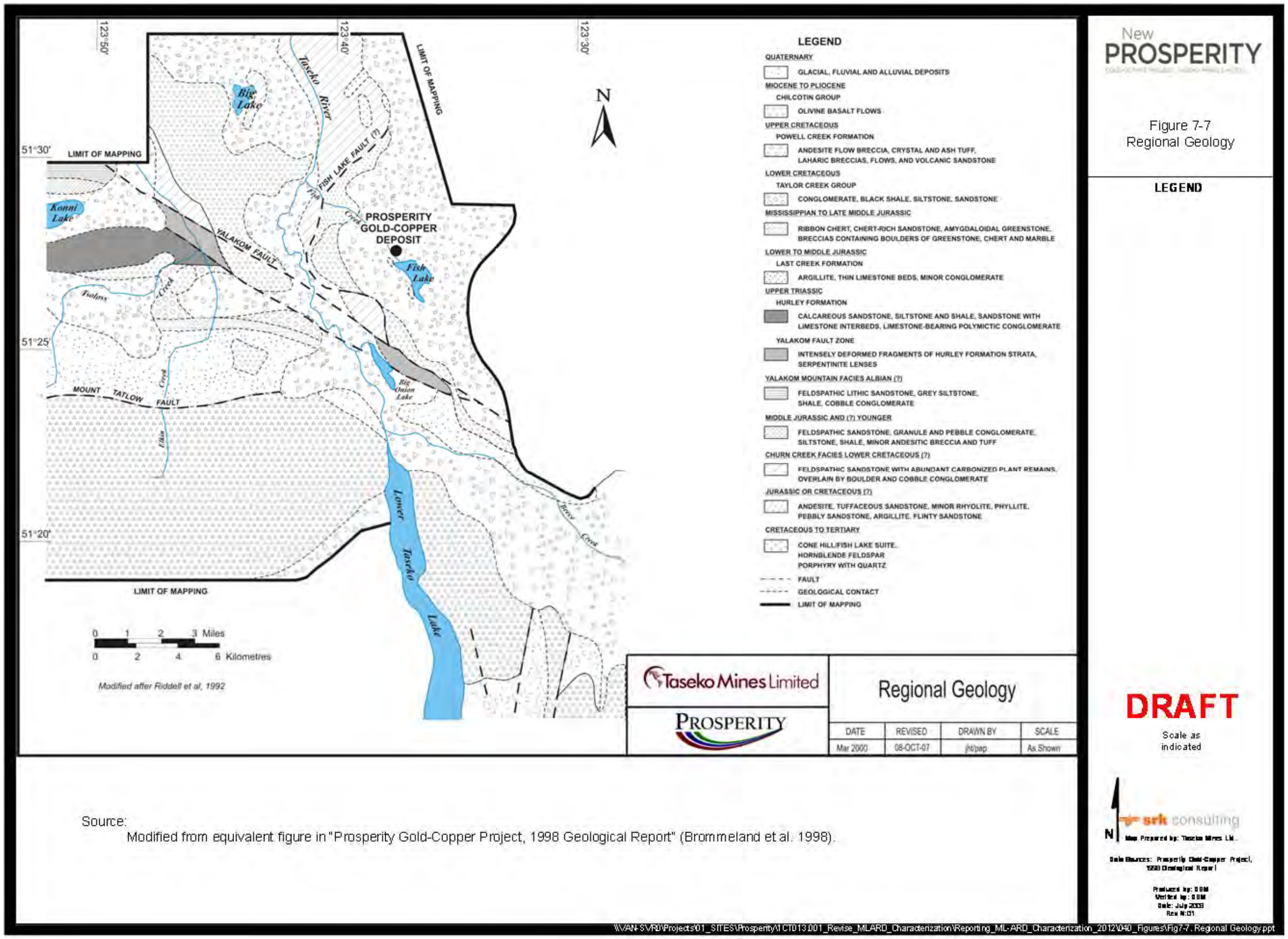


Figure 2.7.2.1-7 Regional Geology

SURFICIAL GEOLOGY

The New Prosperity Gold-Copper deposit subcrops under a 5 to 65 m thick blanket of surficial cover at the north end of Fish Lake.

Regional glaciation occurred most recently during the Wisconsinan (15,000 to 18,000 years before present) during which time ice moved over the low lying and undulating surface of the West Fraser Plateau in a northerly and northeasterly radial dispersal pattern (Talisman, 1997). The hummocky topography resulting from this period of glaciation is typical of that produced by an ablating ice mass and includes kames, eskers and kettles deposited on top of earlier lodgment till or basal till.

During Wisconsinan glaciation, ice movement in the vicinity of Fish Lake was from south to north (Caira and Findlay, 1994). Recent alluvial activity has cut into, and deposited sediments on the older Wisconsinan sediments. In the proposed pit area, 3 main types of glacially-derived overburden were recognized glacial till, glaciofluvial material, and glaciolacustrine material.

Prior to the most recent glaciation, Chilcotin Group flood basalts were deposited regionally across over 25,000 km² in the interior plateau of south central British Columbia. In the immediate vicinity of the New Prosperity deposit, flood basalts are sandwiched between the Wisconsinan sediments above and underlying colluvial and lacustrine sediments.

In general, east of Fish Creek and north of Fish Lake the overburden consists predominantly of a patchy and variably thick sequence of basal till that covers colluvium and bedrock. A prominent 750 m long esker occurs on the east side of Fish Creek and extends south to within 250 m of the outlet of Fish Lake. The west side of Fish Creek is underlain mainly by a thick sequence of basalt flows which can be observed in cliffs outcropping along the bank of the creek. Overlying these basalt flows is an irregular cover of basal till up to 22 m thick. In turn, the flows rest directly on bedrock or overlie a layer of colluvium which varies irregularly in areal extent and is 8 to 70 m in thickness. The southern portion of the deposit, adjacent to Fish Lake is covered by an extensive deposit of lake sediments (Figure 2.7.2.1-8).

Detailed geological logging of the overburden within the proposed pit indicates that there are 4 major types of overburden present: glacial till, basalt flows, colluvium and glacial lacustrine sediments. This overburden sequence consists mainly of basalt and glacial till with lesser colluvium and sediments. The sequence varies from 0 to 65 m in thickness over the deposit, but is as thick as 155 m to the south of the deposit near Fish Lake (Figure 2.7.2.1-9). The overburden level plans in Figure 2.7.2.1-10 through Figure 2.7.2.1-14 show the distribution of the four main overburden units laterally and with depth.

HOST ROCKS

The deposit is predominantly hosted in Cretaceous andesitic volcaniclastic and volcanic rocks which are transitional to a sequence of sparsely mineralized, volcanically derived sedimentary rocks to the south (Figure 2.7.2.1-15). The andesitic volcaniclastics are comprised of coarse-grained crystal tuff and ash tuff, and thinly bedded tuff with lesser lapilli tuff. The upper eastern portion of the deposit is hosted by subvolcanic units of crowded feldspar porphyritic andesite and thick feldspar and hornblende porphyritic flows as shown in Table 2.7.2.1-1.

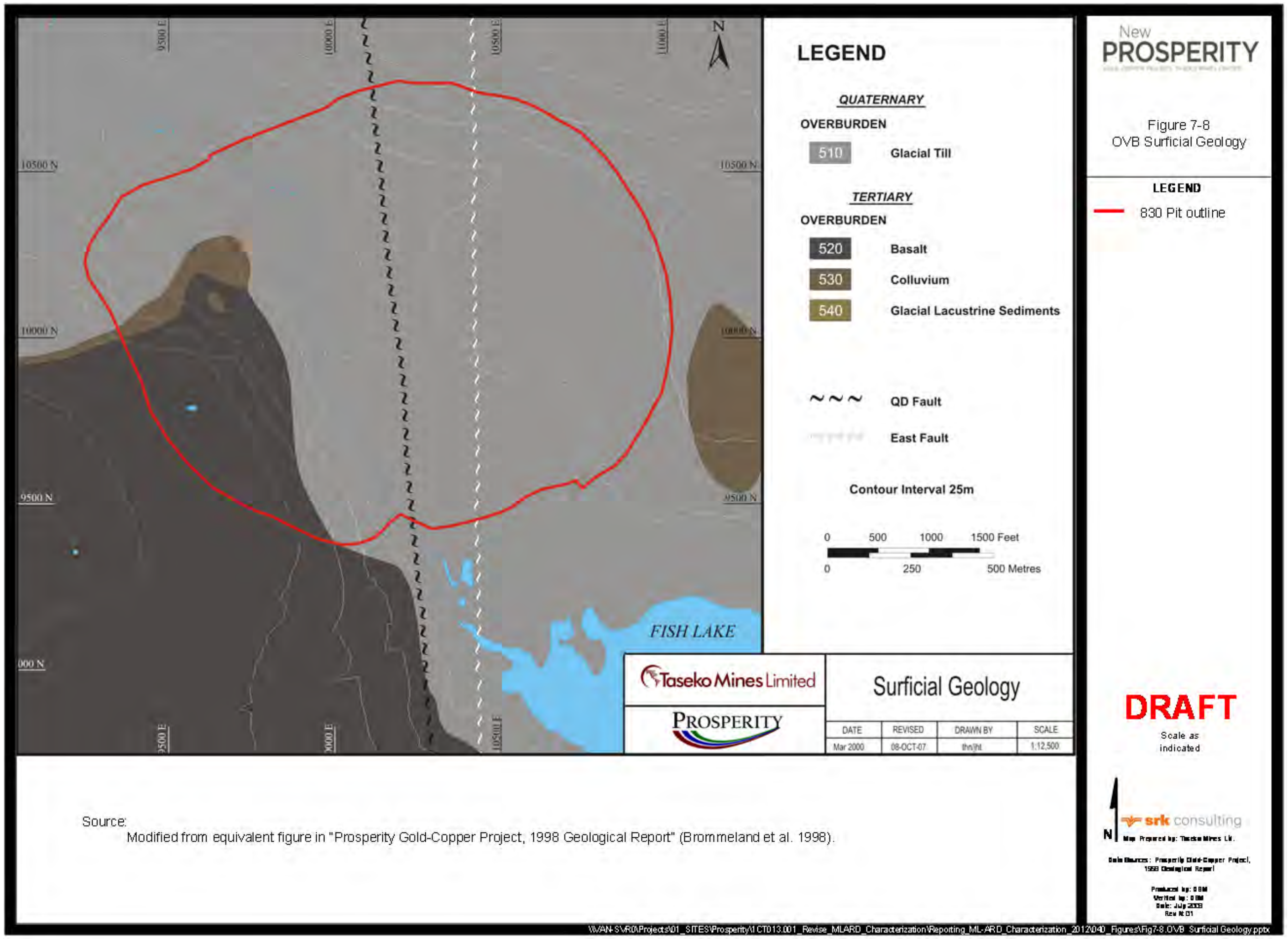


Figure 2.7.2.1-8 OVB Surficial Geology

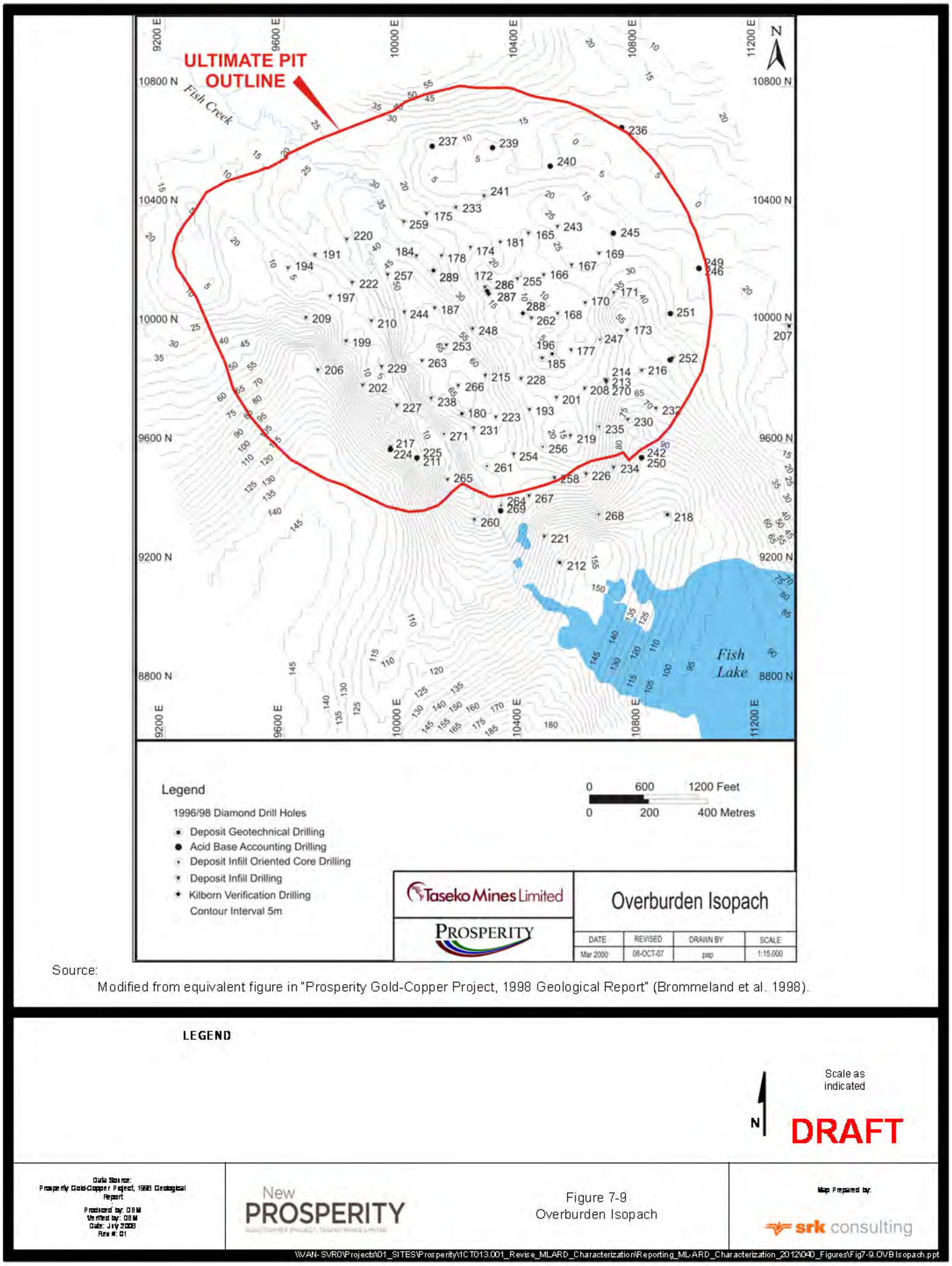


Figure 2.7.2.1-9 Overburden Isopach

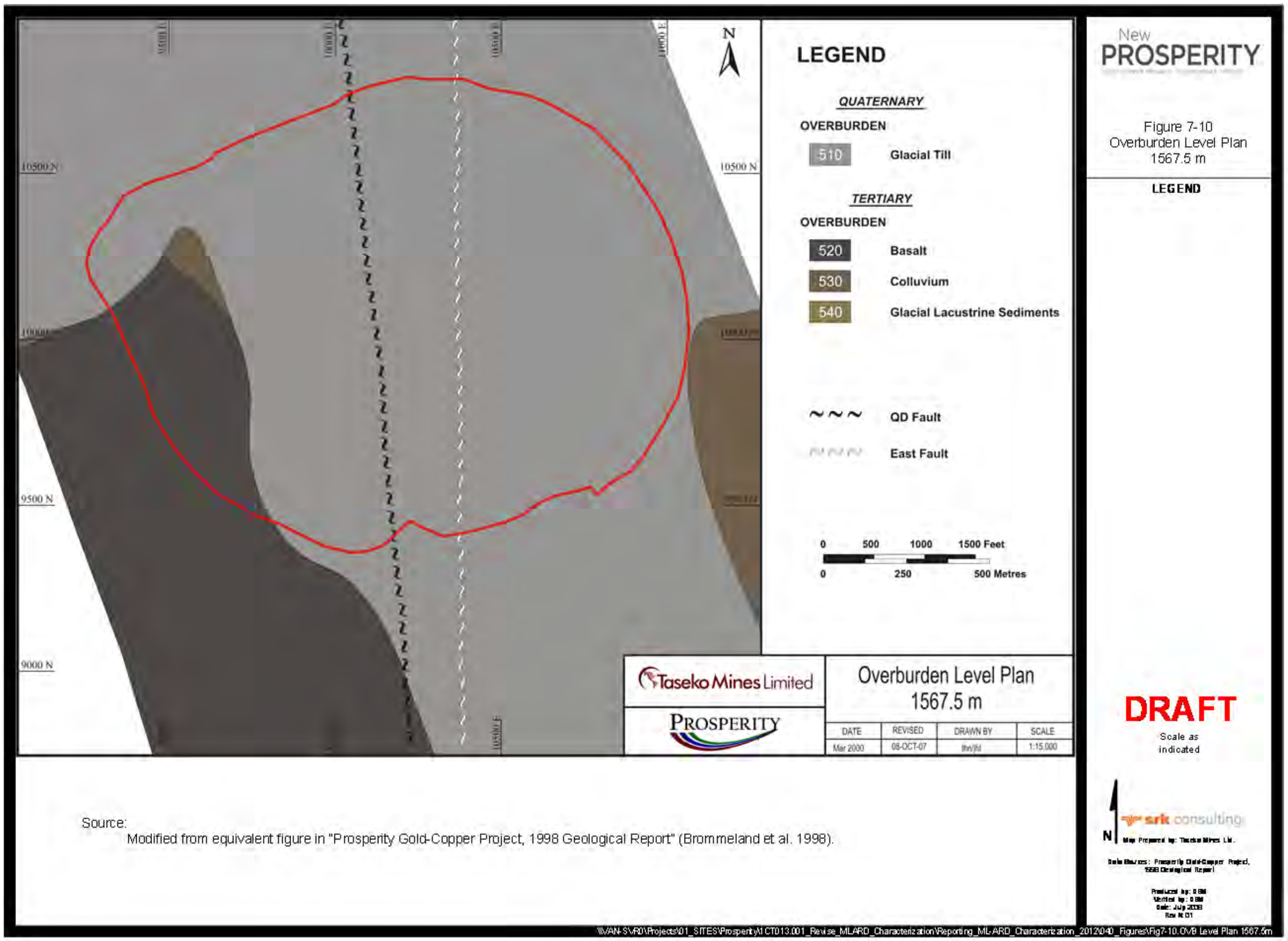


Figure 2.7.2.1-10 Overburden Level Plan 1567.5 m

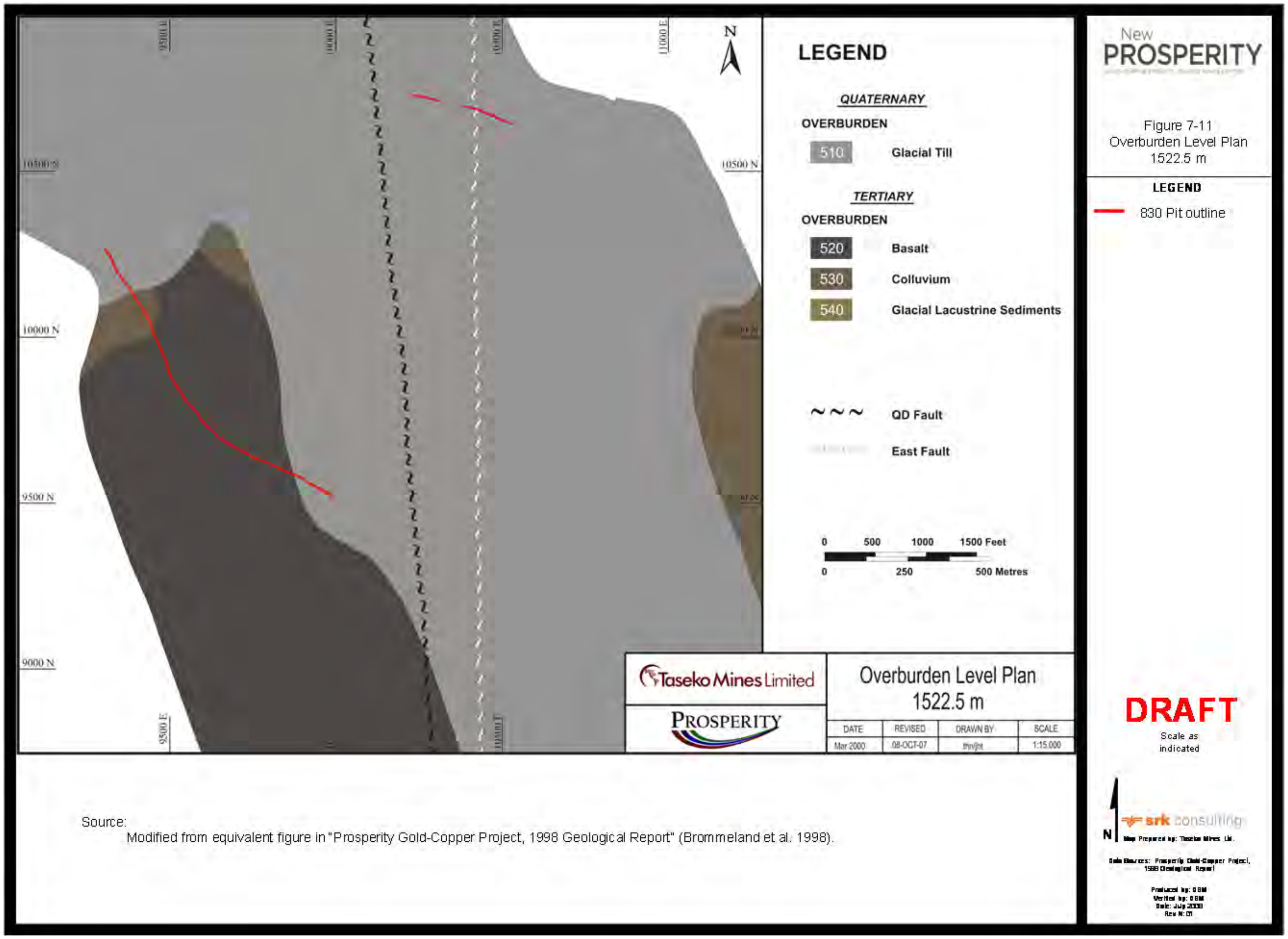


Figure 2.7.2.1-11 Overburden Level Plan 1522.5 m

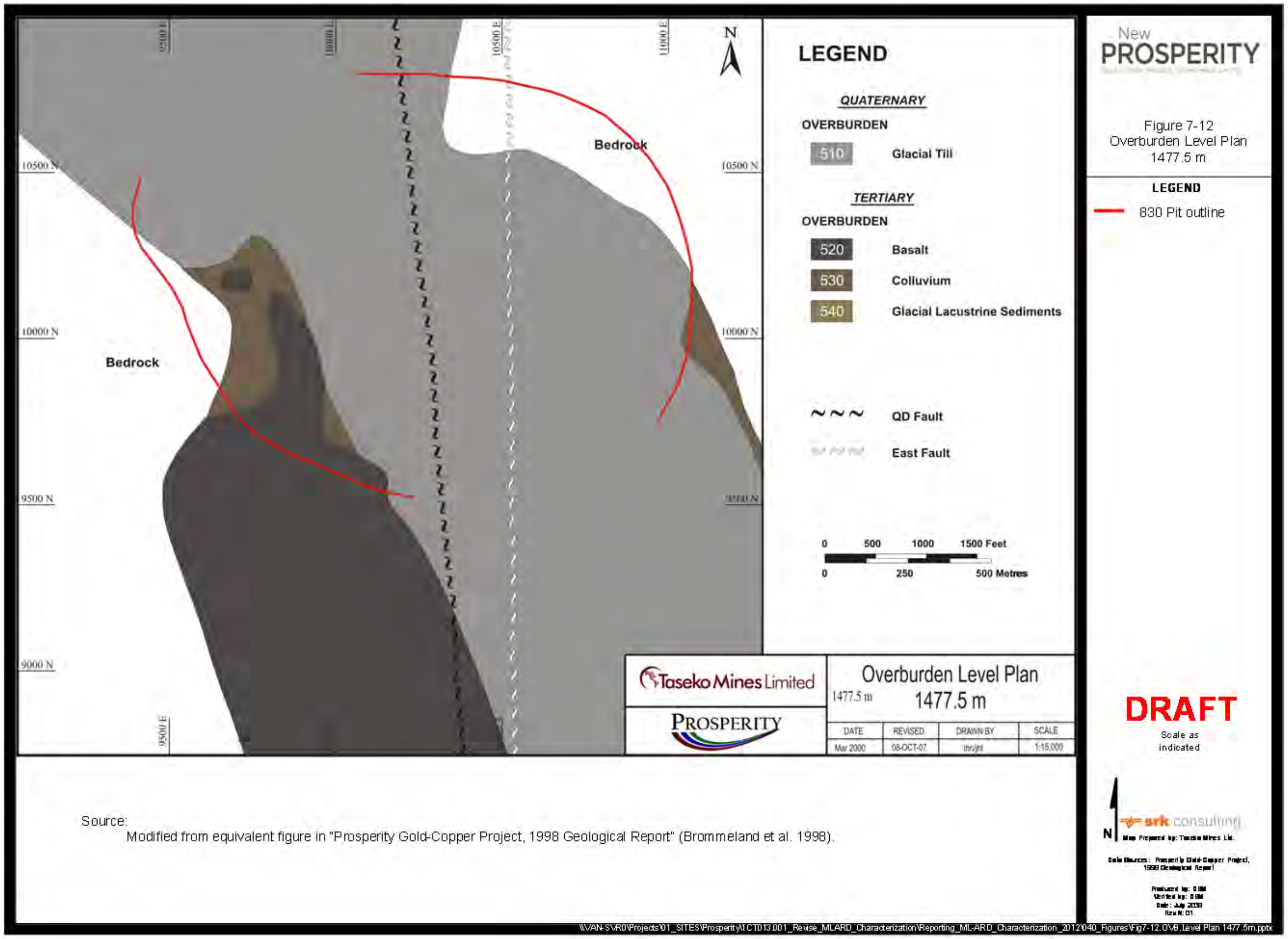


Figure 2.7.2.1-12 Overburden Level Plan 1477.5 m

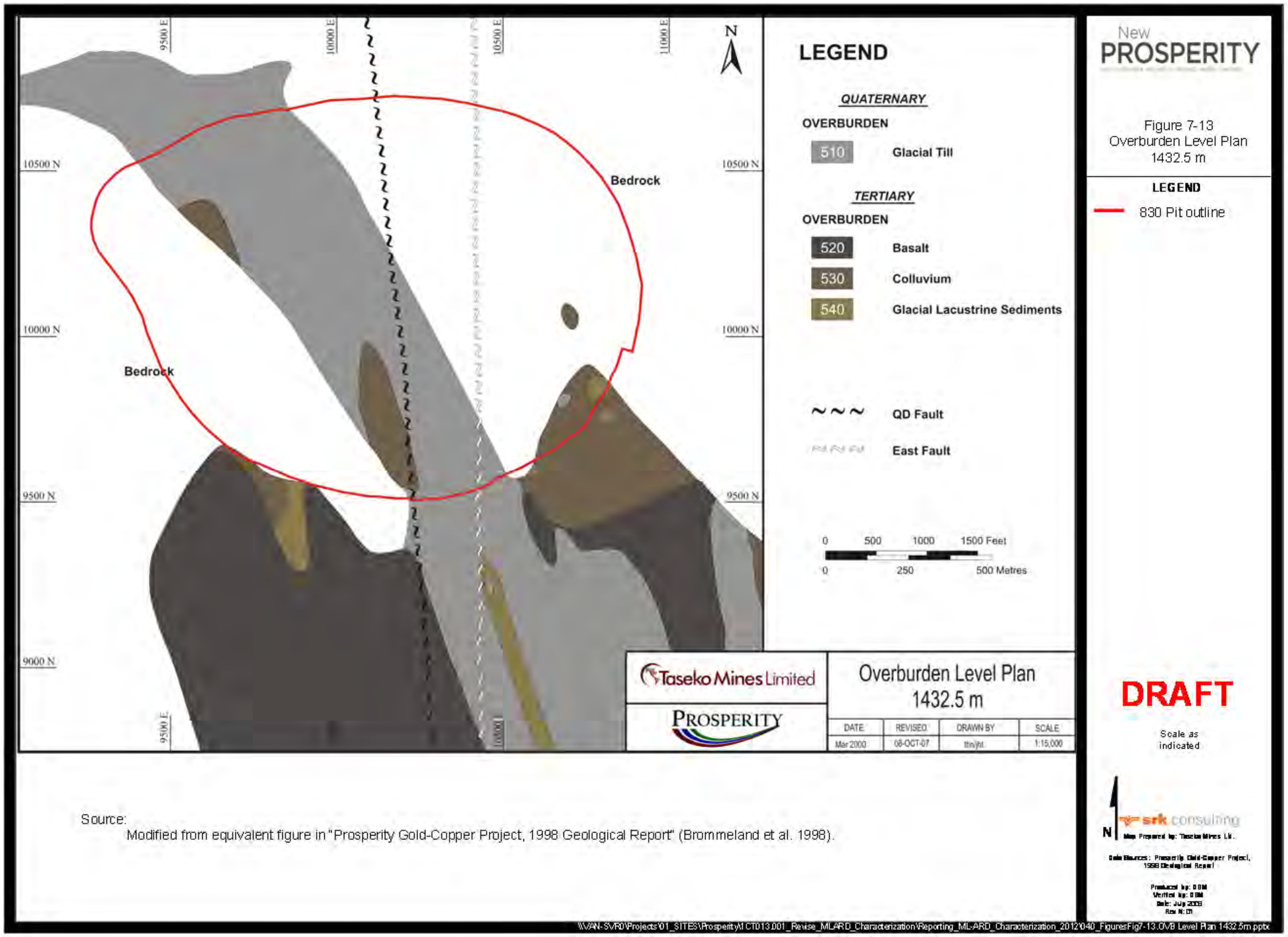


Figure 2.7.2.1-13 Overburden Level Plan 1432.5 m

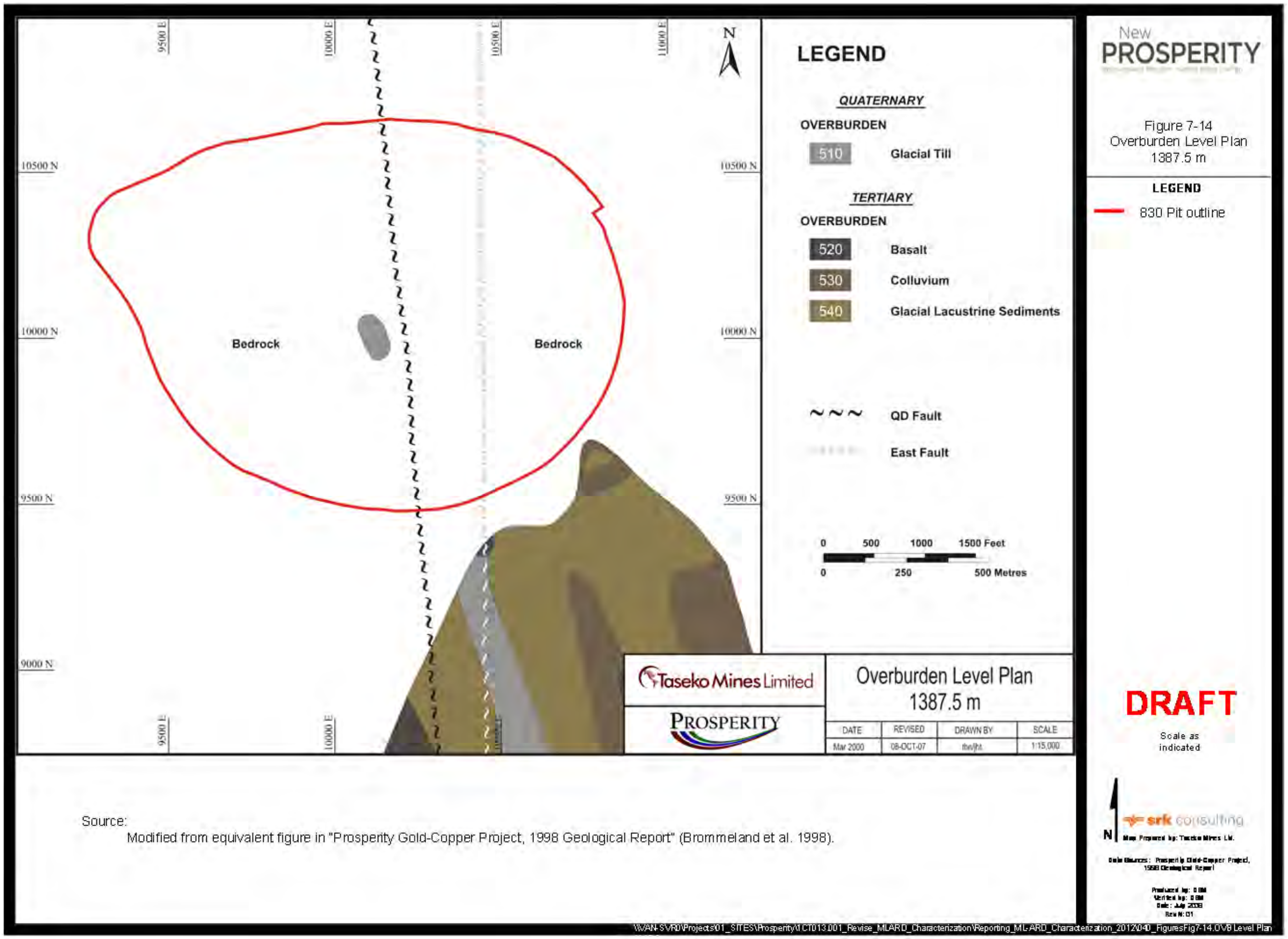


Figure 2.7.2.1-14 Overburden Level Plan 1387.5 m

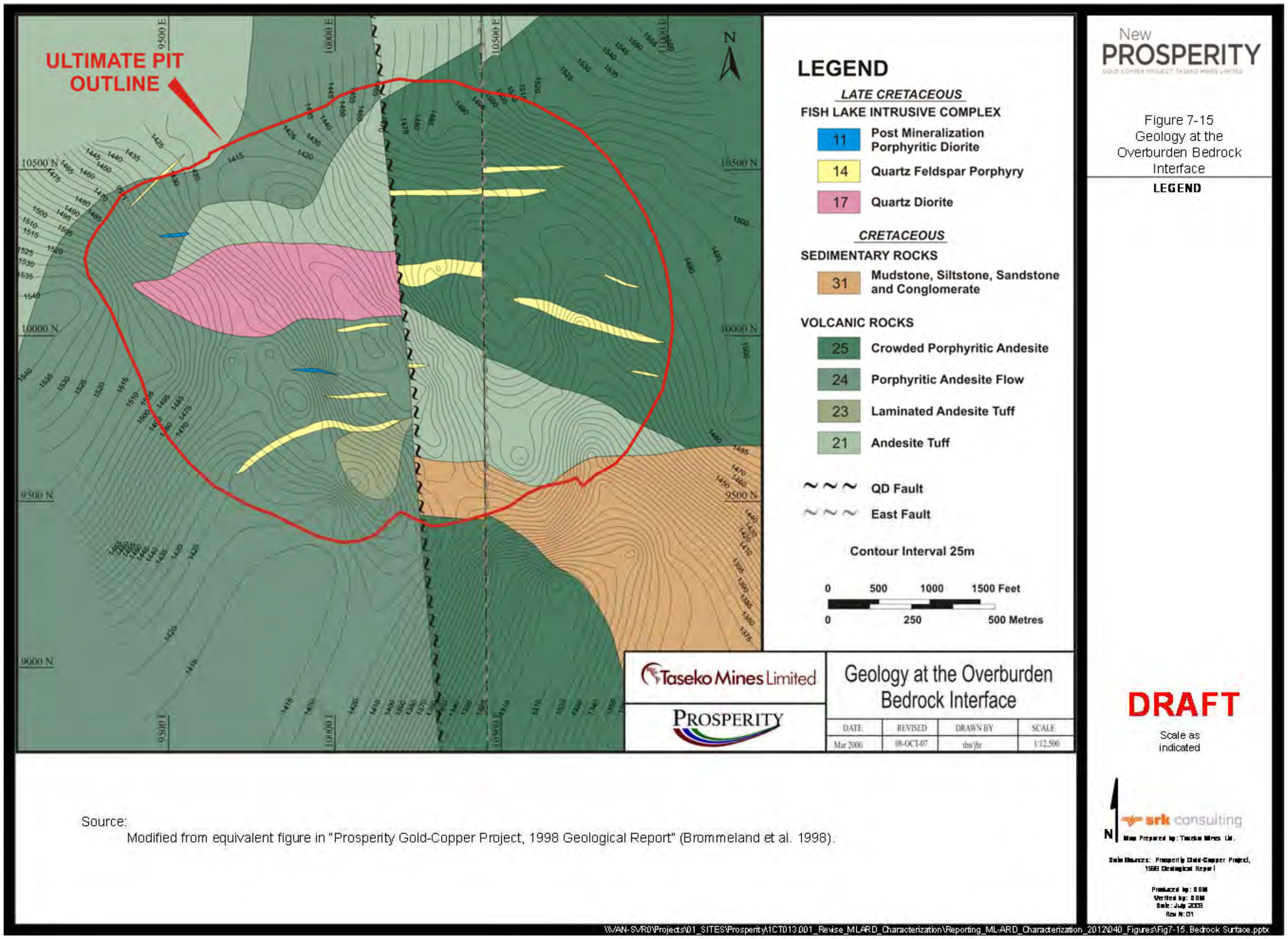


Figure 2.7.2.1-15 Geology at the Overburden Bedrock Interface

Table 2.7.2.1-1 New Prosperity Project Geology Codes - DRAFT

	QUATERNARY COVER		
	Pleistocene Glacial Till		
	511	TILB	Basal Till
	512	CLAYU	Clay
	513	SICLU	Silt/Clay Mix
	514	SILTU	Silt
	515	GRAVU	Gravel
	TERTIARY COVER		
CENOZOIC	**Miocene to Pliocene Basalt Flows**		
	520	BSLT	Basalt
	Colluvium		
	531	FANL	Fanglomerate – Limonitic
	532	FAN	Fanglomerate
	Glacial Lacustrine Sediments		
	541	GRAV	Gravel
	542	SICL	Silt/Clay Mix
	543	CLAY	Clay
	544	SILT	Silt
	LATE CRETACEOUS FISH LAKE INTRUSIVE COMPLEX		
	11	PMPD	Post Mineralization Porphyritic Diorite
	12	INBX	Igneous Breccia
	13	FP	Feldspar Porphyry
	14	QFP	Quartz Feldspar Porphyry
	FISH CREEK STOCK (QD)		
	15	QD3	Subporphyritic to Equigranular Quartz Diorite
	16	QD2	Seriate Porphyritic Quartz Diorite
MESOZOIC	17	QD1	Heterogeneous Fine Porphyritic Quartz Diorite
	CRETACEOUS SEDIMENTARY ROCKS		
	31	SEDS	Mudstone, Siltstone, Sandstone and Conglomerate
	CRETACEOUS VOLCANIC ROCKS		
	25	SUBV	Crowded Porphyritic Andesite
	24	FLOW	Porphyritic Andesite Flow
	23	BEAT	Laminated Andesite Tuff
	22	DEBF	Andesite Lapilli Tuff and Debris Flow
	21	MAT	Andesite Tuff (ash tuff)
	21	FAXT	Andesite Tuff (mainly crystal tuff)

In the western portion of the deposit, the multi-phase Fish Creek Stock has intruded into a thick sequence of andesite flows which overlay volcaniclastic rocks. The steeply south-dipping, oval quartz diorite stock which is approximately 265 m wide by 800 m long is surrounded by an east-west trending swarm of subparallel quartz-feldspar porphyritic dikes which also dip steeply to the south. Together the stock and dikes comprise the Late Cretaceous Fish Lake Intrusive Complex that is spatially and genetically related to the deposit. Post mineralization (post-ore) porphyritic diorite occurs as narrow dikes that crosscut all units within the deposit. They represent the final intrusive phase of the emplacement of the Fish Lake Intrusive Complex.

Geology level plans shown in Figure 2.7.2.1-16 through Figure 2.7.2.1-18 show the plan distribution of the deposit host rocks with depth. The cross-section shown on Figure 2.7.2.1-19 cuts the deposit on a north-south axis shows the spatial relationship between the core of the intrusive complex and the surrounding volcanic country rock. Figure 2.7.2.1-20 shows a section cutting the deposit east-west, or roughly perpendicular to the regional structure that is manifested as the QD Fault and the East Fault in the vicinity of the New Prosperity deposit.

VOLCANIC AND SEDIMENTARY ROCKS

Five volcanic units and one subvolcanic unit comprise the majority of the New Prosperity deposit host rocks. Sorted by quantity within the proposed pit, they are porphyritic andesite flow, andesite crystal, ash and lapilli tuff, and crowded porphyritic andesite. Andesite tuffs and flows are commonly interbedded.

The volcanic rocks present in the deposit area are not typical of the surrounding area and are likely of limited regional extent. Similar volcanic rocks outcrop near the mouth of Fish Creek 3.5 km to the north and they may correlate with those of the deposit.

A sparsely mineralized, volcanically-derived sedimentary unit occupies the upper south-southeast portion of the deposit. Stratigraphically, these sediments although of a different facies, are considered to be the lateral equivalent to the volcanic assemblage that outcrops near the mouth of Fish Creek.

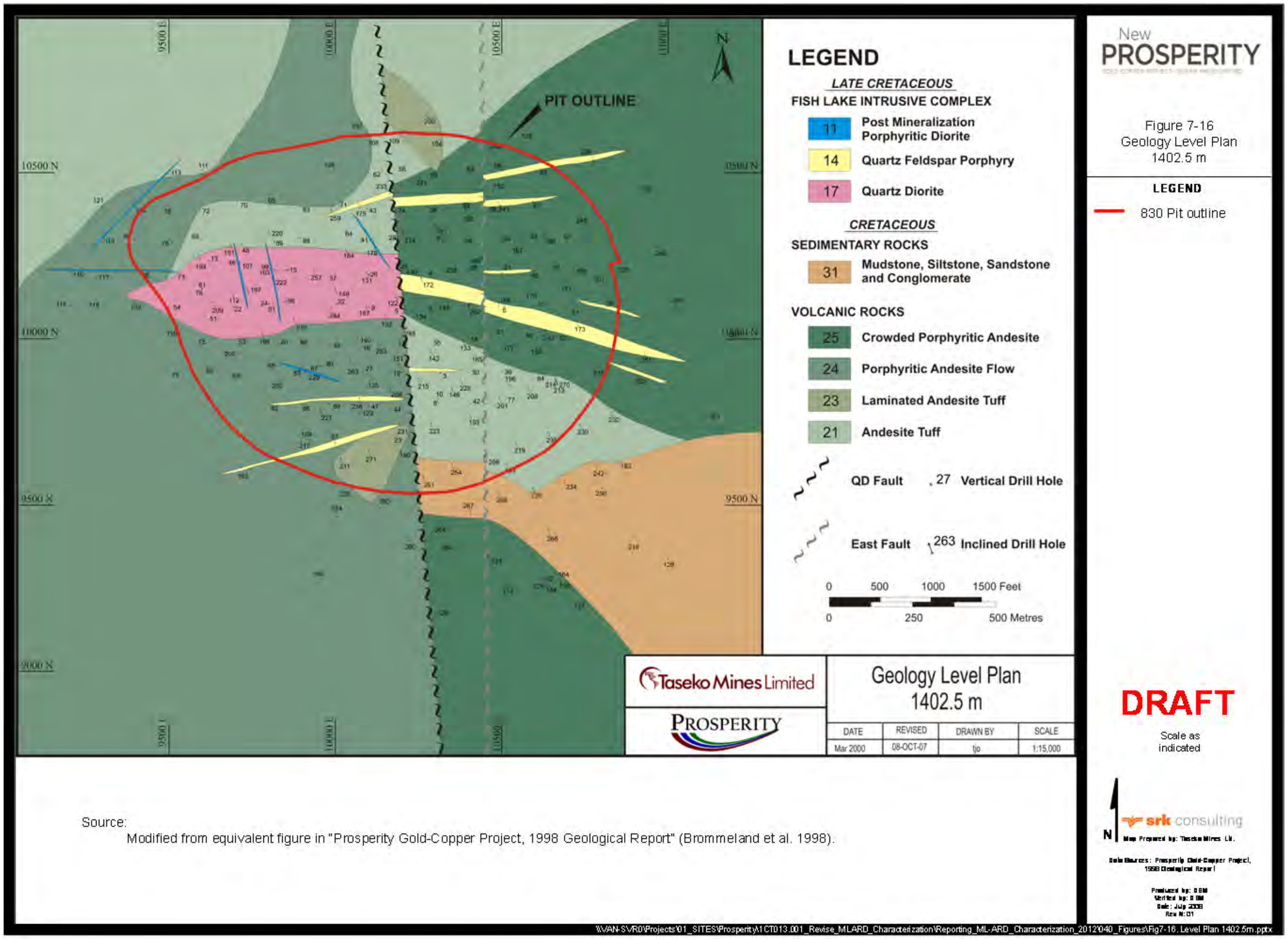


Figure 2.7.2.1-16 Geology Level Plan 1402.5 m

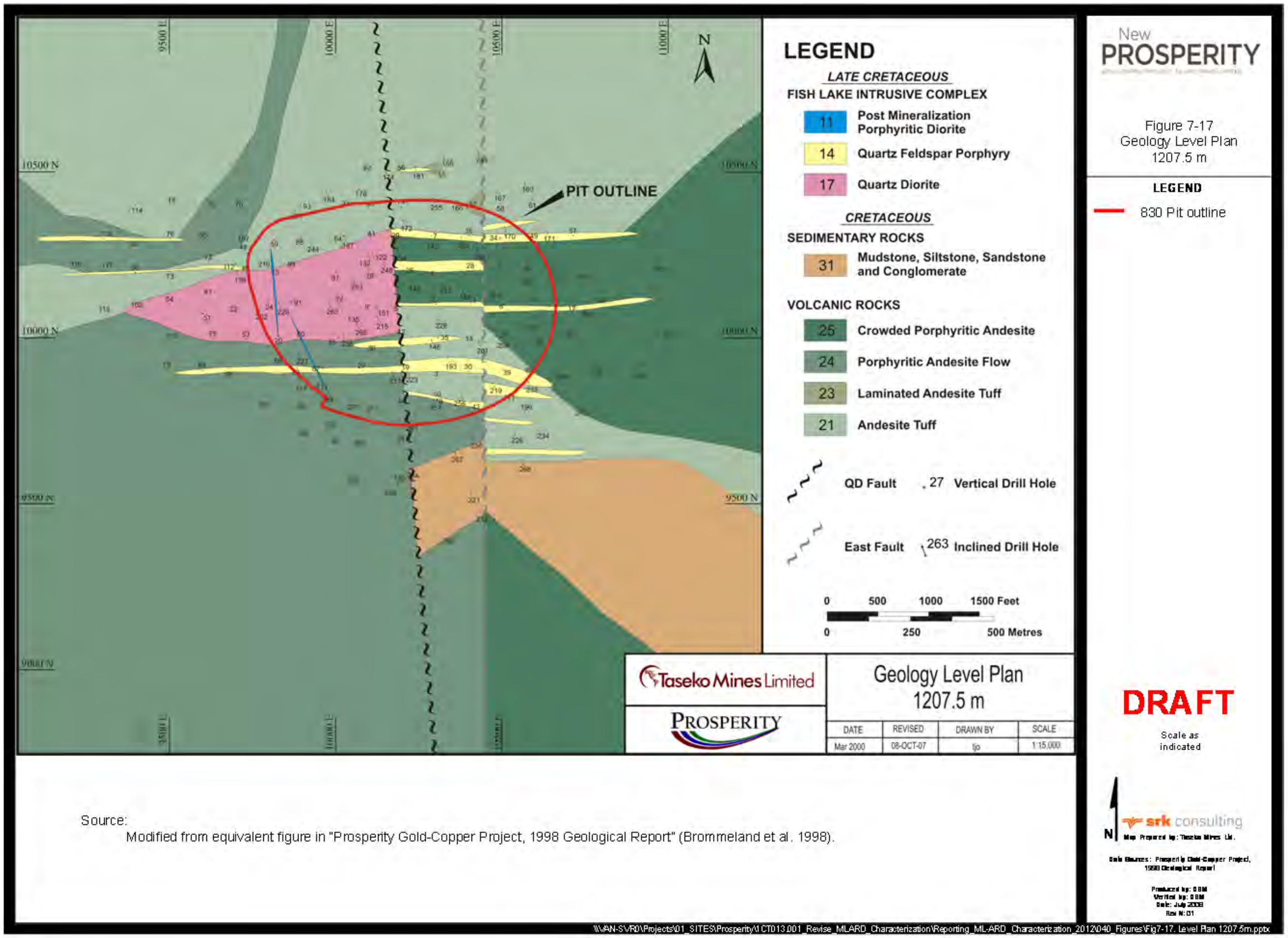


Figure 2.7.2.1-17 Geology Level Plan 1207.5 m

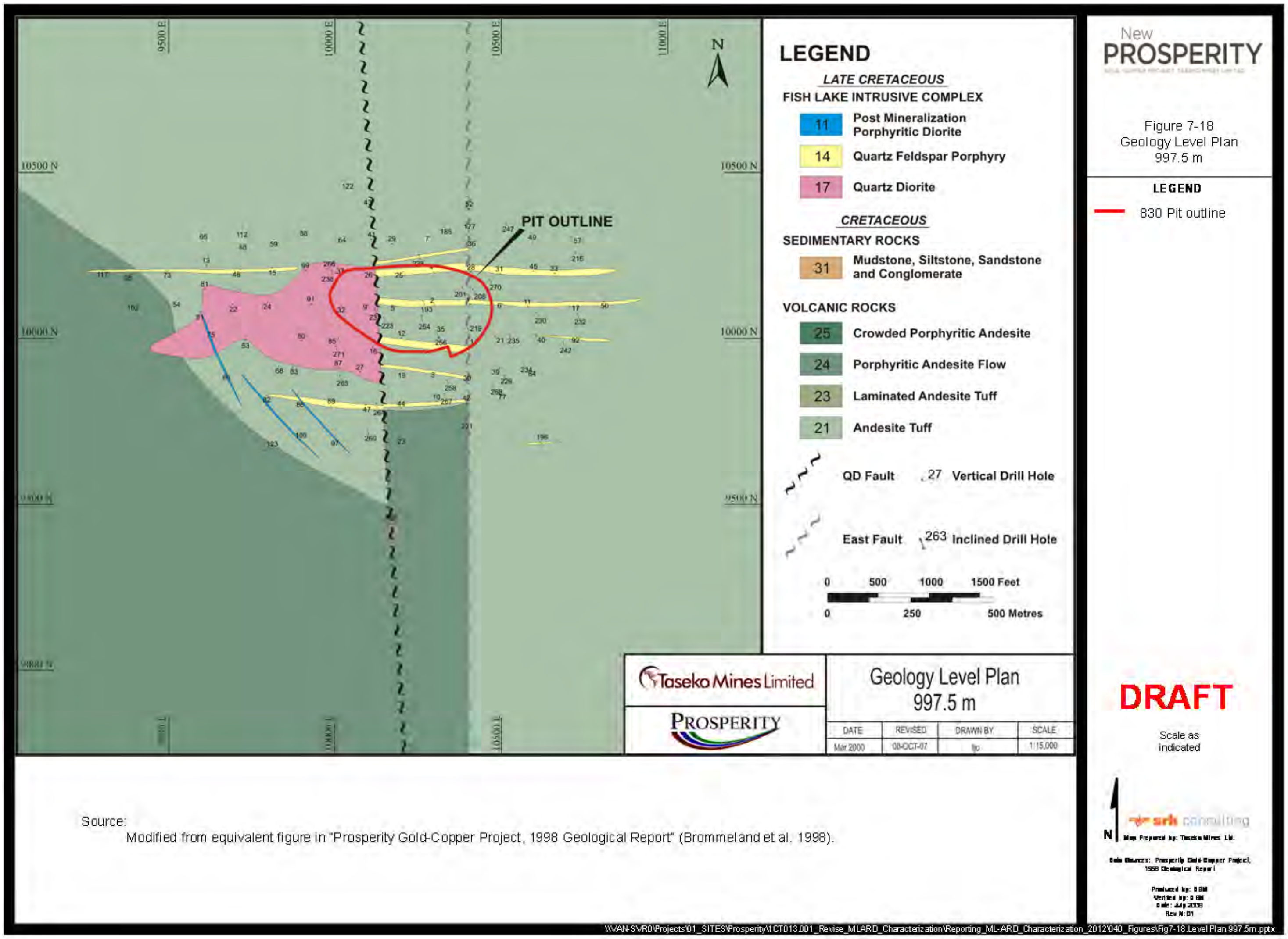


Figure 2.7.2.1-18 Geology Level Plan 997.5 m

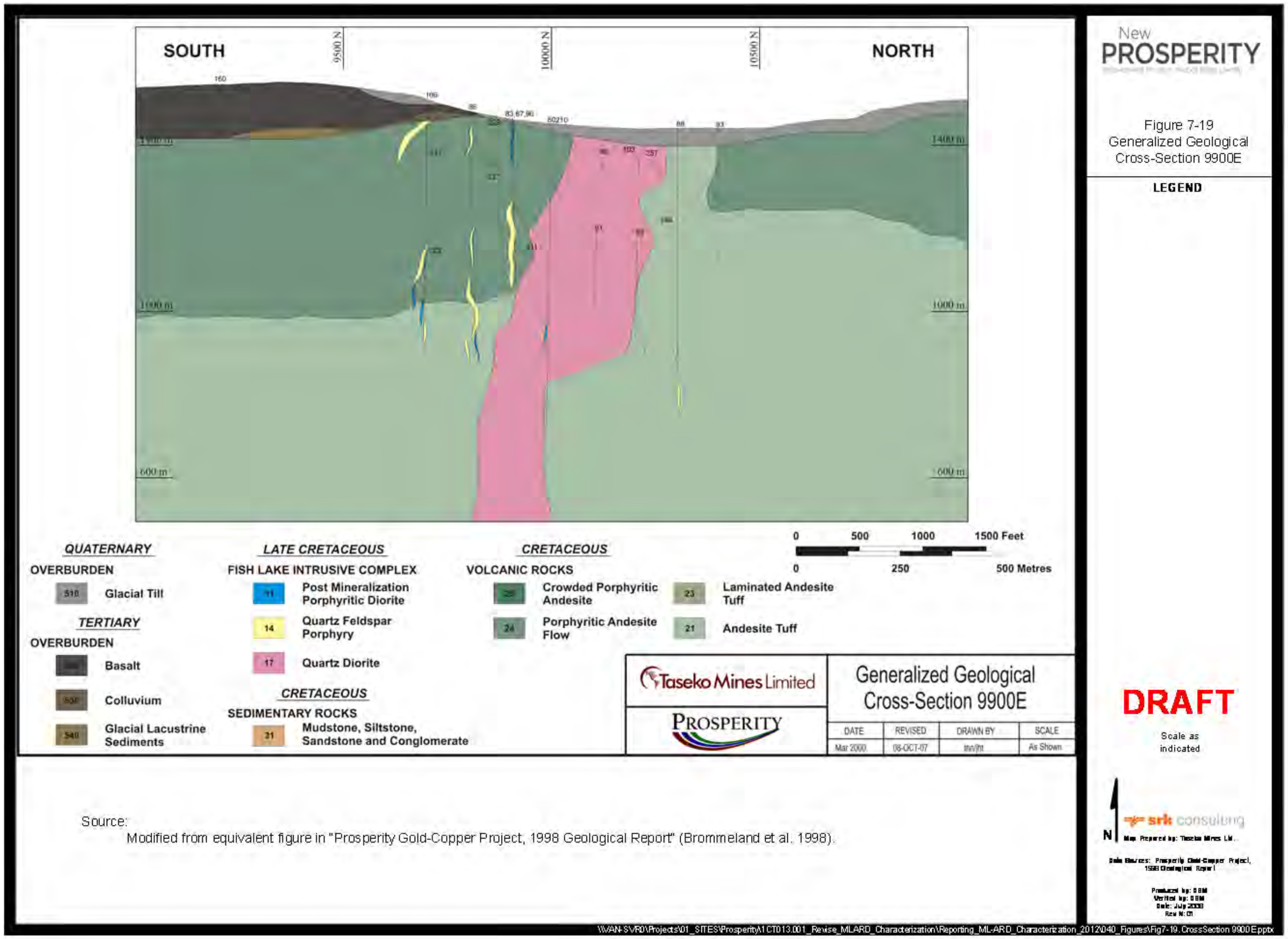


Figure 2.7.2.1-19 Generalized Geological Cross-Section 9900E

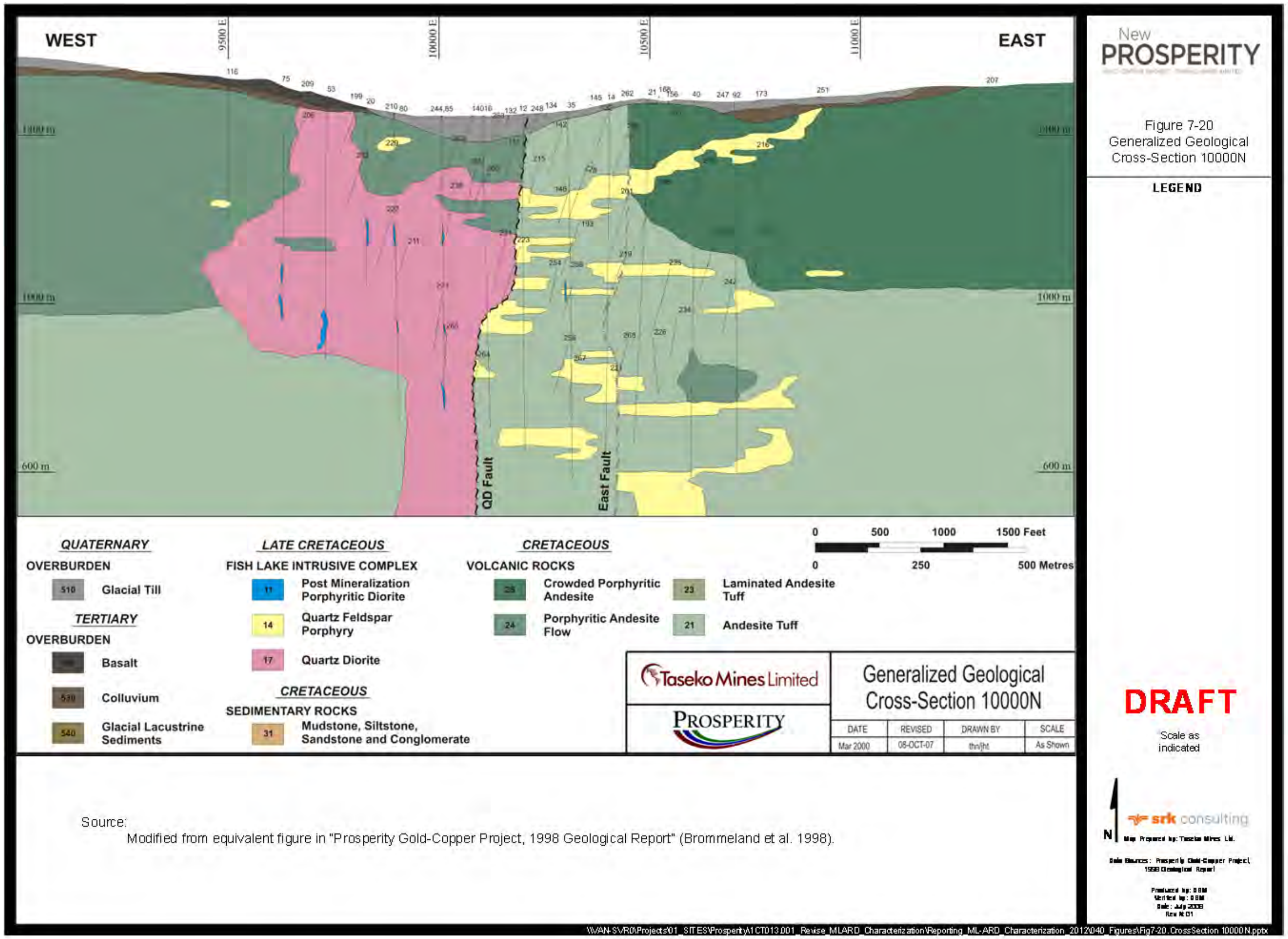


Figure 2.7.2.1-20 Generalized Geological Cross-Section 10000N

FISH LAKE INTRUSIVE COMPLEX

The New Prosperity deposit is spatially and genetically related to the Fish Lake Intrusive Complex which is comprised of the Fish Creek Stock, quartz feldspar and lesser feldspar porphyry dikes and post-mineralization porphyritic diorite dikes.

The Fish Creek Stock is a hypabyssal lenticular east-west trending, steeply south-dipping body of porphyritic quartz diorite that has intruded a thick sequence of volcanic rocks. It is composed of 3 phases, the heterogeneous fine-grained porphyritic quartz diorite, seriate porphyritic quartz diorite and subporphyritic to equigranular quartz diorite units. These units are very similar in chemical composition, but differ in textural characteristics. Contacts are commonly gradational with heterogeneous fine porphyritic quartz diorite grading into seriate porphyritic quartz diorite and seriate porphyritic quartz diorite grading into subporphyritic to equigranular quartz diorite over distances of several m to 10s of m. The heterogeneous fine porphyritic quartz diorite and seriate porphyritic quartz diorite units also occur independently.

Quartz feldspar porphyry and feldspar porphyry dikes occur as an east-west trending, steeply south-dipping swarm centered east of the Fish Creek Stock. The quartz feldspar porphyry units crosscut all of the volcanic and sedimentary rocks identified in the deposit. The contemporaneity of the quartz feldspar porphyry dikes and the Fish Creek Stock is suggested by the occurrence of some units of transitional lithology, close to the border of the stock.

The entire suite of rocks (intrusive, volcanic and sedimentary) hosting the deposit is crosscut by a series of barren, post-mineralization porphyritic diorite dikes. The post mineralization porphyritic diorite unit comprises less than 1% of the deposit rocks.

STRUCTURE

Numerous faults were intersected in drill core throughout the deposit area. Faults are usually indicated by strongly broken core, gouge, shear, cataclastic and rarely mylonitic textures. All of the aforementioned features can occur across intervals of less than 1 cm to over 20 m. Utilizing all available data, two predominant faults (the QD and East Faults) have been delineated.

The QD and East Faults are subparallel, strike north-south and dip steeply to the west, becoming near vertical down-dip (Figure 2.7.2.1-20). They cut the central portion of the deposit and are approximately 230 m apart near surface and 330 m apart at depth. The western QD Fault trends approximately 355º and has a steep westward dip of 82º to 86º. This fault marks the eastern boundary of the Fish Creek Stock. The East Fault strikes approximately 360º and has a steep westward dip of 85º to 87º.

ALTERATION

Five main alteration styles have been identified at the New Prosperity deposit, potassium silicate, propylitic, sericite-iron carbonate, phyllic and argillic. Alteration styles do not occur singularly in discrete zones, they commonly overlap and/or overprint each other. However, one alteration style will typically dominate in any given area, hence the naming of a zone specific to the dominant alteration style (Figure 2.7.2.1-21).

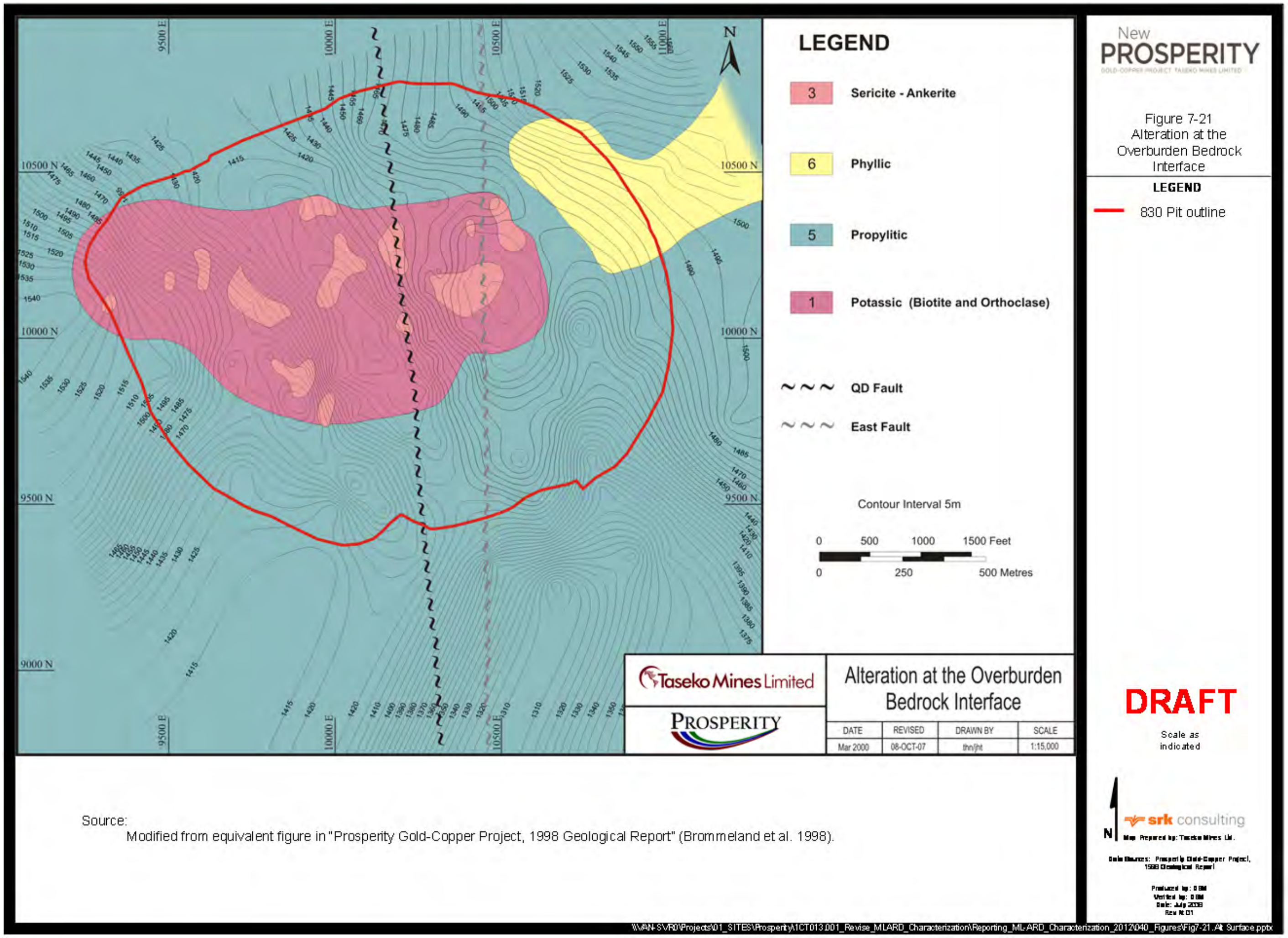


Figure 2.7.2.1-21 Alteration at the Overburden Bedrock Interface

Potassium silicate alteration predominates within the deposit area forming a central east-west trending ovoid zone intimately related to significant gold/copper mineralization (>0.20 g/Au t and >0.20% Cu). The zone of potassium silicate alteration is surrounded by propylitically altered rocks that extend outward for several hundred meters. Along the eastern margin of the deposit a discontinuous belt of phyllic alteration is developed in proximity to the transition between the potassium silicate and propylitically altered rocks. Late stage sericite-iron carbonate alteration forms irregular zones, particularly within the central zone of potassium silicate alteration. Argillic alteration is localized along fault zones and overprints earlier alteration assemblages, and has not been independently incorporated into the ML/ARD characterization due to the small quantity present relative to the other four alteration types.

The sequence of alteration events at the New Prosperity deposit commenced with the emplacement of the Fish Lake Intrusive Complex and the development of a hydrothermal convective cell. Concentric, thermally controlled zones of potassium silicate enclosed by propylitic alteration developed within and adjacent to the intrusive complex. At higher levels in the system a slightly later episode of phyllic alteration occurred as a result of mixing between fluids of the hydrothermal cell and meteoric waters. This phyllic alteration overprinted both potassium silicate and propylitic alteration in certain areas. Sericite-iron carbonate and argillic alteration, the latest events in the alteration history, resulted from the migration of late stage hydrothermal fluids and meteoric waters along structural features. This process led to the formation of secondary mineral assemblages in the host rocks which overprint all other alteration styles.

Selected level plans which pertain to alteration are shown on Figure 2.7.2.1-22 through Figure 2.7.2.1-24.

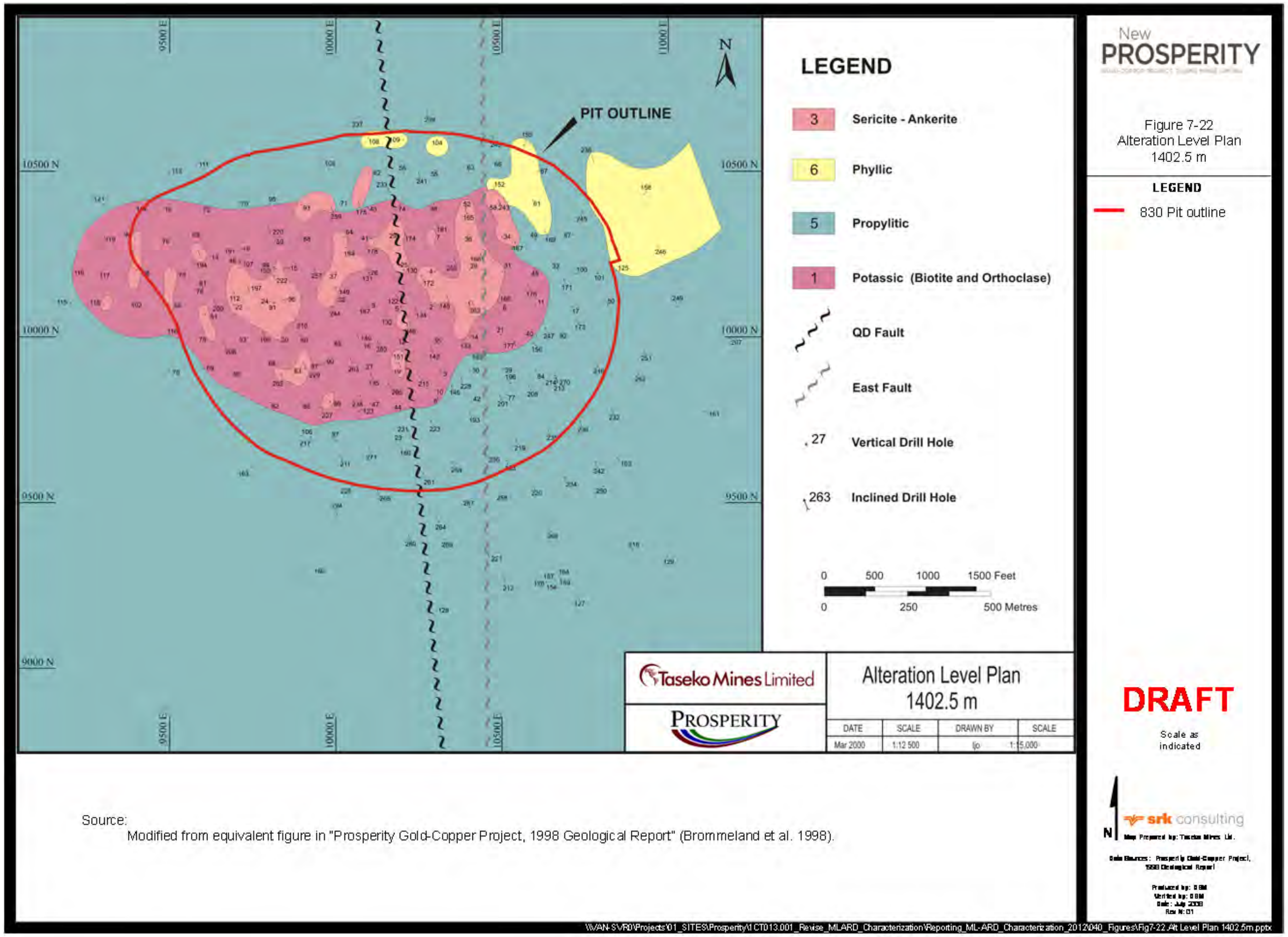


Figure 2.7.2.1-22 Alteration Level Plan 1402.5 m

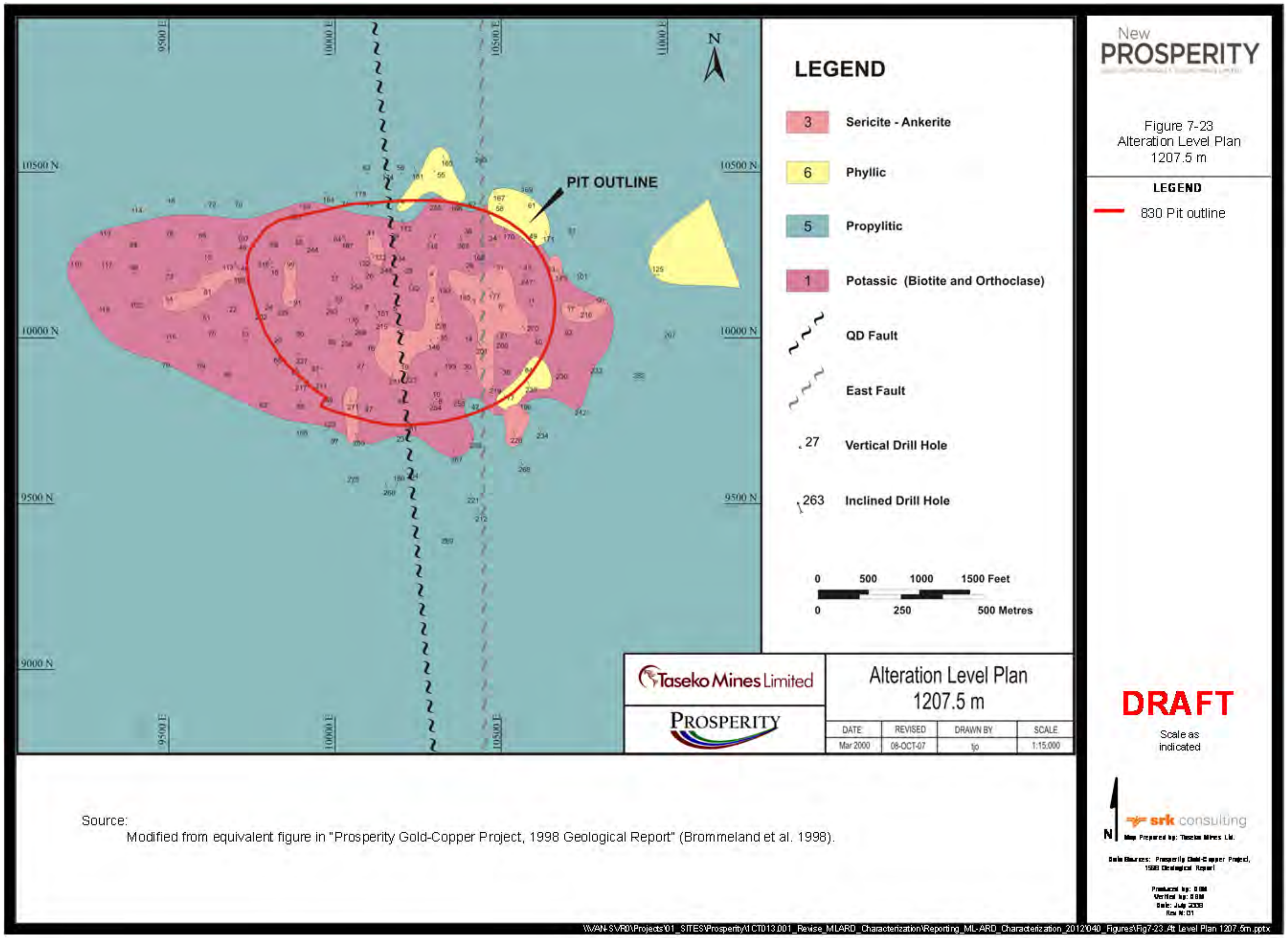


Figure 2.7.2.1-23 Alteration Level Plan 1207.5 m

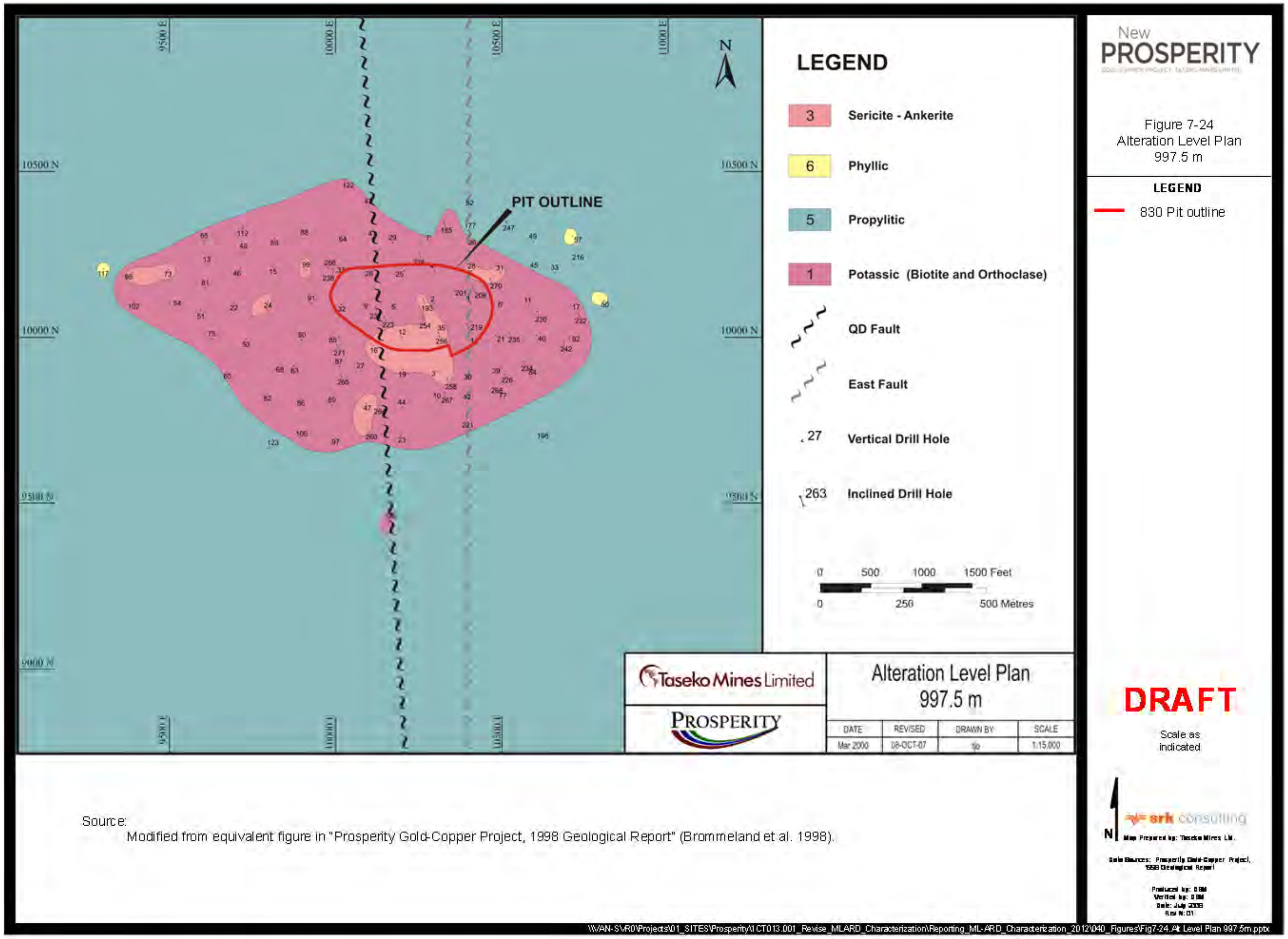


Figure 2.7.2.1-24 Alteration Level Plan 997.5 m

MINERALIZATION

Gold-copper mineralization within the New Prosperity deposit is intimately related to potassium silicate alteration and a later, superimposed sericite-iron carbonate alteration. This is particularly true within a central, east-west trending ovoid zone that hosts the majority of the mineable reserve.

Chalcopyrite-pyrite mineralization and associated copper and gold concentrations are distributed relatively evenly throughout the host volcanic and intrusive units in the deposit. A sedimentary unit which is located in the upper south eastern part of the mineralized zone is sparsely mineralized. Post mineralization porphyritic dikes are essentially barren.

Pyrite and chalcopyrite are the principal sulphide minerals and are accompanied by: minor amounts of bornite and molybdenite, sparse tetrahedrite-tennantite, sphalerite and galena and rare chalcocite-digenite, covellite, pyrrhotite, arsenopyrite, enargite and marcasite. Native gold generally occurs as inclusions in and along microfractures with copper sulphides and pyrite. Pyrite to chalcopyrite ratios throughout most of the proposed pit area range from 0.5:1 to 1:1 and rise to 3:1 or higher around the periphery of the deposit which coincides with the propylitic and locally the phyllic alteration zones.

Sulphide minerals show the thoroughly dispersed mode of occurrence characteristic of porphyry copper deposits. Sulphides occur in relatively equal concentrations as disseminations, blebs and aggregates in mafic sites, as fracture fillings and as veinlets. Disseminated sulphide mineralization is marginally more prevalent than veinlets in intrusive rocks while in volcanic rocks, the reverse was noted.

Gold and copper distribution throughout the deposit is presented on Figure 2.7.2.1-25 through Figure 2.7.2.1-27.

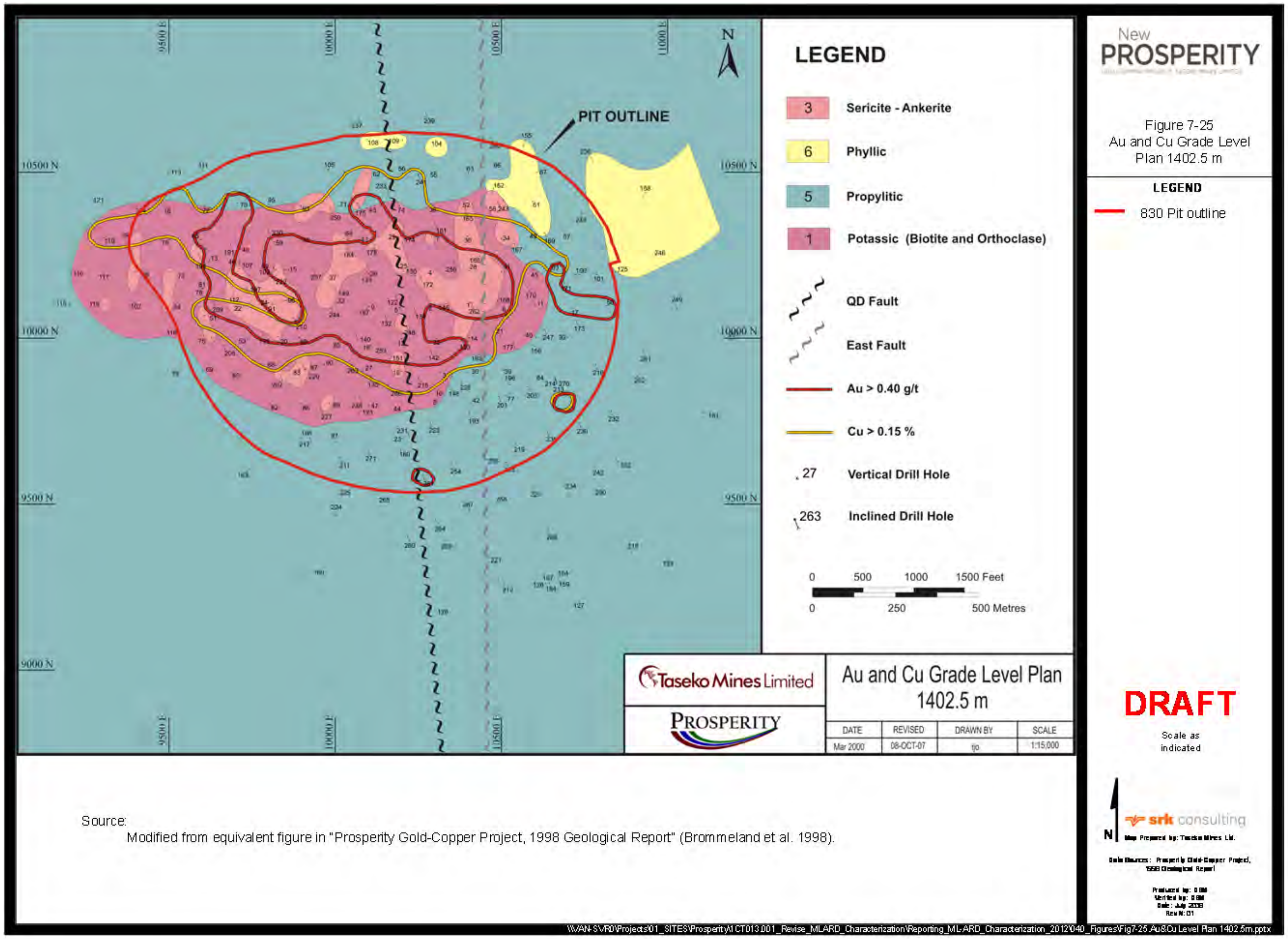


Figure 2.7.2.1-25 Au and Cu Grade Level Plan 1402.5 m

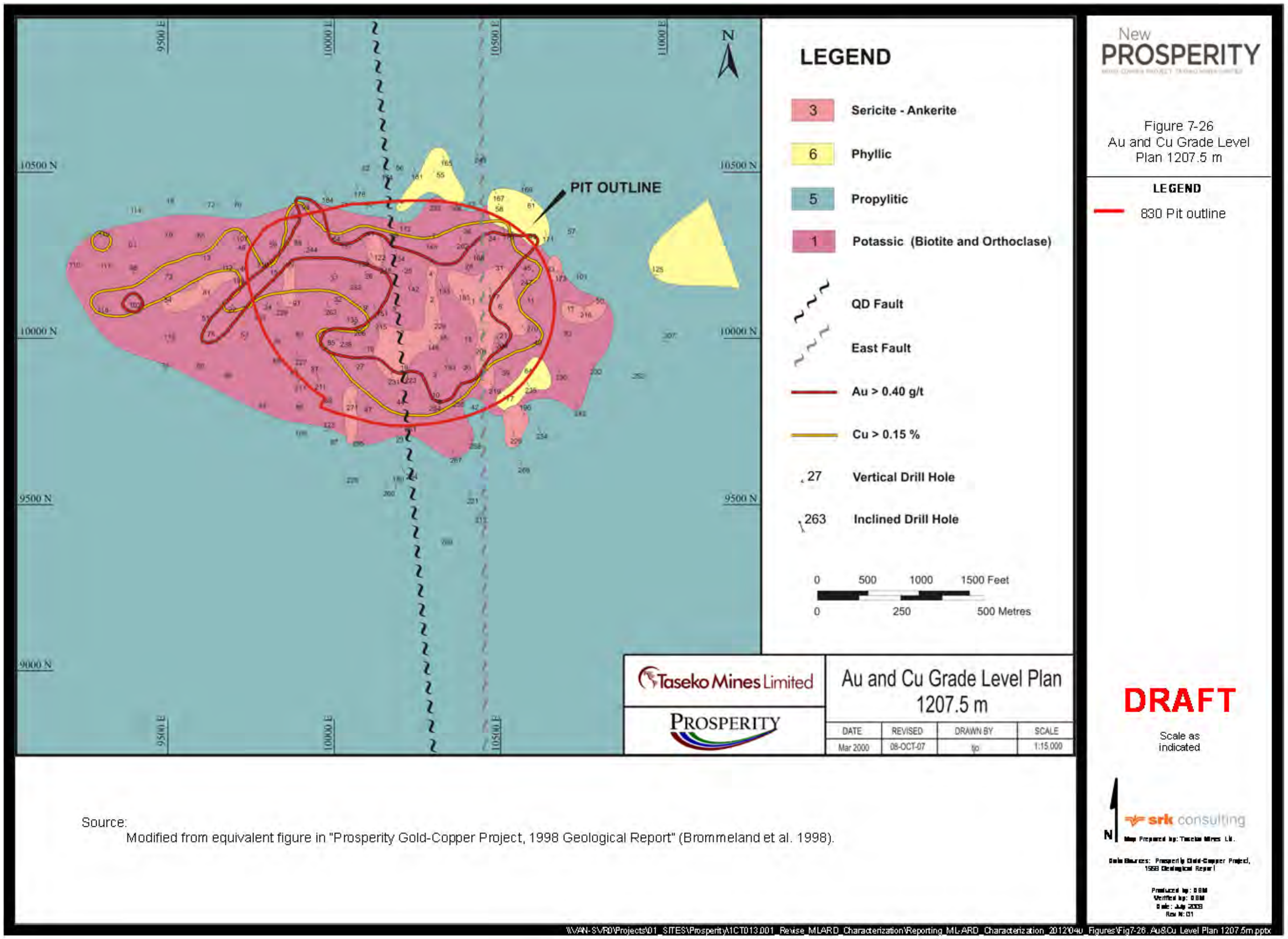


Figure 2.7.2.1-26 Au and Cu Grade Level Plan 1207.5 m

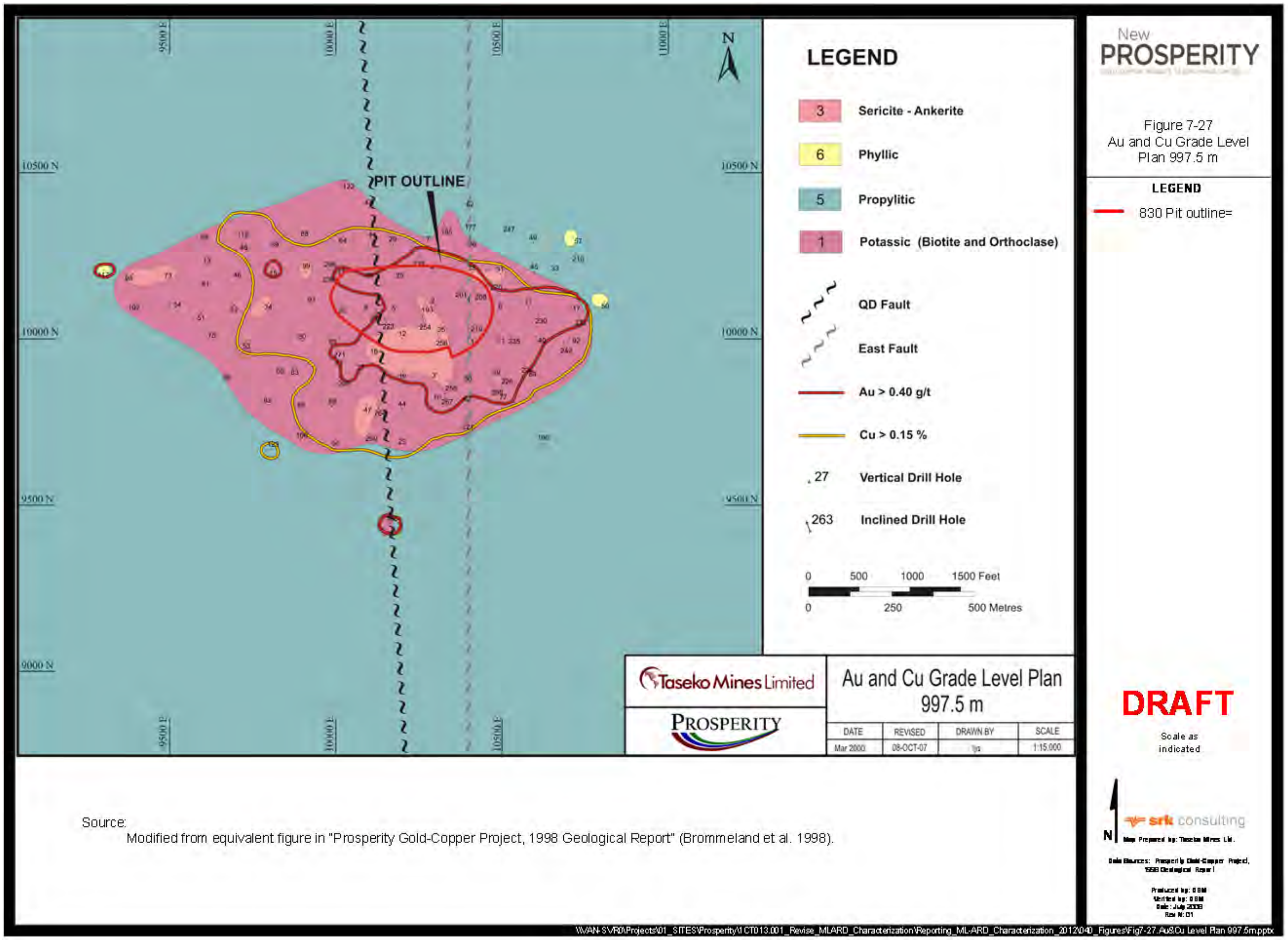


Figure 2.7.2.1-27 Au and Cu Grade Level Plan 997.5 m

GYPSUM AND ANHYDRITE

Anhydrite ($CaSO_4$) and gypsum ($CaSO_4 \cdot 2H_2O$), the major sulphate minerals in the deposit, occur below a zone of broken and weakly weathered rock which is caused by the dissolution of gypsum.

MODE OF OCCURRRENCE

Colourless to orange and pale pink gypsum veins are generally a few millimeters wide but can range up to several centimeters wide and be as closely-spaced as one veinlet per centimeter and in more densely veined intervals, comprise over 5% of the rock.

Gypsum is most often observed healing microfractures and fractures. It also follows older, reactivated sulphide and magnetite bearing veins/veinlets, sometimes incorporating minor wallrock sulphides. It occurs as massive aggregates in the following veins: calcite with or without dolomite, quartz-carbonate with or without sulphides, quartz with or without sulphides, and sulphide veins/veinlets. Gypsum is less commonly seen infilling vugs in carbonate (dolomite-calcite with or without ankerite) vein breccia and variably pseudomorphing anhydrite.

Purple anhydrite usually occurs as aggregates in various vein types; less commonly, it occurs as massive veins up to 5 cm wide and as disseminated small grains identifiable only in thin section. Anhydrite rarely occurs as: alteration patches with quartz, gypsum, biotite, chlorite, calcite and magnetite; as massive blebs and lenses together with gypsum, quartz, calcite, magnetite, pyrite and chalcopyrite; and in vugs with gypsum and chalcopyrite. Veins comprised of anhydrite are noted to contain, in order of decreasing abundance, sulphides (chalcopyrite > pyrite >> molybdenite), quartz, dolomite, calcite, gypsum, magnetite and hematite.

SPATIAL DISTRIBUTION

Gypsum veinlets/veins are pervasive below a sharp upper border, labeled the “Gypsum Line”, which marks the lower limit of gypsum dissolution by ground water. The Gypsum Line varies from 75 to 275 m below the surface throughout the proposed pit and separates a near surface zone of broken rock from more competent rock below.

In the northwestern portion of the deposit, gypsum occurs 100 to 110 m below surface (1340 m elevation); in the southwestern portion, it is 200 to 275 m below surface (1250 to 1280 m elevation), the Gypsum Line is relatively smooth and gradually deepens to the south.

In the central deposit area, the Gypsum Line is more irregular with a trough 330 m below surface (1130 m elevation), proximal to the QD Fault in the southeast corner of the proposed pit. Less pronounced peaks occur in the central proposed pit area where the Gypsum Line is only 75 to 100 m below surface.

In the eastern part of the deposit, the Gypsum Line becomes smoother and ranges from 150 m below the surface in the northwest corner to 210 m below the surface (1260 to 1350 m elevation) in the southeast corner.

Anhydrite’s distribution with respect to depth is determined by the temperature at which calcium sulphate was precipitated from hydrothermal solutions. Anhydrite formed at high temperatures well below surface, while gypsum formed at low temperatures at shallower depths. A late episode of gypsum veining overprinted the entire deposit as the hydrothermal system cooled and collapsed (Brommeland et al., 1998).

GEOLOGICAL MODEL

Taseko used a block model approach to modelling project geology and defining ore-grade mineralization, with 20 m x 20 m x 15 m blocks on 15 m levels forming the basic structure of the model. The following describes how the geology block model was coded.

GEOLOGICAL CONTROLS USED FOR DOMAIN DEFINITION

The geologic domains for the New Prosperity Gold-Copper Deposit Block Model were established by considering the relationship of gold and copper mineralization to 4 key geologic parameters, alteration, lithology, structure and the gypsum line. Individual models were created for each of these key parameters which were then amalgamated to produce the final geologic/domain block model. A brief description of each of these geologic parameters follows.

ALTERATION

Four types of alteration were considered during the construction of the alteration model: potassium silicate, sericite-iron carbonate, propylitic and phyllic. An alteration solids model and an alteration block model were created by the project geologists in a series of steps. First, the drill hole alteration data was plotted in two orthogonal sets of cross-sectional views. Then the outlines of the 4 units were interpreted using the original drill logs, core photos, and sawn core slabs for reference. The resulting polygons were digitized and the mid-bench intersection of these cross sectional polygons were plotted in plan. Outlines of the units were then interpreted in plan view using overlays of the drill data in this view to ensure that the base information was honored. These plan view polygons were then digitized. A solid model of alteration was created by extrapolating the bench polygons vertically 7.5 m above and below the mid-bench elevation. The alteration block model was created by assigning each block the code of the dominant alteration unit. The block model code and mineral assemblage associated with each alteration style is presented in Table 2.7.2.1-2.

Table 2.7.2.1-2 Alteration Codes and Descriptions - DRAFT

Code	Alteration	Mineral Assemblage
1000	Potassium Silicate	Biotite and/or chlorite + pyrite + sericite + magnetite + orthoclase + chalcopyrite
3000	Sericite-iron carbonate	Sericite + iron carbonate + clay + hematite
5000	Propylitic	Chlorite + calcite + pyrite
6000	Phyllic	Quartz + sericite + pyrite

LITHOLOGY

Nine lithological types were considered during the construction of the lithology model (apart from additional overburden types listed in Table 2.7.2.1-3. Gold-copper mineralization is present in all of these lithologies, including some isolated occurrences in the otherwise barren post mineralization porphyritic diorite dikes. A lithologic solid model and a lithologic block model were created in much the same way as the alteration models described above. The block model codes and brief descriptions of each of the lithological units are presented in Table 2.7.2.1-4.

Table 2.7.2.1-3 Overburden Codes - DRAFT

Block Model Code	Unit Description	Group Code	Group Description
511	Basal Till	51	Glacial Till
512	Clay		
513	Silt / Clay Mix		
514	Silt		
515	Gravel		
520	Basalt	52	Basalt
531	Fanglomerate – Limonitic	53	Colluvium
532	Fanglomerate		
541	Gravel	54	Glacial Lacustrine Sediments
542	Silt / Clay Mix		
543	Clay		
544	Silt		

Table 2.7.2.1-4 Lithology Codes - DRAFT

Code	Lithology	Description
110	Post Mineral Porphyritic Diorite Dikes	Post mineralization porphyritic diorite dikes.
140	Quartz Feldspar Porphyry	Quartz feldspar porphyry dikes.
170	Quartz Diorite	Includes fine porphyritic, seriate porphyritic and subporphyritic quartz diorite.
210	Andesite Crystal Tuff	Coarse and fine grained andesite tuffs.
220	Andesite and Lapilli Tuff	Lapilli tuffs and debris flows.
230	Bedded Andesite Tuff	Very fine to fine-grained bedded crystal tuff.
240	Porphyritic Andesite Flow	Porphyritic andesite flows.
250	Crowded Porphyritic Andesite	Fine-grained crowded plagioclase porphyritic andesite.
310	Sedimentary unit	Mudstone, siltstone, sandstone and conglomerate.

STRUCTURES AND THE GYPSUM LINE

Two local faults (QD and East Fault) were delineated with a reasonable level of confidence during the construction of the lithologic model. The mid-bench intersections of these sub-vertical, essentially planar faults were used to create 3 dimensional surfaces of these structural features. The “gypsum line” was modeled by plotting the interpreted drill hole intersections of this feature in plan view and contouring them to form a 3 dimensional surface. This formed an undulating, essentially sub-horizontal surface. The intersection of the 2 faults and the gypsum line was used to sub-divide the deposit into 6 structural or “geographic” domains (Figure 2.7.2.1-28), which were then modeled as solids. A domain/gypsum block model was created from this solids model. Details are listed in Table 2.7.2.1-5.

Table 2.7.2.1-5 Geographic Domain Codes and Descriptions – DRAFT

Code	Geographic Domain	Description
1	West Zone Above the Gypsum Line	The area west of the QD Fault and above the gypsum line.
2	Central Zone Above the Gypsum Line	The area bounded by the QD and East Faults and above the gypsum line.
3	East Zone Above the Gypsum Line	The area east of the East Fault and above the gypsum line.
4	West Zone Below the Gypsum Line	The area west of the QD Fault and below the gypsum line.
5	Central Zone Below the Gypsum Line	The area bounded by the QD and East Faults and below the gypsum line.
6	East Zone Below the Gypsum Line	The area east of the East Fault and below the gypsum line.

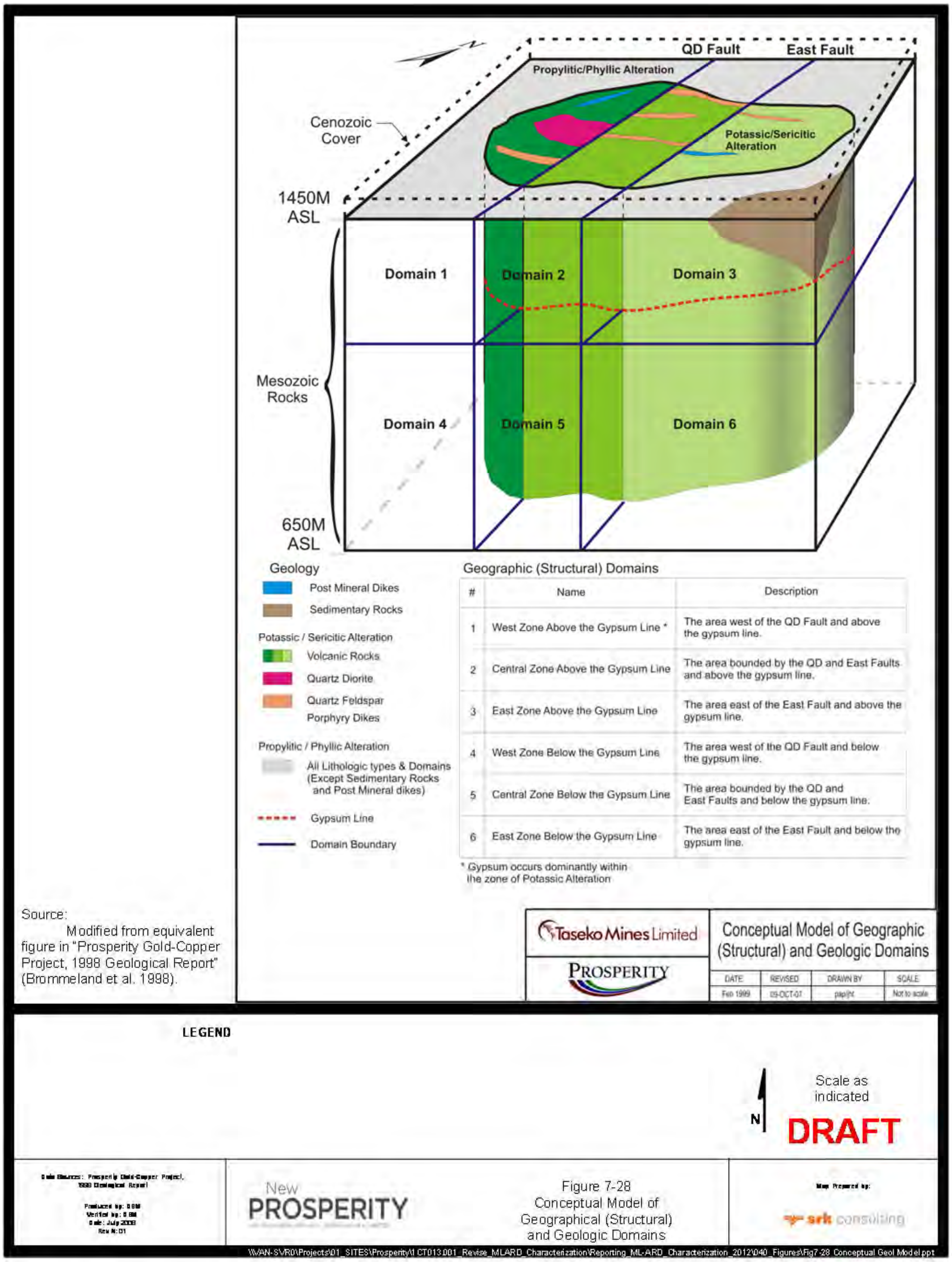


Figure 2.7.2.1-28 Conceptual Model of Geographical (Structural) and Geologic Domains

COMBO CODE

Each block in the block model was assigned a unique value for each of alteration code, lithology code, and domain code. These values were then combined into a single four-digit code (referred to as the COMBO code) that defined the geological attributes of each block.

The COMBO code was combined by adding together the alteration, lithology, and domain codes for each block to yield a single four digit number. Because the code for each geological attribute was a unique order of magnitude, the COMBO code structure results in alteration indicated in the first digit, lithology in the second and third digit, and domain in the fourth and final digit. For example, a potassic quartz diorite in the West Zone below the gypsum line (Alteration= 1000, Lithology= 170, Domain= 4) would have a COMBO code of 1174.

ABA BLOCK MODEL

Each block in the block model was assigned an ABA code to allow volumes of potentially acid generating (PAG) and non-potentially acid generating (non-PAG) waste to be estimated for mine planning purposes. Coding was carried out by Taseko geologists by carrying out the following steps:

- Plotting Phase 2 and Phase 3 ABA data on level plans representing the mid-bench elevation of every bench (i.e. level plans at 15 m vertical intervals). The collection and interpretation of the ABA data are described.
- Defining PAG / non-PAG polygons by interpolating between spatially representative ABA data points. Interpretation was carried out manually, and the level plans immediately above and below were reviewed to ensure that the interpretations were consistent vertically as well as laterally.
- PAG/ non-PAG polygons were digitized and the result was extruded upwards and downwards to make three dimensional solids for each bench.
- The extruded solids, with the associated PAG / non-PAG designations, were then used to code each block in the block model as either PAG (code = 1) or non-PAG (code = 2).

The block model was coded using a preliminary classification criteria that was adopted to allow mine planning to proceed in advance on the completion of ML/ARD characterization. Based on experience with other porphyry copper deposits, a provisional estimate of available neutralization potential (NP) was made by subtracting 10 kg $CaCO_3$ equiv./tonne from the NP value determined in laboratory tests to deduct the portion of measured NP commonly derived from silicate minerals. This estimate of available NP was then compared to acid potential (AP) values to arrive at a waste category classification, as follows:

- Non-PAG: all material having (NP-10)/AP ≥ 2; and
- PAG: all material having (NP-10)/AP < 2.

The block model was then used to estimate tonnages of PAG and non-PAG waste that would be produced as mining progresses. Subsequent ML/ARD characterization showed that the ‘NP-10’ value underestimates actual available NP, indicating that the preliminary classification is conservative in that it overestimates the tonnage of PAG waste. Details are discussed below.

GEOLOGICAL FEATURES RELEVANT TO ML/ARD CHARACTERIZATION

The following features of the geology are relevant to the ML/ARD characterization.

- The main rock types are quartz diorite intrusives, andesitic volcanics, and volcanically-derived sediments.
- Alteration is pervasive and rock mineralogy is dominated by alteration type. Economic mineralization is largely hosted in a potassic core surrounded by propylitic host rock.
- Pyrite and chalcopyrite are the principle sulphide minerals. These occur as disseminations, fracture-fillings and sub-vertical veinlets.
- Pyrite and chalcopyrite are accompanied by minor amounts of bornite and molybdenite; sparse tetrahedrite-tennantite, sphalerite and galena; and rare chalcocite-digenite, covellite, pyrrhotite, arsenopyrite and marcasite.
- Potentially leachable elements include arsenic, antimony, copper, cadmium, molybdenum, lead and zinc.
- There is potential for preferential exposure of veinlet and fracture-fill sulphides during blasting.
- Carbonate minerals are present and dolomite and calcite are the main minerals.
- The dominant silicate minerals have low reactivity and are expected to contribute limited acid consuming capacity at near neutral pH.
- Calcium sulphate is a major alteration mineral. It can be expected to leach from exposed rock to release dissolved sulphate.

ROCK AND OVERBURDEN CHARACTERIZATION

Taseko conducted vertical and angled diamond drilling on the New Prosperity deposit in several campaigns between 1991 and 1997. Retrieved core was logged and split, and split samples were submitted for elemental analyses by aqua regia digestion followed by ICP finish. Mercury analysis was carried out by cold vapour atomic absorption (CVAA). Drill core was archived in at the New Prosperity site, and assay pulps were archived in Taseko's warehouse in Port Kells, BC.

PHASE 1 STATIC TESTING

A metallurgical testing program was carried out at Lakefield Research in 1992/1993. Batch flotation tests were carried out using 24 composite ore samples each collected from approximately 200 m of drill core from a single drill hole. The central portion of the New Prosperity deposit was divided into eight blocks (designated A through H- see Figure 2.7.2.1-29), and one sample was collected from the upper, middle, and lower portions of each region. The composites were labelled according to sub-zone (blocks A to H), depth within the deposit (U= upper, M= middle and L= lower) and the number of the drill hole from which the sample was taken. Appendix 3-7-A of the March 2009 EIS/Application lists the sampled composite intervals used.

Nine locked cycle flotation tests were performed to evaluate metallurgical conditions in different regions of the deposit using feed prepared from the 24 individual drill hole ore composites. Three large ore composites representing the upper, middle, and lower portions of the deposit were tested, as well as 6 smaller ore composites representing the west (blocks A, B, C, and D) and east (blocks E, F, G, and H) zones for each of the three levels.

A parallel static testing program was carried out whereby elemental analyses and ABA tests were performed on each of the 24 ore composites. ABA analyses were performed at Mineral Environments Laboratories (Min-En) on the 24 ore composites and associated batch flotation tailings composites from the individual drill holes, and on the nine larger locked cycle flotation tailings composites were prepared from the eight samples within each of the U, M, and L depths (Phase 1 tailings testing is discussed further).

ABA testing is reported to have been carried out according to the modified Sobek method- this is assumed to be equivalent to the Modified ABA method (MEND, 1991). Elemental analyses were carried out by Lakefield Research using ICP analysis (Hallam Knight Piesold, 1993; Watermark, 1997). The digestion method is not known. Aqua regia digestion is assumed because it was commonly in use at that time.

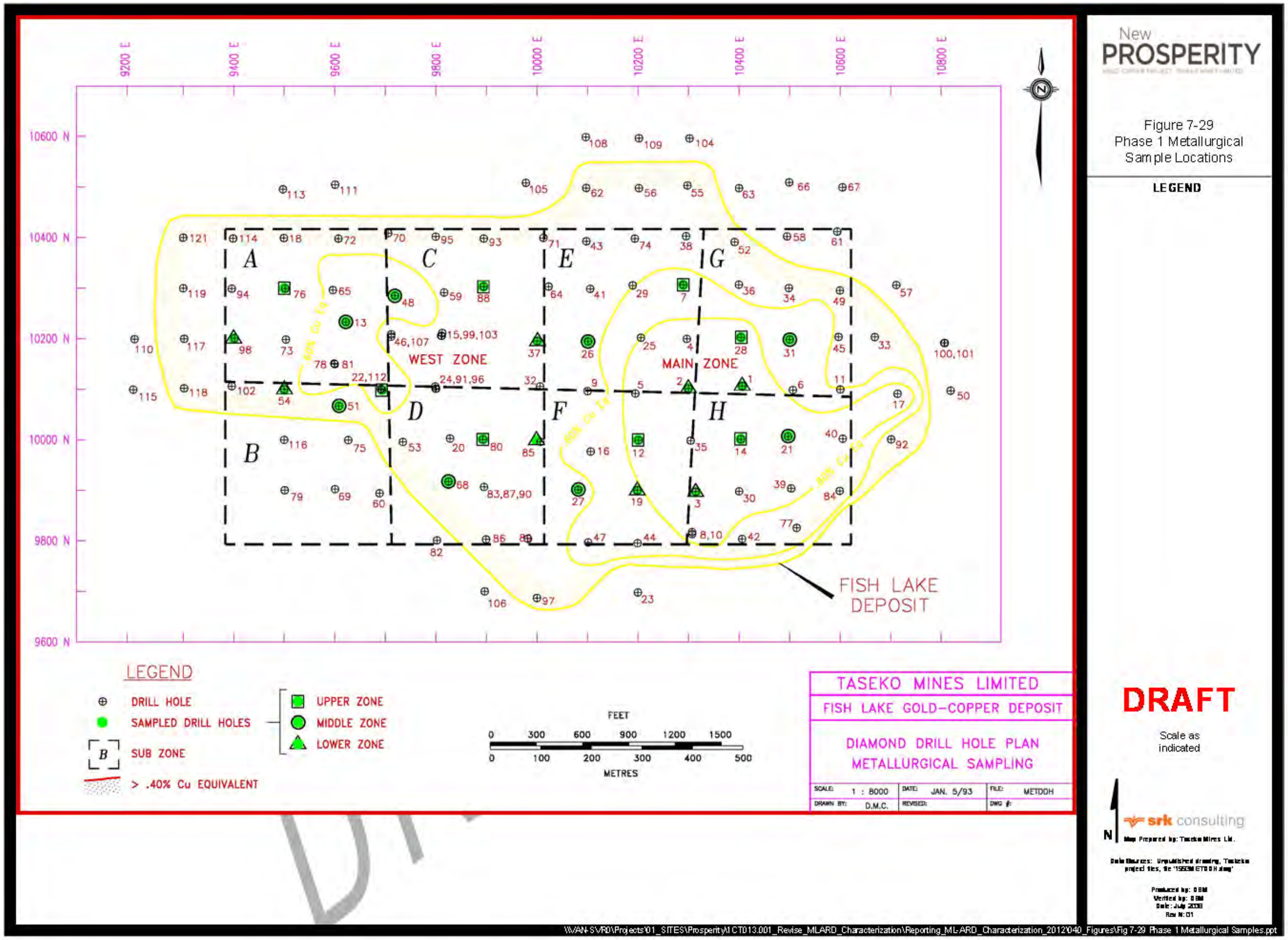


Figure 2.7.2.1-29 Phase 1 Metallurgical Sample Locations

PHASE 2 AND 3 STATIC TESTING

Taseko conducted over 33,000 elemental analyses and 343 ABA tests on core samples and assay rejects of rock and overburden collected from within the 852 pit limits during drilling campaigns spanning 1991 through 1998. Figures 2.7.2.1-5 and 2.7.2.1-6 show the collar locations of all drill holes sampled for ABA testing in Phase 2 and 3, and sample intervals and lithology are listed in Appendix 3-7-B of the March 2009 EIS/Application. Cross sections showing ABA sample locations are provided in Appendix 3-7-C of the March 2009 EIS/Application.

Phase 2 ABA tests were conducted at Chemex Laboratories, North Vancouver (Watermark, 1997), according to the EPA 600 procedure, also known as the Sobek method (Sobek et al., 1978).

Phase 3 ABA tests were carried out at Cominco Engineering Services Ltd., Vancouver, BC, using the Modified ABA method (MEND, 1991).

PHASE 4 STATIC AND KINETIC TESTING

Taseko conducted 12 humidity cell tests, and 9 column tests on a range of waste rock samples collected from 1996 and 1997 drill core. Shake flask extractions, elemental analyses, and ABA tests were performed on all kinetic test samples. Of the kinetic test samples, five were sourced from within the 852 pit limits, while seven were within the limits of the larger pit under consideration at the time.

The Phase 4 testing program was carried out by Cominco Engineering Services Limited (CESL) according procedures recommended by Price (1997) under the direction of Watermark Consulting Inc. Phase 4 kinetic testing was initiated in 1998 and continued into 2000. Samples were selected to cover a range of materials that would be placed in the non-PAG dumps, with a focus on materials with NP/AP ratios between one and three. A few samples with NP/AP ratios less than one were selected to inform evaluations of inclusion of small pockets of PAG waste in the non-PAG dumps, of delays to onset of acid generation for PAG material placed in the PAG disposal facility, of loadings from temporarily exposed PAG rock in the PAG disposal facility prior to flooding, and of effects of PAG rock remaining in the ultimate pit highwall. Figure 2.7.2.1-6 shows the collar locations of all drill holes sampled for Phase 4 testing, and sample intervals and characteristics are listed in Appendix 3-7-D of the March 2009 EIS/Application.

2006-2012 ROCK CHARACTERIZATION PROGRAMS

The Phase 5 static and kinetic testing program was started in 2006, and kinetic testing remained ongoing at the time this report was prepared. Phase 5 was intended to gather the remaining necessary information for completion of the ML/ARD assessment and for development of a water quality prediction for the New Prosperity Project.

PHASE 5 STATIC TESTING

Archived assay pulps from 1991 through 1997 drilling programs were retrieved for a variety of tests.

- To assess soluble weathering products that had accumulated in the assay pulps, 32 shake flask extractions (3:1 method, Price 1997) were carried out. Sample intervals and material types are catalogued in Appendix 3-7-E of the March 2009 EIS/Application, and collar locations are shown on Figure 2.7.2.1-6.
- To evaluate leaching and ABA characteristics of the Chilcotin basalts (an important source of construction rock), archived bags of core samples were retrieved from Taseko's warehouse. Fines that

had accumulated in the bags were subjected to shake flask extractions, and ABA tests were performed on core samples over 6 to 10 m composite intervals. Sample intervals are catalogued in Appendix 3-7-F of the March 2009 EIS/Application, and collar locations are shown on Figure 2.7.2.1-6.

- To evaluate whether PAG and non-PAG waste occurs in sufficiently-discrete zones that segregation will be feasible, composite samples (approximately 6 m in length) were prepared from the archived assay pulps for two drill holes and subjected to ABA tests. Composite samples were prepared from the collar to the intersection of the drill trace with either the ore zone or the pit wall.

An additional 6 drill holes from the modelled non-PAG zone in the southwest portion of the pit were evaluated in similar fashion, to test both whether segregation is feasible and whether the modelled non-PAG characteristic of a large portion of the waste in the southwest portion of the pit was accurate. Sample intervals are catalogued in Appendix 3-7-G of the March 2009 EIS/Application, and collar locations are shown on Figures 2.7.2.1-5 and 2.7.2.1-6.

Selenium content was determined for the 68 samples from DDH 92-071 and DDH 92-082 which were composited for evaluation of segregation as noted above. Mercury analyses were also carried out on the same samples to confirm mercury concentrations.

- To evaluate the leaching properties of overburden materials, three 2007 test pit grab samples and eight core samples from a single 2007 diamond drill hole were submitted for shake flask extraction testing. Sample locations and logs are catalogued in Appendix 3-7-H of the March 2009 EIS/Application, and collar and test pit locations are shown on Figure 2.7.2.1-30.

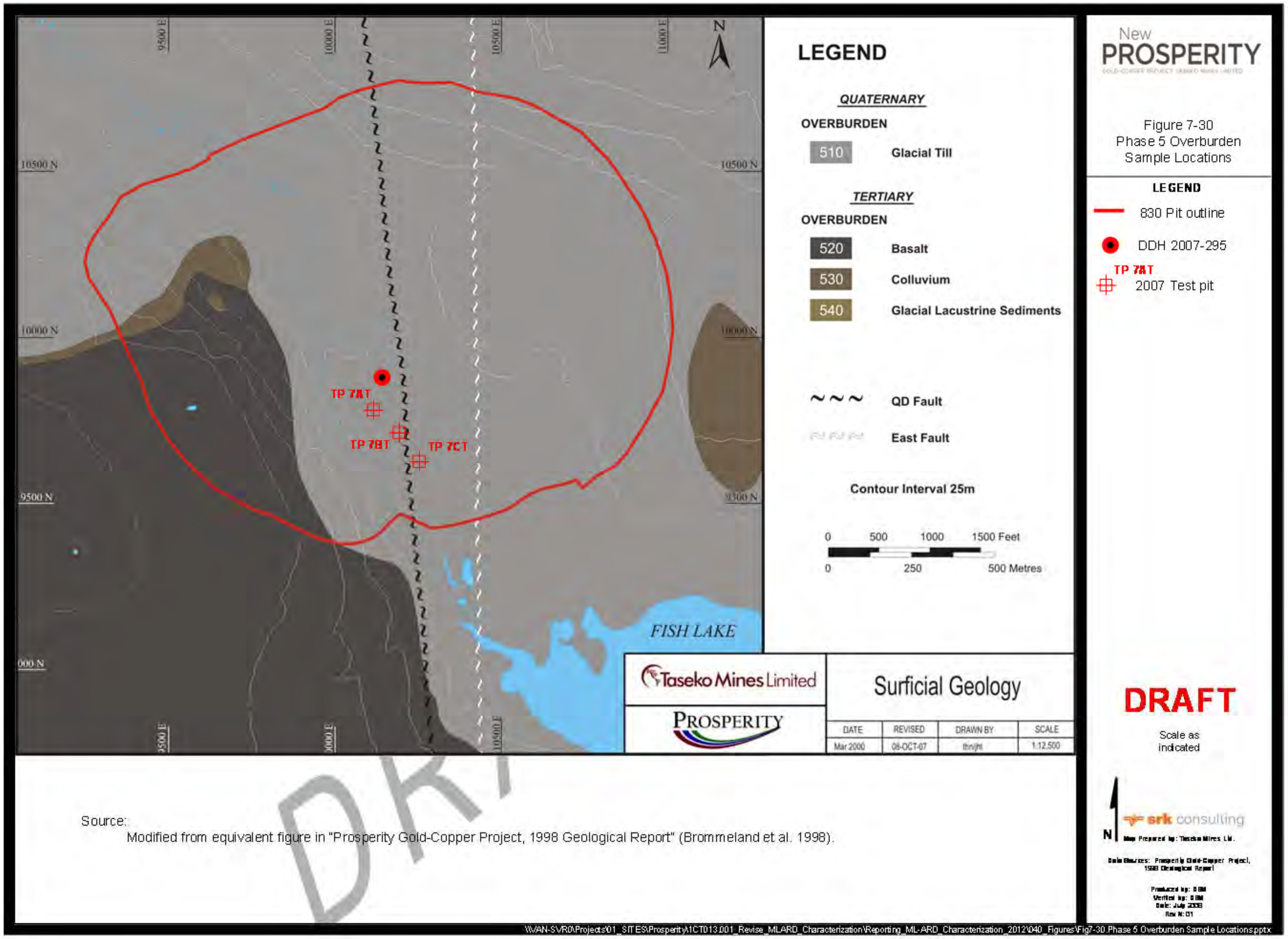


Figure 2.7.2.1-30 Phase 5 Overburden Sample Locations

PHASE 5 KINETIC TESTING

Archived drill core from 1992, 1996, and 1997 was collected from the core storage facility at the New Prosperity site. Materials targeted for collection included ore and stockpile grade ore, potassic waste, and propylitic waste with elevated zinc content. Samples were collected by SRK in December 2006 with assistance from Taseko staff.

The coded assay database was used to identify appropriate target intervals. It was expected that many intervals would be missing due to disintegration of core racks and to previous retrieval of core for other testing programs. The samples that were ultimately retrieved were selected based on actual intervals that were available from within the target population at the time of collection.

Archived Chilcotin basalt core was retrieved from Taseko's warehouse in September 2007. The sawn half core from the entire length of DDH 96-224 had been stored in wooden bins, including the upper 94 m of basalt core, with composite samples contained in large plastic bags each holding about 10 m intervals.

Table 2.7.2.1-6 lists the samples selected for kinetic testing, and drill collar locations are shown on Figures 2.7.2.1-5 and 2.7.2.1-6.

Table 2.7.2.1-6 Core Intervals Collected for Phase 5 Kinetic Testing – DRAFT

HCT ID	HOLE ID	From (m)	To (m)	Interval (m)	Sample ID	Material Type
HC1	92-011	142.0	144.0	2.0	92-011 142-144	stockpile Grade Ore
HC2	92-048	158.0	160.0	2.0	92-048 158-160	stockpile Grade Ore
HC3	92-059	58.0	60.0	2.0	92-059 58-60	Stockpile Grade Ore
HC4	92-084	90.0	92.0	2.0	92-084 90-92	High Zn propylitic waste
HC5	97-251	68.0	70.0	2.0	97-251 68-70	High Zn propylitic waste
HC6	92-024	150.0	152.0	2.0	92-024 150-153	Potassic waste
HC7	92-083	86.0	88.0	2.0	92-083 86-88	Potassic waste
HC8	92-084	318.0	320.0	2.0	92-084 318-320	Potassic waste
HC9	97-264	290.0	292.0	2.0	97-264 290-292	High Zn propylitic waste
HC10	See Tailings section for source of feed				KM 1961 Master Comp 1/2" Crush	Composite ore
HC11	See Tailings section for source of feed				KM 1961 Master Comp 1/2" Crush	Composite ore
HC12	96-224	50	58	8	234170-24173 Comp.	Chilcotin Basalt
HC13	96-224	86	94	8	234189-234192 Comp.	Chilcotin Basalt

A composite sample of PAG rock was prepared for subaqueous rock column testing from the available samples listed in Table 2.7.2.1-6. The composite was prepared using equal weights of PAG stockpile grade ore and of each of two high zinc propylitic samples; Table 2.7.2.1-7 lists the intervals used to prepare the PAG composite.

Table 2.7.2.1-7 Makeup of Subaqueous Rock Column Composite Sample – DRAFT

HCT ID	HOLE ID	From (m)	To (m)	Interval (m)	Sample ID	Material Type
HC1	92-011	142.0	144.0	2.0	92-011 142-144	stockpileOre
HC4	92-084	90.0	92.0	2.0	92-084 90-92	High Zn propylitic waste
HC9	97-264	290.0	292.0	2.0	97-264 290-292	High Zn propylitic waste

PHASE 5 LABORATORY METHODS

Mineralogical characterization was carried out on all samples gathered for Phase 5 humidity cell testing, as well as on several archived samples from the Taseko geology collection. Locations and descriptions of these samples are provided in Appendix 3-7-I of the March 2009 EIS/Application.

Polished thin sections were examined by petrographic microscope and optical thin section descriptions were prepared by Petrascience Consultants Inc. of Vancouver. Individual carbonate grains were identified optically and carbonate mineral species were determined by election microprobe at the Department of Earth and Ocean Sciences at UBC. Parallel samples were submitted to UBC for quantitative X-ray diffraction analysis with Rietveld refinement (QXRD).

STATIC GEOCHEMICAL TESTING

During exploration, drill core was analyzed at a variety of laboratories for elemental content by aqua regia digestion with ICP finish. Mercury analyses were carried out by cold vapour atomic absorption for drill core collected from 1991 to 1997, but selenium was not included in the analytical suite. As part of Phase 5 ML/ARD characterization, a total of 68 samples were analyzed for selenium and mercury at Canadian Environmental and Metallurgical Inc. (CEMI) in 2006 to assess whether elevated selenium was present and to provide a set of modern mercury analyses.

ABA testing was carried out at CEMI according to the MEND (1991) method which includes paste pH, sulphur speciation (total sulphur and sulphate sulphur), and Modified Neutralization Potential (NP). Sulphide sulphur was estimated by difference. Carbonate NP was estimated by analyzing for Total Inorganic Carbon (TIC).

LEACH EXTRACTIONS

Shake flask extractions (SFEs) were carried out on 32 archived assay pulps via a 24 hour extraction using a 3:1 ratio of distilled water to solid (Price, 1997).

Twelve samples of overburden collected during drilling and test pitting programs in 2007 were also tested using the method described above.

KINETIC TESTING

The thirteen humidity cell tests (HCTs) listed in Table 2.7.2.1-6 were carried out by CEMI according to the method presented in MEND (1991) and recommended by Price (1997). HCTs consisted of plexiglass columns loaded with 1.0 kg of crushed rock, and flushing was carried out by flood leach on a weekly cycle. Cell operation consisted of an initial flush with 750 mL of deionized water, followed by weekly flushing with 500 mL of deionized water.

Leachate analysis was initially conducted on a weekly/ biweekly schedule, as follows:

- pH, ORP, conductivity – weekly

- Sulphate, chloride, fluoride, acidity and alkalinity – biweekly, and
- Elements by ICP-MS – First flush, second week and then at two week intervals (i.e. 0, 2, 4, 6 etc.).

After 57 cycles (HC1 through HC9) and 47 cycles (HC10 and HC11), monitoring frequency was reduced in January 2008 to the following schedule:

- pH, ORP, conductivity – biweekly
- Sulphate, fluoride, acidity and alkalinity – biweekly, and
- Elements by ICP-MS – every fourth weekly cycle.

Most cells were terminated in July 2011; only HC1, HC3, HC5 and HC8 remain in operation as of April 2012. Testing frequency for these four tests was reduced in to July 2011 to a long term monitoring frequency consisting of:

- pH, conductivity – every fourth weekly cycle
- Sulphate, fluoride, acidity and alkalinity – every 12th weekly cycle, and
- Elements by ICP-MS – every 12th weekly cycle.

HC12 and HC13 were monitored on the initial schedule through 199 cycles (July 27, 2011), when both tests were terminated.

SUBAQUEOUS ROCK COLUMN TESTS

Duplicate subaqueous rock columns (Sub WR A and Sub WR B) were constructed using 61 cm lengths of 17.14 cm diameter Plexiglass pipe. These columns were fitted with a perforated PVC disk and a nylon mesh at the base, and charged with 3.90 kg of composite PAG sample, crushed to less than 12.7 mm (1/2”). This mass of sample filled each column to a depth of 11 cm, and deionized water was added to achieve a 30 cm depth of water over the sample surface. Monitoring ports were located in the base of the column to sample porewater and in the side of the column to sample the water cover.

Because the available sample consisted of 1990s core, a series of initial flushing cycles were carried out to remove stored weathering products. Each flushing cycle consisted of flooding the column with deionized water, allowing it to equilibrate for 24 hours, and draining. This procedure was repeated 5 times (until minimal change in leachate conductivity was observed between cycles) and the leachate was composited and analyzed for metals and other parameters.

Column operation consisted of withdrawing only the minimum quantity of water required for analyses from the bottom port and the side port. Water removed was made up by adding deionized water (up to 160 mL) to the water cover on a weekly basis from week 1 through week 27, then on a biweekly basis from week 29 through week 211. The water cover was circulated to ensure oxygen concentrations did not become depleted at the rock interface. Both subaqueous rock column tests were terminated after week 211 in July 2011.

Monitoring was conducted of both the overlying water cover and the sample porewater, via sampling ports in the side and base of the column respectively. Water cover monitoring (side port) was limited to immediately measureable parameters, and was carried out on the following schedule:

- pH, ORP, conductivity and dissolved oxygen (DO)– weekly (through week 27); biweekly (week 29 through week 211).

Porewater monitoring (on samples drawn from the bottom port) was carried out on the following schedule:

- pH, ORP, conductivity and dissolved oxygen (DO)– weekly (through week 27); biweekly (week 29 through week 211)
- Sulphate, acidity and alkalinity – biweekly for duration of testing

- Chloride and fluoride– biweekly (through week 27); then every fourth week (week 31 through week 211), and
- Metals by ICP-MS – biweekly (through week 27); then every fourth week (week 31 through week 211).

RESULTS AND INTERPRETATION

The mineralogical studies indicated that the dominant sulphide mineral in the rocks hosting the New Prosperity deposit is pyrite, with lesser chalcopyrite and traces of digenite, covellite, enargite, sphalerite and several occurrences of undetermined mixed Fe+Cu sulphide minerals (Appendix 3-7-J of the March 2009 EIS/Application). The abundance of primary sulphate minerals gypsum and anhydrite was found to be up to 12.5 wt% of the samples evaluated by quantitative x-ray diffraction (QXRD).

The occurrence of sulphur in individual rock groups, as measured in Phase 2 and 3 ABA tests, is shown on Figure 2.7.2.1-31. The late porphyritic diorite dikes (Unit PMPD) have uniformly low total sulphur concentrations, with a high proportion of the sulphur present as sulphate. All other units display a wide range of both total and sulphate sulphur content.

Summary statistics for Phase 2 and 3 ABA parameters for all rock types are presented in Appendix 3-7-K of the March 2009 EIS/Application and statistics for elemental content for all rock types are presented in Appendix 3-7-L of the March 2009 EIS/Application.

Results of optical characterization of samples completed for this study (provided in Appendix 3-7-J of the March 2009 EIS/Application) indicate several types of minerals capable of neutralizing acid to some degree, including carbonates, potassium feldspar, biotite and sericite. QXRD results (Appendix 3-7-J of the March 2009 EIS/Application) added several other silicates including actinolite, clinochlore, diopside, kaolinite and vermiculite. The QXRD results indicated that the main carbonate minerals are calcite, dolomite, ankerite and siderite. Rhodochrosite was not identified by QXRD.

Microprobe analyses (Appendix 3-7-M of the March 2009 EIS/Application) of 434 optically-selected carbonate mineral grains from the New Prosperity deposit showed that the main types of carbonate were calcite and dolomite, with minor ankerite and siderite (Figure 2.7.2.1-32). Manganese content was minimal for all grains, with a maximum manganese content of 7% measured for a single grain.

As shown in, the majority of grains analyzed were calcite and dolomite. Calcite grains contained minimal cations other than calcium, however dolomite grains contained minor iron component (up to 36 mole % as iron carbonate). Although QXRD identified ankerite rather than dolomite, the technique cannot reliably distinguish between the two forms. The majority of binary carbonate grains were correctly classified as dolomite rather than ankerite because magnesium exceeds iron (Gribble and Hall, 1992). The composition of these carbonates varies continuously from 13% to 30% Mg. As shown, one grain was iron and magnesium carbonate that was classified as siderite but the composition is intermediate between magnesite and siderite. Based on the results obtained, average compositions for calcite, the series ankerite-dolomite, and siderite are shown in Table 2.7.2.1-8.

Table 2.7.1.2-8 Tally of Mineral Grain Composition as determined by Microprobe Analyses –DRAFT

Alteration	Potassic	Potassic	Propylitic	Propylitic	Propylitic	Phyllic	Phyllic	Stockpile Grade Ore	Ore
Rock Type	Intrusive	Volcanic	Intrusive	Volcanic	Sedimentary	Intrusive	Volcanic		
Mineral	(Count)								
Calcite	34	16	28	7	34	21	19	43	6
Ankerite	0	0	0	0	1	0	0	1	0
Siderite	0	1	0	16	5	0	0	5	2
Dolomite	47	23	0	10	20	24	0	16	15
Rhodochrosite	0	0	0	0	0	0	0	0	0
Total grains analyzed	81	40	28	33	60	45	19	65	23

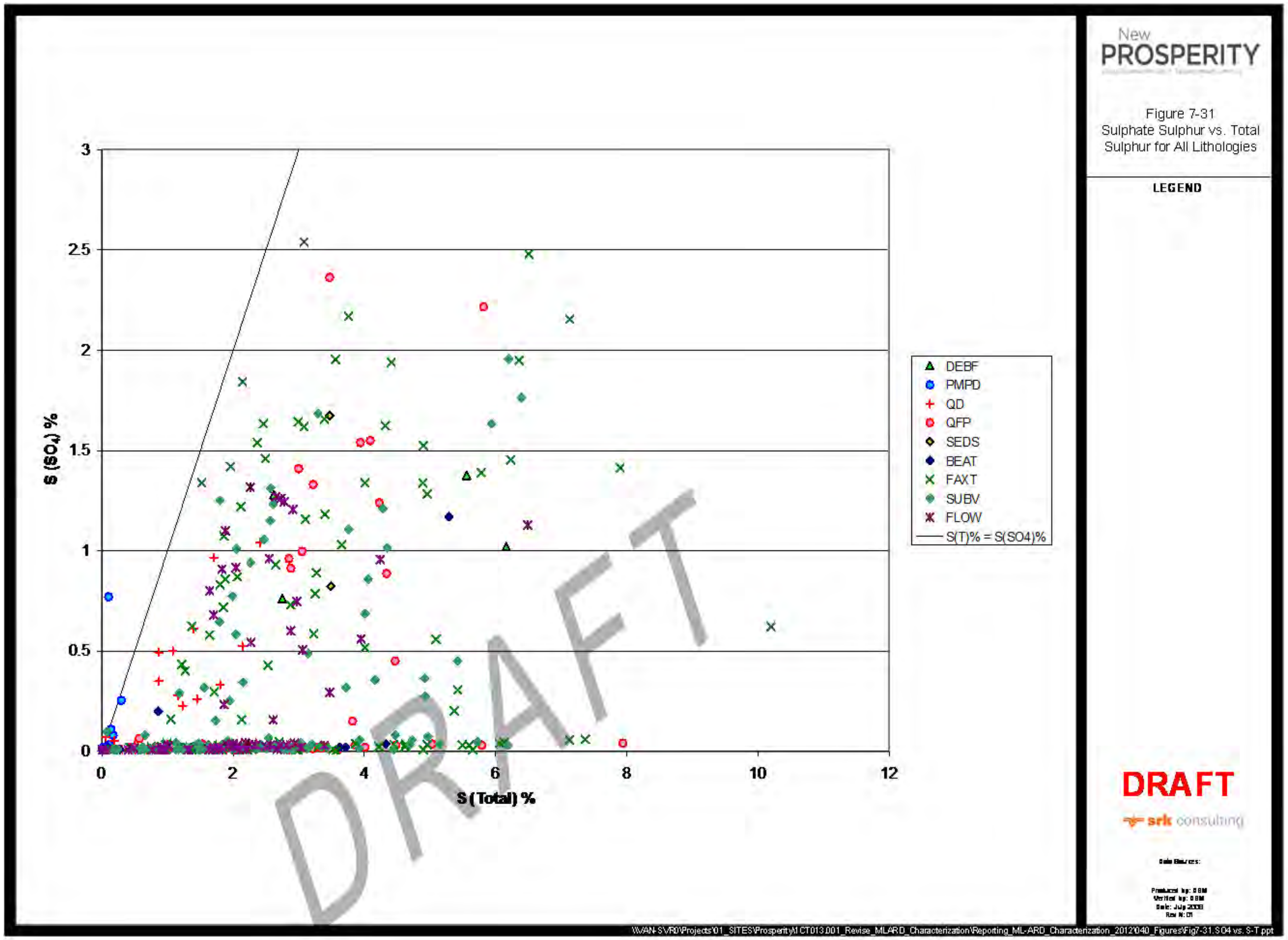


Figure 2.7.2.1-31 Sulphate Sulphur vs. Total Sulphur for All Lithologies

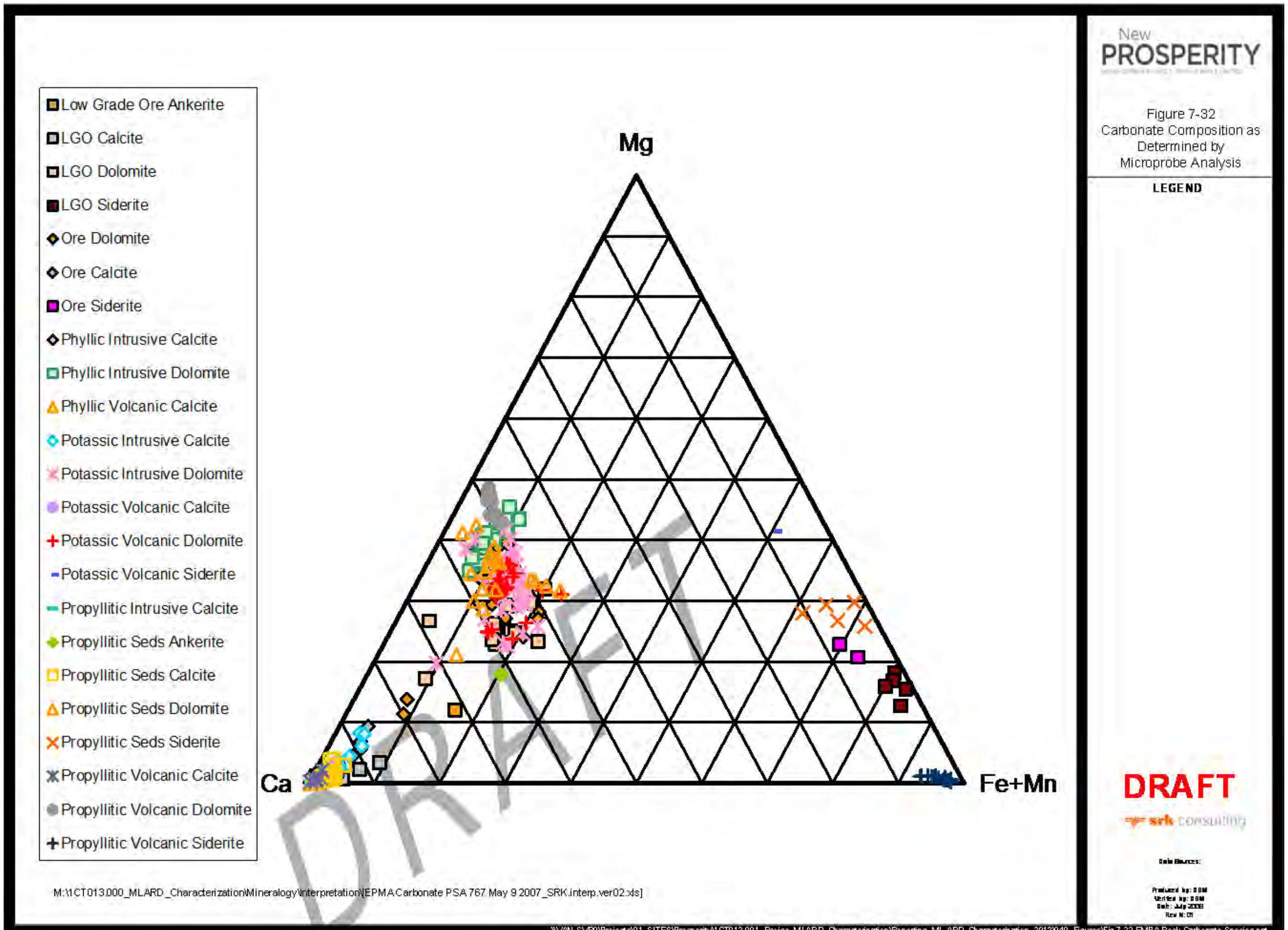


Figure 2.7.2.1-32 Carbonate Composition as Determined by Microprobe Analysis

Table 2.7.2.1-9 Average Compositions of Carbonate Minerals in Mine Rock – DRAFT

Mineral	Average Formula	Formula Weight (g/mole)
Calcite	$Ca_{0.97}Mg_{0.01}Fe_{0.01}Mn_{0.01}CO_3$	100.2
Ankerite-Dolomite	$Ca_{1.09}Mg_{0.66}Fe_{0.24}Mn_{0.01}(CO_3)_2$	193.8
Siderite	$Ca_{0.04}Mg_{0.12}Fe_{0.82}Mn_{0.01}CO_3$	111.2

The majority of silicate minerals are aluminosilicates. These provide limited buffering ability at higher pHs due both to the release of aluminum during dissolution and to the resistant silicate crystal structure. The buffering capacity provided by aluminosilicates below pH 5 is not effective in controlling concentrations of copper in water and should be eliminated from calculations of potential for ARD. Only reactive neutralization potential derived from calcium and magnesium carbonates should be considered in the assessment of ARD potential.

Bulk neutralization potential values determined by the Sobek et al. (1978) and MEND (1991) methods is expected to represent a combination of neutralization potential below pH 5 by aluminosilicates ($NP_{Silicate}$) and inorganic carbon contained in calcium and magnesium carbonate minerals ($IC_{Ca,Mg}$). This can be represented by

$NP = NP_{Silicate} + IC_{Ca,Mg}$.

Several different types of calcium, magnesium and iron carbonate minerals are present at New Prosperity, and total inorganic carbon (TIC) content of the rocks is not a reliable indicator of neutralization potential available from calcium and magnesium carbonate minerals. TIC represents total carbonate content:

$TIC = IC_{Fe,Mn} + IC_{Ca,Mg}$

The combination of QXRD data and microprobe-indicated carbonate mineral composition allows the $IC_{Ca,Mg}$ content to be evaluated, resulting in an estimate of $NP_{Silicate}$ (SRK 2006). The following steps were carried out:

1. The first step was to check that TIC indicated by chemical analysis corresponded to the mineralogical distribution indicated by QXRD. TIC from mineralogy was calculated from:

$TIC_{mineralogy} = 12P_{calcite}/FW_{calcite} + 24P_{ankerite}/FW_{ankerite} + 12P_{siderite}/FW_{siderite}$

where P and FW are the proportions and formula weights of the indicated minerals. The formula weights were calculated from the average formulas provided in Table 2.7.2.1-9. The proportion of ankerite was assumed to represent the proportion of ankerite-dolomite. Comparison of analytical and mineralogical TIC is provided in Figure 2.7.2.1-33. A reasonable correlation is indicated for the nine samples tested with a tendency for QXRD to indicate higher carbonate content than the chemical analysis at lower levels of carbonate. The results show that the mineralogical analyses are generally consistent with bulk analytically-measured carbonate content. The subsequent calculations do not require that TIC from mineralogy and chemical analysis be equivalent; however, the comparison indicates that QXRD quantified carbonate content.

2. The second step was to use the mineralogical results to calculate the fraction of carbonate associated with calcium and magnesium from the mineralogical results. This fraction ($f_{Ca,Mg}$) is calculated from:

$f_{Ca,Mg} = \{\sum(x_{Ca,m} + x_{Mg,m})IC_m\}/TIC_{mineralogy}$

where IC_m is the carbonate content indicated by QXRD associated with each mineral (m) and $x_{Ca,m}$ and $x_{Mg,m}$ are the mole proportions of calcium and magnesium in each mineral indicated by microprobe (Table 2.7.2.1-9). For the nine samples tested, $f_{Ca,Mg}$ varied from 17% to 98%. The low proportion is for the sample containing siderite.

3. The $f_{Ca,Mg}$ fractions obtained were then applied to the analytical TIC to estimate $IC_{Ca,Mg}$ relative to the laboratory-measured TIC.

4. Figure 2.7.2.1-34 shows $IC_{Ca,Mg}$ (expressed as kg $CaCO_3$/t) compared to bulk neutralization potential. All nine samples showed good correspondence between $IC_{Ca,Mg}$ and NP, indicating that there is little to no contribution of $NP_{Silicate}$ to the bulk NP, and therefore that NP = $IC_{Ca,Mg}$.

In summary, the bulk laboratory measured NP can be used without adjustment as an estimate of the neutralization potential that is available to consume acid under neutral pH weathering conditions. Therefore, the provisional adoption of (NP-10) to represent available NP for waste scheduling purposes is conservative.

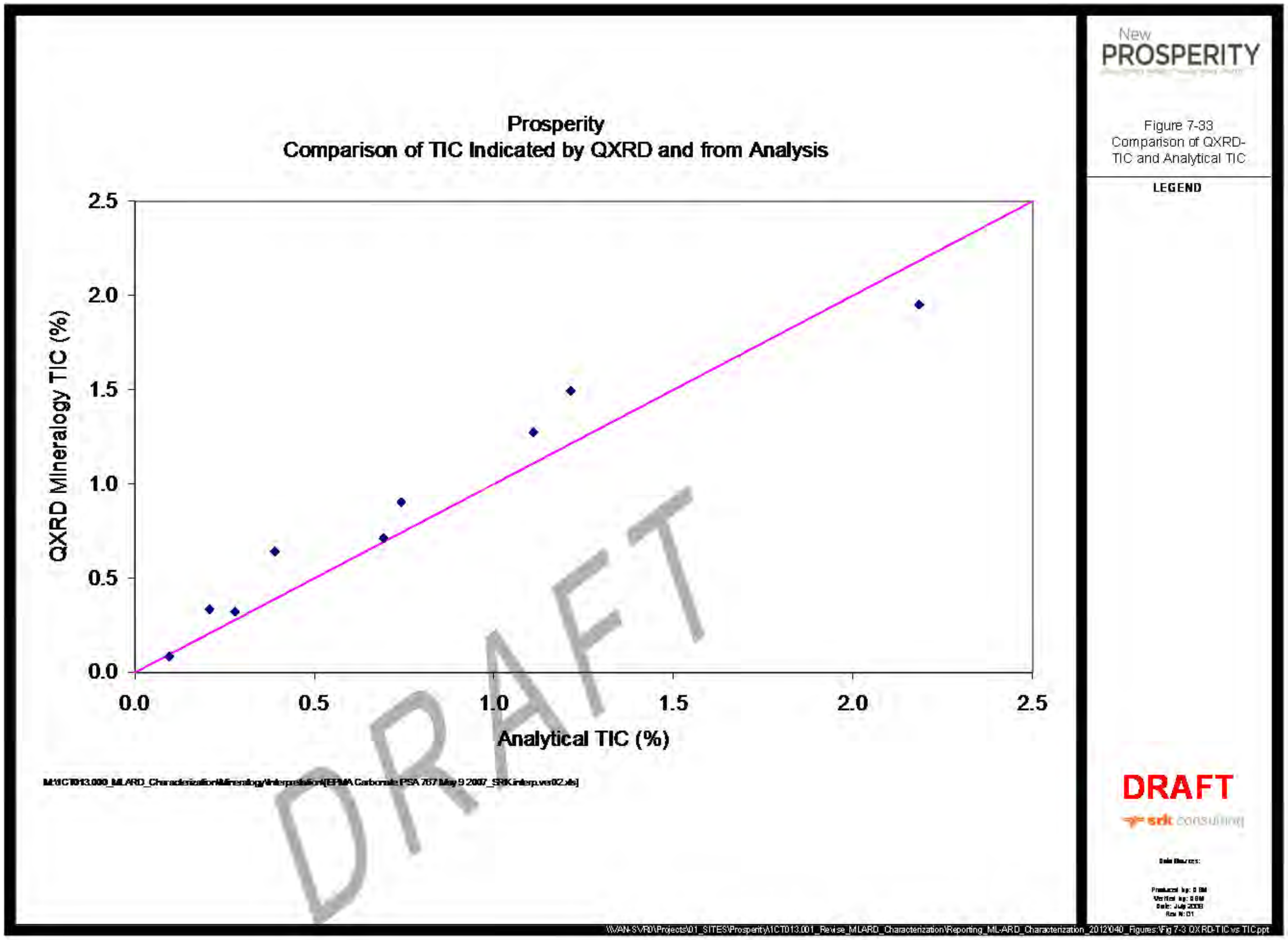


Figure 2.7.2.1-33 Comparison of QXRD-TIC and Analytical TIC

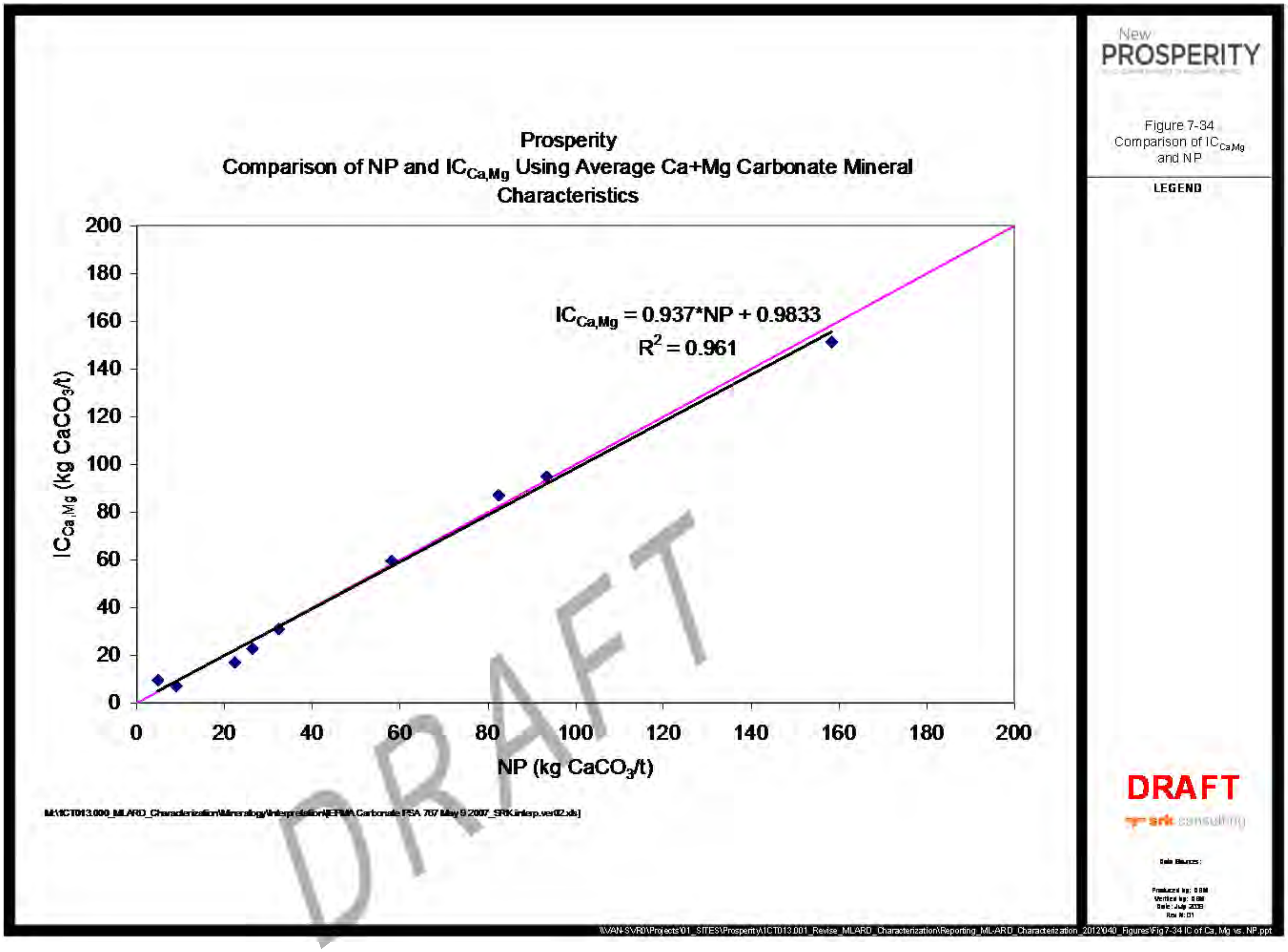


Figure 2.7.2.1-34 Comparison of $IC_{Ca,Mg}$ and NP

Summary statistics of elemental content by rock type for waste rock within the 852 pit are presented in Appendix 3-7-L of the March 2009 EIS/Application. Median concentrations of selected heavy elements are summarized in Table 2.7.2.1-10.

Median Cu concentrations are up to 13 times crustal average concentrations, with the three quartz diorite phases (QD1, QD2, and QD3) having the highest median copper concentrations. The highest median Hg concentrations also occur in quartz diorite, with QD3 having 18 times the crustal average Hg concentration. Quartz diorite unit QD1 has the highest median As and Mo concentrations, with 72 and 18 times crustal average concentrations respectively.

Median Sb concentrations are uniformly greater than the crustal average, although several rock types show median Sb concentrations of 1 ppm, which was the analytical limit of detection. The greatest Sb median concentrations occurred in overburden, with OVBN having an Sb concentration of 55 times the crustal average.

Cd, Mn, Pb and Zn were present close to or below crustal average concentrations in all waste rock types.

Table 2.7.2.1-10 Median Concentrations of Selected Heavy Elements – DRAFT

			As	**Cd**	**Cu**	**Hg**	**Mn**	**Mo**	**Pb**	**Sb**	**Zn**
		Units	**ppm**	**ppm**	**ppm**	**ppb**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**
	No. of	Crustal Average[1]	1.8	0.16	68	85	1060	1.2	13	0.2	76
Rock Type	Samples	Statistic									
OVBN	5	Median	1	0.1	349	655	922	2	11	11	50
BSLT	137	Median	108	0.1	32	10	428	10	1	1	50
OVB2	83	Median	1	0.1	344	60	377	13	1	7	51
PMPD	1774	Median	1	0.1	25	115	380	2	7	1	45
FP	203	Median	1	0.1	188	103	142	2	19	6	16
QFP	4388	Median	10	0.1	312	260	134	8	9	6	24
QD3	1654	Median	8	0.1	642	1520	225	2	7	1	29
QD2	2548	Median	3	0.1	637	280	191	10	4	1	25
QD1	819	Median	130	0.1	864	83	224	21	1	1	24
SEDS	585	Median	13	0.1	56	83	345	1	21	4	23
SUBV	7857	Median	1	0.1	490	165	194	6	6	1	25
FLOW	3281	Median	1	0.1	531	210	212	6	3	1	22
BEAT	322	Median	1	0.1	137	85	202	6	1	1	17
DEBF	211	Median	1	0.1	227	75	167	2	2	2	13
FAXT	10043	Median	1	0.1	352	90	177	12	1	1	18

Note:
Concentration of element in Earth's crust as a whole, from Price (1997), Appendix 3.

ACID-BASE ACCOUNTING ASSESSMENT

ABA results by rock type for all Phase 2 and Phase 3 in-pit samples are shown on Figure 2.7.2.1-35, and summary ABA statistics for individual rock types are presented in Appendix 3-7-K of the March 2009 EIS/Application. Results from Phase 5 are not shown as these samples were not used in coding the ABA block model (which forms the basis for the mine plan). The results show that there is no correlation between rock type and NP/AP characteristics, with most rock types exhibiting a wide range of NP and AP values. The exceptions are the late porphyritic diorite (unit PMPD) and the Tertiary basalt (BSLT).

PMPD forms numerous post-mineralization dikes that cut the deposit and host rocks. PMPD had moderate to high NP and low AP, which caused this unit to consistently have NP/AP values greater than 2.

Figure 2.7.2.1-36 shows the Phase 2 and Phase 3 ABA results by alteration type (unaltered overburden results included for reference). Overall, there is no correlation between alteration type and NP/AP characteristics, with all four main alteration types displaying a range of NP/AP values from <<1 to >2.

ABA results for ore samples from Phase 1, Phase 3, and Phase 5 metallurgical testing are shown on Figure 2.7.2.1-37. NP/AP values range from 0.65 to 3, assuming pyrite is the only source of sulphide sulphur. Since chalcopyrite is the dominant copper ore mineral, a portion of the sulphide sulphur will be hosted by chalcopyrite.

The plot shows that all ore samples tested had NP greater than 20 kg $CaCO_3$/t. The contained NP will neutralize any acid produced over the planned duration of ore exposure in the pit and the ore stockpile.

Assay pulps from two 1992 drill holes and eight 1996/97 drill holes were composited and analyzed for ABA parameters to test whether the scale of PAG/non-PAG variation was sufficiently large that waste could be selectively and successfully managed by segregation of PAG material. The goal of segregation will be to ensure that non-PAG waste rock contains negligible PAG rock and therefore will not generate ARD. Pulps were composited over roughly 6 m intervals to approximate half pit bench heights. A secondary objective of this testing was to evaluate whether test results matched the PAG/non-PAG classification that was assigned during the ABA block modelling process.

The results of the continuous ABA analysis for each drill hole are shown on Figure 2.7.2.1-38, and lines showing potential segregation criteria of NP/AP = 2 and NP/AP = 1.5 are shown for reference. Since all 1996/97 drill holes were oriented at a nominal 45º angle, a 6 m down-hole composite interval represents approximately 4.25 m vertical thickness. 1992 drill holes were drilled vertically, and depth intervals correspond directly to vertical thickness of rock.

Overall, the results show that segregation is a feasible waste management strategy for New Prosperity, as the scale of variation in waste category (PAG or non-PAG) is generally manageable at the bench or half bench scale. Operational bench scale classification will be more challenging in some areas than in others- the vertical variability shown for DDH 92-071, and to a lesser extent DDH 92-082, on Figure 2.7.2.1-38 may mean that some non-PAG rock occurring in narrower widths will need to be disposed as PAG if effective segregation cannot be achieved.

Drill holes 96-224 was chosen to evaluate the characteristics of the near surface Tertiary basalt. The zone of elevated sulphur located 90 m down-hole was expected and is discussed further. The continuous ABA testing suggests that this unit typically has low sulphide sulphur content and that zones of locally elevated sulphur content occur at a sufficiently large scale that segregation could be carried out if required based on operational monitoring results.

Drill holes 96- 219, -230, 97-235, -254, -256, -258 and -261 were chosen to test the ABA characteristics of waste rock in the southwest portion of the pit. The ABA model predicts a disproportionate volume of the non-PAG waste rock produced by the Project will be sourced from this zone, and it will be important to be able to segregate appropriately in this portion of the pit.

Figure 2.7.2.1-39 shows an oblique view of the southwest portion of the pit, with the traces of the above-mentioned drill holes plotted to show the extent of the modelled non-PAG rock in this area of the pit.

The results of the continuous ABA testing shown in Figure 2.7.2.1-38 for the drill holes in the southwest portion of the pit show that the predicted non-PAG character of the rock is largely confirmed:

- DDH 96- 219 and 97-258 were modelled as non-PAG over the interval tested, with the end of the tested interval coinciding with the intersection of the modelled PAG zone.
- The plot of DDH 97-235 results shows a single sample with NP/AP<1- this sample has very low sulphide sulphur (<0.01%) and NP (6 kg $CaCO_3$ equiv./tonne), and would be better classified as 'inert' in this context.
- DDH 97-256 shows higher sulphide sulphur content, and NP/AP values that transition from PAG to non-PAG in the tested interval. This modelled classification is not correct for these samples. The end of the tested interval coincides with the top of the modelled PAG zone, and the results for 97-256 show that, in some areas, there may be substantial uncertainty in the modelled location of the PAG/non-PAG boundary.
- The end of the test interval for DDH 96-230, 97-254 and -261 also coincided with the entry of the drill trace into the modelled PAG zone. Only a short section of modelled non-PAG rock was available in 96-230, which returned high NP/AP values except for the lowest composite tested. 96-254 returned a section of NP/AP < 2 (coinciding with a higher sulphur zone) in the middle of the tested section, however the base of the tested interval had NP/AP>2. Similarly, 97-261 had non-PAG NP/AP values at the end of the tested interval adjacent to the modelled PAG zone, and returned a single high sulphur, low NP/AP interval near the mid-point of the tested section.

Overall, the continuous ABA testing results show that segregation is a feasible waste management strategy and that operational monitoring will be necessary to ensure waste rock is appropriately classified and managed.

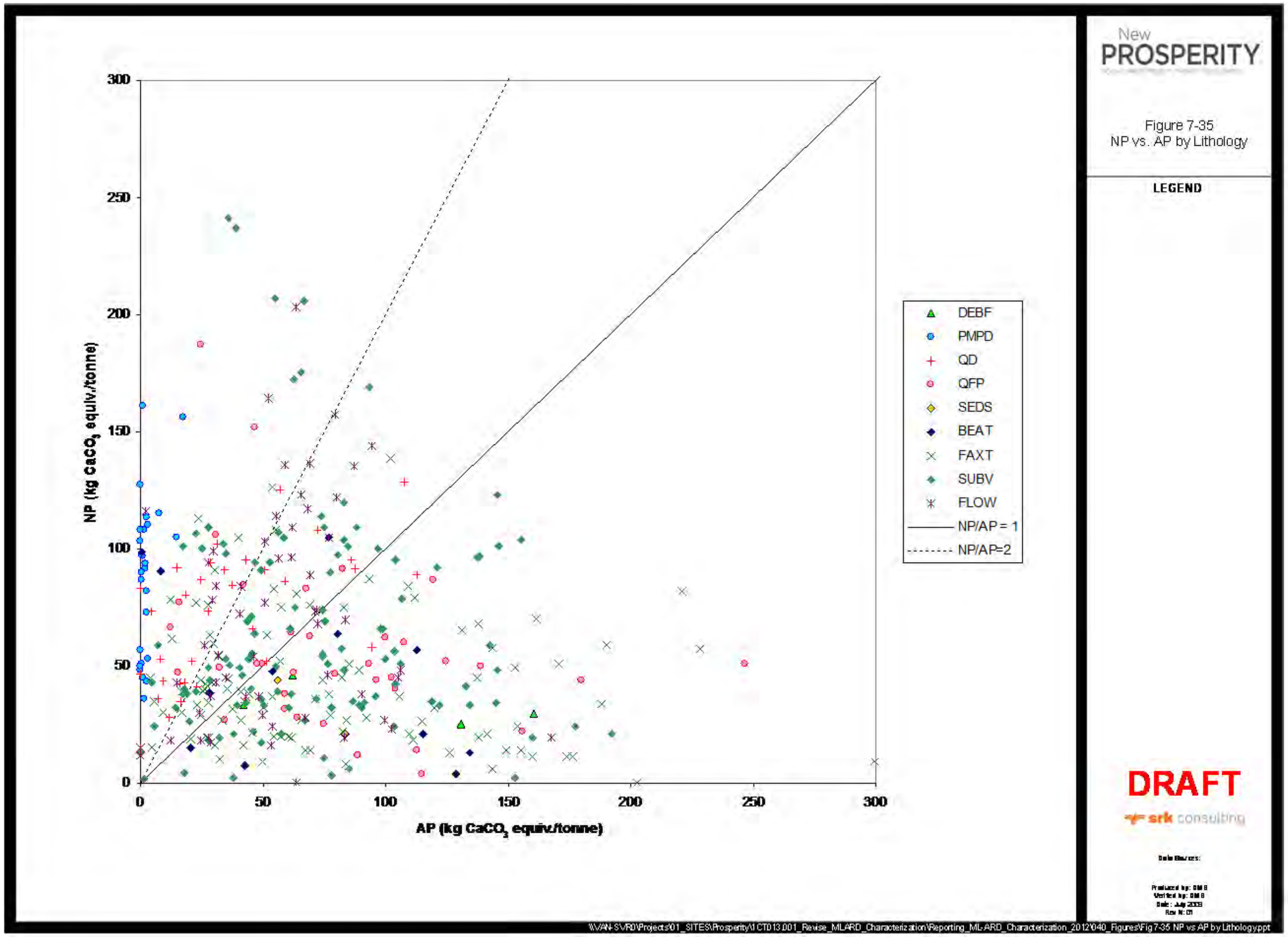


Figure 2.7.2.1-35 NP vs. AP by Lithology

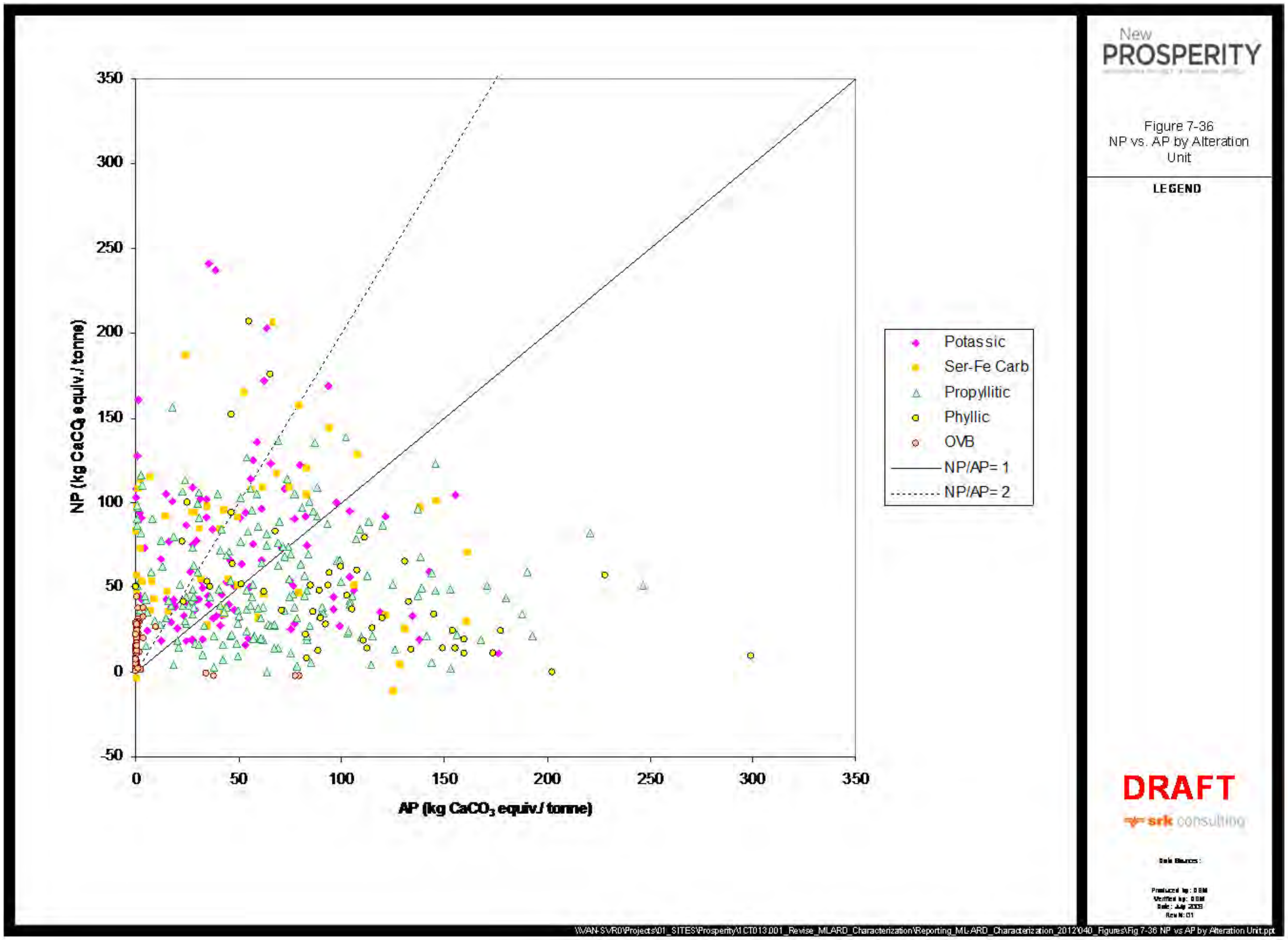


Figure 2.7.2.1-36 NP vs. AP by Alteration Unit

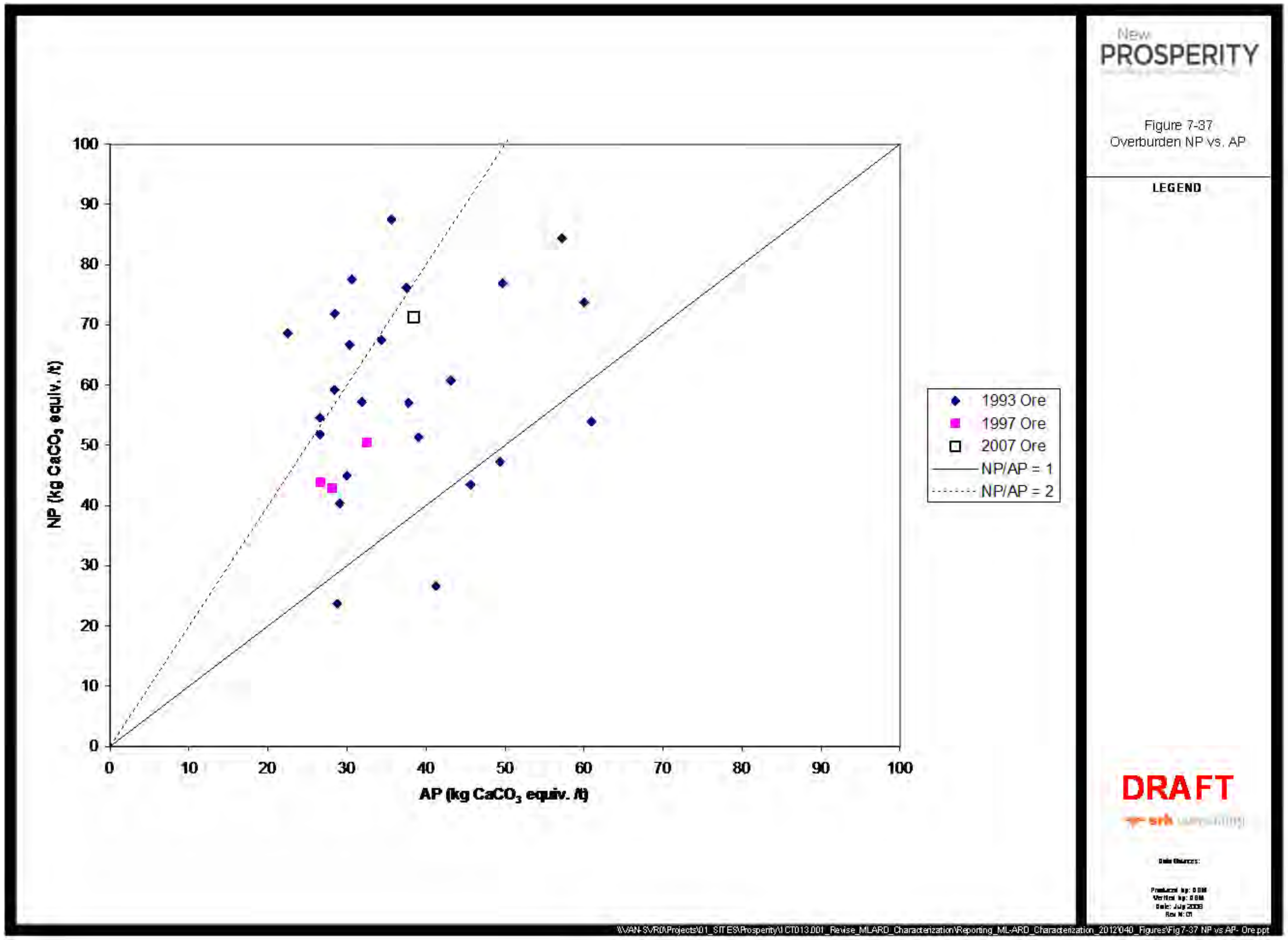


Figure 2.7.2.1-37 Overburden NP vs. AP

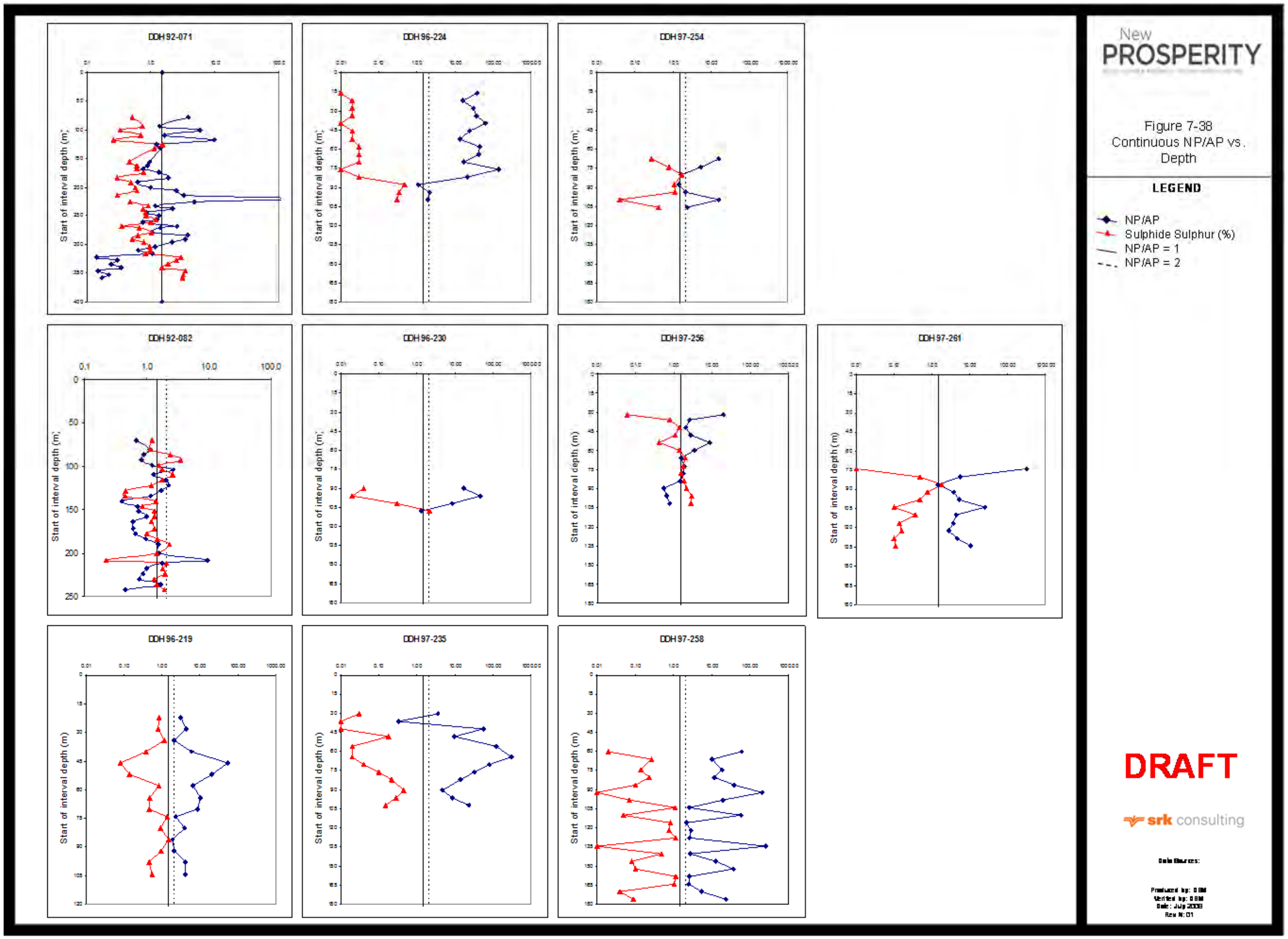


Figure 2.7.2.1-38 Continuous NP/AP vs. Depth

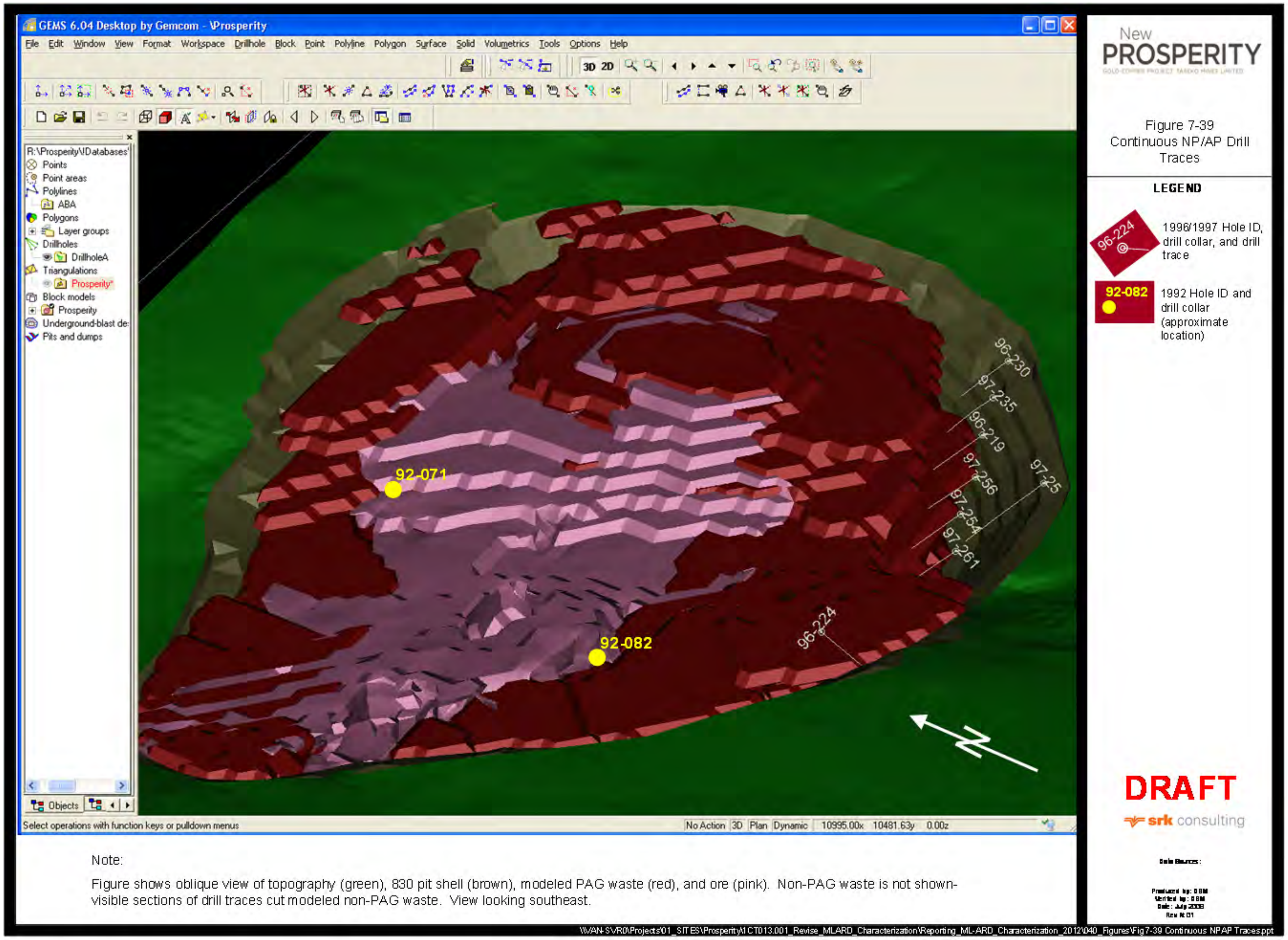


Figure 2.7.2.1-39 Continuous NP/AP Drill Traces

The composite samples from DDH 92-071 and DDH 92-082 which were submitted for continuous ABA analysis were also tested for selenium content to evaluate whether selenium is likely to be elevated in the New Prosperity host rocks. Mercury analyses were also conducted as a check against the original exploration assays. Results of the selenium and mercury analysis are provided in Appendix 3-7-N of the March 2009 EIS/Application.

Selenium concentrations ranged from 0.1 to 5 ppm, with a median concentration of 1.3 ppm, and appear to be correlated with Cu and S content. Average crustal abundance of selenium for both basaltic and granitic rock is 0.05 ppm (Price, 1997). The limited analysis described here indicates that the selenium content of the New Prosperity host rocks is elevated and that leaching selenium from tailings and mine rock may be a concern.

Phase 5 mercury analyses returned lower values than measured during analyses carried out in the 1990s as part of exploration. All phases of Hg analyses were carried out using the Cold Vapour Atomic Absorption technique, with detection limits around 5 ppb in the earlier testing, and no Phase 5 samples below this concentration (minimum Phase 5 concentration of 15 ppb). The lower concentrations measured in Phase 5 testing suggest that some of the mercury has volatilized and been lost during the period of storage. The results do however confirm the validity of the mercury values contained in the exploration assay database.

Phase 2 and Phase 3 ABA results for all overburden and Tertiary basalt samples tested are shown in Figure 2.7.2.1-39. Samples of till, basalt, and conglomerate had low sulphur content and low neutralization potential- these materials are classified as non-PAG (NP/AP > 2), will likely be nearly geochemically inert when excavated, and will be good candidates for use as general construction material. A summary of Phase 2 and Phase 3 overburden ABA testing results is included in Appendix 3-7-O of the March 2009 EIS/Application.

Four of four samples of limonitic conglomerate (Unit 531 (FANL)) were found to have elevated sulphide sulphur content and to have acidic paste pH values. These samples were sourced from adjacent 2 m intervals in a single drill hole (DDH 96-216, Figure 2.7.2.1-5). No other samples of FANL were subjected to ABA testing, however the unit was easily identified geologically. Lateral and vertical distribution of FANL have been estimated by Taseko geologists by correlating between drill holes based on the geological description in the logs (in the same manner carried out for all other overburden units). For mine planning purposes, it has been assumed that the entire volume of FANL will be classified as PAG and that this volume will be placed in the PAG disposal facility. This assumption will need to be verified by operational testing.

Leach extraction tests carried out on 11 overburden samples from 2007 returned uniformly neutral leachates, with pH ranging from 7.15 to 7.94. Soluble sulphate ranged from 3 to 303 mg/kg, and while soluble trace element load generally increased with soluble sulphate, correlations were poor. Complete results of overburden leach extraction testing are presented in Appendix 3-7-P of the March 2009 EIS/Application.

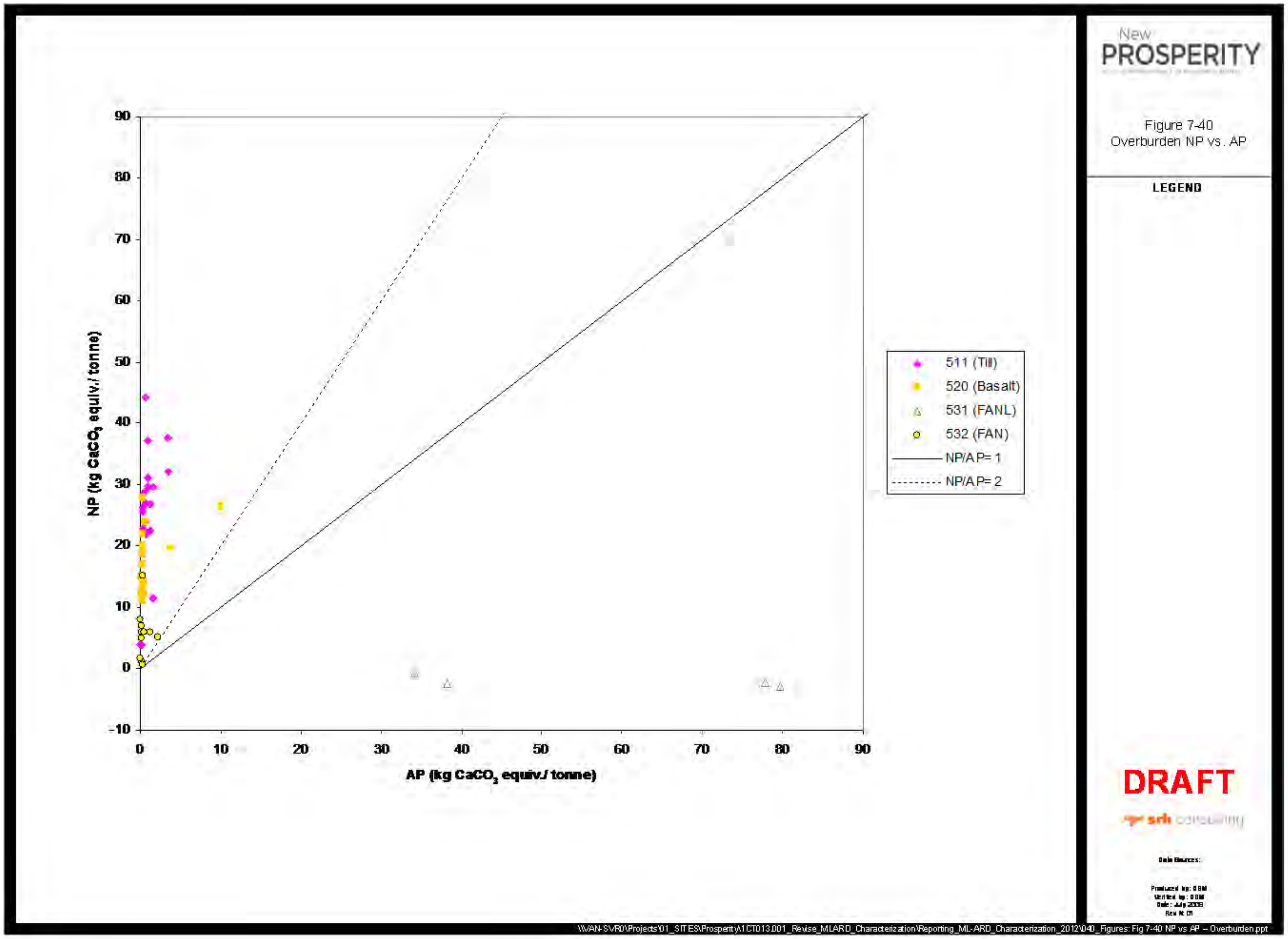


Figure 2.7.2.1-40 Overburden NP vs. AP

Phase 5 ABA results discussed in the previous section showed the Tertiary basalt can have sulphide sulphur concentrations up to 0.5% (compared to average basalt sulphide sulphur concentrations of 0.03%). Of the 14 drill holes from which Tertiary basalt samples were analyzed, the four highest sulphide sulphur contents were measured from samples sourced from an 18 m interval (88-106 m) in DDH 96-224. Outside of DDH 96-224, the maximum sulphide sulphur content in Tertiary basalt was measured to be 0.02%. Therefore, this unit is considered to be largely non-PAG, with the potential for rock with locally elevated sulphide sulphur that will require segregation.

Phase 5 ABA results also showed that NP greatly exceeds TIC-NP for the Tertiary basalt analyzed from DDH 96-224 (Figure 2.7.2.1-41).

Thirty-two 24 hour distilled water leach extractions were performed on assay pulps retrieve from storage. Complete results of are presented in Appendix 3-7-Q of the March 2009 EIS/Application.

Leachate for one sample of potassic intrusive (Sample 234029) had an acidic pH of 2.87, with leachable Sb (1.5 mg/kg) and Hg (12 µg/kg), but low leachable sulphate (210 mg/kg) compared to other pulps tested (median 1143 mg/kg). All other samples had neutral leachate pH ranging from 7.35 to 8.14 with a wide range of leachable sulphate (24 to 5817 mg/kg). Soluble load of several elements were plotted against pH and sulphate, with a positive correlation between Ni and sulphate being the only correlation observed. Although pH conditions varied little, there was a generally at least a tenfold range of soluble load for the elements examined.

In general, these tests provided little useful information on element leachability except to demonstrate the solubility of sulphate due to dissolution of gypsum. Maximum concentrations of other ions were well below expected solubilities of their respective secondary minerals.

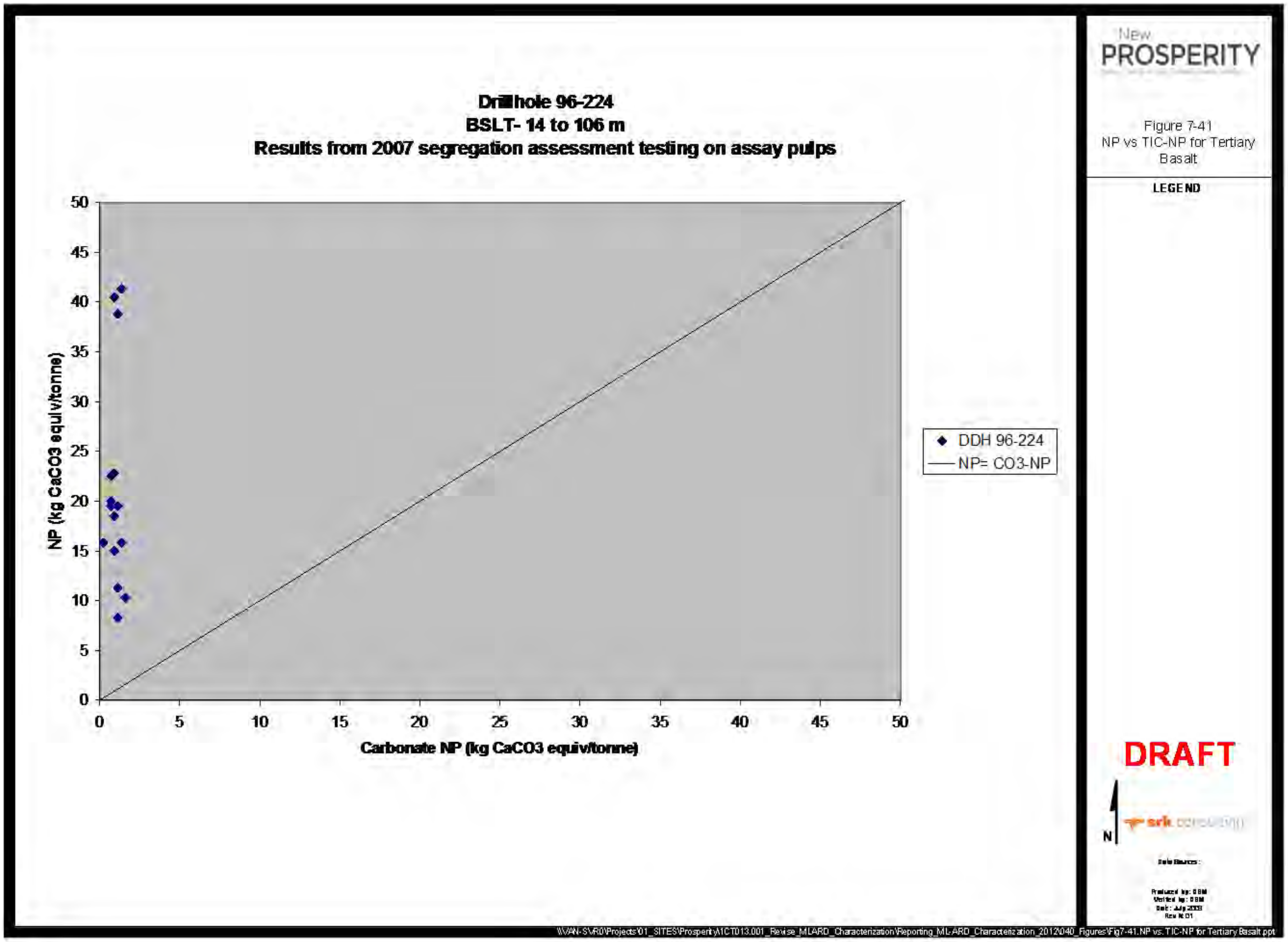


Figure 2.7.2.1-41 NP vs TIC-NP for Tertiary Basalt

KINETIC GEOCHEMICAL TESTING

Twelve humidity cell tests (HCTs) were carried out on samples of different rock units and alteration types. Static characteristics of the individual samples tested are summarized in Table 2.7.2.1-11. Complete tabular results and selected plots of Phase 4 HCT results are provided in Appendices 3-7-R and 3-7-S of the March 2009 EIS/Application.

HCT K3 was carried out on sample that was intended to assess 'worst case' weathering characteristics of Tertiary basalt. The sample had a slightly acidic paste pH (5.9) and displayed acidic leaching conditions for the entire duration of testing. Additional samples of Tertiary basalt were tested as part of the Phase 5 program, and the Phase 4 and Phase 5 results are discussed together in the Phase 5 discussion below.

The other 11 Phase 4 HCTs remained pH neutral for the 77 week duration of testing. Leachate pH for each cell varied within a stable range, with leachate from all cells ranging from 7.1 to 8.6 from the second week on.

Phase 4 samples appear to have been selected specifically to target material with low sulphate sulphur content. Sulphate release from HCTs K4 through K14 was correspondingly low, with leachate sulphate concentrations well below the solubility of gypsum ($CaSO_4 \cdot 2H_2O$). Typical release rates ranged from 1 to 7 mg/kg/wk for the period of stable release beginning around week 20.

Leachate concentrations for most trace elements were below the standard analytical detection level throughout the testing period. A single round of low-level analyses was carried out in week 46, and the resulting analytical data were used in determining source terms for the different alteration units. Both Cd and Se concentrations were less than the low-level detection limits (Cd limit of detection= 0.00005 mg/L; Se limit of detection = 0.001 mg/L), and several other trace elements had similarly low leachate concentrations (e.g. Cr, Co, Ni, Ag). Where concentrations were below detectable levels, calculations of release rates adopted the limit of detection as the leachate concentration. These calculated release rates provide an upper bound estimate of the actual rates of release occurring within the test cells.

PHASE 4 COLUMN TESTS

Nine column leaching tests were carried out on samples of different rock units and alteration types. Static characteristics of the individual samples tested are summarized in Table 2.7.2.1-12. Complete tabular results and selected plots of Phase 4 column test results are provided in Appendices 3-7-T and 3-7-U of the March 2009 EIS/Application.

Unsaturated columns containing between 23 to 33.5 kg of rock were operated for 543 days. Columns were leached with 1 L of deionized water, with leaching cycles varying from 1 to 4 days for the first 60 days, then weekly for the duration of testing.

Leachate pH for all columns varied within a stable pH neutral range (7.5 to 8.3) for the duration of testing. Sulphate production was lower in the initial 60 day period, then increased to maximum observed concentrations before declining for the duration. All columns displayed the same trend, with maximum sulphate concentrations for individual columns ranging from 142 to 383 mg/L. From around Day 270 on, the rate of decrease in weekly sulphate concentration slowed, with sulphate concentrations appearing to approach a steady state ranging from 36 to 183 mg/L. These concentrations are lower than would be expected if equilibrium dissolution of gypsum ($CaSO_4 \cdot 2H_2O$) was occurring.

Concentrations of most trace elements were at or near the limit of detection for the analytical method used for the duration of testing. Exceptions were Mn and Zn, with most leachates showing detectable Mn (>0.005 mg/L) during the initial period of leaching extending to Day 130. The sericite-iron carbonate altered QD1 in column K4 displayed the highest Mn concentration (0.268 mg/L) and the highest rate of Mn leaching, with leachate Mn remaining above detection (0.005 mg/L) through Day 214.

Most columns leached zinc at concentrations above detection levels (0.005 mg/L) in the initial stages of testing. By Day 116, leachate Zn concentrations in eight of nine columns had declined below 0.02 mg/L and continued to decline for the duration of column testing. Column K10 (SUBV with phyllic alteration) leached Zn at detectable concentrations over the duration of testing, with the highest observed zinc concentration in all columns (0.096 mg/L) occurring in K10 on Day 116. Column K10 leachate zinc concentration declined to 0.02 mg/L in the last round of monitoring carried out on Day 543. Zinc content of K10 was the second highest of all columns (246 ppm), with only K12 having a higher initial zinc concentration (262 ppm).

PHASE 5 RESULTS

Thirteen HCTs were carried out on samples of the rock units and alteration types catalogued in Table 2.7.2.1-6. Static characteristics of the individual samples tested are summarized in Table 2.7.2.1-13.

A duplicate subaqueous waste rock column test was carried out for a composite PAG rock sample prepared from equal weights of the samples tested in HC1, HC4, and HC8. No static tests were performed on the composite sample - Table 2.7.2.1-13 includes calculated average composite characteristics for the subaqueous column test material.

Complete tabular results and selected plots are provided in Appendices A through D.

HOST ROCK

HCTs HC6, HC7 and HC8 are testing potassic waste. Leachate from all three tests has remained within a stable neutral pH range for the 79 weeks of testing to date, with maximum observed pH of 8.45 in HC7 leachate in week 12 and minimum observed pH of 6.83 in HC6 leachate in week 46.

The rock in HC6 and HC8 had initial $S(SO_4)$ contents of 0.79% and 0.9% respectively, and sulphate release from these tests reflects the leaching of calcium sulphate minerals (gypsum ($CaSO_4 \cdot 2H_2O$) or anhydrite ($CaSO_4$)). The rock in HC7 had an total sulphur content of 0.02%, and a $S(SO_4)$ content of 0.01%, and low reported sulphate concentrations in HC7 leachate reflect the low total sulphur content of the material being tested.

Table 2.7.2.1-11 Static Characteristics of Phase 4 Humidity Cell Test Samples – DRAFT

HCT	HOLE ID	From	To	Interval	Rock type	Alteration Type	PASTE	S(T)	$S(SO_4)$	AP	NP	NP/AP
		(m)	(m)	(m)			pH	%	%	kg $CaCO_3$/t		
K3	96-224	94	104	10	BSLT	-	5.9	0.35	0.09	8	21	2.5
K4	96-224	156	166	10	QD1	Sericite- Iron Carbonate	8.0	2.27	0.03	70	-55	-0.8
K5	96-224	198	202	4	FAXT	Sericite- Iron Carbonate	8.1	1.53	0.02	47	41	0.9
K6	96-224	270	280	10	BEAT	Propylitic	8.1	0.50	0.01	15	97	6.4
K7	96-225	102	104	2	BEAT	Propylitic	8.2	1.07	<0.01	33	6	0.2
K8	96-225	194	204	10	FLOW	Propylitic	8.4	1.87	0.04	57	99	1.7
K9	97-236	172	178	6	QFP	Phyllic	8.2	4.09	0.04	127	119	0.9
K10	97-236	206	216	9.9	SUBV	Phyllic	8.4	3.31	0.06	102	73	0.7
K11	97-237	150	159.8	9.8	FAXT	Propylitic	8.6	1.58	0.02	49	22	0.5
K12	97-239	62	72	10	SUBV	Phyllic	8.4	1.63	0.04	50	88	1.8
K13	97-251	170	180	10	SUBV	Propylitic	8.8	0.83	0.03	25	52	2.1
K14	97-252	218	228	10	SUBV	Propylitic	8.7	1.27	0.03	39	51	1.3

Table 2.7.2.1-12 Static Characteristics of Phase 4 Column Test Samples – DRAFT

Column Test	HOLE ID	From	To	Interval	Mass	Rock Type	Alteration Type	PASTE pH	S(T)	S (SO_4)	AP	NP	NP / AP
		(m)	(m)	(m)	(kg)			s.u.	%	%	kg $CaCO_3$/t		
K4	96-224	156	166	10		QD1	Sericite-iron carbonate	8	2.27	0.03	70	-55	-0.8
K5	96-224	198	202	4	9.5	FAXT	Sericite-iron carbonate	8	3.53	0.02	110	37	0.3
	97-237	122	132	10	13.5								
K6	96-224	270	280	10		BEAT	Propylitic	8.1	0.5	0.01	15	97	6.4
K8	96-225	194	204	10		BEAT	Propylitic	8.4	1.87	0.04	57	99	1.7
K10	97-236	206.1	216	9.9	23.5	SUBV	Phyllic	8.4	2.93	0.05	90	85	0.9
	97-236	226	236	10	10								
K11	97-237	150	159.8	9.81	23.5	FAXT	Propylitic	8.6	1.51	0.02	47	36	0.8
	96-225	30	40	10	10								
K12	97-239	62	72	10	19	SUBV	Phyllic	8.4	1.78	0.04	54	98	1.8
	97-236	226	236	10	10								
K13	97-251	170	180	10	20	SUBV	Propylitic	8.7	1.15	0.03	35	60	1.7
	97-251	242	251.2	9.16	5								
K14	97-252	218	228	10	20	SUBV	Propylitic						
	97-251	242	251.2	9.16	10			8.7	1.74	0.03	53	61	1.1

Table 2.7.2.1-13 Static Characteristics of Phase 5 Kinetic Test Samples – DRAFT

Humidity Cell ID	Rock Type	Alteration Type	Paste pH	Fizz Test	CO_2	TIC-NP	S(T)	S(SO_4)	S(S-2)	AP	NP	NP/AP
			s.u.		%	kg $CaCO_3$/t	%	%	%	kg $CaCO_3$/t		
HC1	SUBV	Phyllic	8.3	Slight	2.72	62	2.02	0.03	1.99	62	58	0.9
HC2	FAXT	Potassic	8.2	Slight	0.76	17	1.73	1.57	0.16	5	22	4.5
HC3	FAXT	Potassic	8.8	Slight	4.07	93	2.08	0.05	2.03	63	83	1.3
HC4	SUBV	Propylitic	6.9	None	0.35	8	6.04	0.1	5.94	186	9	0.0
HC5	SUBV	Propylitic	7.7	None	2.54	58	2.48	0.05	2.43	76	5	0.1
HC6	QFP	Potassic	8.5	Slight	1.43	33	1	0.79	0.21	7	32	4.9
HC7	PMPD	Potassic	9.2	Mod.	8.01	182	0.02	0.01	0.01	0.3	158	507
HC8	SUBV	Potassic	8.4	Slight	1.02	23	2.7	0.9	1.8	56	26	0.5
HC9	FLOW	Propylitic	9.1	Mod.	4.45	101	0.56	0.02	0.54	17	93	5.5
HC10, HC11	Ore Comp.	-	8.15	Mod.	3.89	88	1.69	0.46	1.23	38	71	1.9
HC12	BSLT	-	8.01	None	0.07	1.6	0.02	<0.01	0.02	0.6	14	23
HC13	BSLT	-	5.76	None	<0.02	<0.5	0.47	0.25	0.22	7	19	2.7
Sub WR A, B (average of HC1, HC4, HC8)	-	-	-	-	1.36	31	3.59	0.34	3.24	101	31	0.3

Trace element release for all three potassic HCTs was stable or declining as of June 2008. HC7 showed the highest initial As release of all Phase 5 tests, with release rates ranging from 0.0015 to 0.0039 mg/kg/wk for the first 20 weeks of testing before declining to a range similar to HC6 and HC8. From week 50 through week 77, As release from all potassic tests was stable and ranged from 0.00006 to 0.0005 mg/kg/wk.

HCTs HC4, HC5 and HC9 are testing propylitic waste with elevated zinc content, with 678, 638, and 779 ppm Zn, respectively. For reference, the 99th percentile zinc content for all in-pit assay intervals to be 498 ppm, which demonstrates the anomalously high zinc content of the selected samples.

HC4 and HC5 had low NP/AP ratios (<0.05 and 0.1, respectively). HC4 leachate was pH neutral to slightly acidic (pH 5.97 to 7) through week 43, transitioned from pH 6 to pH 3.4 by week 59, the continued to decline at a slower rate through the most recent monitoring in week 79 at pH 2.72. Zn release from HC4 was steadily increasing, with a release rate of 4.6 mg/kg/wk for the latest (week 77) monitoring in June 2008.

Release rates for other trace elements increasing from HC4 as the cell becomes increasingly acidic. Al, Cd, Cr, Co, Cu, Fe, Mn, Ag, and U also underwent order-of-magnitude increases in release rates with decreasing leachate pH. Pb release rates initially increased with release of other trace metals, but appeared to stabilize in the range of 0.0003 to 0.002 mg/kg/wk from week 39 on. Notably, Sb, As, Se, Mo, and Hg release rates were not increased by the development of increasingly acidic weathering conditions in HC4.

HC5 leachate ranged from pH 5.53 to 6.89 through week 67, but recent monitoring results show pH dropping to pH 5.16 in week 79. Zn release from HC5 peaked in week 9 at 0.24 mg/kg/wk, then dropped to below 0.01 mg/kg/week for the duration of monitoring. However, HC5 is expected to progress to fully acidic conditions at some stage and a parallel increase in Zn release is expected.

Sulphate release from HC5 declined steadily from 75 mg/kg/wk to 13 mg/kg/wk throughout the duration of the test. Cd release appeared to be stable at 0.0005 to 0.0009 mg/kg/wk from week 9 through week 77. Co, Pb and Ni followed a similar pattern to Zn release, with early peaks in release from weeks 5 to 15 mg/kg/wk followed by declines to a stable range of release rates that persisted through the June 2008 monitoring. Mn release was higher than for other Phase 5 tests (0.6 to 1.8 mg/kg/wk from week 15 on).

In contrast, rock in HC9 had an NP/AP ratio of 5.5, and maintained pH neutral leachate (range 7.46 to 8.56) in testing through June 2008. Sulphate release rates were low (ranging from initial rate of 27 mg/kg/wk to 2 mg/kg/wk in the more recent monitoring) and reflect the low total (0.56%) and sulphate (0.02%) sulphur content of the sample.

Release rates for Zn and other trace elements from HC9 were generally stable or declining over the testing period, with release rates similar to other pH neutral Phase 5 tests.

ORE AND STOCKPILE GRADE ORE

Ore (HC10, HC11) and stockpile grade ore (HC1, HC2, HC3) humidity cell tests had neutral pH leachate ranging from pH 6.95 to 8.0 over the duration of testing to date.

Sulphate release rates varied. HC2 had the highest sulphate sulphur (1.57%) content of all Phase 5 samples, and one of the highest sulphate release rates (ranging from initial release of 909 mg/kg/wk in early testing to 117 mg/kg/wk in week 77). HC10 and HC11 (initial $S(SO_4)$of 0.46%) had similar early sulphate release rates to HC2, likely reflecting leaching of calcium sulphate minerals (gypsum or anhydrite), and a similar long term trend of declining sulphate release. In contrast, the two samples with low initial sulphate content (HC1- 0.03% $S(SO_4)$; HC3- 0.05% $S(SO_4)$) declined from release around 100 mg/kg/wk sulphate to 4 to 20 mg/kg/wk sulphate. The trend of sulphate release from HC1 and HC3 from weeks 57 through 77 suggests that sulphate release from these cells may have reached steady state due to depletion of the small amount of sulphate sulphur that was initially present.

Trace element release from ore samples was near the upper limit of release rates for pH neutral Phase 5 HCTs. In particular, Mo release from ore and stockpile grade ore HCTs was up to 100-fold higher than for the highest producing propylitic or potassic sample tested, with a maximum Mo release of 0.23 mg/kg/wk from HC11.

Overall, release rates for most parameters from ore and stockpile grade ore HCTs were stable or declining. One exception is Ba in HC11, which increased from week 31 (0.0068 mg/kg/wk) to week 63 (0.03 mg/kg/wk), likely in response to increased dissolution of barite with declining leachate sulphate concentrations. Ba release then dropped from to 0.016 mg/kg/wk in the most recent leachate sample, indicating that Ba release is not yet at steady state.

TERTIARY BASALT

Tertiary basalt is expected to be an important construction material due to its high stratigraphic position over the deposit and its anticipated favourable geochemical characteristics. A Phase 4 humidity cell test (Cell K3, sulphide sulphur 0.26%- Table 2.7.2.1-12) was carried out for 77 weeks on a basalt sample from the elevated sulphide sulphur interval from DDH 96-224. Despite having a NP/AP value of 2.5, the paste pH was slightly acidic (pH 5.9), and acidic conditions developed almost immediately (initial pH 4.7, minimum pH of 3.4 in week 21) and declined for roughly 30 weeks before gradually increasing to greater than pH for at the time the test was halted at 77 weeks.

During initial Phase 5 review of previous test work, it was decided to confirm the K3 results by carrying out another HCT on the similar, adjacent high sulphide core interval from DDH 96-224. The Phase 5 high sulphide Tertiary basalt was tested in HC13 (NP/AP= 2.7, paste pH 5.8, 0.22% sulphide sulphur). An initial pH in HC13 of 4.0 increased to above pH 5 after 7 weeks, and varied within a stable range between pH 5.1 and 5.9 through week 40 (the most recent results at time of reporting).

Both acidic basalt cells released Co, Cu, Mn, Ni, and Zn at elevated rates relative to other rocks. Release of Co, Cu, and Ni had declined to detection levels in K3 by week 77, but remained elevated and responding to pH fluctuations in HC13 as of week 40.

A parallel sample of ‘typical’ Tertiary basalt was tested during Phase 5 for comparison (HC12- 0.02% sulphide sulphur, paste pH 8.0, NP/AP of 22.7). This sample had an initial pH of 6.5 which increased to around 7.5 and remained in that range for the duration of testing. Sulphate release from HC12 is the lowest of all Phase 5 samples tested, and release of most elements follows the same pattern.

Notably, release of Si occurred at similar rates for the neutral basalt (HC12) and the acidic basalt (HC13). This suggests weathering of silicates is occurring in a way that is not accelerated by acidic conditions in the range of pH 5 to 6. Aluminum release is correlated with pH, but is not clearly correlated with release of silica.

Phase 5 continuous ABA testing of basalt in DDH 96-224 (Section 7.3.3.5) found that measured NP ranged from 12 to 27 kg $CaCO_3$ equiv./tonne, but that TIC-NP was much lower (range 0 to 4.5 kg $CaCO_3$ equiv./tonne). These results suggest a silicate source for measured NP in Tertiary basalt.

Based on the observed behaviour of K3 and HC13, it is likely that any basalt with elevated sulphide sulphur (>0.1%) will generate acid conditions until the sulphide sulphur depletes. The majority of the Tertiary basalt is expected to have low sulphide sulphur (<0.1%), and the HC12 behaviour indicates that this rock will leach at low rates.

INTERPRETATION

Estimates of quantities of PAG and non-PAG waste rock are presently based on a provisional criterion of (NP-10)/AP = 2, as discussed earlier. The provisional criterion was adopted based on waste characteristics at other B.C. copper porphyries, and its use was necessary to allow mine planning to proceed in advance of completion of ML/ARD predictions. The present state of New Prosperity ML/ARD testing now allows an evaluation of a site specific criterion that defines PAG and non-PAG rock.

Data obtained from Phase 4 and Phase 5 humidity cells provide an indication of the site-specific criterion. The relative rates of sulphide oxidation (represented by sulphate release) and carbonate dissolution (represented by release of calcium and magnesium) can be used to estimate discrete sample NP/AP (or more accurately $IC_{Ca,Mg}$/AP since the ratio corresponds to carbonate release) required to maintain neutral drainage conditions. The method has been described elsewhere (for example, Day et al., 1997) and involves calculation of molar normalized Ca+Mg release relative to sulphate.

There are several limitations of the method.

- Laboratory tests are performed on materials that are prepared using procedures that do not necessarily simulate blasting in terms of exposure of minerals.
- Laboratory tests tend to accelerate the dissolution of carbonate minerals due to the use of high water to solid ratios (Mattson, 2005). This effect diminishes as the oxidation rate increases and leaching of carbonates occurs in response to acid generation.
- The resulting $IC_{Ca,Mg}$/AP is applicable to discrete samples, and therefore cannot be applied to large scale rock mixture unless the rock mixture has uniform lithological and geochemical characteristics.

A further complication of the method at New Prosperity is the presence of calcium sulphate which masks sulphide oxidation and carbonate depletion rates. To address this limitation, only those humidity cells with less than 0.1% sulphate sulphur were considered in the evaluation. Cells producing acidic drainage were also excluded, as the rate of buffering in these cells is insufficient to maintain neutral conditions. Twelve tests had neutral drainage and sufficiently low sulphate sulphur content to allow the correlation between sulphide content and sulphate release to be observed.

The average molar ratio of calcium+magnesium to sulphate release is shown compared to sulphate release in Figure 2.7.2.1-42. The figure shows that the molar ratio is highest for the samples showing very low sulphate release (correlated with low sulphide content). The ratio is lower for the one phyllic and two stockpile grade ore samples showing relatively higher sulphate release rates. The ratios for two of these three samples are between the theoretically predicted bounding ratios of 1 and 2 based on complete or partial utilization of carbonate buffering capacity and indicate an $IC_{Ca,Mg}$/AP criterion of 1.5 or lower.

Overall, this interpretation of humidity cell release rates shows that as sulphate release rates increase, the molar ratio falls between the theoretical limits (1 to 2) but the site specific criterion may lie between 1 and 1.5. The proposed $IC_{Ca,Mg}$/AP criterion for discrete sample classification is 1.5. $IC_{Ca,Mg}$ is approximately equal to NP for the New Prosperity host rocks.

Taseko has used a criterion of (NP-10)/AP < 2 to define PAG rock for planning purposes; this provides an additional factor of safety to allow for uncertainties such as the possible preferential release of pyrite along veins by blasting.

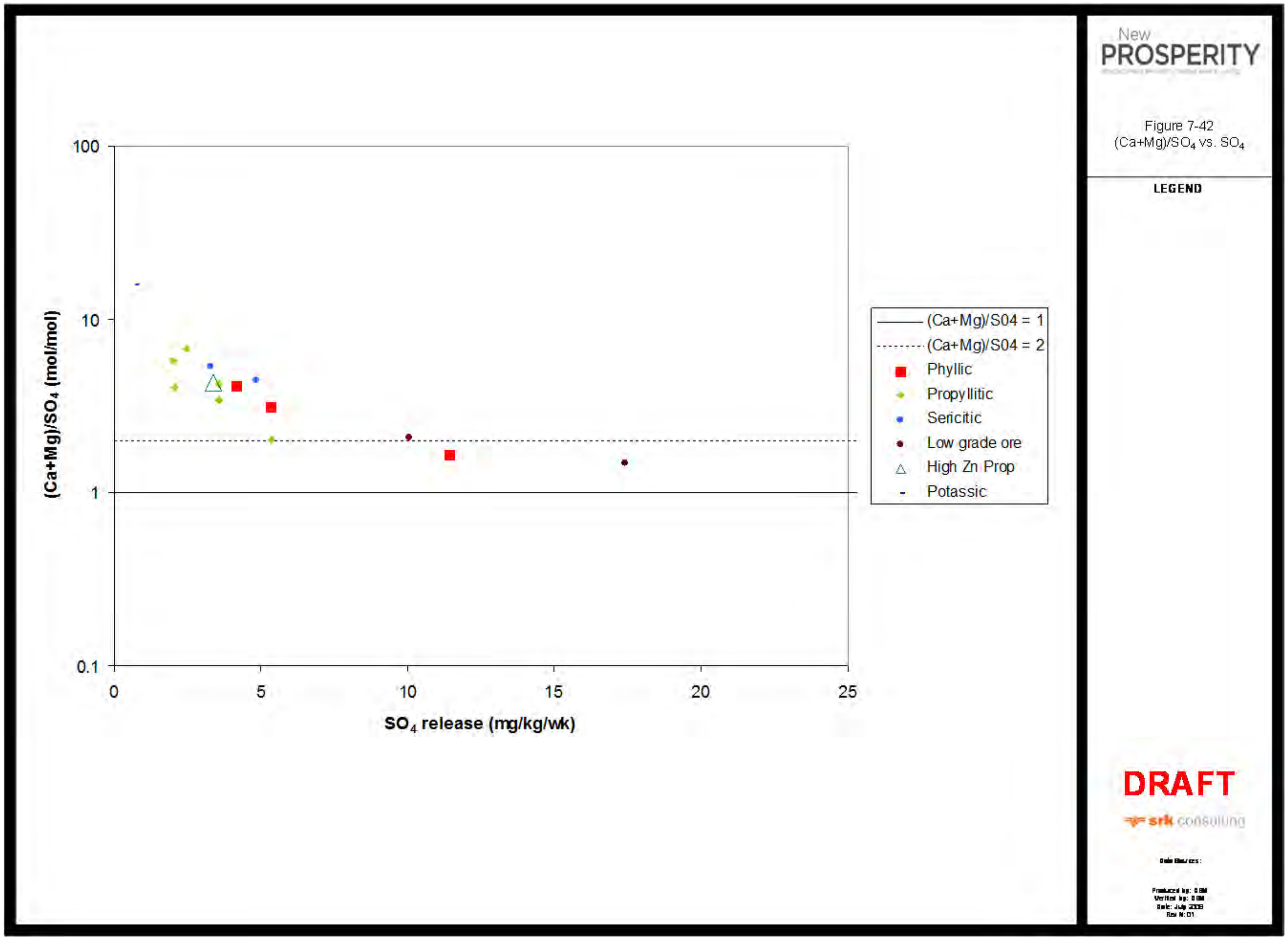


Figure 2.7.2.1-42 (Ca+Mg)/SO_4 vs. SO_4

DETERMINATION OF TIME TO ONSET

The time or delay to onset of ARD (tonset) depends on both the availability of reactive neutralization potential (i.e. carbonate content as calcium and magnesium, $IC_{Ca,Mg}$) and the rate at which reactive neutralization potential ($R_{IC,Ca,Mg}$) is depleted:

$t_{onset} = IC_{Ca,Mg}/R_{IC,Ca,Mg}$

However, the rate at which carbonate is depleted is actually a function of the acid generation (sulphide oxidation) rate (RS). In molar terms, the rate of carbonate depletion to sulphide depletion is the same as the NP/AP criterion for PAG rock ($\{IC_{Ca,Mg}/AP\}_{crit}$ indicated in the previous section:

$R_{IC,Ca,Mg}/ R_S = \{IC_{Ca,Mg}/AP\}_{crit}$

The humidity cell data indicated that rate of oxidation of sulphide is correlated with sulphide content of the rock (**Error! Reference source not found.**3- samples with high sulphate release and lower sulphide content contain gypsum). Assuming a direct linear relationship between oxidation rate and sulphur content, then

$R_S = k.AP$

where k is the slope of the line for those samples with low initial sulphate sulphur content. The non-zero intercept is not included because if no sulphide is present then the rate of sulphide oxidation is zero.

When these three relationships are combined, the delay to onset is:

$t_{onset} = (IC_{Ca.Mg}/AP)/(k.\{IC_{Ca,Mg}/AP\}_{crit})$

Therefore, the delay to onset is function of $IC_{Ca,Mg}/AP$ of the sample, the overall rate of oxidation of sulphide (k) and the effectiveness of NP utilization ($\{IC_{Ca,Mg}/AP\}_{crit}$). Longer delays are indicated for rock higher NP/AP assuming constant values for the two other factors.

A best estimate for tonset for PAG waste rock was calculated using the average k and $IC_{Ca,Mg}/AP$ as follows.

- $k = 7.18 \times 10^{-5}$ week^{-1}. This value represents the average slope of the relationship between sulphide-S and rate of oxidation (see earlier relationship between sulphate release and sulphide content). Since weathering at the site will occur under cooler conditions than the room temperature conditions used for testing, this rate constant was reduced to 23% of the lab rates based on an Arrhenius correction calculated for average site temperatures.
- $\{IC_{Ca,Mg}/AP\}_{crit} = 1.5$.

To estimate the uncertainty in the estimate of t_{onset}, a second set of constants was used ("worst case").

- k = 9.66 x 10-5 week-1. This value represents the 95th percentile of the slope of the relationship between sulphide-S and rate of oxidation.
- {ICCa,Mg/AP}crit = 2.0. This value represents the worst case for the utilization of buffering capacity.

Using the ABA database from Phase 2 and Phase 3 testing, the distribution of measured NP/AP was used to calculate the distribution of t_{onset} for PAG rock (i.e. NP/AP<1.5).

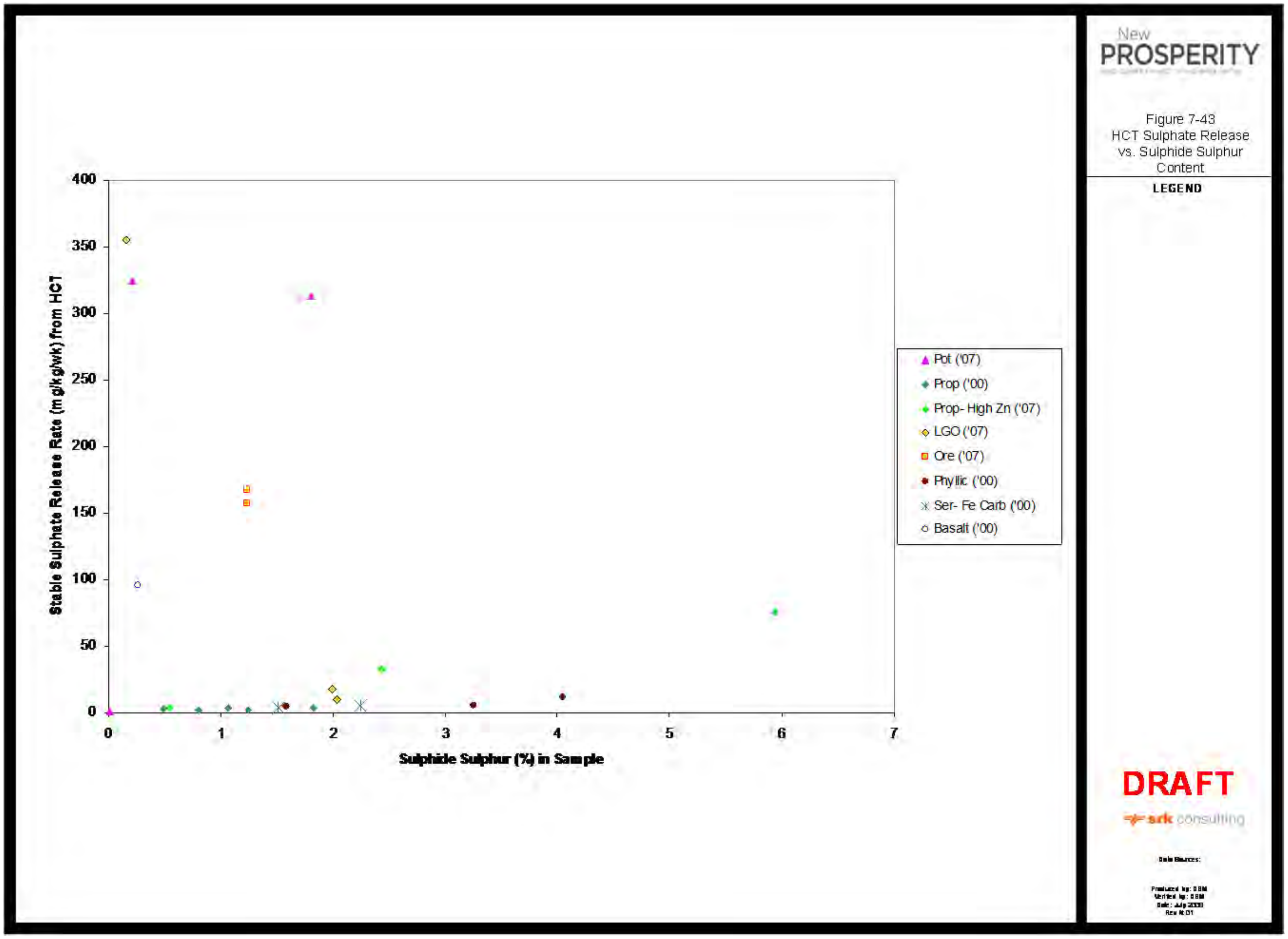


Figure 2.7.2.1-43 HCT Sulphate Release vs. Sulphide Sulphur Content

A small proportion of rock (5%) is shown as becoming acidic within 38 years (which corresponds to the maximum wall age of that portion of the pit wall below the final pit lake elevation). The ‘best estimate’ and ‘worst case’ fractions that are shown to be acidic after 38 years are similar- this shows that the calculation is not particularly sensitive to the rate of sulphide oxidation for time frames on the order of decades.

For the purpose of waste management, an estimate of acceptable exposure times is required since the PAG waste rock is being submerged. It is preferable that the rock is not acidic prior to submergence because it could contribute acidic leachate and leaching of acidic salts could contribute to the tailings impoundment acid and metal load. The criterion is therefore that any acidity is neutralized internally by interaction with the remaining alkalinity.

Taseko plans to submerge or encapsulate PAG rock within 2 years of placement in the PAG rock storage facility. The calculated distribution of tonset indicates that little of the PAG rock will generate acidic leachate in this time frame and acid that might be generated would be neutralized locally by reactive minerals in adjacent PAG rock or by excess alkalinity in the tailings pond water or pore water.

DEPLETION OF TRACE ELEMENTS UNDER ACIDIC WEATHERING CONDITIONS

One challenge in ML/ARD prediction is extrapolating acidic elemental release rates from neutral pH release rates measured in laboratory tests. This is necessary in cases such as New Prosperity where the considerable NP in most PAG materials causes laboratory testing of PAG rock to remain pH neutral for long durations.

One approach is to look to analogous cases where the transition from neutral to acidic weathering conditions has been observed. A long term humidity cell testing waste rock with low sulphate sulphur from Huckleberry Mines (SRK 2002) displayed stable acidic release rates after a long period of stable neutral pH weathering. Copper release rates increased by a factor of 680 and sulphate release increase by a factor of 5 from neutral to acidic leaching conditions.

SRK considers this test to represent an appropriate analog for New Prosperity. The copper and sulphate rate increase factors have been adopted in extrapolating pH neutral release rates from New Prosperity HCTs to estimate acidic release rates for elements and sulphate, respectively. The one exception is selenium, for which no increase in release rate has been applied since selenium mobility is not expected to increase under acidic conditions and may in fact become less mobile due to sorption of selenite ions.

Under acidic weathering conditions, rates of trace element leaching are sufficiently high that the trace element content of weathering rock is depleted over time. Calculations were carried out to estimate the time to deplete the trace element content of New Prosperity HCT samples. Calculations consisted of increasing the observed neutral release rates by a factor of 680 (described above) and determining the time required to leach the contained mass of each element.

Copper depletion times were calculated to be longer than for other trace elements due to the relatively high copper content of the test samples. The average time to deplete copper from all waste rock humidity cells was 16 years, with depletion of other trace elements generally occurring much faster.

For the purposes of estimating elemental loading for water quality predictions, it was assumed that a given volume of rock would release all trace elements at acidic rates for a duration of 16 years and then no further release would occur. This is a conservative approach, as depletion calculations indicate the total contained mass of most elements would be leached in shorter time periods; for example, the average depletion time of cadmium for all waste rock HCTs was 3 years.

The duplicate saturated rock column tests were intended to evaluate leaching of PAG waste rock under flooded conditions that will exist in the PAG rock storage facility or flooded pit walls at closure. The test material had a calculated NP/AP of 0.3, however there is considerable NP and TIC-NP and the delay to onset of acidic conditions for this sample would be greater than any operational exposure period. Therefore, the leachate from the columns provides an indication of the porewater chemistry that can be expected in the PAG storage facility. Table 2.7.2.1-14 shows the worst case values for key parameters observed in the column leachates.

211 weeks of data was collected and tests were terminated following sampling on July 27, 2011. Reproducibility between the two columns has been excellent, and the following discussion relates to the results from both tests. Porewater is represented by leachate from the bottom ports. The side ports sample the water cover, and were monitored for pH, conductivity, ORP and dissolved oxygen (DO) only.

Porewater pH stabilized around pH 7 by week 8, and varied within a range of 6.2 to 7.9 for the duration of testing; porewater pH at test termination was approximately pH 7.6. DO and ORP were substantially reduced in the porewater relative to the water cover, and generally varied within a stable range. Porewater chemistry was dominated by calcium and sulphate. Selenium and cadmium concentrations were at or near detection levels. Initial manganese concentrations up to 1.4 mg/L were observed, however these dropped below 0.8 mg/L by week 9 and continued to decline for the duration of testing (final concentrations in week 211 were below 0.00004 mg/L). Concentrations of other parameters were generally stable or declining.

Equilibrium modeling (MINTEQA2, Allison et al. 1991) of week 3 porewater from test Sub WR B indicated that gypsum was near saturation (saturation index -0.13) and that rhodochrosite (MnCO3) and tenorite (CuO) were undersaturated (SI of -0.86 and -2.8, respectively). Equilibrium concentrations of Cu and Mn were modeled to be 0.09 and 1.91 mg/L respectively. Initial column porewater chemistry was therefore likely controlled by gypsum equilibrium and kinetically limited dissolution of minerals hosting most other parameters.

Table 2.7.2.1-14 Maximum Concentrations in Subaqueous Rock Column Leachate –DRAFT

pH (min.)	Sulphate	Acidity	Alkalinity (min.)	F	Cd	Cu	Fe	Pb	Mn	Mo	Ni	Se	Zn
s.u.	mg/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
• .54	• 608	• 6	• 8 8	• .4	• .0015	• .019	• 8.1	• .0043	• .43	• .011	• .005	• .0037	• .008

SOURCE TERMS FOR SITE WATER CHEMISTRY PREDICTIONS

The following sections describe the methods by which source terms for chemical loadings from mine rock were estimated for use as inputs to the site water and load balance. These predictions address metal leaching and acid rock drainage effects and reflect predictions of dissolved concentrations and loads. Total metal loadings are not included in these predictions. Table 2.7.2.1-15 shows the kinetic tests that were used to develop the source terms.

Table 2.7.2.1-15 Test Results used in Defining Rock Source Terms – DRAFT

Rock Unit	Phase 4 Humidity Cells (1998- 2000)	Phase 5 Humidity Cells (2006-2008)	Cut-off date for Phase 5 results used in water quality prediction
Potassic	None	HC6, HC7, HC8	Update required
Sericite- Iron carbonate	K4, K5	None	n/a
Propylitic	K6, K7, K8, K11, K13, K14	HC4, HC5, HC9	Update required
Phyllic	K9, K10, K12	none	n/a
Stockpile grade ore	None	HC1, HC2, HC3	Update required
Ore	None	HC10, HC11	Update required
Tertiary basalt	K3	HC12, HC13	n/a

NON-PAG WASTE ROCK STORAGE FACILITY

Chemical loading from the non-PAG dump and the Main Embankment were estimated based on release rates from HCTs and scaled up to suit site conditions (SRK 2006). Neutral pH release rates were calculated for each alteration unit as follows:

1. Compile test results from neutral HCTs to produce average lab release rates for each alteration unit (omit cells which have gone acid, as the release rates are elevated due to low pH and are not representative of non-PAG). See Appendix 3-7-Z of the March 2009 EIS/Application for release rate compilation.

2. Scale lab rates to field rates (scaling factors: Arrhenius temperature correction (determined using the average annual baseline temperature at New Prosperity: factor of 0.23); particle size correction (factor of 0.2); contact correction (factor of 0.5) to account for incomplete flushing of secondary weathering products).

3. Apply the field rates to tonnage of rock in non-PAG dump from mine schedule. Assume final tonnage for duration of project- no reductions for only partially constructed dump in early years of schedule.

4. Check for gypsum equilibrium and adjust to reflect equilibrium control (set at 1800 mg/L sulphate and 700 mg/L Ca for modelling purposes, based roughly on equilibrium values from MINTEQA2 modelling of PAG porewater (modelled concentrations of 1616 mg/L sulphate and 652 mg/L Ca) (Allison et al., 1991).

Non-PAG dump loadings report as annual load (mg/year) to the Open Pit. The only consideration of concentrations is reduction of Ca and sulphate concentrations to reflect equilibration with gypsum.

Table 2.7.2.1-16 Summary of Waste Tonnages – DRAFT

Description	Alt Code	Non-PAG	PAG	Total	%PAG
		tonnes x 10^6	tonnes x 10^6	tonnes x 10^6	
Overburden (unconsolidated)	-	60.0	12.0	72.0	17%
Overburden (basalt)	-	31.7	-	31.7	0%
Unaltered	-	0.3	-	0.3	0%
Potassic	1000	31.6	44.6	76.2	59%
Sericite- iron carbonate	3000	7.0	5.6	12.6	44%
Propylitic	5000	26.1	138.1	164.2	84%
Phyllic	6000	5.4	37.2	42.6	87%
	Total	162	237	400	59%

Notes: -Tonnages estimated by Taseko using block models and the 830 pit shell.
-PAG defined as material having (NP-10)/AP < 2

PAG WASTE ROCK

Taseko plans to operate the PAG waste storage facility such that PAG material is inundated within 2 years of placement. The predicted time to onset of acid leaching conditions is much longer, therefore neutral pH release rates are appropriate for estimating loadings from PAG to porewater.

A combined PAG+Tailings porewater source term was derived using maximum observed concentrations from all saturated PAG and saturated tailings columns, with Cu and Mn increased to equilibrium concentrations with tenorite (CuO) and rhodochrosite (MnCO3) (MINTEQA2, Allison et al. 1991; SRK, 2006). The maximum column Cu concentration of 0.02 mg/L was increased to the modelled equilibrium Cu concentration of 0.09 mg/L; the maximum column Mn concentration of 1.43 mg/L was increased to the modelled equilibrium Mn concentration of 1.91 mg/L.

UNSATURATED PAG ROCK SOURCE TERM

Flushing from recently-placed PAG during the 2 year exposure period was estimated using neutral release rates for each alteration type from HCTs, scaled for temperature and surface area, but assuming 100% flushing (no contact correction) due to flooding of rock by tailings pond. Derivation of the unsaturated PAG rock source term is described as follows:

1. Compile bulk composition of PAG (20% Potassic, 2% Ser-Fe Carbonate, 61% Propylitic, 17% Phyllic- Table 2.7.2.1-16).

2. Using average neutral release rates calculated for each ALT type (as part of non-PAG dump prediction), calculated a bulk weighted average neutral PAG release rate.

3. Correct rate for temperature (0.23 factor (heat release by oxidation is not expected to be significant)) and particle size (0.2 factor). Assume 100% flushing due to inundation, therefore no correction for contact factor.

4. Apply bulk neutral PAG corrected release rate to exposed volume (estimate from max. footprint area on Knight Piésold drawing B04.dwg x 2 m exposed height (assumed based on discussions with Knight Piésold).

5. All load assumed to report to tailings pond (conservative- will likely be inundated/ surrounded by tailings, and soluble load will report to porewater).

ORE STOCKPILE

Stockpile grade ore samples tested in humidity cells HC1, HC2 and HC3 had NP/AP ratios of 0.9, 4.5 and 1.3, respectively. Based on the evaluation of the time delay to onset of acidic conditions, the material with NP/AP of 0.9 would be expected to maintain neutral pH conditions for hundreds of years. Therefore, the ore stockpile is expected to remain pH neutral over the 19 year period of operations.

Neutral pH release rates were calculated for ore in similar fashion to waste rock, as follows:

1. Compile test results from stockpile grade ore HCTs to produce an average lab release rates for stockpile grade ore.

2. Scale lab rates to field rates (scaling factors: Arrhenius temperature correction (factor of 0.23), particle size correction (factor of 0.2), contact correction (factor of 0.5) to account for incomplete flushing of secondary weathering products).

3. Apply the field rates to estimated contained tonnage in the stockpile grade ore stockpile at its maximum size. No reductions in calcium or sulphate load were applied to account for concentrations exceeding gypsum solubility.

4. Ore Stockpile loadings report as annual load (mg/year) to Fish Lake and to the Open Pit.

CRUSHER STOCKPILE

The ore handling plan consists of: drill and blast; load and haul to gyratory crusher; crush to <150 mm; and convey overland to crusher stockpile. On average, blasted ore will be exposed in the pit and the crusher stockpile for one month prior to milling. ABA results (Figure 2.7.2.1-37) show that there is sufficient NP in the ore to maintain pH neutral drainage conditions over the duration of exposure.

Leachate from the crusher stockpile will report to the plant site seepage control pond, which will be pumped either to the mill or directly to the TSF. Any soluble load not leached from the crusher stockpile will be dissolved during processing and will report to the TSF in the tailings slurry. Since the TSF is the ultimate receptor for all soluble load from the crusher stockpile, no reduction in annual load was applied to account for storage of secondary weathering products.

Ore stockpile loadings were therefore calculated as follows:

1. Compile test results from ore HCTs (HC10 and HC11) to produce average lab release rates for ore.

2. Scale lab rates to field rates (scaling factors: Arrhenius temperature correction (factor of 0.23), particle size correction (factor of 0.2). As noted above, no scaling factor to account for storage of secondary weathering products was applied.

3. Apply the field release rates to annual ore throughput (70 000 t/day * 365 days/year) over a 30 day period. No reductions in calcium or sulphate load were applied to account for concentrations exceeding gypsum solubility.

Check for gypsum equilibrium and adjust to reflect equilibrium control (set at 1800 mg/L sulphate and 700 mg/L Ca for modelling purposes, based roughly on equilibrium values from MINTEQA2 modelling of PAG porewater (modelled concentrations of 1616 mg/L sulphate and 652 mg/L Ca) (Allison et al., 1991).

4. Annual loadings (mg/yr) were modelled as reporting directly to Fish Lake.

PLANT SITE

To allow for chemical loads generated by the plant site during operations (in addition to ore stockpile loads), chemical release was estimated by assuming material equivalent to stockpile grade ore was present over 50% of the plant area to a depth of 0.1 m. Plant site loadings were therefore calculated as follows:

1. Adopt test results from stockpile grade ore HCTs to produce an average lab release rates for stockpile grade ore in the plant site area.

2. Scale lab rates to field rates (scaling factors: Arrhenius temperature correction (factor of 0.23), particle size correction (factor of 0.2), contact correction (factor of 0.5) to account for incomplete flushing of secondary weathering products).

3. Apply the field release rates to assumed mass of stockpile grade ore in the plant site area. No reductions in calcium or sulphate load were applied to account for concentrations exceeding gypsum solubility.

4. Annual loadings (mg/yr) were modelled as reporting directly to Fish Lake.

CRUSHER PAD

To allow for chemical loads generated by the crusher pad (the area around the primary crusher) during operations, chemical release was estimated by assuming material equivalent to stockpile grade ore was present over 100% of the crusher pad area (estimated to be 20,000 m^2) to a depth of 0.1 m. Crusher pad loadings were therefore calculated as follows:

1. Adopt test results from stockpile grade ore HCTs to produce an average lab release rates for stockpile grade ore in the plant site area.

2. Scale lab rates to field rates (scaling factors: Arrhenius temperature correction (factor of 0.23), particle size correction (factor of 0.2), contact correction (factor of 0.5) to account for incomplete flushing of secondary weathering products).

3. Apply the field release rates to assumed mass of stockpile grade ore in the plant site area. No reductions in calcium or sulphate load were applied to account for concentrations exceeding gypsum solubility.

4. Annual loadings (mg/yr) were modelled as reporting directly to Fish Lake.

ROAD CONSTRUCTION ROCK

To account for chemical loads generated by rock and overburden material used for road construction, chemical release was estimated by assuming that 100% of road materials consisted of basalt (BSLT). Loadings from mine roads were therefore calculated as follows:

1. Adopt test results from BSLT HCT (HC12) to produce an average lab release rates for typical BSLT.

2. Scale lab rates to field rates (scaling factors: Arrhenius temperature correction (factor of 0.23), particle size correction (factor of 0.2), contact correction (factor of 0.5) to account for incomplete flushing of secondary weathering products).

3. Apply the field release rates to assumed mass of material required for road construction (approximately 6 million tonnes). No reductions in calcium or sulphate load were applied to account for concentrations exceeding gypsum solubility.

4. Annual loadings (mg/yr) were modelled as reporting directly to Fish Lake.

TERTIARY AND QUATERNARY OVERBURDEN AND ROCK STOCKPILES

Tertiary and Quaternary materials were tested in Phase 2 and Phase 3 for ABA properties, but no leach extraction data was available. Initially, the background runoff quality (routine monitoring station W1) was adopted as a proxy for overburden runoff quality.

As part of Phase 5 in Fall 2007, samples were collected from 3 test pits and one drill hole. These samples were subjected to 3:1 shake flask extractions. Leachates were neutral to slightly alkaline, with generally low extractable metal load. Elements that were present in somewhat elevated leachable quantities were Cu (for most samples) and As, Mn, Mo, and Se for selected samples. Most of the samples with elevated leachable loads were sourced from the drill hole (Figure 2.7.1.2-30) rather than the shallow test pits, with the drill hole being located to target the underlying near-surface ore deposit.

LEACHING OF RESIDUAL BLASTING AGENTS

Add source term description here.

Reference Ferguson and Leask (1988) and Matts et al. (2007).

OPEN PIT CHARACTERIZATION

Pit development will take place in four phases, with the ultimate pit wall being exposed in the fourth and final phase. The Phase 4 pit shell designed by Taseko is referred to as the 830 pit, and it is this ultimate pit shell that was used as an input to the assessment of pit water chemistry.

The mining schedule developed by Taseko is shown on Figure 2.7.2.1-45, and shows the timing of the development of the Phase 4 pit wall. For the purposes of the pit water chemistry assessment, it was assumed that the final pit wall for a given bench was entirely developed in the first year that Phase 4 mining occurred at that elevation.

A pit wall map was generated with the GEMS 6.1 software package using the 830 pit shell and the alteration block model provided by Taseko (Figure 2.7.2.1-46). From the wall map, the exposed surface area of each alteration unit was calculated in 5 m vertical increments (Figure 2.7.2.1-47). Volume and tonnage of each alteration unit with elevation were calculated by applying a thickness of 2 m to the calculated surface area (this represents over-blast and sub-grade placement), and by applying an in-situ specific gravity of 2680 kg/m^3 to the wall rock (Smyth, 2008, pers. comm.).

The open pit portion of the site-wide water and load balance was modelled in GoldSim. Element and sulphate loads were modelled using the release rates for each alteration type and for Tertiary basalt. Loadings from unconsolidated overburden exposed in the upper portions of the final pit wall were conservatively assumed to occur at the release rates for Tertiary basalt. This series of model calculations yielded an estimate of annual soluble load produced by exposed pit walls.

During the dewatering phase (Year 0 through Year 16), the model was set up to allow 50% of the load generated each year to be flushed to the pit sump, and 50% to be stored. During dewatering, this flushed load will report to the mill and subsequently to the TSF via tailings discharge. Pit groundwater inflows were assigned an average chemistry from baseline monitoring of groundwater wells in the vicinity of the pit.

Exposure of the final pit wall does not start until Year 6 of the schedule. For the purposes of approximating pit water chemistry in these initial years, it was assumed that the full Year 6 wall was exposed and contributing load from Year 0 through Year 6. For Year 7 through Year 16, the cumulative rock mass exposed above the lowest exposed Phase 4 elevation was used to estimate the annual load generated.

Beginning in Year 17, mining will be complete and the pit will be allowed to flood. During the flooding phase, stored oxidation products in fractured rock in the pit walls would be dissolved by the rising pit lake waters, and the effects of this dissolution process were modelled by adding the entire stored load to the pit lake in Year 17. For the period of filling (Year 17 through Year 44), the entire annual load was added to the pit lake, with no allowance for storage of soluble weathering products, to maintain a simple approach to calculating annual loads during this period of decreasing wall exposure. This approach is considered conservative, as chemical loads to the pit lake will be overestimated during the period. Beginning in Year 45, a storage factor of 50% was applied to the release rates to account for incomplete flushing of weathering products within the wall rock and bench talus in the highwall.

Pit filling is expected to span the period from Year 17 to Year 44, with the final pit lake surface elevation controlled by the low point in the pit rim at 1440 m. At the time of initial surface discharge, the oldest portion of the final pit wall above 1440 m will have been exposed for approximately 38 years.

ABA block modelling indicated that approximately 69% of the waste rock is PAG, and it is conservatively assumed that the highwall contains PAG and non-PAG rock in the same proportions as the bulk waste (Table 2.7.2.1-16). Estimates of time to onset of acidic conditions indicate that it is unlikely that significant PAG material will generate acid during the 38 year period between exposure and flooding (**Error! Reference source not found.**2.7.2.1-44), and therefore exposed wall rock below 1440 m is assumed to remain neutral during the period of exposure.

To assess long term loads to the pit lake, PAG rock exposed in the highwall was modelled as generating acidic runoff and related increased metal loads beginning in Year 45 (i.e. immediately following establishment of the lake surface at 1440 m). Estimates of 'time to onset' of acidic conditions, together with estimates of depletion of contained sulphides and metals, showed that a maximum of 3% of the PAG rock would be acidic and leaching metals at peak rates at any given time, and that this maximum would occur from schedule years 136 to 327. To maintain a conservative approach to prediction, the maximum predicted amount of acidic PAG was assumed to be present in the walls from Year 45 on.

To account for increased loadings under acidic conditions, the neutral and acidic pH leachate concentrations observed in humidity cell HC4 were used to develop scaling factors for each predicted parameter. HC4 transitioned from early neutral pH conditions to later acidic pH conditions, with pH dropping below pH 6 following week 43; average neutral pH concentrations were calculated using results from Week 5 through Week 43, and maximum concentrations observed subsequent to Week 43 were adopted as estimates of concentrations under acidic conditions.

SOURCE TERM FOR SITE WATER CHEMISTRY PREDICTIONS

Potassic, sericite- iron carbonate, propylitic, and phyllic alteration units where assigned the source terms (as release rates in mg/kg/yr) derived for each unit in the waste rock assessment. A neutral pH release rate and an acidic pH release rate were estimated for each alteration unit. Tertiary basalt and overburden were treated in the same manner to estimate loading from each material type to the pit lake. Only neutral pH release rates were estimated for Tertiary basalt and overburden.

As the open pit will be the furthest downgradient component of the mine site, development of a water chemistry estimate required consideration of a number of load sources external to the pit itself. For this reason, pit water chemistry estimates are discussed in with the overall site water and load balance.

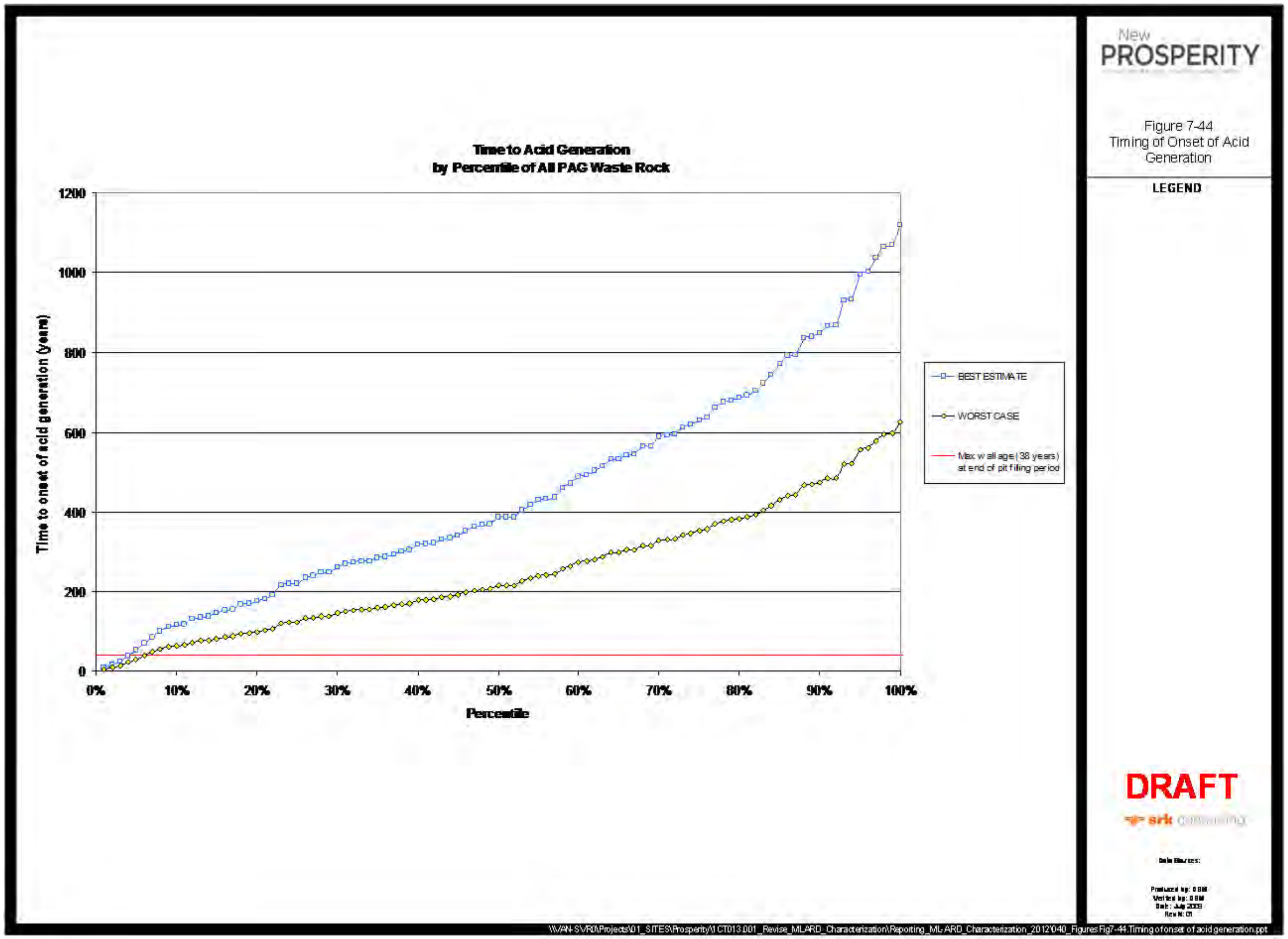
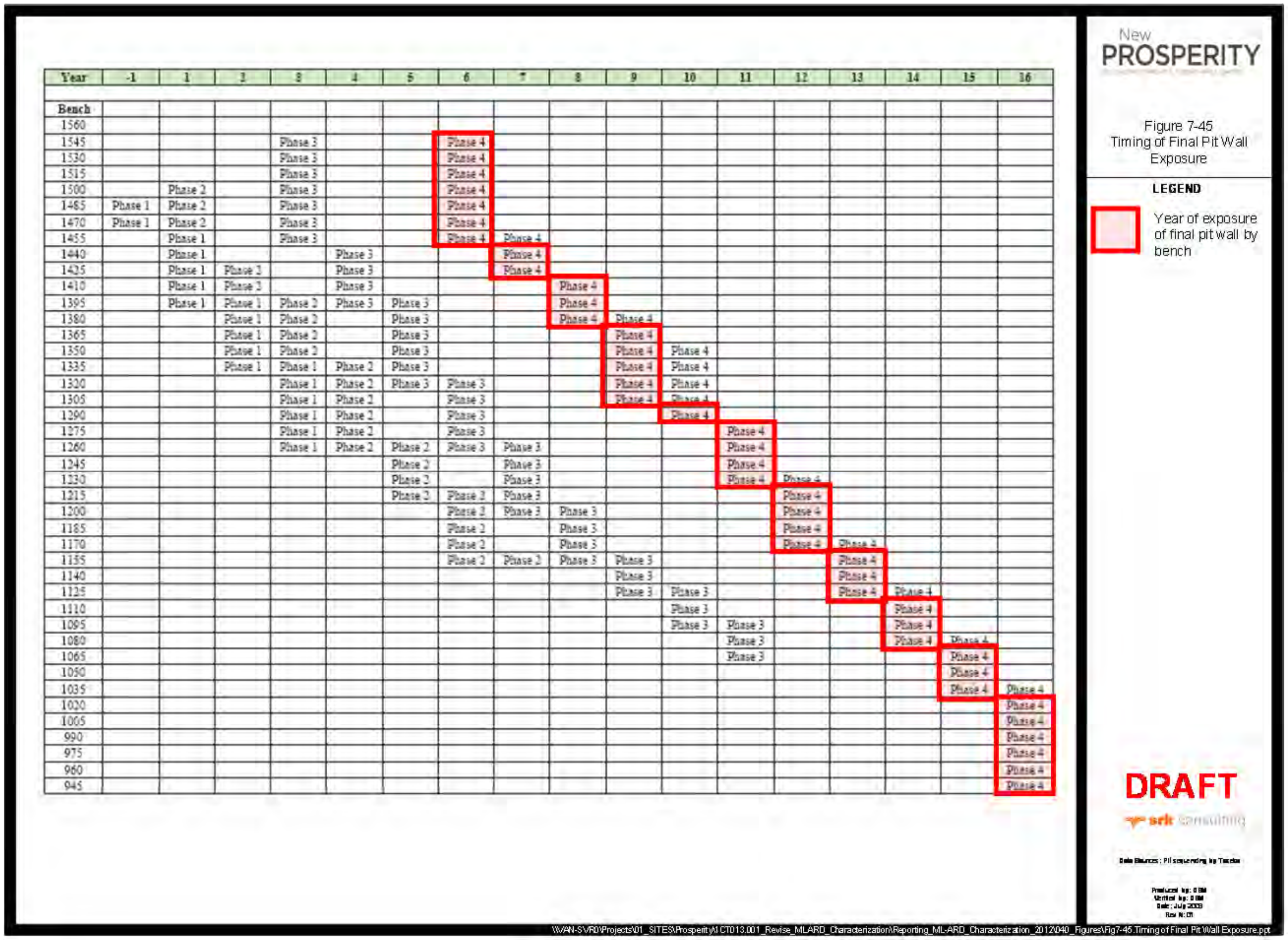


Figure 2.7.2.1-44 Timing of Onset of Acid Generation



Year	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Bench																	
1560																	
1545				Phase 3			Phase 4										
1530				Phase 3			Phase 4										
1515				Phase 3			Phase 4										
1500		Phase 2		Phase 3			Phase 4										
1485	Phase 1	Phase 2		Phase 3			Phase 4										
1470	Phase 1	Phase 2		Phase 3			Phase 4										
1455		Phase 1		Phase 3			Phase 4	Phase 4									
1440		Phase 1			Phase 3			Phase 4									
1425		Phase 1	Phase 2		Phase 3			Phase 4									
1410		Phase 1	Phase 2		Phase 3				Phase 4								
1395		Phase 1	Phase 1	Phase 2	Phase 3	Phase 3			Phase 4								
1380			Phase 1	Phase 2		Phase 3			Phase 4	Phase 4							
1365			Phase 1	Phase 2		Phase 3				Phase 4							
1350			Phase 1	Phase 2		Phase 3				Phase 4	Phase 4						
1335			Phase 1	Phase 1	Phase 2	Phase 3				Phase 4	Phase 4						
1320				Phase 1	Phase 2	Phase 3	Phase 3			Phase 4	Phase 4						
1305				Phase 1	Phase 2		Phase 3			Phase 4	Phase 4						
1290				Phase 1	Phase 2		Phase 3				Phase 4						
1275				Phase 1	Phase 2		Phase 3					Phase 4					
1260				Phase 1	Phase 2	Phase 2	Phase 3	Phase 3				Phase 4					
1245						Phase 2		Phase 3				Phase 4					
1230						Phase 2		Phase 3				Phase 4	Phase 4				
1215						Phase 2	Phase 2	Phase 3					Phase 4				
1200							Phase 2	Phase 3	Phase 3				Phase 4				
1185							Phase 2		Phase 3				Phase 4				
1170							Phase 2		Phase 3				Phase 4	Phase 4			
1155							Phase 2	Phase 2	Phase 3	Phase 3				Phase 4			
1140										Phase 3				Phase 4			
1125										Phase 3	Phase 3			Phase 4	Phase 4		
1110											Phase 3				Phase 4		
1095											Phase 3	Phase 3			Phase 4		
1080												Phase 3			Phase 4	Phase 4	
1065												Phase 3				Phase 4	
1050																Phase 4	
1035																Phase 4	Phase 4
1020																	Phase 4
1005																	Phase 4
990																	Phase 4
975																	Phase 4
960																	Phase 4
945																	Phase 4

Figure 2.7.2.1-45 Timing of Final Pit Wall Exposure

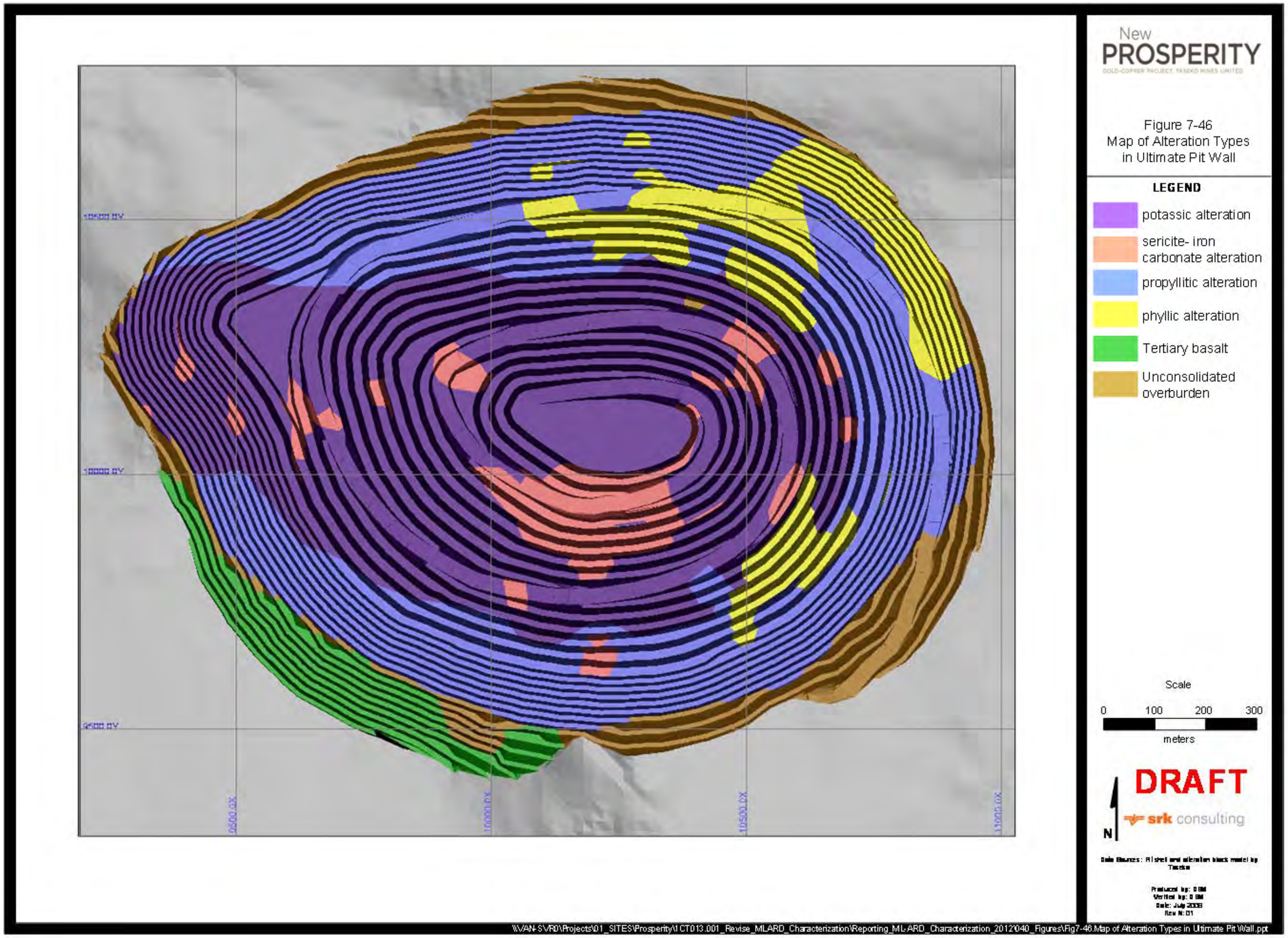


Figure 2.7.2.1-46 Map of Alteration Types in Ultimate Pit Wall

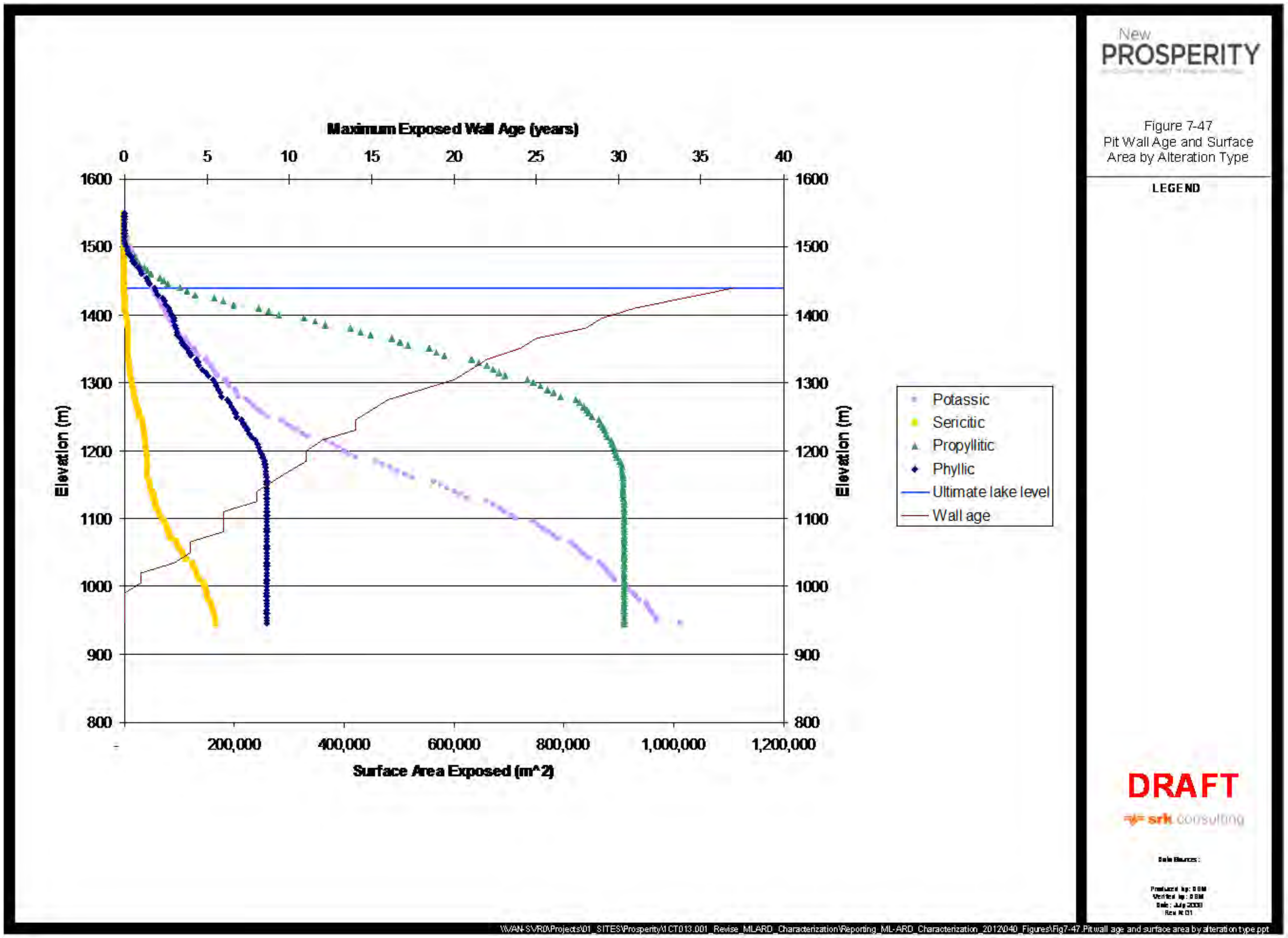


Figure 2.7.2.1-47 Pit Wall Age and Surface Area by Alteration Type

TAILINGS CHARACTERIZATION

New Prosperity ore will be processed by crushing, grinding, and flotation to produce gold-copper concentrates. An initial bulk sulphide flotation step will produce a rougher concentrate and rougher tailings. Cleaning of the rougher concentrate will result in a final copper concentrate and a stream of cleaner tailings. Flotation residues will be combined into a single bulk tailings stream for disposal in the TSF. The main processing reagent of geochemical interest is lime, which regulates pH.

Taseko plans to place bulk tailings in a purpose-built impoundment in the upper Fish Creek valley. As shown on Figure 2.7.2.1-2, the impoundment will require construction of embankments across the valley (the Main Embankment and the South Embankment) and along a portion of the ridge that forms the southwest boundary of the Fish Creek valley (the West Embankment).

Tails will be deposited by spigotting from the embankments. This process will develop a coarser-grained, unsaturated tailings beach that slopes from the embankments to the opposite side of the TSF. The beach will transition into a pond towards the southeast end side of the facility, and in closure outflow from this pond will report to Lower Fish Creek via an engineered spillway in the Main Embankment. Tailings seepage will report downgradient of all three embankments.

The following sections describe the tailings ML/ARD test work that was considered in the design of the TSF and that informs water chemistry predictions for seepage and surface water leaving the TSF.

PREVIOUS TAILINGS CHARACTERIZATION PROGRAMS

Metallurgical test work on samples of New Prosperity ore was carried out by Lakefield Research Ltd. under the supervision of Melis Engineering Ltd. in 1992 and 1993 (Hallam Knight Piésold, 1993; Melis, 1994; Watermark, 1997) as discussed for ore. A parallel program of ABA testing and elemental analysis was carried out for both ore samples and flotation tailings residues from the metallurgical test work.

Twenty-four composite samples from up to 200 m intervals in individual diamond drill holes were subjected to batch flotation tests. Vertical and lateral deposit-scale variability was tested by carrying out locked cycle tests nine composites prepared from the eight individual drill hole composites from each of the upper, middle, and lower zones of the deposit. The Phase 1 feed samples were composited as catalogued in Appendix 3-7-AA of the March 2009 EIS/Application.

ABA tests on both feed and tailings samples were carried out by Min-En Laboratories, Vancouver, B.C. Analytical methods are not known. Sulphur analysis included total and sulphate-sulphur determinations, and AP is based on sulphide-sulphur calculated by difference. The Sobek method is assumed to have been used for NP determination.

Min-En also conducted the elemental analyses of the feed samples, with major elements determined by whole rock analysis and trace elements determined by ICP (digestion not specified- aqua regia assumed). Elemental analyses of the locked cycle tailings samples were conducted by Saskatchewan Research Council- methods are not known, but are assumed to be similar to those employed by Min En for feed samples.

Taseko carried out a metallurgical testing program in July and August of 1997 at Lakefield Research Limited. The program was overseen by Melis Engineering, and included locked cycle and pilot plant testing on three composite ore samples representing the upper, middle and lower portions of the deposit.

Phase 3 pilot plant samples were composited from half core intervals that were retained after sawing core lengthwise and shipping one half of the sawn core for analysis. Appendix 3-7-BB of the March 2009

EIS/Application lists the core intervals that comprised the upper (HCU), middle (HCM), and lower (HCL) samples. ABA and elemental analysis were carried out on ore feed and tailings samples for each of the pilot plant samples.

ABA tests on both feed and tailings samples were carried out by Lakefield Research Ltd. using a method equivalent to the Modified ABA procedure (MEND, 1991). Elemental analyses of both feed and tailings samples were conducted by Saskatchewan Research Council by ICP-MS (digestion not specified-assumed to be aqua regia as it was commonly in use at the time).

2006-2008 TAILINGS CHARACTERIZATION PROGRAM

Previous phases of testing had not characterized the kinetic weathering characteristics of New Prosperity tailings. In order to produce tailings samples for kinetic testing, a program of sampling and batch flotation was carried out.

Twenty-two ore grade intervals from nine 1991 and 1992 drill holes were collected from archived core during the December 2006 sampling round described. These older ore grade intervals were collected because no ore grade intervals from the more recent drilling were available due to having been consumed in the Phase 3 metallurgical program.

Ore samples were shipped to G&T Metallurgical Services Ltd. (G&T) of Kamloops B.C. Taseko reviewed the available ore intervals and prepared compositing instructions to G&T to achieve a typical ore composite. The core intervals selected for the composite and the recommended mass proportions of each are listed in Appendix 3-7-CC of the March 2009 EIS/Application.

G&T prepared a single master composite ore sample using the proportions of available core listed in Appendix 3-7-CC of the March 2009 EIS/Application. A split of this master composite was reserved for kinetic testing. The remainder of the master ore composite was consumed in a series of batch flotation tests carried out specifically to generate tailings for ML/ARD testing. The rougher and cleaner tails were maintained as separate products, and the entire mass of residue was delivered to CEMI for further testing.

MINERALOGICAL CHARACTERIZATION

Mineralogical analysis was conducted on separate cleaner and rougher tails that were produced from bench-scale flotation tests. The rougher and cleaner scavenger tails were each subjected to mineralogical analysis by optical microscopy, quantitative x-ray diffraction with Rietveld refinement (QXRD), and determination of carbonate mineral species by electron microprobe, as described for rock samples earlier.

STATIC TESTING

ABA testing and elemental analysis were conducted by CEMI on separate cleaner and rougher tails, and on the combined tailings product. ABA tests were carried out following the Modified ABA method (MEND, 1991) and elemental analyses were carried out by aqua regia digestion followed by ICP-MS finish.

TAILINGS KINETIC TESTING

All Phase 5 kinetic testing was carried out by CEMI.

Duplicate humidity cell tests (HC A and HC B) were carried out on combined tailings to provide information on primary rates of release for tailings weathering products. The tailings HCTs were constructed and operated according to the MEND humidity cell testing protocol (MEND, 1991) for a period of 211 weeks. One kilogram of tailings was tested in each of the humidity cells.

Duplicate unsaturated column leaching tests (Unsat Column A and Unsat Column B) were conducted to provide a better understanding of how tailings in the unsaturated beach will weather, and what the chemistry of infiltrating water will be. Columns were constructed of Plexiglas pipe with an inner diameter of 10cm and a length of 46 cm, and sample material was supported by a perforated PVC disk overlain by nylon mesh. The duplicate columns were charged with 4.2 kg (dry weight) of combined tailings, which resulted in a sample depth of 37 cm. Columns were operated in the vertical position by trickle leaching with 230 to 500 mL of deionized water on a weekly cycle for a period of 211 weeks.

Duplicate saturated column leaching tests (Sub A and Sub B) were conducted to provide a better understanding of the chemistry of tailings porewater and overlying pond water. Saturated tailings columns were of identical construction to the saturated waste rock columns (17 cm diameter x 61 cm long Plexiglass tubing with a PVC and nylon base). Monitoring ports were located in the base of the column and in the side of the column to sample the water cover. The duplicate saturated columns were each charged with 5 kg (dry weight) of tailings, for a total tailings depth of 16.5 cm.

The saturated columns were initially filled with deionized water to a height of 30 cm above the tailings surface. Operation consisted of withdrawing only sufficient water for analyses from the bottom port and the side port, and by making up for water lost by adding an appropriate amount of deionized water to the water cover on a weekly basis. The water cover was circulated to ensure oxygen concentrations did not become depleted at the tailings interface. The duration of testing was 211 weeks.

RESULTS AND INTERPRETATION

The complete results of the optical microscopy investigation are provided in Appendix 3-7-J of the March 2009 EIS/Application.

Inspection of the cleaner tailings sample thin section (Sample 1961-02 Cu Cleaner) indicated pyrite, quartz, white mica and carbonates as the major mineral constituents of the sample, with pyrite making up approximately 25% of the sample by visual estimation. Pyrite grains were noted to be liberated and subangular. Traces of chalcopyrite were noted as small (<50 µm) liberated grains. No other sulphide minerals were identified. Gypsum was the only major non-sulphide host mineral reported, with a QXRD-reported abundance of 1.8% by weight. The sample was noted to display moderate reaction with dilute HCl.

Inspection of the rougher tailings sample thin section (Sample 1961-02 Cu Ro) indicated quartz, white mica, feldspars, carbonates, and chlorite as the major mineral constituents of the sample. Pyrite and chalcopyrite were noted as trace constituents, occurring as very fine (<50 µm) liberated grains, and a single liberated hematite grain with a core of pyrite was observed. No other sulphide minerals were identified. The sample was noted to display strong reaction with dilute HCl.

Results of tailings sample evaluation by quantitative X-ray diffraction with Rietveld refinement (QXRD) are shown. The accuracy of the QXRD method is low for minerals which make up less than 1% of the sample. However the technique is useful in defining the major mineral species present. The QXRD results generally confirm the thin section observations, with the cleaner tailings sample reporting 22.7% pyrite. Carbonate minerals identified in both samples consisted of calcite, dolomite, and ankerite with a combined total of >8% by weight for both samples. A minor amount of siderite (0.5%) was noted in the rougher tailings. The complete QXRD results can be found in the mineralogical characterization report in Appendix 3-7-J of the March 2009 EIS/Application.

Electron microprobe analysis (EMPA) results shed further light on the carbonate mineralogy of the tailings samples. Fifteen grains in the cleaner tailings polished thin section were probed, with 13 being identified as dolomite and two identified as calcite. Twenty-five grains in the rougher tailings polished thin section were probed- 15 were determined to be dolomite, six were determined to be calcite, and four were determined to be siderite. Figure 2.7.2.1-48 displays the EMPA results on a ternary diagram that shows the range of carbonate minerals identified. The complete EMPA results can be found in Appendix 3-7-M of the March 2009 EIS/Application.

ABA results for tailings from Phases 1, 3, and 5 had sulphide sulphur contents that ranged from 0.03 to 1.09%, and associated AP values between 0.9 and 34 kg $CaCO_3$/tonne. Modified NP and Sobek NP values ranged from 31 to 97 kg $CaCO_3$/tonne. Appendix 3-7-DD contains complete ABA analyses for Phase1, Phase 3, and Phase 5 tailings characterization, and results of all three phases of testing are summarized in Table 2.7.2.1-17.

Total inorganic carbon (TIC) was measured in Phase 3 and Phase 5 testing only. Figure 2.7.2.1-49 shows a plot of NP against TIC-NP. For all samples tested, TIC-NP exceeds NP, which indicates that some of the carbonate minerals contain iron and manganese. These results show that it is appropriate to use NP rather than TIC-NP as a measure of available neutralization potential, as was found for the deposit host rocks.

Figure 2.7.2.1-50 shows a plot of tailings NP and AP for all three phases of testing. The following points summarize key geochemical observations.

- Phase 1 batch flotation tailings display a wide range of NP values (31 to 97 kg $CaCO_3$/t). The reflects the nature of the source materials- individual drill hole composites from 24 different regions of the deposit were tested.
- Phase 1 batch flotation tails have a lower median AP than other samples tested. This may reflect poor performance of the batch cleaner stage, which would result in a higher percentage of pyrite reporting to concentrate and a lower AP value in the resulting tails.
- Phase 1 locked cycle tails display a narrower range of NP values than the Phase 1 batch flotation tails, however the median value is similar. This reflects the composite nature of the locked cycle feed, and shows that Phase 1 batch and locked cycle NP values are consistent.
- Phase 1 locked cycle tails have a higher median AP than the Phase 1 batch flotation tails, possibly reflecting higher pyrite removal in the locked cycle cleaner stage.
- Phase 3 locked cycle and pilot plant tests were conducted on splits of the same sample, however the ABA results show that the two methods did not yield a geochemically uniform tailings product. The pilot plant test conducted on the intermediate depth sample (PP6) had a NP/AP ratio of 1.5 (the lowest of all samples tested).
- The single Phase 5 batch flotation tails sample had a higher NP/AP ratio than all Phase 3 tails and most of the Phase 1 locked cycle tails. The Phase 5 sample had a NP of 60 kg $CaCO_3$/t (slightly above the median of Phase 1 and 3 locked cycle and pilot plant samples). However, similar to the Phase 1 batch flotation tests, AP for the Phase 5 sample was lower than for most Phase 1 and Phase 3 locked cycle/ pilot plant tails.

ABA tests were also carried out on the separate Phase 5 rougher and cleaner tails. Results are tabulated in Table 7.21. The cleaner tails returned a sulphide sulphur content of 10.9% and a NP/AP ratio of 0.2, indicating that the cleaner tails were PAG. The rougher tails returned a sulphide sulphur content of 0.15% and an NP/AP ratio of 16.7, indicating that a separate rougher tailings product would be non-PAG.

Of the tailings tested, the characteristics of the Phase 3 pilot plant tails are considered to the best approximation of the future mill tailings product. Based on NP/AP values of 3, 1.5, and 2.8 for the upper, middle, and lower pilot plant tailings, respectively, it is expected that the bulk tailings will be non-PAG.

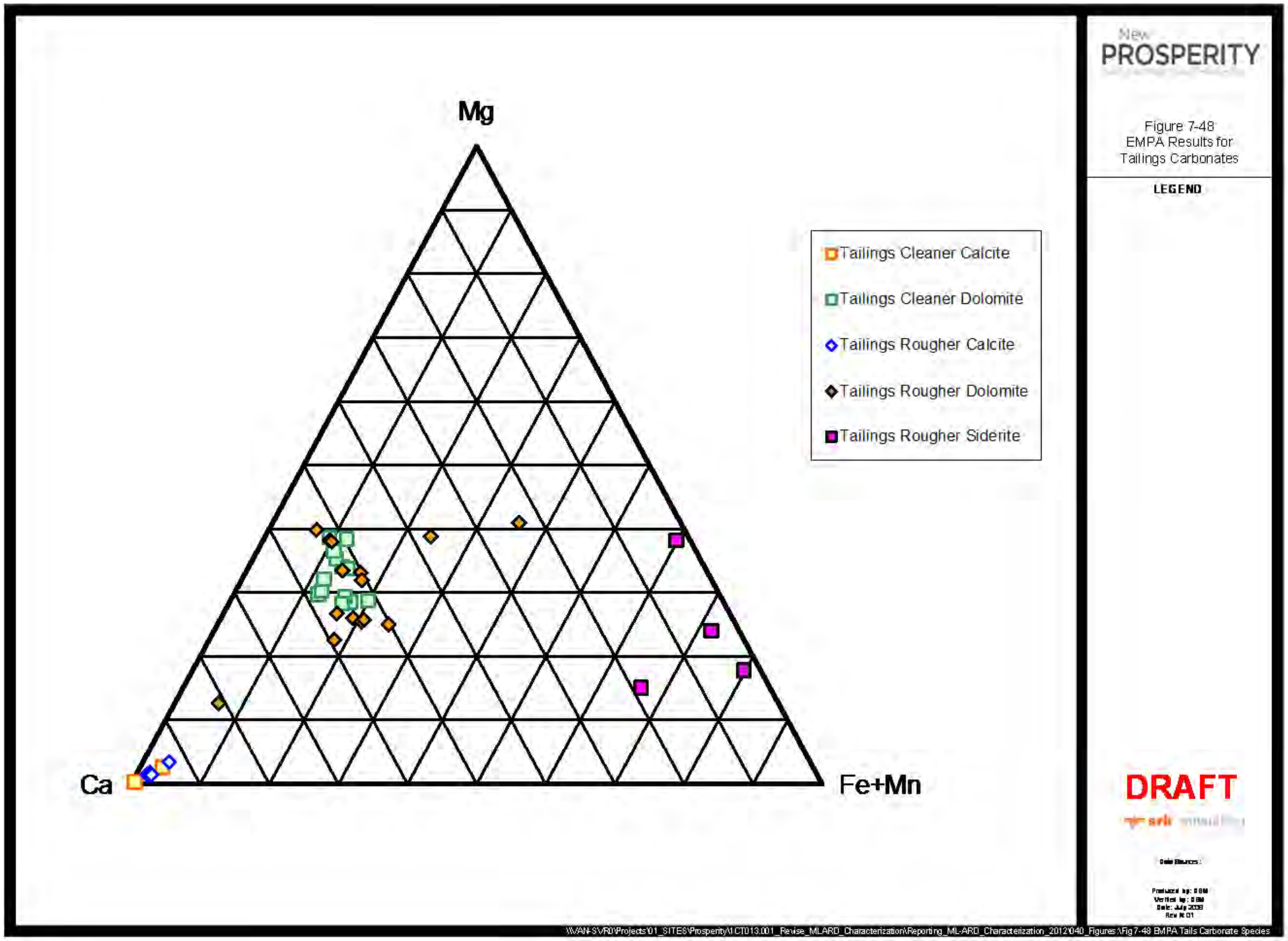


Figure 2.7.2.1 48 EMPA Results for Tailings Carbonates

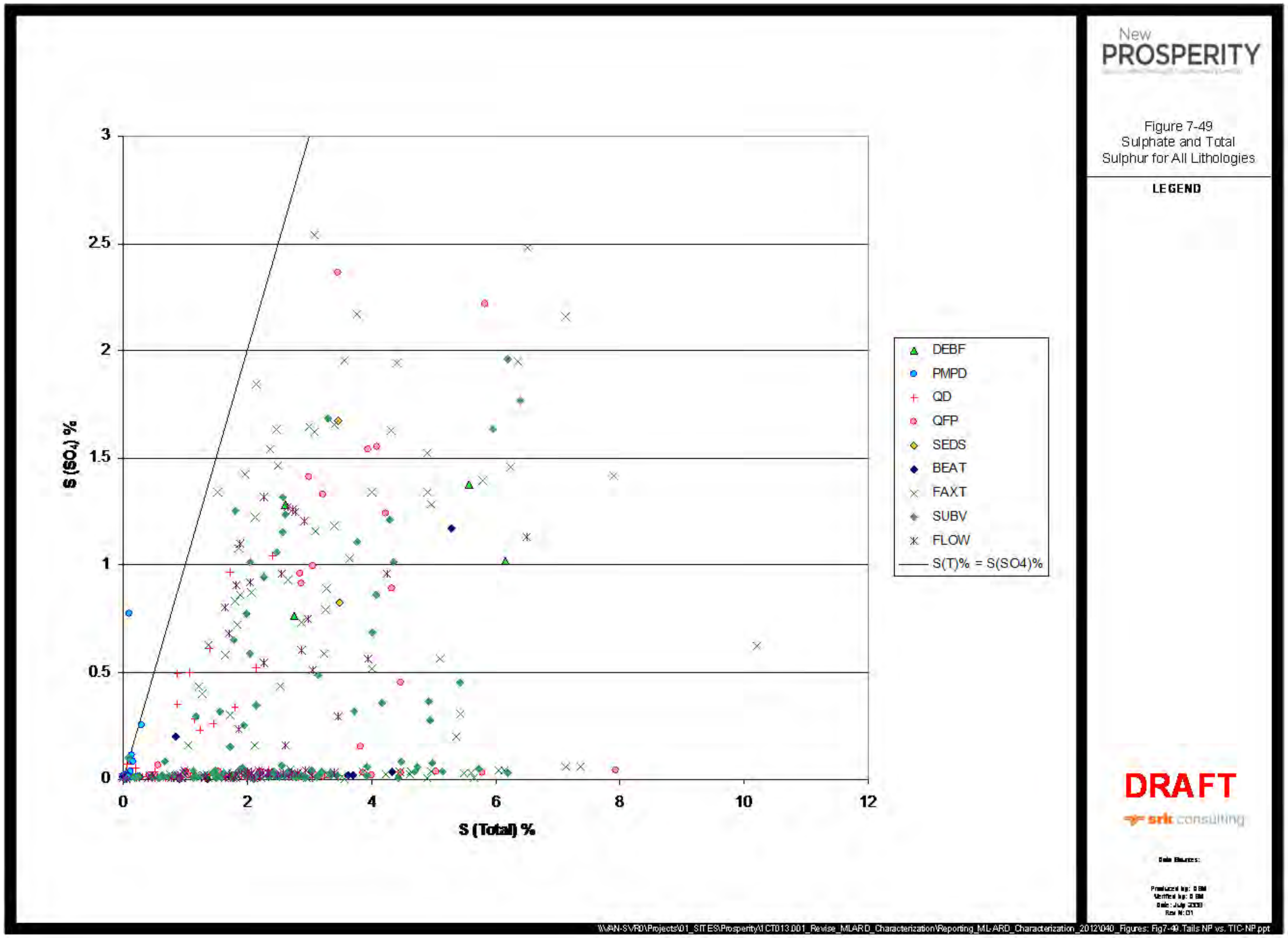


Figure 2.7.2.1-49 Sulphate and Total Sulphur for All Lithologies

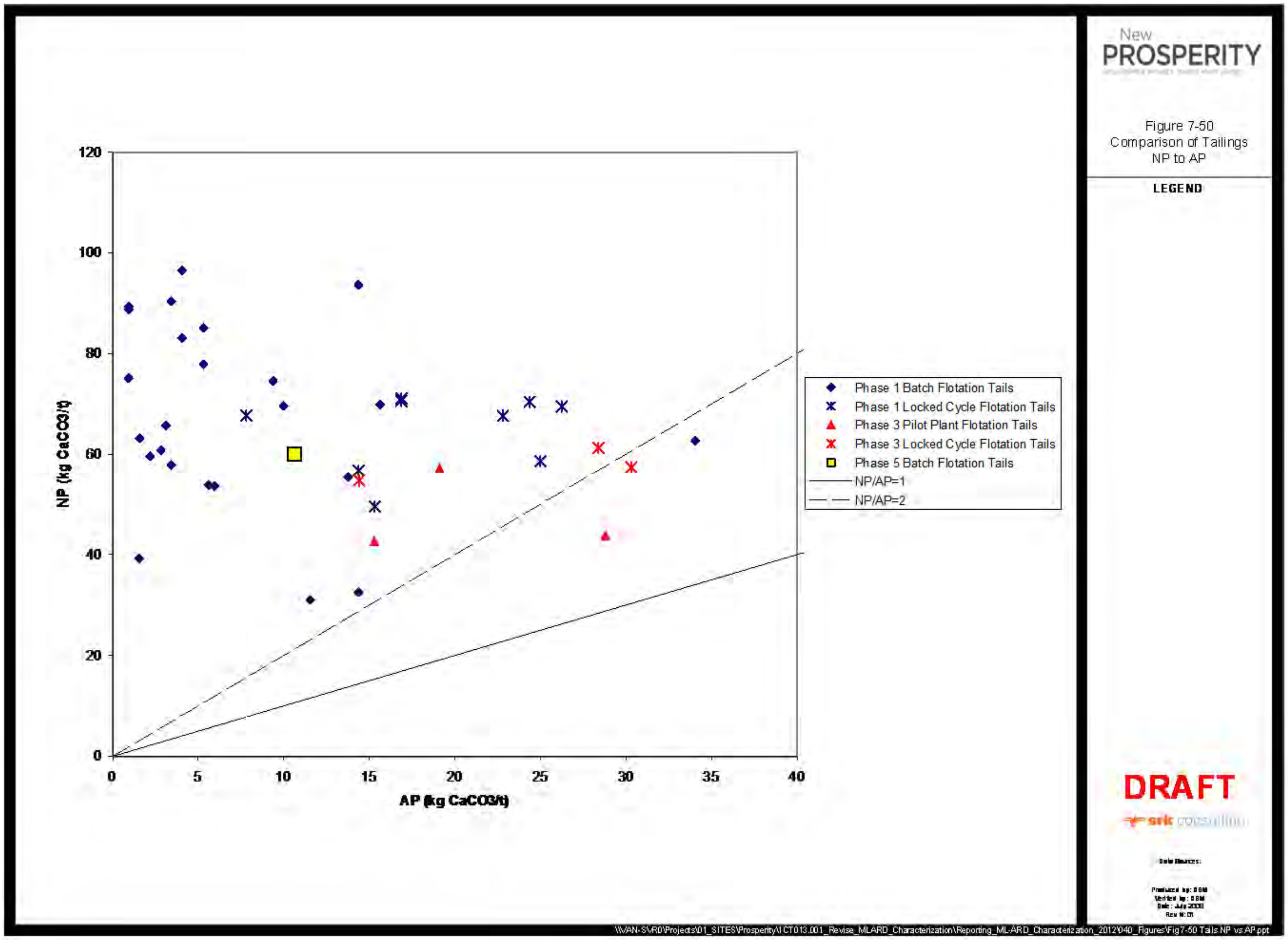


Figure 2.7.2.1-50 Comparison of Tailings NP to AP

Results of elemental analysis of Phase 1, Phase 3, and Phase 5 tailings are shown.

The Phase 1 locked cycle tailings contained 240 to 390 ppm copper. The Phase 3 pilot plant tailings contained a narrower range of copper concentrations (280-310 ppm). The Phase 5 batch flotation tailings had a higher copper concentration (364 ppm) than any of the Phase 1 or Phase 3 samples, possibly due to partial oxidation of the drill core used as feed for Phase 5 testing.

As Phase 5 tailings were subjected to humidity cell and column testing, it is useful to compare Phase 5 elemental concentrations with those determined for the Phase 3 pilot plant tailings, as the pilot plant tailings are considered the best approximation of tailings that will be produced by the full-scale plant. In addition to having higher copper content, the Phase 5 tailings had higher Mn, Ni, Se, and Zn than all three pilot plant tails, and Phase 5 Mo content was the same as the highest Mo content measured for Phase 3 tails. Phase 3 samples had Cd content below detection (0.5 ppm) while the Phase 5 sample had a Cd content of 0.36 ppm, which was lower than the limit of detection for the Phase 3 testing.

Elements present in lower concentrations in the Phase 5 tails include B, Ba, Bi, Co, Cr, Ga, Hg, Th, Tl, U and V. Other elements in Phase 5 samples were within the concentration ranges measured for Phase 3, including As, Mo, Pb and Sb.

In summary, the Phase 5 tailings samples had higher concentrations of several elements and similar or lower concentrations of several others when compared to Phase 3 pilot plant tailings. The Phase 5 tailings that are being tested in humidity cells and leaching columns are considered to be an acceptable proxy for full scale tailings from the Project in terms of overall metal content.

Table 2.7.2.1-17 Summary of Tailings ABA Results – DRAFT

Sample ID	Year	Process Type	Level	Paste pH	CO_2 %	$CaCO_3$ NP	S(T) %	S (SO_4) %	S (S2-) %	APa (kg $CaCO_3$/ t)	NPb	Net NPc	Fizz Test	NP/ AP	TIC-NP/ AP
AL98	1993	Batch	Lower	-	-	-	0.72	-	0.46	14	94	79	-	6.5	-
BL54	1993	Batch	Lower	-	-	-	0.52	-	0.3	9	75	65	-	8.0	-
CL37	1993	Batch	Lower	-	-	-	0.68	-	0.09	3	61	58	-	21.6	-
DL85	1993	Batch	Lower	-	-	-	0.34	-	0.19	6	54	48	-	9.0	-
EL02	1993	Batch	Lower	-	-	-	0.32	-	0.03	1	75	74	-	80.1	-
FL19	1993	Batch	Lower	-	-	-	0.23	-	0.03	1	89	88	-	94.7	-
GL01	1993	Batch	Lower	-	-	-	0.45	-	0.03	1	89	88	-	95.3	-
HL03	1993	Batch	Lower	-	-	-	0.53	-	0.07	2	60	57	-	27.2	-
AM13	1993	Batch	Middle	-	-	-	0.72	-	0.05	2	39	38	-	25.1	-
BM51	1993	Batch	Middle	-	-	-	0.78	-	0.5	16	70	54	-	4.5	-
CM48	1993	Batch	Middle	-	-	-	0.58	-	0.13	4	83	79	-	20.4	-
DM68	1993	Batch	Middle	-	-	-	1.32	-	0.46	14	33	18	-	2.3	-
EM26	1993	Batch	Middle	-	-	-	1.08	-	0.44	14	55	42	-	4.0	-
FM27	1993	Batch	Middle	-	-	-	0.75	-	0.11	3	58	54	-	16.8	-
GM31	1993	Batch	Middle	-	-	-	1.93	-	1.09	34	63	29	-	1.8	-
HM21	1993	Batch	Middle	-	-	-	1.03	-	0.17	5	78	73	-	14.7	-
AU76	1993	Batch	Upper	-	-	-	0.51	-	0.37	12	31	19	-	2.7	-
BU22	1993	Batch	Upper	-	-	-	0.15	-	0.1	3	66	63	-	21.0	-
CU88	1993	Batch	Upper	-	-	-	0.62	-	0.18	6	54	48	-	9.6	-
DU80	1993	Batch	Upper	-	-	-	0.54	-	0.32	10	70	60	-	7.0	-
EU07	1993	Batch	Upper	-	-	-	0.27	-	0.17	5	85	80	-	16.0	-
FU12	1993	Batch	Upper	-	-	-	0.2	-	0.05	2	63	62	-	40.4	-
GU28	1993	Batch	Upper	-	-	-	0.34	-	0.13	4	97	92	-	23.8	-
HU14	1993	Batch	Upper	-	-	-	0.2	-	0.11	3	90	87	-	26.3	-
L2	1993	Locked cycle	Lower	-	-	-	0.87	-	0.54	17	71	54	-	4.2	-

Sample ID	Year	Process Type	Level	Paste	CO_2	$CaCO_3$	S(T)	S (SO_4)	S (S2-)	APa	NPb	Net NPc	Fizz Test	NP/ AP	TIC-NP/ AP
				pH	%	NP	%	%	%	(kg $CaCO_3$/ t)					
M2	1993	Locked cycle	Middle	-	-	-	1.3	-	0.78	24	70	46	-	2.9	-
ABCD-M	1993	Locked cycle	Middle	-	-	-	1.16	-	0.54	17	71	54	-	4.2	-
EFGH-M	1993	Locked cycle	Middle	-	-	-	1.53	-	0.8	25	59	34	-	2.3	-
U15	1993	Locked cycle	Upper	-	-	-	1.03	-	0.84	26	69	43	-	2.6	-
ABCD-U	1993	Locked cycle	Upper	-	-	-	0.85	-	0.49	15	49	34	-	3.2	-
EFGH-U	1993	Locked cycle	Upper	-	-	-	0.97	-	0.73	23	68	45	-	3.0	-
PP7	1997	Pilot Plant	Lower	8.29	3.0	67	1.17	0.63	0.49	15	43	27	Slight	2.8	4.4
PP6	1997	Pilot Plant	Middle	7.84	2.8	63	1.83	0.60	0.092	29	44	15	Slight	1.5	2.2
PP8	1997	Pilot Plant	Upper	8.04	3.7	83	1.02	0.20	0.61	19	57	38	Mod.	3.0	4.4
PP8 Duplicate	1997	Pilot Plant	Upper	8.11	3.8	86	1.02	0.17	1	31	60	28	Mod.	1.9	2.7
Test 19	1997	Locked cycle	Lower	7.93	2.8	62	1.19	0.83	0.46	14	55	40	Mod.	3.8	4.3
Test 20	1997	Locked cycle	Middle	7.84	2.9	66	1.86	0.80	0.97	30	57	27	Mod.	1.9	2.2
Test 21	1997	Locked cycle	Upper	7.72	3.5	80	1.45	0.33	0.91	28	61	33	Mod.	2.2	2.8
Test 21 Duplicate	1997	Locked cycle	Upper	7.71	3.6	82	1.46	0.37	0.95	30	64	34	Mod.	2.1	2.7
Cleaner + Rougher Tails Comp.	2007	Batch	Mixed	7.95	4.0	92	0.64	0.30	0.34	11	60	49	Slight	5.6	8.6
KM1961-02 Cu Clr Scav Tails	2007	Batch	Mixed	7.85	3.6	82	11.02	0.10	10.92	341	71	-270	Slight	0.2	0.2
KM1961-02 Cu Rougher Tails	2007	Batch	Mixed	7.75	4.0	91	0.46	0.32	0.14	4	73	69	Slight	16.7	20.8

Notes:

a. AP = Acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. AP is determined from calculated sulphide sulphur content: S(T) - S(SO_4).

b. NP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.

c. NET NP = NP - AP

Table 2.7.2.1-18 Summary of Rietveld XRD Results for Tailings Samples – DRAFT

		Quartz	Plagioclase	K-feldspar	Muscovite	Paragonite	Clinochlore	Calcite	Dolomite	Ankerite	Siderite	Kaolinite	Gypsum	Magnetite	Pyrite	Total
Sample ID	**Description**	**wt %**	**wt %**	**Wt %**	**wt %**	**wt %**	**Wt %**	**wt %**	**wt %**	**wt%**	**wt %**	**wt%**	**wt %**	**wt %**	**wt %**	**wt%**
1961-02 Cu Cleaner	Cleaner tailings	16.9	11.1	1.6	21	4.4	6.3	2.8	-	5.6	-	4.6	1.8	1.2	22.7	100.1
1961-02 Cu Ro	Rougher tailings	36.3	18.5	1.6	16.8	4.9	5.1	1.6	7.5	-	0.5	4.2	2.2	0.9	-	100.0

Table 2.7.2.1-19 Elemental Analyses of Tailings –DRAFT

	Phase	1	1	1	1	1	1	1	1	1	3	3	3	5	5	5
	Sample ID	**L2**	**ABCD-L**	**EFGH-L**	**M2**	**ABCD-M**	**EFGH-M**	**U15**	**ABCD-U**	**EFGH-U**	**HCL**	**HCM**	**HCU**	**Cleaner + Rougher Tails**	**KM1961-02 Cu Clr Scav Tails**	**KM1961-02 Cu Rougher Tails**
	Test ID	**L2**	**L14**	**L15**	**M2**	**M13**	**M14**	**U15**	**U24**	**U25**	**PP7**	**PP6**	**PP8**	**-**	**-**	**-**
Element	**Units**															
Ag	ppm	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	0.20	0.96	0.19
As	ppm	11	14	6.6	8.6	11	11	18	21	15	6.1	11	15	8	39	4.3
B	ppm	<10	<10	<10	<10	<10	<10	<10	<10	<10	32	43	25	3	3	2
Ba	ppm	-	-	-	-	-	-	-	-	-	470	400	360	62	33	64
Be	ppm	2	2	2	<1	2	2	2	2	2	<0.5	<0.5	<0.5	-	-	-
Bi	ppm	<2	<2	<2	<2	<2	<2	<2	<2	<2	0.2	0.5	0.2	0.17	1.66	0.08
Cd	ppm	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	0.36	0.2	0.27
Co	ppm	12	12	10	12	16	13	18	12	13	18	20	16	12	164	6
Cr	ppm	-	-	-	-	-	-	-	-	-	84	80	81	34	200	18
Cu	ppm	340	240	390	300	300	360	360	250	320	310	280	290	364	480	325
Ga	ppm	14	20	18	16	22	20	15	19	18	28	19	28	3	3.3	3.1
Hg	ppb	440	1000	310	280	500	810	760	1200	450	350	390	420	202	332	225
Li	ppm	7	12	7	8	11	11	7	11	13	19	18	26	-	-	-
Mn	ppm	-	-	-	-	-	-	-	-	-	230	210	260	278	305	285
Mo	ppm	250	<4	7	9	<4	<4	25	<4	<4	24	16	12	24	94	35
Ni	ppm	14	43	59	52	69	60	140	54	64	18	18	16	24	169	15
Pb	ppm	59	11	<4	11	13	13	20	10	18	<1	<1	21	11	73	9.2
Sb	ppm	<4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	2.5	0.8	3.5	1.0	2.7	0.79
Se	ppm	-	-	-	-	-	-	-	-	-	<0.5	0.7	<0.5	0.9	18	0.3
Sn	ppm	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5	<0.5	<0.5	-	-	-
Sr	ppm	-	-	-	-	-	-	-	-	-	420	370	320	97	89	99
Th	ppm	<0.05	3.5	3.5	2.2	3.5	3	2.1	3..5	3.5	3.9	3.1	2.4	1.8	1.6	1.5
Tl	ppm	-	-	-	-	-	-	-	-	-	0.9	<0.1	1.3	0.06	0.18	0.07
U	ppm	-	-	-	-	-	-	-	-	-	2.3	3.2	2.5	0.3	0.4	0.3
V	ppm	-	74	87	-	98	78	-	78	96	130	110	110	46	44	46
W	ppm	-	<4	<4	-	<4	<4	-	<4	<4	<2	4	<2	<.1	0.3	<.1
Zn	ppm	-	60	30	-	52	52	-	55	82	34	39	72	106	83	92

KINETIC TESTING

Results of tailings kinetic testing are provided in Appendix 3-7-EE and 3-7-FF of the March 2009 EIS/Application. The following sections discuss the key geochemical features of the results.

Humidity cells HCA and HCB contain duplicate samples of Phase 5 tailings, and had been running for 66 weeks as of June 24, 2008. Cell leachates were initially around pH 7.5, and rose to a stable range around pH 8 from week 20 on. Generally, the duplicate tailings humidity cells produced leachates with similar chemistry over time.

Calcium and sulphate release were initially high (roughly 300 and 800 mg/kg/wk, respectively) due to dissolution of gypsum and anhydrite, and declined over the period from week 13 to week 21 to much lower stable rates (9.5 and 6.5 mg/kg/wk, respectively) that most likely reflect release of sulphur due to sulphide oxidation and flushing of weathering products. Barium release increased beginning in week 19, which is most likely related to the increased solubility of the sparingly soluble mineral barite ($BaSO_4$) in response to declining sulphate concentrations in the leachate.

Release of most other parameters was either flat or decreasing from week 40 on. An exception was molybdenum, which showed an increase from around 0.005 mg/kg/wk in week 43 to around 0.016 mg/kg/wk in week 65.

Duplicate subaqueous columns containing bulk tailings composite (Subaqueous Column A and Subaqueous Column B) were tested for 227 weeks. Monitoring of both the water cover (Sub A Side Port and Sub B Side Port) and the tailings porewater (Sub A Bottom Port and Sub B Bottom Port) was carried out.

The duplicate tests generally showed good reproducibility, however a weekend malfunction caused by leaking tubing in a recirculating pump caused the water cover in Subaqueous Column B to drain between week 43 and 45 monitoring. The problem was noticed the following Monday and the water cover was re-established using deionized water. Laboratory staff reported that the surface tailings were disturbed by pouring replacement water into the test column. The reproducibility of particularly the duplicate water cover monitoring was understandably poor in subsequent weeks. Subaqueous Column A remained intact and provided valid test results.

The initial pH of the water cover (Sub A Side Port, Sub B Side Port) was around 6.6, indicating that equilibrium between the water cover and the tailings solids had not been achieved. From week 4 on, water cover pH for both tests generally ranged between 7 and 8. Dissolved oxygen ranged from 6.5 to 11 mg/L over the test period, with typical values around 8 mg/L suggesting that the water cover was in equilibrium with atmospheric oxygen.

Sulphate concentrations in the water cover increased gradually to around week 17, then remained within a steady range of 376 to 503 mg/L between weeks 17 and 35, before beginning to decline. A similar pattern was observed for calcium, suggesting initial increases were due to dissolution of gypsum or anhydrite, with declining concentrations reflecting depletion of near-surface grains and depletion of the resident load in the water column by removal of water for monitoring purposes and replacement with deionized water.

Elemental concentrations in the water cover are generally stable (F, Al, Se) or decreasing in the manner described for calcium and sulphate. Exceptions are barite and magnesium, for which steadily increasing concentrations likely reflect dissolution of barite and magnesium-bearing carbonates as calcium and sulphate concentrations decline.

Initial porewater pH values near pH 8 declining over the course of 15 weeks to pH 7, then ranged from a minimum of pH 6.74 to a maximum of pH 7.59 from week 15 through week 65. Porewater appears to be undersaturated with dissolved oxygen, with typical concentrations of 4 mg/L and a range of 2 to 6 mg/L. Dissolved iron concentrations were between 0.4 and 3.9 mg/L over most of the testing period.

Sulphate and calcium concentrations were initially elevated (1400 to 1900 mg/L sulphate and 500 to 600 mg/L calcium) suggesting equilibrium dissolution of gypsum or anhydrite. However, sulphate concentrations appear to begin to slowly decline around week 45 and continue to trend downward. Calcium concentrations increase to 776 mg/L in week 43 before declining back to around 580 mg/L in week 63.

The majority of parameters monitored are decreasing as testing progresses. Several parameters (F, Mo, U, Mg, and Ca) had peak concentrations at some point during the testing period, with the more recent data indicating a decrease in porewater concentrations with time. Several other parameters (Al, Ba, Cu, Sr, Se) appear to have achieved stable porewater concentrations. Overall, the stable, declining, or peaked concentration behaviours suggest that the reactivity of the tailings being tested is slowly declining as the outer surfaces of the tailings particles weather.

Duplicate unsaturated columns containing bulk tailings composite (Unsat Column A and Unsat Column B) have 229 weeks of data available. Monitoring of leachate has been carried out via a port in the base of the column. Reproducibility in the duplicate column results has been high over the duration of testing to date.

Leachate pH was between 7.55 and 8.14 over the test period. Sulphate has declined from initial leachate concentrations of around 1900 mg/L to week 65 concentrations around 1350 mg/L. Calcium concentrations were initially stable at around 550 mg/L, then increased over the course of several months to around 700 mg/L before declining to around 630 mg/L in the later cycles. The increase in calcium concentrations between weeks 27 and 53 was partially paralleled by an increase in sulphates concentrations over this period, but differences between the trends of calcium and sulphate indicate that gypsum and anhydrite were not the only sources of dissolved calcium.

The majority of other parameters are stable or decreasing. In particular, stable cobalt concentrations in unsaturated column test leachate were higher than in other tailings tests (up to 0.0035 mg/L), with pyrite being the suspected source of cobalt in leachate. The exceptions to the trend of stable or decreasing concentrations were increasing barium and zinc concentrations during the later stages of testing. Barium concentrations appear to have increased in response to declining sulphate concentrations and increased dissolution of barite. Up to five-fold increases in zinc concentrations from weeks 43 to 65 do not appear to be correlated with geochemical behaviour of other parameters; as leachate concentrations are within 10 times the lower detection limit of 0.001 mg/L, and as zinc is considered a ubiquitous contaminant in laboratory environments, it is possible that the apparent trend of increasing zinc release is an artefact of the testing procedure.

Column operating procedures entailed adding a sufficient quantity of water to obtain leachate for analyses- actual volumes for addition were specified as a range and actual additions were left to the technician’s judgement. This resulted in variable water additions over the duration of testing which need to be considered when comparing leachate concentrations over time.

INTERPRETATION

The results of the mineralogical investigation showed that the tailings neutralization potential measured through ABA testing is roughly equivalent to the neutralization potential attributable to calcium+magnesium carbonates. Neutralization potential calculated from TIC measurements was found to overestimate the available neutralization potential due to a proportion of iron and manganese in the carbonate minerals.

Sulphate sulphur content of the tailings is variable and can be significant. Sulphur speciation will be necessary when monitoring production tailings to arrive at accurate estimates of acid potential.

ABA testing on Phase 1 batch and locked cycle flotation tailings showed that nearly all samples tested had NP/AP values greater than 2. However, the Phase 3 locked cycle and pilot plant tailings samples overall had lower NP/AP ratios than the Phase 1 samples, with the lowest measured NP/AP ratio of all samples tested coming from the middle zone pilot plant tailings (sample PP6, NP/AP= 1.5).

On the basis of the static test results, the full scale New Prosperity tailings are expected to be non-PAG. However, monitoring of the ABA characteristics of the bulk tailings product will be necessary to ensure that full scale tailings conform to these expectations.

Humidity cell and unsaturated column testing on Phase 5 tailings show that runoff from exposed tailings beaches will be dominated by leaching of gypsum. Metal leaching during the operational period would be negligible, and at closure there will be no exposed tailings to contribute loadings to surface runoff.

The sub-aqueous column leach test on Phase 5 bulk tailings sample showed that leaching under these conditions is negligible with the exception of minerals that are somewhat soluble in water. These minerals include gypsum, fluorite and carbonates which are potentially sources of major ions (i.e. total dissolved solids), fluoride and manganese. MINTEQA2 was used to evaluate the porewater leachate chemistry with respect to these minerals. Leachates were close to saturation with respect to gypsum (saturation index -0.067), calcite (-0.23), celestite (strontium sulphate, -0.21), and wulfenite (lead molybdate, 0.051), but under-saturated with respect to fluorite (-0.99) and rhodochrosite (-0.83). Assuming that these minerals are present, the stable leach column chemistry is a reasonable surrogate for seepage chemistry from the area(s) of the impoundment used for disposal of tailings. Manganese concentrations may be higher than indicated by the column test if rhodochrosite is present- although x-ray diffraction and electron microprobe assessment of the Phase 5 tailings sample did not identify rhodochrosite as discrete mineral phase, other carbonate minerals were found to contain trace amounts of manganese.

Table 2.7.2.1-20 Maximum Concentrations in Tailings Subaqueous Column Leachate – DRAFT

pH (min.)	Sulphate	Acidity	Alkalinity (min.)	F	Cd	Cu	Fe	Pb	Mn	Mo	Ni	Se	Zn
s.u.	mg/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
6.74	1886	15	83	0.4	0.0004	0.017	3.92	0.0013	0.6	0.12	0.01	0.0089	0.021

TAILINGS SOURCE TERMS FOR WATER CHEMISTRY PREDICTIONS

Porphyry copper tailings porewater is often found to have dissolved concentrations of Cu, Mn, and Fe in equilibrium with tenorite (CuO), rhodochrosite ($MnCO_3$) and ferrihydrite ($Fe_2O_3{\cdot}0.5H_2O$). As discussed in the previous section, equilibrium modelling of saturated tailings leachate indicated that the leachate was undersaturated with respect to these minerals. To arrive at an estimate of full scale tailings porewater chemistry, additional MINTEQA2 runs were carried out to determine equilibrium copper, manganese, and iron concentrations.

Modelling was carried out starting with the leachate chemistry from the cycle that returned the lowest pH (pH 6.87, Sub A Bottom Port 20070807). Tenorite, rhodochrosite, gypsum, ferrihydrite, and calcite were allowed to equilibrate at fixed pH, and pCO_2 was set to atmospheric partial pressure. As a separate exercise, pCO_2 was increased by an order of magnitude to evaluate sensitivity to variation in dissolved CO_2, and results of this sensitivity analysis indicated minimal change in predicted porewater chemistry.

Therefore, a source term tailings porewater chemistry was compiled using equilibrium copper and manganese concentrations, and maximum values observed in column leachate for all other parameters (minimum values for pH and alkalinity). This source term was used in estimating South and West Embankment seepage chemistry.

Because PAG rock will be disposed in the central and eastern portion of the TSF, a combined tailings and PAG rock porewater source term was developed to inform estimate of Main Embankment seepage chemistry. A similar assessment to that described for saturated tailings porewater was carried out for PAG waste rock porewater. The maximum values for parameters from all saturated rock and tailings columns, along with equilibrium concentrations of copper and manganese, were adopted as the estimate for a single ‘saturated PAG plus tailings porewater’ source term.

It should be noted that, subsequent to developing the tailings porewater source terms, ongoing testing returned concentrations for As, Sn, and Ti that exceeded the previous maxima by a small amount. Source term estimates were not revised.

The two source terms were then used as inputs to the site water chemistry prediction.

UNSATURATED TAILINGS

A comparison of humidity cell and column test release rates showed that columns released weathering products at a lower rate than humidity cells on both in terms of mass and with respect to flowpath length. From this result, it is inferred that equilibrium conditions were developed within the columns and acted to control the aqueous concentrations of weathering products.

Two separate unsaturated tailings source terms were developed. A beach runoff source term was developed to allow estimates of loadings to the tailings pond via beach runoff. This ‘Beach Runoff’ source term consists of the maximum concentrations observed from the unsaturated tailings columns, and is considered to be conservative as the surface tailings are likely generate lower concentrations due to exposure and repeated flushing.

A ‘Beach Infiltration’ source term was also developed using maximum observed concentrations from unsaturated tailings columns as a basis. These maximum concentrations were then compared to a compiled database of seepage chemistry from porphyry mines in BC to see if higher concentrations might be expected (based on porphyry waste rock seepage (Day and Rees, 2006)). Where the database concentrations exceed the New Prosperity column concentrations, the higher concentration from the database was adopted as the estimate. As a result of this review, alkalinity in the ‘Beach Infiltration’ source term was decreased, and Se and Zn concentrations were increased.

SITE WATER AND LOAD BALANCE

Estimates of chemical loadings from the different various mine site components were used together combined with the site water balance developed by Knight Piésold to generate an integrated overall water and load balance model for the Project. This water and load balance forms the basis for the estimates of site and discharge water quality that have been used to assess the environmental impacts of the Project.

The water balance model was created using GoldSim software. GoldSim is a graphical, object-oriented program for carrying out dynamic, probabilistic simulations of existing or proposed systems. The water and load balance model for the New Prosperity Project includes Monte Carlo simulations to represent the range of anticipated hydrological conditions at the mine site. The inputs and results of the model were estimated on a monthly basis.

MODEL QUALITY ASSURANCE

A quality analysis of the water and load balance model for the New Prosperity Project was conducted, including the following:

- The calculations of loading inflows and outflows and load balance structure were verified for accuracy
- The assignments of loading inflows and outflows for each mine component were verified for consistency with the water balance, project assumptions and changes occurring over the mine life phases
- The behaviour of the calculated loads for each mine component was reviewed over the life of the Project to verify that the changes expected to occur at each mine phase were accurately reflected in the loadings, and
- The results of the water and load balance model were analysed to delineate the contributing factors for key changes in water quality over time at each mine component.

MODEL INPUTS

The specific sources of model inputs for each mine components are discussed in the following sections.

Inputs to the water balance are discussed in Section 2.7.2.4.

The 13 main components of the water and load balance model are shown, along with the loading sources (inflows) and losses (outflows) for each component. A schematic representation the main components of the water and load balance is shown on Figure 2.7.2.1-51 (for the operational period) and on Figure 2.7.2.1-52 (for the post-closure period).

DESCRIPTION OF WATER AND LOAD BALANCE

The water and load balance is a modified mass balance model that was used to estimate dissolved concentrations of regulated parameters in site discharge. Chemical loading from the various mine components is incorporated as source terms, and chemical mass is maintained as a dissolved component except in those instances noted in the source term descriptions in Sections xx and xx. In particular, Ca, SO_4, Fe, Cu and Mn masses were added to the tailings pore water source term to account for expected dissolution of tailings minerals containing these parameters. Ca and SO_4 masses were removed from non-PAG and ore stockpile loadings to reflect control of respective concentrations by the solubility product of gypsum.

For each of the 13 model components, a number of sources contribute chemical mass to the system. For each source, a source term was identified to represent the expected chemical contribution from each source. For surface and groundwater entering the site, baseline water quality monitoring data were adopted as source terms. For all other sources, source terms were developed from ML/ARD characterization testing.

Although the GoldSim model includes water quality predictions for Fish Lake, these are not included in this section. Results from the GoldSim model for the various sources to Fish Lake were provided to Triton Environmental (Triton). Triton developed a separate model of Fish Lake, as discussed in Section 2.7.2.4.

LOAD CALCULATIONS

Loadings into and out of the mine components were carried out in one of the following three methods.

- Chemical concentrations were multiplied by a flow rate as shown below. This method was applied for runoff from undisturbed areas or areas with an overburden cover, groundwater inflows, direct precipitation on ponds, sewage effluent, tailings pore water, consolidation, beach runoff and infiltration, freshwater to the mill, and calcium and sulphate for the ore and non-PAG stockpiles:

$$Total\ Load\ added\ to\ Pond\ (L) = \sum \left[Inflows \times Concentration \right]$$

- Annual loading predictions were distributed monthly according to the average monthly runoff distribution as estimated in the water balance derived by Knight Piésold. This applies to the non-PAG and ore stockpiles, plant site, unsaturated PAG in the TSF, crusher pad and mine site roads,
- Annual loading predictions applied as constant loadings throughout the applicable mine phase. This applies to the ore loadings to the mill and the nitrogen and phosphorous loadings from the sewage effluent.

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.1-51 Schematic Water and Load Balance - Operations

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.1-52 Schematic Water and Load Balance – Post-Closure

Table 2.7.2.1-21 Component Inputs, Outputs, and Source Terms – DRAFT

Component	Input	Source Term
1. Non-PAG Stockpile	*Inflows*	
	NAG Infiltration to Toe (portion to Open Pit as delayed groundwater)	Percentage of total annual non-PAG loading predictions distributed monthly (grows over time based on stockpile area growth) + gypsum saturation concentrations for SO_4 and Calcium
	Non-PAG Runoff	Loading included above
	Undisturbed Runoff from NAG Catchment	Background concentrations (decreases over time based on stockpile area growth)
	Blast losses	Annual Non-PAG blast loss loading predictions distributed monthly
	Outflows	
	Overflow to Open Pit	Concentration from non-PAG Stockpile calculated by model
2. Ore Stockpile	*Inflows*	
	Ore Stockpile Infiltration to Toe (portion to Fish Lake as delayed groundwater)	Ore loading predictions (varies over time depending on materials in stockpile) + gypsum saturation concentrations for SO_4 and Calcium ; Overburden concentrations when stockpile is depleted
	Ore Stockpile Runoff	Included in loadings above
	Undisturbed Runoff from Ore Stockpile Catchment	Background concentrations (decreases over time based on stockpile area growth)
	Blast losses associated with ore	Annual ore blast loss loadings distributed monthly
	Outflows	
	Portion of Overflow to Open Pit	Concentration from Ore Stockpile calculated by model
	Portion of Overflow to Fish Lake	Concentration from Ore Stockpile calculated by model
3. Open Pit	*Inflows*	
	Mine Site Road Runoff	Mine site road loading predictions distributed monthly
	Open Pit Groundwater inflows	Pit groundwater concentrations
	Undisturbed Runoff from Catchment 1	Background concentrations
	Undisturbed Runoff from Catchment 2	Background concentrations
	Pit Wall Runoff	Annual pit wall loading predictions distributed monthly
	Direct Precipitation on Pond	Zero loading
	Non-PAG Infiltration (delayed groundwater)	Percentage of total annual non-PAG loading predictions distributed monthly + gypsum saturation concentrations for SO_4 and Calcium
	Blast losses	Pit wall blast loss loading predictions distributed monthly
	Overflow from non-PAG Stockpile (100%)	Concentration from non-PAG stockpile calculated by model

Component	**Input**	**Source Term**
	Overflow from Ore Stockpile (80%)	Concentration from Ore Stockpile calculated by model
	Seepage from Fish Lake	Concentration from Fish Lake calculated by model
	Overflow from Fish Lake at Closure & Post-Closure	Concentration from Fish Lake calculated by model
	TSF Overflow at Closure	Concentration from TSF calculated by model
	ME Pond 1 Overflow	Concentration from ME Pond 1 calculated by model
	ME Pond 2 Overflow	Concentration from ME Pond 2 calculated by model
	Outflows	
	Lake Evaporation	Zero loading
	Pit Dewatering to Mill during Operations to Year 17	Concentration from Open Pit calculated by model
	Overflow to Lower Fish Creek at Post-Closure - LOWER FISH CREEK NOT MODELED; REPORTS TO SINK	Concentration from Open Pit calculated by model
4. Fish Lake	*Inflows*	
	Flow from Stockpile Topsoil #5	Overburden concentrations
	Undisturbed Runoff from Catchment	Background concentrations
	Direct Precipitation on Pond	Zero loading
	Diverted Water from Non-PAG Area	Background concentrations
	Mine Site Road Runoff	Mine site road runoff loading predictions distributed monthly and divided between Open Pit and Fish Lake
	Crusher Pad (load only)	Annual crusher pad loadings distributed monthly
	Groundwater from TSF area (groundwater within Fish Lake catchment)	Pit groundwater concentrations
	Portion of TSF Basin Seepage	Tailings porewater concentrations
	Ore Stockpile Infiltration (delayed groundwater)	Ore loading predictions + gypsum saturation concentrations for SO_4 and Calcium ; Overburden concentrations when stockpile is depleted
	Plant Site Infiltration (delayed groundwater)	Plant site loading predictions distributed monthly
	Overflow from Plant Site Reservoir at Closure & Post-Closure	Concentration from Plant Site Reservoir calculated by model
	Overflow from Ore Stockpile (10%)	Concentration from Ore Stockpile calculated by model
	Overflow from Trib1	Concentration from Trib1 calculated by model
	Overflow from Upper Fish Creek	Concentration from Upper Fish Creek calculated by model
	Outflows	

Component	Input	Source Term
	Lake Evaporation	Zero loading
	Fish Lake Seepage to Open Pit	Concentration from Fish Lake calculated by model
	Recirculation to Trib1	Concentration from Fish Lake calculated by model
	Recirculation to Upper Fish Creek	Concentration from Fish Lake calculated by model
	Excess to TSF during Operations	Concentration from Fish Lake calculated by model
	Excess to Open Pit at Closure	Concentration from Fish Lake calculated by model
5. Trib 1	*Inflows*	
	Diverted Water from east of Site Access Road	Background concentrations
	Runoff from Undisturbed Catchment	Background concentrations
	TSF ME Seepage Lost (embankment wall + foundation)	Combination of tailings porewater and tailings beach infiltration concentrations
	Portion of TSF Basin Seepage	Tailings porewater concentrations
	Overflow from ME Pond 1 at Post-Closure - REMOVED	Concentration from ME Pond 1 calculated by model
	Diverted Water from TSF Undisturbed Area	Calculated from Diverted Runoff Reservoir calculated by model
	TSF Overflow at Post-Closure	Concentration from TSF calculated by model
	Recirculation from Fish Lake	Concentration from Fish Lake calculated by model
	Outflows	
	Overflow to Fish Lake	Concentration from Trib1 calculated by model
6. Upper Fish Creek	*Inflows*	
	Runoff from Undisturbed Catchment	Background runoff concentrations
	TSF ME Seepage Lost (embankment wall + foundation)	Combination of tailings porewater and tailings beach infiltration concentrations
	Portion of TSF Basin Seepage	Tailings porewater concentrations
	Overflow from ME Pond 2 at Post-Closure - REMOVED	Concentration from ME Pond 2 calculated by model
	Diverted Water from TSF Area	Concentration from Diverted Runoff Reservoir calculated by model
	Recirculation from Fish Lake	Concentration from Fish Lake calculated by model
	Overflow from TSF	Concentration from TSF calculated by model
	Outflows	
	Overflow to Fish Lake	Concentration from Upper Fish Creek calculated by model

Component	Input	Source Term
7. ME Pond 1	*Inflows*	
	Undisturbed Runoff from Catchment	Background runoff concentrations
	Runoff from TSF Main Embankment	Percentage of total NAG loading prediction + combination of Ca and SO4 gypsum-saturation and Overburden concentrations based on ratio of Overburden/NAG material
	TSF ME Seepage Captured	Combination of tailings porewater and tailings beach infiltration concentrations
	Blast losses associated with Non-PAG	Non-PAG blast losses loadings distributed monthly
	GW Wells Recycled	Embankment seepage and basin seepage concentrations based on amount of flow from each source
	Outflows	
	Overflow to TSF during Operations & Closure	Concentration from ME Pond 1 calculated by model
	Overflow to Trib1 at Post-Closure	Concentration from ME Pond 1 calculated by model
8. ME Pond 2	*Inflows*	
	Undisturbed Runoff from Catchment	Background concentrations
	Runoff from TSF Main Embankment	Percentage of total NAG loading prediction + combination of Ca and SO_4 gypsum-saturation and Overburden concentrations based on ratio of Overburden/non-PAG material
	TSF ME Seepage Captured	Combination of tailings porewater and tailings beach infiltration concentrations
	Blast losses associated with Non-PAG	Non-PAG blast losses loadings distributed monthly
	Outflows	
	Overflow to TSF during Operations & Closure	Concentration from ME Pond 2 calculated by model
	Overflow to Upper Fish Creek at Post-Closure	Concentration from ME Pond 2 calculated by model
9. SE Pond	*Inflows*	
	Undisturbed Runoff from Catchment	Background concentrations
	Runoff from TSF South Embankment	Overburden concentrations
	TSF SE Seepage Captured	Combination of tailings porewater and tailings beach infiltration concentrations
	Outflows	
	Overflow to TSF during Operations	Concentration from SE Pond calculated by model
	Overflow to Wasp Lake at Closure & Post-Closure	Concentration from SE Pond calculated by model
10. WE Pond	*Inflows*	

Component	**Input**	**Source Term**
	Undisturbed Runoff from Catchment	Background runoff concentrations
	Runoff from TSF West Embankment	Overburden concentrations
	TSF WE Seepage Captured	Combination of tailings porewater and tailings beach infiltration concentrations
	Outflows	
	Overflow to TSF during Operations	Concentration from WE Pond calculated by model
	Overflow to Big Onion Lake at Post-Closure & Post-Closure	Concentration from WE Pond calculated by model
11. Mill	*Inflows*	
	Freshwater (Operations)	Use Fish Lake concentrations (but do not remove volume from Lake)
	Additional Makeup Water (TSF Deficit)	Use Fish Lake concentrations (but do not remove volume from Lake)
	Ore Load	Mill ore loading predictions (constant annual load)
	Blast losses associated with ore	Ore blast losses loading predictions distributed monthly
	Open Pit Dewatering (Operations)	Concentration from Open Pit calculated by model
	Reclaim from TSF	Concentration from TSF calculated by model
	Plant Site Runoff	Concentration from Plant Site Reservoir calculated by model
	Outflows	
	Tailings Slurry Water to TSF + Open Pit Dewatering during Pre-Production	Concentration from Mill calculated by model
	Water Retained in Concentrate	Concentration from Mill calculated by model
12. TSF	*Inflows*	
	Septic Grey Water	Sewage effluent concentrations + sewage effluent N & P annual loadings
	Consolidation Seepage	Tailings porewater concentrations
	Runoff from East Diverted Catchment	Background runoff concentrations
	Runoff from Soil Stockpile	Background runoff concentrations
	Tailings Beach Runoff	Tailings beach runoff concentrations
	Tailings Beach Infiltration	Tailings beach infiltration concentrations
	Direct Precipitation on Pond	Zero loading
	Unsaturated PAG Contact Water	Unsaturated PAG loadings
	Blast losses associated with PAG	PAG blast losses loading predictions distributed monthly
	Tailings Slurry Water	Concentration from Mill calculated by model
	ME Pond 1 Pumpback (Operations & Closure)	Concentration from Me Pond 1 calculated by model

Component	Input	Source Term
	ME Pond 2 Pumpback (Operations & Closure)	Concentration from ME Pond 2 calculated by model
	SE Pond Pumpback (Operations)	Concentration from SE Pond calculated by model
	WE Pond Pumpback (Operations)	Concentration from WE Pond calculated by model
	Excess Water from Fish Lake (Operations)	Concentration from Fish Lake calculated by model
	Open Pit Dewatering Pre-Production (Mill Water to TSF)	Concentration from Mill calculated by model
	Outflows	
	Evaporation from Pond	Zero loading
	Waste Rock Void Loss	Concentration from TSF calculated by model
	Tailings Void Loss	Concentration from TSF calculated by model
	Embankment Seepage	Concentration from TSF calculated by model
	Basin Seepage	Concentration from TSF calculated by model
	Seepage to Western Embankment	Concentration from TSF calculated by model
	Reclaim to Mill	Concentration from TSF calculated by model
	Overflow to Open Pit at Closure	Concentration from TSF calculated by model
	Overflow to Trib1 at Post-Closure	Concentration from TSF calculated by model
	Overflow to Upper Fish Creek at Post-Closure	Concentration from TSF calculated by model
13. Plant Site	*Inflows*	
	Plant Site Infiltration to Surface Water	Load in mg/year distributed monthly
	Plant Site Runoff	Included in loadings above
	Outflows	
	Overflow to Mill during Operations	Concentration from Plant Site Reservoir calculated by model
	Overflow to Fish Lake at Closure & Post-Closure	Concentration from Plant Site Reservoir calculated by model

CONDITIONS MODELED

The water and load balance model was run under average hydrological conditions and using a Monte Carlo simulation to represent the range of anticipated future hydrological conditions. Under average conditions, average monthly precipitation and runoff was assumed to occur throughout all the phases of the mine life. By isolating the influence of hydrology, the variations in loadings over time could be evaluated from year to year to ensure the loadings behaved according to the changes occurring at each phase of the mine life. The Monte Carlo simulation provides a range of water quality predictions under the influence of varying hydrological conditions.

The following remediation measures were simulated in the water and load balance model:

- Reclamation of the tailings beaches at the end of milling
- “Dewatering” the TSF, that is, pumping water from the TSF to the Open Pit (down to its minimum required volume) at the end of milling (to accelerate the improvement of water quality in the TSF anticipated at the end of milling)
- Termination of pumpback of water from the seepage collection ponds to the TSF at the end of milling (to accelerate the improvement of water quality in the TSF). Note that water from the Main Embankment seepage collection ponds is assumed to be pumped to the Open Pit at closure
- Collection of TSF seepage (both embankment and foundation seepage) in groundwater wells; flow from these wells is assumed to be pumped to the Main Embankment seepage collection pond(s), and
- Remediation of the ore stockpile footprint once the stockpile is depleted.

ELEMENTS OF MODELLING PROCESS LEADING TO A CONSERVATIVE PREDICTION

Development of a site wide water and load balance was governed by the requirement to apply conservative assumptions where specific information was deficient (Price, 1997). The following points summarize the main prediction elements that lead to a conservative prediction of site discharge water quality.

- Source Terms
  - o Maximum concentrations from laboratory test work were generally selected for development of source terms (initial elevated release due to flushing in HCTS was excluded).
  - o Where concentrations were below detection, detection levels were adopted for development of source terms. This represents an upper bound for observed concentrations rather than a maximum observed value.
  - o Where assumptions were required, selection of model parameters was conservative. For example, the stockpile-grade ore stockpile is assumed to be in place and generating load at its maximum ultimate capacity for the entire 19 years of ore processing.
- Pit Lake water quality prediction
  - o Year 0 to 6: assumes entire area of Year 6 final wall is exposed during this period and generating contaminants.
  - o Year 17: stored load from pit mining period is assumed to flush into pit, including all stored load in high wall above final flood elevation that never will be inundated and fully flushed by lake water. This overestimates provides an upper bound to the chemical load contributed by the pit.
  - o Yr 17 to 44: all load generated by permanent highwall is assumed to be flushed. This overestimates provides an upper bound for loading to pit during this period, and was done adopted for simplicity of calculation and to be conservative.
  - o No removal of load in the pit lake is accounted for during any of the above time periods. Experience at other pit lakes indicates that mineral precipitation, scavenging of metals by particulates followed by particulate settling, and biological processes can be responsible for removal of dissolved elemental load from the water column in pit lakes (e.g. Martin et al., 2006).
- TSF Lake water quality prediction
  - o Tailings consolidation assumed to proceed through Year 40. All porewater expelled during consolidation is assumed to be expelled back into the TSF Pond with the chemical load that would arise from having concentrations at the estimated tailings porewater values

- o In reality, a portion of the expelled water will report to tailings seepage as a component of total seepage. Seepage volumes will not increase, so in effect the assumption that all consolidation water reports to the TSF Pond will be overestimating the chemical loads generated.
- o No removal of mass from water column was accounted for. Mineral precipitation, scavenging and settling of dissolved metals by particulates, and biological removal processes are processes that may contribute to mass removal from the TSF Lake water at full scale.

RESULTS

The results of the site water and load balance model for the New Prosperity Project include estimates of future flow rates and water quality associated with all mine facilities. These results are provided for all phases of the mine life cycle, under a range of anticipated hydrological conditions.

Results of the water balance modeling are discussed in Section 2.7.2.4. Water quality predictions are provided in Appendices 2.7.2.1-I.1 through 2.7.2.1-I.13. Table 2.7.2.1-22 outlines the report location of the water quality results for each mine component. Water quality results for Fish Lake and for other surface water bodies outside of the mine site are discussed in Section 2.7.2.4.

Table 2.7.2.1-22 Key to Appendices Containing Water Quality Results – DRAFT

Appendix	Component
Appendix 2.7.2.1- I.1	Upper Fish Creek
Appendix 2.7.2.1- I.2	Tributary 1
Appendix 2.7.2.1- I.3	Open Pit
Appendix 2.7.2.1- I.4	South Embankment (SE) Seepage Pond
Appendix 2.7.2.1- I.5	West Embankment (WE) Seepage Pond
Appendix 2.7.2.1- I.6	Main Embankment (ME) Seepage Pond 1
Appendix 2.7.2.1- I.7	Main Embankment (ME) Seepage Pond 2
Appendix 2.7.2.1- I.8	Tailings Storage Facility
Appendix 2.7.2.1- I.9	Plant Site
Appendix 2.7.2.1- I.10	Non-PAG Stockpile
Appendix 2.7.2.1- I.11	Ore Stockpile
Appendix 2.7.2.1- I.12	Crusher Pad
Appendix 2.7.2.1- I.13	Mine Site Roads

CONCLUSIONS

- The New Prosperity deposit is hosted by andesite flows and volcaniclastic rocks intruded by several phases of quartz diorite intrusions and cut by a complex of quartz feldspar porphyry dikes.
- Pyrite and chalcopyrite are the principal sulphide minerals and are accompanied by: minor amounts of bornite and molybdenite, sparse tetrahedrite-tennantite, sphalerite and galena and rare chalcocite-digenite, covellite, pyrrhotite, arsenopyrite, enargite and marcasite.
- The deposit is dominated by potassic alteration (predominantly biotite) with internal zones of sericite-iron carbonate alteration. The bulk of the surrounding host rock is characterized by propylitic alteration (chlorite+calcite+ pyrite) with smaller zones of phyllic alteration (quartz+sericite+pyrite).

- Anhydrite and gypsum are ubiquitous below an upper leached zone that typically occurs at a depth of 150 m below surface, but extends to greater than 300 m below surface in regions of higher fracture density.
- The deposit is covered by a thick package of Tertiary glacial sediments, colluvium and basalt, and Quaternary glacial sediments. A smaller portion of the Tertiary colluvium may have been sourced from the paleo-surface of the mineralized bedrock and is considered PAG based on ABA characteristics.

STATIC GEOCHEMICAL CHARACTERISTICS OF ROCKS

A number of phases of static testing were carried out to characterize the variability of ARD potential and metal content of the rocks. Interpretation of the results considered both rock and alteration type as a basis for managing waste rock. The following were concluded by this study and by Taseko and its subcontractors in previous studies.

- All rock and alteration types contain rock that ranges in ABA classification from PAG to non-PAG. The exceptions are a late dike unit (PMPD) and a Tertiary basalt unit (BSLT) which have shown minimal potential for acid generation.
- The average sulphide sulphur content of rock is near 2%. It is slightly lower in the intrusives (intrusive unit average ranging from 1.1% to 2.63%) and greater in the volcanics (volcanic and subvolcanic unit average ranging from 1.79% to 2.54%). Extreme sulphide sulphur concentrations exceed 9%.
- Sulphate concentrations are highly variable but are several percent in rock below the zone leached by meteoric waters.
- Assessment of neutralization potential and carbonate mineralogy indicates that modified neutralization potential (NP) reflects the available neutralization potential associated with calcium and magnesium carbonate minerals ($IC_{Ca,Mg}$).
- The ABA block model constructed by Taseko indicates that a large zone of non-PAG waste rock is present peripheral to the ore in the southwest portion of the pit. Most of the waste adjacent to the ore, and peripheral to the ore in the northwest side of the pit, is classified as PAG.
- Continuous sampling of core from 10 holes indicates that potential for ARD typically varies over the scale of tens of meters with local zones of smaller scale variation between PAG and non-PAG rock. This indicates that waste management by segregation of PAG and non-PAG rock is a practical approach for the Project, and that operational monitoring will be important for appropriate waste classification.
- Quaternary overburden is classified as non-PAG as a result of low sulphide sulphur content (up to 0.2%) and moderate NP (average 25 kg $CaCO_3$ equiv./ tonne, up to 44 kg $CaCO_3$ equiv./ tonne).
- Tertiary overburden is mostly classified as non-PAG, however there is a limonitic colluvium unit (FANL) that is classified as PAG based on limited testing. FANL samples subjected to ABA analysis showed acidic paste pH values at the time of testing.
- Tertiary basalt typically has low sulphide content and low calcium and magnesium carbonate NP. There are local zones of higher sulphide sulphur content (up to 0.5%) that will need to be managed as PAG due to the low calcium and magnesium carbonate NP. Modified NP was found to overestimate calcium + magnesium carbonate NP for the Tertiary basalt.

KINETIC GEOCHEMICAL CHARACTERISTICS OF ROCKS

Two kinetic geochemical characterization programs (Phase 4 and Phase 5) consisting of laboratory humidity cells and saturated column testing were designed to provide input into waste management planning (geochemical criteria) and water chemistry predictions (source terms) to inform the overall environmental impact assessment. The following were concluded.

- Sulphate release will be dominated by leaching of calcium sulphate (gypsum and anhydrite). To evaluate sulphide oxidation rates, kinetic test results for samples with low initial sulphate content were considered. Observed sulphide oxidation rates were low.
- Kinetic test results were used to develop a site-specific criterion for segregation of PAG and non-PAG rock. The criterion is NP/AP = 1.5. For the purpose of waste management planning, Taseko has used a criterion of (NP-10)/AP = 2.
- The delay to onset of ARD in PAG rock was calculated based on kinetic test results. These calculations showed that there will be a long delay (decades to centuries) before the majority of the PAG rock transitions from neutral to acidic weathering conditions. Since Taseko plans to flood PAG rock within 2 years of placement, it is expected that pH neutral weathering conditions will be maintained within the PAG waste rock.

STATIC GEOCHEMICAL CHARACTERISTICS OF TAILINGS

Static tailings characterization occurred in two phases (Phase 1 and Phase 3). The following were concluded:

- Static testing of samples of different ore types for Phase 1 indicated that a single bulk tailings product would be non-PAG.
- Phase 3 locked cycle and pilot plant test tailings had lower NP-AP ratios than Phase 1 testing, however ABA results confirmed the Phase 1 conclusion that a bulk tailings product would be non-PAG.
- The lowest observed NP/AP ratio (NP/AP = 1.5) was measured for a Phase 3 pilot plant tailings sample (PP6). Tailings with similar ABA characteristics are unlikely to develop acidic weathering conditions, however monitoring will be necessary to verify that the operational tailings product has ABA characteristics similar to the Phase 1 and Phase 3 samples.

KINETIC GEOCHEMICAL CHARACTERISTICS OF TAILINGS

Kinetic tailings characterization occurred in Phase 5. The following were concluded:

- Humidity cell testing on Phase 5 combined tailings composites indicated initial leaching and depletion of calcium sulphate minerals, followed by stable sulphate release that reflects sulphide oxidation rates in the HCTs.
- Initial elevated release of trace elements from HCTs likely reflects flushing of accumulated oxidation products that were produced since the core was produced in 1992.
- Subaqueous column testing on Phase 5 combined tailings samples indicated that tailings disposed underwater will leach low concentrations of most heavy metal ions. Leaching of sulphate and manganese can be expected from dissolution of calcium sulphate and carbonates, and leaching of fluoride can be expected dissolution of fluorine bearing minerals (possibly apatite, which was identified in select thin sections).
- Unsaturated column testing on Phase 5 combined tailings samples indicated that unsaturated tailings beaches will leach low concentrations of most heavy metal ions. Similar to the saturated tailings column tests, leaching of sulphate and manganese can be expected from beached tails due to dissolution of calcium sulphate and carbonates. Leaching of fluoride in the unsaturated columns occurred at lower concentrations than in the saturated columns.

SITE WATER CHEMISTRY PREDICTIONS

Site water chemistry predictions for saturated and unsaturated tailings, non-PAG waste rock dumps, submerged PAG waste and the open pit were produced using a combination of scale-up of humidity cell and column test results, thermodynamic calculations (for reliable mineralogical controls), and comparison with monitoring data from other copper mines in British Columbia. The following were concluded:

- Leaching of sulphate from tailings, waste rock and wall rock will be controlled by calcium sulphate dissolution.
- The effect of dilution is expected to be significant due to the large catchment area of the site.
- Tailings characterization showed that a single bulk tailings product is expected to be non-PAG.
- Tailings seepage will be pH neutral and is expected to contain sulphate, copper, and manganese concentrations controlled by equilibrium dissolution and precipitation of gypsum ($CaSO_4{\cdot}2H_2O$), tenorite (CuO) and rhodochrosite ($MnCO_3$).
- Subaqueous column testing on combined tailings samples indicated that tailings disposed underwater will leach low concentrations of most heavy metal ions. Leaching of sulphate, manganese and fluoride can be expected from dissolution of calcium sulphate, carbonates and fluorine-bearing minerals such as apatite.
- Pit flooding is expected to require decades following cessation of mining, with overflow to Lower Fish Creek about 28 years after mining is complete.
- Pit water will remain pH neutral indefinitely, and pit water chemistry will be dominated by surface inflow from Fish Lake, by discharge of collected TSF seepage, and by seepage from the non-PAG waste rock storage facility. Loadings from the pit high wall are predicted to be much lower than cumulative loadings from these other sources.

ML/ARD PREDICTION AND PREVENTION PLAN

The ML/ARD Prediction and Prevention Plan (PPP) will be a requirement of the Mines Act Permit for the New Prosperity Mine. The PPP recognizes that the ML/ARD assessments completed during the certification and permitting phases need to be continued for mine construction and operations in the form of confirmation of preliminary findings based on short-term testing, calibration of testwork results to site conditions and ongoing monitoring to direct waste management activities. The PPP also recognizes that it is not practical to completely evaluate all waste components and that monitoring and management plans need to be in place to address potential for impacts due to ML/ARD. As a result of the specific activities proposed for the mine, the PPP will need to contain the following components:

- A careful approach to monitoring and management of PAG and non-PAG waste rock, since effective segregation of these materials is key to the success of the waste management strategy
- Calibration of whole rock ABA data to waste rock fines
- Conservative management criteria for Tertiary basalt and unconsolidated overburden since these materials have limited characterization data at this stage
- Ongoing re-assessment of the mineralogical assumptions used to define management criteria for the mine
- Monitoring and evaluation of seepage from tailings and non-PAG waste rock to verify geochemical weathering is within the predicted range, and
- Monitoring and evaluation of pit walls and pit water chemistry to refine water chemistry predictions.

A draft of the New Prosperity ML/ARD PPP was developed for the previous project proposal was Volume III, Section 9.2 of the March 2009 EIS/Application.

2.7.2.2 Atmospheric Environment

For this EIS, atmospheric environment refers to the state of the atmosphere in the study area. It is the layer of air near the earth's surface to a height of approximately 10 km. It excludes potential effects that may occur within the mine site footprint. Given the mine site footprint has been substantially reduced, and now excludes Fish Lake, effects that previously occurred on the mine site are now offsite, and therefore included in the atmospheric environment. A detailed assessment of atmospheric environment key indicators and measurable parameters outlined in the EIS Guidelines and listed in Table 2.7.2.2-2 has been completed.

Scope of Assessment

This section outlines the scope of the assessment of potential environmental effects of the New Prosperity Project on the atmospheric environment.

In the March 2009 EIS/Application various analyses were completed to assess the potential effects of the proposed Project on the atmospheric environment with respect to the three main development phases: 1) construction and commissioning; 2) operations; and 3) closure. It was stated that post-closure activities associated with the Project were expected to have minimal potential effects on the atmospheric environment.

The Project Activities and Physical Works for New Prosperity are presented in Table 2.7.2.2-1. This table shows whether each activity or physical work has changed from the March 2009 EIS/Application. It also identifies if there are any VEC specific and applicable statutory regulatory changes related to the Project activity. Any project activities or physical works identified with a "Y" in either the Project Activities/Physical Works or Regulatory changes will be carried forward in this exercise. Project activities or physical works identified with an "N" in both of these columns are not carried forward in this vegetation assessment, and are greyed out.

Table 2.7.2.2-1 Project Components, Features and Activities Changed from Previous Project Proposal

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Construction and Commissioning		
Open Pit – Preproduction	N	
Non-PAG waste stockpile	Y	Location and timing only Air emissions by wind erosion New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
PAG Stockpile	Y	Still subaqueous in TSF; just TSF location changed
Non-PAG Overburden Stockpile	Y	Location only Air emissions by wind erosion New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Ore Stockpile	N	
Primary Crusher	N	Material process air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Overland conveyor	N	Material process air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Fisheries compensation works construction	Y	Soil disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Water Management Controls and Operations	Y	
Construction sediment control	Y	
Access road construction and upgrades	N	Soil disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary

Camp construction	N	In mine site Soil disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Site clearing (clearing and grubbing)	Y	Different areas related to moving of TSF, stockpiles, etc. Soil disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Soils handling and stockpiling	Y	Includes overburden removal Soil disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Plant site and other facilities	N	Not emissions; not location New B.C. $PM_{2.5}$ objectives Change in project boundary
Explosives Plant	Y	Location only
Lake dewatering	Y	Only Little Fish Lake
Fish Lake Water Management	Y	Management of inflows and outflows
Starter dam construction	Y	Soil disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Sourcing water supplies (potable, process and fresh)	Y	
Site waste management	N	
Clearing of transmission line ROW	N	Soil disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Construction/Installation of transmission line	N	Soil disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary

Vehicular traffic	Y	2km more road requires more and larger trucks Road dust agitation air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Construction/Installation of transmission line	N	
Concentrate load-out facility near Macalister (upgrades to site)	N	Soil disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Operations		
Pit Production	N	Rock disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Site clearing (clearing and grubbing)	N	
Soils handling and stockpiling	N	
Crushing and conveyance	N	Rock disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary Dust collectors
Ore processing and dewatering	N	Rock disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary Dustfall collectors
Explosive handling and storage	Y	Location only CAC air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Tailing storage	Y	Location changed Wind erosion air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary

Non-PAG waste stockpile	Y	Location and timing only Wind erosion air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
PAG Stockpile	Y	Still subaqueous in TSF; just TSF location changed
Overburden Stockpile	Y	Combined with Non-PAG (i.e. location and timing) Wind erosion air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Ore Stockpile management and processing	Y	Location only Wind erosion air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Potable and non-potable water use	N	
Site drainage and seepage management	Y	
Water Management Controls and Operation	Y	Includes management of flows in and out of Fish Lake
Wastewater treatment and discharge (sewage, site water)	N	
Water release contingencies for extended shutdowns (treatment)	N	
Solid waste management	N	
Maintenance and repairs	N	
Concentrate transport and handling	N	Material Transport air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Vehicle traffic	Y	PAH NO_x; within mine site only Road dust agitation air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Transmission line (includes maintenance)	N	Soil disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Pit dewatering	N	

Fisheries Compensation works operations	Y	
Concentrate load-out facility near Macalister	N	Material Transport air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS) Change in project boundary
Closure		
Water Management Controls and Operation	Y	
Fisheries Compensation Operations	Y	
Site drainage and seepage management	Y	
Reclamation of ore stockpile area	Y	Location only Rock disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS)
Reclamation of Non-PAG waste rock stockpile	Y	Location only Rock disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS)
Tailing impoundment reclamation	Y	Rock disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS)
Pit lake and TSF Lake filling	Y	Rock disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS)
Plant and associated facility removal	N	Rock disruption air emissions New B.C. $PM_{2.5}$ objectives Proposed National Air Quality Management System (NAQMS)
Road decommissioning	N	
Transmission line decommissioning	N	
Post-closure		
Discharge of tailing storage facility water	Y	
Discharge of pit lake water	N	Into lower Fish Creek
Seepage management and discharge	Y	
Ongoing monitoring of reclamation	Y	

None of the changed project activities and physical works for New Prosperity, excepting the spatial boundary changes, are key. There are no new atmospheric environment issues raised by the amended mine plan.

Regulatory Changes (since Prosperity)

A regulatory change, specifically new BC ambient air quality objectives (AAQO) for $PM_{2.5}$, alters the conclusions of the assessment of effects for the atmospheric environment. Additionally, a proposed new framework for managing air quality recently introduced by the Federal government may influence mine operations in the future. The new AAQO for $PM_{2.5}$ necessitates a re-analysis of the dispersion modelling results consistent with the changes. The new Federal framework warrants a review of what is proposed, and a discussion on potential ramifications given what is known at present.

The Province of British Columbia's recently adopted AAQO for respirable particulate matter ($PM_{2.5}$). They are 25 µg/m^3 for a 24-hour averaging period (as a 98th percentile value over one year) and 8 µg/m^3 for the annual averaging period (BC HLS, 2009). The Province has also listed a Planning Goal of 6 µg/m^3 for the annual averaging period. The status of this Goal is uncertain given recent changes in $PM_{2.5}$ measurement methodologies, and the uncertainty surrounding historical $PM_{2.5}$ measurements. For the purposes of this assessment the new AAQO will be considered, and the Planning Goal discounted.

In October 2010, the Canadian Council of Ministers of the Environment (CCME) released a collaborative air quality management approach known as the Comprehensive Air Management System (since renamed as the National Air Quality Management System or NAQMS). The aim of the NAQMS is to standardize a patchwork of air quality regimes and practices across Canada (CAMS, 2010).

The NAQMS is composed of the following four elements:

i. Newly established Canadian Ambient Air Quality Standards (CAAQS), formerly known as Canada Wide Standards (CWS)

ii. A national framework of six air sheds and a provision to delegate functional responsibility for air zones within the six national air sheds to a multi-stakeholder air zone management team

iii. A series of four trigger levels based on measured air quality, and an outline of potential air zone actions in response to pressures on air quality, and

iv. Base-Level Industrial Emission Requirements (BLIERS) for facilities.

Initially, Canadian Ambient Air Quality Standards (CAAQS) will replace the current Canada Wide Standards (CWS) for fine particulate matter ($PM_{2.5}$) and ground level ozone (O_3). Subsequent standards will be considered for other pollutants such as nitrogen oxides (NO_X), sulphur dioxide (SO_2) and volatile organic compounds (VOCs).

The NAQMS timeframe for development and implementation is stated as 2011-2015. The timeframe may be overly ambitious as cross-country stakeholder engagement and geographical analysis of contextual concerns has not been initiated, nor has health science research been disclosed.

The potential ramifications of the NAQMS for New Prosperity are uncertain given what is known at present. Given that New Prosperity has committed to the implementation of BATEA and is in a relatively pristine, remote region, the effect of the NAQMS should be minimal.

Changes as a Result of New Prosperity EIS Guidelines

As a result of the New Prosperity EIS Guidelines, there are no changes to the atmospheric environment KIs and assessment requirements from the March 2009 EIS/Application. Potential effects on atmospheric environment associated with the Project were assessed in the March 2009 EIS/Application using the following two Key Indicators (KIs):

- Criteria air contaminants (CACs), and
- Greenhouse gases (GHGs).

Measurable parameters associated with each KI are summarized in Table 2.7.2.2-2. CACs were selected as they are associated with human health effects and other effects in the receiving environment. They may affect the intrinsic quality of life nearby.

Table 2.7.2.2-2 Key Indicators and Measurable Parameters for Atmospheric Environment

Key Indicator	Measurable Parameter (2009 Prosperity and 2012 New Prosperity)
Criteria Air Contaminants (CACs)	Respirable Particulate Matter ($PM_{2.5}$)
	Inhalable Particulate Matter (PM_{10})
	Total Suspended Particulate (TSP)
	Dustfall
	Oxides of Nitrogen (NO_X), including Nitrogen Dioxide (NO_2)
	Carbon Monoxide (CO)
	Sulphur Dioxide (SO_2)
	Lead (Pb)
Greenhouse Gases (GHGs) Expressed as CO_{2e} (Carbon Dioxide Equivalent)	Carbon Dioxide (CO_2)
	Methane (CH_4)
	Nitrous Oxide (N_2O)

Key Changes and Issues

In Section 2.4.2 of the March 2009 EIS/Application a full analysis of project-related GHGs emissions is conducted as well as the effects of potential changes in climate on the Project, consistent with CEAA (2003) and Environment Canada (2007). However, as it is not possible to attribute potential effects (be they local, regional, or global) to the emissions from any specific project emissions of GHGs were not considered in the effects characterization and subsequent sections of the March 2009 EIS/Application.

Detailed rationale for the selection of the KIs and justification for their inclusion in this assessment were provided in the March 2009 EIS/Application.

The key issues affecting the Atmospheric Environment that were reported in the March 2009 EIS/Application were reviewed in the context of New Prosperity. Physical works and activities identified as having changed due to Project design or regulatory requirements (as shown in Table 2.7.2.2-1 above) have been carried forward and presented in Table 2.7.2.2-3 below. These include all the Project activities/physical works that have changed in some way (previously identified as “Y” in Table 2.7.2.2-1), as a result of the New Prosperity Project. The following criteria were used for the interaction ratings:

0. Effect on atmospheric environment is likely to decrease or stay the same (i.e., no changes to significance conclusions), and there are no required changes to previously proposed mitigation measures, and no additional regulatory requirements have been identified (i.e., from the EAO, Panel, EIS Guidelines or other applicable regulation). Therefore, no further assessment is warranted.

1. Effect on atmospheric environment is likely to decrease or stay the same (i.e., no changes to significance conclusions), but some re-evaluation of effect is required due to changes in project design, proposed mitigation measures, and/or additional regulatory requirements have been identified (i.e., from the EAO, Panel, EIS Guidelines, or other applicable regulations).

2. Effect on atmospheric environment is likely to increase; therefore, further assessment is warranted.

Table 2.7.2.2-3 VEC Potential Environmental Effects Associated with New Prosperity (Effects Scoping Matrix)

General Category	Project Activities/Physical Works	Increase in CACs	Increase in GHGs
Construction of Load-out facility	Concentrate load-out facility near Macalister (upgrades to site)	1	0
Construction of Ore Processing Infrastructure	Primary Crusher	1	0
	Overland conveyor	1	0
	Construction: plant site and other facilities	1	0
Construction of Site Utilities/Access	Access road construction and upgrades	2	0
	Camp construction	1	0
Construction/Installation of transmission line	Clearing of transmission line ROW	1	0
	Construction/Installation of transmission line	1	0
Fisheries compensation works (construction)	Fisheries compensation works construction	0	0
Overburden and Waste Rock Management	Open Pit – Preproduction	1	0
	Non-PAG waste stockpile	1	0
	PAG Stockpile	1	0
	Overburden Stockpile	1	0
	Soils handling and stockpiling	1	0
Site clearing (clearing and grubbing)	Site clearing (clearing and grubbing)	1	0
Site waste management	Site waste management	0	0
	Water Management Controls and Operations	0	0
	Construction sediment control	0	0
	Lake dewatering	0	0
	Fish Lake Water Management	0	0
	Starter dam construction	1	0
Vehicular traffic	Vehicular traffic	2	2
Water Sourcing and Use	Sourcing water supplies (potable, process/TSF)	0	0
Concentrate load-out facility near Macalister	Concentrate load-out facility near Macalister	1	0
Fisheries Compensation works (operations)	Fisheries Compensation works operations	0	0
Ore Extraction and Stockpiling	Pit Production	1	0
	Explosive handling and storage	1	0

General Category	Project Activities/Physical Works	Increase in CACs	Increase in GHGs
	Ore Stockpile management and processing	1	0
	Crushing and conveyance	1	0
	Ore processing and dewatering	1	0
	Maintenance and repairs	0	0
	Concentrate transport and handling	1	0
Overburden and Waste Rock Management	Non-PAG waste stockpile	1	0
	PAG Stockpile	0	0
	Overburden Stockpile	1	0
Site Water Management	Site drainage and seepage management	0	0
	Water Management Controls and Operation	0	0
	Wastewater treatment and discharge (sewage, site water)	0	0
	Water release contingencies for extended shutdowns (treatment)	0	0
	Pit dewatering	0	0
Solid waste management	Solid waste management	0	0
Tailings Management	Tailing storage	0	0
Vehicle traffic	Vehicle traffic	2	2
	Transmission line (includes maintenance)	1	0
Water Sourcing and Use	Potable and non-potable water use	0	0
Fisheries Compensation operations	Fisheries Compensation Operations	0	0
Reclamation	Reclamation of ore stockpile area	1	0
	Reclamation of Non-PAG waste rock stockpile	1	0
	Tailing impoundment reclamation	1	0
	Plant and associated facility removal	0	0
	Road decommissioning	0	0
	Transmission line decommissioning	0	0
Site Water Management	Water Management Controls and Operation	0	0
	Site drainage and seepage management	0	0
	Pit lake and TSF Lake filling	0	0
Site Water Management	Discharge of tailing storage facility water	0	0
	Discharge of pit lake water	0	0
	Seepage management and discharge	0	0
Monitoring	Ongoing monitoring of reclamation	0	0
Interaction of Other Projects and Activities		1	0
Accidents, Malfunctions and Unplanned Events		1	0

The interactions indicated in grey shading in Table 2.7.2.2-3 are not carried forward in this assessment. Based on past experience and professional judgment, the March 2009 EIS/Application determined that there would be no interaction; the interaction would not result in a significant environmental effect, even without mitigation; or the interaction would not be significant due to application of codified environmental protection practices that are known to effectively mitigate the predicted environmental effects. This has not changed since the March 2009 EIS/Application; details on the justification for this rating are provided in the issues scoping section for each KI in the March 2009 EIS/Application (see Volume 4 section 2). These interactions are not discussed further in this assessment.

Project activities and physical works for Prosperity that were included as air emission sources in the March 2009 EIS/Application are presented in Table 2.7.2.2-4. This table is a considerable simplification of Table 2.7.2.2-3, as many project activities can fall into one emission source.

Table 2.7.2.2-4 Summary of Project Activities and Physical Works Assessed included as Air Emission Sources in the Prosperity EA

Emission Source Name		Project Phase		
		Construction	Operations	Closure
Land Clearing Burning		✓		
Mine Pit Area	Fugitives	✓	✓	✓
	Heavy Equipment	✓	✓	✓
Overburden Pile	Fugitives	✓		
	Heavy Equipment	✓	✓	✓
Waste Rock Pile	Heavy Equipment	✓	✓	✓
Road between mine and plant	Heavy Equipment	✓	✓	✓
Plant site	Fugitives		✓	
	Heavy Equipment	✓	✓	✓
Project Access Road	Heavy Equipment	✓	✓	✓
Truck Dump	Fugitives		✓	
	Heavy Equipment	✓	✓	
Generators (Including 4 Units)	Heavy Equipment	✓		✓
NOTE: Emission values for 'Heavy Equipment' are those produced by fuel combustion.				

The New Prosperity Project activities and physical works are changed in many respects. With respect to those that were included as air emission sources in the March 2009 EIS/Application dispersion modelling, the effects of those changes presented in Table 2.7.2.2-5:

Table 2.7.2.2-5 Summary of Project Activities and Physical Works Changes as a Result of the New Prosperity Project

Emission Source Name		Project Phase		
		Construction	Operations	Closure
Land Clearing Burning		Smaller area cleared		
Mine Pit Area	Fugitives	No change	No change	No change
	Heavy Equipment	No change	No change	No change
Overburden Pile	Fugitives	New location		
	Heavy Equipment	Longer haul	Longer haul	Longer haul
Waste Rock Pile	Heavy Equipment	Longer haul	Longer haul	Longer haul
Road between mine and plant	Heavy Equipment	No change	No change	No change
Plant site	Fugitives		No change	
	Heavy Equipment	No change	No change	No change
Project Access Road	Heavy Equipment	No change	No change	No change
Truck Dump	Fugitives		No change	
	Heavy Equipment	No change	No change	
Generators (Including 4 Units)	Heavy Equipment	No change		No change
NOTE: Emission values for 'Heavy Equipment' are those produced by fuel combustion.				

Of all of the Project activities and physical works that were included as air emission sources in the March 2009 EIS/Application dispersion modelling for New Prosperity the only ones that change are the locations of the overburden pile and the waste rock pile. The new locations result in a longer haul distance (2-3 km per trip) and a slight relocation of the source of emissions for the overburden pile fugitives. For land clearing burning there is a reduction in the area cleared, and hence less clearing, grubbing, and burning.

The changed project activities and physical works for New Prosperity do not result in substantial changes to criteria air contaminant emissions in any of the three main development phases. The previous dispersion assessment assumptions are unchanged, and the results are still relevant. As a result the dispersion assessment has not been re-done. However, regulatory and spatial boundary changes necessitate a re-analysis of these results consistent with the changes.

The changed project activities and physical works for New Prosperity do not result in substantial changes to greenhouse gas emissions in any of the three main development phases. There are no changes required to previously proposed mitigation measures and no additional regulatory requirements have been identified.

Temporal Boundary Changes

The changes in the temporal boundaries of project activities for New Prosperity do not alter the conclusions of the assessment of effects for the atmospheric environment. There are no changes required to previously proposed mitigation measures.

Spatial Boundary Changes

The change to the spatial boundary for New Prosperity alters the findings of the assessment of effects for the atmospheric environment. Effects that previously occurred on the mine site are now offsite and therefore included in the atmospheric environment. The Prosperity and New Prosperity mine disturbance boundaries is presented in Figure 1 in Appendix 2.7.2.2-A. While the New Prosperity mine disturbance boundary is generally smaller (excluding Fish Lake) in some areas it has greater extents than the Prosperity mine disturbance boundary (NW extremity and NE extremity). This necessitates a re-analysis of the dispersion modelling results consistent with the changed spatial boundary.

Project Impact Assessment for Atmospheric Environment

Table 2.7.2.2-6 presents the maximum predicted ground-level concentrations associated with both the 2009 Prosperity and the 2012 New Prosperity Projects. The New Prosperity results take into account both the regulatory changes and spatial boundary changes noted above.

Table 2.7.2.2-6 Maximum Predicted Ground-level Concentrations Associated with the 2009 Prosperity and 2012 New Prosperity Projects

Substance	Averaging Period	Predicted Concentration ($\mu g/m^3$)				Most Stringent Regulatory Objective / Standard
		Operation Case		Construction Case		
		Prosperity	New Prosperity	Prosperity	New Prosperity	
NO_2	One-hour	198	184	133	153	400 [b]
	24-hour	101	111	71	88	200 [b]
	Annual	30	30	14	23	60 [b]
CO	One-hour	1,465	1,216	524	877	14,300 [a]
	8-hour	627	1,037	232	424	5,500 [a]
$PM_{2.5}$	24-hour	**29**	**34**	17	**37**	25 [c]
	Annual	--	7.9	--	12	8 [c]
PM_{10}	24-hour	**234**	**438**	**311**	**595**	50 [a]
TSP	24-hour	**234**	**509**	**437**	**1,125**	120 [b]
	Annual	46	**89**	**117**	**246**	60 [b]
SO_2	One-hour	1.8	1.4	0.7	1.2	450 [b]
	24-hour	0.3	0.4	0.1	0.3	150 [b]
	Annual	0.03	0.03	0.02	0.03	25 [a]
Lead	24-hour	1.38E-02	1.76E-02	6.72E-03	1.34E-02	4 [a]
	Annual	1.69E-03	1.75E-03	1.19E-03	2.56E-03	2 [a]
Dustfall ($mg/dm^2/d$)	24-hour	20	92	57	154	NA
	30 day	**9**	**24**	**23**	**49**	1.7-2.9 [d]

SOURCES:
Boldface font indicates predicted concentrations in excess of the Most Stringent Regulatory Objective / Standard
[a] BC Ministry of Environment. 2009. Air Quality Objectives and Standards.
Available at: http://www.bcairquality.ca/reports/pdfs/aqotable.pdf.
[b] Health Canada. National Ambient Air Quality Objectives. 2007.
Available at: http://www.hc-sc.gc.ca/ewh-semt/pubs/air/naaqo-onqaa/index-eng.php.
[c] BC Ministry of Healthy Living and Sport, Air Quality Objectives and Standards.2009. Available at: http://www.bcairquality.ca/reports/pdfs/aqotable.pdf. The $PM_{2.5}$ 24-hour average is based on 98th percentile value for one year.
[d] BC MOE 1979 Pollution Control Objectives for the Mining, Smelting, and Related Industries (BC MOE, 1979). The DF Objective is a daily rate, referenced to a 30-day sampling interval.
- - Indicates analysis not done for Prosperity report
NA Indicates that there is no applicable Regulatory Objective / Standard

Appendix 2.7.2.2-A contains 34 revised isopleth maps that correspond to isopleth maps presented in the March 2009 EIS/Application.

Summary: Construction Phase Dispersion Modelling Results

For the construction phase of the Project the maximum predicted ground-level concentrations for most CACs occurs on the northern extremity of the mine disturbance boundary, similar to where they occurred in the March 2009 EIS/Application. In a few instances the maxima has shifted to a location on the northern shore of Fish Lake from a location on the northern extremity. Note that, in discussing the maxima, the land within the mine disturbance boundary is excluded from consideration because this region is restricted to the general public. However, since the mine disturbance boundary has been modified to exclude Fish Lake, values previously excluded from consideration are now reported.

For NO_2, CO, SO_2 and Pb the maximum predicted ground-level concentrations are less than the applicable objective. For $PM_{2.5}$, PM_{10}, TSP and DF the maximum predicted ground-level concentrations are greater than the applicable objectives or standards. In each instance, the area over which the predicted exceedances occur is very small, but somewhat larger than in the March 2009 EIS/Application.

Summary: Operational Phase Dispersion Modelling Results

For the operational phase of the Project the maximum predicted ground-level concentrations for most CACs the maxima has shifted to a location on the northern shore of Fish Lake from a location on the northern extremity of the mine disturbance boundary. In a few instances the maxima has remained on the northern extremity of the mine disturbance boundary, similar to where they occurred in the March 2009 EIS/Application. Note that, in discussing the maxima, the land within the mine disturbance boundary is excluded from consideration because this region is restricted to the general public. However, since the mine disturbance boundary has been modified to exclude Fish Lake, values previously excluded from consideration are now reported.

For NO_2, CO, SO_2 and Pb the maximum predicted ground-level concentrations are less than the applicable objective. For $PM_{2.5}$, PM_{10}, TSP and DF the maximum predicted ground-level concentrations are more than the applicable Objectives or Standards. In each instance, the area over which exceedance of the objective or standard that lies outside of the mine disturbance boundary is very small, but somewhat larger than in the March 2009 EIS/Application.

Atmospheric Environment Mitigation Measures

The mitigation measures proposed in the March 2009 EIS/Application for atmospheric environment still apply. Compensation has not been raised as an issue with respect to the atmospheric environment.

Cumulative Effects Assessment

As described in Section 2.7.1, cumulative environmental effects were only assessed if all three of the following conditions were met for the environmental effect:

- The Project results in a measurable, demonstrable or reasonably-expected residual environmental effect on a component of the environment
- The project-specific residual environmental effect does, or is likely to, act in a cumulative fashion with the environmental effects of other past or future projects and activities that are likely to occur, and
- There is a reasonable expectation that the Project's contribution to cumulative environmental effects will affect the viability or sustainability of the resource or value.

The Project inclusion list (Table 2.7.1.4-1) identifies past, present and reasonably foreseeable projects and activities that could interact cumulatively with the Project. The locations of each of the 22 projects and activities are shown on Figure 2.7.1.4-1. As indicated in Table 2.7.1.4-1, eight of these project and activities are new since 2009. In addition, there is more existing disturbance at baseline as the result of logging (see Section 2.6.1.2). Of the eight new projects, only one, the Newton Mountain mine development, is located west of the Fraser River and, therefore, considered likely to interact cumulatively with the Project's residual effects on the atmospheric environment.

Regional sources of CACs include logging and forestry operations, forest fires, and vehicle emissions from public highways and roads. Given the Project location, low ground level concentrations of CACs are expected year-round. Exceptions include periods where fire is present locally or long-range transportation is affecting the region. Effects attributable to existing sources of CACs in the Project area are not significant. The March 2009 EIS/Application revealed no industrial sources of CACs were present locally at that time. At this time, no other major industrial project with a potential to emit CACs has been publicly announced for the Project area. [Review statement against current PIL] Therefore, Project effects on CACs were judged to not result in a demonstrable overlap with similar effects from other projects or activities.

Determination of the Significance of Residual Effects

The assessment methodology for residual effect characterization and determination of significance is as described in Section 2.7.1.5.

The findings of the Project residual effects assessment for atmospheric resources for New Prosperity are summarized in Table 2.7.2.2-7.

Accounting for the conservative nature inherent in dispersion modelling exercises in general, and the location and limited areas over which predicted concentrations are in exceedance of the objectives and/or standards, it is concluded that the residual project effects for all phases of the Project are not significant. While the direction is adverse, in general the magnitude is small, local in extent, and reversible. The duration and frequency for most activities is regular and medium term, however concentrations above the objectives and/or standards are expected to be very rare, local, short in duration and reversible.

An analysis of the construction related emissions reveals that land clearing burning produces the majority of CAC emissions (mainly particulate). There are also substantial fugitive emissions of particulate from the mine pit area and overburden pile. Other sources emit quantities of CACs insufficient to be of concern.

Of the CACs modelled particulate matter ($PM_{2.5}$, PM_{10}, TSP and DF) are predicted to exceed the applicable objectives or standards. All of these exceedances occur at or very near the mine disturbance boundary on the northern and western extremity. This is owing to plumes impinging on steep terrain in this area—a phenomenon commonly overestimated in dispersion modelling exercises. In each instance, the area in which exceedances of the objective or standard occur lies outside of the mine disturbance boundary and is very small.

Table 2.7.2.2-7 Project Residual Effects Assessment Summary for Criteria Air Contaminants (CACs) for New Prosperity

			Residual Effects Characterization						
Activity	**Effect**	**Proposed Mitigation and Compensation Measures**	**Direction**	**Magnitude**	**Geographic Extent**	**Frequency**	**Duration**	**Reversibility**	**Significance**
Construction and Commissioning									
Site preparation activities (vegetation removal)	Increases to particulate matter concentrations	• Implement management practices to reduce smoke during brush burning	A	M	L	R	ST	R	N
Construction of Project infrastructure and facilities	Increases to particulate matter concentrations	• Turn equipment off when not in use • Ensure equipment is properly tuned and maintained	A	M	L	F	MT	R	N
Power supply for mine site construction (diesel generators)	Increases to particulate matter concentrations	• Incorporate BATEA into project design wherever possible • Turn equipment off when not in use	A	M	L	C	MT	R	N
Exhaust emissions from mine fleet vehicles and equipment	Increases to particulate matter concentrations	• Incorporate BATEA into project design wherever possible • Turn equipment off when not in use • Ensure equipment is properly tuned and maintained • Minimize vehicle idling time	A	M	L	C	MT	R	N
Pit and mine site development, overburden removal, transport conveyer systems, and waste rock stock piling	Increases to particulate matter concentrations	• Incorporate BATEA into project design wherever possible • Turn equipment off when not in use • Ensure equipment is properly tuned and maintained • Minimize vehicle idling time	A	M	S	C	MT	R	N
Operations									
Exhaust emissions	Increases to particulate	• Incorporate BATEA into project design wherever	A	M	L	C	MT	R	N

Activity	Effect	Proposed Mitigation and Compensation Measures	Residual Effects Characterization						
			Direction	Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Significance
from mine fleet vehicles and equipment	matter concentrations	possible • Turn equipment off when not in use • Ensure equipment is properly tuned and maintained • Minimize vehicle idling time							
Ore extraction, crushing, transport conveyer systems, and processing	Increases to particulate matter concentrations	• Incorporate BATEA into project design wherever possible • Turn equipment off when not in use • Ensure equipment is properly tuned and maintained • Minimize vehicle idling time	A	M	S–	C	MT	R	N
Rock stockpiling	Increases to particulate matter concentrations	• Minimize drop heights from conveyors and trucks	A	L	L	C	MT	R	N
Vehicular traffic	Increases to particulate matter concentrations	• Turn equipment off when not in use • Follow posted speed limits • Ensure equipment is properly tuned and maintained • Minimize vehicle idling time	A	L	L	C	MT	R	N
Closure									
Removal of Project infrastructure and facilities	Increases to particulate matter concentrations	• Turn equipment off when not in use • Ensure equipment is properly tuned and maintained	A	L	L	F	ST	R	N
Operation of construction equipment for mine site closure	Increases to particulate matter concentrations	• Turn equipment off when not in use • Ensure equipment is properly tuned and maintained	A	L	L	F	ST	R	N
Power supply for mine site closure (diesel generators)	Increases to particulate matter concentrations	• Incorporate BATEA into project design wherever possible • Turn equipment off when not in use	A	L	L	F	ST	R	N

			Residual Effects Characterization						
Activity	Effect	Proposed Mitigation and Compensation Measures	Direction	Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Significance

KEY Direction: P Positive N Neutral A Adverse Magnitude: Defined for each KI individually. In general: L Low–environmental effect occurs that may or may not be measurable, but is within the range of natural variability. M Moderate–environmental effect occurs, but is unlikely to pose a serious risk or present a management challenge. H High–environmental effect is likely to pose a serious risk or present a management challenge.	Geographic Extent: S Site-specific L Local R Regional Duration: ST: Short term MT: Medium Term LT: Long Term FF: Far Future or Permanent.	Frequency: R Rare - Occurs Once I Infrequent - Occurs sporadically at irregular intervals F Frequent - Occurs on a regular basis and at regular intervals C Continuous Reversibility: R Reversible I Irreversible Ecological Context: U Undisturbed: Area relatively or not adversely affected by human activity D Developed: Area has been substantially previously disturbed by human development or human development is still present N/A Not applicable.	Significance: S Significant N Not Significant Prediction Confidence: Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation L Low level of confidence M Moderate level of confidence H High level of confidence

Table 2.7.2.2-8 provides a concise summary of the effects assessment for atmospheric environment. Considering the updated findings of the Project, mitigation measures, and cumulative residual effects on the atmospheric environment presented in this document, the overall significance determination for the New Prosperity Project, including all three major components (mine site, access road, transmission line), is unchanged from 2009. That is, the effect of the Project on the condition of the atmospheric environment is considered to be not significant.

Table 2.7.2.2-8 Summary of Effects Assessment for Atmospheric Environment

Effects Assessment	Concise Summary
Beneficial and Adverse Effects	The New Prosperity Project has reduced the spatial boundary. The New Prosperity Project has redesigned the mine site layout to include the conservation of Fish Lake. Otherwise The beneficial and adverse effects remain the same as predicted in the original EA (Taseko, 2009).
Mitigation and Compensation Measures	Mitigation measures from the Prosperity Project for avoiding and/or mitigating potential environmental effects to atmospheric resources have been proposed for project-related activities, There are no compensation measures associated with the atmospheric environment.
Potential Residual Effects	The potential project residual effects for all phases of the Project are adverse in direction, small in magnitude, local in extent, and reversible. The duration and frequency for most activities is regular and medium term, however concentrations above the objectives and/or standards are expected to be very rare, local, short in duration and reversible.
Cumulative Effects	To be completed when CE section is finalized
Determination of the significance of residual effects	The combined residual environmental effects of the Project on the condition of the atmospheric environment are predicted to be not significant. This assessment is predicated on the implementation of proposed mitigation measures.
Likelihood of occurrence for adverse effects found to be significant	As no significant residual effects are predicted, there is no likelihood of occurrence. There is the possibility that the prediction of significant adverse effects is incorrect, whereby an adverse effect deemed to be not significant may have an adverse effect. The likelihood of this remains low.

Additional Work

No additional work is recommended.

Follow-up and Monitoring

The development and maintenance of an annual inventory of CACs for both internal management and potential external reporting needs is recommended as a follow-up action. Also important is the development and implementation of an air quality and dust control management plan, and a burn plan for vegetative debris prior to initiation of the construction and commissioning phase.

It is also recommended that Taseko Mines establish an ambient air quality monitoring network to characterize the effects of the Project on the atmospheric environment. The dispersion modelling predicts that particulate matter ($PM_{2.5}$, PM_{10}, TSP and DF) may exceed the applicable Objectives or Standards at or very near the mine disturbance boundary on the northern and western extremity. While the area affected is very small, project effects in this region are representative of worst case.

It is therefore recommended that one station be established in this region to measure both PM_{10} and DF. The PM_{10} measurements should be 24-hour average concentrations, taken midnight-to-midnight on the

National Air Pollution Surveillance program 6-day schedule. Dustfall should be collected for monthly intervals coincident with the calendar month.

It is further recommended that a second identical station be established in a region nearby, but unaffected by mine emission sources. This station will establish a baseline to which the other stations measurements can be compared to differentiate between Project and other regional and global influences.

To assist in the interpretation of these (and other) data, it is recommended that Taseko Mines continue to support the collection of meteorological data at the present location (M05). This station continuously measures temperature, relative humidity, wind speed and direction, precipitation, and solar irradiance. This site is regionally representative and the installation, data acquisition, and quality assurance is consistent with best practices.

2.7.2.3 Acoustic Environment

This section identifies how the Project has changed from the previous project proposal and whether changes would result in changes to the acoustic environmental**.**

Scope of Assessment

The noise assessment in this EIS was completed to support regulatory applications to construct and operate the proposed Project. This section focuses on potential effects of noise on the general public located outside the Project mine site area. It excludes potential effects that may occur within the mine site footprint. Given the mine site footprint has been substantially reduced, and now excludes Fish Lake, effects that previously occurred on the mine site are now offsite, and therefore included in the acoustic environment. For potential noise effects on wildlife, refer to the Wildlife Section in Section 2.7.2.8.

Similar to the original EA (Taseko, 2009), this noise assessment focused on the activities that will generate noise that may occur during different phases of the Project, including:

- Construction
- Operations, and
- Closure.

After closure of the Project, the acoustic environment is expected to return to the original ambient conditions. As a result, post-closure is not considered further in this assessment.

The following Table 2.7.2.3-1 displays a listing of the Project Activities and Physical Works for New Prosperity and whether each activity or physical work has changed from the original Prosperity submission. Project activities or physical works that have noise effects, identified with a “Y” in either Changes in Project Design or Changes in Regulatory Requirements will be carried forward for assessment of the changes to effects on the acoustic environment. Project activities or physical works that do not have any noise effects, or identified with an “N” in both of these columns are not carried forward in this acoustic environment assessment, and are greyed out.

Table 2.7.2.3-1 Project Components, Features and Activities Changed from Previous Project Proposal

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Construction and Commissioning		
Open Pit – Preproduction	N	
Non-PAG Waste Stockpile	Y	
PAG Stockpile	Y	
Non-PAG Overburden Stockpile	Y	
Ore stockpile	N	
Primary Crusher	N	
Overland Conveyor	N	
Fisheries Compensation Works Construction	N	

Water Management Controls and Operations	N	
Construction Sediment Control	N	
Access Road Construction and Upgrades	N	
Camp Construction	N	
Site Clearing (Clearing and Grubbing)	Y	
Soils Handling and Stockpiling	Y	
Plant Site and Other Facilities	N	
Explosives plant	N	
Lake Dewatering	Y	No noise effect
Fish Lake Water Management	Y	No noise effect
Starter Dam Construction	Y	
Sourcing Water Supplies (Potable, process and fresh)	Y	No noise effect
Site Waste Management	N	
Clearing of Transmission Line ROW	N	
Construction/Installation of Transmission Line	N	
Vehicular Traffic	Y	
Concentrate Load-out Facility near Macalister (Upgrades to Site)	N	
Operations		
Pit Production	N	
Site clearing (clearing and grubbing)		
Soils handling and stockpiling		
Crushing and Conveyance	N	
Ore Processing and Dewatering	N	
Explosive Handling and Storage	Y	No noise effect
Tailing Storage	Y	No noise effect
Non-PAG Waste Stockpile	Y	
PAG Stockpile	Y	
Overburden Stockpile	Y	
Ore Stockpile Management and Processing	Y	
Potable and Non-potable Water Use	N	
Site Drainage and Seepage Management	Y	No noise effect
Water Management Controls and Operation	Y	No noise effect

Wastewater Treatment and Discharge (Sewage, Site Water)	N	
Water Release Contingencies for Extended Shutdowns (Treatment)	N	
Solid Waste Management	N	
Maintenance and Repairs	N	
Concentrate Transport and Handling	N	
Vehicle Traffic	Y	
Transmission Line (Includes Maintenance)	N	
Pit Dewatering	N	
Fisheries Compensation Works Operations	Y	No noise effect
Concentrate Load-out Facility near Macalister	N	
Closure		
Water Management Controls and Operation	Y	No noise effect
Fisheries Compensation Operations	Y	No noise effect
Site Drainage and Seepage Management	Y	No noise effect
Reclamation of ore Stockpile Area	Y	
Reclamation of Non-PAG Waste Rock Stockpile	Y	
Tailing Impoundment Reclamation	Y	
Pit Lake and TSF Lake Filling	Y	No noise effect
Plant and Associated Facility Removal	N	
Road Decommissioning	N	
Transmission Line Decommissioning	N	
Post-closure		
Discharge of Tailing Storage Facility Water	Y	No noise effect
Discharge of Pit Lake Water	N	
Seepage Management and Discharge	Y	No noise effect
Ongoing Monitoring of Reclamation	Y	No noise effect

Regulatory Changes

Within British Columbia, there are no specific regulatory guidance documents for mining development that relate to noise effects on the general public (i.e. human receptors and residential dwelling locations that are located outside the Project mine site and not associated with the Project). However, the Noise Control

Best Practices Guideline (BC, 2009) by the BC Oil & Gas Commission (OGC) regulates noise emission from the oil and gas sectors within the BC province.

The ERCB Noise Control Directive 38 was used as the noise guideline in the original EA (Taseko, 2009). As this study focuses on addressing potential noise effects of the Project on the general public in BC, the BC OGC Noise Control Best Practices Guideline was used as guidance.

The OGC Noise Control Best Practices Guideline is similar to the ERCB Directive 038, which sets out the outdoor noise limit Permissible Sound Levels (PSLs) for a receptor. A receptor is defined as In cases for facilities in remote areas where a receptor is not present, a PSL limit of 40 A-weighted decibels equivalent sound level (dBA L_{eq}) during night time period (22:00 to 7:00 hr) should be met at 1.5 kilometers (km) from the facility boundary. The OSG Noise Control Best Practices Guideline and ERCB Directive 038 do not have a quantitative limit on noise level at a receptor due to construction activities.

In a federal level Canadian Environmental Assessment Agency (CEAA) review, the Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise (April 2011) by Health Canada should be considered in addition to the OGC guideline. Baseline sound level monitoring and the percentage annoyance (%HA) indicator should be considered for the receptors. However, there is no receptor within the study area.

Key Changes and Issues

None of the changed project activities and physical works for New Prosperity, excepting the spatial boundary changes, are key changes. There are no new issues raised by the amended mine plan.

The key acoustic environment issue for the Project is the likelihood that the activities associated with the Project will result in an increase to the existing acoustic environment during construction, operations, and closure. In Section 3.1.1 of the original EA (Taseko, 2009), a full summary of expected Project activities that may affect ambient sound levels was provided.

The measurable parameter for the acoustic environment is the ambient sound level. Rationale for the selection of ambient sound levels and justification for their inclusion in this assessment is provided in Table 2.7.2.3-2. Ambient sound levels have been selected as a measurable parameter because of the possibility that they will be affected as a result of Project activities.

Environmental noise is typically not steady and continuous, but constantly varies over time. To account for the time-varying nature of environmental noise, a single number descriptor known as the energy equivalent sound level (L_{eq}) is used. The L_{eq} value, expressed in dBA, is the energy-averaged, A-weighted sound level for the complete period. It is defined as the steady, continuous sound level over a specified time that has the same acoustic energy as the actual varying sound levels over the same time. The unit for L_{eq} is dBA (A-weighted decibels), which reflects the response of the human ear to different sound frequencies. Periods commonly used for L_{eq} measurements and criteria are daytime (07:00 to 22:00) and night-time (22:00 to 07:00). The daytime L_{eq} is a 15-hour A-weighted energy equivalent sound level, denoted as $L_{eq}(15)$. Similarly, the night-time L_{eq} is a 9-hour A-weighted energy equivalent sound level denoted as $L_{eq}(9)$. The same environmental noise description was used in the original EA (Taseko 2009).

Table 2.7.2.3-2 Noise Measurable Parameters

Measurable Parameter	Rationale for Selection	Linkage to EA Guidelines, Other Regulatory Drivers, Policies and Programs	Ambient Data for EA
Ambient Sound Levels	Potential environmental effects on ambient sound levels due to the following Project related activities: construction, operations and closure Increases to ambient sound levels directly affect quality of life for humans	OGC Noise Control Best Practices Guideline (OGC 2009) ERCB Directive 38: Noise Control Directive (ERCB, 2007)	As the location and environmental setting of the Project is considered remote, average night-time ambient sound level of 35 dBA Leq(9) recommended by the OGC Noise Control Best Practice for remote rural areas has been used

Considering any of the physical works and activities with noise effects and identified as changed in Project Design (previously identified as "Y") from Table 2.7.2.3-1, the following Table 2.7.2.3-3 VEC Project Effects Scoping (interaction) Matrix indicates a rating for each potential project effect using the following interaction VEC Project Environmental Effect Rating Criteria:

0. Effect on VEC is likely to decrease or stay the same (i.e., no changes to significance conclusions), and there are no required changes to previously proposed mitigation measures, and no additional regulatory requirements have been identified (i.e., from the EAO, Panel, or other applicable regulation). Therefore, no further assessment is warranted.
1. Effect on VEC is likely to decrease or stay the same (i.e., no changes to significance conclusions), but some re-evaluation of effect is required due to changes in project design, proposed mitigation measures, and/or additional regulatory requirements have been identified.
2. Effect on VEC is likely to increase; therefore, further assessment is warranted.

Table 2.7.2.3-3 VEC Potential Environmental Effects Associated with New Prosperity (Effects Scoping Matrix)

General Category	Project Activities/Physical Works	Increase in Ambient Noise Level
Construction and Commissioning		
Overburden and Waste Rock Management	Non-PAG waste stockpile	1
	PAG Stockpile	1
	Overburden Stockpile	1
	Soils handling and stockpiling	1
Site Clearing (Clearing and Grubbing)	Site Clearing (Clearing and Grubbing)	1
Starter dam construction	Starter dam construction	1
Vehicular Traffic	Vehicular Traffic	1
Operations		

General Category	Project Activities/Physical Works	Increase in Ambient Noise Level
Overburden and Waste Rock Management	Non-PAG waste stockpile	1
	PAG Stockpile	1
	Overburden Stockpile	1
Vehicle Traffic	Vehicle traffic	1
	Transmission line (includes maintenance)	0
Ore Extraction and Stockpiling	Ore Stockpile management and processing	0
Closure		
Reclamation	Reclamation of ore stockpile area	1
	Reclamation of Non-PAG waste rock stockpile	1
	Tailing impoundment reclamation	1

Temporal Boundary Changes

The changes in the timing of project activities for New Prosperity do not alter the conclusions of the assessment of effects for the acoustic environment. There are no changes required to previously proposed mitigation measures.

Spatial Boundary Changes

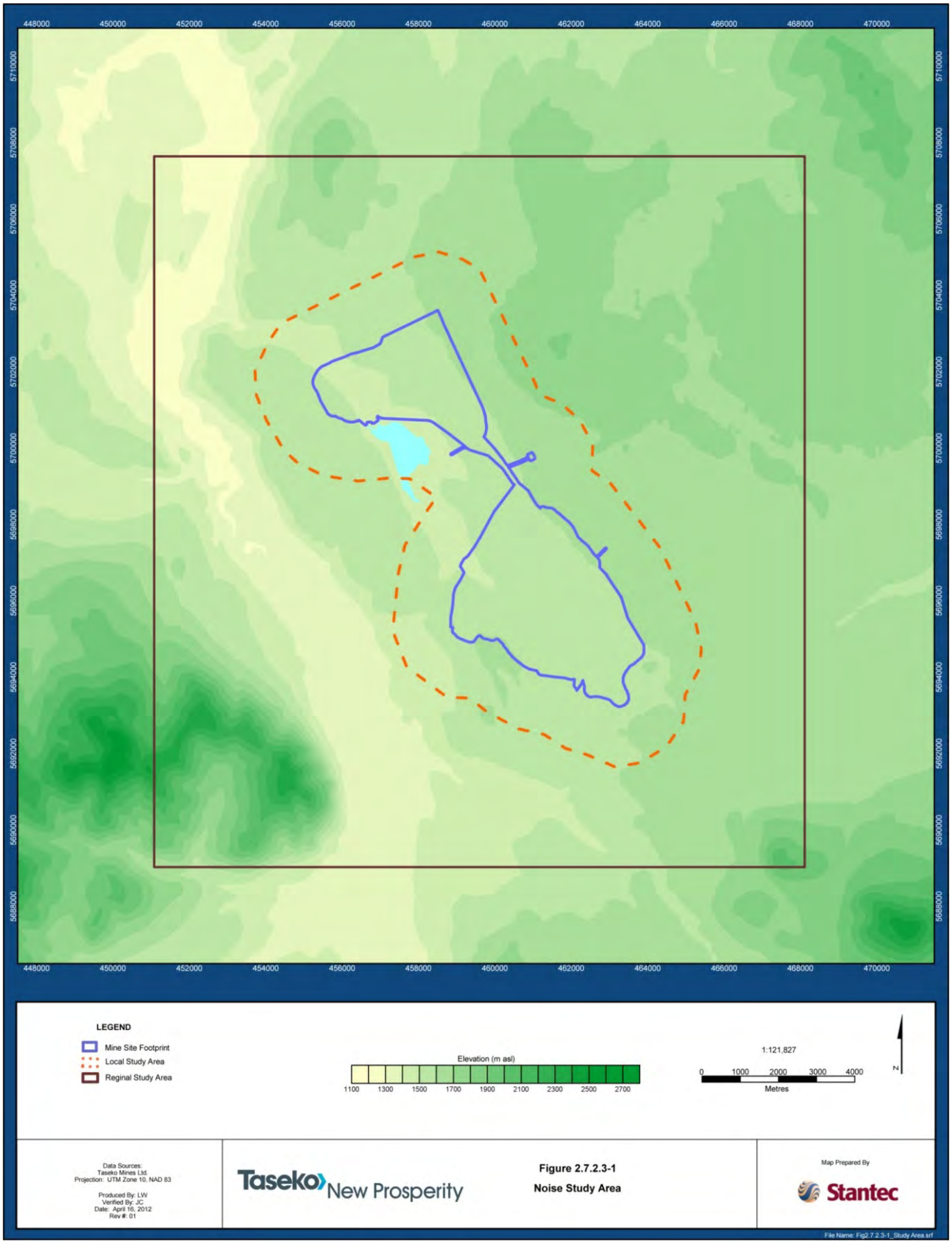
The changes to the spatial boundary for New Prosperity alter the conclusions of the assessment of effects for the acoustic environment. Effects that previously occurred on the mine site are now offsite and therefore included in the acoustic environment. This necessitates a re-analysis of the acoustic modelling results consistent with the changed spatial boundary.

The OGC 1.5 km criteria boundary is measured at a distance of 1.5 km from the PDA. A local study area (LSA) of 1.5 km from the boundaries of the mine site Maximum Disturbance Area or PDA has been selected for this study. The LSA alignment coincides with the definition of OGC 1.5 km criteria boundary from the Project boundary.

At distances greater than 4 km from the boundaries of the Project Maximum Disturbance Area (PDA), the Project related noise effects would be expected to decrease to background level due to the geometrical dissipation of sound energy with respect to distance. To cover all potential areas where noise from the operations of the Project might have an effect, a regional study area (RSA) was defined by a rectangle 17 by 19 km in size centered on the Project. This RSA was chosen to encompass potential noise effects of the Project.

Based on available information, there are no known permanent or seasonally occupied human dwellings within the RSA. The RSA, LSA, PDA, and OGC 1.5 km criteria boundary are shown in Figure 2.7.2.3-1.

Figure 2.7.2.3-1 Noise Study Area



Project Impact Assessment for Acoustic Environment

There are three Project phases that have potential noise effect for the acoustic environment. The three phases are construction, operations, and closure. The Project effects for the three phases are discussed in the following sections.

Effects Assessment Methodology for Acoustic Environment

The effects assessment methods for the acoustic environment will be the same as those used in the March 2009 EIS/Application. The methods used to evaluate the noise effects were described fully in Section 3.2.2 of Volume 4 in the March 2009 EIS/Application.

Project activities and physical works for Prosperity that were included as noise emission sources in the original EA acoustic (Taseko, 2009) are represented in Table 2.7.2.3-4. The applicable activity has the potential to increase ambient sound levels are indicated with a checked mark.

Table 2.7.2.3-4 Summary of Project Activities and Physical Works Assessed included as Noise Emission Sources in the Prosperity EA

Emission Source Name	Project Phase		
	Construction	Operations	Closure
Open pit	✓	✓	-
Non-PAG waste stockpile	✓	✓	✓
PAG stockpile	✓	✓	-
Overburden stockpile	✓	✓	✓
Primary crusher	✓	✓	-
Overland conveyor	✓	✓	-
Access road	✓	-	✓
Camp construction	✓	-	-
Site clearing (clearing and grubbing)	✓	-	-
Soils handling and stockpiling	✓	-	-
Plant site and other facilities	✓	✓	✓
Starter dam construction	✓	-	-
Transmission line	✓	✓	✓
Vehicular traffic	✓	✓	✓
Ore stockpile management and processing	-	✓	-
Concentrate load-out facility near Macalister	-	✓	-
Concentrate transport and handling	-	✓	-
Reclamation of ore stockpile area	-	-	✓
Tailing impoundment reclamation	-	-	✓

NOTE:
"✓" indicates that the applicable activity has the potential to increase ambient sound levels
"-" indicates not applicable

The New Prosperity Project activities and physical works are changed in many respects. With respect to those that were included as noise sources in the original EA acoustic modelling (Taseko, 2009), the effects of those changes are presented in Table 2.7.2.3-5. The changes correspond with the information provided in Table 2.7.2.3-1. The grey-out area indicates activities and physical works that are still represented in the acoustic assessment but remain unchanged when compared to the original EA acoustic modelling (Taseko, 2009). The changes summarized in Table 2.7.2.3-5 are mainly associated locations of the stockpiles and the new tailing locations. The new stockpile locations result in a longer haul distance (2-3 km per trip). On the other hand, the decrease in project footprint results in the reduction of land clearing area.

Table 2.7.2.3-5 Summary of Project Activities and Physical Works Changes as a Result of the New Prosperity Project

Project Activities with Noise Emission Sources	Project Phase		
	Construction	Operations	Closure
Open pit	no change	no change	-
Non-PAG waste stockpile	new location	new location	new location
PAG stockpile	new location	new location	-
Overburden stockpile	new location	new location	new location
Primary crusher	no change	no change	-
Overland conveyor	no change	no change	-
Access road	no change	-	no change
Camp construction	no change	-	-
Site clearing (clearing and grubbing)	reduced area	-	-
Soils handling and stockpiling	new location	-	-
Plant site and other facilities	no change	no change	no change
Starter dam construction	new location	-	-
Transmission line	no change	no change	no change
Vehicular traffic	new volume	new volume	new volume
Ore stockpile management and processing	-	no change	-
Concentrate transport and handling	-	no change	-
Concentrate load-out facility near Macalister	-	no change	-
Reclamation of ore stockpile area	-	-	new location
Tailing impoundment reclamation	-	-	new location

NOTE:
"-" indicates not applicable

Change in Acoustic Environment Baseline Conditions

Data sources and fieldwork used for characterizing the acoustic environment baseline conditions have not changed or been updated since the March 2009 EIS/Application. The baseline conditions or existing acoustic environment for such remote rural areas is expected to be quiet and dominated by sounds of nature (e.g., wind noise, vegetation rustling, bird chirping, etc.). The location of the mine site is remote and the existing night-time acoustic environment (i.e. ambient conditions) is expected to be similar to the average night-time ambient sound level for remote rural area established by the OGC Noise Control Best Practices Guideline. An average daytime and night time ambient sound level of 45 dBA L_{eq}(15) and 35 dBA L_{eq}(9) respectively has been used for this study.

Project Effects to the Acoustic Environment

The section addresses the residual effects of the Project during the three main development phases as a result of the changed project activities and physical works identified in Tables 2.7.2.3-3 and 2.7.2.3-5. The spatial boundary changes necessitate a re-analysis of these results consistent with the changes. In all three phases, the assessment assumes that the mitigation and noise management measures have been implemented.

Table 2.7.2.3-5 indicates change in vehicular traffic for the New Prosperity Project. The volume change is not quantifiable at this point; however, the change is expected to be marginal and it is assume that the residual effects due to vehicular traffic will no change from the results presented in Secton 3.4.2 of the original EA (Taseko, 2009).

Construction Noise

Noise emission information associated with the construction phase of the Project is presented in Table 3-5 of the original EA (Taseko, 2009). Location of the changed project activities identified in Table 2.7.2.3-5 has been revised in the acoustic model. Construction noise levels at a distance of 1.5 km from the PDA (OGC 1.5 km boundary) were predicted. Figure 2.7.2.3-2 shows the predicted noise contour maps resulting from construction phase activities during daytime period. The highest predicted sound level at a distance of 1.5 km from the boundaries of the PDA is 47 dBA L_{eq}(15) Day as compared to 45 dBA predicted in the original EA (Taseko, 2009). However, there are no sensitive human dwelling locations within the local study area. The duration of construction noise effects is medium term. The direction is adverse and the magnitude of effect is moderate. The effect is reversible and is expected to cease immediately after construction.

Project Operations Noise

Noise emission information associated with the operation phase of the Project is presented in Table 3-6 of the original EA (Taseko, 2009). For a conservative estimate of the maximum disturbance during normal operation, all applicable night-time sound sources were assumed to be operating simultaneously and at peak power throughout the night-time periods. Similarly, all applicable daytime sound sources were assumed to be operating simultaneously and at peak power throughout the daytime periods. Figure 2.7.2.3-3 and Figure 2.7.2.3-4 show the predicted noise contour maps resulting from normal Project operations during daytime and night-time periods, respectively.

Table 2.7.2.3-6 summarizes the predicted sound level at 1.5 km from the PDA during daytime and night-time periods. The predicted sound level during daytime is higher than night-time level because more equipment will be operating at daytime than night-time as illustrated in Table 3-6 of the original EA (Taseko 2009). The results indicate that the maximum predicted sound level at 1.5 km from the boundaries of the PDA is 42 dBA, 2 dB above the night-time PSLs during Project operations. However, there is no receptor located within the RSA or along this 1.5 km boundary. The magnitude of effect is high, the direction is adverse. The duration of project operation noise effects is long term and the effect is reversible and so is expected to cease immediately after the operation phase of the Project site.

Table 2.7.2.3-6 Predicted Highest Sound Level along OSC 1.5 km criteria boundary during Operations

	Prosperity Prediction [a] dBA L_{eq}	New Prosperity Prediction dBA L_{eq}	Permissible Sound Level (PSL) dBA $L_{eq}(15)$	Meeting PSL
Daytime	43	45	50	Yes
Night time	38	42	40	No
NOTE: [a] Original EA (Taseko, 2009)				

Closure Noise

Noise generating activities associated with the closure of the Project are expected to be of limited duration, restricted to daytime hours and ending as the mine site and ancillary facilities are reclaimed. Noise generating activities associated with closure of the mine site itself are anticipated to last approximately 180 days. The typical noise outputs of machinery that will be used for Project closure are listed in Table 3-8 of the original EA (Taseko, 2009). In the table, equipment noise levels and the anticipated number of daytime operating hours is presented.

Figure 2.7.2.3-5 shows the predicted noise contour maps resulting from closure phase activities during daytime period. The highest predicted sound level resulting from closure related activities at a distance of 1.5 km from the PDA is 43 dBA $L_{eq}(15)$ during daytime as compared to 41 dBA predicted in the original EA (Taseko 2009). However, there are no sensitive human dwelling locations within the local study area. The magnitude of effect is low, the direction is adverse. The duration of closure noise effects is medium term and the effect is reversible and so is expected to cease immediately after reclamation of the Project site.

Blasting Noise

There is no change in residual effects due to blasting noise as presented in Section 3.4.3 of the original EA (Taseko, 2009).

Figure 2.7.2.3-2 Operation Noise Contour – Daytime

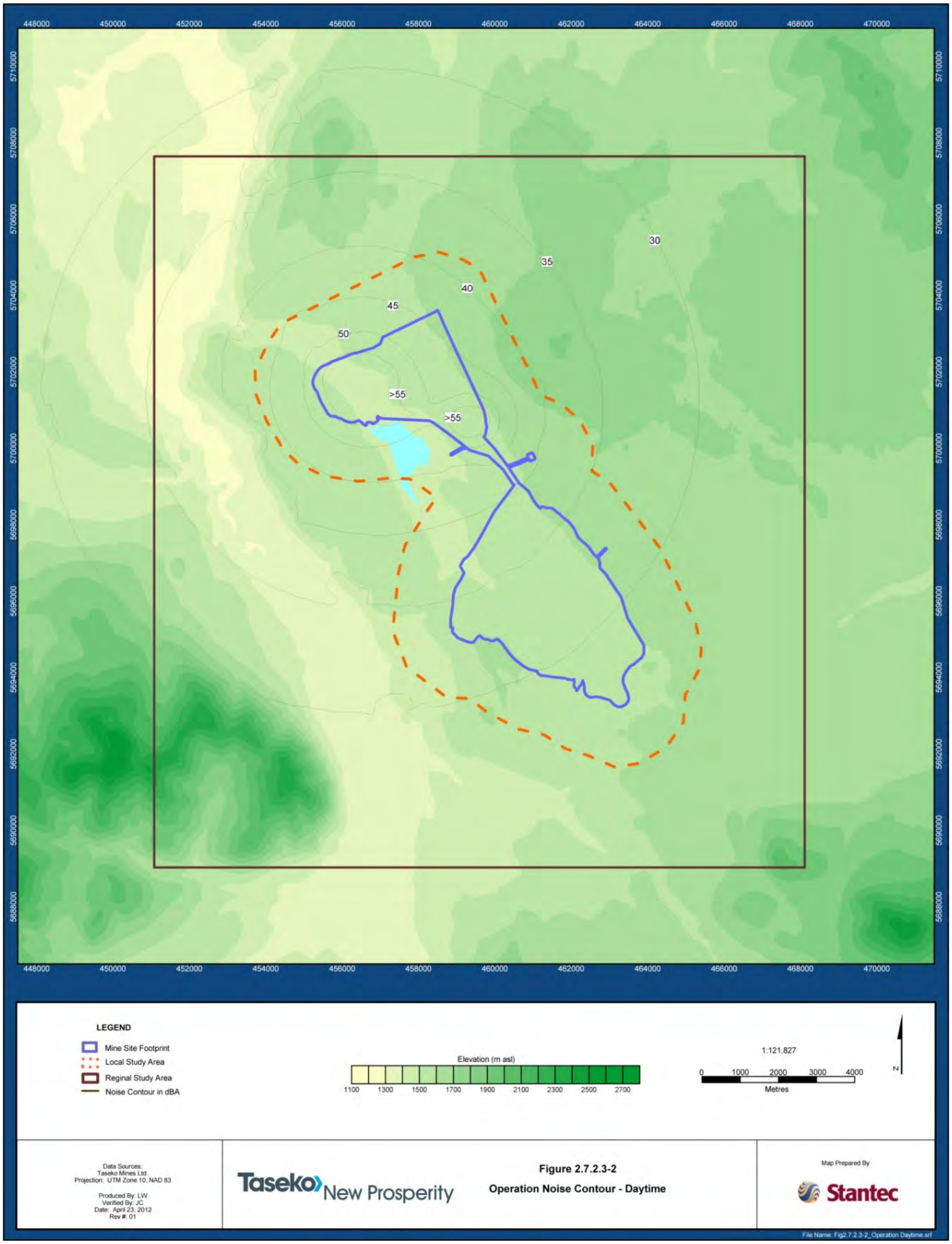


Figure 2.7.2.3-3 Operation Noise Contour – Nighttime

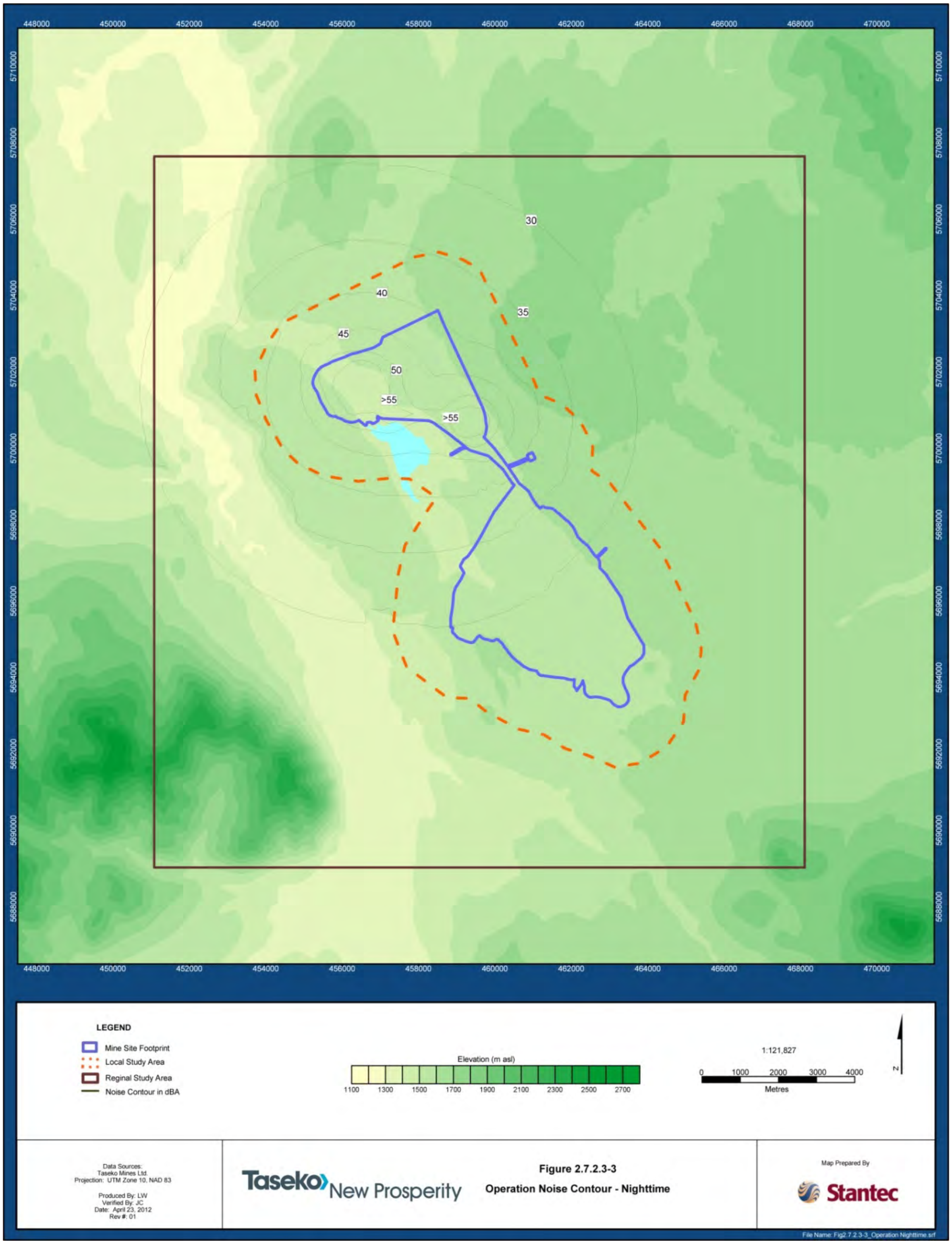


Figure 2.7.2.3-4 Construction Noise Contour – Daytime

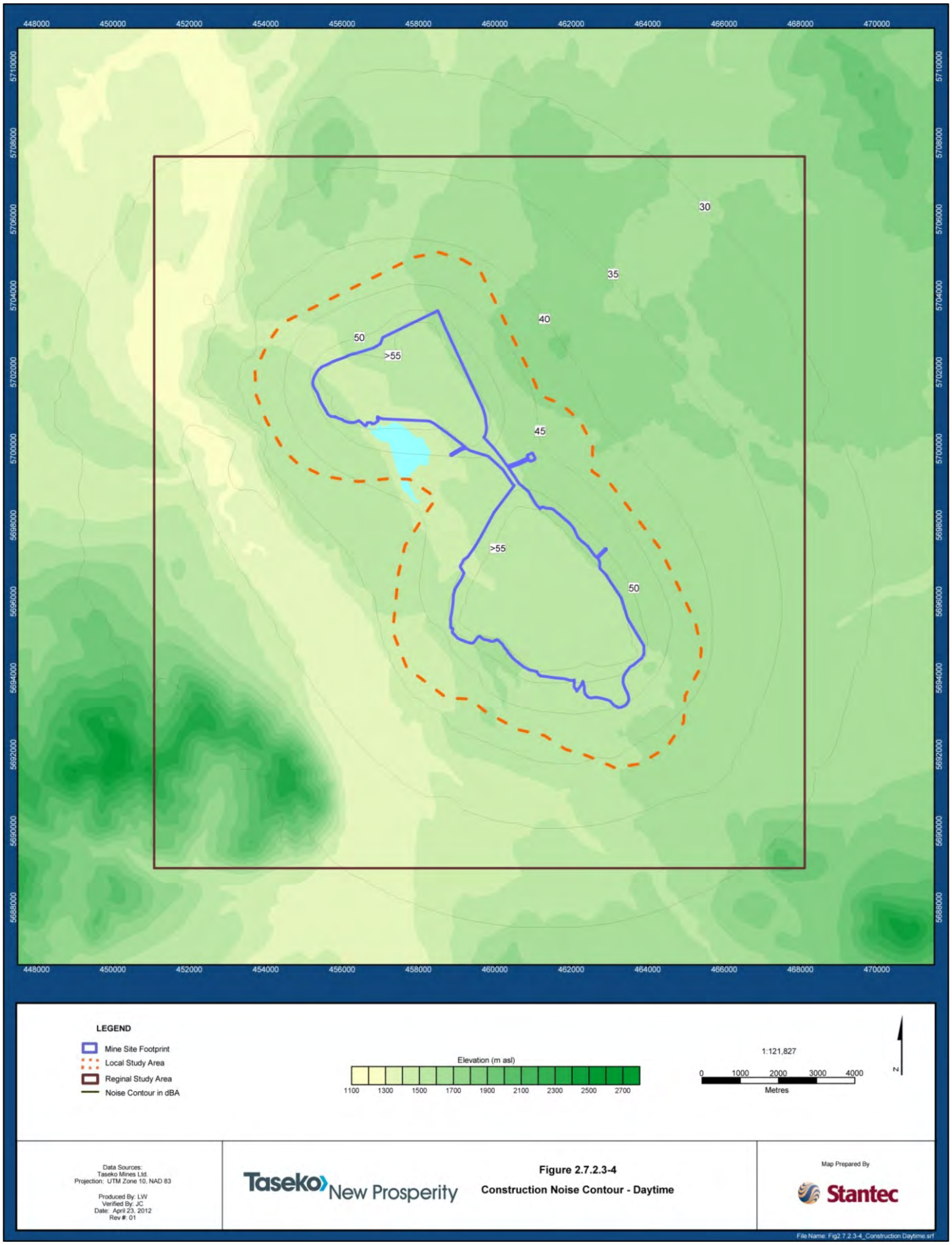
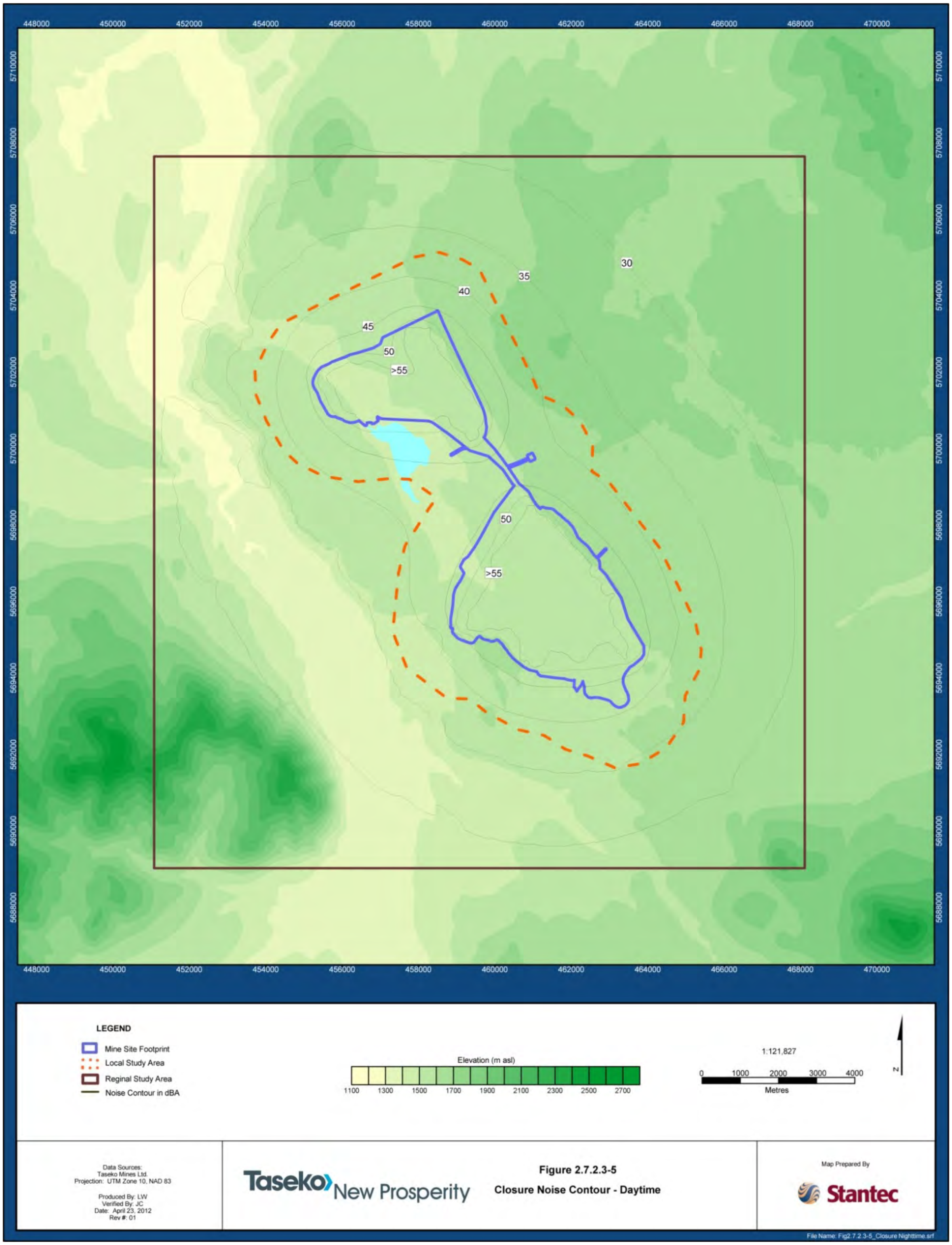


Figure 2.7.2.3-5 Closure Noise Contour – Daytime



Acoustic Environment Mitigation Measures

A number of Project design features and mitigation measures will be used to minimize Project effects on the acoustic environment during various activities associated with the Project. There are no changes required to previously proposed mitigation measures were presented in Section 3.3 of the original EA (Taseko, 2009). They will be employed to address effects associated with increases to ambient sound levels during Project construction, operations and closure.

Mitigation and noise management measures such as those described in details in Section 3.3 of the original EA (Taseko, 2009) will considerably minimize the environmental effects of noise during construction, operation and closure. Given the Project design and noise mitigation measures described in Section 3.3 of the original EA (Taseko, 2009), as well as the absence of human dwelling within the RSA and along the proposed access road, the overall residual effects of the construction, operation, and closure phases are predicted to be not significant. Traffic noise associated with Project-related vehicle traffic will not result in significant changes in existing acoustic environment along Highway 20 the Taseko Lake and 4500 Roads.

Cumulative Effects Assessment

As described in Section 2.7.1, cumulative environmental effects were only assessed if all three of the following conditions were met for the environmental effect:

- The Project results in a measurable, demonstrable or reasonably-expected residual environmental effect on a component of the environment
- The Project-specific residual environmental effect does, or is likely to, act in a cumulative fashion with the environmental effects of other past or future projects and activities that are likely to occur, and
- There is a reasonable expectation that the Project's contribution to cumulative environmental effects will affect the viability or sustainability of the resource or value.

The Project inclusion list (Table 2.7.1.4-1) identifies past, present and reasonably foreseeable projects and activities that could interact cumulatively with the Project. The locations of each of the 22 projects and activities are shown on Figure 2.7.1.4-1. As indicated in Table 2.7.1.4-1, eight of these project and activities are new since 2009.

At this time, there are no existing or planned industrial facilities within the RSA. As a result, there is a low likelihood of overlap of noise effects with similar environmental effects from other existing or planned developments in the area. Therefore, no cumulative effects are expected during Project operations given known past, present and reasonably foreseeable projects and activities in the region.

Determination of Significance of Residual Effects

The assessment methodology for residual effect characterization and determination of significance is as described in Section 2.7.1.5.

Ambient sound levels during construction, operation and closure phases of the Project are predicted to be adverse, range in magnitude from low to high and continue for the medium term but are determined to be not significant as they will be sporadic, local and are reversible.

The findings of the Project residual effects assessment for ambient sound levels for New Prosperity are summarized in Table 2.7.2.3-7.

Overall prediction accuracy depends on two factors: the accuracy of the acoustical source data and the accuracy of the sound propagation model. The sound level data used in this assessment were based on the Project design-basis sound level data from the engineering team. The ISO 9613 propagation algorithms have a published accuracy of +/-3 dBA over source receiver distances between 100 and 1000 m. A similar degree of accuracy would be expected over the distances considered in this assessment. This is considered an excellent degree of accuracy for an environmental noise model over such a large distance. A 3 dBA increase or decrease in sound pressure levels (SPLs) would be imperceptible to humans.

Additionally, the ISO 9613 model also produces results representative of conservative meteorological conditions favouring sound propagation (e.g., downwind and temperature inversion conditions). These meteorological conditions have been described in details in Section 3.2.3.2 and includes downwind and temperature inverse conditions. The temperature (10°C) and relative humidity (70%) values were conservatively selected as per ISO 9613 publication (ISO, 1993) because these two conditions minimize atmospheric absorption of sound energy thereby enhancing sound propagation. As these conditions do not occur all the time, so the model predictions are conservative, and actual sound levels during other climate conditions are expected to be less than indicated for much of the time. Based on these factors, confidence is high that the model has not under-predicted noise levels.

Table 2.7.2.3-7 Project Residual Effects Assessment Summary for Ambient Sound Levels for New Prosperity

Activity	Effect	Residual Effects Characterization						
		Direction	Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Significance of Residual Effects
Construction • Operation of construction equipment • Temporary and permanent access road development • Construction of Project infrastructure and facilities • Pit and mine site development, overburden removal and waste rock stock piling	Increase in ambient sound levels	Adverse	Moderate	Local	Sporadic	Medium-term	Reversible	Not Significant
Operation Ore extraction, crushing, transport conveyor systems, and processing	Increase in ambient sound levels	Adverse	High	Local	Continuous	Long-term	Reversible	Not Significant
Closure • Operation of construction equipment for mine closure • Removal of Project infrastructure and facilities	Increase in ambient sound levels	Adverse	Low	Local	Sporadic	Medium-term	Reversible	Not Significant

Table 2.7.2.9-8 provides a concise summary of the effects assessment for the acoustic environment. Given the Project design and noise mitigation measures described in Section 3.3 of the original EA (Taseko, 2009), as well as the absence of human dwelling within the RSA and along the proposed access road, the overall residual effects of the Project are predicted to be not significant.

Table 2.7.2.3-8 Summary of Effects Assessment for Acoustic Environment

Effects Assessment	Concise Summary
Beneficial and Adverse Effects	The New Prosperity Project has reduced the spatial boundary. The beneficial and adverse effects remain the same as predicted in the original EA (Taseko, 2009).
Mitigation and Compensation Measures	A wide variety of methods for mitigating potential acoustic environmental effects have been proposed for project-related activities. There is no compensation measures associated with the acoustic environment. The mitigation and management measures for the construction and closure phases are: • Schedule construction activities during daytime hours where practical • Maintain equipment and provide effective mufflers on construction equipment • Turn equipment off when not in use where practical The mitigation and management measures for the operational phase are: • Most noise generating equipment will be housed inside buildings with insulation and metal cladding for improved noise suppression • Conveyors will be enclosed • Appropriate mufflers will be installed on mining equipment • Speed Limits will be enforced
Potential Residual Effects	Residual effects on the acoustic environment are predicted. See Table 2.7.2.3-6 for a full summary of project residual effects. In summary, the potential residual effect has been predicted for all three phases of the Project are listed as follows: • Direction: Adverse • Magnitude: Moderate for construction phase / High for operational phase / Low for closure phase • Frequency: Sporadic for construction and closure phase / Continuous for operation phase • Duration: Medium-term for construction and closure phase / Long-term for operation phase • Geographic Extent: Regional • Reversibility: Reversible
Cumulative Effects	The cumulative effects predicted in the 2009 assessment for the acoustic environment are low for the construction, operation, and closure phase of the Project. The same cumulative effects are expected to apply to the New Prosperity Project.
Determination of the significance of residual effects	The combined residual environmental effects of the Project on the acoustic environment are predicted to be not significant. This assessment is predicated on the implementation of proposed mitigation.
Likelihood of occurrence for adverse effects found to be significant	As no significant residual effects are predicted, there is no likelihood of occurrence. There is the possibility that the prediction of significant adverse effects is incorrect, whereby an adverse effect deemed to be not significant may have an adverse effect. The likelihood of this remains low.

ADDITIONAL WORK

No additional work is planned or anticipated

FOLLOW-UP AND MONITORING

New Prosperity is committed to managing noise issues and to promptly respond to any noise complaint. No follow up monitoring is planned or anticipated.

2.7.2.4 Water Quality and Quantity

A. HYDROLOGY AND HYDROGEOLOGY

This section examines potential effects of the proposed Project on surface and groundwater quantity and quality within the Project area. The aquatic components described in this section are impacted by, and include:

- Water Management & the Operational Water Balance
- Effects on:
  - Surface Water Quantity
  - Surface Water Quality
  - Groundwater Quantity, and
  - Groundwater Quality.

Scope of Assessment

The scope of the assessment is only for changes relative to the Prosperity Project based on the New Prosperity Mine Development Plan, the New Prosperity EIS Guidelines, or regulatory changes since the March 2009 EIS/Application.

The Project activities and Physical Works for New Prosperity are presented in Table 2.7.2.4A-1. This table shows whether each activity or physical work has changed from the original Prosperity submission. Project activities or physical works identified with a “Y” will be carried forward for assessment of the changes to effects on hydrology and hydrogeology. Project activities or physical works identified with an “N” are not carried forward in this hydrology and hydrogeology assessment, and have been greyed out. It should be noted that changes to hydrology and hydrogeology are quantified only, and no significance determination is made on these changes specifically. The rational for this approach related to these VECs is as follows:

- Change to Hydrology – flow reductions (or increases) primarily affect Water Quality, Aquatic Ecology and Fish/Fish Habitat. As such, the changes are quantified and then utilized by these related VECs in assessing their potential effects.
- Change in Hydrogeology – flow changes are directly linked to hydrology changes, and the net change to the hydrological regime is quantified and used as an input to the effects assessment for other VECs (Water Quality and Aquatic Ecology, etc…). Changes to groundwater quality are quantified, and are used as inputs to the changes in surface water quality. Hence, a significance determination is done on the Water Quality and Aquatic Ecology VECs, based on the groundwater quality change input.

Table 2.7.2.4A-1 Project Components, Features and Activities Changed from Previous Project Proposal

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal (Y/N)	Comments
Construction and Commissioning		
Open Pit – Pre-production	N	
Non-PAG waste stockpile	Y	Location and timing only
PAG Stockpile	Y	Still subaqueous in TSF, just TSF location change
Non-PAG Overburden Stockpile	Y	Combined with Non-PAG (i.e. location and timing)
Ore Stockpile	Y	Location only
Primary Crusher	N	This is considered in 'Plant Site and other facilities'
Overland conveyor	N	This is considered in 'Plant Site and other facilities'
Fisheries compensation works construction	Y	Scope and Timing
Water Management Controls and Operation	Y	
Construction sediment control	Y	
Access road construction and upgrades	N	
Camp construction	N	This is considered in 'Plant Site and other facilities'
Site clearing (clearing and grubbing)	Y	Different areas related to moving of TSF, stockpiles, etc…
Soils handling and stockpiling	Y	Includes overburden removal
Plant Site and other facilities	N	
Explosives Plant	Y	Location only
Lake dewatering	Y	Fish Lake retained
Fish Lake Water Management	Y	Management of inflows and outflows
Starter dam construction	Y	Location and volume of material
Sourcing water supplies (potable, process and fresh)	Y	Fresh water sources and routing only as a result of reconfigured stockpiles

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal (Y/N)	Comments
Site waste management	N	
Clearing of transmission line ROW	N	
Construction/Installation of transmission line	N	
Vehicular traffic	Y	Additional haulage trucks and 2km of added haulage road as a result of TSF relocation.
Concentrate load-out facility near Macalister (upgrades to site)	N	
Operations		
Pit production	N	
Site clearing (clearing and grubbing)	Y	Area and relocation of TSF and stockpiles
Soils handling and stockpiling	Y	Area, volume, and relocation of TSF and stockpiles; revised soil stockpile locations
Crushing and conveyance	N	
Ore processing and dewatering	N	
Explosive handling & storage	Y	Location only
Tailing storage	Y	Location and embankments changed
Non-PAG waste stockpile	Y	Location and timing only
PAG Stockpile	Y	Still subaqueous in TSF, just TSF location change
Overburden Stockpile	Y	Combined with Non-PAG (i.e. location and timing)
Ore Stockpile management and processing	Y	Location only
Potable and non-potable water use	N	
Site drainage and seepage management	Y	
Water Management Controls and Operation	Y	Includes management of flows in and out of Fish Lake
Wastewater treatment and discharge (sewage, site water)	N	

Project Work (Elements, Components, Features) / Activities	**Change from Previous Project Proposal (Y/N)**	**Comments**
Water release contingencies for extended shutdowns (treatment)	N	
Solid waste management	N	
Maintenance and repairs	N	
Concentrate transport and handling	N	
Vehicle traffic	Y	Additional haulage trucks and 2km of added haulage road as a result of TSF relocation.
Transmission line (includes maintenance)	N	
Pit dewatering	N	
Fisheries Compensation works operations	Y	Scope and Timing
Concentrate load-out facility near Macalister	N	
Closure		
Water Management Controls and Operation	Y	
Fisheries Compensation operations	Y	Scope and Timing
Site drainage and seepage management	Y	
Reclamation of ore stockpile area	Y	Location only
Reclamation of Non-PAG waste rock stockpile	Y	Location only
Tailing impoundment reclamation	Y	
Pit lake, and TSF Lake filling	Y	
Plant and associated facility removal and reclamation	N	
Road decommissioning	N	
Transmission line decommissioning	N	
Post-closure		
Discharge of tailings storage facility water	Y	

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal (Y/N)	Comments
Discharge of pit lake water	N	Into Lower Fish Creek
Seepage management and discharge	Y	
Ongoing monitoring of reclamation	Y	

WATER MANAGEMENT

Project development occurs in discrete stages: pre-construction, construction, operations, closure, and post-closure. Each stage has its own unique water management objectives and requirements. These are discussed in the following sections. For the purposes of the water management plan presented here and the modelling of water quality predictions in the closure phase, the closure period has been broken into two phases; Closure Phase I and Closure Phase II. Closure Phase I starts with the cessation of tailings deposition in the TSF and ends when water quality in the TSF is suitable for discharge to the inlets to Fish Lake. For the purposes stated abovethe duration of this period has been assumed to be 10 years. Closure Phase II starts with the discharge of the TSF to the inlets to Fish Lake and ends when the pit fills and discharges to lower Fish Creek. Again, for the purposes stated above this period has been assumed to last 16 years. It should be clear to the reader from the project description and this water management discussion that the project as proposed contains all of the water management infrastructure to accommodate a transition from Closure Phase I to Closure Phase II at any time, dependant on suitability of TSF water quality for discharge to the inlets to Fish Lake.

The water management plan has been broken down by time period to describe the water management strategies and design elements during construction, operation, closure and post-closure for the New Prosperity Gold-Copper project. The activities for the four time periods include:

- Construction:
  - Construction activities will commence 2 years prior to mill start up and will include construction of site access roads, the Tailings Storage Facility (TSF) starter embankment, the plant site and construction camp. The Starter Embankment will result in a reduction of Fish Creek Lake inflow catchment area of up to 30 km^2, which equates to less than 50% of the Fish Lake Drainage (68 km^2), as shown on Figure 2.7.2.4A-1.
  - The Open Pit footprint will be stripped. The non-PAG waste rock will be used to construct the embankment, PAG waste rock will be stored in the TSF storage basin, and the ore mined from the pit will be stored adjacent to the pit.
  - The TSF is assumed to begin storing water 1 year prior to mill start up.
  - Fish Lake outflow will be recirculated to the inlets of Fish Lake in order to support inlet spawning, with excess water being pumped to the TSF start-up pond.
- Operations (Years 1-16) (Figure 2.7.2.4A-2 to Figure 2.7.2.4A-4):
  - TSF East (above road/diversion ditch) and TSF South catchments diverted and pumped around to Fish Lake inlets as required.

  - TSF East (below road/diversion ditch) contributes to TSF pond – undiverted.
  - Fish Lake outflow recirculation pumping to Fish Lake inlets.
  - Excess Fish Lake outflow not required for supplemental flow to Fish Lake inlets is pumped to TSF.
  - OP dewatering sent to mill for use in process.
  - All TSF embankment seepage ponds pumped back to TSF.
  - Groundwater recovery wells located downstream of Main Embankment seepage ponds – captures 60% of lost seepage, pumped back to Main Embankment seepage ponds.

- Operations (Years 17-20) (Figure 2.7.2.4A-5):
  - OP dewatering ceases; all process for mill water sourced from TSF pond.
  - Fish Lake outflow recirculation pumping to Fish Lake inlets continues.
  - Excess Fish Lake outflow not required for supplemental flow to Fish Lake inlets is directed to the Open Pit.
  - All TSF embankment seepage ponds continued to be pumped back to TSF.
  - Groundwater recovery wells pumped back to Main Embankment seepage ponds.

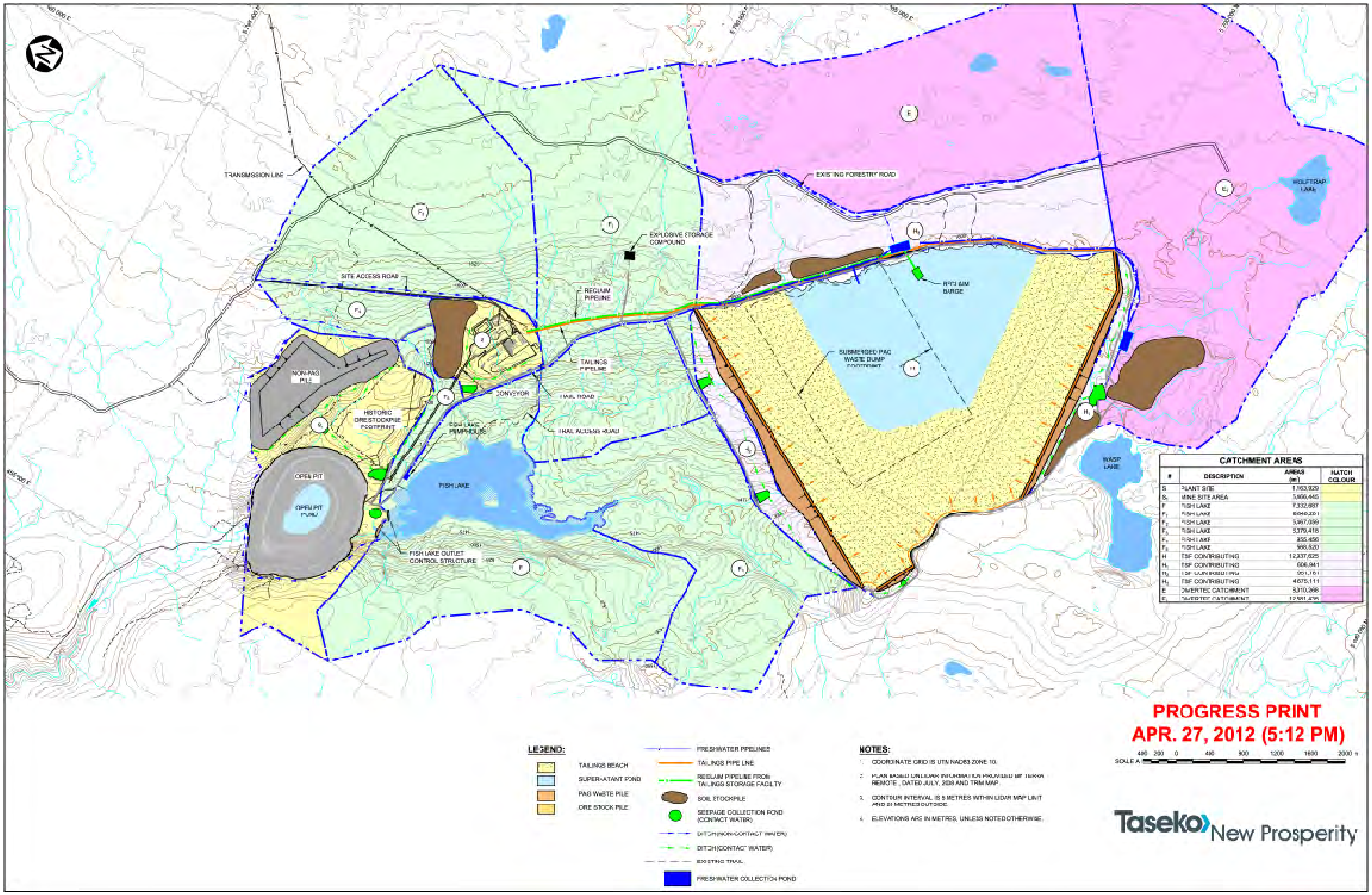


Figure 2.7.2.4A-1 Catchment Areas

- Closure Phase I (Years 21 – 30) (Figure 2.7.2.4A-6):
  - TSF East and TSF South catchments continue to be diverted and pumped around to Fish Lake inlets as required; excess catchment flow sent to Wasp Lake.
  - TSF East (below road/diversion ditch) contributes to TSF pond.
  - Fish Lake outflow recirculation pumping to Fish Lake inlets.
  - Excess Fish Lake outflow not required for supplemental flow to Fish Lake inlets is pumped to TSF.
  - All TSF embankment seepage ponds pumped back to TSF.
  - Groundwater recovery wells located downstream of Main Embankment seepage ponds – captures 60% of lost seepage, pumped back to Main Embankment seepage ponds.

- Closure Phase II (Years 31 – 44) (Figure 2.7.2.4A-7):
  - TSF East catchment (all) contributes to TSF pond.
  - TSF South catchment directed to Wasp Lake.
  - Fish Lake recirculation to inlets ceases,
  - Fish Lake outflow (excess) continues to spill to OP filling.
  - TSF pond overflow spillway routed through Trib 1 and Upper Fish Creek to Fish Lake,
  - South and west embankment seepage pond overflow to Wasp and Big Onion Lakes, respectively.
  - Main embankment seepage pond pumping to TSF ceases; pond overflow directed to Open Pit in the long term.
  - Groundwater recovery wells pumped back to Main Embankment seepage ponds.

- Post-closure (Years 45 and onwards) (Figure 2.7.2.4A-8):
  - Start of discharge from the Open Pit to Lower Fish Creek, and TSF overflow routed through Fish Lake into the Open Pit, continuing in the long term.

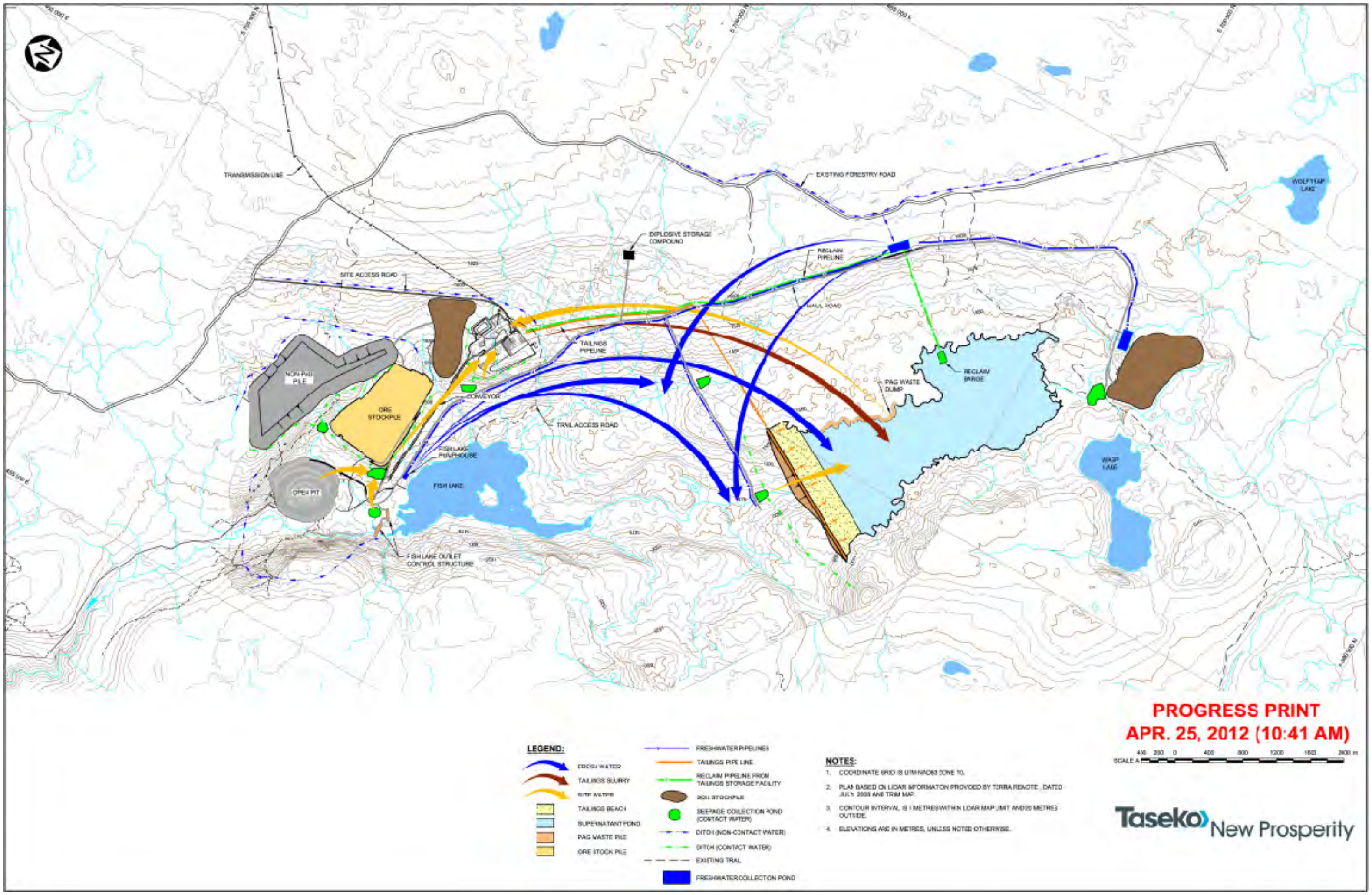


Figure 2.7.2.4A-2 Water Management - End of Year 1

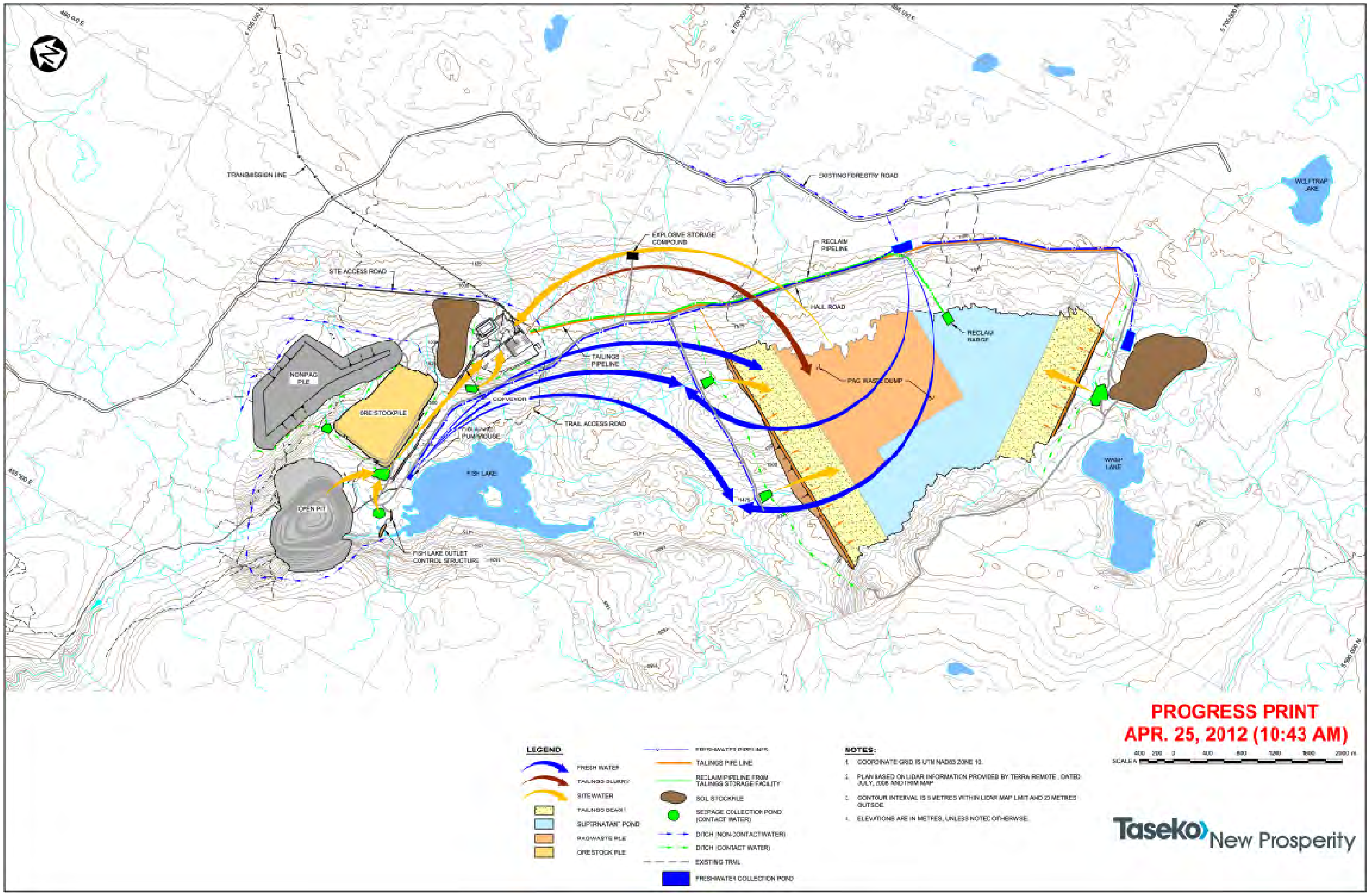


Figure 2.7.2.4A-3 Water Management - End of Year 3

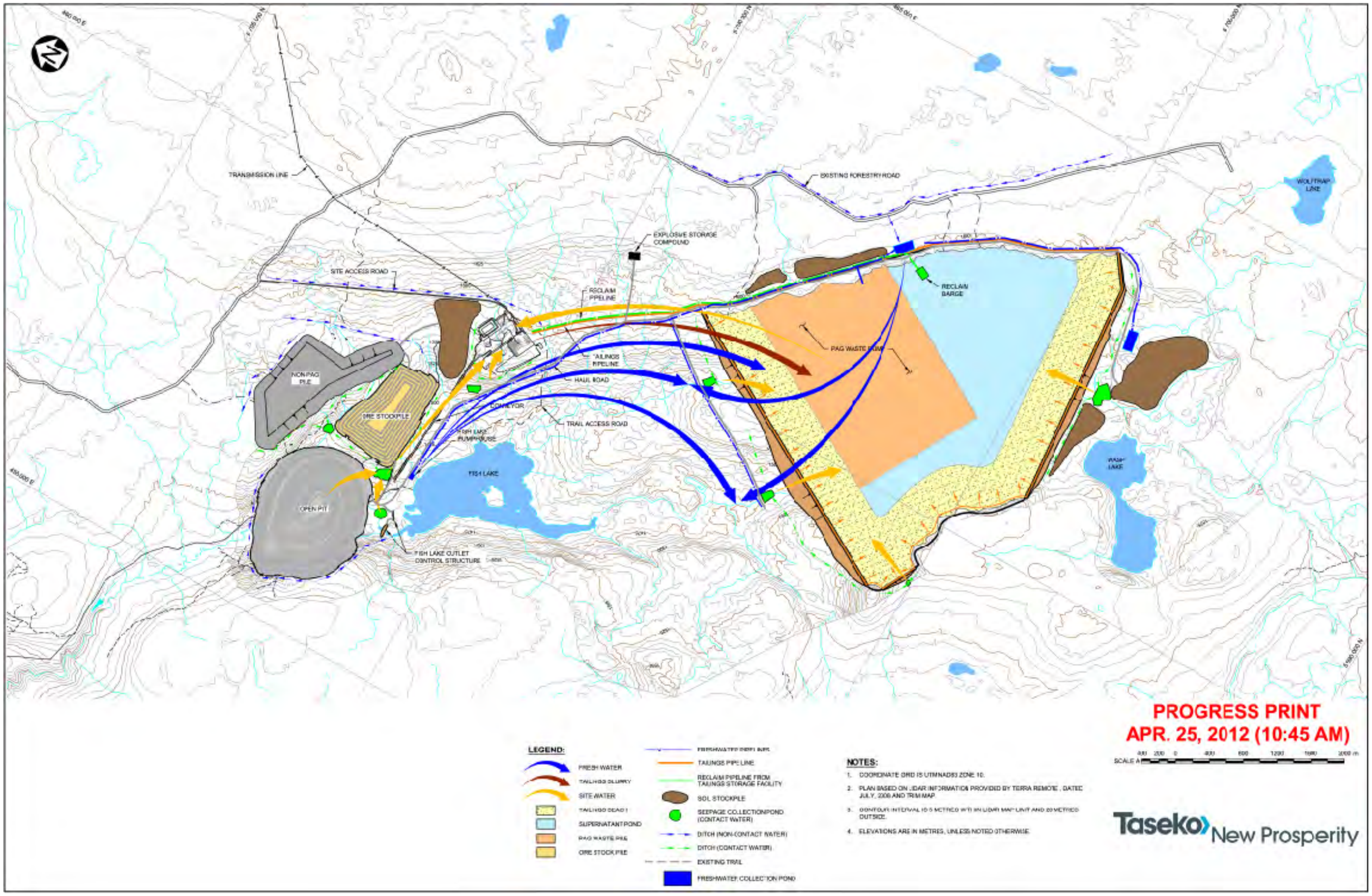


Figure 2.7.2.4A-4 Water Management - End of Year 16

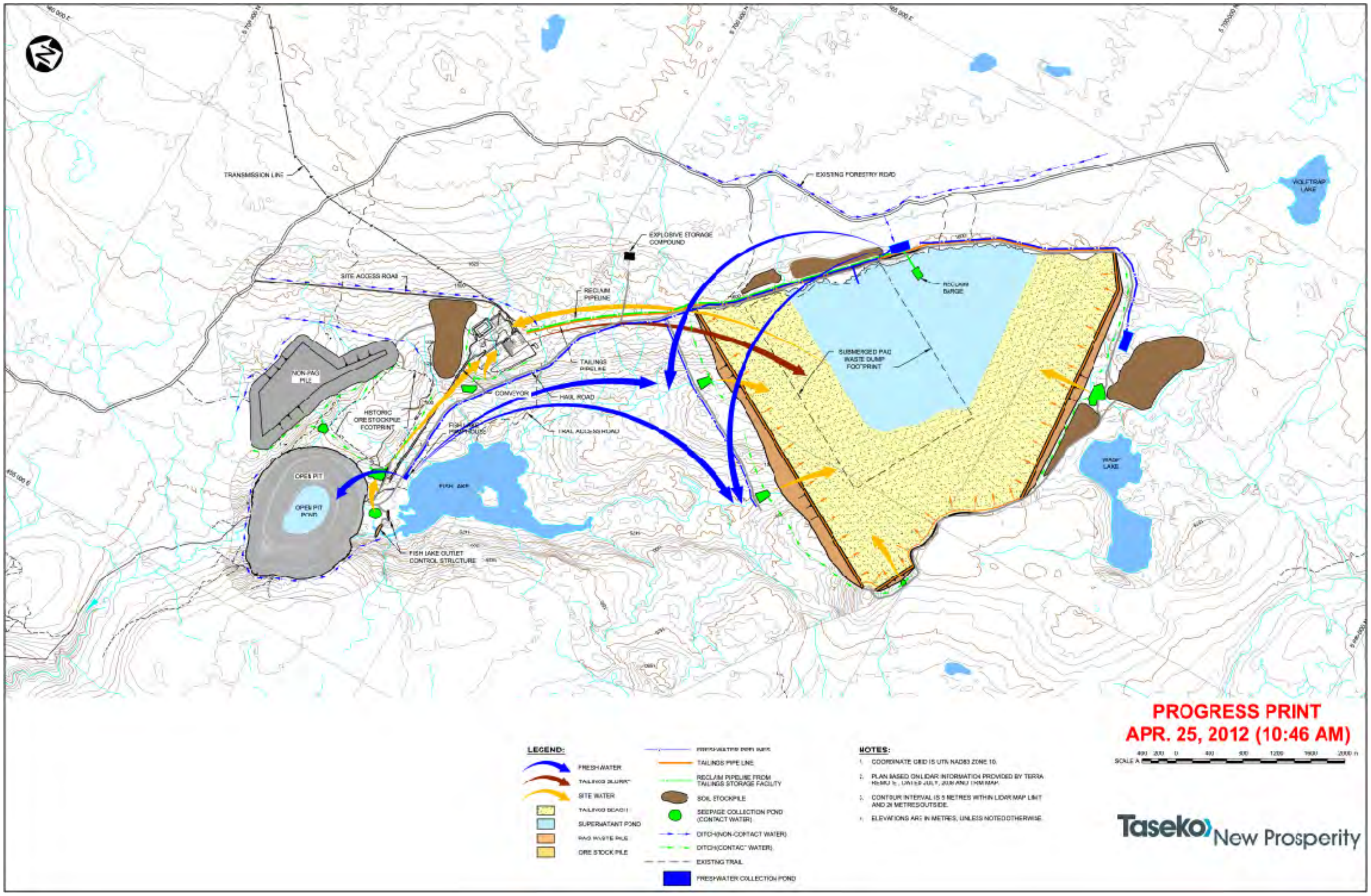


Figure 2.7.2.4A-5 Water Management – End of Year 20 (Ultimate)

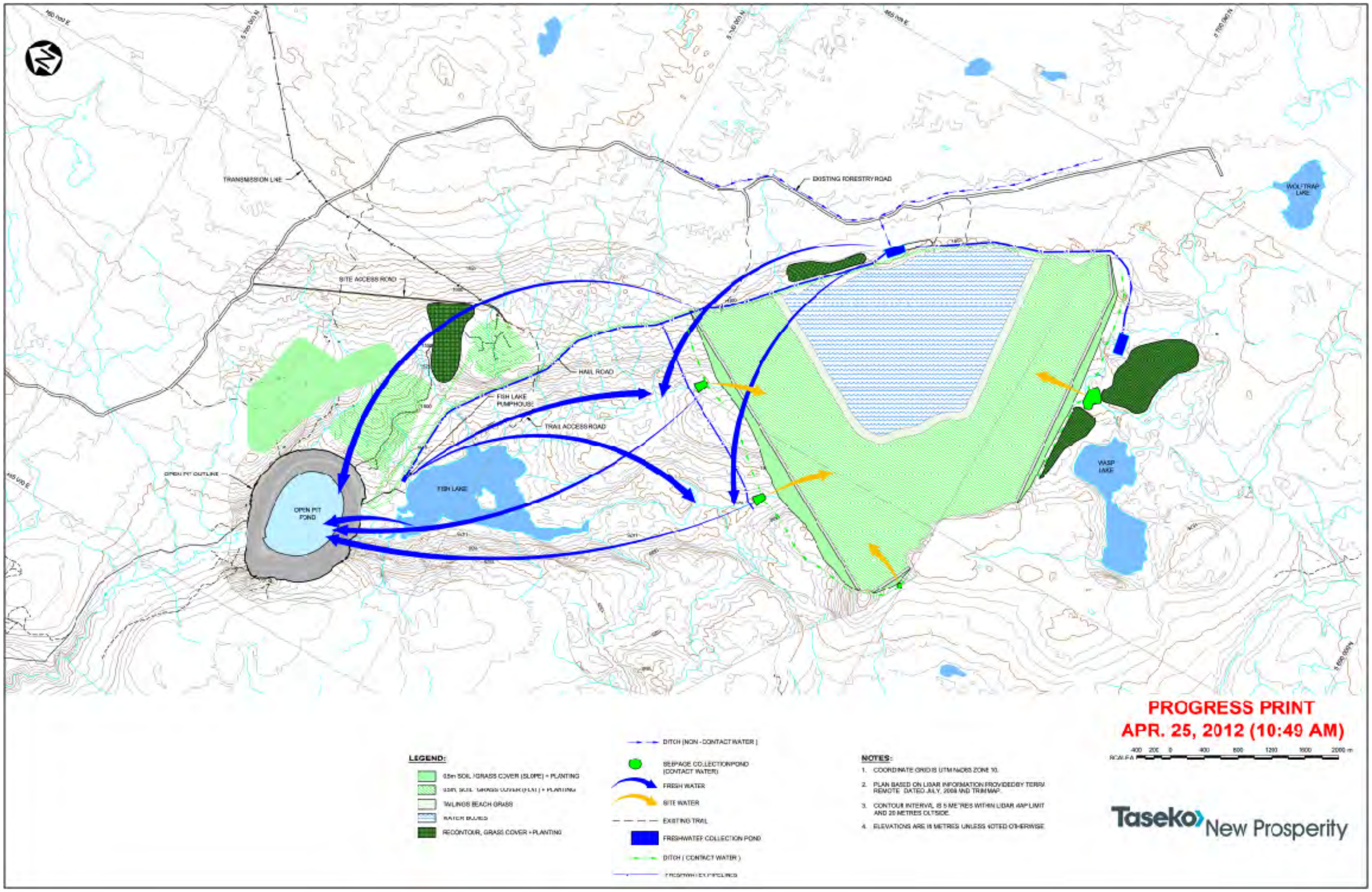


Figure 2.7.2.4A-6 Water Management – Closure Phase I (Years 21-30)

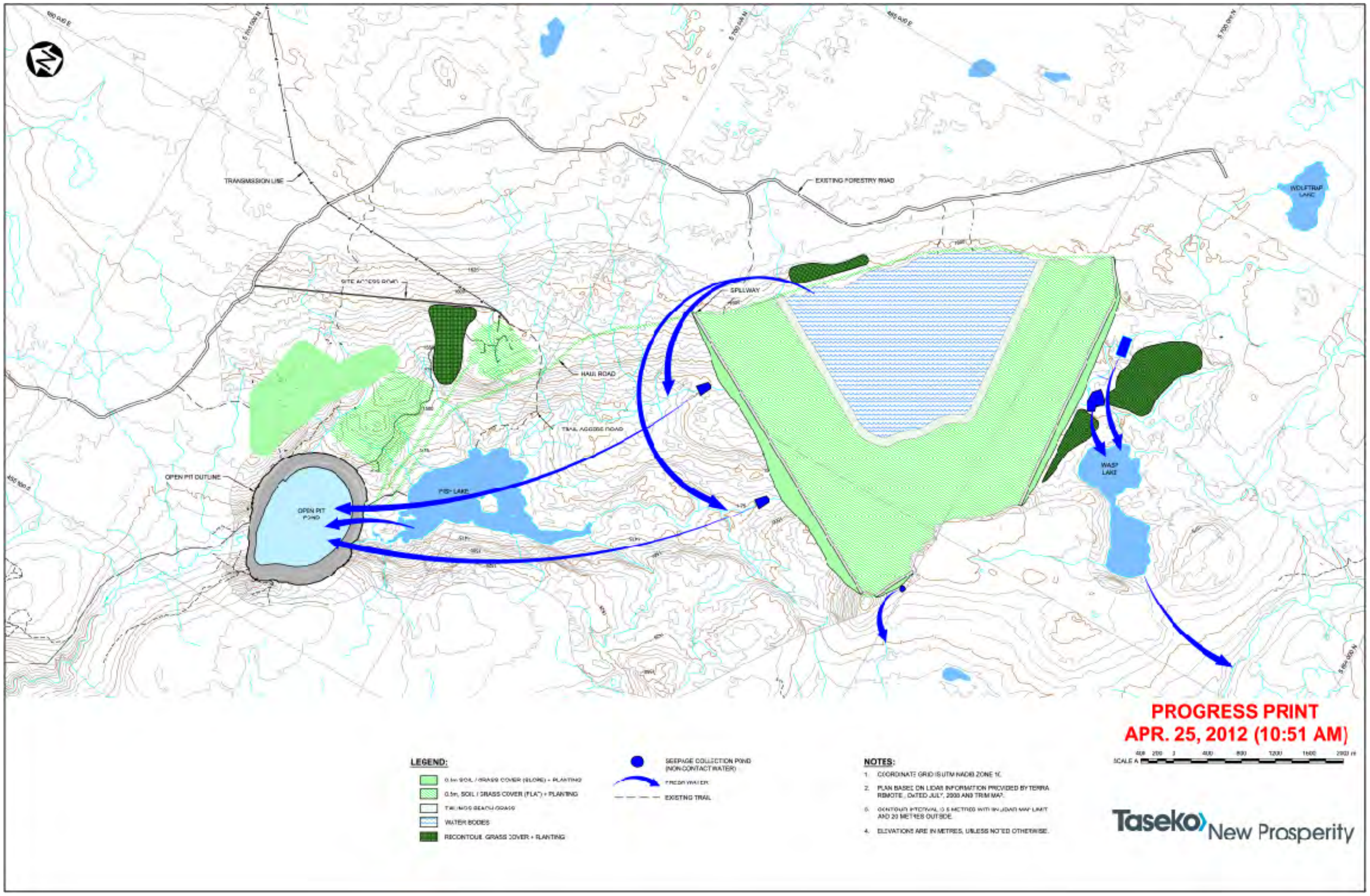


Figure 2.7.2.4A-7 Water Management – Closure Phase II (Years 31-44)

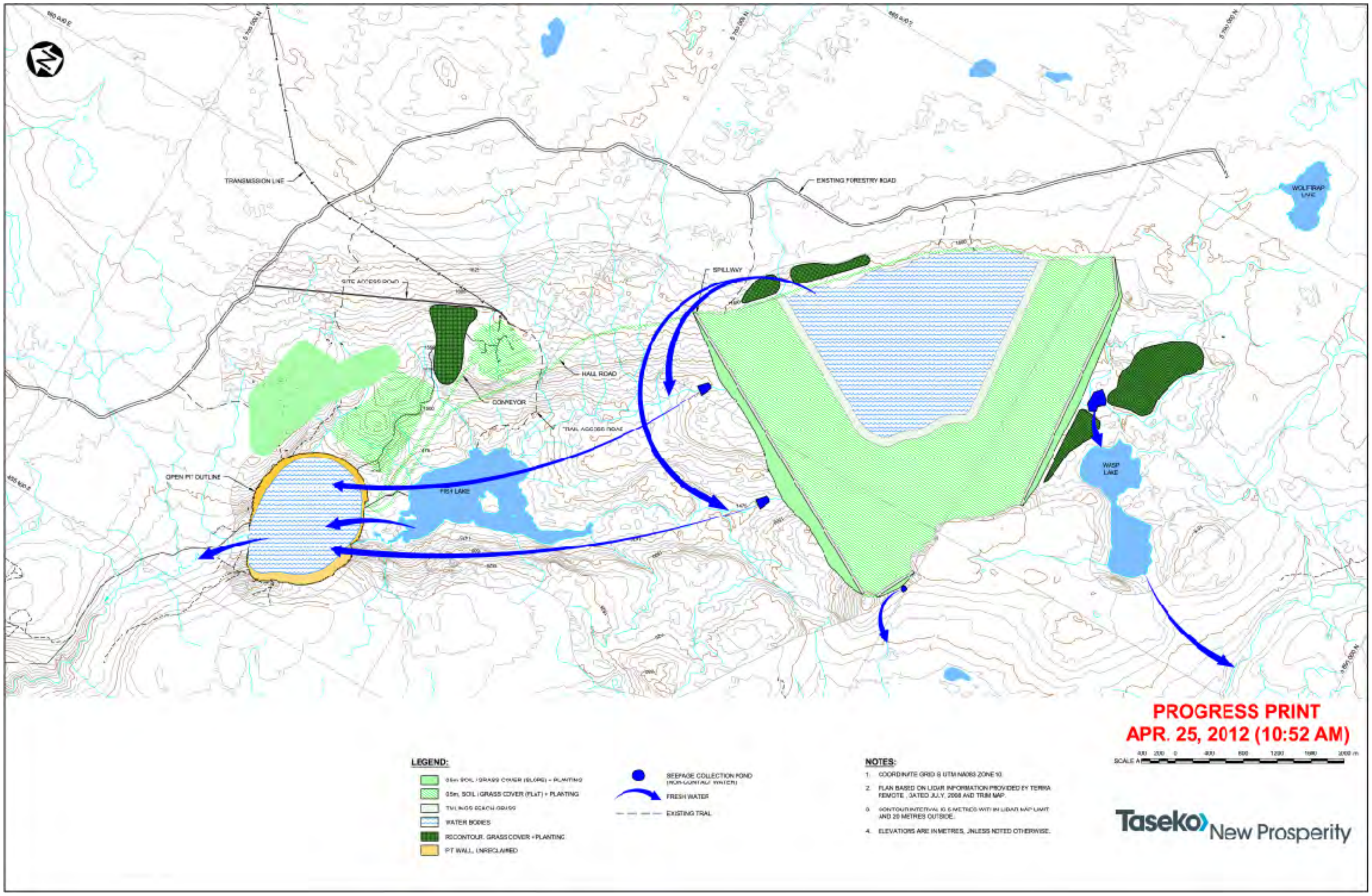


Figure 2.7.2.4A-8 Water Management – Final Reclamation Plan

Numerous design elements were included to achieve the objectives of the site wide water management plan. These design elements are identified and briefly described below:

- Cofferdams and pumping systems.
- Sediment and erosion control elements and “Industry Standard Practices”.
  - Diversion ditches
  - Runoff collection ditches
  - Sediment control ponds
  - Surface roughening
  - Temporary seeding
  - Sediment traps and sediment basins, and
  - Mulching.
- Seepage collection and recycle ponds.
- Vertical depressurization wells around the Open Pit.

Details of the design basis for the key water management structures are included in KP report ‘New Prosperity Gold-Copper Project – Water Management Plan, provided in Appendix 2.7.2.4-B.

OPERATIONAL WATER BALANCE

General

An operational water balance was completed to aid in water management, estimate contingency process/supernatant pond water requirements, and estimate when the TSF and Open Pit will begin to overflow in closure and post-closure, respectively.

The water balance was completed in monthly time steps from January 1, 2012 (year -1) to January 1, 2112 (80 years following the end the mine life) using GoldSim®, a dynamic probabilistic simulation model used extensively for mine site water management applications. GoldSim® permits inputs to be entered as probability distributions (rather than discrete values), performs Monte Carlo simulations, tracks outputs from those simulations and provides a graphic interface to facilitate the review and identification of interactions between components.

The water balance was based on the following assumptions and input parameters:

- Hydrometeorological conditions
- Construction schedule
- Production schedule
- Water management plan
- Tailings, waste rock, and overburden properties
- Tailings consolidation
- Groundwater inflows
- Seepage, and
- Fisheries mitigation requirements.

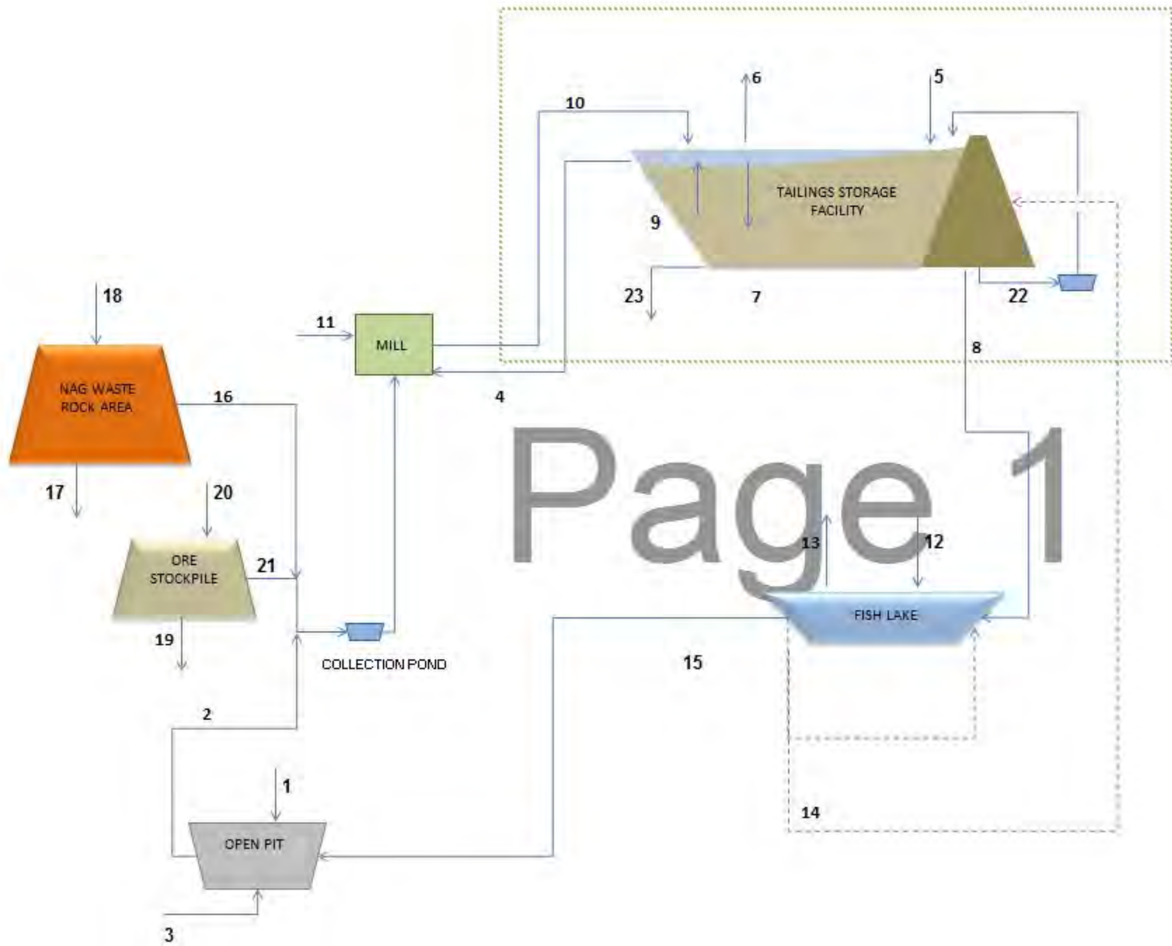
The water balance was developed using the simplified schedule shown in Table 2.7.2.4A-2. The annual production schedule was provided by Taseko and modified by KPL to provide monthly values of tailings, waste rock, and overburden production. The production schedule is shown in Table 2.7.2.4A-3. A water balance schematic was developed, based on the water management plan, and used as the framework for the water balance model. The water balance schematic for operations is shown on Figure 2.7.2.4A-9. Details of the assumptions and input parameters are provided below.

Table 2.7.2.4A-2 Water Balance Project Schedule

Phase	Mine Life (yrs)	Details
Construction	-1	Start of construction: TSF begins to accumulate water; Fish Lake (FL) outflows recirculated to FL inlet tributaries are required, outflows not required for FL are pumped to TSF.
Operations	1	Mill start up. FL outflow continue to be recirculated as needed and remainder of outflow pumped to TSF. Open pit (OP) dewatering sent to mill for use in process, remainder of reclaim sourced from TSF pond. All TSF recoverable seepage is recycled to TSF.
	16	OP mining ceases; Ore stockpile processed through mill. OP dewatering ceases, pit filling commences. FL outflow not required for recirculation allowed to overflow to OP.
	20	Last year of operations
Closure Phase I	21	TSF pond overflow is directed to OP filling. TSF embankment seepage recycle continued to be pumped back to TSF. FL outflow recirculation pumping continues; excess overflows to OP.
Closure Phase II	31	Fish Lake outflow recirculation ceases and all outflow is directed to the OP. TSF pond overflow is directed to FL via the inlet tributaries. South and West TSF embankment seepage recycle pumping to TSF cease. Main embankment seepage ponds pumped to OP in perpetuity.
	44	Pit filling Complete
Post-closure	45	OP filling complete, overflow directed to Lower Fish Creek.
	100	End of model simulation

Table 2.7.2.4A-3 Production Schedule

YEAR	ORE				TAILINGS	PAG WASTE		Non-PAG WASTE	
	PIT TO MILL	PIT TO STOCKPILE	STOCKPILE TO MILL	TOTAL ORE TO MILL	TO TAILINGS STORAGE FACILITY	PAG WASTE ROCK	PAG OVERBURDEN	Non-PAG WASTE ROCK	Non-PAG OVERBURDEN
	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes
-2	0	0		0	0	303,000	0	76,000	3,514,000
-1	0	1,372,000		0	0	2,025,000	235,000	1,199,000	9,562,000
1	9,135,000	4,480,000	356,000	9,491,000	9,396,090	4,434,000	287,000	4,899,000	11,273,000
2	25,560,000	7,006,000		25,560,000	25,304,400	7,147,000	1,694,000	8,759,000	8,014,000
3	25,560,000	9,046,000		25,560,000	25,304,400	13,197,000	1,918,000	8,831,000	6,030,000
4	25,560,000	7,027,000		25,560,000	25,304,400	21,007,000	275,000	7,595,000	3,319,000
5	25,560,000	9,180,000		25,560,000	25,304,400	17,026,000	1,164,000	13,774,000	1,823,000
6	25,560,000	9,641,000		25,560,000	25,304,400	11,962,000	3,572,000	16,733,000	6,038,000
7	25,560,000	5,161,000		25,560,000	25,304,400	22,265,000	2,499,000	11,405,000	7,375,000
8	25,560,000	4,348,000		25,560,000	25,304,400	32,830,000	91,000	8,353,000	3,104,000
9	25,560,000	3,371,000		25,560,000	25,304,400	35,153,000	0	6,977,000	22,000
10	25,560,000	4,037,000		25,560,000	25,304,400	29,791,000	0	5,768,000	0
11	25,560,000	10,267,000		25,560,000	25,304,400	17,256,000	0	3,320,000	0
12	25,560,000	6,770,000		25,560,000	25,304,400	6,854,000	0	1,713,000	0
13	25,560,000	5,028,000		25,560,000	25,304,400	2,486,000	0	1,015,000	0
14	25,560,000	697,000		25,560,000	25,304,400	971,000	0	729,000	0
15	25,560,000	0		25,560,000	25,304,400	655,000	0	668,000	0
16	25,560,000	0		25,560,000	25,304,400	191,000	0	115,000	0
17	6,822,000	0	18,738,000	25,560,000	25,304,400	0	0	0	0
18	0	0	25,560,000	25,560,000	25,304,400	0	0	0	0
19	0	0	25,560,000	25,560,000	25,304,400	0	0	0	0
20	0	0	17,218,000	17,218,000	17,045,820	0	0	0	0
TOTALS	**399,357,000**	**87,431,000**	**87,432,000**	**486,789,000**	**481,921,110**	**225,553,000**	**11,735,000**	**101,929,000**	**60,074,000**



Number	Description
1	Open Pit direct precipitation and catchment runoff
2	Open Pit dewatering direct to mill
3	Open Pit groundwater inflows
4	TSF reclaim water
5	TSF catchment and beach runoff; direct precipitation on pond
6	TSF pond evaporation
7	Water trapped in tailings and PAG waste rock void spaces
8	Unrecoverable TSF seepage to Fish Lake
9	Tailings consolidation seepage
10	Water in slurry
11	Freshwater make-up
12	Fish Lake direct precipitation and catchment runoff
13	Fish Lake evaporation
14	Fish Lake outflow (potential recirculation to Fish Lake or TSF as required)
15	Fish Lake seepage to Open Pit
16	NAG waste rock storage area runoff
17	Unrecoverable NAG waste rock seepage
18	NAG waste rock direct precipitation
19	Unrecoverable ore stockpile seepage
20	Ore stockpile direct precipitation
21	Ore stockpile runoff
22	Recoverable TSF seepage - recycled to TSF
23	Unrecoverable seepage to Wasp Lake/Big Onion Lake

NOTES:

1. WATER BALANCE SCHEMATIC IS NOT DRAWN TO SCALE.
2. NAG = NON-ACID GENERATING

Figure 2.7.2.4A-9 Water Balance Schematic for Operations

<u>Water Balance Assumptions and Input Parameters</u>

Climate Inputs

The base case mine site water balance model was developed using average estimated values for precipitation and runoff, as presented in Table 2.7.2.4A-4. The mean annual precipitation for the project site was assumed to be 445 mm for the lower areas in Fish Creek (i.e. open pit, non-PAG pile, plant site , low grade ore stockpile and Fish Lake) and 527 mm for upper reaches of the catchment (i.e. TSF area). Details of the determination of the average climatic conditions can be found in KP Hydrometeorology Report (Appendix ?).

The average runoff conditions for Fish Creek were based on the watershed model for Fish Creek developed for baseline conditions (Appendix 2.6.1.4B). The mean annual unit runoff for the Fish Creek basin range from 119 mm to 129 mm. The majority of the natural catchment area included in the water balance model is located around Fish Lake, therefore the representative mean annual surface water runoff for this catchment was assumed to be 121 mm for undisturbed areas within the water balance model. The groundwater inputs to Fish Lake were based on the results of groundwater modelling completed by BGC (Appendix ?), as described later in this section.

Stochastic Inputs

The potential variability of climatic conditions was addressed by using a stochastic version of the water balance model, which involved Monte Carlo type simulation techniques and the modelling of monthly climatic parameters as probability distributions, rather than simply as mean values. The year-to-year variability of monthly runoff and precipitation values was quantified using coefficient of variation (C_v) values, which were derived from regional datasets. Table 2.7.2.4A-4 lists the monthly C_v values for runoff and precipitation, along with the monthly mean and corresponding standard deviation values. The monthly mean and standard deviation values were used to develop monthly probability distributions, as required for a Monte Carlo simulation, and the precipitation and runoff values were correlated, and were modelled using the Gamma distributions. Correlation coefficients for runoff and precipitation were derived using a built-in function in Excel. These coefficients provide a measure of the linear relationship between the two variables and vary between 1 and -1, with positive values indicating that the variables increase or decrease together, and negative values indicating that increasing one variable decreases the other, and vice versa. A correlation coefficient of 0 indicates no correlation; that is, the variables are independent of each other (GoldSim, 2009). The Monte Carlo simulations were run with 10,000 iterations, enabling nearly every conceivable combination of wet, dry and average months and years of precipitation to be considered, with corresponding varying monthly runoff values. The TSF pond volume was tracked for each month of each year. Each iteration resulted in distributions of possible results for each month in each year, from which probabilities of occurrence were assessed.

Table 2.7.2.4A-4 Summary of Hydrometeorological Estimates for Water Balance Modelling

Parameter	Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Rainfall (Elevation 1,600 m)	Mean (mm)	0	0	0	0	42	66	69	61	37	21	0	0	295
Snowfall (Elevation 1,600 m)	Mean (mm)	47	29	18	26	8	0	0	0	5	10	37	50	232
Total Precipitation (Elevation 1,600 m)	Mean (mm)	47	29	18	26	50	66	69	61	42	32	37	50	527
	Coefficient of Variation	0.72	0.89	0.80	0.83	0.63	0.75	0.73	0.68	0.73	0.61	0.87	0.68	-
	StDev (mm)	34	26	15	22	32	49	50	41	31	19	32	34	-
Rainfall and Snowmelt (Elevation 1,600 m)	Mean (mm)	0	0	11	112	143	74	69	61	37	21	0	0	527
Natural Unit Runoff (Elevation 1,600 m)	Mean (mm)	0	0	4	36	51	25	5	0	0	0	0	0	121
	Coefficient of Variation	0.00	0.00	0.74	0.61	0.68	1.08	0.80	0.00	0.00	0.00	0.00	0.00	-
	StDev (mm)	0	0	3	22	35	27	4	0	0	0	0	0	-
Lake/Pond Evaporation (Elevation 1,600 m)	Mean (mm)	0	0	0	0	69	109	100	104	70	0	0	0	452

Hydrologic Inputs

The runoff coefficients used for various components of the mine site include:

- TSF Pond – 100%
- TSF beach – 70%
- NAG Waste Storage Area – 50%
- Exposed PAG Waste Storage Area – 90%
- Open Pit – 90%, and
- Plant Site – 75%.

Groundwater Flows

Groundwater flows in the Fish Creek basin, for baseline and post-development conditions, were based on groundwater modelling completed by BGC. Detailed results of the groundwater models are described in Appendix 2.7.2.4-A. Groundwater flows used in the water balance model were applicable to the Open pit and Fish Lake. The following are the relevant groundwater flow rates, broken down by facility and/or area for the different project phases:

- Fish Lake basin (entering and leaving the lake):
  - Baseline groundwater inflow = 420 m^3/day
  - Baseline groundwater seepage from lake = 0.02 m^3/day
  - Operational groundwater inflow = 410 m^3/day (Year 1) to 392 m^3/day (Year 21)
  - Operational groundwater seepage from lake = 0.03 m^3/day (Year 1) to 6.75 m^3/day (Year 21)
  - Closure/post-closure groundwater inflow = 392 m^3/day
  - Closure/post-closure groundwater seepage from lake = 6.75 m^3/day
- Open Pit area
  - Baseline groundwater inflow = 0 m^3/day
  - Operational groundwater inflow = 0 m^3/day (Year -2) to 1900 m^3/day (Year 17)
  - Operational groundwater seepage from open pit = 0 m^3/day
  - Closure/post-closure groundwater inflow = 1900 m^3/day (Year 17) to 0 m^3/day (Year 45)
  - Closure/post-closure groundwater seepage from open pit = 0 m^3/day

TSF Embankment Seepage

Seepage from the TSF embankments (Main, South and West embankments) was estimated using the finite element computer program SEEP/W from GEO-SLOPE International Ltd. completed as part of the preliminary engineering design for the project. The TSF embankment seepage is broken into two components: seepage through the embankment wall and seepage under the embankment foundations.

The total TSF embankment seepage is estimated to be 5 L/s at start-up (January 2013) and then increasing to 40 L/s at Year 20. The seepage rates are assumed to increase linearly from start-up to the end of operations in Year 20. The total embankment seepage leaving through the Main and South embankments combined was estimated to be 39 L/s, with the remaining 1 L/s leaving through the West embankment. Of the total seepage through the North and South embankments, 65% is assumed to be through the Main and the remaining 35% through the South.

For each embankment (Main, South and West), the distribution of seepage through the respective embankment foundation and embankment wall is as follows:

- 90% of seepage is through the embankments wall; 90% of this seepage is assumed recovered in the seepage collection ponds and pumped back to the TSF. The remaining 10% that is not captured by the seepage recycle system is assumed to contribute to surface water inflows to Fish Lake to the north, Wasp Lake to the south and Big Onion Lake to the west.
- 10% of the total seepage is through the foundation, of which 100% is assumed to be lost to groundwater immediately downstream of the embankment and, in the absence of any mitigation measures, is assumed to eventually contribute to surface water inflows to Fish Lake to the north, Wasp Lake to the south and Big Onion Lake to the west.
- Main embankment groundwater pumping wells:
  - In order to minimize the amount of TSF seepage contributing to Fish Lake, groundwater pumping wells will be installed downstream of the seepage collection ponds in order to improve the capture of seepage from the facility. The wells are assumed to capture approximately 60% of the total seepage from: the embankment foundation seepage lost to groundwater and the portion of the embankment wall seepage that bypasses the seepage collection pond. The captured seepage will be pumped back to the Main embankment seepage pond(s) in the long term.

A flow chart of the TSF wall and foundation seepage components at the end of operations is illustrated on Figure 2.7.2.4A-10.

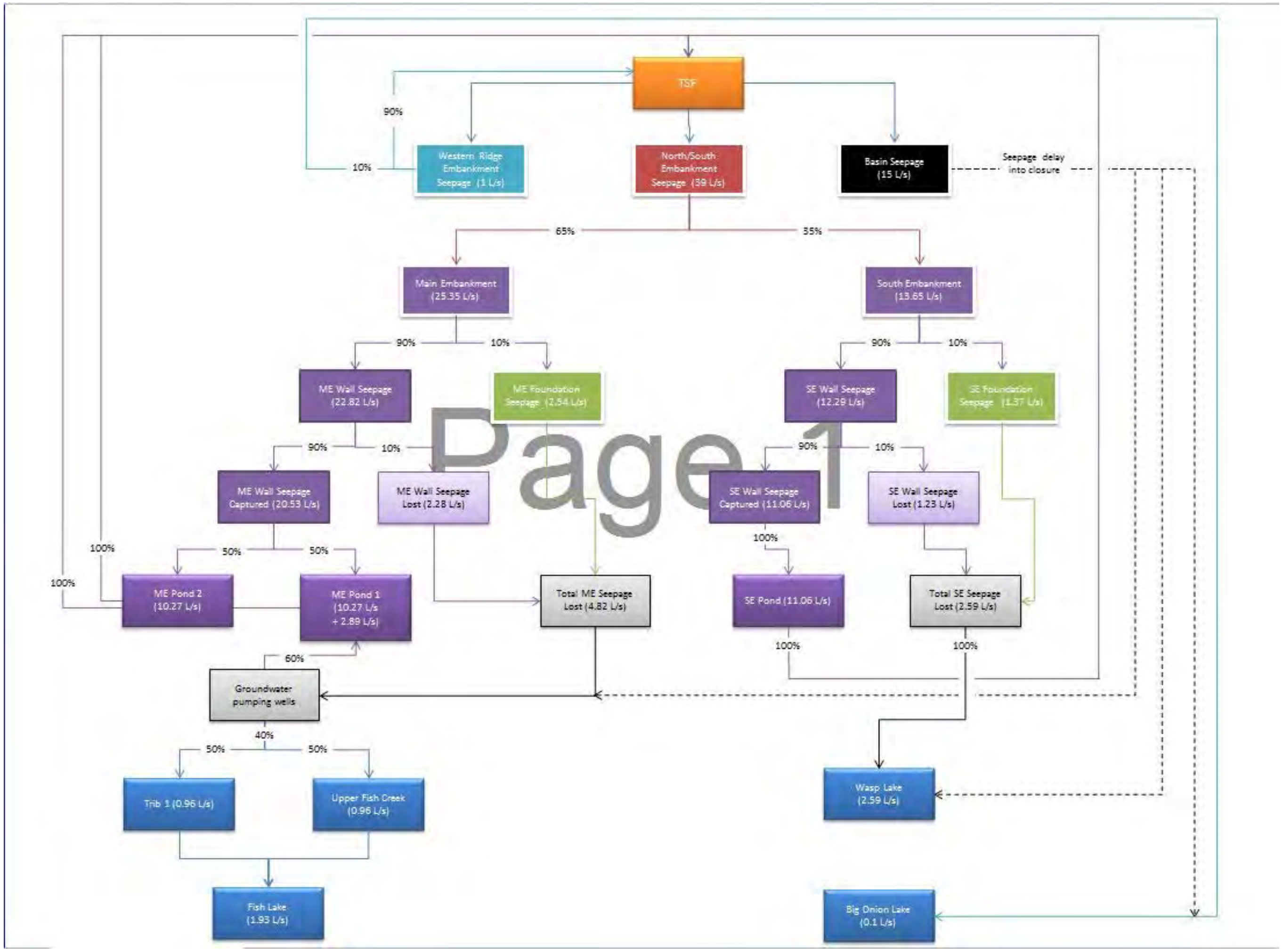


Figure 2.7.2.4A-10 TSF Seepage Flow Chart

TSF Basin Seepage

- TSF basin footprint (leaving the facility):
  - Beginning of operations (Year 1) = 0 L/s
  - Year 22 = 15 L/s
  - Year 23 = 9 L/s, and
  - The groundwater flow rates from 0 to 15 L/s were assumed to grow linearly until Year 22. After this point, the rate was assumed to decrease to 9 L/s once the TSF is full and overflowing from the closure spillway.

Fish Lake Inflow Requirements

Approximately 50% of the upstream contributing catchment to Fish Lake will be cut off due the development of the TSF, reducing the baseline catchment area of Fish Lake from approximately 68 km^2 to 30 km^2 during operations. In order to preserve inlet spawning habitat in Fish Lake, as well as mitigate for the loss of outlet spawning due the Open Pit development, outflow from Fish Lake will be recirculated to the inlet channels of the lake, beginning in construction to the end of closure phase II. The total monthly flow requirements to inlets of Fish Lake were estimated as follows:

- April = 0.29 m^3/s
- May = 0.6 m^3/s
- June = 0.75 m^3/s
- July = 0.35 m^3/s, and
- Aug = 0.25 m^3/s.

These flow requirements were determined by Triton and discussed in Section 2.7.2.4B.

<u>Water Balance Results</u>

Operations

Model results were used to determine the likelihood of having a surplus and/or deficit of water in the TSF, as illustrated on Figure 2.7.2.4A-11. The figure presents the range of possible cumulative pond volumes available in the TSF over the life of the mine, as defined by the 95^{th} percentile values (5% chance of being equalled or exceeded in any year). This range of volumes can also be thought of as the required active, or “live”, storage capacity of the TSF pond for a reasonably large range of anticipated climatic conditions. It is evident from these results that the 95^{th} percentile monthly wet pond volumes are about twice as large as the 95^{th} percentile monthly dry pond volumes.

The system (including the TSF, Open Pit, water pumped from Fish Lake outflows and contributing catchments) is able to supply enough water to meet the process water mill requirements throughout the mine life, for all scenarios.

Closure

As of Year 21, tailings deposition to the TSF ceases and the TSF supernatant pond is assumed to fill naturally until it reaches the closure overflow spillway crest, at an assumed elevation of 1591 m. The open pit begins filling in Year 17, when mining in the open pit ceases. The TSF supernatant pond and open pit filling volumes presented on Figure 2.7.2.4A-12 for the median scenario. The TSF is expected to overflow in Year 21 to the Open Pit, after the end of mining operations, for the median case. The open pit is expected to take approximately 24 years to fill to capacity (Year 45), for the median scenario. Accordingly, discharge from the open pit is expected to begin overflowing to Lower Fish Creek in post-closure. Table 2.7.2.4A-5 summarizes the range of annual overflow volumes expected from both facilities in closure and post-closure for the 95th percentile wet and dry scenarios, as well as the median case.

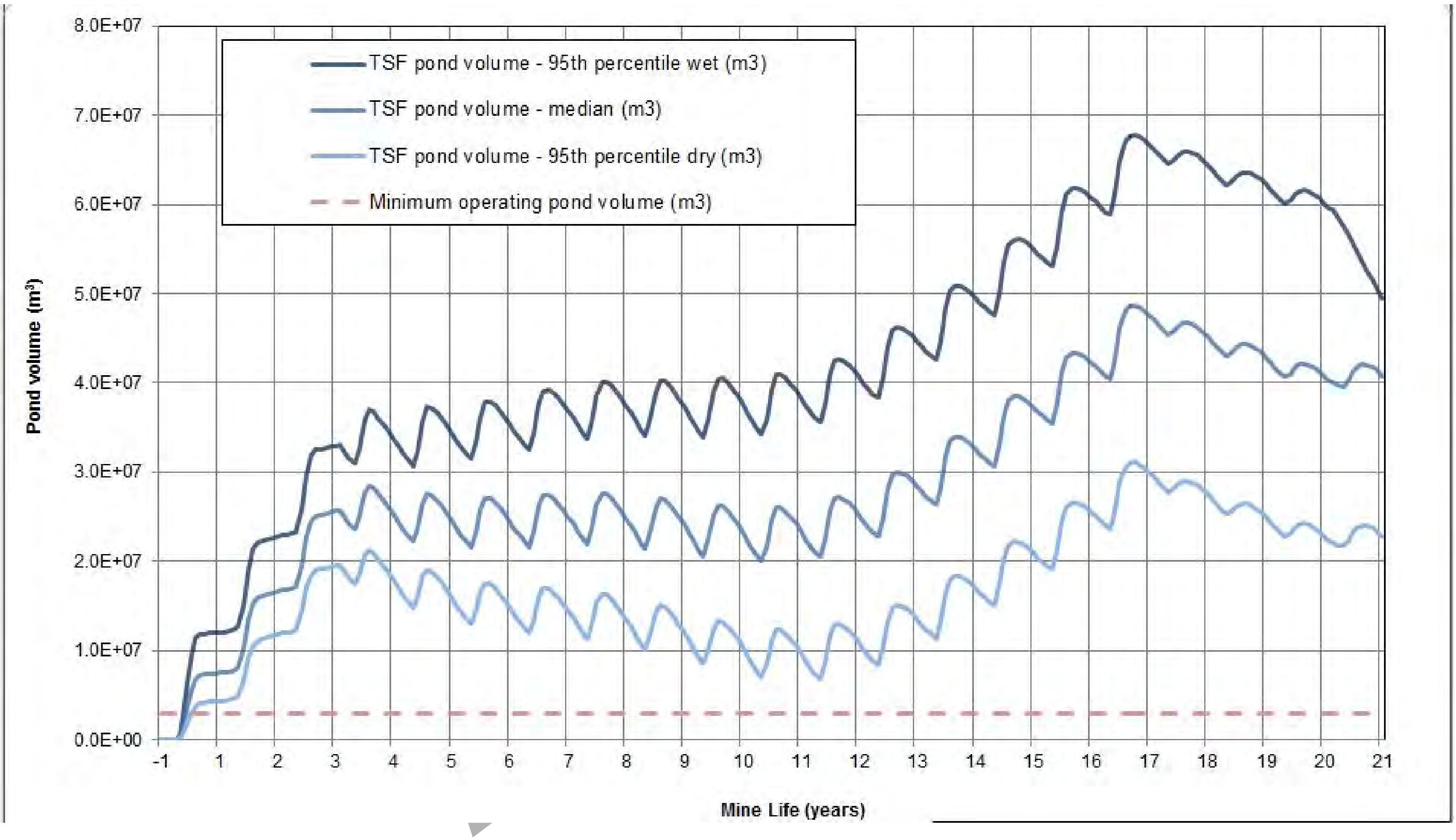


Figure 2.7.2.4A-11 Operations Water Balance Results

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.4A-12 Closure Water Balance Results

TABLE TO BE INCLUDED IN FINAL EIS SUBMISSION

Table 2.7.2.4A-5 Closure Water Balance Results

PROJECT EFFECTS

SURFACE WATER HYDROLOGY

The Projects effects to surface water streamflow are discussed in terms of changes in flow pathways and watershed areas, annual flow volumes, lake level in Fish Lake and monthly flow distributions for the Fish Creek watershed and the downstream watershed of Beece Creek.

The Project will result in a decrease in surface water streamflow in the local study area of Fish Creek and Fish Lake during mine operations. This effect will occur continuously from pre-construction to closure, with an improvement to surface water streamflow upon the commencement of the post-closure period. The reclamation of the TSF and open pit to natural flow paths will lead to the re-establishment of near baseline flows contributing to Fish Lake and in Lower Fish Creek in post-closure. For Beece Creek, the Project will result in no change during operations and an increase to surface water streamflow in post-closure. This effect will have no change to the contributing drainage area to Wasp Lake and Beece Creek from pre-construction to closure. In closure and post-closure, the watershed area will be permanently increased from baseline conditions. The increase in surface water streamflow during closure and post-closure is irreversible, although the change is minor compared to the mean annual runoff for Beece Creek.

Climate change could also potentially have effects to the surface water streamflow with the increase in extreme rainfall events and warmer temperatures. However, potential climate change effects have already been accounted for in the conservative nature of the estimates associated with surface water streamflow volumes. In addition, trends of regional stations indicate that the increases in precipitation and temperature will not cause substantial changes to surface water streamflow volumes outside the natural variability of systems in British Columbia.

CHANGES TO FLOW PATHWAYS AND WATERSHED AREAS

Diversion of water within and around the New Prosperity Project area will permanently alter the baseline flow regime for the Fish Creek Watershed. A component of this is the inflow reduction to Fish Lake. A summary of the watersheds diverted or affected by the Project area is presented in Table 2.7.2.4A-6.

Table 2.7.2.4A-6 Summary of Catchment Areas

Catchments	Area (km^2)							
	Baseline	Year -1	Year 5	Year 12	Year 19	Closure Phase I	Closure Phase II	Post Closure
TSF East catchment	0.0	8.3	8.3	8.3	8.3	8.3	0.0	0.0
TSF South catchment	0.0	12.6	12.6	12.6	12.6	12.6	0.0	0.0
TSF contributing catchment	0.0	19.2	19.2	19.2	19.2	19.2	0.0	0.0
Fish Lake contributing catchment	65.8	29.2	29.2	29.2	29.2	29.2	56.7	56.7
Plant Site	0.0	1.2	1.2	1.2	1.2	1.2	0.0	0.0
Mine site facilities	0.0	5.5	5.5	5.5	5.5	5.5	0.0	0.0
Lower Fish Creek Catchment at H4b	99.3	23.4	23.4	23.4	23.4	23.4	30.0	30.0
Wasp Lake Catchment	3.9	3.9	3.9	3.9	3.9	3.9	16.5	16.5
Beece Creek at H8c	221.9	221.9	221.9	221.9	221.9	221.9	234.5	234.5

NOTES:

1. The Lower Fish Creek subcatchment includes the area downstream of the mine footprint to the hydrology station H4b.
2. The contributing catchment area for Lower Fish Creek for baseline conditions at H4b 99.3 km^2.
3. The total contributing catchment are for Beece Creek at H8c for baseline conditions is 221.9 km^2.

ANNUAL FLOW VOLUME

The effects to annual flow volumes will focus on flow values near the confluence of Lower Fish Creek at H4b and the Taseko River, inflows to Fish Lake from Upper Fish Creek (H17b) and Fish Lake Tributary 1, and at H8c on Beece Creek. These locations were chosen because they have the longest period of record that best represent the baseline conditions. The previous section discussed the changes in flow paths and watershed areas due to the development of the Project. A large portion of the natural runoff in Fish Creek and contributing to Fish Lake will be impounded in the TSF or captured by the Project site drainage system. During operations, with the reduction in contributing watershed area to Fish Lake and Lower Fish Creek, the annual flow volumes are expected to decrease in this drainage. Also during operations, with the increase in contributing watershed area to Beece Creek, the annual flow volume is not expected to change in this drainage.

Annual flow volumes based on average precipitation for Lower Fish Creek for baseline conditions, during operations and post-closure are presented in Table 2.7.2.4A-7. The annual flow volumes in Lower Fish Creek are expected to be reduced by approximately 76%, during operations and by 1% after decommissioning of the Project.

Table 2.7.2.4A-7 Lower Fish Creek Annual Flow Volumes

Phase	Annual flow volume (million m^3)	Percent change (%)
Baseline	11.8	-
Operations and Closure Phase I & II (Years 1-44)	2.8	-76%
Post closure (Years 45-100)	11.7	-1%

Annual flow volumes based on average precipitation for Upper Fish Creek, Fish Lake Tributary 1 and the total inflow catchment to Fish Lake for baseline conditions, during operations and post-closure are presented in Table 2.7.2.4A-8. The annual flow volumes in Upper Fish Creek are expected to be reduced by approximately 38%, during operations and by 50% after decommissioning of the Project. The annual flow volumes in Tributary 1 are expected to increase by approximately 8%, during operations and by 42% after decommissioning of the Project. The increase in annual flow in Tributary 1 is due to the recirculation of the Fish Lake outflow as a mitigation measure to support lake inlet spawning, thereby increasing the channel capacity. The annual flow volume based on the total contributing catchment area to Fish Lake is expected to decrease by 24% during operations/closure phase I and by 55% as of closure phase II.

Table 2.7.2.4A-8 Fish Lake Inlet Annual Flow Volumes

Location	Phase	Annual flow volume (million m^3)	Percent change (%)
Upper Fish Creek (H17b)	**Baseline**	5.1	-
	Operations and Closure Phase I (Years 1-30)	3.2	-38%
	Closure Phase II & Post closure (Years 31-100)	2.6	-50%
Fish Lake Tributary 1	**Baseline**	2.1	-
	Operations and Closure Phase I (Years 1-30)	2.3	8%
	Closure Phase II & Post closure (Years 31-100)	3.0	42%
Fish Lake total catchment inflow	**Baseline**	8.2	
	Operations and Closure Phase I (Years 1-30)	6.2	-24%
	Closure Phase II & Post closure (Years 31-100)	3.7	-55%

The baseline and post-development annual flow volume based on average precipitation for Beece Creek at H8c is presented in Table 2.7.2.4A-9. The annual flow volumes are not expected to change during operations, and increase by 1.6% in post-closure. Due to the large size of the Beece Creek watershed, the annual increase or decrease in flow volume due to the Project is considered minor.

Table 2.7.2.4A-9 Beece Creek (H8c) Annual Flow Volumes

Phase	Annual flow volume (million m^3)	Percent change (%)
Baseline	93.1	-
Operations and Closure Phase I (Years 1-30)	93.1	0%
Closure Phase II and Post closure (Years 31-100)	94.7	1.6%

SEASONAL FLOW DISTRIBUTION

The assessment of the Project effects to the seasonal flow distribution were focused on station H4b on Lower Fish Creek (located just upstream from the confluence with the Taseko River), station H17b on Upper Fish Creek (located at the major tributary inlet to Fish Lake) and station H8c on Beece Creek.

For Lower Fish Creek, the development of the Project will have the overall effect of reducing flows through the year at H4b. The flow distribution for the baseline conditions at H4b were based on the Type A2 distribution as presented in Table 2.7.2.4A-10.

Table 2.7.2.4A-10 Estimated Long-Term Project Area Monthly Flows for Baseline Conditions

Example Drainage Basin	Area (km^2)	Elevation	Distribution Type	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Fish Creek	99.3	1540	A1	flow distribution	**0.5%**	**2%**	**4%**	**10%**	**72%**	**2%**	**0.5%**	**0.5%**	**0.5%**	**2%**	**4%**	**2%**	**100%**
(H4b)				avg. unit area flow (mm)	0.6	2.4	4.8	11.9	85.7	2.4	0.6	0.6	0.6	2.4	4.8	2.4	119
				average flow (m^3/s)	0.02	0.10	0.18	0.46	3.18	0.09	0.02	0.02	0.02	0.09	0.18	0.09	0.37
			A2	flow distribution	**2.0%**	**1.0%**	**3.0%**	**28.0%**	**39.0%**	**19.0%**	**4.0%**	**1.0%**	**0.5%**	**0.5%**	**1.0%**	**1.0%**	**100%**
				avg. unit area flow (mm)	2.4	1.2	3.6	33.3	46.4	22.6	4.8	1.2	0.6	0.6	1.2	1.2	119
				average flow (m^3/s)	0.09	0.05	0.13	1.28	1.72	0.87	0.18	0.04	0.02	0.02	0.05	0.04	0.37
Beece Creek	221.9	1760	B	flow distribution	**1%**	**1%**	**1%**	**3%**	**17%**	**26%**	**23%**	**15%**	**6%**	**4%**	**2%**	**1%**	**100%**
(H8c)				avg. unit area flow (mm)	4.2	4.2	4.2	12.7	72.2	110.4	97.7	63.7	25.5	17.0	8.5	4.2	425
				average flow (m^3/s)	0.4	0.4	0.4	1.1	6.0	9.5	8.1	5.3	2.2	1.4	0.7	0.4	3.0

Notes

1. For the purposes of the effects assessment, the A2 flow distribution was adapted for Lower Fish Creek.
2. The Beece Creek flow distribution from the baseline study was accepted for all stations within the Beece Creek watershed.
3. Annual runoff values calculated for Fish Creek (H4b) were based on the baseline watershed model.
4. Annual runoff value for Beece Creek (H8c) was estimated by multiplying the mean annual precipitation of 708 mm by the runoff coefficient of 0.6, from the baseline study.

The Type A1 distribution is for the condition where the majority of the annual runoff is concentrated in one month. The preliminary 2006–2007 data at H4c (which replaced historical station H4b), suggests that the flow distribution for Lower Fish Creek is somewhere between the A1 and A2 distributions. The freshet flows occur during a two month period, from April to May. There is also an indication of a slight dampening of peak flows at H4c (downstream of Fish Lake), compared to H17b (upstream of Fish Lake) due to Fish Lake; however, these effects were considered minimal, as the timing of the peak flows are fairly consistent at both stations. For the purposes of this effects assessment, the A2 flow distribution was adopted as the flow distribution for the Fish Creek catchment for baseline conditions and during mine operations to provide a more conservative estimate of monthly flow volumes and timing.

In post-closure, the runoff regime of the Fish Creek Catchment is altered from baseline conditions due to approximately 5% of the surface area being the Pit Lake and TSF Lake. The equivalent runoff entering Lower Fish Creek in post-closure was estimated by a water balance that takes into account precipitation and evaporation losses from the Pit and TSF lakes. With the changes to annual flow volumes as discussed in the previous section, the post-development monthly flows at H4b during operations and post-closure are presented in Table 2.7.2.4A-11 and the annual hydrographs for all three conditions are shown on Figure 2.7.2.4A-13. The flows during operations have been reduced from the baseline conditions, with an annual decrease of 76%.

Table 2.7.2.4A-11 Seasonal Flow Distributions for Lower Fish Creek

Condition	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Baseline (m^3/s)	0.09	0.05	0.13	1.28	1.72	0.87	0.18	0.04	0.02	0.02	0.05	0.04	0.37
Operations/Closure Phase I & II (m^3/s)	0.02	0.01	0.03	0.30	0.40	0.20	0.04	0.01	0.01	0.01	0.01	0.01	0.09
Post Closure (m^3/s)	0.09	0.05	0.13	1.26	1.70	0.86	0.17	0.04	0.02	0.02	0.05	0.04	0.37

Notes

1. For the purposes of the effects assessment, the A2 flow distribution was adapted for H4b Lower Fish Creek for baseline and during operations.
2. For the post closure scenario, the Open pit lake was assumed to be spilling to Lower Fish Creek, as of Year 45.

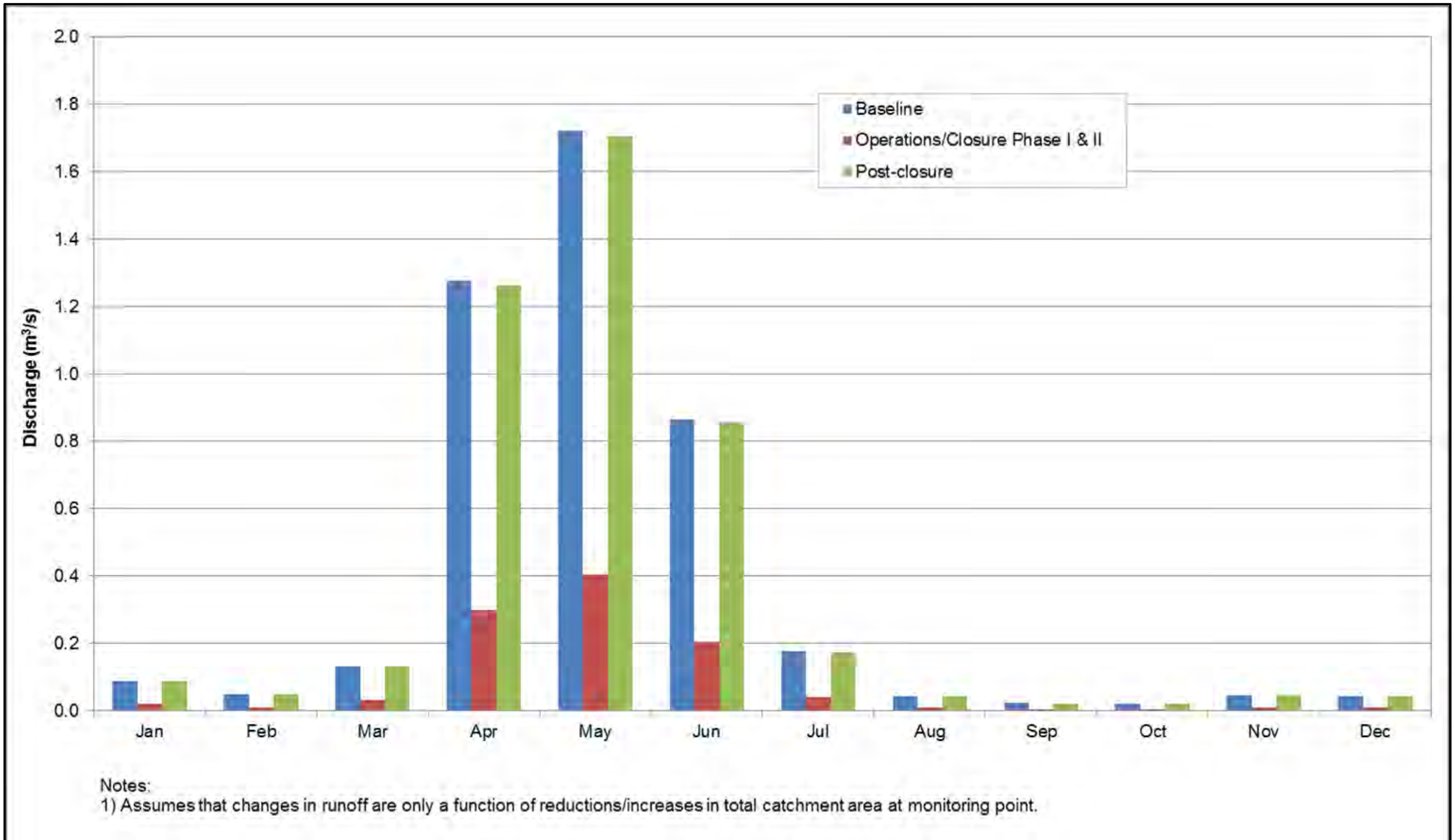


Figure 2.7.2.4A-13 Pre-Development and Post-development Flow Rates for Fish Creek (H4b)

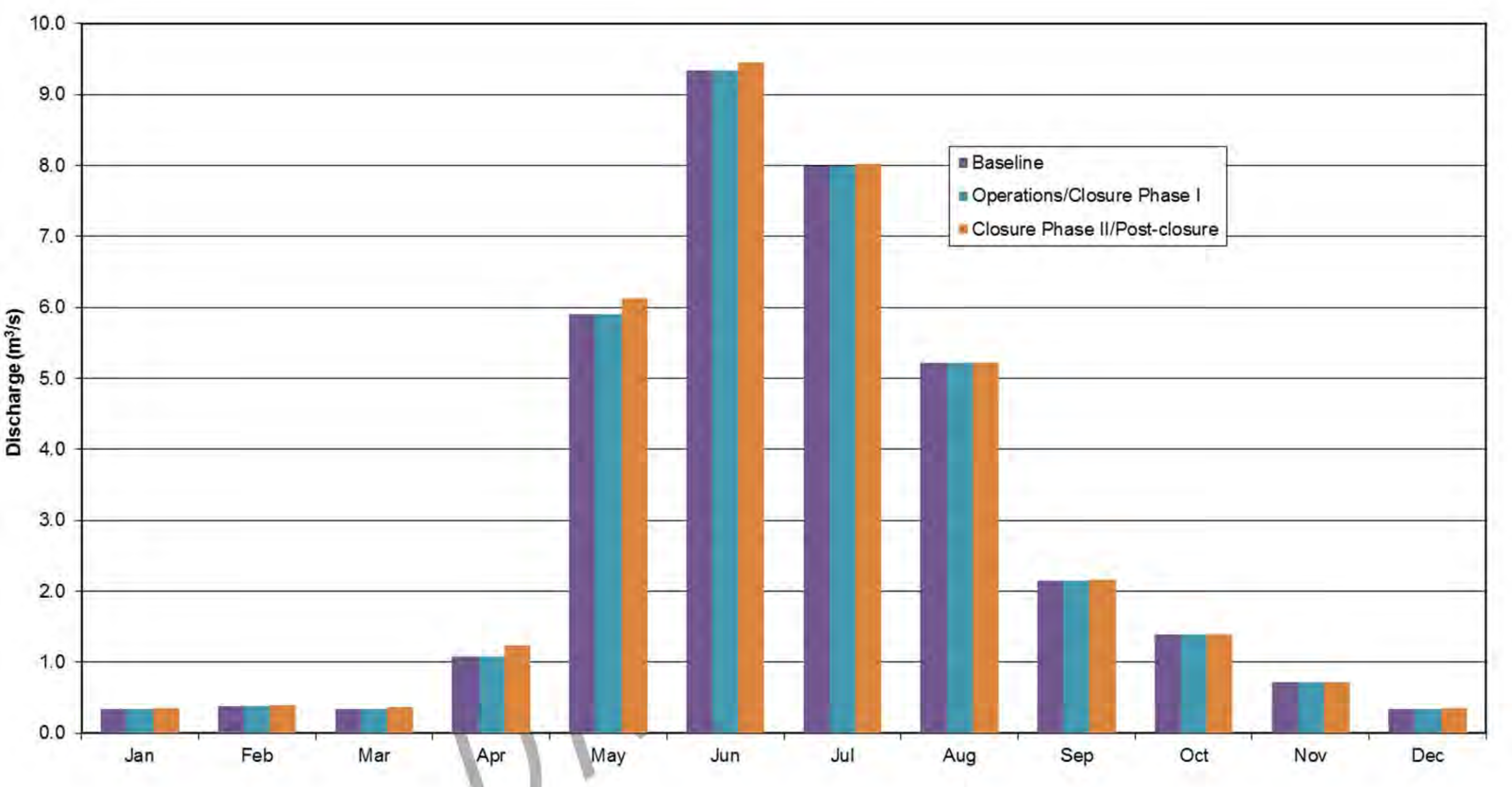
TABLE TO BE INCLUDED IN FINAL EIS SUBMISSION

Table 2.7.2.4A-12 Seasonal Flow Distributions for Upper Fish Creek

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.4A-14 Pre-Development and Post-development Flow Rates for Upper Fish Creek (H17b)

For Beece Creek, the development of the Project will have a positive effect by increasing the flows in post-closure. There will be no change to flows during operations and closure. The baseline flow distribution for Beece Creek at H8c is shown in Table 2.7.2.4A-10. The post-development flows during operations, closure and post-closure are shown in Table 2.7.2.4A-13 and the annual hydrograph for all three conditions is shown on Figure 2.7.2.4A-15. In post-closure, the flow distribution in Beece Creek will be increased from baseline conditions.



Notes:
1) Assumes that changes in runoff are only a function of reductions/increases in total catchment area at monitoring point.
2) Baseline flows for Beece Creek were based on the estimated long-term flow distribtion for H8c.

Figure 2.7.2.4A-15 Pre-Development and Post-development Flow Rates for Beece Creek (H8c)

Table 2.7.2.4A-13 Seasonal Flow Distributions for Beece Creek

Condition	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Baseline (m^3/s)	0.35	0.38	0.35	1.08	5.91	9.34	8.00	5.22	2.16	1.39	0.72	0.35	2.94
Operations/Closure Phase I (m^3/s)	0.35	0.38	0.35	1.08	5.91	9.34	8.00	5.22	2.16	1.39	0.72	0.35	2.94
Closure Phase II/Post Closure (m^3/s)	0.36	0.39	0.36	1.24	6.13	9.45	8.02	5.22	2.16	1.39	0.72	0.35	2.99

Notes

1. The Beece Creek flow distribution from the baseline study was accepted for all stations within the Beece Creek watershed.
2. As of Closure Phase II, it was assumed that the TSF South catchment is directed through Wasp Lake before entering Beece Creek watershed.

FISH LAKE LEVEL CHANGES

Baseline Lake Levels

The Fish Lake Level model was validated by comparing the calculated weir flows with the measured lake outflows at H6b. The broad crested weir assumption reasonably predicts the outflows from Fish Lake as shown on Figure 2.7.2.4A-16. The close agreement in timing and magnitude of the predicted and measured Fish Lake outflows suggests that the Fish Lake Level model provides a reasonable tool for modelling future scenarios.

Baseline Fish Lake levels were calculated for the period of 2006 to 2007 in order to estimate the maximum range of lake level fluctuations. Considering that the lake levels were calculated using measured inflows, there will be gaps in lake levels at any time the inflow data were not available. Based on the available inflow data for 2006 and 2007, our results indicate that the lake levels are within 0.5 m for most of the time (1457.5 masl). According to the model, the lake level exceeded 1457.5 masl for 19 days in 2007. The maximum predicted variation in lake levels for the modelled time period is approximately equal to 1.03 m, ranging between 1456.82 masl (meters above sea level) and 1457.85 masl. The maximum lake elevation modelled was equal to 1457.85 masl on May 9, 2007. The model predicts that the lake elevations fall below the weir invert in the late summer when evaporation exceeds inflows.

Post Development Lake Levels

Flows in and out of Fish Lake will be managed during operations, resulting in moderated lake level fluctuations. As mentioned above, the outflows for Operations Phase I are designed to maintain a constant lake level by pumping the excess water to the TSF. Accordingly, the lake level model indicates much smaller fluctuations in this period than during the baseline period (<0.05 m), and that the lake levels may rise slowly from 1457.0 masl to 1457.1 masl during the first phase of operations. This model is based on average monthly flows and does not account for storm events with a longer return period (e.g. 1 in 10 year event). In such cases, the lake levels may rise somewhat more for a period of the time until the excess water is pumped out. The pumping system will be designed with taking this into consideration, such that lake levels do not exceed natural levels for extended periods of time.

During Operations Phase II, Closure Phase I and II, and Post Closure, the lake level model uses the broad crested weir calculation method as validated for baseline conditions. The weir outflow enables more natural lake level fluctuations to resume, as compared to the pumped outflows in Operations Phase I. Considering that the weir discharge is correlated to the weir width, sensitivity testing showed that doubling the weir width approximately halved the maximum range of lake level fluctuations. For this reason, a weir width of 2 m is proposed to determine the lake outflow in the post development stages.

According to the lake level fluctuation model, the maximum post-development lake levels are estimated at 1457.48, 1457.54, and 1457.54 masl during operations, closure, and post closure, respectively. The estimated maximum lake levels are somewhat less than the maximum fluctuations estimated for baseline conditions, and are approximately equal to 0.5 m. Lake levels above 1457.5 m were predicted to occur for periods of 24 days or less.

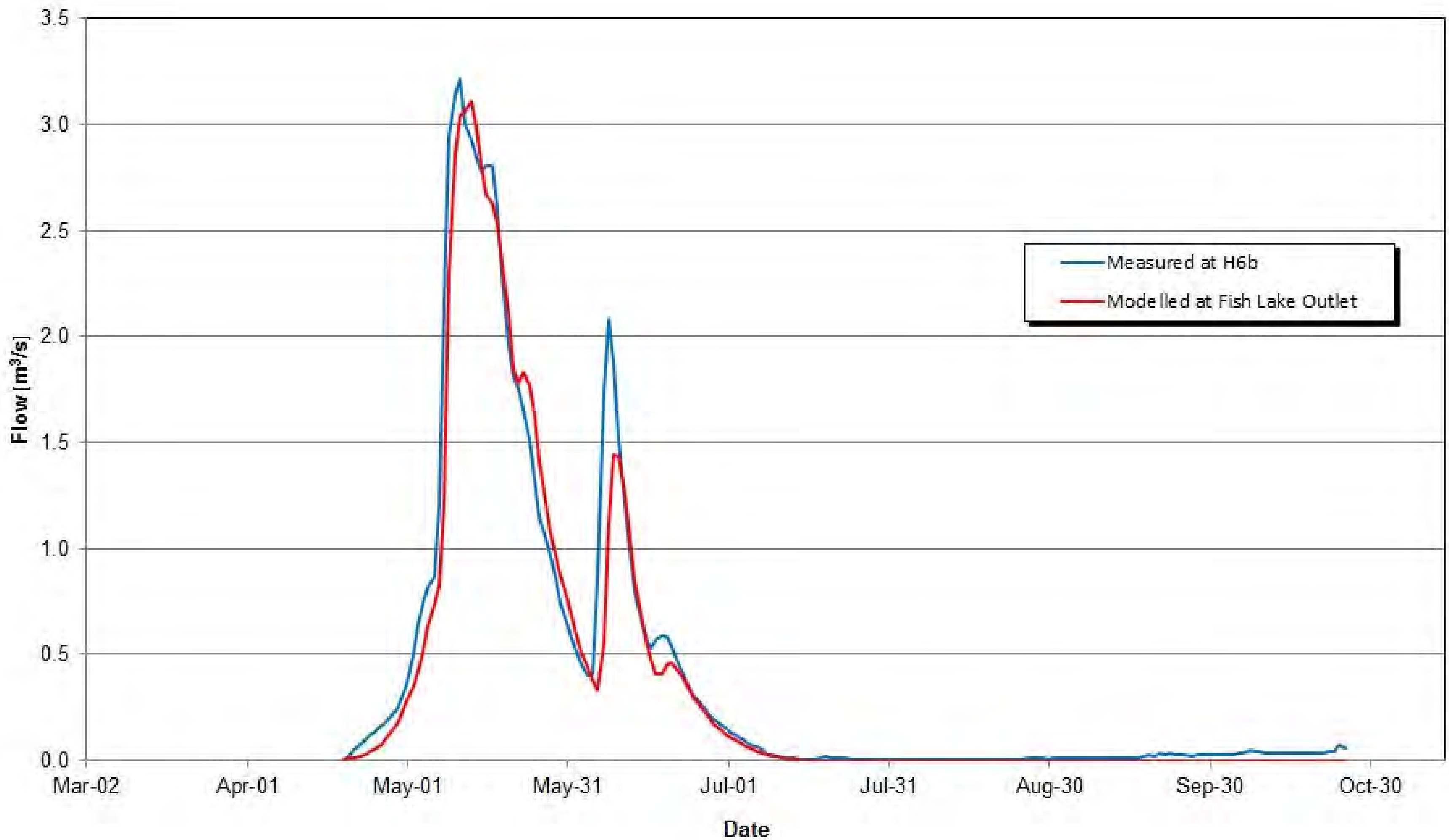


Figure 2.7.2.4A-16 Fish Lake Level Fluctuation Model Calculated and Measures Outlet Flows

HYDROGEOLOGY

A number of Project activities will interact with the groundwater system. The effects of these activities on groundwater quantity were assessed for the Fish Creek catchment area, the peripheral Big Onion Lake catchment area and portions of the Beece Creek and Taseko River catchments. The project effects assessment was conducted by simulating the effects of major mine facilities (i.e., the open pit, temporary ore stockpile, waste rock stockpile, proposed surface water diversions and the tailings storage facility) on groundwater elevations using a 3D numerical groundwater flow model, as discussed in the following sections. Predicted project effects on groundwater flows to and from the Taseko River, Lower Fish Creek, Fish Lake, Big Onion Lake, Little Onion Lake and Wasp Lake are included in these discussions, as they contribute to the assessment of project effects related to groundwater quality and other VECs.

Effects Assessment Methodology

A 3D numerical model encompassing the key features identified in the conceptual model was constructed and calibrated to pre-development hydrogeologic conditions. MODFLOW, an industry standard 3D finite difference flow model developed by the U.S. Geological Survey (Harbaugh et. al., 2000; Harbaugh and McDonald, 1996), was selected as the 3D numerical groundwater flow model. MODFLOW-SURFACT, a proprietary code developed by Hydrogeologic Inc (1996) was used to model the predevelopment and operations phases of the mine. For closure and post closure conditions, MODFLOW 96 was used in order to implement a pit lake filling package developed by Jones (2007, update 2010). Groundwater Vistas (version 6.04; ESI, 2011), a graphical user interface, was used to develop the MODFLOW groundwater flow models for the site. Inputs to the model include: 1) hydraulic parameters that control the flow of groundwater within the model domain; and 2) areal properties and boundary conditions that control the addition and removal of water to and from the model domain.

The model was run using six month stress periods to simulate seasonal trends in groundwater recharge and evapotranspiration, hydraulic heads and creek flows. The division of stress periods was based on precipitation patterns, and extended from May to October (i.e., summer) and November to April (i.e., winter). Continuous groundwater level monitoring data available from four wells during the period from November 2009 through February 2012 confirm the division of stress periods used is appropriate. Further details on model geometry and the application of areal properties (I.e., recharge and evaporation) and boundary conditions are documented in Appendix 2.7.2.4-C.

The model was calibrated to available baseline groundwater and stream flow data and then used to simulate the effects of potentially large stresses (e.g., surface water diversions, pit dewatering, construction and filling of the TSF, and flooding of the pit lake at closure) on the groundwater flow regime (e.g., groundwater elevations, groundwater discharge as baseflow and groundwater inflow to lakes) for operations, closure and post-closure project phases.

Model Calibration

Available piezometric, shut-in pressure and stream flow data for the modeled area were used for calibration. Data taken from shut-in pressure tests in bedrock are considered to be less reliable due to the expected slow equilibration time in low permeability bedrock. Limited seasonal groundwater elevation data were available to calibrate to seasonal fluctuations in groundwater elevation; therefore, calibration statistics were calculated using mean annual hydraulic heads predicted by the model.

Simulated versus measured hydraulic heads for the calibrated model are provided in Appendix 2.7.2.4-C. A normalized root mean square (NRMS) of 10% is generally suggested as a guideline for the maximum difference between simulated and measured data values (NBLM, 2006; MOE, 2012). The NRMS of the calibration is 9.9% for piezometers only, and 11.8% considering piezometers and shut-in pressure tests (Figure 2.7.2.4A-17). This was considered to be an adequate calibration given the regional scale of the modelling.

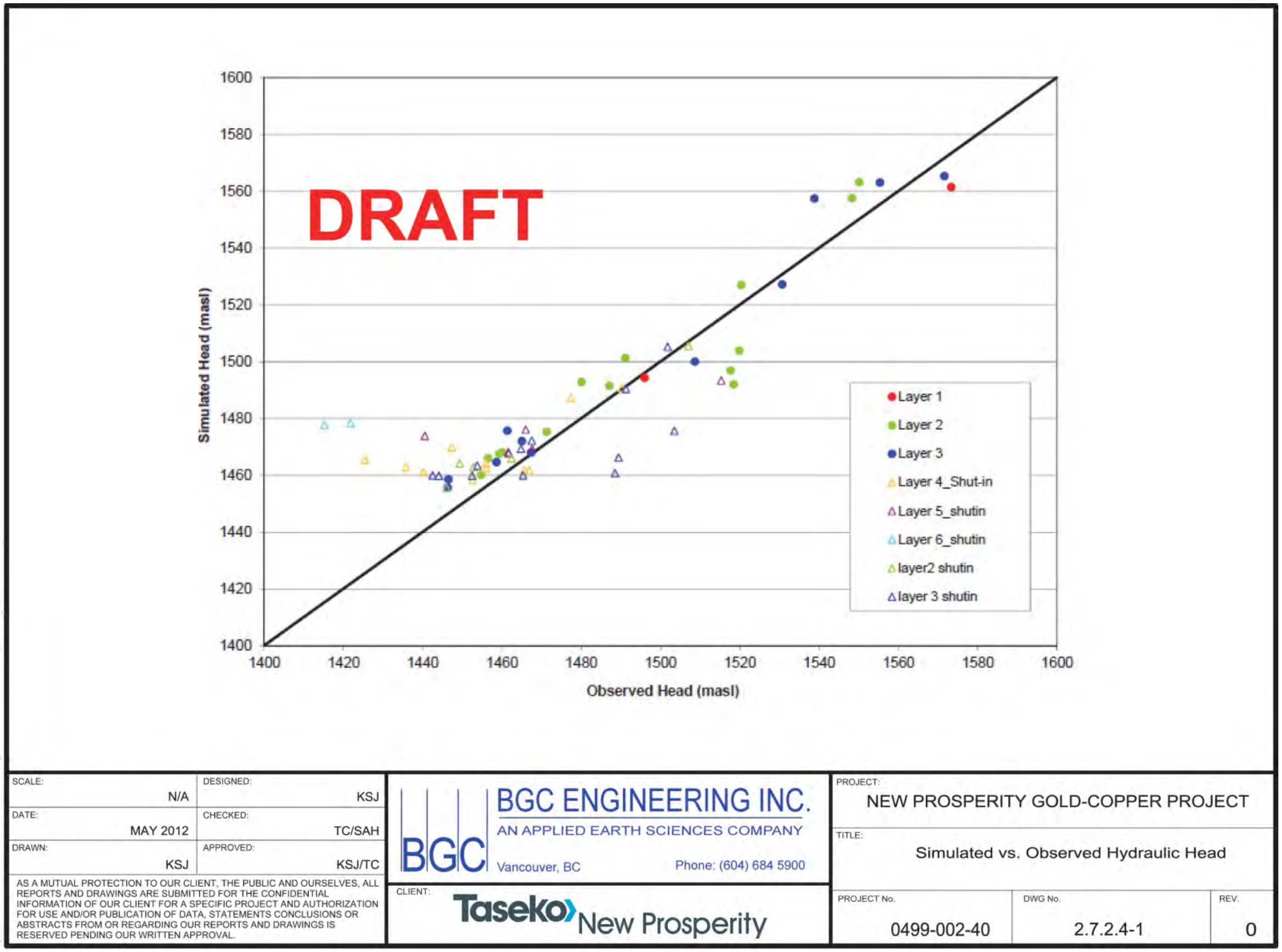


Figure 2.7.2.4A-17 Simulated vs. Observed Hydraulic Head

Data from hydrology station H4b near the confluence of Fish Creek with the Taseko River was used for calibration of predicted versus measured stream flows in the modeled area. Predicted stream flows at the outlet of lower Fish Creek during the summer and winter periods are approximately two times greater and two times less than what has been measured, respectively (Table 2.7.2.4A-14).

The discrepancy between measured and simulated values is partially attributed to the chosen duration of stress periods which capture precipitation and observed recharge patterns, but do not capture the multi-modal character of the Fish Creek surface water system (Section 2.6.1.4). Simulated versus measured stream flows for station H4b are provided in Table 2.7.2.4A-14.

On an average annual basis, the simulated flow is about 30% greater than the measured flow data available for station H4b. This difference in predicted versus observed average annual stream flows was considered adequate given the available stream flow data and the 6-month stress period applied during the modeling.

It should be noted that the runoff rate assigned to each stream segment was computed assuming the orographic effect in precipitation noted in Table 2.6.1.4D-1 for station M1 and using a runoff coefficient of 0.25 for Fish Creek watershed, 0.1 for plateau watersheds (e.g. Big Onion Lake), and 0.6 for Beece Creek watershed (Appendix 4-4-D of the March 2009 EIS/Application). Comparison of average stream flow rates simulated by the model for summer and winter periods with long-term average baseline flow rates estimated by KP for lower Fish Creek at Station H4b (Table 4-20; flow distribution A1 in the March 2009 EIS/Application) indicates better agreement than for the measured data. Simulated average summer flow is greater than the long-term average by about 17%; similarly, the simulated winter flow is less than the long-term average by about 22%, while on an average annual basis, simulated flow is greater by about 8% than the estimated long term average stream flow at Station H4b.

Table 2.7.2.4A-14 Average Measured, Estimated Long-Term and Simulated Stream Flows at Station H4b

Method	Summer Period (m^3/s)	Winter Period (m^3/s)	Average Annual (m^3/s)
Measured	0.37	0.27	0.32
Estimated Long-Term Average Baseline	0.60	0.18	0.39
Simulated	0.70	0.14	0.42

Baseline Conditions for Groundwater Quantity

As discussed in Section 2.6.1.4D, the interpreted pre-development water table mimics the surface topography. Within the Fish Creek watershed, groundwater is interpreted to flow from topographically higher regions towards lower lying areas in the center of the valley before discharging to Fish Creek. Outside of the Fish Creek watershed, groundwater flow is directed towards discharge areas located at lakes, and along the Taseko River and Beece Creek. Simulated pre-development water table elevation contours generated by the calibrated model are presented on Figure 2.7.2.4A-18.

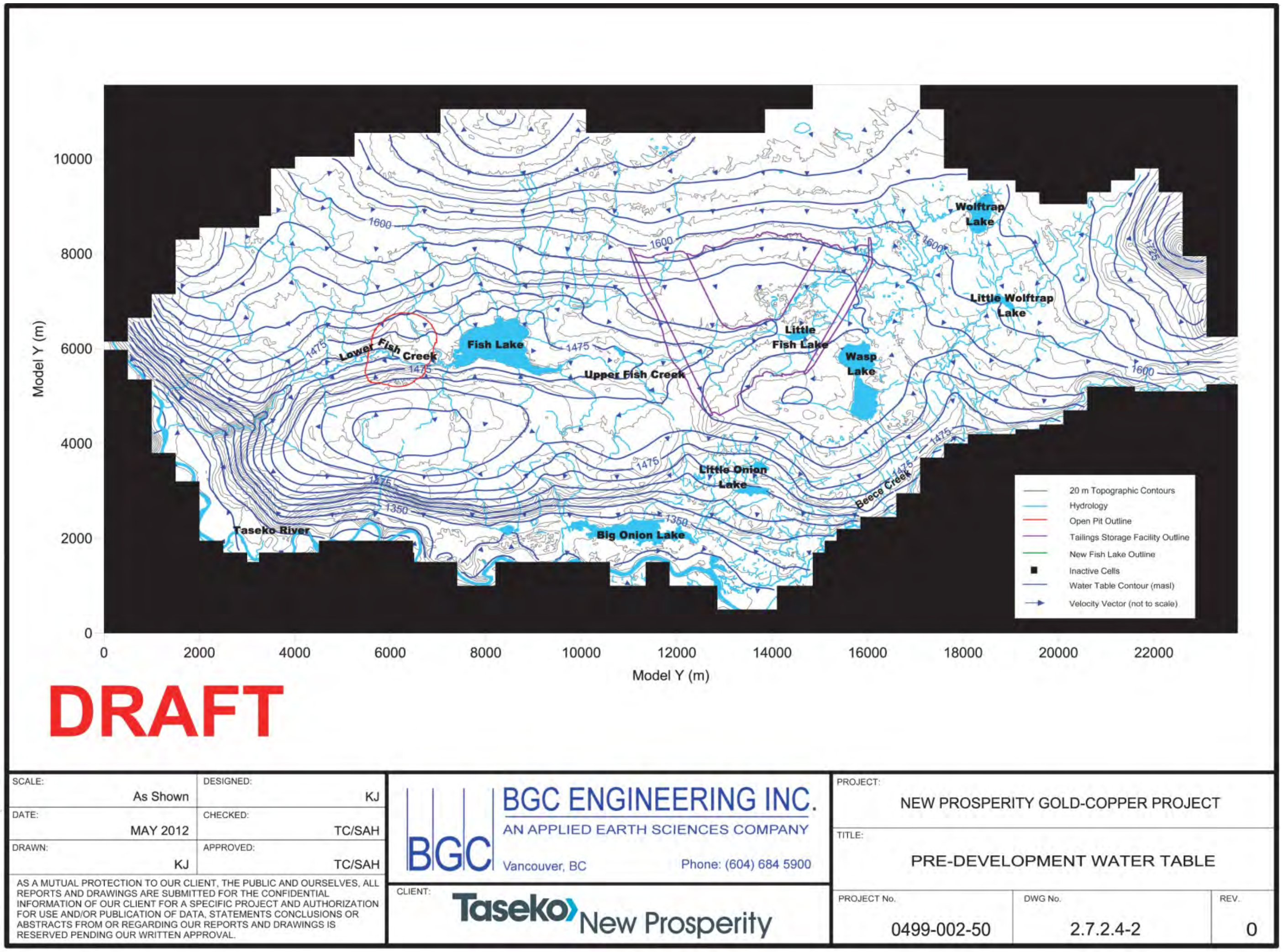


Figure 2.7.2.4A-18 Pre-Development Water Table

Predicted baseflow to Lower Fish Creek, downstream of the confluence with the proposed surface water diversion, is 431 m^3/d (4.9 L/s) and 1621 m^3/d (18.8 L/s) during the summer and winter periods, respectively. Predicted baseflow to the portion of the Taseko River simulated by the model is 537 m^3/d (6.2 L/s) and 1520 m^3/d (17.6 L/s) during the summer and winter periods, respectively.

Predicted annual average groundwater flows to Fish Lake, Big Onion Lake, Little Onion Lake, and Wasp Lake for best estimate parameters are summarized in Table 2.7.2.4A-15. The potential range of variation in these flows was evaluated using a sensitivity analyses; results are presented in Appendix 2.7.2.4-C.

Table 2.7.2.4A-15 Predicted Annual Average Groundwater Flows to Fish, Big Onion, Little Onion and Wasp Lakes

Lake	Groundwater Flow (m^3/d)		
	Type	**Summer**	**Winter**
Fish Lake	Groundwater Baseflow	446	493
	Lakebed seepage	0	0
Big Onion	Groundwater Baseflow	407	450
	Lakebed seepage	0	0
Little Onion	Groundwater Baseflow	68	65
	Lakebed seepage	0	0
Wasp	Groundwater Baseflow	92	73
	Lakebed seepage	19	24

Assessment of Change in Groundwater Quantity

Pre-Construction and Construction Periods

During the pre-construction and construction periods, localized, nominal changes in groundwater elevation and flow direction are anticipated in response to initial changes in groundwater recharge distribution due to construction, as well as groundwater extractions from water supply wells for construction and potable purposes. These changes in groundwater elevation and flow direction during the pre-construction and construction periods will be localized (within the project footprint) and minor compared to the predicted changes on groundwater elevation and flows as a result of, open pit dewatering and tailings storage (see below). It should be noted that effects related to mine site development activities and construction of the tailings storage facility starter dam were not explicitly considered in the numerical assessment, but were interpreted from results for larger stresses applied to the model for operating conditions.

Activities during this phase of the project are not expected to affect baseflow to lower Fish Creek and the Taseko River or groundwater inflow to Fish Lake, Wasp Lake, Big Onion Lake, Little Onion Lake.

Operations

Simulated water table contours at the end of active open pit extraction activities (Year 17) are similar to simulated pre-development contours, except in the area of the open pit and TSF (Figure 2.7.2.4A-8). Near the TSF, groundwater levels have risen on the order of 90 m to near 1589 masl, the TSF pond elevation at the end of operations. Within the open pit area, the water table has been lowered approximately 500 m to an elevation of 945 masl. The lowered water table and resultant cone of depression is predicted to extend outside of the Fish Creek watershed and is predicted to shift the location of the groundwater divide separating the Fish Creek and Taseko River watersheds approximately 100 m closer to the Taseko River (Figure 2.7.2.4A-18).

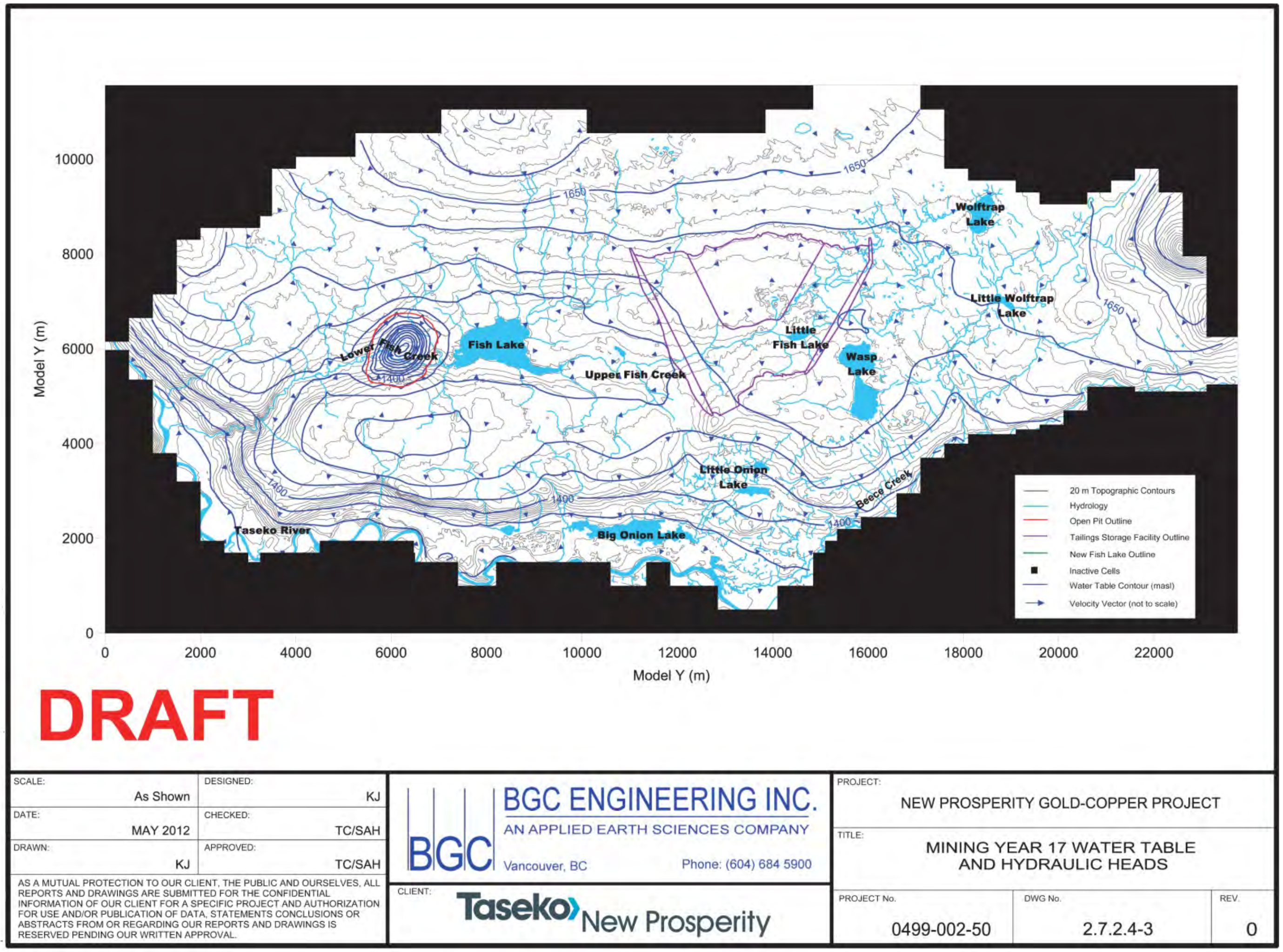


Figure 2.7.2.4A-19 Mining Year 17 Water Table and Hydraulic Heads

Results of the numerical simulations for the operational period predict that groundwater inflows to the open pit will increase from approximately 1000 m^3/d (11.6 L/s) in Year 1 to approximately 1500 m^3/d (11.7 L/s) in Year 17, for the case with active open pit dewatering wells. The total extraction rate for dewatering wells is predicted to increase from approximately 700 m^3/d (8.1 L/s) in Year 1 to approximately 960 m^3/d (11.1 L/s) in Year 17, (Figure 2.7.2.4A-20 and Appendix 2.7.2.4-C). Groundwater captured by the pit dewatering system will be pumped directly to the mill and, ultimately, will report to the tailings pond.

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.4A-20 Dewatering Wells Scenario: Predicted Groundwater Inflows to the Open Pit and Dewatering Wells

In response to nearby open pit dewatering, and the reduction in groundwater recharge due to mine site development, the groundwater baseflow to Fish Lake decreases by about 8% and 10% for the summer and winter periods. This decrease starts in about Year 5 of operations. Similarly, lakebed seepage of water from Fish Lake is predicted to increase linearly from 0 m^3/day in pre-development to about 15 m^3/day in Year 17. Upstream of the open pit in the footprint of the TSF, the water table elevation is predicted to increase relative to the pre-development simulation to near the level of the tailings pond at the end of Year 17 (1589 masl).

In Year 1-2 of operations, the TSF pond rises to between 1539 and 1549 masl (Appendix 2.7.2.4-B), the associated rise in the water table starts to force groundwater through the western ridge at the low point below the west embankment. This predicted increase in water table elevation results in the loss of a portion of the groundwater divide separating the Fish Creek and Big Onion Lake watersheds. Solute transport simulations (discussed below) indicate solute migration towards the west through the ride (in the absence of mitigation) in about Year 8.

In-spite of the rising groundwater levels in the west ridge, inflow rates to Big Onion Lake are predicted to decrease nominally (3%) during operations for the winter period and remain unchanged for the summer period. Inflow rates to Little Onion Lake are predicted to increase by 1% and 5% for the summer and winter periods respectively.

Inflow rates to Wasp Lake are predicted to increase by 4 to 21% in summer and winter periods beginning in Year 1 of operations due mainly to the rise in groundwater level associated with the adjacent TSF. Lakebed seepage from Wasp Lake is predicted to decrease by 13 to 17% in summer and winter in response to the rise in groundwater level.

No change in baseflow to the Taseko River is predicted by the end of operations (Year 17) and only nominal reductions (1 to 2%) in baseflow to Lower Fish Creek are predicted during operations beginning in Year 1 and continuing until Year 17. Potential effects to Beece Creek are considered in Appendix 2.7.2.4-C.

Assessment of Seepage Potential – Operations

The loss of the groundwater divide that separates Fish Creek from Big Onion Lake creates the potential for migration of seepage from the tailings facility into the Big Onion Lake catchment. The west embankment is designed as a water retaining structure to minimize the potential for seepage through the embankment. Seepage through the embankment will be mitigated using a low permeability till core and cut-off keyed into the native till materials that blanket the Fish Creek basin. Drains incorporated in the dam will divert seepage into lined collection ponds for recycle back to the water collection pond (KPL Design Report for Tailings Storage Facility – Appendix XXX).

However, in order to assess the potential interactions of this seepage with down gradient aquatic receptors during the operations phase of the project, a scoping level transient solute transport model was developed using the Analysis of Contaminant Transport (ACT) modules in MODFLOW-SURFACT. The solute transport model was used to evaluate groundwater flow paths originating from the TSF and to bracket contaminant concentrations and arrival times at these potential receptors in the absence of mitigation measures for use as inputs to significance determinations made for other VECs.

An ideal, non-dispersive, non-reactive and non-retarded solute with a normalized source concentration of 1.0 was introduced at inflowing boundaries within the expanding footprint of the impoundment to illustrate potential groundwater seepage pathways from the TSF. In this way, a conservative, quantitative evaluation of potential contaminant concentrations for different chemical species or compounds of interest can be made along the transport pathway (spatially and temporally) if the source concentration is known, or can be predicted. In this case, the source material is considered to be the worst-case predicted tailings pore water chemistry (refer to Sections 2.6.1.1 and 2.7.2.1 – Geology and Geochemistry).

Because the solute is defined to be ideal, non-reactive and non-retarded (i.e. effects due to mechanical dispersion, chemical diffusion, sorption, and chemical reaction are not simulated and no solute mass is lost to these mechanisms during transport), it will migrate at the average groundwater velocity. In this way a conservative, first-order, quantitative estimate of flow path direction, migration time and concentration at potential down gradient receiving environments can be made. Numerical model development and boundary conditions are documented in Appendix 2.7.2.4-C.

Maximum vertical solute concentration at the end of Year 17 is plotted in Figure 2.7.2.4A-21. Results show that no solute is predicted to reach a surface water receptor during the operational phase of the mine life. However, migration of solute beyond the footprint of the TSF is shown to be possible along the axis of Fish Creek valley towards the Fish Lake tributaries, west towards Big/Little Onion Lake and south towards Wasp Lake. Complete details of the solute transport modeling are provided in Appendix 2.7.2.4-C; seepage potential during the closure and post closure phases of the project is discussed in the following section.

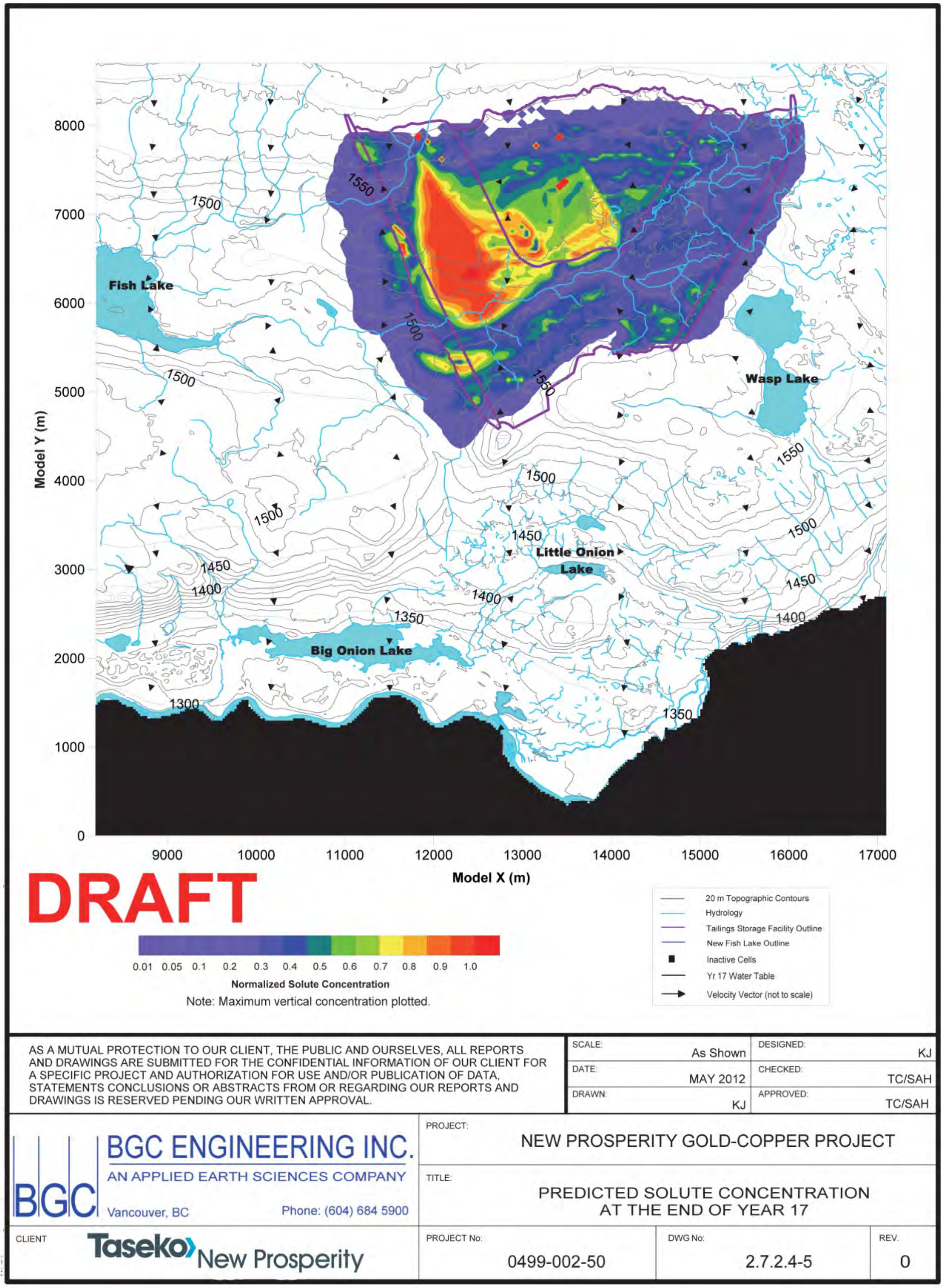


Figure 2.7.2.4A-21 Predicted Solute Concentration from the TSF at the End of Year 17

Closure and Post-closure

A plot of simulated water table contours in Year 100 (i.e., 83 years after the end of active pit dewatering) is provided on Figure 2.7.2.4A-22. As shown on Figure 2.7.2.4A-22, predicted water table contours are similar to predicted pre-development contours except in the area of the open Pit Lake and TSF.

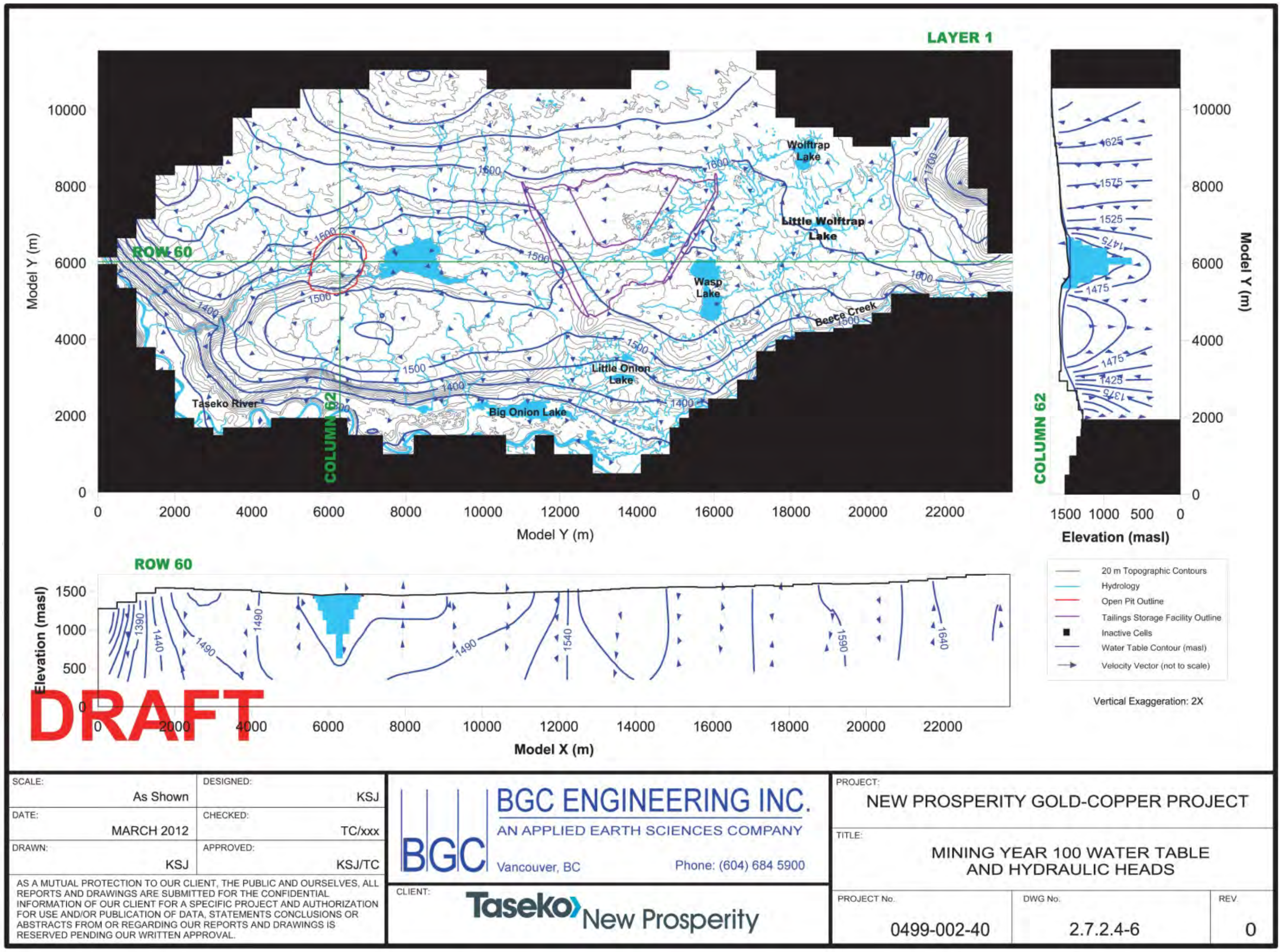


Figure 2.7.2.4A-22 Mining Year 100 Water Table and Hydraulic Heads

Within the pit lake area, the predicted water table has risen to the elevation of the decant level of the lake (assumed to be 1441 masl). The predicted location of the groundwater divide adjacent to the pit lake is similar to that predicted for pre-development conditions. The predicted filling time of the pit lake of 30 years (i.e., Year 47) matches well with the predicted filling time from the site water balance of 28 years (i.e. Year 44) (Figure 2.7.2.4A-23). The increase in groundwater elevation in the vicinity of the pit lake is predicted to increase baseflow to lower Fish Creek downstream of the Pit Lake by approximately ##% and ##% in the summer and winter periods, respectively.

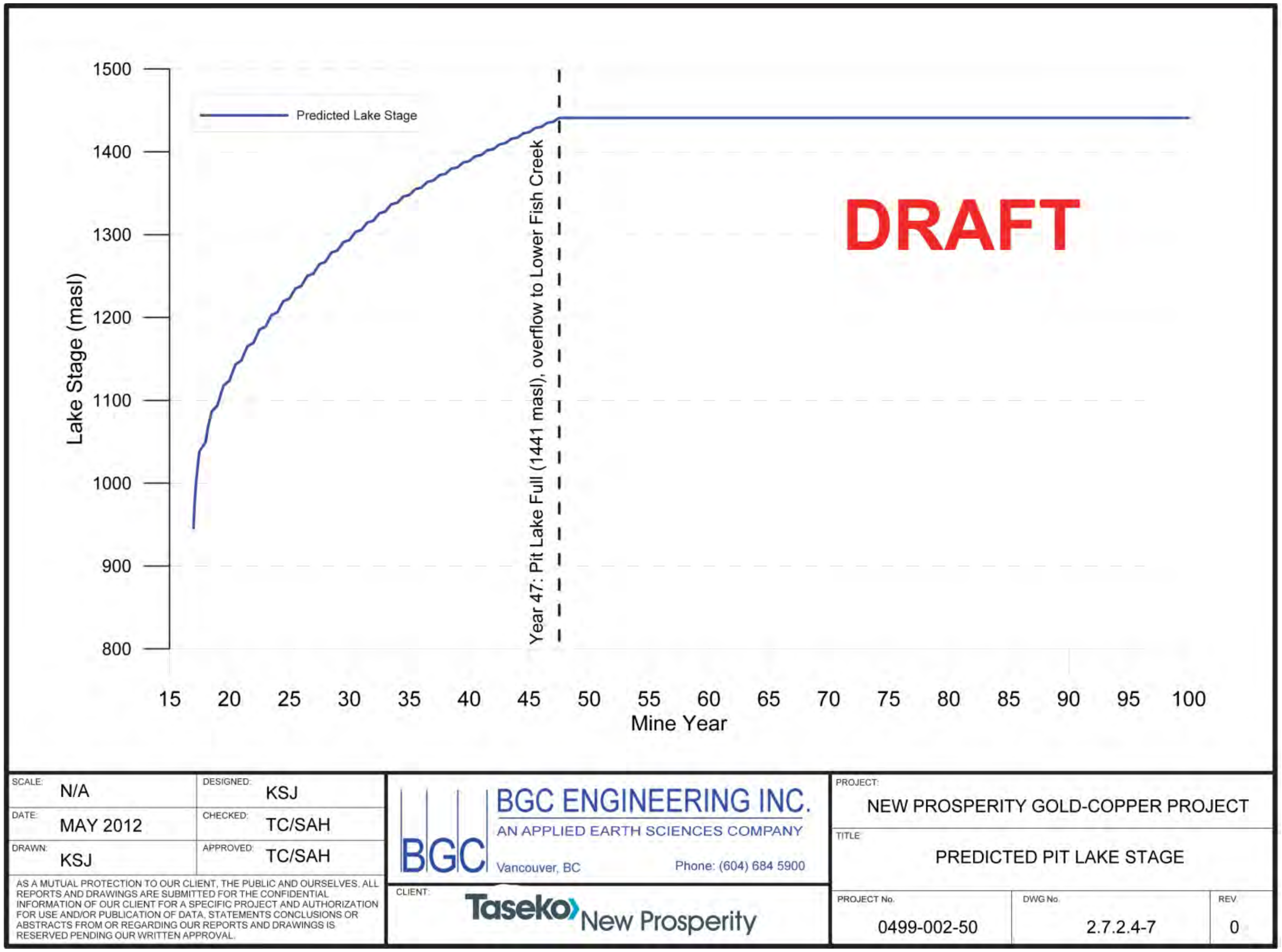


Figure 2.7.2.4A-23 Predicted Pit Lake Stage

Predicted groundwater flows to and from the pit lake are plotted on Figure 2.7.2.4A-24. As shown, groundwater inflow to the pit lake is predicted to decrease from approximately 1600 m^3/d (18.5 L/s) immediately after closure to a generally stable annual average of approximately 910 m^3/d (10.5 L/s) in Year 100. Groundwater flow (seepage) out of the pit lake[16] is predicted to decrease from a maximum of approximately 250 m^3/d (2.9 L/s) in Year 18 to 0 m^3/d (0 L/s) in year 47 (i.e. upon completion of pit lake filling).

[16] Seepage from the pit lake occurs to re-saturate low hydraulic conductivity pit wall rock dewatered by mining operations; overall, groundwater flow directions in the vicinity of the open pit remain oriented towards the rising pit lake.

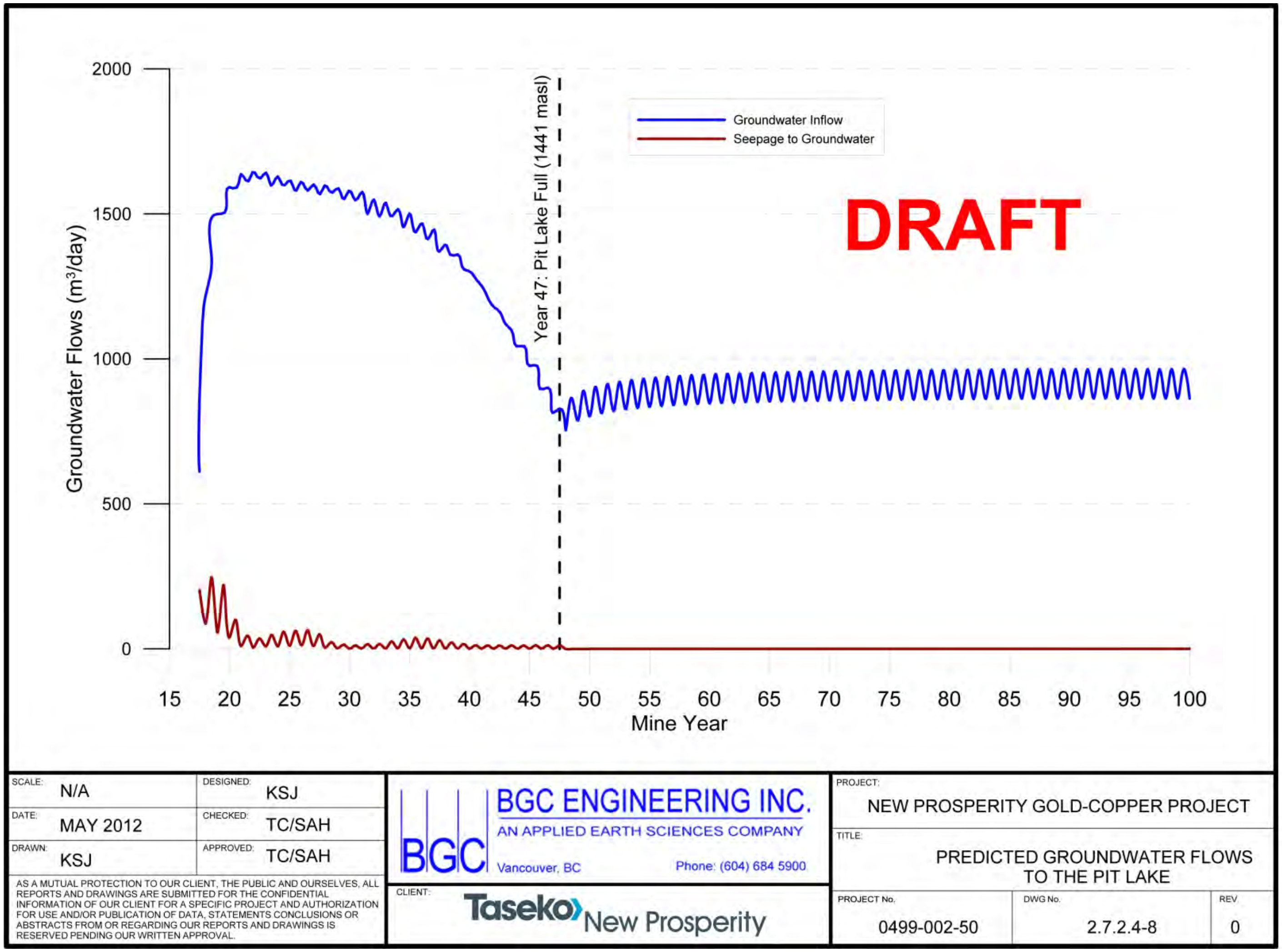


Figure 2.7.2.4A-24 Predicted Groundwater Flows to the Pit Lake

At the end of pit dewatering, groundwater baseflow into Fish Lake starts to increase in response to recovering groundwater levels. Once the pit lake is full, groundwater baseflow into Fish Lake stabilizes at an average annual rate of 410 m^3/day, slightly lower (10-15%) than pre-development conditions, likely in response to local bifurcation of groundwater baseflow towards the adjacent pit lake. Similarly, as the pit lake fills, lakebed seepage out of Fish Lake decreases back to pre-development conditions (0 m^3/day) (Figure 2.7.2.4A-25).

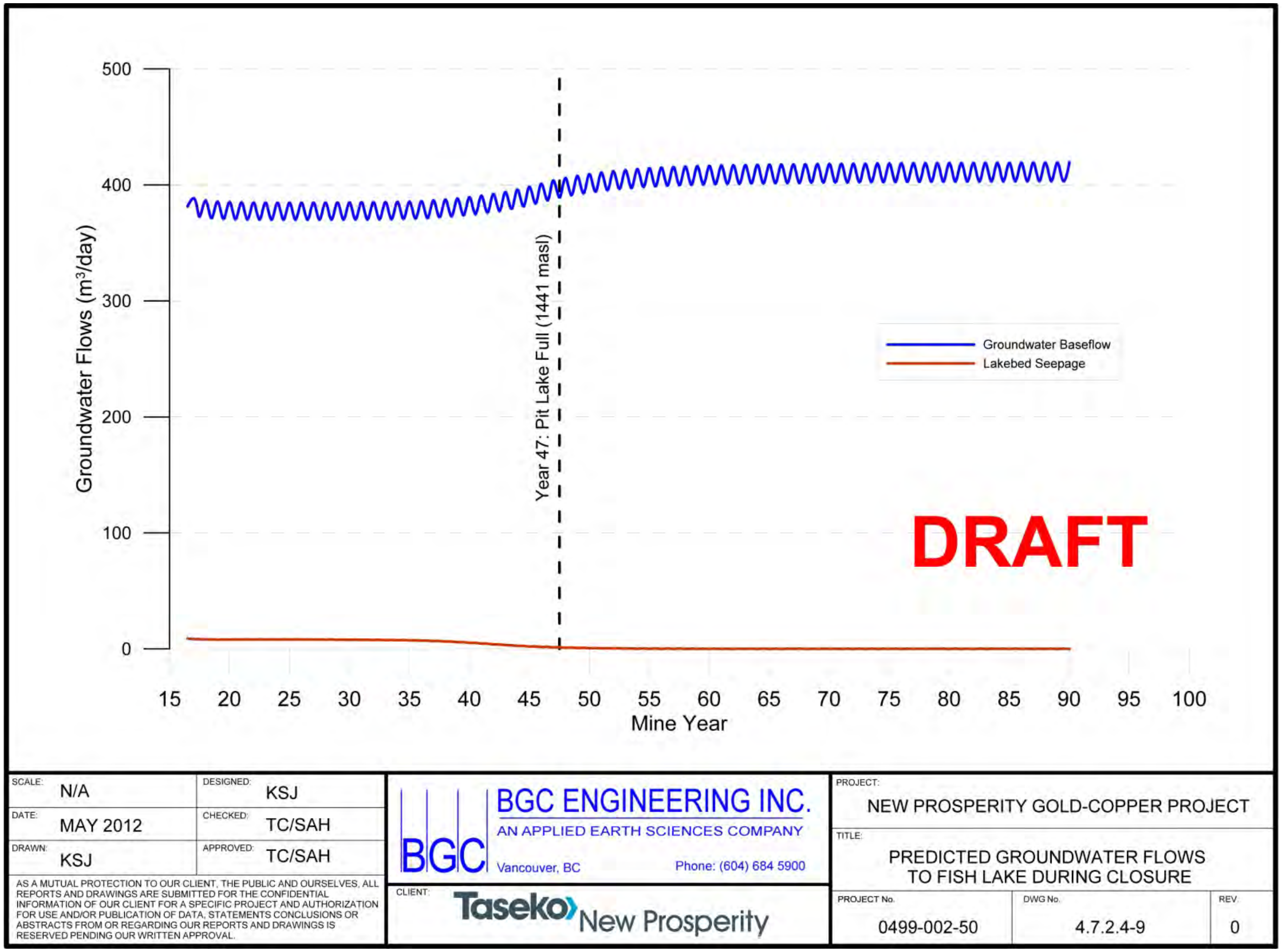


Figure 2.7.2.4A-25 Predicted Groundwater Flows to Fish Lake

Predicted hydraulic heads near the Taseko River are generally unchanged during the closure period relative to pre-development conditions except near the location of Big Onion and Little Onion Lakes. The presence of the TSF has resulted in a regional rise in the water table in this area, leading to increased groundwater inflow to these lakes. As a result, groundwater inflow to Big Onion Lake and Little Onion Lake is predicted to be increased by an annual average of approximately 2% and 16%, respectively (Figures 2.7.2.4A-26 and 2.7.2.4A-27). Increased discharge of groundwater to these lakes is predicted to result in a decrease in annual average baseflow to the Taseko River of approximately 7% (Figure 2.7.2.4A-28). The rise in water table elevation in the vicinity of the TSF is predicted to cause a nominal increase in groundwater inflow to Wasp Lake of approximately 5% during the summer period and 13% during the winter period (Figure 2.7.2.4A-29). Lakebed seepage out of Wasp Lake is predicted to decrease by an annual average of about 19%.

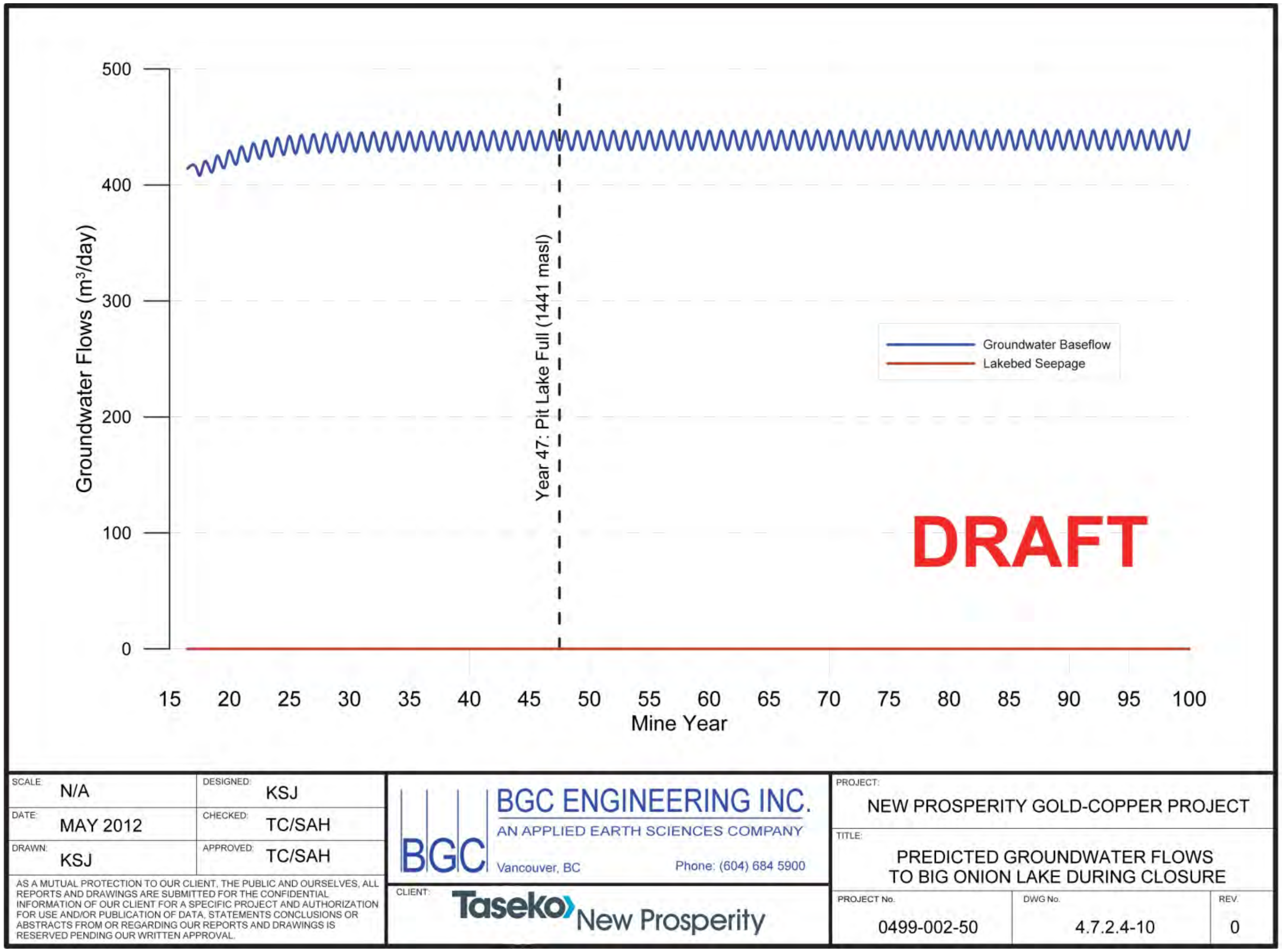


Figure 2.7.2.4A-26 Predicted Groundwater Flows to Big Onion Lake During Closure

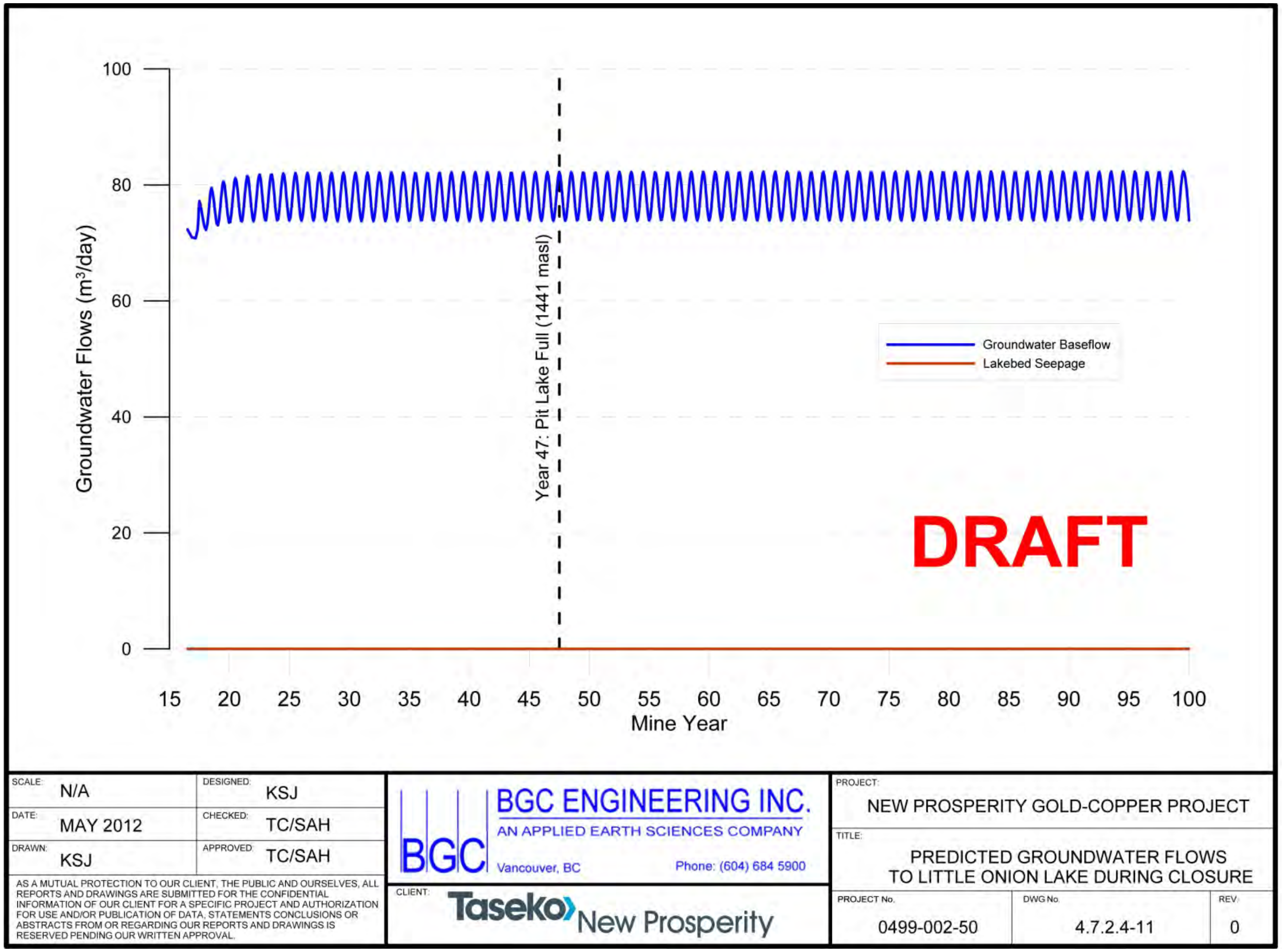


Figure 2.7.2.4A-27 Predicted Groundwater Flows to Little Onion Lake During Closure

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.4A-28 Predicted Baseflow to the Taseko River During Closure

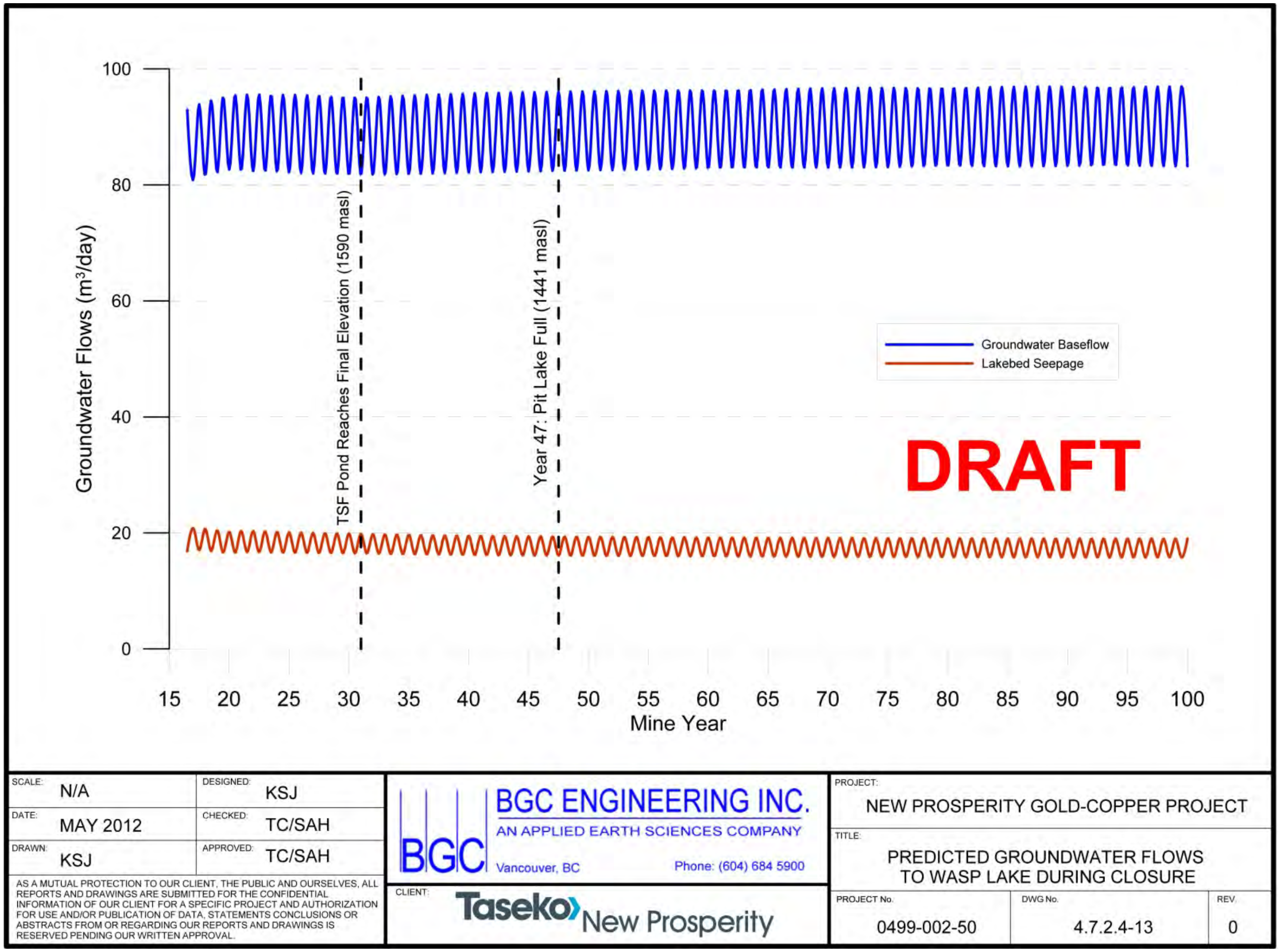


Figure 2.7.2.4A-29 Predicted Groundwater Flow to Wasp Lake during Closure

In the footprint of the TSF, the water table elevation is predicted to be near the ultimate level of the tailings pond at 1590 masl, elevated above what was predicted in the pre-development simulation. The increased water table elevation results in a portion of the groundwater divide separating the Fish Creek watershed from the Big Onion Lake watershed and Taseko River along the western ridge continuing to be lost, allowing groundwater to flow from the TSF region towards Big Onion Lake and Taseko River. Average annual seepage to the underlying groundwater system is predicted to stabilize at about 760 m^3/day (8.8 L/s) once the TSF pond reaches the final elevation of 1590 masl. Groundwater discharge to the TSF is predicted to stabilize at about 110 m^3/d (1.3 L/s) (Figure 2.7.2.4A-30).

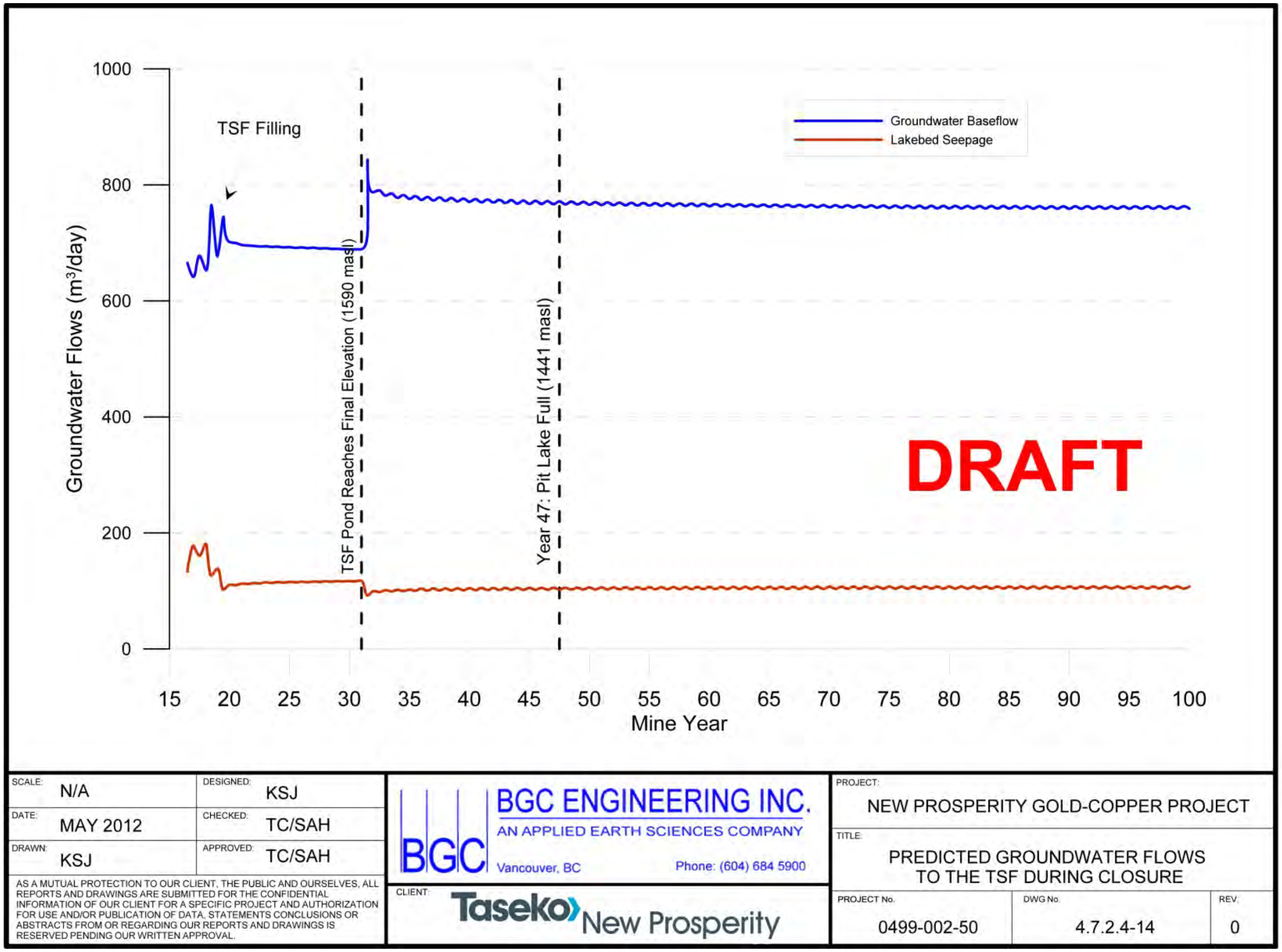


Figure 2.7.2.4A-30 Predicted Groundwater Flow from TSF during Closure

Predicted changes in groundwater baseflow and groundwater inflow to lakes is summarized in Table 2.7.2.4A-16 for the operations and closure/post closure phases of the project.

Table 2.7.2.4A-16 Summary of Predicted Baseflow and Groundwater Inflows to Lakes – Best Estimate Parameters

Season	Taseko River		Lower Fish Creek		Fish Lake		Wasp Lake		Big Onion Lake		Little Onion Lake	
	Groundwater Baseflow (m^3/day)	% Change	Groundwater Baseflow (m^3/day)	% Change	Groundwater Baseflow (m^3/day)	% Change	Groundwater Baseflow (m^3/day)	% Change	Groundwater Baseflow (m^3/day)	% Change	Groundwater Baseflow (m^3/day)	% Change
Baseline Conditions												
Summer	527	N/A	431	N/A	446	N/A	92	N/A	407	N/A	68	N/A
Winter	1520	N/A	1621	N/A	493	N/A	73	N/A	450	N/A	65	N/A
Year 2 (Start Mining and Milling)												
Summer	593	13%	444	3%	455	2%	89	-3%	411	1%	69	1%
Winter	1438	-5%	698	-57%	502	2%	79	8%	448	0%	68	5%
Year 17 (End of Mining)												
Summer	580	10%	494	15%	413	-7%	95	3%	407	0%	69	1%
Winter	1420	-7%	802	-51%	450	-9%	85	16%	444	-1%	68	5%
Year 19 (End of Milling)												
Summer	577	9%	coming		coming	coming	coming	coming	coming	coming	coming	coming
Winter	1379	-9%	coming		coming	coming	coming	coming	coming	coming	coming	coming
Year 100												
Summer	coming		coming		403	-10%	97	5%	430	6%	82	21%
Winter	coming		coming		419	-15%	83	14%	447	-1%	73	12%

Assessment of Seepage Potential – Closure and Post-Closure

Results of the numerical groundwater flow simulations indicate that seepage from the TSF to the underlying groundwater flow system is predicted to occur at an annual average rate of approximately 1,000 m^3/d (11.6 L/s) in Year 1. The seepage rate is predicted to increase during operations and then decline through time to a relatively constant rate of approximately 760 m^3/d (8.8 L/s) at the end of Year 100 as the regional water table rises in response to the presence of the pond. Based on the predicted configuration of the water table, three potential pathways for migration of seepage waters exist (Figure 2.7.2.4A-31). These include:

- From the TSF through the center of Fish Lake Valley towards the open pit/open pit lake
- From the TSF through the adjacent western ridge, where the pre-development groundwater divide is predicted to be lost, towards Big Onion Lake and the Taseko River, and
- From the TSF through the south embankment towards Wasp Lake.

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.4A-31 Potential Seepage Pathways during Closure

A telescopically refined or “zoomed in” flow and solute transport model (TRM) was developed for the region shown on Figure 2.7.2.4A-32 in order to track the distribution and concentration of any potential seepage migrating from the TSF along the three pathways noted above.

The current mine plans call for primary TSF seepage mitigation measures in the form of cutoff ditches that collect and divert seepage to control ponds and, as a secondary measure seepage interception wells where seepage is found to bypass the ditches (Appendix ###). It is anticipated that these measures will mitigate the potential for migration of TSF seepage in the Fish Lake valley. However, the solute transport simulations were conducted to provide conservative estimates of the potential for seepage related impacts to groundwater and down gradient aquatic receiving environments in the absence of proposed seepage mitigation measures. Potential seepage interception measures were subsequently evaluated using the groundwater flow and transport model; results are documented in Appendix 2.7.2.4-C.

All flow simulations were conducted using the Analysis of Contaminant Transport (ACT) modules in MODFLOW-SURFACT. A detailed discussion of the transport model geometry and boundary conditions used for the transport simulations is provided in Appendix 2.7.2.4-C.

Maximum vertical solute concentration at the end of active mining in Year 17 was previously shown in Figure 2.7.2.4A-21. Results of the transport simulation at this point in time demonstrate that no solute is predicted to reach a surface water receptor during the operational period at a concentration greater than 1% of the source concentration. Towards Fish Lake, groundwater concentrations of up to 70% pore water chemistry are starting to migrate towards the tributaries but that the stronger concentration plume does not reach the tributaries until about Year 50.

For the purposes of illustrating the potential migration pathways and timing of seepage derived from the TSF, groundwater affected by seepage has been arbitrarily defined as groundwater with a solute concentration of 1% of the source concentration (i.e., 1 % of the predicted tailings pore water chemistry); assessment of the impact threshold or significance level to various receptors for an arbitrary pore water component dissolved in groundwater is evaluated in other sections of this document.

As shown on Figure 2.7.2.4A-21, at the end of Year 17 seepage is predicted to occur beneath the majority of the TSF, migrating a maximum of about 700 m downstream in the Fish Lake valley.

By Year 50, the area potentially affected by seepage from the TSF (in the absence of mitigation measures) is predicted to be within approximately 800 m of Little Onion Lake and about 1200 m of Big Onion Lake (Figure 2.7.2.4A-32). However, a solute concentration of 1% is predicted to have reached a depression/gully that, in the model, intersects the water table to the northeast of the lake in approximately Year 30. The gully could provide a direct pathway to Big Onion Lake at significantly increased transport rates if it contains water year round. As such, a seepage collection pond will be constructed near the downstream toe of the west TSF embankment and future hydrology investigations will be designed to determine expected surface water and groundwater flow rates and seasonality in this area to support design of this facility.

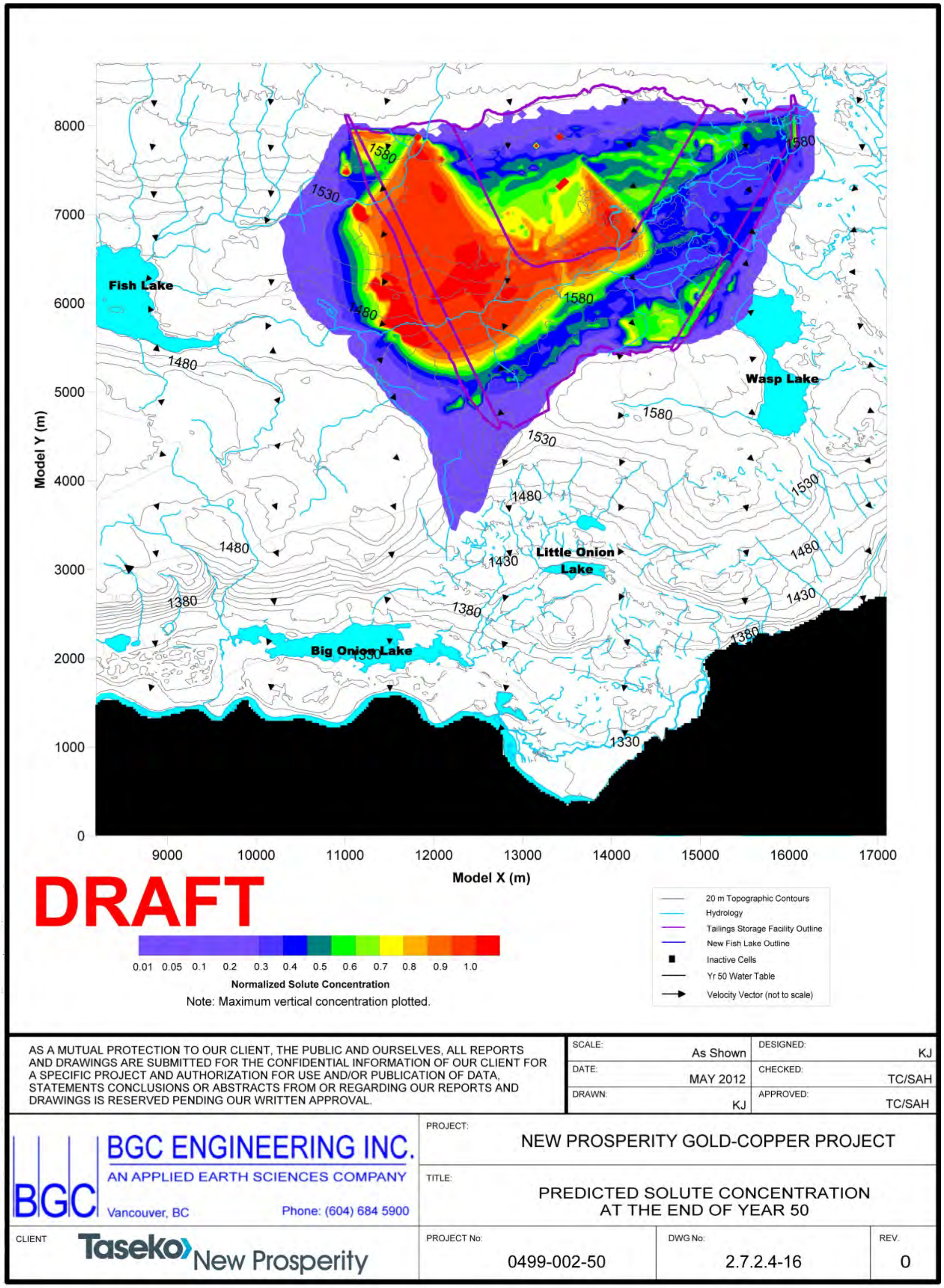


Figure 2.7.2.4A-32 Predicted Solute Concentration at the End of Year 50

In the absence of mitigation, seepage is predicted to first reach Wasp Lake in about Year 30, and to first reach Big Onion Lake in Year 85. By year 100, seepage at concentrations up to 5% of source concentration could be discharging to the northeastern portion of Wasp Lake, and seepage at concentrations up to 2% could be discharging to the southern portion of the Big Onion lakeshore (Figure 2.7.2.4A-33).

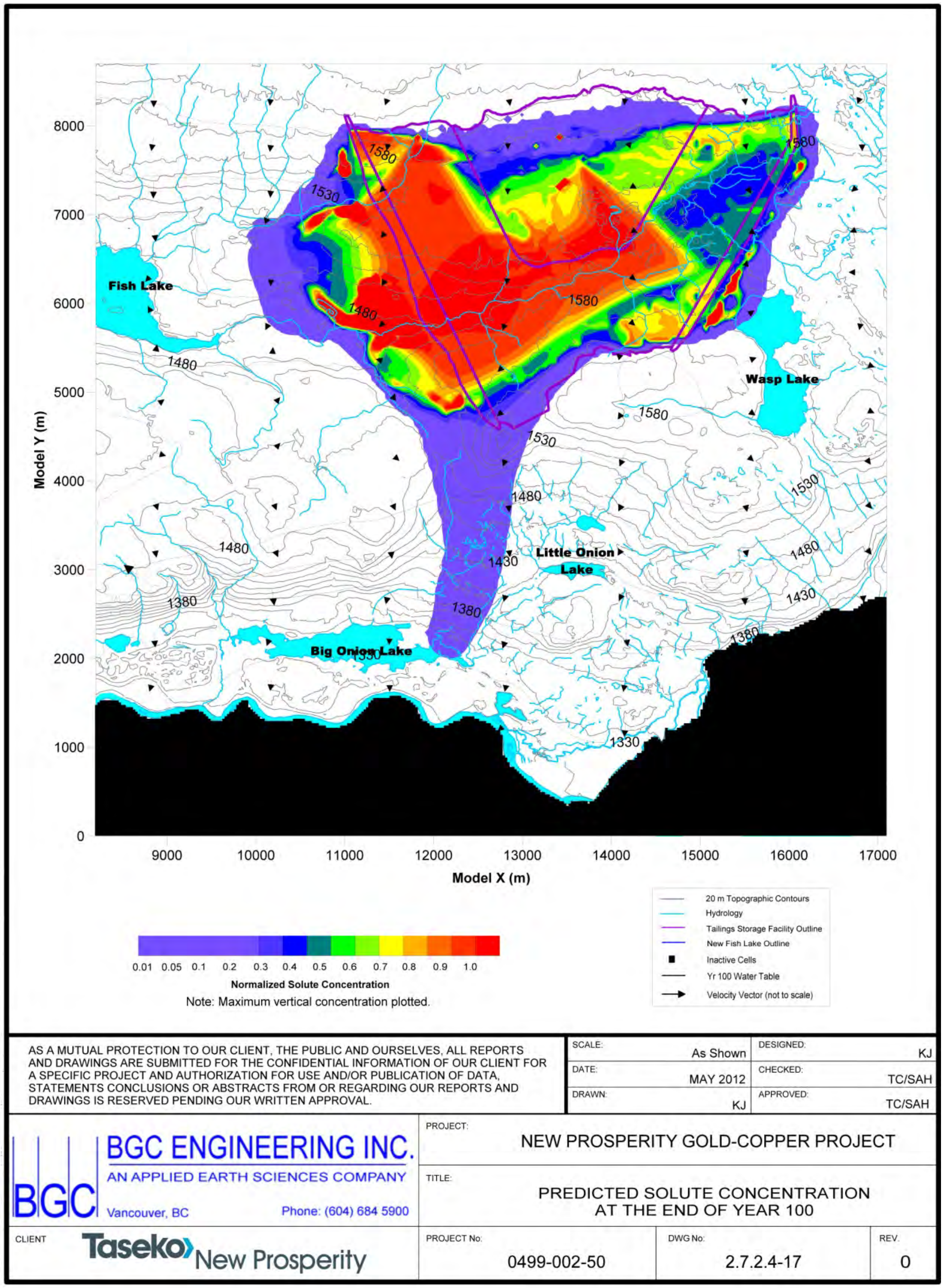


Figure 2.7.2.4A-33 Predicted Solute Concentration at the End of Year 100

Model Sensitivity Simulations

To increase confidence in the predicted transport concentrations and migration times, sensitivity analysis was used to evaluate potential changes to the predicted rates of seepage migration from the TSF towards Fish Lake, Wasp Lake, the Onion Lakes catchment and the Taseko River for a reasonable range of input parameters. For each sensitivity simulation, a single hydraulic parameter was modified to investigate its impact on simulation results. The following simulations were conducted:

- Hydraulic conductivity of all hydrogeologic units was decreased by a factor of 5 (i.e. one half order of magnitude)
- Hydraulic conductivity of all hydrogeologic units was increased by a factor of 5
- Conductance of TSF river cells was increased by a factor of 10 (i.e. simulates an increase in the permeability of the tailings)
- Conductance of TSF river cells was decreased by a factor of 10 (i.e. simulates a decrease in permeability of the tailings), and
- Dispersion was added to the transport process with assigned dispersivity values of 25 m (horizontal), 2.5 m (transverse) and 1 m (vertical).

Sensitivity simulation results are documented in Appendix 2.7.2.4-C.

Mitigation

The following mitigation measures are proposed to minimize the Project effects on groundwater elevations and baseflow:

- Diverting surface water into the open pit to create a pit lake will restore groundwater elevations to near baseline groundwater conditions in the pit vicinity
- Incorporating primary seepage control measures in the design of the main, south and west embankments of the TSF (e.g., low permeability till core and cut-off keyed into the native till, embankment drains and seepage collection ponds)
- Deposition of tailings so as to create a beach along the TSF embankments that will force the supernatant pond during operations, and the tailings lake during closure and post-closure away from the embankment crest to mitigate seepage through the embankment, and
- Installing and operating vertical seepage interception wells downstream of the TSF and upgradient of aquatic receiving environments (i.e. Fish Lake tributaries, Big Onion and Little Onion Lake tributaries, and Wasp Lake).

Follow-up and Monitoring

It will be important to collect additional hydrogeologic data in the Fish Lake watershed and in the adjacent Big Onion and Little Onion Lake systems, Wasp Lake, and Taseko River during future phases of the project to increase confidence in the interpreted hydrogeologic conditions assumed for these areas.

Collection of this data could be accomplished as part of the drilling program to install groundwater monitoring wells that will be necessary to meet compliance monitoring requirements for the project. Installation of the compliance monitoring well network should proceed as soon as a project development decision is made and the ultimate footprints are known for major mine structures (e.g., open pit extents, ultimate downstream toe of tailings dam, etc., etc.) such that baseline conditions in the new wells can be established a minimum of one year prior to commencement of active mining activities.

Reversal of groundwater gradients along a portion of the west ridge of the Fish Creek Valley system is predicted to occur in about year 8 of active mining operations. A groundwater well network should be installed along this ridge and groundwater elevation (and chemistry) in this area should be monitored (and sampled) on at least a quarterly basis for deviation from baseline conditions during operations, closure and post-closure phases of the project to assess the potential for seepage effects on ambient groundwater quality flowing towards the Big Onion Lake watershed.

Investigations that will permit design and construction of deep seepage recovery systems (e.g., seepage pump back wells) should be completed during the project pre-construction period according to the Table of Committments for the prior EIS submission for the Prosperity Project.

An overall follow-up and/or monitoring program is discussed in Section 2.8.3.

B. WATER QUALITY AND AQUATIC ECOLOGY

This section examines potential effects of the proposed Project on water quality (water and sediment) and aquatic ecology in Fish Lake and the Upper Fish Creek watershed, as well as streams and lakes adjacent to the Fish Creek watershed. The aquatic components described in this section include:

- Water quality
- Sediment characteristics
- Benthic invertebrates of streams and lakes
- Periphyton of streams, and
- Zooplankton and phytoplankton of lakes.

Scope of Assessment

- This section outlines the scope of the assessment of potential environmental effects of the New Prosperity Project on water quality and aquatic ecology. The scope of the assessment is only for changes relative to the previously assessed project based on the New Prosperity Mine Development Plan, the New Prosperity EIS Guidelines, or regulatory changes since the March 2009 EIS/Application.
- The Project activities and Physical Works for New Prosperity are presented in Table 2.7.2.4B-1. This table shows whether each activity or physical work has changed from the original Prosperity submission, and whether there are any VEC specific applicable regulatory changes related to the project activity. Project activities or physical works identified with a “Y” in either Changes in Project Design or Changes in Regulatory Requirements will be carried forward for assessment of the changes to effects on water quality and aquatic ecology. Project activities or physical works identified with an “N” in both of these columns are not carried forward in this water quality and aquatic ecology assessment, and are greyed out.

Table 2.7.2.4B-1 Project Components, Features and Activities Changed from Previous Project Proposal

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal (Y/N)	Comments
Construction and Commissioning		
Open Pit – Pre-production	N	
Non-PAG waste stockpile	Y	• Location and timing only
PAG Stockpile	Y	• Still subaqueous in TSF, just TSF location change
Non-PAG Overburden Stockpile	Y	• Combined with Non-PAG (i.e. location and timing)
Ore Stockpile	Y	• Location only
Primary Crusher	N	• This is considered in 'Plant Site and other facilities'
Overland conveyor	N	• This is considered in 'Plant Site and other facilities'
Fisheries compensation works construction	Y	• Scope and Timing
Water Management Controls and Operation	Y	• Stipulate that contingency plans be prepared for dealing with "excessive" and "drought" scenarios. Require assessment of water in all water bodies that could be affected.
Construction sediment control	Y	• Require discussion surrounding erosion and sediment control and Best Management Practices
Access road construction and upgrades	N	
Camp construction	N	• This is considered in 'Plant Site and other facilities'
Site clearing (clearing and grubbing)	Y	• Different areas related to moving of TSF, stockpiles, etc
Soils handling and stockpiling	Y	• Includes overburden removal
Plant Site and other facilities	N	
Explosives Plant	Y	• Location only •

Project Work (Elements, Components, Features) / Activities	**Change from Previous Project Proposal (Y/N)**	**Comments**
Lake dewatering	Y	• Fish Lake retained • Little Fish Lake Drained
Fish Lake Water Management	Y	• Management of inflows and outflows • Stipulate that contingency plans be prepared for dealing with "excessive" and "drought" scenarios. Require assessment of water in all water bodies that could be affected.
Starter dam construction	Y	• Location and volume of material
Sourcing water supplies (potable, process and fresh)	Y	• Fresh water sources and routing only as a result of reconfigured stockpiles
Site waste management	N	
Clearing of transmission line ROW	N	
Construction/Installation of transmission line	N	
Vehicular traffic	Y	• Additional haulage trucks and 2 km of added haulage road as a result of TSF relocation.
Concentrate load-out facility near Macalister (upgrades to site)	N	
Operations		
Pit production	N	
Site clearing (clearing and grubbing)	Y	• Area and relocation of TSF and stockpiles • Require discussion surrounding erosion and sediment control and Best Management Practices
Soils handling and stockpiling	Y	• Area, volume, and relocation of TSF and stockpiles; revised soil stockpile locations • Require discussion surrounding erosion and sediment control and Best Management Practices
Crushing and conveyance	N	
Ore processing and dewatering	N	
Explosive handling & storage	Y	• Location only

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal (Y/N)	Comments
		•
Tailing storage	Y	• Location and embankments changed
Non-PAG waste stockpile	Y	• Location and timing only
PAG Stockpile	Y	• Still subaqueous in TSF, just TSF location change
Overburden Stockpile	Y	• Combined with Non-PAG (i.e. location and timing)
Ore Stockpile management and processing	Y	• Location only
Potable and non-potable water use	N	
Site drainage and seepage management	Y	• Require discussion surrounding erosion and sediment control and Best Management Practices
Water Management Controls and Operation	Y	• Includes management of flows in and out of Fish Lake • Stipulate that contingency plans be prepared for dealing with "excessive" and "drought" scenarios. Require assessment of water in all water bodies that could be affected
Wastewater treatment and discharge (sewage, site water)	N	
Water release contingencies for extended shutdowns (treatment)	N	• Stipulate that contingency plans be prepared for dealing with "excessive" and "drought" scenarios. Require assessment of water in all water bodies that could be affected
Solid waste management	N	
Maintenance and repairs	N	
Concentrate transport and handling	N	
Vehicle traffic	Y	• Additional haulage trucks and 2km of added haulage road as a result of TSF relocation.
Transmission line (includes maintenance)	N	
Pit dewatering	N	

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal (Y/N)	Comments
Fisheries Compensation works operations	Y	• Scope and Timing
Concentrate load-out facility near Macalister	N	
Closure		
Water Management Controls and Operation	Y	
Fisheries Compensation operations	Y	• Scope and Timing
Site drainage and seepage management	Y	• Require consideration and modeling for all potentially impacted water bodies
Reclamation of ore stockpile area	Y	• Location only
Reclamation of Non-PAG waste rock stockpile	Y	• Location only
Tailing impoundment reclamation	Y	
Pit lake, and TSF Lake filling	Y	
Plant and associated facility removal and reclamation	N	
Road decommissioning	N	
Transmission line decommissioning	N	
• Post-closure		
Discharge of tailings storage facility water	Y	• Require consideration and modeling for all potentially impacted water bodies
Discharge of pit lake water	N	• Into Lower Fish Creek
Seepage management and discharge	Y	
Ongoing monitoring of reclamation	Y	

The primary objective of this aquatic impact assessment will be to focus on Project elements, components, and features that have changed since the previous Prosperity EIS submission. Specifically, it will focus on how the New Prosperity plan will impact Water Quality and Aquatic Ecology in Fish Lake and the Upper Fish Creek watershed. Specific changes in the Mine Development Plan (MDP) that may impact water quality and aquatic ecology within the study area include;

- Placement of the TSF upstream of Fish Lake

- Maintenance of Fish Lake
- Long-term changes to the to the hydrological regime in the Fish Lake Watershed
    - Loss of inputs into Upper Fish Creek and Fish Lake Tributary 1
    - Far future redirection of flow accumulated to the south of the TSF to Beece Creek drainage

This environmental assessment will also discuss how the proposed changes may impact streams and lakes adjacent to the Fish Creek watershed. For clarity and completeness, the environmental assessment will focus on updated and changed aspects of the plan within the framework provided in the Project Environmental Impact statement (EIS) guidelines (March 2011). However where applicable, text from the original EIS has been included to address aspects unchanged between the proposed projects

Regulatory Changes (since Prosperity)

Applicable Acts, policies, and guidelines related to the protection of water quality and aquatic ecology include the following:

- Canadian Fisheries Act
- Metal Mine Effluent Regulation (MMER), including an amendment to Schedule 2
- Canadian Environment Assessment Act
- British Columbia Environmental Assessment Act
- British Columbia Environmental Management Act
- Fish-Stream Crossing Guidebook (MOF, 2002)
- Riparian Management Area Guidebook (MOF, 1995)
- Pacific Region Operational Statement Overhead Line Construction Version 2 (DFO, 2006)
- Model Class Screening Report—Embedded Culverts Project in Fish-bearing Streams on Forestry Roads in British Columbia (DFO, 2005), and
- Land Development Guidelines for the Protection of Aquatic Habitat (DFO and MOELP, 1992).

Discharge of effluent from metal mines to receiving waters is regulated under the *Fisheries Act*, through the MMER, which came into effect in 2002. Environment Canada administers MMER and associated Environmental Effects Monitoring (EEM) programs that are required to assess effects of effluent discharges on fish and fish habitat. Although monitoring programs under MMER will not be required during the operations phase, given there are no plans for discharge of effluent until post-closure, it is anticipated that an amendment to the MMER Schedule 2 (for the TSF) will be required for this Project.

Since Taseko's previous EIS submission in 2009, no applicable changes have occurred to the Provincial acts, regulations and guidelines outlined above. Amendments have occurred with the Canadian *Fisheries Act;* however, to the best of our understanding these changes should not affect the project proposal as it is described in Section 2.2.3.

Amendments to the Canadian *Environmental Assessment Act* have made changes to the types and situations in which an environmental assessment and comprehensive studies will occur. Additional changes have been made to the roles and responsibilities of the governing agency and minister, however, it is not anticipated that these changes will affect the water quantity and quality chapter of the EIS.

Amendments to the Metal Mining Effluent Regulations (MMER) since the previous EIS submission have been made to clarify reporting requirements and authorities. For the purpose of this EIS, changes to the MMER guidelines specific to the monitoring and reporting include;

- Schedule 5 para.1 - Fish Tissue mercury concentrations from 0.5 to 0.45 µg/g, statistically above the baseline concentrations (schedule 5-1) will be considered an “effect”
- Schedule 5 para.4 - Effluent and monitoring studies will consider updated parameter list
- Schedule 5 para. 17 - Comparison and correlation between biological and environmental effects monitoring (EEM) will be completed
- Schedule 5 Division 2 – Preparation and submission of interpretive reports will occur on a 24 month schedule, and
- Schedule 5 Division 3 – Schedule and considerations of a final monitoring plan will be consistent with Schedule 5 para. 23.

Changes to EIS as a Result of New Prosperity EIS Guidelines

As a result of the changes and updates to the New Prosperity project description, updated EIS guidelines were prepared and followed for this project. Some of the notable changes and updates in the most recent EIS guidelines that are applicable to the Water Quantity and Quality section of the EIS include;

- The need to identify and discuss how the updated project description varies from the initial description:
- The need to include water quality predictions for all water bodies that may be impacted as a result of the new proposal:
- Consideration and discussion of contingency plans in the event that significant uncertainties or risks arise from water quality modelling,
- A detailed discussion of the updated water management plan that addresses all project components and phases, and:
- A detailed description of the sediment and erosion best management plans that will be employed in conjunction with the water management plan to separate contact water and non-contact water.

Key considerations and Issues related to Water Quality

Table 2.7.2.4B-1 above clearly identifies all the changes that have been incorporated into the revised project description. As with the previous project description the revised Mine Development Plan (MDP) will limit development to the Fish Creek watershed, re-use site water, and divert non-contact water around major installations. In regards to key changes that could impact water quality and aquatic ecology, the primary change from the original proposal involves the location of the TSF. As a measure to maintain Fish Lake, and the healthy aquatic ecosystem contained within, the TSF has been moved roughly 2 km upstream (to the southeast) of Fish Lake.

The change in the location of the TSF required that an updated water management strategy be developed. Details of the new water management plan are provided in Section 2.7.2.4A. The position of the TSF upstream of Fish Lake and the project objective of maintaining Fish Lake required that the following relevant factors be considered:

- Maintenance of the lake water level, while preventing downstream outflows
- Maintenance of available habitat to support all life stages of Rainbow Trout within Fish Lake
- Potential long-term changes in the ambient water chemistry in Fish Lake and its upstream tributaries resulting from changing flow regimes and source water chemistries
- Potential long-term changes to the fisheries and ecological habitat quality in the lake resulting from the anticipated changes.

Flows in Fish Creek downstream of the pit will be reduced during operations and until the pit starts discharging at approximately year 45 (considering 28 years for the pit to fill). Under baseline conditions, Fish Creek contributes approximately 1% of the mean annual Taseko River flow (Section 2.6.1.4B). During operations, this would be reduced to approximately 0.4%. The anticipated changes on water quality and aquatic ecology to Lower Fish Creek that will need to be considered include:

- Temporary changes to the flows in lower Fish Creek resulting from flow reductions for a period of 44 years, and
- Potential long-term changes to Fish Creek due to changes in ambient water chemistry following the establishment of discharge from the Pit Lake.

In addition to the Fish Creek Watershed, adjacent watersheds may be impacted as a result of the new project description. Water capture and seepage along the southern embankment wall could lead to changes in discharge from Wasp Lake to Beece Creek during operations and closure phase 1. At the completion of closure phase 1, all runoff contributions from the Fish Lake watershed south of the TSF will contribute directly to Wasp Lake and Beece Creek, through a newly formed diversion channel. The anticipated changes on water quality and aquatic ecology in the adjacent environments that will need to be considered include:

- Permanent changes to the flows entering Wasp Lake and Beece Creek
- Potential long-term changes to adjacent receiving environments due to changes in ambient water chemistry resulting from changes to flow regime and TSF seepage
- Potential long-term changes to adjacent receiving environments due to changes in Groundwater flow patterns, and
- Potential changes to aquatic habitat and ambient water chemistry downstream of the project in the Taseko River

Identified Valued Ecosystem components

Valued Ecosystem components (VECs) for water quality and aquatic ecology have been defined for the environmental assessment based on the Project Report Specifications (PRS) (BC EAO, 1998) and the Environmental Impact Statement (EIS) Guidelines (March 2011) and a review of baseline information collected within the area since 1992. The PRS and EIS outline requirements for description of baseline water quality and aquatic resource data, as well as mitigation and compensation measures that need to be developed. In regards to water quality, the following VECs will apply and be evaluated in this section.

- Water Quantity (section 2.7.2.4A) and Water Quality (section 2.7.2.4B)
- Water Temperature
- Aquatic Ecology; Including Benthos and Sediment Quality

These VECs have been chosen because they are sensitive to Project effects and because they provide a vital link in sustaining healthy aquatic ecosystems. Assessment of Project effects on water and sediment quality provides an indication of potential effects on aquatic organisms at the population and community levels. Many aquatic organisms have known tolerances and responses to metals, nutrients, and sediments typically associated with mining operations.

Predictions of potential Project effects under routine construction, operations, closure, and post-closure phases are informed by site water management plans and predictions of the tailings storage facility (TSF) source water concentration and seepage. Water quality predictions, derived from laboratory testing for acid rock drainage (ARD) generation and metals leaching (ML) from ore and tailings, as well as modelling for surface water hydrology, hydrogeology, and groundwater quality as described in Sections 2.7.2.1 and 2.7.2.4a, are essential sources of information for the assessment of effects on water quality and aquatic ecology.

Measurable Parameters

Measurable parameters were defined for the assessment of the potential effects of the New Prosperity MDP on water quality and aquatic ecosystems. Given that water and sediment samples can be analyzed for chemical characteristics and compared with guidelines, and biological samples can be analyzed for taxonomic characteristics, the use of key indicators was not considered applicable.

Measurable parameters for water / sediment quality and aquatic ecology are summarized in Table 2.7.2.4B-2. Measurable parameters for aquatic ecology reflect changes in abundance, diversity, or community composition that link water or habitat quality with productive capacity of the systems (fish, fisheries) or with potential issues of toxicity and bioaccumulation of metals (in fish, birds, wildlife). By extension, these environmental effects are relevant to socio-economic VECs, including traditional, recreational, and agricultural uses in the area.

Metal levels, with supporting information from particle size and total organic carbon analysis, are used to quantify the potential effects of Project activities on sediment quality. For ease of application Federal and Provincial Regulatory authorities provide guidelines established to protect aquatic life from elevated elemental concentrations. Guidelines are established through a process of careful toxicity testing on a wide variety of aquatic organisms. Following testing the eventual guideline concentrations are arrived at to ensure that the most sensitive observed organism remains unharmed. Commonly, an additional safety factor is applied to provide additional conservatism to guidelines.

Often this process contains many conservative assumptions that may or may not apply to the individual situation. For instance, the most sensitive organism may not be present in the aquatic environment of interest or the physio-chemical conditions in the water body may act to reduce the bio-availability of the potentially toxic element. These site specific factors can make a significant difference to the true toxicity level of a water body. For this assessment, potential risks will initially be identified by using the generic water quality guidelines, while any true toxicological concerns will be assessed with site specific conditions in mind. In situations where no guideline concentrations exist, predicted values will be compared against the observed baseline concentrations (i.e. plus or minus).

Measurements of metal levels in fish tissue provide information about their availability in water and sediment and about the extent of metal uptake by fish. For mercury, in particular, concentrations in water are normally quite low and require very clean sample collection methods and precise laboratory detection techniques, which may not be achievable when collecting samples from remote locations. Measuring mercury levels in fish tissue can provide a more accurate measure of environmental conditions. Mercury and other metals can have adverse effects on human health (Volume 6, Section 6 from the March 2009 EIS/Application) and other species that consume fish, and direct deleterious effects on the fish themselves.

For phytoplankton, levels of chlorophyll a, the predominant photosynthetic pigment found in all algae (Wetzel, 2001), was used as an indicator of biomass. This pigment is a measure of primary production that enables comparison among sites and systems. Chlorophyll a concentration gives a quantitative measure of the standing crop of phytoplankton, and offers a way to compare primary production in different aquatic systems. Species composition and cell numbers obtained in taxonomic studies were used to describe communities, along with taxon richness, Shannon Weiner diversity index, and an evenness index.

For zooplankton and benthic invertebrates, community abundance, taxon richness, diversity, evenness and taxonomic composition were used to assess environmental effects. Zooplanktons are important secondary producers and provide food for fish (Mazumder, 1994; Vadstein et al., 1995). The smallest zooplankton (rotifers and protozoa) recycle nutrients in the water column and often respond to nutrient enrichment. Larger zooplankton (the crustacean Cladocera and Copepoda) are important food for forage fish species and larval stages of all fish.

Table 2.7.2.4B-2 Measurable Parameters for Potential Water / Sediment Quality and Aquatic Ecology Environmental Effects

Environmental Effect (VEC)	Measurable Parameter	Rationale for Selection	Regulatory guidelines, policies and programs	Baseline Data for EA
Water quality	Nutrient concentrations (P,N,C)	Potential Project effects to increased nutrients in Fish Lake, Fish Creek and tributaries	CCME Water Quality framework BC Water quality guidelines	1992 to 1996 1997 to 1998 2006 2011

Environmental Effect (VEC)	Measurable Parameter	Rationale for Selection	Regulatory guidelines, policies and programs	Baseline Data for EA
Water quality	Metals levels (e.g., Cu, As)	Potential Project effects due to ARD and metal leaching affecting Fish Cr. and groundwater discharges to adjacent watersheds Potential bioaccumulation and toxic effects on aquatic resources	BC Water quality guidelines CCME Water Quality guidelines MMER Water Quality guidelines	1992 to 1996 1997 to 1998 2006 2011
Water quality	Sulphate	Potential Project effects associated with tailings and pit water quality Potential effects on aquatic biota	BC Water quality guidelines CCME Water Quality guidelines MMER Water Quality guidelines	1992 to 1996 1997 to 1998 2006 2011
Water quality	Metals levels in fish tissue	Greater accuracy measuring mercury in fish tissue than in water Indicator of bioaccumulation	Project Report Specifications Environmental Impact Statement Guidelines Water quality guidelines	1997 2006
Sediment Quality	Metals concentrations	Potential Project Effects due to TSF seepage Potential bioaccumulation and toxic effect on benthic invertebrate	PRS EIS Guidelines Sediment Quality Guidelines	1992 to 1996 1997 to 1998 2006 2011
Sediment Quality	Total Suspended Sediment	Potential effects due to reduced inflow to Fish Lake Potential effects due to project activities	PRS EIS Guidelines Sediment Quality Guidelines	1992 to 1996 1997 to 1998 2006 2011
Sediment Quality	Nutrients content	Potential effects associated with tailings seepage	PRS EIS Guidelines Sediment Quality Guidelines	1992 to 1996 1997 to 1998 2006 2011
Aquatic Ecology – Streams	Productivity	Potential changes to nutrient loadings may affect population Potential changes to suspended sediment levels may affect productivity	EIS Guidelines	1992 to 1996 1997 to 1998 2006 2011
Aquatic Ecology – Lakes	Productivity	Potential changes to nutrient loadings may affect population Potential changes to suspended sediment levels may affect productivity	EIS Guidelines	1992 to 1996 1997 to 1998 2006 2011

Environmental Effect (VEC)	Measurable Parameter	Rationale for Selection	Regulatory guidelines, policies and programs	Baseline Data for EA
Aquatic Ecology – Streams	Community composition	Potential changes to ambient conditions may affect community Potential Changes in contaminant loadings may affect community	EIS Guidelines	1992 to 1996 1997 to 1998 2006 2011
Aquatic Ecology – Lakes	Community composition	Potential changes to ambient conditions may affect community Potential Changes in contaminant loadings may affect community	EIS Guidelines	1992 to 1996 1997 to 1998 2006 2011

Physical works and activities identified as having changed due to Project design or regulatory requirements (Table 2.7.2.4B-1) have been brought forward to Table 2.7.2.4B-3 and given project environmental effects ratings. For clarity, these effects ratings have been divided into ratings for effects onsite and effects that occur offsite. Onsite potential effects are those that may occur within the immediate project area (Fish Lake, Fish Creek and Fish Lake Tributary 1). Offsite potential effects are those that may occur downstream of the project or in adjacent waterbodies The following criteria were used for the interaction ratings:

0. Effect on water / sediment quality and aquatic ecology is likely to decrease or stay the same (i.e., no changes to significance conclusions), and there are no required changes to previously proposed mitigation measures, and no additional regulatory requirements have been identified (i.e., from the EAO, Panel, EIS Guidelines or other applicable regulations). Therefore, no further assessment is warranted, but information is provided to substantiate that the effect is likely to decrease or stay the same.
1. Effect on water / sediment quality and aquatic ecology is likely to decrease or stay the same (i.e., no changes to significance conclusions), but some re-evaluation of effect is required due to changes in project design, proposed mitigation measures, and/or additional regulatory requirements have been identified (i.e., from the EAO, Panel, EIS Guidelines, or other applicable regulations).
2. Effect on water / sediment quality and aquatic ecology is likely to increase; therefore, further assessment is warranted.

Table 2.7.2.4B-3 Water / Sediment Quality and Aquatic Ecology Potential Environmental Effects Associated with New Prosperity (Effects Scoping Matrix)

General Category	Project Activities/Physical Works	Potential Environmental Effects							
		Change in Surface Water Quality		Change in Sediment Quality		Change in Aquatic Ecology			
						Streams (Periphyton & Benthic Invertebrate Productivity)		Lakes (Phytoplankton, Zooplankton, Benthic Invertebrate Productivity)	
		Onsite	Offsite	Onsite	Offsite	Onsite	Offsite	Onsite	Offsite
Construction and Commissioning									
Explosives Plant	Explosives Plant	1	0	0	0	0	0	0	0
Fisheries compensation works (construction)	Fisheries compensation works construction	1	0	1	0	2	0	1	0
Overburden and Waste Rock Management	Non-PAG waste stockpile	1	0	1	0	1	0	1	0
	PAG Stockpile	2	0	1	0	1	0	1	1
	Non-PAG Overburden Stockpile	1	0	0	0	0	0	0	0
	Ore Stockpile	1	0	1	0	1	0	1	0
	Soils handling and stockpiling	1	0	1	0	1	0	1	0
Site clearing (clearing and grubbing)	Site clearing (clearing and grubbing)	1	0	1	0	1	0	1	0
Site Waste Management	Water Management Controls and Operations	2	2	2	2	2	2	2	2
	Construction sediment control	1	0	1	0	1	0	0	0
	Lake dewatering	1	0	1	0	1	0	1	0
	Fish Lake Water Management	2	2	1	1	2	2	1	0
	Starter dam construction	2	0	2	0	2	0	2	0

General Category	Project Activities/Physical Works	Potential Environmental Effects							
		Change in Surface Water Quality		Change in Sediment Quality		Change in Aquatic Ecology			
						Streams (Periphyton & Benthic Invertebrate Productivity)		Lakes (Phytoplankton, Zooplankton, Benthic Invertebrate Productivity)	
		Onsite	Offsite	Onsite	Offsite	Onsite	Offsite	Onsite	Offsite
Vehicular traffic	Vehicular traffic	1	1	0	0	0	0	0	0
Water Sourcing and Use	Sourcing water supplies (potable, process/TSF)	1	0	0	0	0	0	0	0
Operations									
Fisheries Compensation works (operations)	Fisheries Compensation works operations	1	0	2	0	2	0	2	0
Site Clearing (clearing & grubbing)	Site clearing (clearing and grubbing)	1	0	1	0	1	0	1	0
Ore Extraction and Stockpiling	Explosive handling and storage	1	0	1	0	1	0	1	0
	Ore Stockpile management and processing	1	0	1	0	1	0	1	0
Overburden and Waste Rock Management	Non-PAG waste stockpile	1	0	0	0	0	0	0	0
	PAG Stockpile	2	1	1	0	1	0	1	0
	Overburden Stockpile	1	0	0	0	0	0	0	0
	Soils handling and stockpiling	1	0	1	0	1	0	1	0
Site Water Management	Site drainage and seepage management	2	0	2	0	2	0	2	0
	Water Management Controls and Operation	2	2	2	1	2	1	2	1
Tailings Management	Tailing storage	2	2	2	2	2	2	2	2
Vehicle traffic	Vehicle traffic	1	0	1	0	1	0	1	0
Closure									

General Category	Project Activities/Physical Works	Potential Environmental Effects							
		Change in Surface Water Quality		Change in Sediment Quality		Change in Aquatic Ecology			
						Streams (Periphyton & Benthic Invertebrate Productivity)		Lakes (Phytoplankton, Zooplankton, Benthic Invertebrate Productivity)	
		Onsite	Offsite	Onsite	Offsite	Onsite	Offsite	Onsite	Offsite
Fisheries Compensation works (operations)	Fisheries Compensation works operations	1	0	2	0	2	0	2	0
Reclamation	Reclamation of ore stockpile area	1		1		1		0	
	Reclamation of Non-PAG waste rock stockpile	0	0	0	0	0	0	0	0
	Tailing impoundment reclamation	1		2		2		2	
Site Water Management	Water Management Controls and Operation	2	2	2	2	2	2	2	2
	Site drainage and seepage management	2	2	2	2	2	2	2	2
	Pit lake and TSF Lake filling	2	0	2	0	2	0	2	0
Post-Closure									
Site Water Management	Discharge of tailings storage facility water	2	2	2	2	2	2	2	2
	Seepage management and discharge	2	2	2	2	2	2	2	2
Monitoring	Ongoing monitoring of reclamation	1	1	1	1	1	1	1	1
Interaction of Other Projects and Activities									
Interaction of Other Projects and Activities		1	0	1	0	1	0	1	0
Accidents, Malfunctions and Unplanned Events									
Accidents, Malfunctions and Unplanned Events									

Those interactions indicated in grey shading in Table 2.7.2.4B-3 are not carried forward in this assessment. Based on past experience and professional judgment, the March 2009 EIS/Application determined that there would be no interaction; the interaction would not result in a significant environmental effect, even without mitigation; or the interaction would not be significant due to application of codified environmental protection practices that are known to effectively mitigate the predicted environmental effects. This has not changed since the March 2009 EIS/Application. These interactions are not discussed further in this assessment.

Those activities ranked as a “2” (interaction could result in an environmental effect of concern even with mitigation) are considered further in the Environmental Assessment (EA). Those ranked as a “1” (interaction occurs; however, based on past experience and professional judgment the interaction would not result in a significant environmental effect, even without mitigation; or interaction would not be significant due to application of codified environmental protection practices that are known to effectively mitigate the predicted environmental effects.

In some instances, while a potential effect on may be indicated by a “2” for a category (eg.change is surface water quality offsite) the application of a “2” does not apply to some aspects of that category. For example, the limit of the downstream surface water quality effects is considered down to the confluence of Fish Creek and the Taseko River. Downstream of this point the effects of proposed changes in the New Prosperity MDP relative to the previously assessed project are unchanged and are therefore not considered further.

New Prosperity Phases

Project development occurs in discrete stages: pre-construction, construction, operations, closure, and post-closure. Each stage has its own unique water management objectives and requirements. These are discussed in the following sections. For the purposes of developing water quality predictions in the closure phase, the closure period has been broken into two phases; Closure Phase I and Closure Phase II. Closure Phase I starts with the cessation of tailings deposition in the TSF and ends when water quality in the TSF is suitable for discharge to the inlets to Fish Lake. For purposes of the water management plan presented in Section 2.7.2.4 and for purposes of the water quality model predictions the duration of this period has been assumed to be 10 years. Closure Phase II starts with the discharge of the TSF to the inlets to Fish Lake and ends when the pit fills and discharges to lower Fish Creek. Again, for the purposes of the water management plan presented and for consistency with the water quality model predictions this period lasts 16 years. It should be clear to the reader from the project description and this water management discussion that the project as proposed contains all of the water management infrastructure to accommodate a transition from Closure Phase I to Closure Phase II at any time, dependant on suitability of TSF water quality for discharge to the inlets to Fish Lake.

Based upon the anticipated Project interactions assessment outlined in Table 2.7.2.4B-3, and the project schedule the following activity categories have been identified as having the potential to effect water quality and aquatic ecology:

- Fisheries Compensation (Construction, Operations and Closure)
- Potentially Acid Generating (PAG) stockpile (Construction, Operations I, Operations II)
- Water Management Controls and Operations (All phases)
- Fish Lake Water Management (Construction, Operations I, Operations II, Closure I)

- Starter Dam Construction (Construction)
- Site Drainage and Seepage Management (All phases)
- Discharge of Tailings Storage Facility (Closure phase II), and
- Discharge of Pit Lake Water (Closure Phase II).

Temporal Boundary Changes

There have been no changes in the temporal boundaries for construction and commissioning, operations, and closure and decommissioning phases between the previously assessed project and the New Prosperity project (see March 2009 EIS/Application Volume 5, Section 2.1.4). The temporal boundaries used for the New Prosperity assessment of potential Project effects on water quality and aquatic ecology include:

- **Baseline Scenario**: represents water quality and aquatic ecology conditions prior to any Project-specific developments. These baseline conditions incorporate the environmental effects of existing human-caused disturbances (i.e., forest harvesting, road networks, other mine footprints etc.).
- **Construction, Operations, Closure and Post Closure Scenarios**: represents conditions during construction activities, operations and decommissioning/reclamation activities. Due to the integral relationship between the water quality, aquatic ecology and the water management plan - the temporal boundaries for the Fish Lake water quality and ecology assessment are reflective of the principal phases of the Project water management plan (Section 2.6.1.4). This was done for two reasons: firstly, the large majority of the potential residual effects are tied to phases in the water management plan (i.e., TSF spilling, lake-recirculation). Secondly, all models used to predict water quality were tied to water balances that are divided into water management phases. For a detailed description of the water management plan please see Section 2.6.1.4 and Section 2.7.2.4a.

Spatial Boundary Changes

See Table 2.7.2.4B-4 for the changes to the study areas used, relative to the March 2009 EIS/Application. There have been no changes to the study areas for the transmission line corridor and access road.

Table 2.7.2.4B-4 Mine Site Study Area Comparison

Study Area	Mine Site Study Areas	
	2009 Prosperity	**2012 New Prosperity**
Regional Study Area (RSA)	Encompasses most of the Fish Creek watershed, extending to the top of the bluffs on the east side of the Taseko Valley. The mine site RSA is also the area of 1:20,000 TEM mapping previously developed for the mine site. The mine site RSA had a total area of 18,267 ha.	The study area is expected to include the indirect impacts from seepage, groundwater flow changes, and downstream effects. Specifically it will evaluate the area of the Beece Creek watershed downstream of the proposed outlet form Wasp Lake, including Big Onion and Little Onion Lake. Aquatic effects are tracked downstream from the mouth of Fish Creek into the Taseko River.
Local Study Area (LSA)	A buffer of 500 m on the proposed mine footprint, including the section of new road required at the north end of the mine footprint. This study area is expected to include the maximum area that could be indirectly affected by the Project as a result of dustfall, windfall and localized changes in drainage patterns and is also intended to accommodate any potential for future changes to the mine footprint. The mine site LSA had a total area of 4,812 ha.	The study area is expected to include the direct impacts from the proposed infrastructure construction and mine footprint. Specifically will evaluate the effects on Upper Fish Creek Watershed and Fish Lake resulting from the proposed water management and mine development plan.
Maximum Disturbance Area (MDA)	A buffer of 100 m on the mine footprint. The mine site MDA had a total area of 4,419 ha	A buffer of 100 m on the proposed mine footprint, to represent a “worst case” for development. The MDA has a total area of 2,601 ha

Project Impact Assessment for Water / Sediment Quality and Aquatic Ecology

There are three potential environmental effects identified for water / sediment quality and aquatic ecology, including change in water quality, change in sediment quality and changes to aquatic ecology. The changes to aquatic ecology have been furthered divided into aquatic ecology for lake (phytoplankton, zooplankton and benthic invertebrates) and aquatic ecology of streams (periphyton and benthic invertebrates).

Scope of Assessment – Water Quality

The scope of the water quality assessment has increased since the previous EIS. As is shown in table 2.7.2.4B-4 potential water quality effects exist at all stages of the project development. Primarily, the scope of the assessment has changed due to the project objective to retain Fish Lake by moving the TSF upstream of the lake inlet. Furthermore, the scope has expanded based upon the instructions contained in the EIS guidelines that require predictions over time from all water bodies that may be impacted.

To ensure that the assessment is comprehensive the scope of the water quality assessment will be inclusive of Upper Fish Creek and Fish Lake Tributary 1 and Fish Lake. Additionally, the adjacent Beece Creek drainage and the Big and Little Onion Lake system will be evaluated. Finally, the downstream water quality effects will be examined within lower Fish Creek down to the confluence with the Taseko River.

Effects Assessment Methods – Water Quality

The assessment methods used to determine the effects on water quality will be consistent with the EIS guidelines. In general this will involve predictive mass balance water quality modelling for all of the evaluated water bodies. These predictive models will include source term concentrations and volumes for major mine and natural components (i.e., Groundwater, Seepage, Plant site runoff) and will be calculated on a monthly basis, through the different phases of the project and beyond.

Predictive water quality models have been utilized by investigators for decades to forecast changes in aquatic environments. They accomplish their predictions by simplifying the system into discrete components (ie. Inflows and outflows) that behave in an assumed manner. In the absence of whole lake experiments and manipulations they represent the only tool by which to do so. The predictive accuracy of the models is entirely subject to the quality of the inputs to the models and appropriateness of the assumptions. And as a result of natural variability and non-ideal conditions every model will contain some level of uncertainty.

The complexity of the models ranges from simple correlations to advanced 3 dimensional simulations, with each level of complexity providing clarity to some aspects while adding additional potential uncertainty in others. In regards to mining applications predictive water quality modelling is employed for pit water, natural stream water and lake water projections. Some recent examples of lake and stream water quality modelling applications include De Beers Canada Inc. modelling of Snap and Kennady Lake in support of a diamond mining application and Terrane Metals modelling of stream water quality around the approved Mount Milligan mine.

For the New Prosperity EIS a comprehensive mass balance approach was utilized for to predict water quality in Fish Lake as well as the adjacent waterbodies. This approach included comprehensive flow and source chemistry values for both aqueous and airborne particles as well as consideration for in lake scavenging processes and water column stratification. The results achieved from this modelling were used for two primary functions, firstly, they provided effective predictions to help guide management and development processes, Secondly, they provide necessary guidance to develop and inform the proposed monitoring plan.

The Fish Lake water quality model was initially calibrated to baseline conditions and subsequently with parallel models throughout the process. Water quality in the adjacent waterbodies was modelled using a mixing point model using inputs from the baseline investigation of the area. The results were compared against baseline concentrations as well as the applicable provincial and federal guidelines where available to determine the nature of environmental effects. Results will be presented in both a tabulated and graphic form. Where necessary, a description of contingency plans will be presented to address uncertainties and risks associated with predictions. Additionally, these results provide the basis for additional ecological modelling to answer questions surrounding anticipated lake productivity and potential for aquatic toxicology.

Baseline Conditions – Water Quality / Fish Tissue Metals Concentration

Baseline conditions are clearly described in Section 2.6.1.4. In general, water quality baseline data for much of the local and regional study area has not changed following the previous EIS submission. However, some additional data was collected in 2011 and 2012 as components of field studies specifically evaluating Fish Lake. Refer to Section 2.6.1.4B for complete details.

From 1993 through 1997, fish tissue samples (muscle and liver) were collected throughout the RSA to establish background levels of metals. Results for the RSA are presented in Appendix 5-2A (vol 2) of the previous EIS.

Project Effects – Water Quality

As a component of the larger aquatic effects assessment, a surface water quality model for Fish Lake has been prepared. The purpose of the model is to provide a predictive tool to assess how the proposed changes to elemental loading and surface discharges will affect the water quality of Fish Lake. In order to characterize the resulting water chemistry in Fish Lake, a mass balance approach was adopted.

Fish Lake Water Quality Model

The mass balance model is a quantitative approach that has been used extensively to describe both controlled and environmental systems. It calculates the change in mass of an element by accounting for both gains into the system and losses from a system. Within the Canadian Mining sector, it has recently been used to provide water quality predictions for Duncan Lake as a part of Northgate Minerals Kemess North proposal as well as for watersheds downstream of DeBeers Snap Lake project.

The lake model is essentially composed of a few basic components.

$$\frac{(Elemental\ Inputs - Elemental\ Outputs) + Elemental\ Volume\ in\ Lake}{Lake\ Volume\ (4{,}400{,}000\ m^3)}$$

In this situation, the elements that are being modelled are a comprehensive list of chemical parameters predicted by the source term predictive modelling carried out by SRK consulting (Appendix 2.7.2.1A). The total mass of an element entering the lake is a function of both source term concentrations as well as anticipated discharge volume.

While the mass balance approach is a useful tool to approximate water quality in environmental systems, it does require certain simplifying assumptions – most notably, that the system is a perfectly mixed environment. In the lacustrine environment this assumption would suggest that the lake would exhibit an isothermal profile, a constant density and uniform concentration. Previous baseline water quality work has shown that during the summer months Fish Lake does become thermally stratified. During this period the system would violate the assumption of perfecting mixing and could result in uncertainty in the model. In this situation we have attempted to address this by applying an epilimnion/hypolimnion partitioning coefficient, based upon seasonal baseline concentrations (discussed below).

Mass Inputs to Fish Lake

Mass inputs are a function of both discharges into the lake as well as elemental concentrations in the water. Within the model the total amount of flux into the lake was calculated by summing the flux values from the identified sources around the lake.

$$\frac{Kg}{month} = \sum_{i=0}^{n} \frac{\left(C_i \left(\frac{mg}{L}\right) x\ D_i \left(\frac{m^3}{month}\right)\right)}{1000}$$

Where C_i is the predicted source-term concentration of source i in mg/L and D_i is the predicted discharge entering the lake from source i in m^3/month.

The Fish Lake water quality model was calculated on a monthly basis for all project and closure phases (years 1-44). Additionally, monthly predictions were extended beyond the closure phases into a post closure phase (through 2111). The model consists of monthly discharges and accompanying source term concentrations for a comprehensive list of contributors, refer to Table 2.7.2.4B-5.

Table 2.7.2.4B-5 Data Sources for the Water Fish Lake Water Quality Model

Discharge Source	Source-term concentration
Top Soil Stockpile (appendix ?)	Overburden (appendix ?)
Undisturbed Catchment (appendix ?)	Background (appendix ?)
Direct Precipitation (appendix ?)	Precipitation (assumed to be negligible)
Water Diverted Around the TSF (appendix ?)	Background (appendix ?)
Mine Site Road Runoff (appendix ?)	Mine Site Roads (appendix ?)
Plant Site Runoff (appendix ?)	Overflow Plant Reservoir (appendix ?)
Plant Site Infiltration (appendix ?)	Overflow Ore stockpile (appendix ?)
Ore Stockpile Runoff (appendix ?)	Overflow Ore stockpile (appendix ?)
Ore Stockpile Infiltration (appendix ?)	Overflow Ore stockpile (appendix ?)
TSF Seepage (appendix ?)	Basin Seepage (appendix ?)
Groundwater (appendix ?)	Groundwater (appendix ?)
Grey water discharge (appendix ?)	Grey water discharge (appendix ?)
Upper Fish Creek *	Lake concentration preceding month and Background
Fish Lake Tributary 1 *	Lake concentration preceding month and Background

*Grey shading indicates that the monthly source-term concentrations were calculated based upon separate mass mixing calculations employing anticipated recirculation volumes and the predicted lake chemistry in addition to the natural background volumes and concentrations.

Mass Outputs from Fish Lake

Unlike a typical lake, the outlet of the lake will be blocked and discharge water will be recirculated back into either the TSF or the inlets as mitigation flow. The recirculated mitigation flow represents a large elemental output flux from the lake and is considered as a loss for the mass balance calculations. However, this is a temporary loss and a large quantity of the mass will report back to the lake a short time later, as a conservative factor 100% of flux lost through recirculation is modelled to return to the lake. A small amount of water is anticipated to be lost from the system via groundwater seepage. However, this number represents (>0.002%) of the lowest predicted monthly inflows of 120,124 m^3/month. The lake loses water via evaporation during the warmer months of the year; however this is considered to be distilled water for the overall mass balance and hence is not an elemental mass output. The methods for accounting for evaporative losses are discussed below. In the absence of effective surface and groundwater discharges the only elemental loss factor is a natural loss from the water column to the lake sediments. Table 2.7.2.4B-6 summarizes the various elemental losses.

Table 2.7.2.4B-6 Data Sources for the Water Fish Lake Water Quality Model

Elemental loss	Quantity
Surface water	N/A
Re-circulated flow	(Lake concentration * Volume) – temporary
Evaporation	Considered to be negligible
Scavenging to the sediments	Described in Technical Appendix ??
Seepage from the Fish Lake basin	Described in Technical Appendix ??

Scavenging

In lake systems sediment scavenging can be an important factor in the elemental budget. Within Fish Lake, lake sediment scavenging values were measured from intact dated sediment cores (see appendix??). To ensure that only permanently scavenged elements were accounted for in this analysis, only elemental concentrations in sediments older than 50 years were considered. These measured values were then extrapolated across the depositional area in Fish Lake to provide a whole lake average annual scavenging value as shown in Table 2.7.2.4B-7. For the purpose of the Fish Lake water quality model, the annual average scavenging rate was divided by 12 to provide an average annual monthly scavenging rate for incorporation into the mass balance model. By using this loss term we are assuming:

1. Scavenging rates are roughly equal month to month, and
2. Scavenging rates will remain stable over the course of the extended life of the Project.

In regards to the applicability of the first assumption, sedimentation rates are generally believed to exhibit seasonal maximums during the productive summer period and seasonal minimums during the ice covered winter/spring period. In this situation, average annual values were used because current technology cannot accurately date sediments greater than 50 years old with more than yearly accuracy. This assumption will be accurate on an annual basis and is therefore appropriate for the long-term modelling conducted in this situation.

The second assumption in this analysis is considered to be a conservative one. Fish Lake sediments will likely accumulate more sediment and scavenge more material during the construction, and operational phases of this project. Some of this material is anticipated to come from airborne sources, such as dust, while some additional material may come from terrestrial sources and in lake productivity.

Table 2.7.2.4B-7 Measured Fish Lake Scavenging Rates

Element	Units	Average	Std. deviation	Minimum	Maximum	Number (n)
Antimony	µg/g	0.52	0.03	0.49	0.56	11
Arsenic	µg/g	3.28	0.53	2.80	4.30	11
Barium	µg/g	43.60	1.86	40.40	46.30	11
Beryllium	µg/g	0.23	0.02	0.20	0.25	11
Cadmium	µg/g	0.22	0.01	0.20	0.23	11
Chromium	µg/g	43.91	3.14	39.00	48.00	11
Cobalt	µg/g	9.60	0.41	8.90	10.10	11
Copper	µg/g	42.65	1.99	39.10	44.50	11
Lead	µg/g	2.43	0.55	1.97	3.73	11
Mercury	µg/g	0.14	0.04	0.10	0.24	11
Molybdenum	µg/g	1.97	0.14	1.75	2.20	11
Nickel	µg/g	59.05	2.17	54.20	62.20	11
Phosphorus	µg/g	689.82	58.68	619.00	815.00	11
Selenium	µg/g	1.65	0.14	1.40	1.90	11
Silver	µg/g	0.11	0.01	0.10	0.12	11
Thallium	µg/g	<0.05		<0.05	<0.05	11
Tin	µg/g	0.45	0.14	0.32	0.72	11
Vanadium	µg/g	65.09	4.95	59.00	73.00	11
Zinc	µg/g	69.36	2.69	64.00	74.00	11

Evaporative Losses

Evapo-concentration/dilution was factored into the model in the manner described below.

$$Predicted\ Lake\ concentration * evapoconcentration\ factor$$

$$evapoconcentration\ factor = \left(1 + \left(\frac{Monthly\ Evaporation\ \left(\frac{m^3}{month}\right) - Direct\ Precipitation\ \left(\frac{m^3}{month}\right)}{Lake\ Volume\ m^3}\right)\right)$$

The calculation of evapoconcentration and/or dilution is based on the assumption that the volume of the lake can fluctuate. Technically speaking this may not always be true in Fish Lake, as the volume and surface level of the lake will be maintained within the natural variation observed at baseline. For this reason the evapoconcentration factor and the dilution factor are considered to be conservative in nature.

Under natural conditions variations in lake concentrations due to evapoconcentration would be less pronounced than this method would tend to predict.

Based upon the watershed model detailed in Appendix 2.6.1.4B, Fish Lake appears to receive approximately 55,000 m3 more water from direct precipitation than is lost to evaporation (see Table 2.7.2.4B-8). As expected, during the summer months of July, August, September, and October, the lake exhibits a small concentration factor resulting from excess evaporation. This is more than compensated for during the cooler spring and fall months which are dominated by direct precipitation.

Table 2.7.2.4B-8 Predicted Evaporation and Direct Precipitation Values for Fish Lake

Month	Anticipated Evaporation (m^3/month)	Anticipated Direct Precipitation (m^3/month)	Net Evapoconcentration Factor in Fish Lake
January	0	0	0
February	0	0	0
March	0	0	0
April	0	7,210	0.998
May	0	60,421	0.986
June	82,554	128,104	0.990
July	130,332	123,899	1.001
August	120,557	108,799	1.003
September	124,902	86,202	1.009
October	83,630	52,301	1.007
November	0	30,083	0.993
December	0	0	0
Total	541,985	597,019	0.987

Model Calibration

Prior to predictive modelling, the mass balance model was calibrated using the background inlow data available for water quality monitoring station at the inlet of the lake (W1) as well as stations at the outlet of the lake (W2) (see technical appendix ??). The results of the calibration were compared with Fish Lake water quality data to ensure stability and accuracy. Essentially, this involved running the model with baseline values to ensure that the water quality model predicted stable concentrations in the Lake.

Modelled Water Quality Results for Fish Lake

Modelled results were calculated based on the average year water balance scenario for Fish Lake and have been divided by season (winter/fall, spring/summer). These results are summarized for the phases of the project in tabular form in Table 2.7.2.4B-9 and graphically in Figure 2.7.2.4B-1. The details of yearly results can be found in Appendix. Note that the actual graphs presented for the draft EIS are for demonstration purposes only and do not represent final data.

Table 2.7.2.4B-9 Predicted Water Quality Results for Fish Lake

Row Labels	Operational 1 (1 - 16 yrs)				Operational 2 (17 - 20 yrs)				Closure 1 (21 - 30 yrs)				Closure 2 (31 - 40 yrs)				Post Closure (40 - 112 yrs)			
	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)
Aluminum																				
Spring/Summer																				
Fall/Winter																				
Antimony																				
Spring/Summer																				
Fall/Winter																				
Arsenic																				
Spring/Summer																				
Fall/Winter																				
Barium																				
Spring/Summer																				
Fall/Winter																				
Beryllium																				
Spring/Summer																				
Fall/Winter																				
Bismuth																				
Spring/Summer																				
Fall/Winter																				
Boron																				
Spring/Summer																				
Fall/Winter																				
Cadmium																				
Spring/Summer																				
Fall/Winter																				

Row Labels	Operational 1 (1 - 16 yrs)				Operational 2 (17 - 20 yrs)				Closure 1 (21 - 30 yrs)				Closure 2 (31 - 40 yrs)				Post Closure (40 - 112 yrs)			
	Min (μg/L)	Avg (μg/L)	Max (μg/L)	StdDev (μg/L)	Min (μg/L)	Avg (μg/L)	Max (μg/L)	StdDev (μg/L)	Min (μg/L)	Avg (μg/L)	Max (μg/L)	StdDev (μg/L)	Min (μg/L)	Avg (μg/L)	Max (μg/L)	StdDev (μg/L)	Min (μg/L)	Avg (μg/L)	Max (μg/L)	StdDev (μg/L)
Calcium																				
Spring/Summer																				
Fall/Winter																				
Chloride																				
Spring/Summer																				
Fall/Winter																				
Chromium																				
Spring/Summer																				
Fall/Winter																				
Cobalt																				
Spring/Summer																				
Fall/Winter																				
Copper																				
Spring/Summer																				
Fall/Winter																				
Flouride																				
Spring/Summer																				
Fall/Winter																				
Hardness																				
Spring/Summer																				
Fall/Winter																				
Iron																				
Spring/Summer																				
Fall/Winter																				
Lead																				
Spring/Summer																				

Row Labels	Operational 1 (1 - 16 yrs)				Operational 2 (17 - 20 yrs)				Closure 1 (21 - 30 yrs)				Closure 2 (31 - 40 yrs)				Post Closure (40 - 112 yrs)			
	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)
Fall/Winter																				
Lithium																				
Spring/Summer																				
Fall/Winter																				
Magnesium																				
Spring/Summer																				
Fall/Winter																				
Managanese																				
Spring/Summer																				
Fall/Winter																				
Mercury																				
Spring/Summer																				
Fall/Winter																				
Molybdenum																				
Spring/Summer																				
Fall/Winter																				
Nickel																				
Spring/Summer																				
Fall/Winter																				
Nitrate																				
Spring/Summer																				
Fall/Winter																				
Nitrite																				
Spring/Summer																				
Fall/Winter																				
Nitrogen																				
Spring/Sum																				

Row Labels	Operational 1 (1 - 16 yrs)				Operational 2 (17 - 20 yrs)				Closure 1 (21 - 30 yrs)				Closure 2 (31 - 40 yrs)				Post Closure (40 - 112 yrs)			
	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)
mer																				
Fall/Winter																				
Phosphorous																				
Spring/Summer																				
Fall/Winter																				
Potassium																				
Spring/Summer																				
Fall/Winter																				
Selenium																				
Spring/Summer																				
Fall/Winter																				
Silicon																				
Spring/Summer																				
Fall/Winter																				
Silver																				
Spring/Summer																				
Fall/Winter																				
Sodium																				
Spring/Summer																				
Fall/Winter																				
Strontium																				
Spring/Summer																				
Fall/Winter																				
Sulphate																				
Spring/Summer																				
Fall/Winter																				
Sulphur																				

Row Labels	Operational 1 (1 - 16 yrs)				Operational 2 (17 - 20 yrs)				Closure 1 (21 - 30 yrs)				Closure 2 (31 - 40 yrs)				Post Closure (40 - 112 yrs)			
	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)
Spring/Summer																				
Fall/Winter																				
Thallium																				
Spring/Summer																				
Fall/Winter																				
Tin																				
Spring/Summer																				
Fall/Winter																				
Titanium																				
Spring/Summer																				
Fall/Winter																				
Uranium																				
Spring/Summer																				
Fall/Winter																				
Vanadium																				
Spring/Summer																				
Fall/Winter																				
Zinc																				
Spring/Summer																				
Fall/Winter																				
Zircon																				
Spring/Summer																				
Fall/Winter																				

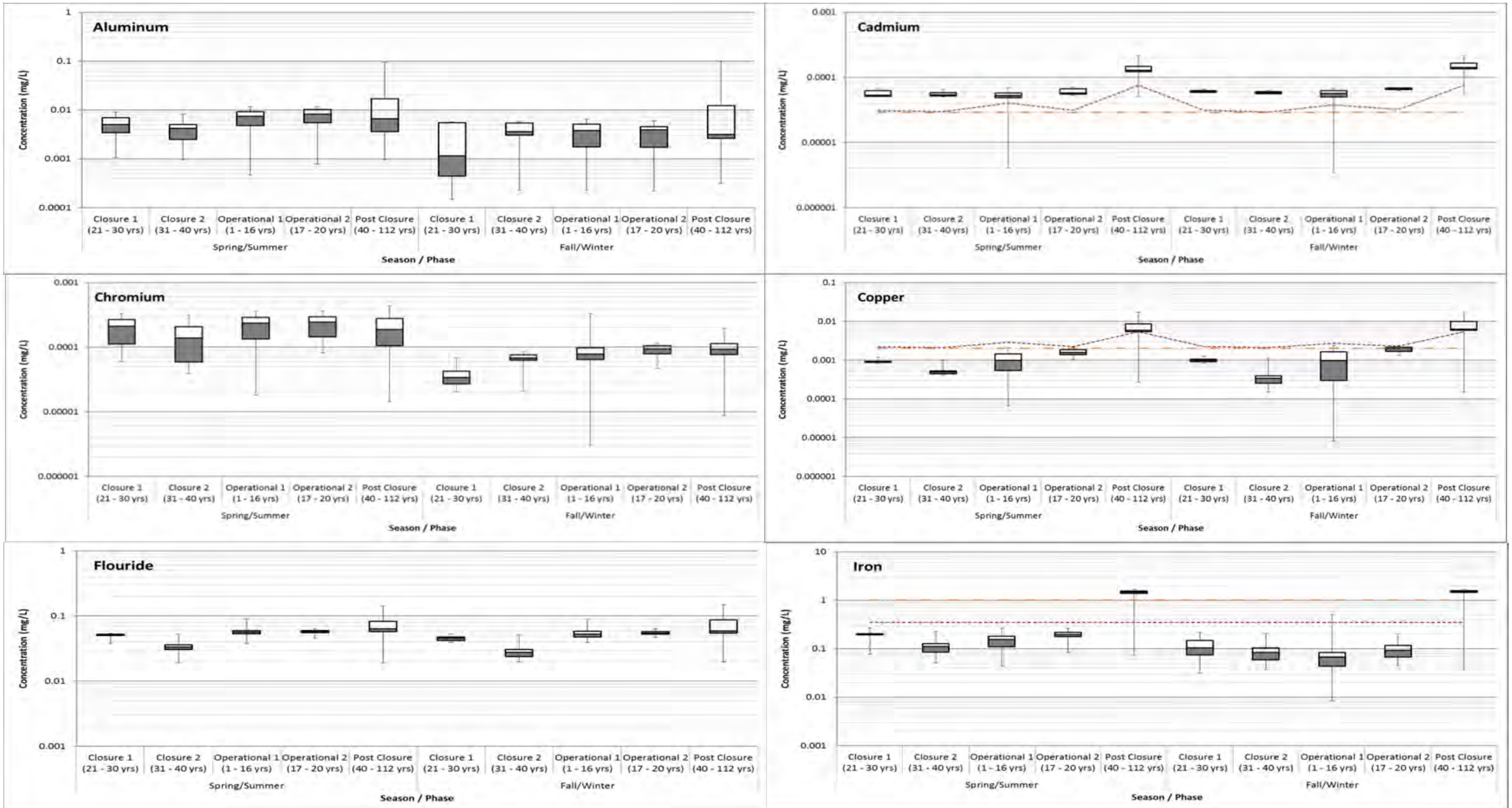


Figure 2.7.2.4B-1 **Graphical presentation of Fish Lake Concentrations – Orange Dashed Line (CCME); Red Dashed Line (BC Guidelines)**

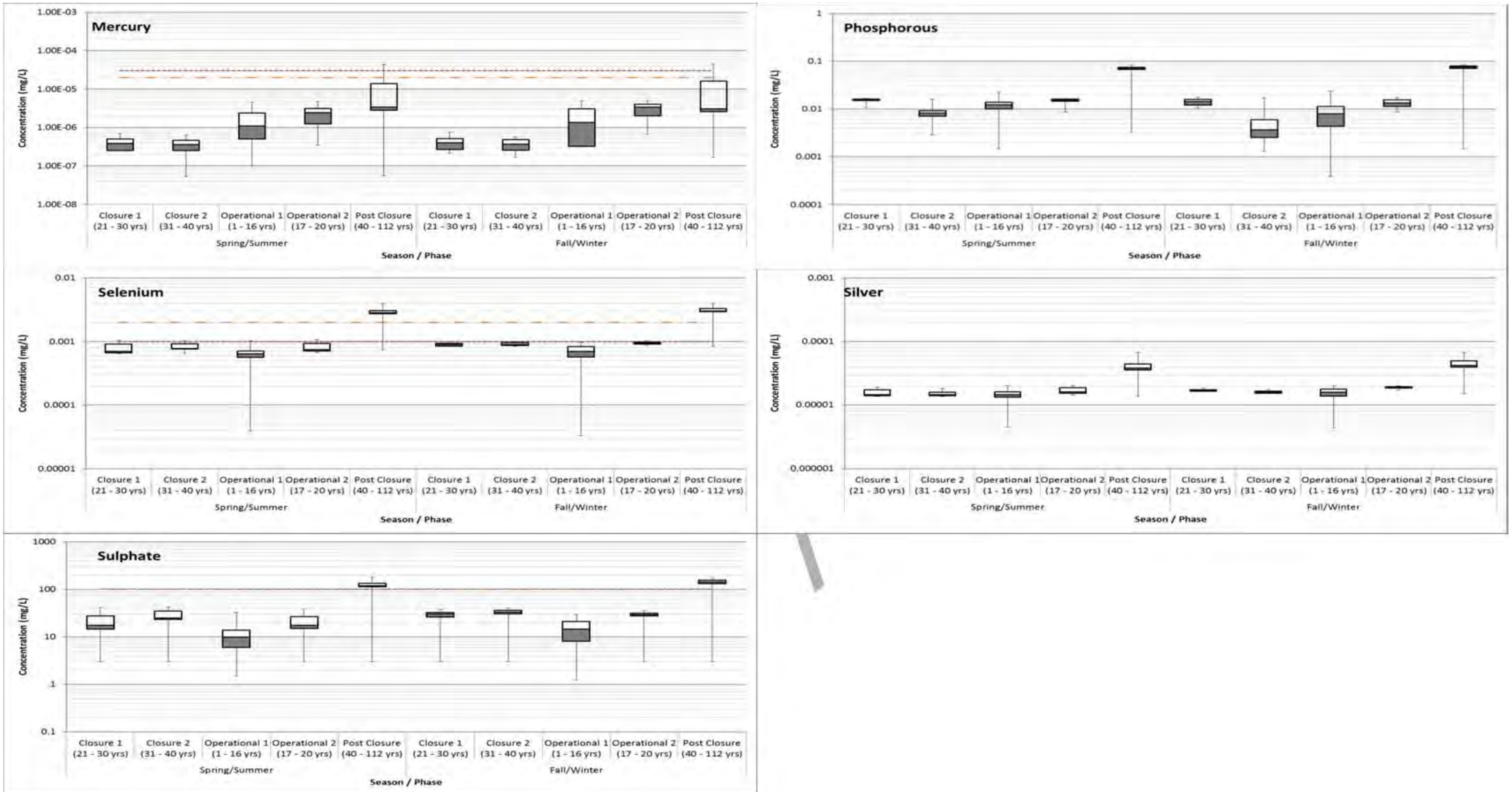


Figure 2.7.2.4B-1 Graphical Presentation of Fish Lake Concentrations – Orange Dashed Line (CCME); Red Dashed Line (BC Guidelines)

Comparison of Predicted Fish Lake Water Quality Data with Guidelines and Standards

A review and comparison of the predicted water quality in Fish Lake was conducted with the following guidelines and standards for purposes of identifying potential adverse effects:

- BC Approved Water Quality Guidelines (updated 2011)
- Compendium of BC Working Water Quality Guidelines (updated 2006)
- CCME Water Quality Guidelines (updated 2011), and
- Contaminated Sites Regulation-Generic Numerical Water Standards (updated 2011).
-

A summary of the average values and associated exceedances for the identified elements spread across the five operational time frames (Years 1 to 16, 17-20, 21-30, 31-40 and 40-112 years) is provided in Table 2.7.2.4B-10. This analysis shows that with the exception of cadmium and mercury, that the average concentrations of the identified elements are not predicted to exceed guidelines until such time as the TSF is permitted to discharge to the inlets to Fish Lake (end of Closure Phase I).

The data were also evaluated in the contexts of the minimum, average, and maximum concentrations for the period of record (1 to 112 years) (Table 2.7.2.4B-11). In all situations the values are reflective of monthly water quality predictions and would hence be representative of the monthly average. The reader should be reminded that the guideline exceedances indicated in Table 2.7.2.4B-11 are based on the modelling assumption that that the transition from Closure Phase I to Closure Phase II occurs in year 31. This is an arbitrary assumption for purposes of modelling and the actual transition will be determined on the basis of suitable water quality identified by actual operational and Closure Phase I monitoring.

Table 2.7.2.4B-10 Comparison of the average elemental concentrations in Fish Lake - Years 1-16, 17-20-21-30, 31-40 and 40-112 with Water Quality Guidelines and Standards

Parameter	(Year 1-16)	(Year 17-20)	(Year 21-30)	(Year 31-40)	(Year 40-112)	BC WQG (maximum)	BC WQG (30 d average)	CCME guideline value	CSR Generic Numerical Water Standards
Aluminum (mg/L)	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	0.1 (dissolved)	0.05 (dissolved)	0.05 to 0.1 (dissolved)	-
	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx	Fall/Winter xxx	Fall / Winter xxxx				
Cadmium (mg/L)	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	0.000022 to 0.00006	-	0.000017	0.0003 to 0.0006
	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx	0.00002 to 0.00006	-		
Copper (mg/L)	Spring / Summer xxxx	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	0.0078 to 0.0190	0.0024 to 0.0072	0.002 to 0.0039	>0.03
	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx	0.0071 to 0.0199	0.0022 to 0.0076	0.002 to 0.0041	
Flouride (mg/L)	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxxx	-	-	0.12	3
	Fall / Winter xxxx	Fall / Winter xxxx	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx				
Iron (mg/L)	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxxx	Spring / Summer xxx	Spring / Summer xxx	0.35 (dissolved)	-	0.3	-

Parameter	(Year 1-16)	(Year 17-20)	(Year 21-30)	(Year 31-40)	(Year 40-112)	BC WQG (maximum)	BC WQG (30 d average)	CCME guideline value	CSR Generic Numerical Water Standards
	Fall / Winter xxx	Fall / Winter xxxx	Fall / Winter xxx	Fall / Winter xxxx	Fall / Winter xxxx	1.0 mg/L (total)			
Mercury (mg/L)	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	Aquatic life: 0.000002 to 0.00002 depending on MeHg %		0.000026 (inorganic) and 0.000004 MeHg	0.001
	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter 0.0000015	Fall / Winter xxx	Fall / Winter xxx	Wildlife: 0.00000125 to 0.000002 depending on MeHg % (total)			
Selenium (mg/L)	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	0.002 (mean)		0.001	0.01
	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxxx				
Sulfate (mg/L)	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	50 (alert level)		-	1,000
	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx	100 (max)			
Silver (mg/L)	Spring / Summer xxx	Spring / Summer xxxx	Spring / Summer xxx	Spring / Summer xxx	Spring / Summer xxx	0.0015 to 0.003	0.00005 to 0.0001	0.0001	0.0005
	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx	Fall / Winter xxx				

<table>
<tr><th>Parameter</th><th>(Year 1-16)</th><th>(Year 17-20)</th><th>(Year 21-30)</th><th>(Year 31-40)</th><th>(Year 40-112)</th><th>BC WQG (maximum)</th><th>BC WQG (30 d average)</th><th>CCME guideline value</th><th>CSR Generic Numerical Water Standards</th></tr>
<tr><td rowspan="2">Hardness (mg/L)</td><td>Spring / Summer xxx</td><td>Spring / Summer xxx</td><td>Spring / Summer xxx</td><td>Spring / Summer xxx</td><td>Spring / Summer xxx</td><td colspan="4" rowspan="2">No guideline or standards for hardness available although <60 mg/L is considered soft water and >120 mg/L is considered hard water (MELP, 1998)-</td></tr>
<tr><td>Fall / Winter xxx</td><td>Fall / Winter xxx</td><td>Fall / Winter xxx</td><td>Fall / Winter xxx</td><td>Fall / Winter xxx</td></tr>
</table>

Table 2.7.2.4B-11 Minimum, Average and Maximum Concentrations in Fish Lake for Years 1 through 112

Parameter	Predicted min	Predicted max	Predicted avg	BC WQG (max)	BC WQG (30d avg)	CCME guideline value	CSR Generic Numerical Water Standards
Aluminum (mg/L)				0.1 (dissolved)	0.05 (dissolved)	0.1 (dissolved)	-
Cadmium (mg/L)				0.0000156 to 0.00007606 (total) based on predicted hardness		0.000017	≥0.0003 based on hardness ≥30
Copper (mg/L)				0.0148 to 0.0267 based on predicted hardness	0.002 to 0.005 based on predicted hardness	0.002 to 0.0054 based on predicted hardness	0.02 to 0.09 based on hardness <50≥200
Flouride (mg/L)				≥0.96 (based on hardness)	-	0.120	2 to 3 based on hardness <50≥50
Iron (mg/L)				0.35 (dissolved) 1.0 mg/L (total)	-	0.30	-
Mercury (mg/L)				Aquatic life: 0.000002 to 0.00002 depending on MeHg % (total) Wildlife: 0.00000125 to 0.000002 depending on MeHg % (total)		0.000026 (inorganic) 0.000004 (MeHg)	0.001
Selenium (mg/L)				0.002 (mean)		0.001	0.01

Parameter	Predicted min	Predicted max	Predicted avg	BC WQG (max)	BC WQG (30d avg)	CCME guideline value	CSR Generic Numerical Water Standards
Sulfate (mg/L)				50 (alert level) 100 (max)			1,000
Silver (mg/L)				0.0015 to 0.003	0.00005 to 0.0001	0.0001	0.0005
Water chemistry parameters used to calculated guideline values for aluminum, copper, cadmium, silver							
pH	7	8	7.5	Unrestricted change in the 6.5 to 9.0 range (BCWQG)		6.5 to 9.0	-
Hardness (mg/L)	40.3	263.0	136.7	60 mg/L = soft water; 120 mg/L = hard water (MELP, 1998)		-	-
		30 day average of 0.00005 mg/L based on hardness of <100 mg/L; identified as a potential exceedance here to be conservative					

For the purposes of the draft EIS the following text is provided as an example of the approach to a comparison of predicted results to appropriate guidelines but should not be considered indicative of actual final results

None of the predicted maximum values exceeded the CSR Generic Numerical Water Standards. However some of the predicted values exceeded either the provincial or federal guidelines, or both, as follows:

- **Maximum aluminum** (xxx mg/L) exceeds the 30-d average concentration of 0.05 mg/L specified in the BC WQG (Butcher, 1998). The predicted maximum concentration occurs during the post closure phase of the project (years 40 – 112) and was essentially equal to the instantaneous maximum concentration specified in the BC WQG and the CCME (0.1 mg/L at pH ≥6.5) (Butcher 1988; CCREM 1987).
- **Average and maximum cadmium** were xxx mg/L and xxx mg/L respectively and exceed the maximum water quality guidelines of 0.0000156 mg/L and 0.0000761 mg/L total cadmium, calculated using the range of predicted hardness in the lake (40.3 mg/L to 263.0 mg/L). The predicted average and maximum concentrations also exceed the CCME guideline of 0.000017 mg/L total cadmium.
- **Maximum copper** (xxx mg/L) exceeds the 30-day average guideline value of 0.005 mg/L total copper calculated for hardness >50 mg/L, reflective of the average (136.7 mg/L) and maximum (263.0mg/L) predicted hardness in the lake. The predicted average dissolved copper fell within the range calculated for the 30 day average concentration guideline based upon the average and maximum hardness values (xxx mg/L to xxx mg/L). This would suggest that depending upon the hardness the average dissolved copper could exceed guidelines
- **Average and maximum iron** were xxx mg/L and xxx mg/L respectively, and could exceed the maximum water quality guidelines of 0.35 mg/L dissolved iron (Phippen et al. 2008), depending on the fractionation between dissolved and total iron. The maximum iron concentration also exceeded the provincial total iron guideline of 1 mg/L and both the average and maximum concentrations exceeded the CCME guideline of 0.3 mg/L (CCREM, 1987).
- **Average and maximum mercury** were xxx mg/L and xxx mg/L respectively. These values exceed the available provincial guidelines of 0.00000125 mg/L @ 8% methyl mercury (MeHg) to 0.00002 mg/L @ 0.5% MeHg (Nagpal 1989). Additionally, the maximum predicted value exceeds the CCME guideline of 0.000026 mg/L of total mercury (CCME 2003).
- **Maximum selenium** during the post closure phase could increase to xxx mg/L. This value exceeds the maximum instantaneous guideline concentration of 0.002 mg/L (Nagpal and Howell 2001) as well as the federal total selenium guideline concentration of 0.001mg/L (CCREM 1987). The overall predicted average concentration throughout all phases was equal to the provincial guideline concentration and roughly two times greater than the federal maximum.
- **Maximum silver** (xxx mg/L) exceeds the provincial 30-day average guideline of 0.00005 mg/L for hardness concentrations of ≤ 100 mg/L (Warrington 1996). However, the maximum predicted hardness when silver reaches is expected to reach its maximum is 263.0 mg/L. At this hardness, the 30-day guideline would 0.0015 mg/L total silver, which is above the predicted maximum. This potential exceedance of the provincial guideline has been included here to be conservative. The predicted maximum was below the 0.0001 mg/L CCME guideline for silver (CCREM 1987).
- **Maximum sulphate** (xxx mg/L) exceeds the provincial guidelines of 50 mg/L (alert level) and 100 mg/L (maximum) (Singleton 2000). No CCME guideline is available for this parameter.

Maximum fluoride (xxx mg/L) exceeds the CCME guideline value for inorganic fluorides of 0.120 mg/L (CCME 2002), but is below the variable fluoride LC_{50} (0.92 mg/L to 1.722 mg/L) calculated based upon the predicted hardness values (Warrington 1995).

Water Quality Results for Fish Lake Tributaries (Data w**ill be updated and discussion expanded in Final EIS to same level of detail provided for Fish Lake as indicated by tables provided below**)

Modelled results (Tables 2.7.2.4B-12 to Table 2.7.2.4B-13) were calculated based on the average year water balance scenario. The results have been divided based upon the location (Upper Fish Creek, and, Fish Lake Tributary 1) as well as by season (winter/fall, spring/summer). Graphical figures are presented for the fish Lake tributaries (Figures 2.7.2.4B-2 to 2.7.2.4B-3)

Table 2.7.2.4B-12 Predicted Water Quality in Upper Fish Creek

Row Labels	Operational 1 (1 - 16 yrs)				Operational 2 (17 - 20 yrs)				Closure 1 (21 - 30 yrs)				Closure 2 (31 - 40 yrs)				Post Closure (40 - 112 yrs)			
	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)
Aluminum																				
Spring/Summer																				
Fall/Winter																				
Antimony																				
Spring/Summer																				
Fall/Winter																				
Arsenic																				
Spring/Summer																				
Fall/Winter																				
Barium																				
Spring/Summer																				
Fall/Winter																				
Beryllium																				
Spring/Summer																				
Fall/Winter																				
Bismuth																				
Spring/Summer																				
Fall/Winter																				
Boron																				
Spring/Summer																				
Fall/Winter																				
Cadmium																				
Spring/Summer																				
Fall/Winter																				
Calcium																				

Row Labels	Operational 1 (1 - 16 yrs)				Operational 2 (17 - 20 yrs)				Closure 1 (21 - 30 yrs)				Closure 2 (31 - 40 yrs)				Post Closure (40 - 112 yrs)			
	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)
Spring/Summer																				
Fall/Winter																				
Chloride																				
Spring/Summer																				
Fall/Winter																				
Chromium																				
Spring/Summer																				
Fall/Winter																				
Cobalt																				
Spring/Summer																				
Fall/Winter																				
Copper																				
Spring/Summer																				
Fall/Winter																				
Fluoride																				
Spring/Summer																				
Fall/Winter																				
Hardness																				
Spring/Summer																				
Fall/Winter																				
Iron																				
Spring/Summer																				
Fall/Winter																				
Lead																				
Spring/Summer																				
Fall/Winter																				

Row Labels	Operational 1 (1 - 16 yrs)				Operational 2 (17 - 20 yrs)				Closure 1 (21 - 30 yrs)				Closure 2 (31 - 40 yrs)				Post Closure (40 - 112 yrs)			
	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)
Lithium																				
Spring/Summer																				
Fall/Winter																				
Magnesium																				
Spring/Summer																				
Fall/Winter																				
Managanese																				
Spring/Summer																				
Fall/Winter																				
Mercury																				
Spring/Summer																				
Fall/Winter																				
Molybdenum																				
Spring/Summer																				
Fall/Winter																				
Nickel																				
Spring/Summer																				
Fall/Winter																				
Nitrate																				
Spring/Summer																				
Fall/Winter																				
Nitrite																				
Spring/Summer																				
Fall/Winter																				
Nitrogen																				
Spring/Su																				

Row Labels	Operational 1 (1 - 16 yrs)				Operational 2 (17 - 20 yrs)				Closure 1 (21 - 30 yrs)				Closure 2 (31 - 40 yrs)				Post Closure (40 - 112 yrs)			
	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)
mmer																				
Fall/Winter																				
Phosphorous																				
Spring/Summer																				
Fall/Winter																				
Potassium																				
Spring/Summer																				
Fall/Winter																				
Selenium																				
Spring/Summer																				
Fall/Winter																				
Silicon																				
Spring/Summer																				
Fall/Winter																				
Silver																				
Spring/Summer																				
Fall/Winter																				
Sodium																				
Spring/Summer																				
Fall/Winter																				
Strontium																				
Spring/Summer																				
Fall/Winter																				
Sulphate																				
Spring/Summer																				
Fall/Winter																				

Row Labels	Operational 1 (1 - 16 yrs)				Operational 2 (17 - 20 yrs)				Closure 1 (21 - 30 yrs)				Closure 2 (31 - 40 yrs)				Post Closure (40 - 112 yrs)			
	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)
Sulphur																				
Spring/Summer																				
Fall/Winter																				
Thallium																				
Spring/Summer																				
Fall/Winter																				
Tin																				
Spring/Summer																				
Fall/Winter																				
Titanium																				
Spring/Summer																				
Fall/Winter																				
Uranium																				
Spring/Summer																				
Fall/Winter																				
Vanadium																				
Spring/Summer																				
Fall/Winter																				
Zinc																				
Spring/Summer																				
Fall/Winter																				
Zircon																				
Spring/Summer																				
Fall/Winter																				

Table 2.7.2.4B-13 Predicted Water Quality in Fish Lake Tributary 1

	Operational 1 (1 - 16 yrs)				Operational 2 (17 - 20 yrs)				Closure 1 (21 - 30 yrs)				Closure 2 (31 - 40 yrs)				Post Closure (40 - 112 yrs)			
Row Labels	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)
Aluminum																				
Spring/Summer																				
Fall/Winter																				
Antimony																				
Spring/Summer																				
Fall/Winter																				
Arsenic																				
Spring/Summer																				
Fall/Winter																				
Barium																				
Spring/Summer																				
Fall/Winter																				
Beryllium																				
Spring/Summer																				
Fall/Winter																				
Bismuth																				
Spring/Summer																				
Fall/Winter																				
Boron																				
Spring/Summer																				
Fall/Winter																				
Cadmium																				
Spring/Summer																				
Fall/Winter																				
Calcium																				
Spring/Sum																				

Row Labels	Operational 1 (1 - 16 yrs)				Operational 2 (17 - 20 yrs)				Closure 1 (21 - 30 yrs)				Closure 2 (31 - 40 yrs)				Post Closure (40 - 112 yrs)			
	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)
mer																				
Fall/Winter																				
Chloride																				
Spring/Summer																				
Fall/Winter																				
Chromium																				
Spring/Summer																				
Fall/Winter																				
Cobalt																				
Spring/Summer																				
Fall/Winter																				
Copper																				
Spring/Summer																				
Fall/Winter																				
Flouride																				
Spring/Summer																				
Fall/Winter																				
Hardness																				
Spring/Summer																				
Fall/Winter																				
Iron																				
Spring/Summer																				
Fall/Winter																				
Lead																				
Spring/Summer																				
Fall/Winter																				
Lithium																				
Spring/Sum																				

Row Labels	Operational 1 (1 - 16 yrs)				Operational 2 (17 - 20 yrs)				Closure 1 (21 - 30 yrs)				Closure 2 (31 - 40 yrs)				Post Closure (40 - 112 yrs)			
	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)
mer																				
Fall/Winter																				
Magnesium																				
Spring/Summer																				
Fall/Winter																				
Managanese																				
Spring/Summer																				
Fall/Winter																				
Mercury																				
Spring/Summer																				
Fall/Winter																				
Molybdenum																				
Spring/Summer																				
Fall/Winter																				
Nickel																				
Spring/Summer																				
Fall/Winter																				
Nitrate																				
Spring/Summer																				
Fall/Winter																				
Nitrite																				
Spring/Summer																				
Fall/Winter																				
Nitrogen																				
Spring/Summer																				
Fall/Winter																				
Phosphorous																				

	Operational 1 (1 - 16 yrs)				Operational 2 (17 - 20 yrs)				Closure 1 (21 - 30 yrs)				Closure 2 (31 - 40 yrs)				Post Closure (40 - 112 yrs)			
Row Labels	**Min (µg/L)**	**Avg (µg/L)**	**Max (µg/L)**	**StdDev (µg/L)**	**Min (µg/L)**	**Avg (µg/L)**	**Max (µg/L)**	**StdDev (µg/L)**	**Min (µg/L)**	**Avg (µg/L)**	**Max (µg/L)**	**StdDev (µg/L)**	**Min (µg/L)**	**Avg (µg/L)**	**Max (µg/L)**	**StdDev (µg/L)**	**Min (µg/L)**	**Avg (µg/L)**	**Max (µg/L)**	**StdDev (µg/L)**
Spring/Summer																				
Fall/Winter																				
Potassium																				
Spring/Summer																				
Fall/Winter																				
Selenium																				
Spring/Summer																				
Fall/Winter																				
Silicon																				
Spring/Summer																				
Fall/Winter																				
Silver																				
Spring/Summer																				
Fall/Winter																				
Sodium																				
Spring/Summer																				
Fall/Winter																				
Strontium																				
Spring/Summer																				
Fall/Winter																				
Sulphate																				
Spring/Summer																				
Fall/Winter																				
Sulphur																				
Spring/Summer																				
Fall/Winter																				
Thallium																				

Row Labels	Operational 1 (1 - 16 yrs)				Operational 2 (17 - 20 yrs)				Closure 1 (21 - 30 yrs)				Closure 2 (31 - 40 yrs)				Post Closure (40 - 112 yrs)			
	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)	Min (µg/L)	Avg (µg/L)	Max (µg/L)	StdDev (µg/L)
Spring/Summer																				
Fall/Winter																				
Tin																				
Spring/Summer																				
Fall/Winter																				
Titanium																				
Spring/Summer																				
Fall/Winter																				
Uranium																				
Spring/Summer																				
Fall/Winter																				
Vanadium																				
Spring/Summer																				
Fall/Winter																				
Zinc																				
Spring/Summer																				
Fall/Winter																				
Zircon																				
Spring/Summer																				
Fall/Winter																				

FIGURE WILL BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.4B-2 Upper Fish Creek Contaminant Concentrations Red Dashed (CCME Guidelines), Orange Dashed (BC Guidelines)

FIGURE WILL BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.4B-3 Tributary 1 Concentrations Red Dashed (CCME Guidelines), Orange Dashed (BC Guidelines)

Comparison of Predicted Fish Lake Tributary Water Quality Data with Guidelines and Standards

A review and comparison of the predicted water quality in Fish Lake was conducted with the following guidelines and standards for purpose of identifying potential adverse effects:

- BC Approved Water Quality Guidelines (updated 2011)
- Compendium of BC Working Water Quality Guidelines (updated 2006)
- CCME Water Quality Guidelines (updated 2011), and
- Contaminated Sites Regulation-Generic Numerical Water Standards (updated 2011).

The data were evaluated in the contexts of the minimum, average, and maximum concentrations for the period of record (1 to 112 years) (Table 2.7.2.4B-14) and as six month averages for Year 1 to 16, 17-20, 21-30, 31-40 and 40-112 years. The six month averages were expressed as values predicted for spring/summer and fall/winter. A summary of those elements showing exceedances of current water quality guidelines and/or standards for the 1 to 112 year minimum, maximum, and average values is provided in Table 2.7.2.4B-15.

Table 2.7.2.4B-14 Table of Exceedances of Water Quality Guidelines Based on Minimum, Average and Maximum Predicted Concentrations for Years 1 Through 40+ In Upper Fish Creek

Parameter	Predicted min	Predicted max	Predicted avg	BC WQG (max)	BC WQG (30d avg)	CCME guideline value	CSR Generic Numerical Water Standards
Aluminum (mg/L)							
Cadmium (mg/L)							
Copper (mg/L)							
Flouride (mg/L)							
Iron (mg/L)							
Mercury (mg/L)							
Selenium (mg/L)							
Sulfate (mg/L)							
Silver (mg/L)							
Water chemistry parameters used to calculated guideline values for aluminum, copper, cadmium, silver							
pH							

Parameter	Predicted min	Predicted max	Predicted avg	BC WQG (max)	BC WQG (30d avg)	CCME guideline value	CSR Generic Numerical Water Standards
Hardness (mg/L)							
		30 day average of 0.00005 mg/L based on hardness of <100 mg/L; identified as a potential exceedance here to be conservative					

Note: Guidelines are for total metals unless indicated otherwise in the text of the table.

A summary of the average values and associated exceedances for the identified elements spread across the five operational time frames (Years 1 to 16, 17-20, 21-30, 31-40 and 40-112 years) is provided in Table 2.7.2.4B-17.

Table 2.7.2.4B-15 Comparison of Years 1-16, 17-20-21-30, 31-40 and 40-112 with Water Quality Guidelines and Standards In Upper Fish Creek

Parameter	(Year 1-16)	(Year 17-20)	(Year 21-30)	(Year 31-40)	(Year 40-112)	BC WQG (maximum)	BC WQG (30 d average)	CCME guideline value	CSR Generic Numerical Water Standards
Aluminum (mg/L)						0.1 (dissolved)	0.05 (dissolved)	0.05 to 0.1 (dissolved)	-
Cadmium (mg/L)						0.000022 to 0.00006	-	0.000017	0.0003 to 0.0006
						0.00002 to 0.00006	-		
Copper (mg/L)						0.00776 to 0.01903	0.0024 to 0.0072	0.002 to 0.0039	>0.03
						0.00713 to 0.01987	0.0022 to 0.0076	0.002 to 0.0041	
Flouride (mg/L)						-	-	0.12	3
Iron (mg/L)						0.35 (dissolved)	-	0.3	-

Parameter	(Year 1-16)	(Year 17-20)	(Year 21-30)	(Year 31-40)	(Year 40-112)	BC WQG (maximum)	BC WQG (30 d average)	CCME guideline value	CSR Generic Numerical Water Standards
						1.0 mg/L (total)			
Mercury (mg/L)						Aquatic life: 0.000002 to 0.00002 depending on MeHg %		0.000026 (inorganic) and 0.000004 MeHg	0.001
						Wildlife: 0.00000125 to 0.000002 depending on MeHg % (total)			
Selenium (mg/L)						0.002 (mean)		0.001	0.01
Sulfate (mg/L)						50 (alert level)		-	1,000
						100 (max)			
Silver (mg/L)						0.0015 to 0.003	0.00005 to 0.0001	0.0001	0.0005

Parameter	(Year 1-16)	(Year 17-20)	(Year 21-30)	(Year 31-40)	(Year 40-112)	BC WQG (maximum)	BC WQG (30 d average)	CCME guideline value	CSR Generic Numerical Water Standards
Hardness (mg/L)						No guideline or standards for hardness available although <60 mg/L is considered soft water and >120 mg/L is considered hard water (MELP, 1998)-			

MELP 1998 - Guidelines for Interpreting Water Quality Data

Water Quality Results for Adjacent Watersheds

Predicted Water Quality

KPL has prepared water mixing models for the surface water regime in the vicinity of the proposed Prosperity Gold-Copper Mine (Figure 2.7.2.4B-4) and further downstream from the Project area (Figure 2.7.2.4B-5) using a similar approach to that used in the March 2009 EIS/Application. The models have been used to quantify predicted changes in surface water quality downstream of the Project in Wasp Lake, Little Onion Lake, and Big Onion Lake, and downstream creeks and rivers (Beece Creek, lower Fish Creek and the Taseko River).

Methods

The water quality model for the Project was developed using a mass balance calculation approach in Excel to predict monthly water quality for dissolved parameters (including physical water quality and dissolved metals) at select locations within and downstream of the Project area. The mass balance method assumes that the incoming flows are thoroughly mixed a short distance downstream of the confluence. The generalized mass balance equation for mixing points on creeks and rivers is as follows:

$$C_{New} = \frac{C_A \times Q_A + C_B \times Q_B}{(Q_A + Q_B)}$$

Where C_{New} = mixed concentration (mg/L)

C_A = concentration of stream A (mg/L)
Q_A = flow rate of stream A (m^3/s)
C_B = concentration of stream B (mg/L)
Q_B = flow rate of stream B (m^3/s)

A conservative approach was adopted for the prediction of water quality in the lakes (reservoir components). For these components the monthly concentrations were determined as a sum of the previous month's stored load and all new loads divided by the sum of the previous month's stored volume plus all new volumes minus the evaporation. Loads removed from each reservoir were determined using this concentration multiplied by the volume of each of the individual losses.

The generalized mass balance equation for lake models is as follows:

$$C_{New} = \frac{1000(C_A \times V_A) + 1000(C_B \times Q_B)}{(V_A + P - E)}$$

Where C_{New} = mixed concentration (mg/L)

C_A = concentration of lake A at the previous time step (mg/L)
V_A = volume of lake A (m^3)
C_B = concentration of stream B (mg/L)
Q_B = flow rate of stream B (m^3/month)

P = monthly precipitation (m3)

E= monthly evaporation (m3)

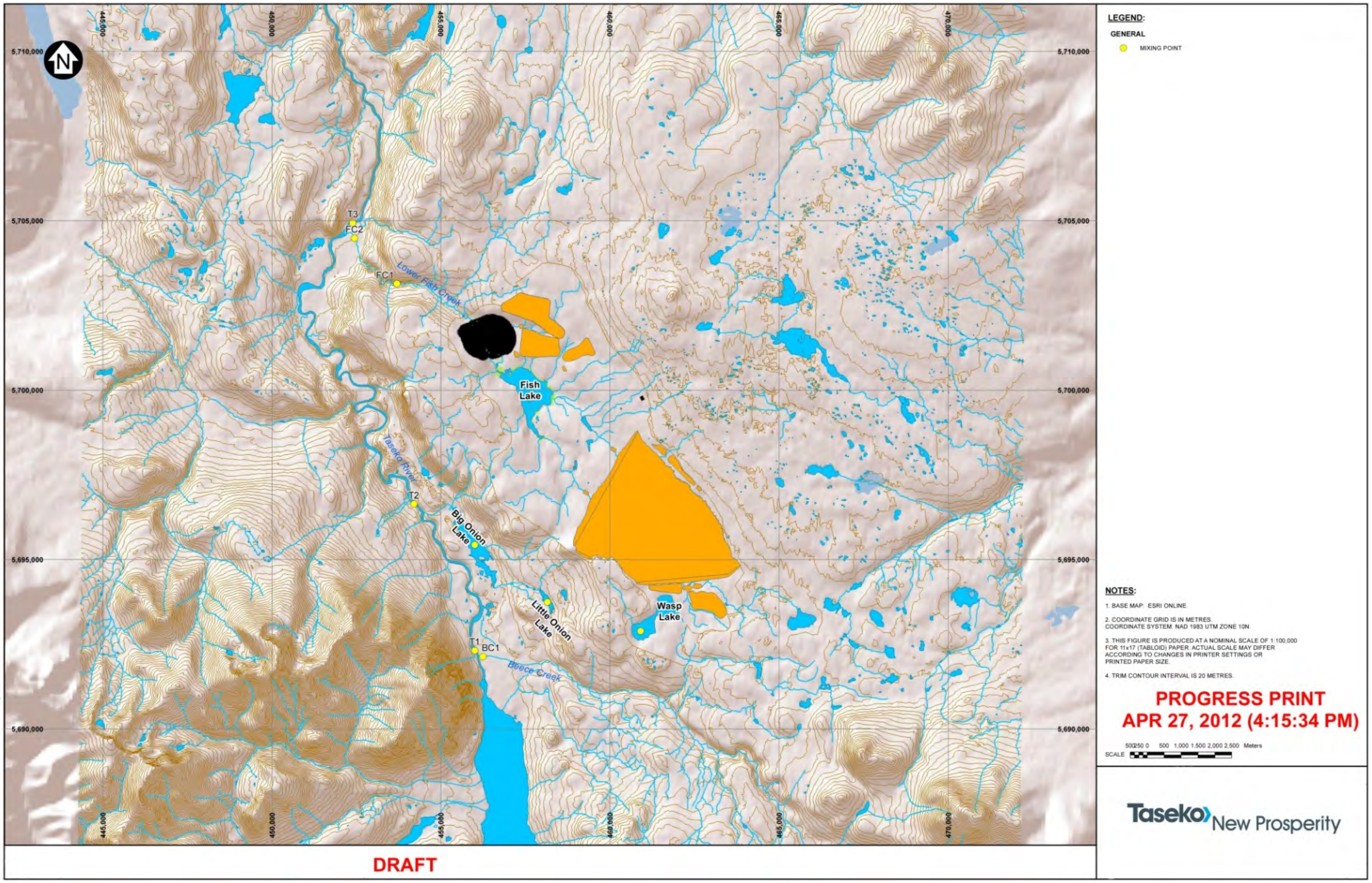


Figure 2.7.2.4B-4 WQ Mixing Points

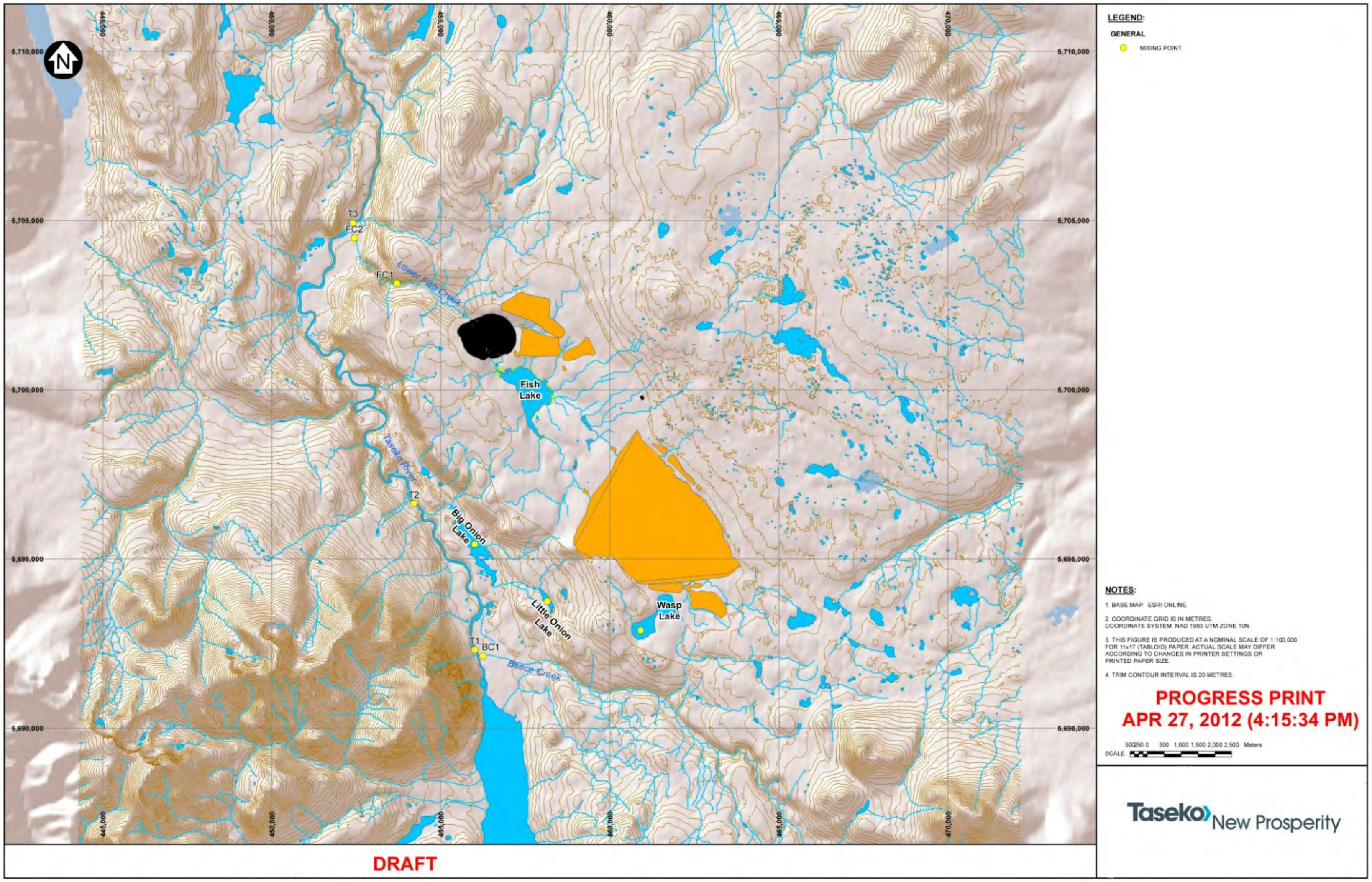


Figure 2.7.2.4B-5 WQ Mixing Points in the Taseko, Chilco, Chilcotin and Fraser Rivers

Model Assumptions

General Assumptions

- Precipitation and evaporation are neutral inputs and outputs; the concentration of dissolved metals, physical parameters and nutrients in precipitation and in evaporate is assumed to be zero.
- Mixing for each model component is instantaneous and complete. Thermal stratification and the effects that would result on surface water reservoirs were not modelled.
- Dissolved components remain in solution.
- The models do not account for attenuation of metals and other parameters due to natural geochemical and biological processes in soils and bedrock.
- Baseline water quality data that were below the limits of detection were applied to the model as background concentrations equal to the detection limit.
- TSF pore water impacts only the groundwater quality and not the flow rate.
- Worst Case refers to pure tailings pore water reaching discharge point with no mixing with natural groundwater.
- Summer is from May to October; winter is from November to April.

Fish Creek Related Assumptions

- Average annual precipitation at 1600 m elevation is assumed to apply to all areas of the Fish Creek basin H4b (0.527 m).
- Assumed runoff coefficient for undisturbed Fish Creek Basin is 0.25.
- The calculated flow rate for the source of Fish Creek (at Pit Lake) also applies to flow rate at baseline water quality site W1 (before Fish Lake).
- The water quality of the Fish Lake catchment runoff is assumed to be equal to W1.
- The Pit Lake overflows into Fish Creek in year 45.

Taseko River Related Assumptions

- Average annual precipitation and runoff coefficient for all points along the Taseko river are assumed to be the same as that in the Fish Creek basin (0.527 m; 0.25).
- Taseko river water quality is assumed to be the same at all points along the river at baseline conditions.
- Monthly runoff flow distribution is assumed to be the same for the Taseko River as for Fish Creek.

-
- Beece Creek Related Assumptions:

- Average annual precipitation at 1860 m elevation is assumed to apply to all areas of the Beece Creek basin H8c (0.708 m).
- Assumed runoff coefficient for undisturbed Beece Creek Basin is 0.6.

<u>Lake Assumptions:</u>

- All lakes are assumed to have constant volume.
- Little Onion Lake baseline water quality is the same as that of Big Onion Lake.
- Surface water quality in the catchment areas of Wasp Lake, Big Onion Lake and Little Onion Lake are the same as that of their respective lake baseline conditions.
- All seepage from the west seepage pond goes to Big Onion Lake and all seepage from the south seepage pond goes to Wasp Lake.
- Seepage pond discharge begins at year 30 and enters the lakes via surface water instantaneously.
- TSF seepage enters Wasp Lake, Little Onion Lake and Big Onion Lake via groundwater seepage in years 30, 50 and 70, respectively.
- Any water quality concentrations for baseline data that are below detection are assumed to be equal to the detection limit.
- Groundwater flow rates into any of the lakes are assumed to be constant.

Schedule

The water quality predictions were modelled from the end of construction through to post-closure, including the modelling assumption regarding TSF discharge to the Fish Lake inlets described previously, with monthly outputs over a 200 year period. During this time, several changes occur at specific years which are noted when analyzing results of the model:

- The operations period was modelled for year 1 to 20, at which time the flow rates for the lakes change because of changing groundwater flow
- TSF pore water mixes with groundwater baseflow and enters Wasp Lake at year 17 and enters Big Onion Lake and Little Onion Lake at Year 50
- Surface water seepage from the south and west seepage collection ponds enters Wasp Lake and Big Onion Lake, respectively, at year 30
- Catchment runoff from Area G is diverted into Wasp Lake at year 31, and
- Pit Lake becomes full and begins to spill into lower Fish Creek at year 45.

Parameters

The parameters considered in the model include dissolved metals, metalloids, and nutrients. Total concentrations and pH were not modelled. The parameters examined in detail were chosen based on the ratio of the parameter concentrations present in the predicted undiluted tailings pore water to the guidelines. Parameters that exceed guidelines in the undiluted pore water include fluoride, sulphate, arsenic, copper, iron, mercury, molybdenum, and selenium. The following parameters have hardness dependent guidelines and were examined in detail, even though the pore water concentrations did not exceed guidelines: cadmium, lead, nickel, silver and zinc. Concentrations of these parameters were higher in the predicted pore water than background conditions but the guidelines were also higher due to high hardness.

Model Output Summary

Modelled results in Tables 2.7.2.4B-16 to 2.7.2.4B-22 were calculated based on the average year water balance scenario. The results have been divided based upon the location (Upper Fish Creek, and, Fish Lake Tributary 1) as well as by season (winter/fall, spring/summer). Corresponding graphical figures are presented in Figures 2.7.2.4B-6 to 2.7.2.4B-12. Again note that the actual graphs presented for the draft EIS are for demonstration purposes only and do not represent final data

Lab detection limits for mercury and selenium can be higher than and equal to the CEQG, depending on the lab report. As a conservative estimate, any concentration reported as being below the lab detection limit was assumed to be equal to the lab detection limit. In the case of mercury and selenium, this has caused some modelled concentrations of these elements to be above the CEQG when they may actually be below the guidelines. The following modelled sites are presented in order from upstream to downstream, starting at Wasp Lake.

Table 2.7.2.4B-16 Predicted water Quality for Fish Creek Mixing Point 1 (µg/L)

	Operation 1 (1 - 16yrs)				Operation 2 (17 - 20yrs)				Closure 1 (21 - 30yrs)				Closure 2 (31 - 40yrs)				Post Closure (40 - 200yrs)			
Row Labels	Max	Mean	Min	StdD	Max	Mean	Min	StdD	Max	Mean	Min	StdD	Max	Mean	Min	StdD	Max	Mean	Min	StdD
Aluminum																				
Fall/Winter																				
Spring/Summer																				
Antimony																				
Fall/Winter																				
Spring/Summer																				
Arsenic																				
Fall/Winter																				
Spring/Summer																				
Barium																				
Fall/Winter																				
Spring/Summer																				
Boron																				
Fall/Winter																				
Spring/Summer																				
Cadmium																				
Fall/Winter																				
Spring/Summer																				
Calcium																				
Fall/Winter																				

Spring/Summer
Chloride
Fall/Winter
Spring/Summer
Cobalt
Fall/Winter
Spring/Summer
Copper
Fall/Winter
Spring/Summer
Fluoride
Fall/Winter
Spring/Summer
Hardness
Fall/Winter
Spring/Summer
Iron
Fall/Winter
Spring/Summer
Lead
Fall/Winter
Spring/Summer
Magnesium
Fall/Winter
Spring/Summer
Manganese
Fall/Winter
Spring/Summer
Mercury
Fall/Winter
Spring/Summer
Molybdenum
Fall/Winter
Spring/Summer
Nickel
Fall/Winter
Spring/Summer
Nitrate Nitrogen
Fall/Winter
Spring/Summer
Nitrite Nitrogen
Fall/Winter
Spring/Summer
pH
Fall/Winter
Spring/Summer
Phosphorus
Fall/Winter
Spring/Summer
Selenium
Fall/Winter
Spring/Summer

Row Labels																				
Silver																				
Fall/Winter																				
Spring/Summer																				
Sulphate																				
Fall/Winter																				
Spring/Summer																				
Thallium																				
Fall/Winter																				
Spring/Summer																				
Uranium																				
Fall/Winter																				
Spring/Summer																				
Zinc																				
Fall/Winter																				
Spring/Summer																				

Table 2.7.2.4B-17 Predicted Water Quality for Fish Creek Mixing Point 2 (µg/L)

	Operation 1 (1 - 16yrs)				Operation 2 (17 - 20yrs)				Closure 1 (21 - 30yrs)				Closure 2 (31 - 40yrs)				Post Closure (40 - 200yrs)			
Row Labels	Max	Mean	Min	StdD	Max	Mean	Min	StdD	Max	Mean	Min	StdD	Max	Mean	Min	StdD	Max	Mean	Min	StdD
Aluminum																				
Fall/Winter																				
Spring/Summer																				
Antimony																				
Fall/Winter																				
Spring/Summer																				
Arsenic																				
Fall/Winter																				
Spring/Summer																				
Barium																				
Fall/Winter																				
Spring/Summer																				
Boron																				
Fall/Winter																				
Spring/Summer																				
Cadmium																				
Fall/Winter																				
Spring/Summer																				
Calcium																				
Fall/Winter																				
Spring/Summer																				
Chloride																				
Fall/Winter																				
Spring/Summer																				
Cobalt																				
Fall/Winter																				
Spring/Summer																				
Copper																				
Fall/Winter																				
Spring/Summer																				
Fluoride																				

	Fall/Winter	
	Spring/Summer	
Hardness		
	Fall/Winter	
	Spring/Summer	
Iron		
	Fall/Winter	
	Spring/Summer	
Lead		
	Fall/Winter	
	Spring/Summer	
Magnesium		
	Fall/Winter	
	Spring/Summer	
Manganese		
	Fall/Winter	
	Spring/Summer	
Mercury		
	Fall/Winter	
	Spring/Summer	
Molybdenum		
	Fall/Winter	
	Spring/Summer	
Nickel		
	Fall/Winter	
	Spring/Summer	
Nitrate Nitrogen		
	Fall/Winter	
	Spring/Summer	
Nitrite Nitrogen		
	Fall/Winter	
	Spring/Summer	
pH		
	Fall/Winter	
	Spring/Summer	
Phosphorus		
	Fall/Winter	
	Spring/Summer	
Selenium		
	Fall/Winter	
	Spring/Summer	
Silver		
	Fall/Winter	
	Spring/Summer	
Sulphate		
	Fall/Winter	
	Spring/Summer	
Thallium		
	Fall/Winter	
	Spring/Summer	
Uranium		
	Fall/Winter	
	Spring/Summer	

Zinc	
Fall/Winter	
Spring/Summer	

Table 2.7.2.4B-18 Predicted Water Quality for Taseko River Mixing Point 1 (µg/L)

Row Labels	Operation 1 (1 - 16yrs)				Operation 2 (17 - 20yrs)				Closure 1 (21 - 30yrs)				Closure 2 (31 - 40yrs)				Post Closure (40 - 200yrs)			
	Max	Mean	Min	StdD	Max	Mean	Min	StdD	Max	Mean	Min	StdD	Max	Mean	Min	StdD	Max	Mean	Min	StdD
Aluminum																				
Fall/Winter																				
Spring/Summer																				
Antimony																				
Fall/Winter																				
Spring/Summer																				
Arsenic																				
Fall/Winter																				
Spring/Summer																				
Barium																				
Fall/Winter																				
Spring/Summer																				
Boron																				
Fall/Winter																				
Spring/Summer																				
Cadmium																				
Fall/Winter																				
Spring/Summer																				
Calcium																				
Fall/Winter																				
Spring/Summer																				
Chloride																				
Fall/Winter																				
Spring/Summer																				
Cobalt																				
Fall/Winter																				
Spring/Summer																				
Copper																				
Fall/Winter																				
Spring/Summer																				
Fluoride																				
Fall/Winter																				
Spring/Summer																				
Hardness																				
Fall/Winter																				
Spring/Summer																				
Iron																				
Fall/Winter																				
Spring/Summer																				
Lead																				
Fall/Winter																				
Spring/Summer																				
Magnesium																				
Fall/Winter																				
Spring/Summer																				
Manganese																				

Fall/Winter
Spring/Summer
Mercury
Fall/Winter
Spring/Summer
Molybdenum
Fall/Winter
Spring/Summer
Nickel
Fall/Winter
Spring/Summer
Nitrate-N
Fall/Winter
Spring/Summer
Nitrite-N
Fall/Winter
Spring/Summer
pH
Fall/Winter
Spring/Summer
Phosphorous
Fall/Winter
Spring/Summer
Selenium
Fall/Winter
Spring/Summer
Silver
Fall/Winter
Spring/Summer
Sulphate
Fall/Winter
Spring/Summer
Thallium
Fall/Winter
Spring/Summer
Uranium
Fall/Winter
Spring/Summer
Zinc
Fall/Winter
Spring/Summer

Table 2.7.2.4B-19 Predicted water Quality for Wasp Lake (µg/L)

	Operation 1 (1 - 16yrs)				Operation 2 (17 - 20yrs)				Closure 1 (21 - 30yrs)				Closure 2 (31 - 40yrs)				Post Closure (40 - 200yrs)			
Row Labels	Max	Mean	Min	StdD	Max	Mean	Min	StdD	Max	Mean	Min	StdD	Max	Mean	Min	StdD	Max	Mean	Min	StdD
Aluminum																				
Fall/Winter																				
Spring/Summer																				
Antimony																				
Fall/Winter																				
Spring/Summer																				
Arsenic																				
Fall/Winter																				

Spring/Summer
Barium
Fall/Winter
Spring/Summer
Boron
Fall/Winter
Spring/Summer
Cadmium
Fall/Winter
Spring/Summer
Calcium
Fall/Winter
Spring/Summer
Chloride
Fall/Winter
Spring/Summer
Cobalt
Fall/Winter
Spring/Summer
Copper
Fall/Winter
Spring/Summer
Fluoride
Fall/Winter
Spring/Summer
Hardness
Fall/Winter
Spring/Summer
Iron
Fall/Winter
Spring/Summer
Lead
Fall/Winter
Spring/Summer
Magnesium
Fall/Winter
Spring/Summer
Manganese
Fall/Winter
Spring/Summer
Mercury
Fall/Winter
Spring/Summer
Molybdenum
Fall/Winter
Spring/Summer
Nickel
Fall/Winter
Spring/Summer
Nitrate-N
Fall/Winter
Spring/Summer
Nitrite-N
Fall/Winter
Spring/Summer
pH
Fall/Winter

Spring/Summer
Phosphorous
Fall/Winter
Spring/Summer
Selenium
Fall/Winter
Spring/Summer
Silver
Fall/Winter
Spring/Summer
Sulphate
Fall/Winter
Spring/Summer
Thallium
Fall/Winter
Spring/Summer
Uranium
Fall/Winter
Spring/Summer
Zinc
Fall/Winter
Spring/Summer

Table 2.7.2.4B-20 Predicted water Quality for Beece Creek Mixing Point #1 (µg/L)

	Operation 1 (1 - 16yrs)				Operation 2 (17 - 20yrs)				Closure 1 (21 - 30yrs)				Closure 2 (31 - 40yrs)				Post Closure (40 - 200yrs)			
Row Labels	Max	Mean	Min	StdD	Max	Mean	Min	StdD	Max	Mean	Min	StdD	Max	Mean	Min	StdD	Max	Mean	Min	StdD
Aluminum																				
Fall/Winter																				
Spring/Summer																				
Antimony																				
Fall/Winter																				
Spring/Summer																				
Arsenic																				
Fall/Winter																				
Spring/Summer																				
Barium																				
Fall/Winter																				
Spring/Summer																				
Boron																				
Fall/Winter																				
Spring/Summer																				
Cadmium																				
Fall/Winter																				
Spring/Summer																				
Calcium																				
Fall/Winter																				
Spring/Summer																				
Chloride																				
Fall/Winter																				
Spring/Summer																				
Cobalt																				
Fall/Winter																				
Spring/Summer																				
Copper																				

Fall/Winter
Spring/Summer
Fluoride
Fall/Winter
Spring/Summer
Hardness
Fall/Winter
Spring/Summer
Iron
Fall/Winter
Spring/Summer
Lead
Fall/Winter
Spring/Summer
Magnesium
Fall/Winter
Spring/Summer
Manganese
Fall/Winter
Spring/Summer
Mercury
Fall/Winter
Spring/Summer
Molybdenum
Fall/Winter
Spring/Summer
Nickel
Fall/Winter
Spring/Summer
Nitrate Nitrogen
Fall/Winter
Spring/Summer
Nitrite Nitrogen
Fall/Winter
Spring/Summer
pH
Fall/Winter
Spring/Summer
Phosphorous
Fall/Winter
Spring/Summer
Selenium
Fall/Winter
Spring/Summer
Silver
Fall/Winter
Spring/Summer
Sulphate
Fall/Winter
Spring/Summer
Thallium
Fall/Winter
Spring/Summer
Uranium
Fall/Winter
Spring/Summer
Zinc
Fall/Winter

Spring/Summer

Table 2.7.2.4B-21 Predicted water Quality for Little Onion Lake (µg/L)

Row Labels	Operation 1 (1 - 16yrs) Max	Mean	Min	StdD	Operation 2 (17 - 20yrs) Max	Mean	Min	StdD	Closure 1 (21 - 30yrs) Max	Mean	Min	StdD	Closure 2 (31 - 40yrs) Max	Mean	Min	StdD	Post Closure (40 - 200yrs) Max	Mean	Min	StdD
Aluminum																				
Fall/Winter																				
Spring/Summer																				
Antimony																				
Fall/Winter																				
Spring/Summer																				
Arsenic																				
Fall/Winter																				
Spring/Summer																				
Barium																				
Fall/Winter																				
Spring/Summer																				
Boron																				
Fall/Winter																				
Spring/Summer																				
Cadmium																				
Fall/Winter																				
Spring/Summer																				
Calcium																				
Fall/Winter																				
Spring/Summer																				
Chloride																				
Fall/Winter																				
Spring/Summer																				
Cobalt																				
Fall/Winter																				
Spring/Summer																				
Copper																				
Fall/Winter																				
Spring/Summer																				
Fluoride																				
Fall/Winter																				
Spring/Summer																				
Hardness																				
Fall/Winter																				
Spring/Summer																				
Iron																				
Fall/Winter																				
Spring/Summer																				
Lead																				
Fall/Winter																				
Spring/Summer																				
Magnesium																				
Fall/Winter																				
Spring/Summer																				
Manganese																				
Fall/Winter																				
Spring/Summer																				
Mercury																				

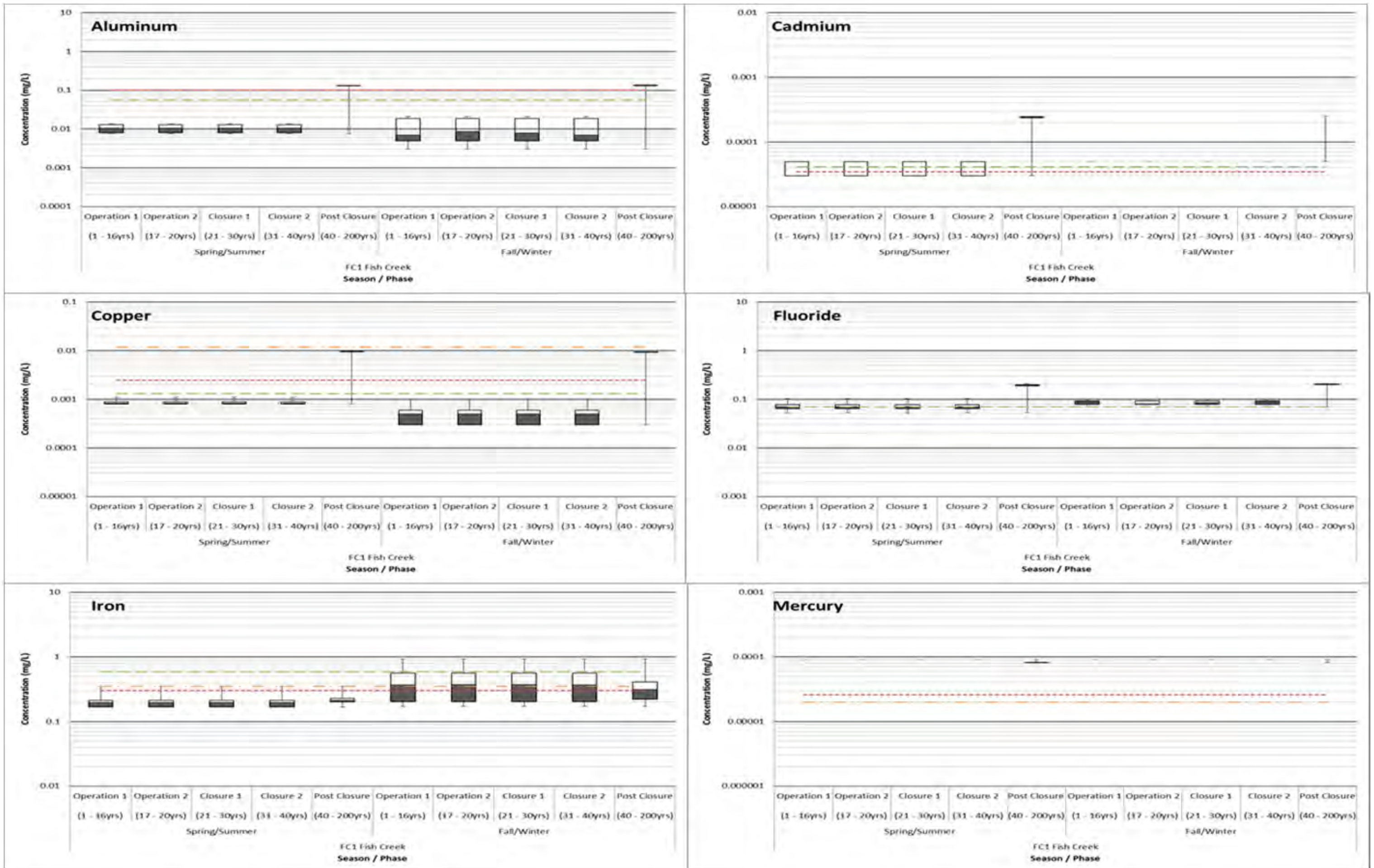
Fall/Winter
Spring/Summer
Molybdenum
Fall/Winter
Spring/Summer
Nickel
Fall/Winter
Spring/Summer
Nitrate Nitrogen
Fall/Winter
Spring/Summer
Nitrite Nitrogen
Fall/Winter
Spring/Summer
pH
Fall/Winter
Spring/Summer
Phosphorus
Fall/Winter
Spring/Summer
Selenium
Fall/Winter
Spring/Summer
Silver
Fall/Winter
Spring/Summer
Sulphate
Fall/Winter
Spring/Summer
Thallium
Fall/Winter
Spring/Summer
Uranium
Fall/Winter
Spring/Summer
Zinc
Fall/Winter
Spring/Summer

Table 2.7.2.4B-22 Predicted water Quality for Big Onion Lake (μg/L)

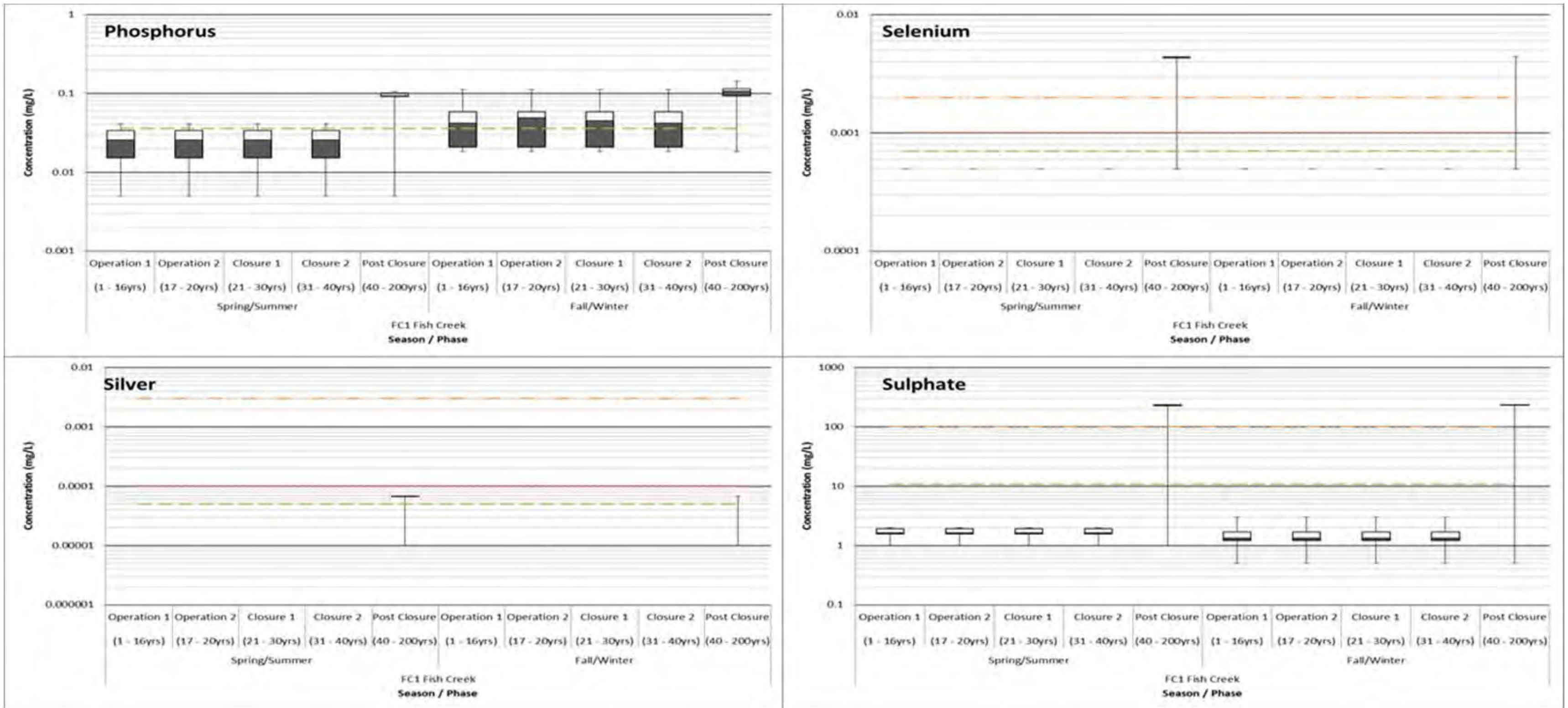
	Operation 1 (1 - 16yrs)				Operation 2 (17 - 20yrs)				Closure 1 (21 - 30yrs)				Closure 2 (31 - 40yrs)				Post Closure (40 - 200yrs)			
Row Labels	**Max**	**Mean**	**Min**	**StdD**	**Max**	**Mean**	**Min**	**StdD**	**Max**	**Mean**	**Min**	**StdD**	**Max**	**Mean**	**Min**	**StdD**	**Max**	**Mean**	**Min**	**StdD**
Aluminum																				
Fall/Winter																				
Spring/Summer																				
Antimony																				
Fall/Winter																				
Spring/Summer																				
Arsenic																				
Fall/Winter																				
Spring/Summer																				
Barium																				
Fall/Winter																				
Spring/Summer																				
Boron																				

Fall/Winter
Spring/Summer
Cadmium
Fall/Winter
Spring/Summer
Calcium
Fall/Winter
Spring/Summer
Chloride
Fall/Winter
Spring/Summer
Cobalt
Fall/Winter
Spring/Summer
Copper
Fall/Winter
Spring/Summer
Fluoride
Fall/Winter
Spring/Summer
Hardness
Fall/Winter
Spring/Summer
Iron
Fall/Winter
Spring/Summer
Lead
Fall/Winter
Spring/Summer
Magnesium
Fall/Winter
Spring/Summer
Manganese
Fall/Winter
Spring/Summer
Mercury
Fall/Winter
Spring/Summer
Molybdenum
Fall/Winter
Spring/Summer
Nickel
Fall/Winter
Spring/Summer
Nitrate-N
Fall/Winter
Spring/Summer
Nitrite-N
Fall/Winter
Spring/Summer
pH
Fall/Winter
Spring/Summer
Phosphorous
Fall/Winter
Spring/Summer
Selenium
Fall/Winter

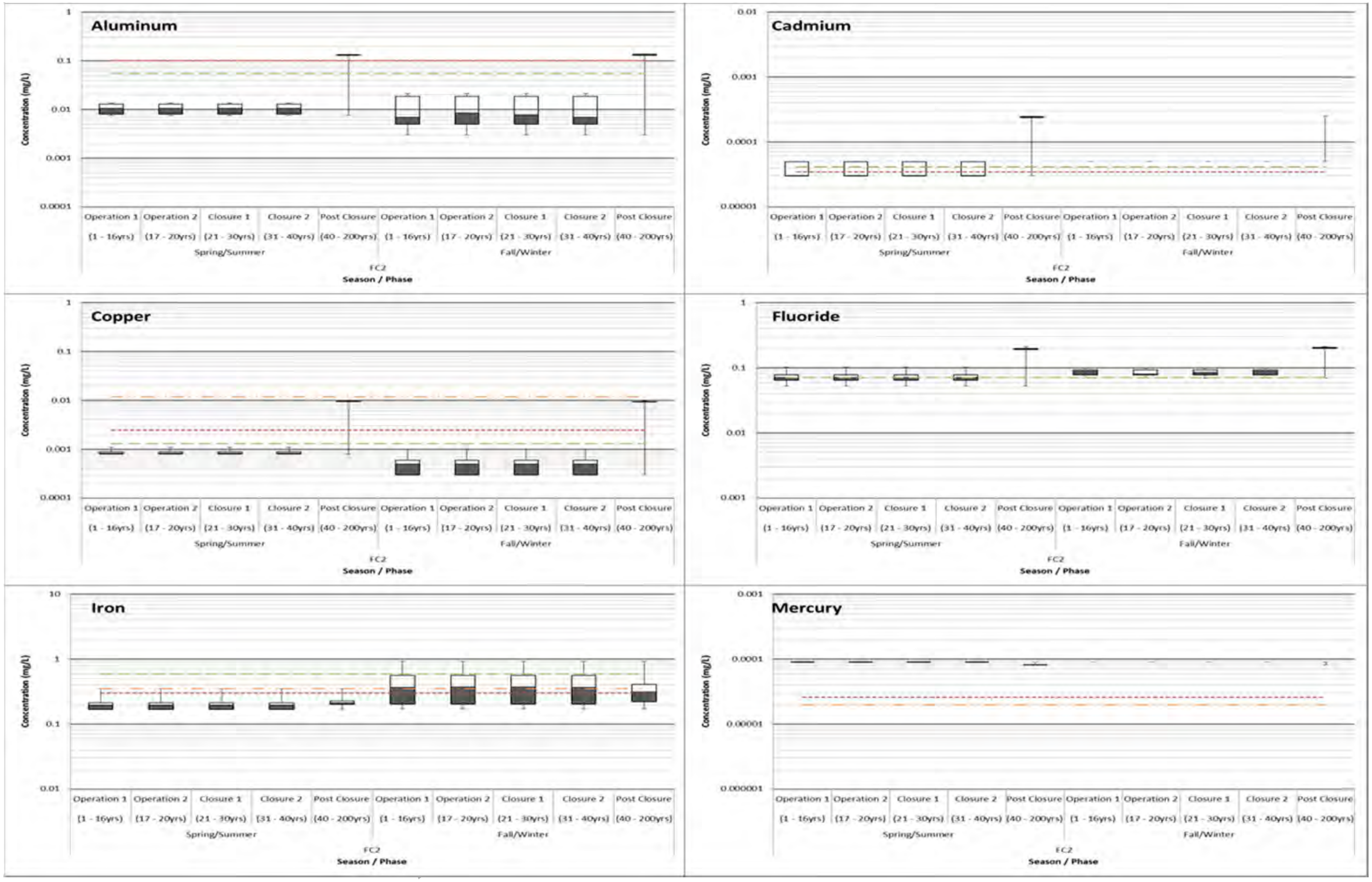
Spring/Sum mer
Silver
Fall/Winter
Spring/Sum mer
Sulphate
Fall/Winter
Spring/Sum mer
Thallium
Fall/Winter
Spring/Sum mer
Uranium
Fall/Winter
Spring/Sum mer
Zinc
Fall/Winter
Spring/Sum mer



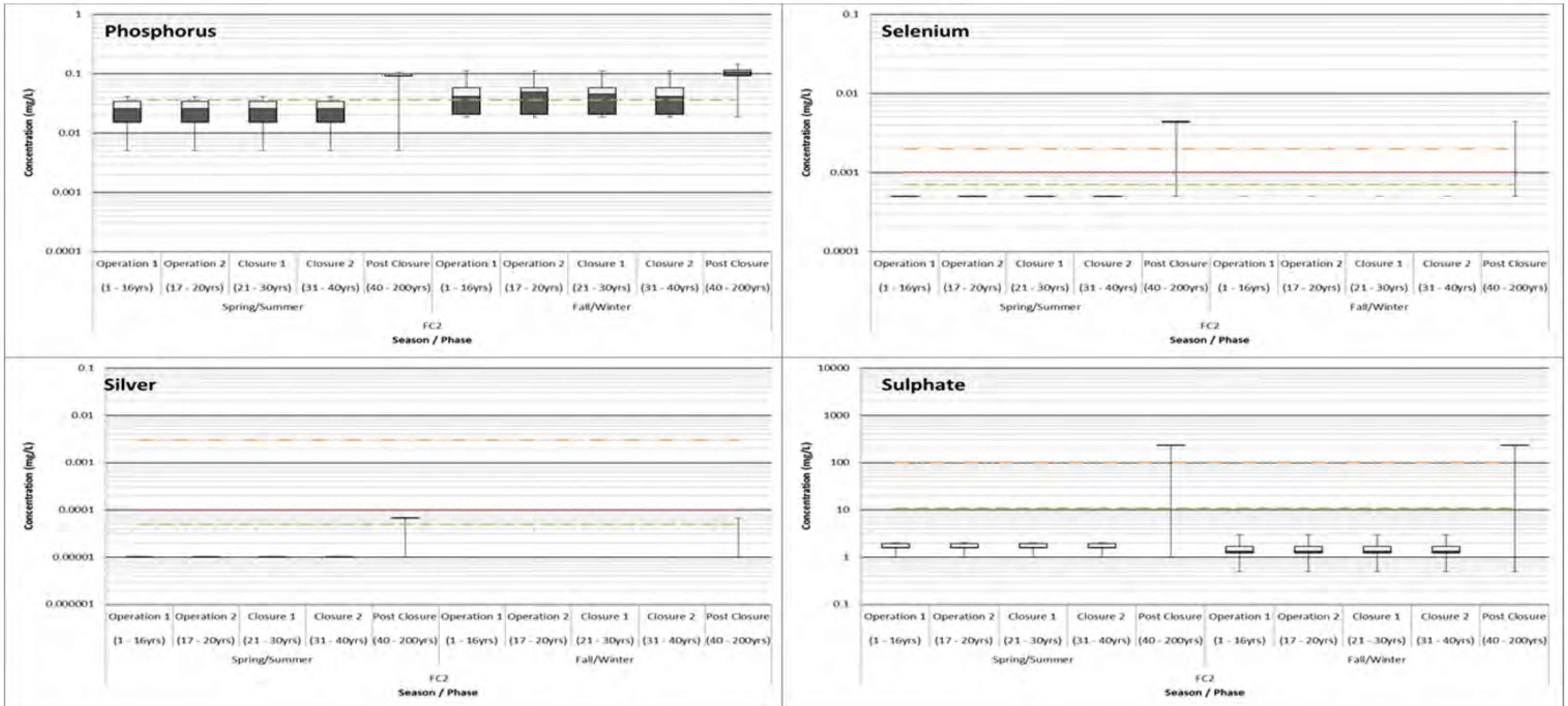
Figures 2.7.2.4B-6 Water Quality Figures for Fish Creek Mixing Point 1 – Red Dashed Line (CCME Guidelines) - Orange Dashed Line (BC WQG) - Green Dashed Line (Baseline)



Figures 2.7.2.4B-6 Water Quality Figures for Fish Creek Mixing Point 1 – Red Dashed Line (CCME Guidelines) - Orange Dashed Line (BC WQG) - Green Dashed Line (Baseline)



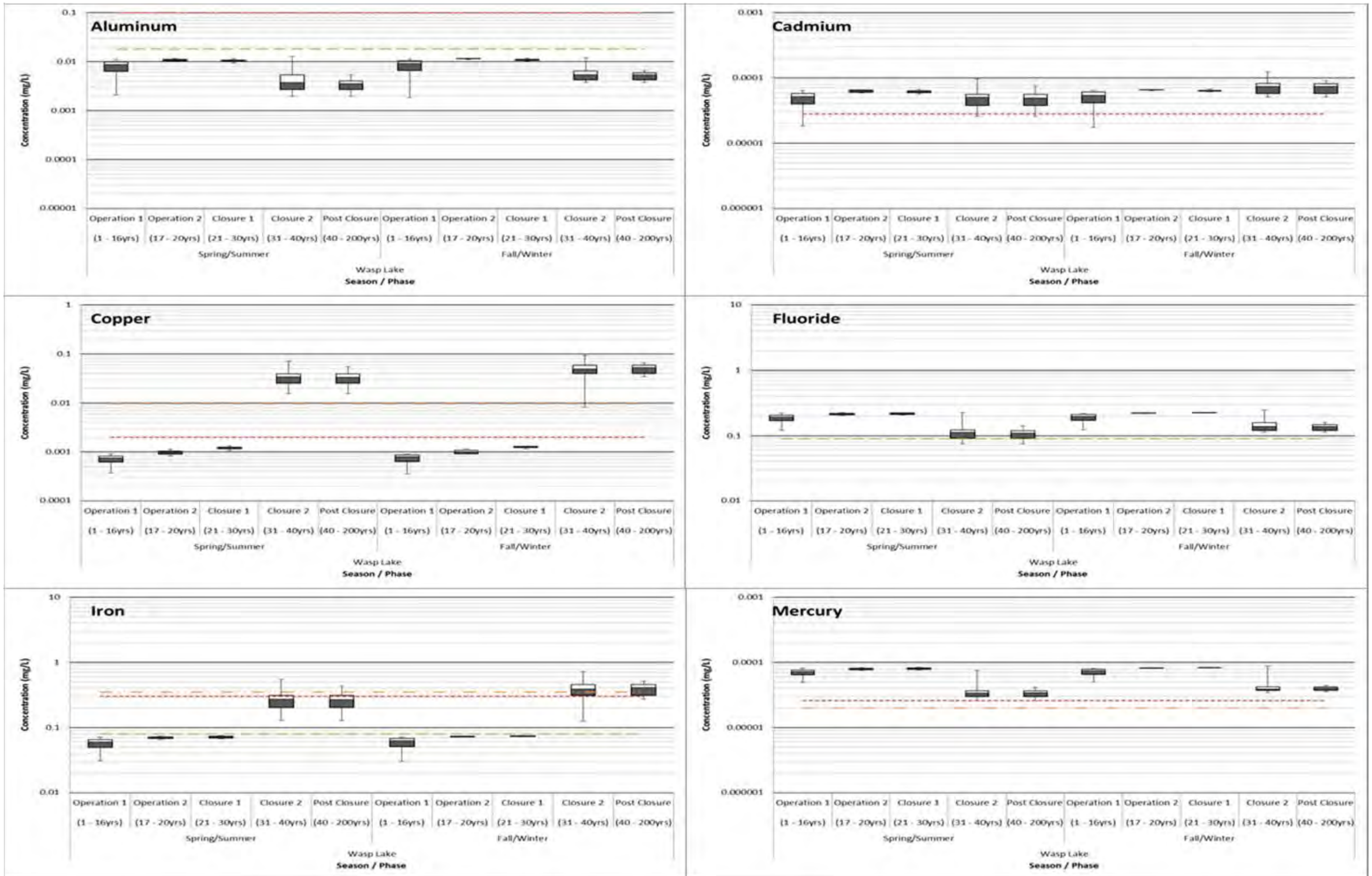
Figures 2.7.2.4B-7 Water Quality Figures for Fish Creek Mixing Point 2 – Red Dashed Line (CCME Guidelines) - Orange Dashed Line (BC WQG) - Green Dashed Line (Baseline)



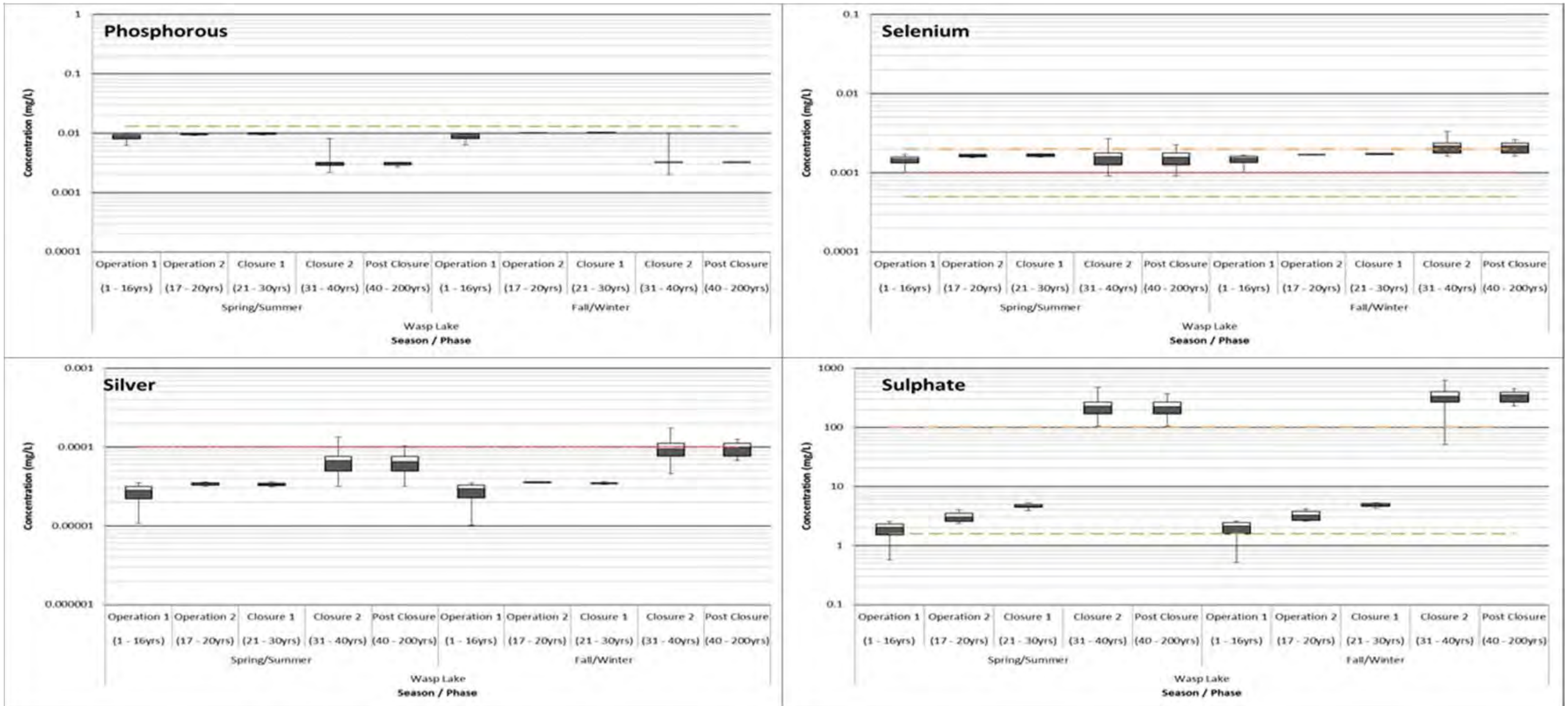
Figures 2.7.2.4B-7 Water Quality Figures for Fish Creek Mixing Point 2 – Red Dashed Line (CCME Guidelines) - Orange Dashed Line (BC WQG) - Green Dashed Line (Baseline)

FIGURE WILL BE INCLUDED IN FINAL EIS SUBMISSION

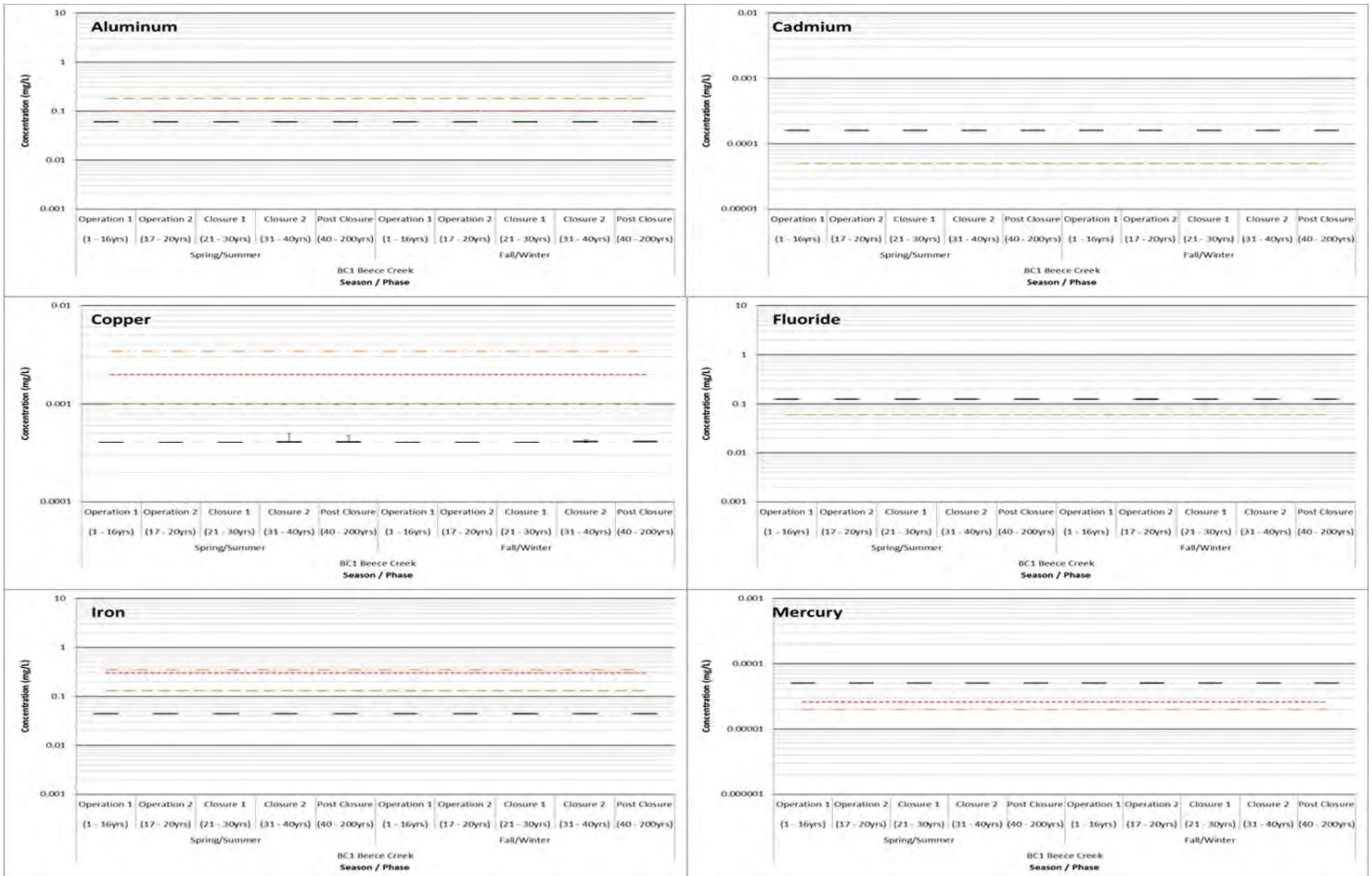
Figures 2.7.2.4B-8 Water Quality Figures for Taseko River Mixing Point 1 – Red Dashed Line (CCME Guidelines) - Orange Dashed Line (BC WQG) - Green Dashed Line (Baseline)



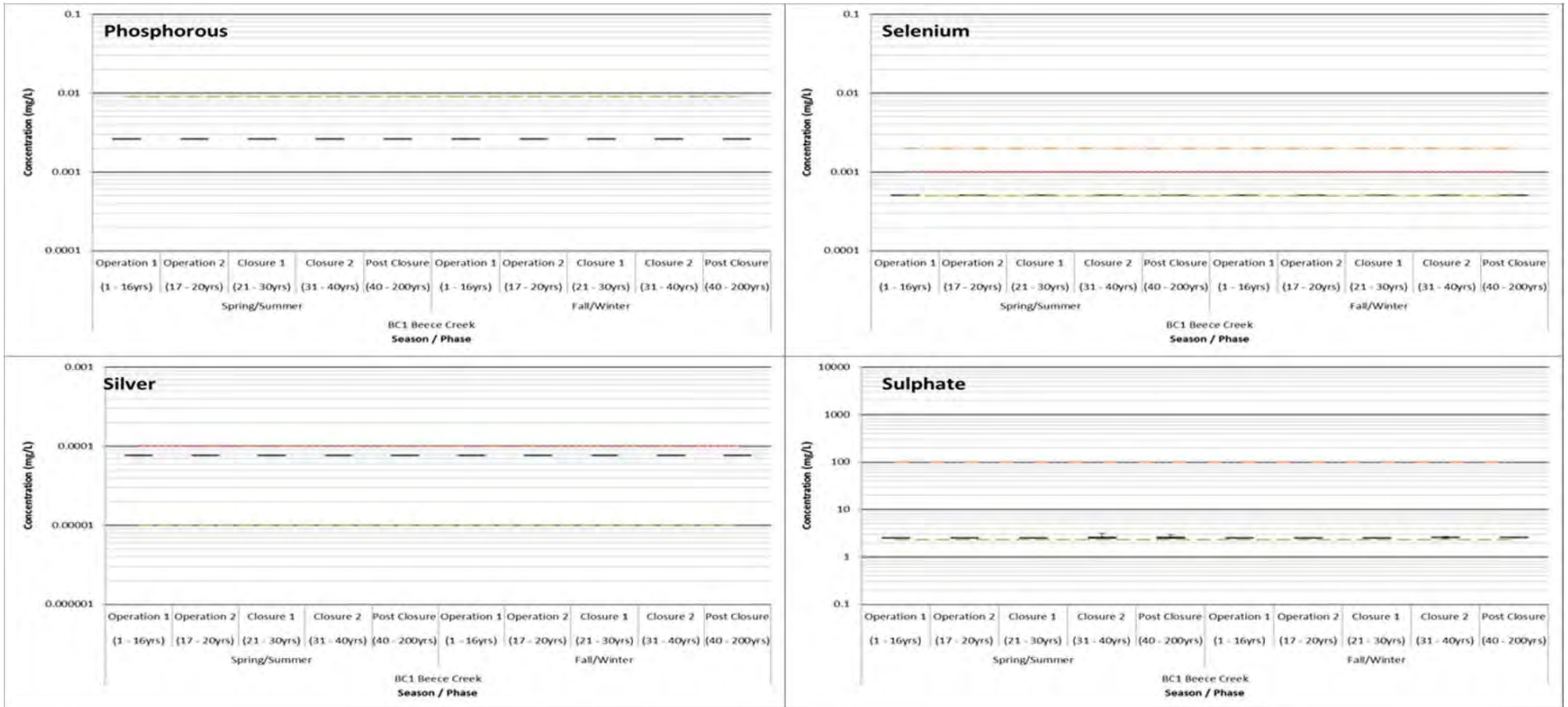
Figures 2.7.2.4B-9 Water Quality Figures for Wasp Lake – Red Dashed Line (CCME Guidelines) - Orange Dashed Line (BC WQG) - Green Dashed Line (Baseline)



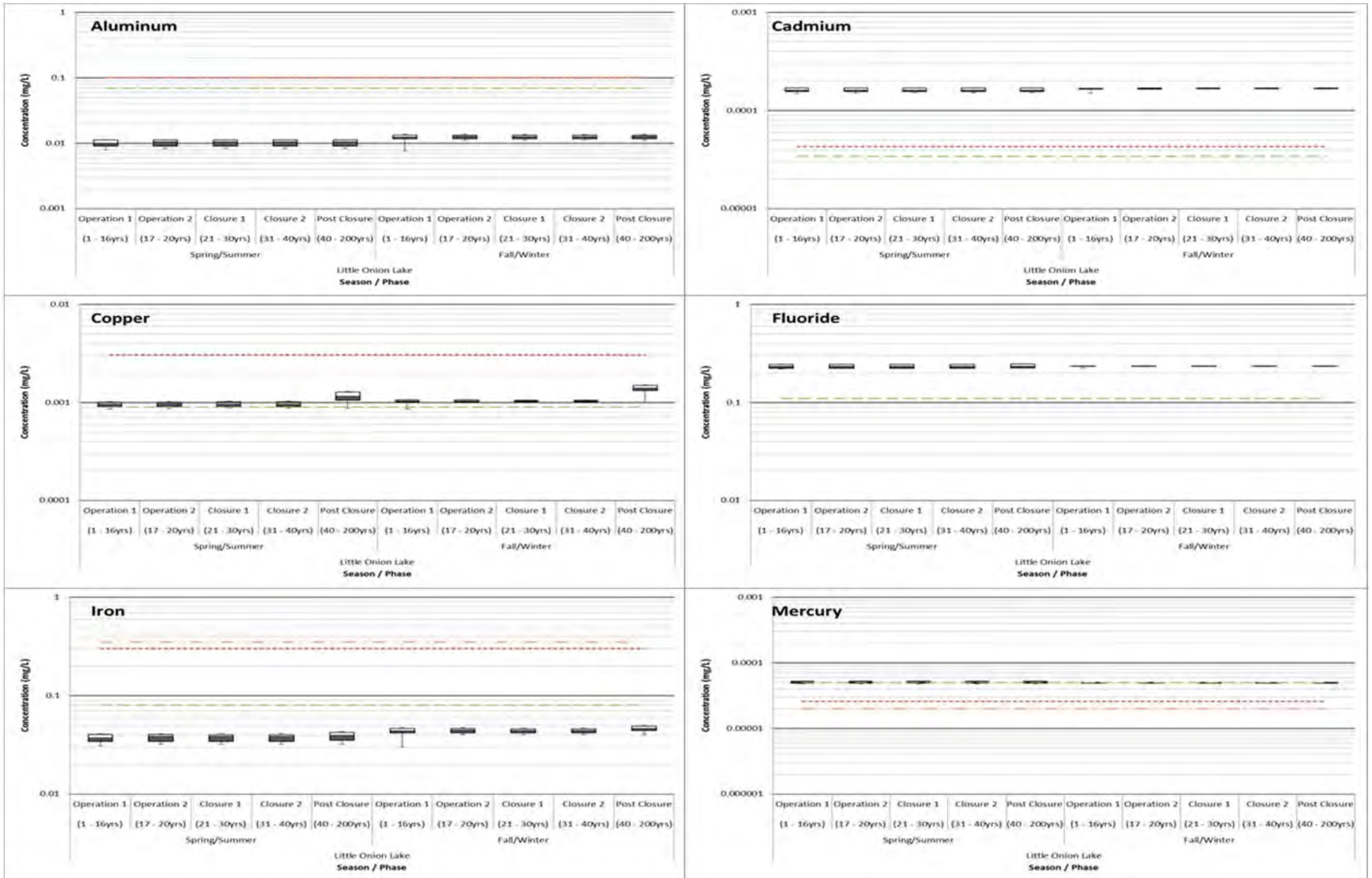
Figures 2.7.2.4B-9 Water Quality Figures for Wasp Lake – Red Dashed Line (CCME Guidelines) - Orange Dashed Line (BC WQG) - Green Dashed Line (Baseline)



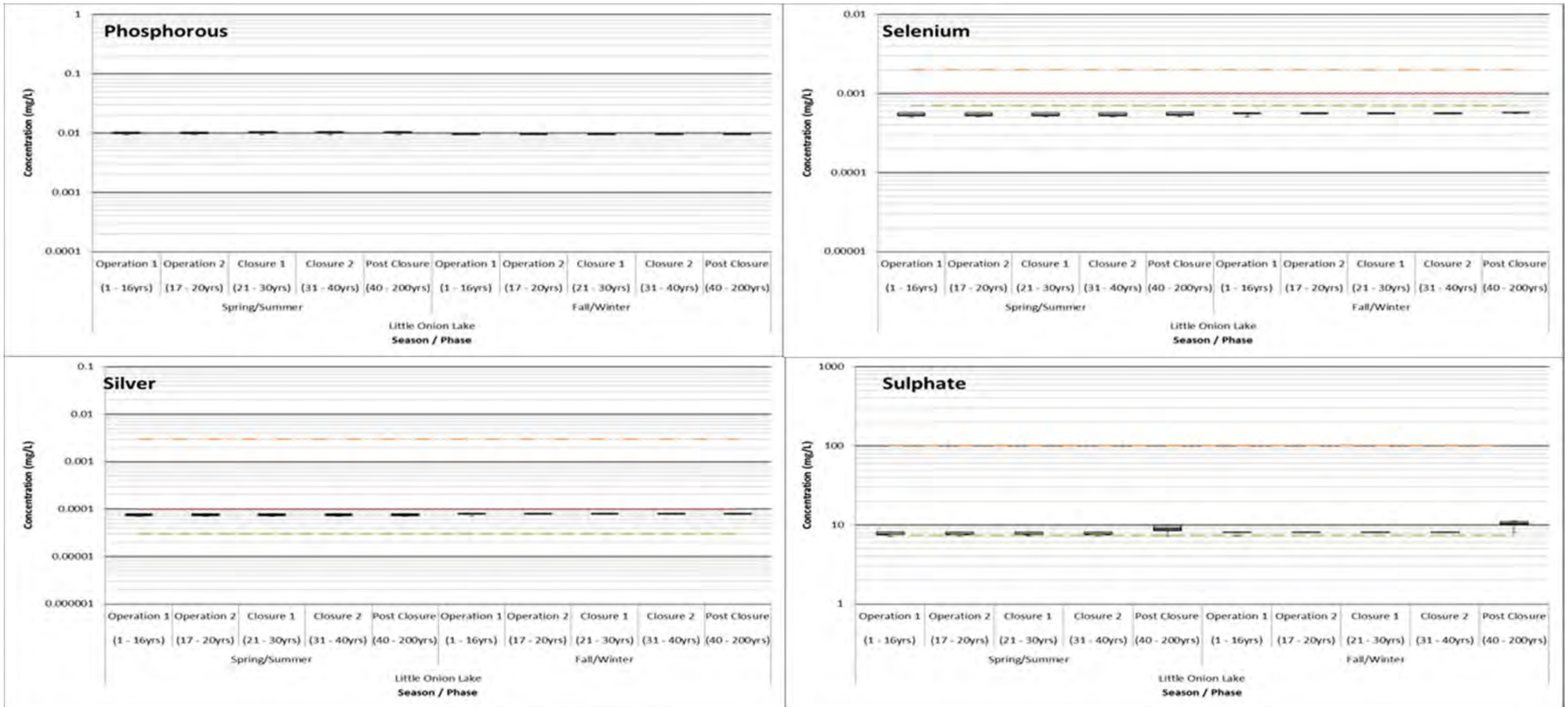
Figures 2.7.2.4B-10 Water Quality Figures for Beece Creek mixing Point 1 – Red Dashed Line (CCME Guidelines) - Orange Dashed Line (BC WQG) - Green Dashed Line (Baseline)



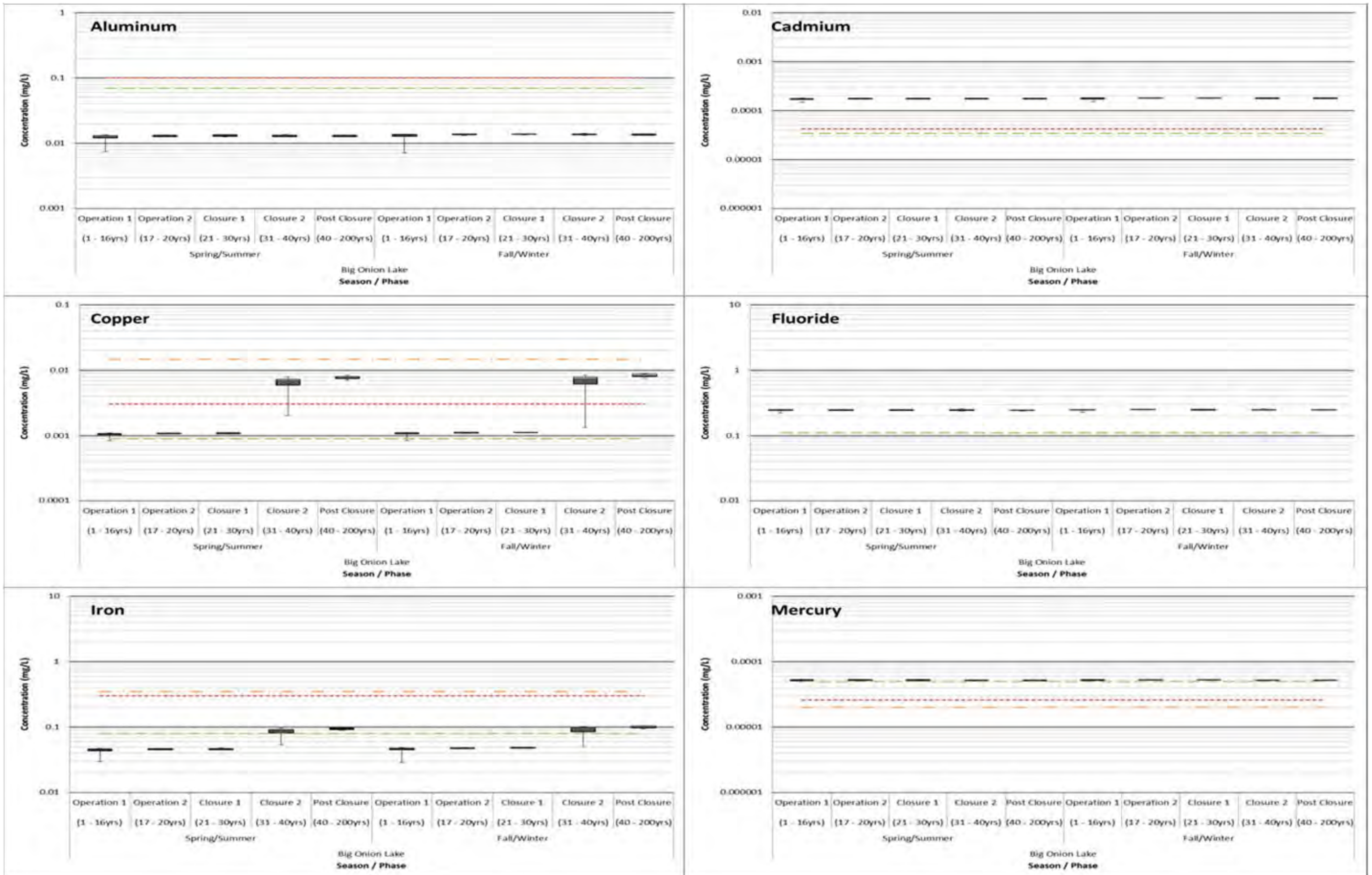
Figures 2.7.2.4B-10 Water Quality Figures for Beece Creek mixing Point 1 – Red Dashed Line (CCME Guidelines) - Orange Dashed Line (BC WQG) - Green Dashed Line (Baseline)



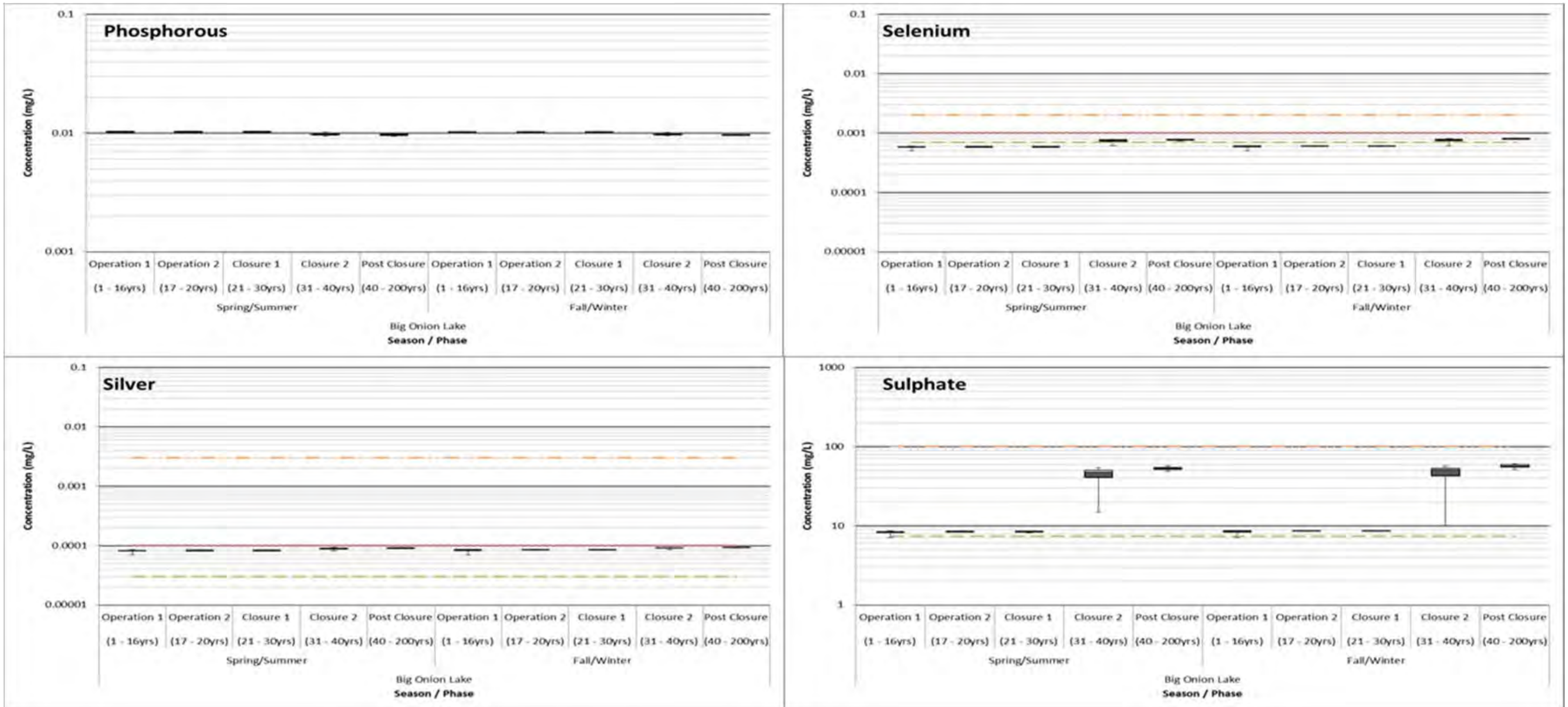
Figures 2.7.2.4B-11 Water Quality Figures for Little Onion Lake – Red Dashed Line (CCME Guidelines) - Orange Dashed Line (BC WQG) - Green Dashed Line (Baseline)



Figures 2.7.2.4B-11 Water Quality Figures for Little Onion Lake – Red Dashed Line (CCME Guidelines) - Orange Dashed Line (BC WQG) - Green Dashed Line (Baseline)



Figures 2.7.2.4B-12 Water Quality Figures for Big Onion Lake – Red Dashed Line (CCME Guidelines) - Orange Dashed Line (BC WQG) - Green Dashed Line (Baseline)



Figures 2.7.2.4B-12 Water Quality Figures for Big Onion Lake – Red Dashed Line (CCME Guidelines) - Orange Dashed Line (BC WQG) - Green Dashed Line (Baseline)

Table 2.7.2.4B-23 Table of Exceedances of Water Quality Guidelines Based on Minimum, Average and Maximum Predicted Concentrations for Years 1 Through 40+ - Lower Fish Creek (If applicable)

Parameter	(Year 1-16)	(Year 17-20)	(Year 21-30)	(Year 31-40)	(Year 40-112)	BC WQG (maximum)	BC WQG (30 d average)	CCME guideline value	CSR Generic Numerical Water Standards
Aluminum (mg/L)						0.1 (dissolved)	0.05 (dissolved)	0.05 to 0.1 (dissolved)	-
Cadmium (mg/L)						0.000022 to 0.00006	-	0.000017	0.0003 to 0.0006
						0.00002 to 0.00006	-		
Copper (mg/L)						0.00776 to 0.01903	0.0024 to 0.0072	0.002 to 0.0039	>0.03
						0.00713 to 0.01987	0.0022 to 0.0076	0.002 to 0.0041	
Flouride (mg/L)						-	-	0.12	3
Iron (mg/L)						0.35 (dissolved)	-	0.3	-

Parameter	(Year 1-16)	(Year 17-20)	(Year 21-30)	(Year 31-40)	(Year 40-112)	BC WQG (maximum)	BC WQG (30 d average)	CCME guideline value	CSR Generic Numerical Water Standards
						1.0 mg/L (total)			
Mercury (mg/L)						Aquatic life: 0.000002 to 0.00002 depending on MeHg %		0.000026 (inorganic) and 0.000004 MeHg	0.001
						Wildlife: 0.00000125 to 0.000002 depending on MeHg % (total)			
Selenium (mg/L)						0.002 (mean)		0.001	0.01
Sulfate (mg/L)						50 (alert level)		-	1,000
						100 (max)			
Silver (mg/L)						0.0015 to 0.003	0.00005 to 0.0001	0.0001	0.0005

Parameter	(Year 1-16)	(Year 17-20)	(Year 21-30)	(Year 31-40)	(Year 40-112)	BC WQG (maximum)	BC WQG (30 d average)	CCME guideline value	CSR Generic Numerical Water Standards
Hardness (mg/L)						No guideline or standards for hardness available although <60 mg/L is considered soft water and >120 mg/L is considered hard water (MELP, 1998)-			

A summary of the average values and associated exceedances for the identified elements spread across the five operational time frames (Years 1 to 16, 17-20, 21-30, 31-40 and 40-112 years) is provided in Table 2.7.2.4B-25.

TABLE WILL BE INCLUDED IN FINAL EIS SUBMISSION

Table 2.7.2.4B-24 Table of Exceedances of Water Quality Guidelines Based on Minimum, Average and Maximum Predicted Concentrations for Years 1 Through 40+ - Taseko River (If applicable)

TABLE WILL BE INCLUDED IN FINAL EIS SUBMISSION

Table 2.7.2.4B-25 Table of Exceedances of Water Quality Guidelines Based on Minimum, Average and Maximum Predicted Concentrations for Years 1 Through 40+ - Wasp Lake (If applicable)

TABLE WILL BE INCLUDED IN FINAL EIS SUBMISSION

Table 2.7.2.4B-26 Table of Exceedances of Water Quality Guidelines Based on Minimum, Average and Maximum Predicted Concentrations for Years 1 Through 40+ - Beece Creek (If applicable)

TABLE WILL BE INCLUDED IN FINAL EIS SUBMISSION

Table 2.7.2.4B-27 Table of Exceedances of Water Quality Guidelines Based on Minimum, Average and Maximum Predicted Concentrations for Years 1 Through 40+ - Little Onion Lake (If applicable)

TABLE WILL BE INCLUDED IN FINAL EIS SUBMISSION

Table 2.7.2.4B-28 Table of Exceedances of Water Quality Guidelines Based on Minimum, Average and Maximum Predicted Concentrations for Years 1 Through 40+ - Big Onion Lake (If applicable)

Comparison of Adjacent Watershed Water Quality Data with Guidelines and Standards

A review and comparison of the predicted water quality in adjacent watersheds was conducted with the following guidelines and standards for purpose of identifying potential adverse effects:

- BC Approved Water Quality Guidelines (updated 2011)
- Compendium of BC Working Water Quality Guidelines (updated 2006)
- CCME Water Quality Guidelines (updated 2011), and
- Contaminated Sites Regulation-Generic Numerical Water Standards (updated 2011).

The data were evaluated in the contexts of six month averages for Year 1 to 16, 17-20, 21-30, 31-40 and 40-112 years. The six month averages were expressed as values predicted for spring/summer and fall/winter. A summary of those elements showing exceedances of current water quality guidelines and/or standards for the 1 to 112 year minimum, maximum, and average values is provided in Table 2.7.2.4B-23 to 2.7.2.4B-28.

Project Effects – Metal Levels in Fish Tissue

This Section will be prepared in the same manner as the fish tissue metal level predictions made in the initial Prosperity EIS (Section 5-2) (Table 2.7.2.4B-29). In addition to considerations of Fish Creek and the Taseko River the assessment will be expanded to include considerations of the fish Lake population of Rainbow Trout.

Table 2.7.2.4B-29 Bioconcentration Factors Used to Predict Metal Accumulation in Fish Tissue Post-closure

Metal	Bioconcentration Factor (L/kg)		Reference
	Fish Creek (mixing point B)	Taseko River (mixing point D)	
Aluminum	28	28	Empirical measurements of fish tissue
Antimony	100	100	Canadian Standards Association (1987)
Arsenic	100	100	Based on trophic level three fish (US EPA 1999)
Cadmium	319	2,197	McGeer et al. (2003)
Chromium	200	200	Canadian Standards Association (1987)
Copper	237	1,043	McGeer et al. (2003)
Lead	77	468	McGeer et al. (2003)
Manganese	34	34	Nussey et al. (1999)
Nickel	124	443	McGeer et al. (2003)
Selenium	170	170	Davis et al. (1993)
Zinc	2,590	22,676	McGeer et al. (2003)

Predictions for Fish Creek and the Taseko River for metal concentrations in fish tissue are contained in Table 2.7.2.4B-30. Predictions were compared with baseline values (ratio of predicted to maximum baseline concentration) and with guidelines and literature values (Table 2.7.2.4B-30). Reliability of the predictions was also assessed by comparing observed baseline levels with predicted baseline levels (i.e., using the bioconcentration factor [BCF] (Table 2.7.2.4B-29) and mean baseline water chemistry to calculate a "predicted baseline").

Table 2.7.2.4B-30 Fish Tissue Metal Concentration Predictions; Fish Creek and Taseko River

Metal[1]	Fish Creek (Mixing Point B)				Taseko River (Mixing Point D)			
	Predicted Post-closure Concentration in muscle or liver tissue (mg/kg ww)		Predicted Worst Case Post-closure/Maximum Baseline		Predicted Post-closure Concentration in muscle or liver tissue (mg/kg ww)		Predicted Worst Case Post-closure/Maximum Baseline	
	Using Worst Case Water Quality	Using Maximum BC WQG	Muscle	Liver	Using Worst Case Water Quality	Using Maximum BC WQG	Muscle	Liver
Aluminum								
Antimony								
Arsenic								
Cadmium								
Chromium								
Copper								
Lead								
Manganese								
Nickel								
Selenium								
Zinc								

NOTES:
Values in bold indicate concentrations above guidelines or reference values for both liver and muscle.
[a] Indicates concentrations within the range of reference values for fish liver, but not for muscle.
No data (–) indicates that most of baseline values were below detection limits or no baseline data (copper).
[1] Predictions for other metals (cobalt, iron, molybdenum, silver and vanadium) were also made, but are not discussed because they were based on very low levels in water or there is insufficient literature from which to make comparisons.
NA indicates that predicted worst case water quality is lower than WQG, so a calculation is not appropriate

Comparison of Predicted Water Quality Data with Guidelines and Standards

A review and comparison of the predicted water quality in Fish Lake was conducted with the following guidelines and standards for purpose of identifying potential adverse effects:

- BC Approved Water Quality Guidelines (updated 2011)
- Compendium of BC Working Water Quality Guidelines (updated 2006)
- CCME Water Quality Guidelines (updated 2011), and
- Contaminated Sites Regulation-Generic Numerical Water Standards (updated 2011).

The provincial and federal water quality guidelines were used as a screening tool to identify parameters recommended for evaluation in the effects assessment. Water quality guidelines are generally developed on the basis of chronic and / or acute toxicity data, with an emphasis on the use of values such as Lowest Observed Effects Levels (LOEL), and, where chronic data are not necessarily available, the lowest available LC_{50} concentrations. The guidelines typically include the application of a safety factor to toxicity data. For example, the province applied a safety factor of 5 to the LOEL of 0.01 mg/L selenium to establish the guideline value of 0.002 mg/L. Similarly, the CCME (2001) applied a safety factor of 10 to the 14-d EC_{50} (for growth using the alga *S. obliquus*) of 50 µg/L (0.05 mg/L); to derive the 5 µg/L (0.005 mg/L) guideline value.Toxicity data are expressed in numerous ways and it is important to understand the terminology as it may relate to the nature of the tests being undertake for which toxicity data is reported. Some of the terms and data reported in the text are shown and defined below:

- LC_{50} – the test concentration that results in the death of 50% of the test organisms. The time period for the tests can be from several hours to days depending on the design of the test. These types of tests are referred to as bioassays.
- EC_{50} – the test concentration that elicits a response in the organisms being tested. The response, timeframes and organisms being used can be variable and the main purpose of the tests is to determine the levels of a substance eliciting adverse responses.
- NOEC – no observed effects concentration or the lowest concentration of a test substance that does not elicit a response.
- NAOEL – no adverse observed effects level or the lowest concentration of a substance that does not elicit an adverse response.

Bioassays may also be acute where mortality is the measure or chronic where longer-term exposures are used to evaluate the adverse effects of substances. As discussed above, the aggregate toxicity data for a particular substance is considered in establishing a guideline level. Normally, the lowest observed effect level of the most sensitive organism is used and an application or uncertainty factor applied to provide the “guideline” level.

Consequently, the important point to note here is that exceedence of a guideline value does not necessarily indicate an “effect” and it is important to consider the magnitude and duration of the exceedence before concluding it will elicit an adverse effect. So, guideline levels are important first steps in identifying the potential for an effect where organisms are exposed to contaminants. There are cases where the natural levels of metals and other elements may be higher than guidelines and where fish and other aquatic organisms function without adverse effects. In these cases, guideline levels may default to the higher natural background concentrations and a procedure for establishing site specific water quality objectives may be considered. Establishing site specific water quality or sediment quality objectives will provide a more accurate and defensible basis for comparing and determining the potential for adverse effects in exposed organisms.

It is also important to note that levels of metals and other elements are often significantly higher than guidelines and where fish and other aquatic organisms function without adverse effects. The tailings facility at the Gibraltar mine is a prime example where rainbow trout thrive in both an operating tailings facility and seepage pond.

Assessment of predicted exceedances

The identified exceedances suggest potential effects on aquatic life as a result of changing water quality**.** Provincial and federal guideline technical documents and additional information available through journals and other information sources was reviewed to compare the predicted concentrations with the results of chronic and acute studies. In addition, the Biotic Ligand Model (BLM) (HydroQual Inc, 2007) was used to evaluate the potential toxicity of the predicted cadmium, copper and silver concentrations in Fish Lake as described in further detail in Appendix x.

The BLM uses published toxicity data for fish and invertebrate species including Rainbow Trout *(Oncorhynchus mykiss)*, *Daphnia magna*, *D. pulex* and *Ceriodaphnia dubia* to predict the toxicity of copper, silver, cadmium (and zinc) relative to the ambient water quality conditions The toxicity of selected metals varies with pH and water hardness. As hardness increases, for example, more calcium (Ca^{++}) is available to compete with free metals for binding sites on the biotic ligand. Similarly, the formation of inorganic and organic ligands[17] can bind metals, reducing their availability for accumulation at the biotic ligand (HydoQual, Inc., 2007). The toxicity is evaluated as metal accumulation at the biotic ligand, a biologically active and/or sensitive receptor, which is considered the site of action for acute toxicity (HydoQual, Inc., 2007). Ultimately, the BLM generates an acute accumulation value at the ligand and an LC50 concentration for the dissolved form of each metal, by species (e.g., copper: Cu2+; CuOH+; Cu(OH)2). The BLM also generates a Final Acute Value (FAV)[18] and proposed water quality guideline for copper, the latter calculated being 50% of the FAV

Application of the BLM was considered appropriate to the evaluation of cadmium, copper and silver specifically because it uses a wider range of parameters to model potential toxicity that are more reflective of processes in the water column that affect the manifestation of responses to toxicants. Although the provincial guideline value for cadmium has been established on the basis of hardness; other parameters like dissolved organic matter (DOM) affect the toxicity of cadmium. CCME (1999) noted the most important factors determining the fate of cadmium in aquatic systems were pH, hardness, redox potential, the type and relative abundance of organic ligands, hydroxides and anions. Similarly, the copper guideline has been established on the basis of hardness, although other parameters like pH and DOM are known to influence the toxicity of copper.

The following sections of the report provide a review of exceedances against specific toxicity data (where available) used to develop the provincial and federal guidelines, an overview of all parameters for which excedances were predicted (emphasizing comparisons with published toxicity data and Toxicity

[17] Ligand - ion or molecule that binds to a metal atom to form a coordination complex

[18] FAV - 5thpercentile of the distribution of 48-96 hr LC_{50} values or equivalent median effective concentration (EC_{50}) value for a given chemical (Stephan et al. 1985)

Reference Values (TRV) / Ecological Screening Values (ESV)[19])and the results of the BLM applied to seasonal average concentrations for the operating Years 1 -16, 17-20, 21-30, 31-40 and 41-112.

Predicted Exceedances in Fish Lake and Comparisons with published toxicity data

As discussed earlier, an exceedence to a guideline may not necessarily mean there has been an effect. This is because guidelines are conservative and have built-in safety factors. Consequently, if a guideline is exceeded it is a signal of concern and should be taken seriously with respect to evaluating water quality and the potential effects of contaminants. In the case of water quality predictions for this project some parameters exceed those for the protection of aquatic life although increases within the magnitude of the safety factor applied would not be expected to lead to an effect. Predicted increases beyond the magnitude of safety factors, however, could lead to adverse effects.

This section reviews the predicted levels (Tabels 10 and 11) in the context of their potential effects not just as an exceedence to guidelines. To accomplish this, predicted water quality in Fish Lake was compared with the toxicity data used by the Provincial and Federal agencies for establishing water quality guidelines. Comparisons were made with the predicted minimum, average and maximum values for Years 1 through 112, and for the five individual operating periods extending out to year 112 (i.e. Years 1-16, 17-20, 21-30, 31-40 and 40-112.

This approach provides more insight into the relevance of the predicted levels because comparisons are being made with data from actual published studies. Based on this approach the predicted maximum concentrations of Cd, Cu, SO_4 and Ag were above the toxicology data used, in part, to establish the guidelines (Table 2.7.2.4B-31 and Table 2.7.2.4B-32). Discussions for all parameters showing some exceedences to guidelines (Tables 2.7.2.4B-10 and Table 2.7.2.4B-11) including those below in Tables 33 and 34 are provided. Cd, Cu and Ag exceedences are discussed further in the section describing the application of the Biotic Ligand model (Technical Appendix XX). Please note the discussion of the relevance of predicted levels pertains to the predictions made without any water treatment or other mitigation measures being applied.

[19] Used in the Savannah River Site (SRS) environmental remediation program in Region IV of the US ; included a detailed information review to derive the TRV/ESV values

Table 2.7.2.4B-31 Summary of exceedances (Year 1 through 112) compared with toxicity or other data used to establish guidelines

Parameter (mg/L)	Predicted min	Predicted max	Predicted avg	Toxicity or other data used to establish provincial guideline	Toxicity or other data used to establish federal guideline
Cadmium				-	LOEL of 0.00017 mg/L for *Daphnia magna* (Biesinger and Christensen 1972)
Copper				-	0.002 mg/L minimum in all cases - Demayo and Taylor, (1981)
Sulfate				LC_{50} 100 mg/L for *Fontinalis antipyretica* (Frahm, 1975)	CCME guidelines available for livestock watering only (1,000 mg/L)
				96-h LC50 for *Hyalella* in soft, medium and hard water: 205, 3711, and 6,787 mg/L SO_4	
				2, 3, and 4 day LC_{50} of 2000, 1000, 500, and 250 mg/L for *Morone saxitilus* larvae	
				2, 3, and 4 day LC_0 (no effect) of 500, 100, 100, and 100 mg/L for *Morone saxitilus* larvae	
Silver				Hardness >100 mg/L (chronic) 0.0039 mg/L (Nebeker et al., 1983)	
				Hardness <100 mg/L (acute) 0.00039 mg/L (Lemke, 1981)	

Parameter (mg/L)	Predicted min	Predicted max	Predicted avg	Toxicity or other data used to establish provincial guideline	Toxicity or other data used to establish federal guideline
				Hardness <100 mg/L (chronic) 0.0001 mg/L (Davies & Goettl, 1978)	
				Hardness <100 mg/L (NOEL) 0.00006 mg/L (Davies & Goettl, 1978)	

Source information
CCME factsheets (cadmium, fluoride, mercury); CCME Summary Table of Water Quality Guidelines (May 2012)
AMBIENT WATER QUALITY CRITERIA FOR SILVER (Warrington, 1996)
Ambient Aquatic Life Guidelines for Iron - Overview Report (MOE, 2008)
Ambient Water Quality Guidelines for Selenium - Overview report (MOE, 2001)
Ambient Water Quality Guidelines for Sulphate - Overview report (MOE, 2000)
Ambient Water Quality Criteria for Fluoride (Warrington, 1995)

TABLE WILL BE INCLUDED IN FINAL EIS SUBMISSION

Table 2.7.2.4B-32 Summary of exceedances in Fish Lake (Years 1-16, 17-20-21-30, 31-40 and 40-112 compared with toxicity or other data used to establish guidelines

In progress (section will identify/compare average predicted values for the five operating periods with available toxicity data specifically used to establish guidelines)

Aluminum

The predicted maximum of xxx mg/L is above the 0.087 mg/L TRV / ESV, reflective of the chronic benchmark established for aluminum in surface water and the US EPA National Ambient Water Quality Criteria (NAWQC)[20]. It is also above Neville's (1985) no observed effect concentration (NOEC) of 0.075

[20] As outlined in APPENDIX A Summary of Data for Environmental Media Ecological Risk Assessment for the Standard Mine Site Addendum

mg/L for Rainbow Trout at 6.5 pH and represents xx% of LC_{50} concentration of 0.6 mg/L at pH 8.0 to 8.6 derived by Gunderson (1994). None of the average levels for spring/summer (xxx to xxx mg/L) or fall/winter (xxx to xxx mg/L) exceeded any of the toxicity data reviewed as part of this assessment. Additional details and summary tables of toxicity data referenced in this section may be found in the technical appendix (Appendix x).

Cadmium

Background concentrations of cadmium in Canadian waters range from <0.0001 mg/L to 0.122 mg/L (CCME, 1999). The total cadmium guideline values for Fish Lake using minimum, average and predicted hardness values of 40.318 mg/L, 136.726 mg/L and 262.982 mg/L would be as follows:

- xxx ug/L (0.000015 mg/L) @ hardness 40.318 mg/L
- xxx ug/L (0.000043 mg/L) @ hardness 136.726 mg/L
- xxx ug/L (0.000076 mg/L) @ hardness 262.982 mg/L

The maximum and average levels predicted for Cd are xxx mg/L and xxx mg/L and both are above the calculated guidelines. These predicted values are, however, below the cadmium chronic screening value of 0.00066 mg/L (NAWQC, and the average is also below the Oakridge National Laboratory (ORNL) lowest chronic value for *Daphnids* of 0.00015 mg/L. Predicted seasonal averages also exceed some of the calculated guideline levels but were below LOELs in studies conducted with rainbow trout such as 200h LC50 and LC10 bioassays as well as a 90 week exposure investigating growth and survival (Chapman, 1978; Brown et al., 1994). .

Copper

Like cadmium, the provincial working water quality guidelines for total copper are based on hardness and are calculated with the equations shown below:

30 day average Total Cu µg/L	Instantaneous maximum Total Cu µg/L
≤0.04 x (mean hardness) @ ≥50 mg/L hardness	(0.094 x hardness+2) at any hardness concentration

The predicted average copper of xxx mg/L (Table 2.7.2.4B-11) exceeds the 30 day guideline value of 0.002 mg/L total copper at ≤50 mg/L hardness. The predicted average hardness in the lake is 136.728 mg/L, resulting in a guideline value of 0.00547 mg/L. This concentration is xxx times above the predicted average copper and several times above the predicted seasonal averages over the period Years 1-112 (Table 2.7.2.4B-10). The maximum predicted copper concentration (xxx mg/L) also exceeds the 30 day guideline value of 0.0105 mg/L[21]. but it does not exceed the instantaneous maximum value of 0.0267 mg/L calculated with the maximum predicted hardness of 262.982 mg/L. The average copper values are below the TRV/ESV value of 0.00654 mg/L but above the ORNL lowest chronic value of 0.00023 mg/L for

[21] The predicted maximum copper concentration has been compared to the 30 day guideline as the predicted maximum concentrations may occur for period of time >30 days

Daphnids (reported in Suter and Tsao, 1996; Appendix x). Additional examples of published copper toxicity data are provided in in the technical appendix (Appendix x).

Fluoride

The CCME Fluoride (F) guideline of 0.120 mg/L was derived by applying a safety factor of 100 to the lowest acceptable adverse effect level of 11.5 mg/L for caddisfly (*Hydropsyche bronta)* (144-h LC_{50}) (Camargo et al., 1992; Camargo, 1996). The predicted maximum concentration of 0.xxx for F (Table 2.7.2.4B-11) is close to the CCME guideline value of 0.12 mg/L. The predicted value is ≥ 4 times below some of the lowest EC50 toxicity values for *Daphnia magna* in 48h EC50 bioassays (Fieser et al., 1986) and ≥14 times below some of the lower LC_{50} results for Rainbow Trout (Neuhol & Sigler, 1960; Pimentel and Bulkley, 1983; Appendix x).

Iron

The provincial guidelines for iron were revised in 2008, bringing the total iron guideline up to 1 mg/L and introducing a dissolved iron guideline of 0.35 mg/L. The Ministry of Environment (MOE, 2008) established the dissolved iron guideline using the lowest 96-hour LC_{50} value reported by the BC Ministry of Environment in their toxicity testing. This concentration was 3.5 mg/L for *Hyalella*[22] in soft water and was supported with an additional LC_{50} value of 3.6 mg/L for *Selenastrum*[23] (MOE, 2008). The provincial water quality guideline value was established by dividing the LC_{50} of 3.5 mg/L by a safety factor of 10. The predicted average and maximum concentrations of xxx mg/L and xxx mg/L are ≥xxx times lower than the LC_{50} of 3.5 mg/L reported for *Hyallela*. The maximum concentration is, however, above an ESV of 1 mg/L and the ORNL lowest chronic value of 0.158 mg/L for *Daphnids* (NAWQC; Suter and Tsao, 1996). .

Mercury

The CCME (2003) reports mercury concentrations in natural waters ranging from <1 ng/L to 20 ng/L (<0.000001 mg/L to 0.000020 mg/L), with methylmercury (MeHg) generally <1 ng/L. Wetland drainage areas appear to have higher concentrations of MeHg (mean of 0.626 ng/L) than watersheds without wetlands (mean of 0.03 ng/L) (CCME, 2003). Levels of 20 ng/L have been reported for humic lakes (Meili, 1997).

The predicted maximum and average levels of mercury over years 1-112 of the project exceed guidelines. Interpreting the significance of predicted Hg levels is complicated by the fact the predictions do not provide an estimate of the percent methylmercury. Guideline levels are lower the greater the percent of methylmercury and for discussing the relevance of the predicted data it is only possible to refer to date pertaining to inorganic mercury.

Reported 24- to 96-h LC50 concentrations for inorganic Hg range from 0.005 mg/L to 5.6 mg/L in invertebrates and 0.150 mg/L to 0.900 mg /L in fish (Biesinger and Christensen, 1972; Call et al., 1983; Rehwoldt et al., 1973; Wobeser, 1975 in CCME, 2003). Chen and Lin (1997) reported 24-h LC50s from 0.009 to 0.027 mg/L inorganic Hg. Acute toxicity for MeHg reported by Thomas and Montes 1978; Wobeser 1975 for MeHg ranged from 0.024 mg/L to 0.125 mg/L in fish and from 0.0035 mg/L to 0.0063 mg/L in algae. EC50s derived by Biesinger et al. 1982; McKim et al. 1976; Spehar and Fiandt 1986

[22] *Hyallela*: amphipod crustacean, fresh and brackish waters
[23] *Selenastrum*: algae species

(CCME, 2003) ranged from 0.00004 mg/L to 0.00114 mg/L for invertebrates and 0.00093 mg/L to 0.063 mg/L in fish.

The CCME MeHg guideline is based on the Biesinger et al. 1982 study which reported MeHg concentrations ranging from 0.00004 mg/L to 0.00026 mg/L resulted in a significant decrease in the production of Daphnia magna young (CCME, 2003). A safety factor of 10 was applied to the LOAEL of 0.00004 mg/L to derive the MeHg guideline of 4 ng/L (0.000004 mg/L). The CCME's inorganic mercury guideline is 0.000026 mg/L and is based on an LOAEL of 0.00026 mg/L reported for juvenile fathead minnow. The predicted maximum mercury of xxx mg/L is xxx times lower than the LOAEL of 0.00026 mg/L reported by Snarski and Olson (1982) in CCME (2003).

Selenium

MOE (2001) reports total selenium concentration in rivers and streams is typically <0.001 mg/L. The current provincial guideline value is 0.002 mg/L, which is based on the lowest observed effect level (LOEL) of 0.01 mg/L with an applied safety factor of 5. Examples of chronic toxicity testing results on freshwater invertebrates are provided in Appendix x. Levels from 0.002 mg/L to 0.025 mg/L for chironomids exposed to selenate / selenite at a 60:40 ratio showed decreased abundance, and LC_{50} values ranged from 1.87 to 2.0 mg/L for *Daphnia magna* exposed to selenite (MOE, 2001). Leveles exhibiting chronic toxicity in Rainbow Trout using selenite / selenite ranged from 0.012 mg/L (30, 60 and 90-d, growth effects) to 5 mg/L (28-d EC_{50}, mortality, deformity).

The predicted average (Table 2.7.2.4B-10) selenium concentration is xxx times below the LOEL of 0.01 mg/L used by MOE to establish the guideline. The maximum concentration of xxxmg/L (Table 2.7.2.4B-11) is xxx times below the LOEL of 0.01 mg/L. It is also below the reported range of chronic toxicity values for Rainbow Trout (0.012 mg/L to 5 mg/L) but does exceed the lowest reported test concentration of 0.002 mg/L for chironomids and *Eurycercus lamellatus* (513-d, decrease in abundance). The predicted concentrations are below the 0.005 mg/L TRV/ESV, based on the Final Chronic Value derived by the EPA (Appendix x)..

Sulphate

The maximum predicted sulphate in Fish Lake is xxx mg/L, which is above the provincial maximum guideline of 100 mg/L. This guideline reflects a safety factor of 2:1 in soft water and provides a greater safety factor in waters with increased hardness (MOE, 2000). The 100 mg /L guideline was derived, in part, from the Frahm (1975), study which generated an LC_{50} of 100 mg/L for the aquatic moss *Fontinalis antipyretica* using potassium sulphate (K2SO4). Davies (2006) conducted 21 day studies on sulphate toxicity (as Na_2SO_4) to *Fontinalis antipyretica* using concentrations of 200 mg/L to 1,500 mg/L in soft water (19 mg/L) and medium hard water (105 mg/L) and reported effects on Chlorophyll *a* and *b* first noted at 400 mg/L. Davies suggested the 2006 study indicated *Fontinalis antipyretica* was more tolerant of sulphate than the BC Approved Water Quality guideline suggested, noting the toxicity of 100 mg/L derived in the Frahm 1975 study was more likely due to the potassium (K) than the sulphate. No observed effects concentrations (NOEC) of 1,060 mg/L derived for *Hyallela azteca* (survival) and *Ceriodaphnia* (survival/reproduction) and rainbow trout (embryo test) have been reported withLC_{50} values ranging from 205 mg/L for *Hyallela* to 5,000 mg/L for rainbow trout (MOE, 2000). The maximum predicted sulphate values (Table 2.7.2.4B-11) are below the lowest LC_{50} value of 205 mg/L reported for *Hyallela* and below reported value of 400 mg/L for reduced shoot growth and Chlorophyll *a* and *b* (Davies, 2006) for *Fontinalis antipyretica*. Predicted seasonal averages (Table 2.7.2.4B-10) of sulphate indicate the guidelines will not be exceeded until the post closure phase years 40-112.

Silver

The maximum predicted silver concentration of xxx mg/L (Table 13) is above the no observed effects level (NOEL for eyed eggs) of 0.00003 mg/L to 0.00006 mg/L reported by Davies and Geottl (1978) but below the 21 day NOEL (reproduction) of 0.0016 mg/L, 0088 mg/L and 0.02 mg/L for *Daphnia magna* reported by Nebeker 1982. Silver predictions were above the TRV/ESV of 0.000012 mg/L based on the chronic AWQG derived for EPA Region IV. None of the predicted seasonal average levels were above guidelines for any operational phase.

Results of Biotic Ligand Modelling (BLM) for Predicted Copper, Cadmium and Silver in Fish Lake

The BLM was applied to copper, cadmium and silver using the original minimum, maximum and average predicted values across all years, and the seasonal average concentrations for the operating Years 1 -16, 17-20, 21-30, 31-40 and 41-112. A detailed discussion of the BLM is provided in Technical Appendix X, however a brief summary is provided here. The BLM predicts the toxicity of selected metals (copper, cadmium, silver and zinc) in the context of ambient water quality conditions as shown in Table 2.7.2.4B-33.

Table 2.7.2.4B-33 BLM Input Parameters are Limiting Ranges

Parameter	Model Input Range
Temperature °C	10°C to 25°C
pH	4.9 - 9.2
Dissolved organic carbon	0.05 mg/L to 29.65 mg/L
Dissolved inorganic carbon	0.056 mg/L to 44.92 mg/L
Humic Acid Content (%)	10% to 60%
Calcium (Ca)	0.204 mg/L to 120.24 mg/L
Magnesium (Mg)	0.024 mg/L to 51.9 mg/L
Alkalinity	1.99 mg/L to 360 mg/L
Nitrate (NO_3)	0.0013 mg/L to 1.65 mg/ L (predicted)
Sodium (Na)	0.16 mg/L to 236.9 mg/L
Potassium (K)	0.039 mg/L to 156 mg/L
Sulphate (SO_4)	0.096 mg/L to 278.4 mg/L
Chloride (Cl-)	0.32 mg/L to 279.72 mg/L
Sulfide (SO2)	0 mg/L

Note: DIC data not available, BLM uses alkalinity and pH to estimate DIC

The BLM addresses the mitigating effects of organic matter, calcium and other parameters on metal toxicity and generates an LC_{50} for the subject metal based on these ambient conditions. The BLM has a limiting temperature range of 10°C to 25°C and as a result only the spring / summer average concentrations could be used for modelling. The fall and winter lake temperatures fell below the 10°C limit precluding the use of BLM. The baseline dissolved organic carbon (DOC) data collected in Fish Lake ranged from 14.5 mg/L to 20.5 mg/L and averaged 16.27 mg/L (n=23). By comparison, these DOC concentrations are high relative to most of BC (≤5 mg/L median concentration) except in waterbodies with naturally elevated carbon levels (MOE, 2001a).

The spring / summer averages over the five different operating periods were considered a more accurate and informative reflection of potential exceedances in the lake over time and the modelling results for these values are discussed below. The BLM results for the original minimum, maximum and average predicted values across all years are provided in Technical Appendix X.

The model input data for each of the five operating periods is shown in Table 2.7.2.4B-34 and these data consistently show the highest predicted concentrations in Years 40-112. The average pH was derived from the water quality predictions conducted in support of the project. The temperature and dissolved organic carbon were taken from actual baseline data collected in Fish Lake. Note a sensitivity analysis was conducted on the predicted and baseline conditions using a 50% value for the baseline DOC data (8.135 mg/L).

Table 2.7.2.4B-34 Model Input Parameters for the Five Operating Periods (Using Spring/Summer Mean Average Concentrations for Modelled Parameters)

Parameters (mg/L)	Year 1-16	Year 17-20	Year 21-30	Year 31-40	Years 40-112
Alkalinity					
Cadmium					
Calcium					
Chloride					
Copper					
Dissolved organic carbon					
Magnesium					
Nitrate					
pH *(pH units)*					
Potassium					
Silver					
Sodium					
Sulphate					

Parameters (mg/L)	Year 1-16	Year 17-20	Year 21-30	Year 31-40	Years 40-112
Temperature *°C*					
Sulfide					

Sulfide value: 1E-10 recommended input where no actual data are available

Copper

The copper toxicity modelling was completed for Rainbow Trout, Fathead Minnow, *Daphnia magna, D. pulex* and *Ceriodahpnia dubia.* The results are shown in Table 2.7.2.4B-35, and indicate *D. pulex* was the most sensitive organism to the modelled conditions. The highest predicted mean concentration of xxx mg/L is xxx% of the lowest modelled LC50 value of 0.1459 mg/L

Table 2.7.2.4B-35 BLM Results for Copper

Species	Copper LC_{50} values generated with BLM for spring/summer				
	Year 1 to 16	Year 17 to 20	Year 21-30	Year 31-40	Year 41-112
	mg/L	mg/L	mg/L	mg/L	mg/L
Fathead Minnow	1.1464	1.1438	1.1311	1.0784	1.1928
Rainbow Trout	1.0174	1.0161	1.0072	0.9672	1.0580
Daphnia magna	0.2800	0.2796	0.2783	0.2668	0.2958
Daphnia pulex	0.1542	0.1534	0.1526	0.1459	0.1610
Ceriodaphnia dubia	0.2058	0.2052	0.2042	0.1953	0.2165
		Lowest modelled LC_{50} values			

Cadmium

The cadmium toxicity modelling using the BLM was completed for Rainbow Trout, Fathead Minnow and *Ceriodahpnia dubia*[24]*.* The results are shown in Table 2.7.2.4B-36 and indicate Rainbow Trout was the most sensitive test organism to the modelled conditions. The highest predicted mean concentration of xxx mg/L in Years 40-112 is xxx% of the lowest modeled LC50 value of 0.00958 mg/L.

[24] Only the copper toxicity prediction tool is available for Rainbow Trout, Fathead Minnow*, Daphnia magna, D. pulex* and *Ceriodaphnia dubia*. Fewer species are available for cadmium and silver predictions.

Table 2.7.2.4B-36 BLM Results for Cadmium

Species	Cadmium LC_{50} values generated with BLM for spring/summer				
	Year 1 to 16	Year 17 to 20	Year 21-30	Year 31-40	Year 41-112
	mg/L	mg/L	mg/L	mg/L	mg/L
Rainbow Trout	0.00958	0.01038	0.01045	0.00999	0.0196
Fathead Minnow	0.02137	0.02317	0.02330	0.0222	0.0435
Ceriodaphnia dubia	0.21886	0.23584	0.23618	0.2271	0.4413
		Lowest modelled LC_{50} values			

Silver

The silver toxicity modelling was completed for Rainbow Trout, Fathead Minnow and *D. magna.* The results are shown in Table 2.7.2.4B-37 and are reflective of the lowest modelled LC_{50} values for the three metals *D. magna* was the most sensitive test organism to the modelled conditions. The highest predicted concentration of xxx mg/L is xx% of the lowest modeled LC50 value of 0.000965 mg/L.

Table 2.7.2.4B-37 BLM Results for Silver

Species	Silver LC_{50} values generated with BLM for spring/summer				
	Year 1 to 16	Year 17 to 20	Year 21-30	Year 31-40	Year 41-112
	mg/L	mg/L	mg/L	mg/L	mg/L
Rainbow Trout	0.01297	0.01295	0.01295	0.01292	0.01325
Fathead Minnow	0.01000	0.01000	0.009999	0.009970	0.010221
Daphnia magna	0.000969	0.000969	0.000968	0.000965	0.000988
		Lowest modelled LC_{50} values			

Conclusions (more to follow)

Although the concentrations of selected parameters exceeded available provincial and / or federal water quality guidelines, a review of the technical data used to develop the guidelines and the application of the BLM suggest the predicted values for cadmium, copper and silver will either not exceed the toxicity data used to develop the guidelines or will not exceed the modelled LC_{50} values using BLM. Additionally, Davies suggested the 2006 study indicated *Fontinalis antipyretica* was more tolerant of sulphate than the BC Approved Water Quality guideline suggested, noting the toxicity of 100 mg/L derived in the Frahm 1975 study was more likely due to the potassium (K) than the sulphate. Davies further noted the reduced toxicity of sulphate with increasing hardness suggests the use of a site-specific objective as opposed to a broad guideline value may be more appropriate when considering discharge limits (Davies, 2006).

The biotic ligand model is considered relevant in this application because it has taken into consideration a number of water quality parameters that are central to evaluating and predicting the toxicity of metals. One of its most important aspects is that it uses site specific water quality data to integrate site conditions and water quality to provide a more insightful and defensible view of potential toxicity. The approach has gained widespread use and interest because of its potential for use in developing water quality standards. It is also helpful in conducting risk assessments for metals. Evidence to this is the fact the USEPA (2007) has established copper guidelines for aquatic organisms including fish based on the BLM.

Results of the BLM has helped distill the vast amount of predicted water quality data into a few short and sensible conclusions. For example, some elements have higher BLM LC50's than the toxicity data used to establish guidelines (predicted levels from BLM suggest we may not have effects at predicted water quality). The BLM is less conservative than guidelines although the resulting LC50s that are calculated can be defended as more relevant to site specific conditions and water quality.

Adaptive Management, Monitoring and Proposed Mitigation Measures

Adaptive Management

As discussed in Section 2.8.3 Adaptive Management will be adopted for the Project and is considered a useful and integral component of managing uncertainty while identifying and implementing corrective and mitigation measures. The value of Adaptive Management as it pertains to water and sediment quality is that it provides a recognizable and defensible framework which includes a description of the monitoring programs to be implemented as well as a listing of conceptual mitigation measures for implementation should monitoring indicate there is a need to implement mitigation.

Water and sediment quality predictions indicate some metals and sulphate will increase with some exceeding Provincial and Federal guidelines as seepage and discharges from the TSF commence. As the project proceeds monitoring programs will be in place to gauge the accuracy of the predictions and based on the results of the monitoring implement precautionary planning and/or mitigation where required. Monitoring in itself does not mitigate but is the central and key component for determining if predictions are accurate and if implementing mitigation is needed. Because of uncertainty, it is not possible to predict exactly the timing or concentration of these parameters and monitoring is the tool available to confirm predictions. For the example of water quality in Fish Lake tributaries, should monitoring show or suggest levels are increasing the AMP will include an "alert" level which could reflect a particular parameter is within X% of the guideline level. The alert level could be tied to increased monitoring and an "action level" would be declared if the level were to approach X_i% of the guideline. The action level would initiate corrective actions which might include treatment and/or pumping captured seepage into the TSF. This scenario is presented in a conceptual context only but it is intended to illustrate how an AMP would be implemented to address uncertainty and manage project effects to design or acceptable levels.

The concept of alert and action levels could be applied to but not necessarily limited to all of the following:

- Predicted water quality in Fish Lake and tributaries
- Success of habitat compensation programs
- Survival, growth and health of fish in Fish Lake
- Fish Lake trophic status and capability of the lake to support and sustain the monoculture population of Rainbow Trout, and
- Other project components not just those related to environmental receptors.

Adaptive management is expected to be a valuable tool for monitoring project effects and for making adjustments in order to continuously improve and ensure the project functions as predicted. AMPs have been identified in concept only and their development will proceed with the permitting phase of the project. Monitoring programs developed will be part of adaptive management.

Mitigation measures presented in this section are specifically designed for Fish Lake and adjacent waterbodies in the new Project regional area. The new Project design preserves Fish Lake and adjacent aquatic habitat. Mitigation measures outlined here are developed and evaluated based on the potential environmental effects (i.e., change in sediment concentrations).

Proposed Mitigation

Proposed mitigation includes a variety of environmental management and best management plans that are common to many natural resource development projects and as a result have been clearly described and codified. These measures are clearly described in Section 2.8.1. In regards to water quality some of the plans that will be developed include;

- Vegetation management strategy to minimize the disturbance to riparian habitat
- Sediment and Erosion Control strategy that will deal the overall project and specific tasks
- Air Quality and Dust Control management strategy
- Explosive and Blasting management strategy
- Instream Work practices and management strategies specific to all instream works
- Concrete management plans for all works in or close to water.
- Acid Rock Drainage and Metal Leaching management and monitoring programs
- Dangerous and hazardous material storage and handling procedures
- Water Quality, Sediment Quality and Aquatic Ecology monitoring framework.

In addition to the standard best management practices that will be employed as a part of the New Prosperity MDP, several project specific strategies will be employed (Tables 2.7.2.4B-38 to 2.7.2.4B-41)

Proposed Monitoring Plan

There is always some degree of uncertainty when predicting effects, particularly decades into the future, in a complex aquatic system. To address uncertainties regarding model predictions, water quality, sediment quality and aquatic biota in Fish Lake and other waterbodies in the regional study area will be routinely monitored. These comprehensive plans are detailed Section XX. Other studies planned as part of the monitoring program include ground water quality, fish spawning and tissue chemistry. The planned sampling program will be conducted during construction, operations, closure and post-closure phase.

Cumulative Effects Assessment for Water Quality

As described in Section 2.7.1, cumulative environmental effects are only assessed if all three of the following conditions are met for the environmental effect:

- The Project results in a measurable, demonstrable or reasonably-expected residual environmental effect on a component of the environment
- The Project-specific residual environmental effect does, or is likely to, act in a cumulative fashion with the environmental effects of other past or future projects and activities that are likely to occur, and
- There is a reasonable expectation that the Project's contribution to cumulative environmental effects will affect the viability or sustainability of the resource or value.

The Project inclusion list (Table 2.7.1.4-1) identifies past, present and reasonably foreseeable projects and activities that could interact cumulatively with the Project. The locations of each of the 22 projects and activities are shown on Figure 2.7.1.4-1. As indicated in Table 2.7.1.4-1, eight of these project and activities are new since 2009. Of the eight new projects, only one, the Newton Mountain property, is located west of the Fraser River and, therefore, considered potentially able to interact cumulatively with the Project's residual effects on water quality.

For water quality, the first condition is met. Although there is an established conclusion by the provincial government and the previous panel of no significant adverse effect on the Taseko River, there is potential for Project-specific residual effects on water quality within Fish Creek and Beece Creek watersheds. The predicted residual effect on the water quality of the Taseko River for New Prosperity has remained similar relative to 2009.

With respect to the second condition, while Newton Mountain constitutes an active exploration program, there is no defined resource and the likelihood that it will develop into a mining project is far from likely.

As a result there is not a reasonable expectation that the Project's contribution to cumulative environmental effects will affect the viability or sustainability of the resource or value.

Characterization of Residual Project Effects for Water Quality in Fish Lake

The assessment methodology for residual effect characterization and determination of significance is as described in Section 2.7.1.5.

The findings of the Project residual effects assessment for water quality changes for Fish Lake are summarized in Table 2.7.2.4B-38

Note re Determination of Significance

The determination of significance tables and rationale for significance that follow for all aspects of this section are currently being left blank for purposes of the draft EIS as it is being reviewed by third parties and will be completed in the EIS submitted for panel.

Table 2.7.2.4B-38 Determination of Significance of Residual Effects for Water Quality Changes in Fish Lake

Potential Environmental Effect: Water Quality Changes in Fish Lake	Proposed and Potential Mitigation Measures/ Compensation Measures	Determination of Significance of Residual Effects Significance ranking assumes effective implementation of the adaptive management plan and actions If predetermined alert or action levels are observed								
		Direction	Magnitude[+]	Geographical Extent	Duration	Frequency	Reversibility	Ecological context	Significance	Prediction Confidence
Fish Lake Water Quality										
Nutrient Concentrations	• Implementation of EMP's and BMP's (Section 2.8.1) • Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Multiport water withdrawal for recirculation pump • Partial draining and early reclamation of TSF at the end of ore processing • Eutrophication control using hypolimnetic aeration and/or flocculent treatment • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									
Metal Concentrations	• Implementation of EMP's and BMP's (Section 2.8.1) • Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Multiport water withdrawal for recirculation pump • Partial draining and early reclamation of TSF at the end of ore processing • Maintenance of TSF discharge directly									

	to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									
Sulphate Concentrations	• Implementation of EMP's and BMP's (Section 2.8.1) • Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Multiport water withdrawal for recirculation pump • Partial draining and early reclamation of TSF at the end of ore processing • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									
Total Suspended Sediments	• Implementation of EMP's and BMP's (Section 2.8.1) • Limiting the disturbance of native materials and vegetation • Implementation of erosion and sediment control best management plans (BMP) • Partial draining and early reclamation of TSF at the end of ore processing • Dust control strategy (reclamation, vegetation control)									
Metal levels in fish	• Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Multiport water withdrawal for recirculation pump • Partial draining and early reclamation of TSF at the end of ore processing • Development of consumptive guidelines • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									

KEY	Geographic Extent:	Reversibility:	Significance:
†Alert – a level or change identified from monitoring that requires precautionary planning should the adverse changes and levels continue. Action – mitigation designed and planned as part of adaptive management would be implemented and would continue until the levels and and/or changes return to manageable and acceptable levels. ***Direction*:** **P:** Positive **N:** Neutral **A:** Adverse ***Magnitude:*** **L:** Low–environmental effect occurs that may or may not be measurable, but is within the range of natural variability. **M:** Moderate–environmental effect occurs, but is unlikely to pose a serious risk or present a management challenge. **H:** High– environmental effect is likely to pose a serious risk or present a management challenge.	**S:** Site-specific **L:** Local **R:** Regional ***Duration:*** **ST**: Short term **MT**: Medium Term **LT**: Long Term **FF**: Far Future or Permanent. ***Frequency*:** **R:** Rare - Occurs Once **I:** Infrequent - Occurs sporadically at irregular intervals **F:** Frequent - Occurs on a regular basis and at regular intervals **C:** Continuous	**R:** Reversible **I:** Irreversible ***Ecological Context:*** **U:**Undisturbed: Area relatively or not adversely affected by human activity **D:**Developed: Area has been substantially previously disturbed by human development or human development is still present **N/A:** Not applicable.	**S:** Significant **N:** Not Significant ***Prediction Confidence:*** Based on scientific information and statistical analysis, professional judgment, effective mitigation and adaptive management **L:** Low level of confidence **M:** Moderate level of confidence **H** High level of confidence

The water quality effects assessment is largely based upon water quality modelling that considers hydrologic inputs and chemical loadings. These hydrologic inputs are reflective of the various phases of the project. For many of the phases anticipated dates are fairly close to the actual date on which they will occur, others (ie. closure phase II) were selected arbitrarily for modelling purposes.

The selection of the closure phase II period is a very important one to the water quality assessment because this coincides with the TSF Lake being allowed to flow naturally into Fish Lake. In nearly all situations this period exhibited the greatest aqueous elemental concentrations and therefore the greatest potential effect. The actual timing of closure phase II, and subsequently release of water from the TSF Lake into Fish Lake, will actually occur when water quality is deemed suitable.

The rationale for the significance determinations for Fish Lake are as follows:

- xxxxxxxx
- xxxxxxxx x
- xxxxxxxxxx
- xxxxxxxxx.
- xxxxxxxxxx

Characterization of Residual Project Effects for Water Quality in Fish Lake Tributaries

The findings of the Project residual effects assessment for water quality changes for Fish Lake tributaries are summarized in Table 2.7.2.4B-39.

Note re Determination of Significance

The determination of significance tables and rationale for significance that follow for all aspects of this section are currently being left blank for purposes of the draft EIS as it is being reviewed by third parties and will be completed in the EIS submitted for panel.

Table 2.7.2.4B-39 Determination of Significance of Residual Effects for Water Quality Changes in Fish Lake Tributaries

Potential Environmental Effect: Water Quality Changes in Fish Lake Tributaries	Proposed and Potential Mitigation Measures/ Compensation Measures	Determination of Significance of Residual Effects Significance ranking assumes effective implementation of the adaptive management plan and actions If predetermined alert or action levels are observed

		Direction	Magnitude[+]	Geographical Extent	Duration	Frequency	Reversibility	Ecological context	Significance	Prediction Confidence
Fish Lake Tributaries Water Quality										
Nutrient Concentrations	• Implementation of EMP's and BMP's (Section 2.8.1) • Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Multiport water withdrawal for recirculation pump • Partial draining and early reclamation of TSF at the end of ore processing • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									
Metal Concentrations	• Implementation of EMP's and BMP's (Section 2.8.1) • Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Multiport water withdrawal for recirculation pump • Partial draining and early reclamation of TSF at the end of ore processing • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									
Sulphate Concentrations	• Implementation of EMP's and BMP's (Section 2.8.1) • Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Multiport water withdrawal for recirculation pump • Partial draining and early reclamation of TSF at the end of ore processing • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets									

	acceptable quality objectives.									
Total Suspended Sediments	• Implementation of EMP's and BMP's (Section 2.8.1) • Limiting the disturbance of native materials and vegetation • Implementation of erosion and sediment control best management plans (BMP) • Partial draining and early reclamation of TSF at the end of ore processing • Dust control strategy (reclamation, vegetation control)									
Metal levels in fish	• Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Multiport water withdrawal for recirculation pump • Partial draining and early reclamation of TSF at the end of ore processing • Development of consumptive guidelines • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									

KEY

[†]Alert – a level or change identified from monitoring that requires precautionary planning should the adverse changes and levels continue.

Action – mitigation designed and planned as part of adaptive management would be implemented and would continue until the levels and/or changes return to manageable and acceptable levels.

Direction:
P: Positive
N: Neutral
A: Adverse

Magnitude:
L: Low–environmental effect occurs that may or may not

Geographic Extent:
S: Site-specific
L: Local
R: Regional

Duration:
ST: Short term
MT: Medium Term
LT: Long Term
FF: Far Future or Permanent.

Frequency:
R: Rare - Occurs Once
I: Infrequent - Occurs sporadically at irregular intervals
F: Frequent - Occurs on a regular basis and at regular intervals
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological Context:
U:Undisturbed: Area relatively or not adversely affected by human activity
D:Developed: Area has been substantially previously disturbed by human development or human development is still present
N/A: Not applicable.

Significance:
S: Significant
N: Not Significant

Prediction Confidence:
Based on scientific information and statistical analysis, professional judgment, effective mitigation and adaptive management
L: Low level of confidence
M: Moderate level of confidence
H High level of confidence

be measurable, but is within the range of natural variability. **M:** Moderate–environmental effect occurs, but is unlikely to pose a serious risk or present a management challenge. **H:** High– environmental effect is likely to pose a serious risk or present a management challenge.			

The rationale for the significance determinations are as follows:

- xxxxxxxxxxxxx
- xxxxxxxxxxxxxx
- xxxxxxxxxxxx
- xxxxxxxxxxxxx
- xxxxxxxxxxxxxx.

Characterization of Residual Project Effects for Water Quality in adjacent streams

The findings of the Project residual effects assessment for water quality changes in adjacent streams are summarized in Table 2.7.2.4B-40.

Note re Determination of Significance

The determination of significance tables and rationale for significance that follow for all aspects of this section are currently being left blank for purposes of the draft EIS as it is being reviewed by third parties and will be completed in the EIS submitted for panel.

Table 2.7.2.4B-40 Determination of Significance of Residual Effects for Water Quality Changes in Adjacent Streams and Rivers

Potential Environmental Effect: Water Quality Changes in Adjacent Streams and Rivers	Proposed and Potential Mitigation Measures/ Compensation Measures	Determination of Significance of Residual Effects Significance ranking assumes effective implementation of the adaptive management plan and actions If predetermined alert or action levels are observed								
		Direction	Magnitude†	Geographical Extent	Duration	Frequency	Reversibility	Ecological context	Significance	Prediction Confidence
Water Quality in Adjacent Streams and Rivers (Lower Fish Creek, Beece Creek, Taseko River										
Nutrient Concentration	• Implementation of EMP's and BMP's (Section 2.8.1) • Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Multiport water withdrawal for recirculation pump • Partial draining and early reclamation of TSF at the end of ore processing • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									
Metal Concentrations	• Implementation of EMP's and BMP's (Section 2.8.1) • Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Multiport water withdrawal for recirculation pump • Partial draining and early reclamation of TSF at the end of ore processing • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									

Sulphate Concentrations	• Implementation of EMP's and BMP's (Section 2.8.1) • Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Multiport water withdrawal for recirculation pump • Partial draining and early reclamation of TSF at the end of ore processing • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									
Metal levels in fish	• Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Multiport water withdrawal for recirculation pump • Partial draining and early reclamation of TSF at the end of ore processing • Development of consumptive guidelines • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									

KEY

†Alert – a level or change identified from monitoring that requires precautionary planning should the adverse changes and levels continue.

Action – mitigation designed and planned as part of adaptive management would be implemented and would continue until the levels and/or changes return to manageable and acceptable levels.

***Direction*:**
P: Positive
N: Neutral
A: Adverse

Magnitude:
L: Low–environmental effect occurs that may or may not be measurable, but is within the range of natural variability.

Geographic Extent:
S: Site-specific
L: Local
R: Regional

Duration:
ST: Short term
MT: Medium Term
LT: Long Term
FF: Far Future or Permanent.

***Frequency*:**
R: Rare - Occurs Once
I: Infrequent - Occurs sporadically at irregular intervals
F: Frequent - Occurs on a regular basis and at regular intervals
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological Context:
U:Undisturbed: Area relatively or not adversely affected by human activity
D:Developed: Area has been substantially previously disturbed by human development or human development is still present
N/A: Not applicable.

Significance:
S: Significant
N: Not Significant

Prediction Confidence:
Based on scientific information and statistical analysis, professional judgment, effective mitigation and adaptive management
L: Low level of confidence
M: Moderate level of confidence
H High level of confidence

M: Moderate–environmental effect occurs, but is unlikely to pose a serious risk or present a management challenge. **H:** High– environmental effect is likely to pose a serious risk or present a management challenge.			

The rationale for the significance determinations are as follows:

- xxxxxxxxxxx
- xxxxxxxxxxxxxx
- xxxxxxxxxxx
- xxxxxxxxxxxxx
-

Characterization of Residual Project Effects for Water Quality in adjacent lakes

The findings of the Project residual effects assessment for water quality changes in adjacent lakes are summarized in Table 2.7.2.4B-41.

Note re Determination of Significance

The determination of significance tables and rationale for significance that follow for all aspects of this section are currently being left blank for purposes of the draft EIS as it is being reviewed by third parties and will be completed in the EIS submitted for panel.

Table 2.7.2.4B-41 Determination of Significance of Residual Effects for Water Quality Changes in Adjacent Lakes

Potential Environmental Effect: Water quality changes in adjacent lakes	Proposed and Potential Mitigation Measures/ Compensation Measures	Determination of Significance of Residual Effects Significance ranking assumes effective implementation of the adaptive management plan and actions If predetermined alert or action levels are observed								
		Direction	Magnitude+	Geographical Extent	Duration	Frequency	Reversibility	Ecological context	Significance	Prediction Confidence
Water Quality in Adjacent Lakes (Wasp Lake, Little Onion Lake and Big Onion Lake)										
Nutrient Concentration	• Implementation of EMP's and BMP's (Section 2.8.1) • Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Partial draining and early reclamation of TSF at the end of ore processing • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									
Metal Concentrations	• Implementation of EMP's and BMP's (Section 2.8.1) • Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Partial draining and early reclamation of TSF at the end of ore processing • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									

Sulphate Concentrations	• Implementation of EMP's and BMP's (Section 2.8.1) • Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Partial draining and early reclamation of TSF at the end of ore processing • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									
Metal levels in fish	• Seepage collection and pump back to TSF and/or OP • Groundwater collection wells around TSF • Partial draining and early reclamation of TSF at the end of ore processing • Development of consumptive guidelines • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									

KEY

†Alert – a level or change identified from monitoring that requires precautionary planning should the adverse changes and levels continue.

Action – mitigation designed and planned as part of adaptive management would be implemented and would continue until the levels and/or changes return to manageable and acceptable levels.

***Direction*:**
P: Positive
N: Neutral
A: Adverse

Magnitude:
L: Low–environmental effect occurs that may or may not be measurable, but is within the range of natural variability.
M: Moderate–environmental effect occurs, but is unlikely to pose a serious risk or present a management challenge.
H: High– environmental effect is

Geographic Extent:
S: Site-specific
L: Local
R: Regional

Duration:
ST: Short term
MT: Medium Term
LT: Long Term
FF: Far Future or Permanent.

***Frequency*:**
R: Rare - Occurs Once
I: Infrequent - Occurs sporadically at irregular intervals
F: Frequent - Occurs on a regular basis and at regular intervals
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological Context:
U:Undisturbed: Area relatively or not adversely affected by human activity
D:Developed: Area has been substantially previously disturbed by human development or human development is still present
N/A: Not applicable.

Significance:
S: Significant
N: Not Significant

Prediction Confidence:
Based on scientific information and statistical analysis, professional judgment, effective mitigation and adaptive management
L: Low level of confidence
M: Moderate level of confidence
H High level of confidence

likely to pose a serious risk or present a management challenge.			

The rationale for the significance determinations are as follows:

- xxxxxxxxx
- xxxxxxxxxxxx
- xxxxxxxxxx
- xxxxxxxxxxxxx

Scope of Assessment – Sediment Quality

There is a potential for interactions between sediment and Project works and activities (Table 2.7.2.4B-3). The key environmental effects of potential concern considered in detail in the sediment quality assessment include:

- Altered sediment quality in Fish Lake resulting from decreased flow from construction through post-closure
- Altered sediment quality in Fish Lake related to site drainage arising from potential erosion and sediment export from construction activities, and
- Altered sediment quality in Fish Lake resulting from uncaptured tailings seepage from operations through post-closure and tailings pond discharge post-closure.

The following section presents the assessments of the potential effects of the Project on Fish Lake sediment.

Effects Assessment Methods – Sediment Quality

The assessment methods used to determine the effects on sediment quality will be consistent with the EIS guidelines. A qualitative approach to predicting future sediment conditions resulting from the Project was developed considering baseline characteristics and the physical forces (flow diversions or additions) and altered water chemistry that would induce any changes.

The results will be compared against baseline concentrations as well as the applicable provincial and federal guidelines where available to determine the nature of environmental effects. Results will be presented in both a tabulated and graphic form. Where necessary, a description of contingency plans will be presented to address uncertainties and risks associated with predictions.

Baseline Conditions – Sediment Quality

The concentrations of metals in Fish, Little Fish and Wasp lakes sediments are provided in Table 2.7.2.4B-42. Although total organic carbon levels in sediment were significantly higher in Wasp Lake than Fish Lake (*t = test*, p <0.05), there were few significant differences in metals levels (higher manganese levels in Wasp Lake, higher chromium and nickel levels in Fish Lake). The elevated chromium and nickel levels in Fish Lake are associated with the basalt deposits in that area (Volume 3, Section 7.1 from the March 2009 EIS/Application).

Table 2.7.2.4B-42. Metal and Organic Carbon Levels in Sediment of Fish, Little Fish and Wasp Lakes, 1997 and 2011 (mean, n = 5 replicates)

Parameter	Fish 1997	Fish 2011	Little Fish	Wasp	SQG[1]
Antimony, total	**0.6**	**0.46**	**0.8**	**0.7**	0.43
Arsenic, total	3.3	3.3	3.4	4.0	5.9
Cadmium, total	0.1	0.17	0.1	<0.5	0.6
Chromium, total	**52**	**42**	**50**	**38**	37.3
Copper, total	**41**	34.2	**49**	**45**	35.7
Iron, total	17,900	15,850	17,400	**28,200**	21,200
Lead, total	6	2.9	6	<20	35
Manganese, total	269	208	194	373	460
Mercury, total	0.110	**0.319**	0.106	0.018	0.170
Nickel, total	**66**	**56**	**87**	**48**	16
Selenium, total	1	1	1	1	5
Silver, total	**0.6**	0.1	0.1	**<1**	0.5
Zinc, total	71	61	76	61	123
TOC (%)	16.5	14.4	16.9	30.1	-
Lake volume (m^3)	4,438,000	4,438,000	133,000	1,611,000	

Both Fish Lake and Wasp Lake sediments had antimony, chromium, copper and nickel levels higher than PRS, EIS Guidelines or BC SQG. Iron exceeded its SQG in Wasp Lake, as did silver in Fish Lake. Levels of cadmium, lead, mercury, selenium and zinc were always lower than the SQG. A recent (July 2011) Fish Lake sediment chemistry however showed that some metals including antimony, chromium, mercury and nickel frequently exceeded BC sediment quality guidelines (Table 2.7.2.4B-43).

Project Effects – Sediment Quality

To have a better understanding of potential Project effects on Fish Lake aquatic environment, the predicted water quality in Fish Lake was compared for the different Project phases from construction through post-closure with several guidelines and standards, where available, for the protection of aquatic life. These guidelines include the BC Approved Water Quality Guidelines (updated 2011), CCME Water Quality Guidelines (updated 2011), and Contaminated Sites Regulation-Generic Numerical Water Standards (updated 2011). A summary of the mean concentrations and identified exceedances for the various elements during the defined five Project phases [(Years 1 to 16 (Operational 1), 17-20 (Operational 2), 21-30 (Closure 1), 31-40 (Closure 2) and 40-112 years (Post closure)] is presented in Table 2.7.2.4B-10 & Table 2.7.2.4B-11. In general, this analysis showed that mean cadmium concentrations exceeded the provincial and federal guidelines in all five Project phases, while mean mercury concentrations surpassed guidelines during the operational and post-closure phases. Mean copper, iron, selenium and sulphate however do not surpass the guidelines until post-closure (Years 40 - 112). Mean aluminum, fluoride and silver do not exceed guideline values.

Fish Lake Productivity modelling was also conducted in order to evaluate how the proposed changes to Fish Lake inflow, elemental loading, and TSF seepage will affect Fish Lake productivity or trophic status. Briefly, the results of the productivity model showed that with recirculated flow, the trophic status of Fish Lake will remain largely unchanged from the current meso-eutrophic status during construction and operation. In contrast, model results suggest that during closure and post-closure phases, Fish Lake trophic status may shift from meso-eutrophic to a more highly productive eutrophic lake (Figures 2.7.2.4-14 to 2.7.2.4-19).

There are currently no regional sediment quality guidelines that are specific to British Columbia. Therefore, the parameters measured in the Fish Lake sediment samples were compared to guidelines recommended by the Canadian Council of Ministers of the Environment (CCME, 2007) and the Canadian Nuclear Safety Commission (CNSC) (Thompson et al., 2005). These guidelines are only available for a limited number of parameters. The Interim Sediment Quality Guideline (ISQG) represents total metal concentrations below which there is unlikely to be any adverse biological effects (CCME, 2007) are based on Lowest Effect Levels (LELs). The Probable Effects Level (PEL) is the guideline level above which adverse effects are expected to frequently occur (CCME, 2007). In addition, LELs guidelines are the concentrations below which harmful effects on benthic invertebrates are not expected (Thompson et al., 2005). British Columbia currently uses the CCME guidelines for sediment (Nagpal et al., 2006).

These guidelines are available for a number of parameters and are listed in the Table 2.7.2.4B-43 below.

Table 2.7.2.4B-43 Applicable Sediment Quality Guidelines

Parameter	CCME Interim Sediment Quality Guideline (ISQG, µg/g)	Lowest Effects Level (LEL, µg/g)	Probable Effects Level (PEL, µg/g)
Arsenic	5.9	9.8	17.0
Cadmium	0.6	0.6	3.5
Chromium	37.3	37.3	90.0
Copper	35.7	22.2	197.0
Iron	-	21,200	43,766
Lead	35.0	36.7	91.3
Manganese	-	460	1100
Mercury	0.170	0.170	0.486
Molybdenum	-	13.8	-
Nickel	-	16	75
Selenium	-	2	-
Silver		0.5	
Uranium	-	104.4	-
Zinc	123.0	-	315.0

These guidelines were used to screen the sediment chemistry to identify parameters that may be of potential concern to Fish Lake benthic organisms. Results of the recent (2001) Fish Lake sediment chemistry showed that some metals including antimony, chromium, mercury and nickel frequently exceeds Interim Sediment Quality Guideline (ISQG) (Table 2.7.2.4B-42). Thus any additional influx of metals with the release of sediments or sediment-laden water to the lake during construction or operational phases may affect the benthos. It is important to note that these guidelines are for total metal concentrations in sediment and site-specific sediment characteristics can affect the bioavailability of sediment contaminants. Thus, if sediment concentrations appear high relative to the guidelines as above, an assessment of the bioavailable fraction would be required to more accurately define the risk potential. High sediment load may decrease water clarity and impact algal productivity in Fish Lake although no significant adverse Project effects are anticipated mitigation measures are effective.

As highlighted in Table 2.7.2.4B-3, some Project activities associated with open pit construction, fisheries compensation works (constructions and operations), Fish Lake water management controls and operation, and TSF starter dam construction (flooding of the upper Fish Creek drainage), will alter the hydrologic conditions in Fish Lake. The TSF in the Upper Fish Creek valley starts approximately 2 km upstream of Fish Lake and will reduce natural inflows to Fish Lake by approximately 60% (without mitigation) from construction through post-closure. A reduction in average flows of Fish Creek upstream of Fish Lake will result in increased water or hydraulic residence time (HRT) in Fish Lake from construction through post-closure. An increased HRT may also result in concentration of naturally occurring substances (i.e., nutrients, salts, and metals) in Fish Lake with implications for water quality, sediment quality and biota (plankton and benthic invertebrates).

Similarly, an increased HRT as a result of reduced inflow coupled with internal nutrient regeneration in Fish Lake may result in increased organic matter production (cf. Schindler, 2006). An increased organic matter production with attendant sedimentation in Fish Lake could alter the sediment environment for benthic organisms. Fish Lake sediment is largely made up of organic materials and bacterial decomposition of these materials normally requires oxygen. Limnological profiling of Fish Lake indicates that Fish Lake experiences thermal stratification and hypolimnetic anoxia during summer. For instance, thermal stratification with a well-delineated thermocline from approximately 4 to 7 m was evident in a recent (July 2011) Fish Lake water quality survey. In that study, surface (<5 m) dissolved oxygen levels at two Fish Lake stations were within the acceptable limits of 6.0 to 9.5 mg/L established by the Canadian Council of Ministers of the Environment (CCME 2007). In contrast, the DO levels were below this guideline in the deeper waters of Fish Lake. Thus, an additional biochemical oxygen demand (BOD) as a result of increased organic matter decomposition may negatively impact benthos. Equally important, the concentrations of compounds in sediment tend to increase with decreasing particle size, due to an increase in surface area per unit mass (Muller and Tissue, 1997).

Any seepage that is not captured that reports to Fish Lake during the Project's operational phase and beyond has the potential to impact the aquatic environment. As presented in the water quality model earlier in this section, changes in water chemistry may occur due to the seepage water that may bypass the multiple seepage-recovery systems. A change in water chemistry could lead to elevation of the current metal concentrations in sediment with implications for bottom-dwelling (benthos) organisms.

During the mine post-closure phases, sulphate concentrations were modelled to be approximately xxx mg/L in Spring/Summer and xxx mg/L compared to the British Columbia maximum guideline of 100 mg/L for Sulphate (BCWQG) (Nagpal et al., 2006; MWLAP, 2011). Potential effects of increased sulphate and other cations and anions in seepage discharges on benthic invertebrates may include impaired growth of some of the more pollution sensitive benthic organisms (i.e., some Ephemeroptera, Plecoptera and Trichoptera) although no significant adverse Project effects are anticipated with effective mitigation measures.

Mitigation – Sediment Quality

It should be noted that the mitigation measures designed to protect water quality in Fish Lake will also protect sediment quality and aquatic communities, including fish. However, attempts are made to highlight some project effects and mitigation measures that are peculiar to sediment quality in this section. Descriptions of proposed mitigation measures and adaptive mitigation strategies for Fish Lake and adjacent upper Fish Creek are described earlier in this section.

To maintain appropriate flows into Fish Lake, the proposed Project configuration re-circulates the outlet water leaving Fish Lake back into Fish Lake through the main inlet and tributary. This re-circulation will help limit the overall change in the hydraulic residence time (HRT) of the lake as a result of the planned reduced flow. Under current conditions, Fish Lake water residence time was estimated to be 0.72 years while residence time was determined to be 1.81 years with the planned reduced flow (no mitigation).

With the recirculated flow, Fish Lake HRT was determined to be 1.05. In essence, the potential impact of reduced flow to Fish Lake will be partially mitigated by the re-circulation of water from outlet back to the inlet during operation. In addition, the new water management activities of the Project include the collection and utilization of surface water runoff upstream from the open pit and downstream of the TSF to supply Fish Lake. Fish Lake volume will be maintained with the installation of an outlet control structure and a commitment by the proponent to maintain the baseline levels through the life of mine and beyond. Even with the relative increase in HRT, the Fish Lake productivity model showed that there was no trophic state shift with the reduced flow during construction and operational phases. There was, however, a slight increase in Lake Total Phosphorus (TP) concentrations with reduced inflow.

To limit the export of sediment to Upper Fish Creek and Fish Lake during construction and operation, a Sediment Control and Surface Erosion Protection Plan will be developed and implemented to manage the potential for sediment generation associated with construction work. A plan will also be put in place to train work crews in proper installation, use and maintenance of sediment and erosion control methods. However, to ensure that the water quality are adequate to support Rainbow Trout, Fish Lake sediment quality will need to be monitored over the life of the mine for TOC, hardness, nutrients, sulphate, and metals concentrations.

Mitigation measures to reduce the magnitude of metals generated in TSF water are built into the Project design and include management of acid generating and potentially acid generating waste rock and tailings during operations (Section 2.7.2.1) and re-vegetation of disturbed areas according to the closure and reclamation plan (Section 2.8.2). It is expected that the chemical and biological processes within the TSF pond including solubility, precipitation, and adsorption reactions will result in settling of metals to sediment in the TSF. As well, seepage from the TSF will be, to the greatest extent possible, collected in seepage collection ponds and interception wells located downstream of the embankments. The water collected in these wells will be recirculated back into the TSF. The Proponent has committed to ensuring that water quality in Fish Lake will meet either generic WQG or site specific WQG that may be developed. Taseko is committed to implementing seepage water treatment as a contingency measure to ensure suitable water quality in Fish Lake and downstream waterbodies.

The Proponent will put in place water, plankton, sediment quality, and fish abundance and tissue chemistry monitoring programs. The Project Proponent is committed to continuing the ongoing limnological and water quality monitoring program for Fish Lake and adjacent creeks (Upper Fish Creek, and Lower Fish Creek). Several other monitoring sites in the vicinity of the plant site and the TSF main embankment are planned. In addition, seepage quality will be monitored from the monitoring wells installed downstream of the tailings embankment for dissolved and particulate metals, sulphate and nutrients. A sediment-core sampling survey can also be conducted in Fish Lake periodically throughout the LOM. The main objective of the monitoring exercise is to ensure that the water quality of Fish Lake is adequate to support Rainbow Trout and that appropriate treatment or mitigation measures, if required, are implemented. There is also an adaptive management strategy in place to manage Project effects on Fish Lake water quality and upper Fish Creek drainage (described earlier in this section).

Cumulative Effects Assessment for Sediment Quality

As described in Section 2.7.1, cumulative environmental effects were only assessed if all three of the following conditions were met for the environmental effect:

- The Project results in a measurable, demonstrable or reasonably-expected residual environmental effect on a component of the environment
- The Project-specific residual environmental effect does, or is likely to, act in a cumulative fashion with the environmental effects of other past or future projects and activities that are likely to occur, and
- There is a reasonable expectation that the Project's contribution to cumulative environmental effects will affect the viability or sustainability of the resource or value.

The Project inclusion list (Table 2.7.1.4-1) identifies past, present and reasonably foreseeable projects and activities that could interact cumulatively with the Project. The locations of each of the 22 projects and activities are shown on Figure 2.7.1.4-1. As indicated in Table 2.7.1.4-1, eight of these project and activities are new since 2009. Of the eight new projects, only one, the Newton Mountain mine development, is located west of the Fraser River and, therefore, considered potentially able to interact cumulatively with the Project's residual effects on sediment quality. However, it should be noted the while Newton Mountain constitutes an active exploration program, there is no defined resource and the likelihood that it will develop into a mining project is far from likely.

In regards to cumulative assessment to sediment quality, the first condition is met there is potential for Project-specific residual effects on sediment quality in the Fish Creek and Beece Creek watersheds. However, the combination of the relative unlikelihood of the development of the Newton Mountain Project and the spatial separation of the two projects do not constitute a reasonable expectation of cumulative effects between the projects. Therefore the predicted residual effects on the sediment quality resulting from cumulative effects are not anticipated to be significant.

Determination of the Significance of Residual Effects for Sediment Quality

The assessment methodology for the characterization of residual effects and determination of significance is described in Section 2.7.1.5. The findings of the residual effects assessment for sediment quality changes for Fish Lake are summarized in Table 2.7.2.4B-44. While nutrients, metals and sulphate concentrations in Fish Lake may become high in sediment during mine operation and through closure phases no significant residual adverse effects to Fish Lake sediment quality are anticipated with the proposed mitigation and application of environmental management plans similar conclusions are also reached for change in sedimentation and invertebrate community structure in Fish Lake.

Note re Determination of Significance

The determination of significance tables and rationale for significance that follow for all aspects of this section are currently being left blank for purposes of the draft EIS as it is being reviewed by third parties and will be completed in the EIS submitted for panel.

Table 2.7.2.4B-44 Determination of Significance of Residual Effects for Sediment Quality & Benthic Invertebrates

Potential Environmental Effect: Fish Lake Sediment Quality and Benthic invertebrate Community	Proposed and Potential Mitigation Measures/ Compensation Measures	Determination of Significance of Residual Effects Significance ranking assumes effective implementation of the adaptive management plan and actions If predetermined alert or action levels are observed								
		Direction	Magnitude+	Geographical Extent	Duration	Frequency	Reversibility	Ecological context	Significance	Prediction Confidence
Sediment Quality										
Nutrient Concentrations	• Implementation of EMP's and BMP's (Section 2.8.1) • Maintenance of stable water levels in Fish Lake • Seepage collection and pump back to TSF and/or OP • Partial draining and early reclamation of TSF at the end of ore processing • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives. • Eutrophication control via hypolimnetic aeration, alum treatment,									
Metal Concentrations	• Implementation of EMP's and BMP's (Section 2.8.1) • Seepage collection and pump back to TSF and/or OP • Partial draining and early reclamation of TSF at the end of ore processing • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									

Sulphate Concentrations	• Implementation of EMP's and BMP's (Section 2.8.1) • Seepage collection and pump back to TSF and/or OP • Partial draining and early reclamation of TSF at the end of ore processing • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives.									
Change in Sedimentation	• Implementation of EMP's and BMP's (Section 2.8.1) • Maintenance of stable water levels in Fish Lake • Maintenance of TSF discharge directly to pit bypassing Fish Lake, and recirculation to fish habitat until such time as the TSF water quality meets acceptable quality objectives. • Eutrophication control via hypolimnetic aeration, alum treatment,									
Benthic Invertebrates										
Changes in invertebrate community structure	• Implementation of EMP's and BMP's (Section 2.8.1) • Maintenance of stable water levels in Fish Lake • Flow recirculation to offset hydrologic impacts • Regulation of temperatures with multi-port water withdrawal • Maintenance of TSF pump back and recirculation to fish habitat until such time as water quality meets acceptable quality objectives • Eutrophication control via hypolimnetic aeration, alum treatment, water Treatment									

KEY

†Alert – a level or change identified from monitoring that requires precautionary planning should the adverse changes and levels continue.

Action – mitigation designed and planned as part of adaptive management would be implemented and would continue until the levels and and/or changes return to manageable and acceptable levels.

***Direction*:**

Geographic Extent:
S: Site-specific
L: Local
R: Regional

Duration:
ST: Short term
MT: Medium Term
LT: Long Term
FF: Far Future or Permanent.

***Frequency*:**
R: Rare - Occurs Once
I: Infrequent - Occurs sporadically at irregular intervals
F: Frequent - Occurs on a regular basis and at

Reversibility:
R: Reversible
I: Irreversible

Ecological Context:
U:Undisturbed: Area relatively or not adversely affected by human activity
D:Developed: Area has been substantially previously disturbed by human development or human development is still present
N/A: Not applicable.

Significance:
S: Significant
N: Not Significant

Prediction Confidence:
Based on scientific information and statistical analysis, professional judgment, effective mitigation and adaptive management
L: Low level of confidence
M: Moderate level of confidence
H High level of confidence

P: Positive **N:** Neutral **A:** Adverse ***Magnitude:*** **L:** Low–environmental effect occurs that may or may not be measurable, but is within the range of natural variability. **M:** Moderate–environmental effect occurs, but is unlikely to pose a serious risk or present a management challenge. **H:** High– environmental effect is likely to pose a serious risk or present a management challenge.	regular intervals **C:** Continuous		

The sediment quality effects assessment is largely based upon predictive water quality modelling that considers hydrologic inputs and chemical loadings. These hydrologic inputs are reflective of the various phases of the project. For many of the phases anticipated dates are fairly close to the actual date on which they will occur, others (ie. closure phase II) were selected arbitrarily for modelling purposes.

The selection of the closure phase II period is a very important one to the water quality assessment because this coincides with the TSF Lake being allowed to flow naturally into Fish Lake. In nearly all situations this period exhibited the greatest aqueous elemental concentrations and therefore the greatest potential effect to sediment quality. The actual timing of closure phase II, and subsequently release of water from the TSF Lake into Fish Lake, will actually occur when water quality is deemed suitable.

The rationale for the significance determinations for sediment quality are as follows:

- xxxxxxx
- xxxxxxx
- xxxxxxx
- xxxxxxxx
- xxxxxxxx

Scope of Assessment – Aquatic Ecology

There is a potential for interactions between lake productivity (phytoplankton, zooplankton and benthic invertebrate communities) and Project works and activities (Table 2.7.2.4B-2). The key environmental effects of potential concern considered in detail in the plankton and macro-invertebrate communities' assessment include:

- Altered productivity of phytoplankton, zooplankton and benthic invertebrate communities in Fish Lake resulting from decreased inflow (recycled flow, altered water chemistry) from construction through post-closure

- Altered productivity of phytoplankton, zooplankton and benthic invertebrate communities in Fish Lake as a result of sediment loading from construction works, and
- Altered productivity of phytoplankton, zooplankton and benthic invertebrate communities in Fish Lake resulting from TSF seepage (altered water and sediment chemistry) from operations through post-closure.

The following sections describe potential project effects (main phases) on Fish Lake plankton (phytoplankton and zooplankton) and benthic invertebrates communities. In addition, the planned mitigation and/or adaptive management measures are also highlighted.

Effects Assessment Methods – Aquatic Ecology

The assessment methods used to determine the effects on sediment quality are consistent with the EIS guidelines. Changes in aquatic ecosystems and ecology resulting from the Project were predicted qualitatively and quantitatively considering available baseline phytoplankton, zooplankton and benthic invertebrate communities' data, water chemistry predictions, physical forces (flow diversions or additions) and Fish Lake model productivity predictions.

Two aspects are considered in assessing effects of the Project on aquatic ecology:

- Stream productivity (periphyton and benthic invertebrates (See section XXXXX).
- Lake productivity (phytoplankton, zooplankton, and benthic invertebrates).

The results are compared against baseline concentrations as well as the applicable provincial and federal guidelines where available to determine the nature of environmental effects. Results are presented in both a tabulated and graphic form. Where necessary, a description of contingency plans is presented to address uncertainties and risks associated with predictions.

The assessment of changes in Fish Lake Productivity involved three (3) separate analyses relating to:

- Alteration of productivity (phytoplankton, zooplankton and benthic invertebrate communities) resulting from decreased inflow from Project construction phase through post-closure
- Altered productivity (phytoplankton, zooplankton and benthic invertebrate communities) with respect to potential erosion and sediment export from construction activities, and

Alteration of productivity (phytoplankton, zooplankton and benthic invertebrate communities) in due to adverse effects of potential uncaptured tailings seepage and tailings pond discharges from the operational phase through post-closure.

Baseline Conditions – Aquatic Ecology

The baseline aquatic conditions are clearly described in Section 2.6.1.4. No additional invertebrates were collected from Fish Lake, the adjacent streams or adjacent lakes. Therefore the baseline data for this submission corresponds directly to that presented in the previous EIS submission.

Project Effects – Aquatic Ecology

Fish Lake Trophic Status/Productivity Model

While the old Prosperity Project configuration included the loss of Fish Lake, the New Prosperity Mine design preserves Fish Lake and the main inlet streams, which provide most of the spawning habitats and feeding areas for resident adult fish. In support of this revised Project description, Triton Environmental Consultants Ltd. (Triton) was retained in 2011 by Taseko Mines Limited (TML) to conduct additional water quality surveys, develop limnological models to predict the potential effects of mine operations, develop a continual environmental quality monitoring plan for the Project area, and if necessary, develop impact mitigation strategies for Fish Lake. The physical, chemical, and biological characteristics of Fish Lake have been detailed in numerous reports as indicated above and the Productivity Model Report is provided as a technical appendix (Appendix x).

The primary objective of the modeling was to utilize nutrient balance and eutrophication response models to understand how the expected reduction in stream flow rates, caused by the New Prosperity Mine Project configuration, may impact nutrient cycling and fish population dynamics in Fish Lake. The ability to predict the potential impact of mine operations on the water quality of Fish Lake provides an indication of whether or not water quality may be of concern to aquatic organisms as a result of the project. Modeling capabilities will help predict the environmental responses to mining activities as well as providing the data needed to develop and implement effective mitigation measures to counteract reduced flows. The anticipated changes to both the inlet and outlet flow rates of Fish Late may have implications for algal and fish ecology and population structure in the lake. The reduced and recycled inflow has the potential to alter the nutrient cycle of the lake. Understanding the potential changes to this system is essential for ensuring the success of a whole-lake management plan. The principal objective of the modeling was to determine the potential impacts of reduced flow and potential uncaptured tailings seepage from operations through post-closure to the productivity of Fish Lake. The modelling was based on the the following:

1. A review of the scientific literature (Vollenweider, 1975, 1976; Volohonski et al., 1992; Brett and Benjamin, 2008)
2. Reports on the ecology and habitat of wild Rainbow Trout monoculture lakes in the Cariboo-Chilcotin region of British Columbia (Lirette and Chapman, 1993; Triton, 1997)
3. Fish and fish habitat studies of the Fish Lake watershed (Triton, 2011a)
4. Research into the effects of water withdrawal on northern lakes (Cott, 2008)
5. The professional knowledge, experience, and judgment of Triton's team of water quality specialists and fisheries biologists

This modelling employed two nutrient mass balance models: (1.) the classic empirical model developed by Vollenwieder, which is retention time and load driven (Vollenweider, 1975, 1976); and, (2.) the "BATHTUB" model developed by the United States Army Corps of Engineers, USGS, which is morphometric and process driven (Walker, 1986). Detailed descriptions of the Vollenweider Model and the BATHTUB model underlying theory, program operation, model options, output variables, calibrations, and application scenarios are provided in *Fish Lake productivity model* report (Appendix 2.7.2.4B-XX). The use of two models was to determine if predictions from the two models corroborate each other and in the process, increase the reliability of productivity predictions.

Mass balance models are practical tools in strategic planning aimed at predicting the effect of different loading scenarios on the trophic status of a lake (Vollenweider, 1975, 1976; see review by Brett and

Benjamin, 2008). Although temporal variations in water quality cannot be described by these models, changes between successive steady states can be (transient models, Bilaletdin et al., 2011).

Effects Prediction – Aquatic Ecology

Fish Lake is a relatively small (111 ha), shallow (maximum depth of 12 m, mean depth of 4 m), dimictic, meso-eutrophic lake with a substantial amount of P retained in the sediments. Models showed that over 60% of the P budget in Fish Lake may be due to internal P regeneration (Kirchner and Dillon, 1975). The proposed 60% reduced inflow to Fish Lake was determined to increase hydraulic residence time (HRT) in Fish Lake from the current 0.72 years to 1.81 years (Table 2.7.2.4B-45). However, the planned recirculation of water from the outlet of Fish Lake back through the principal inlets will help stabilize the Fish Lake HRT, and in the process minimize the effects of reduced flow on the ecology of the lake. In fact, the HRT was determined to be 1.05 years with the recirculated flow.

Table 2.7.2.4B-45 Hydraulic Residence Time for Fish Lake Under Different Flow Regimes

Flow Regime	Inflow Sources	Lake Volume	Annual Outflow	*HRT = Lake Volume / Outflow
Baseline (current) flow	Watershed + precipitation = 6.13 x 10^6 m^3	4.44 x 10^6 m^3	6.13 x 10^6 m^3	0.72 years
Flow reduced by 60%	Watershed + precipitation = 2.45 x 10^6 m^3	4.44 x 10^6 m^3	2.45 x 10^6 m^3	1.81 years
With recirculated flow	Watershed + precipitation + mitigation flows = 4.66 x 10^6 m^3	4.44 x 10^6 m^3	4.66 x 10^6 m^3	1.05 years

*Brett and Benjamin (2008)

The results presented here for purposes of the draft EIS are provided solely as examples of content and format for purposes of adequacy and do not reflect final data or analysis. That will be completed fotr submission in the final EIS.

The result of both the Vollenweider and BATHTUB models suggest that the trophic status of Fish Lake will remain largely unchanged with reduced flow as long as water draining out of Fish Lake is recirculated back to Upper Fish Creek's spawning and rearing habitats, and ultimately into Fish Lake (Figures 2.7.2.4B-14 to 2.7.2.4B-19). In addition, the Fish Lake water volume (stage) should be continually maintained through the life of mine and beyond. This outcome was predicated on the assumption that there was no seepage influence on Fish Lake water quality (i.e., prior to closure and post-closure phases). Additionally, the level of Fish Lake fish productivity was compared to other regional lakes using the Plante and Downing (1993) fish productivity model equation. In general, Fish Lake productivity with reduced flow compares favourably with values obtained from lakes in the vicinity and other parts of British Columbia (without seepage discharge).

BATHTUB models and Carlson indices showed that during mine closure and post-closure phases, Fish Lake trophic status may shift from being meso-trophic to a more highly productive eutrophic lake (Figures 2.7.2.4B-14 to 2.7.2.4B-19).

The potential effects of additional P influx from TSF seepage discharge post-closure for Fish Lake water quality are discussed in the attached EIS appendices (APPENDIX XXXX) and may include increased algal (cyanobacteria) blooms and hypolimnetic oxygen depletion (cf. Schindler, 1974, 1977; Edmondson, 1991, Ogbebo et al., 2009a, b). Consequently, a monitoring program will be undertaken for Fish Lake during construction, operations (life-of-mine), and beyond. In addition should there be any signs of change or deterioration in Fish Lake water quality mitigation measures can be applied. These measures are outlined in the Productivity Model technical appendix (Appendix x) and could include hypolimnetic aeration as well as flocculent treatment to control nutrients and active water treatment to remove other parameters.

Table 2.7.2.4B-46 Summary of BATHTUB Predicted Fish Lake TP Concentrations Compared to Lake Trophic Status from Nordin (1985), Wetzel (1975, 2001), and CCME (2007)

Source	Trophic Status	Spring TP (µg/L)	Measured Fish Lake TP (µg/L)	Flow Regime/loading scenarios	Fish Lake TP (µg/L) – Derived from Vollenweider Model
Nordin, 1985	Oligotrophic	1 - 10			
	Mesotrophic	10 - 30	26	Baseline (current) flow	22
				Flow reduced by 60%	17
				With recirculated flow	20
				Recirculated flow (operation)	**25.2**
	Eutrophic	>30		**Recirculated flow (closure and post-closure)**	**57.3**
Wetzel, 1975	Ultra-oligotrophic	<1 - 5			
	Oligo-mesotrophic	5 - 10			
	Mesotrophic	n/a			
	Meso-eutrophic	10 - 30	26	Baseline (current) flow	22
				Flow reduced by 60%	17
				With recirculated flow	20
				Recirculated flow (operation)	**25.2**
	Eutrophic	> 30		**Recirculated flow (closure and post-closure)**	**57.3**
CCME, 2007	Ultra-oligotrophic	<4			
	Oligotrophic	4 - 10			
	Meso-trophic	10-20			
	Meso-eutrophic	20 - 35	26	Baseline (current) flow	22
				Flow reduced by 60%	17
				With recirculated flow	20
				Recirculated flow (operation)	**25.2**
	Eutrophic	35-100		**Recirculated flow (closure and post-closure)**	**57.3**
	Hyper-eutrophic	>100			

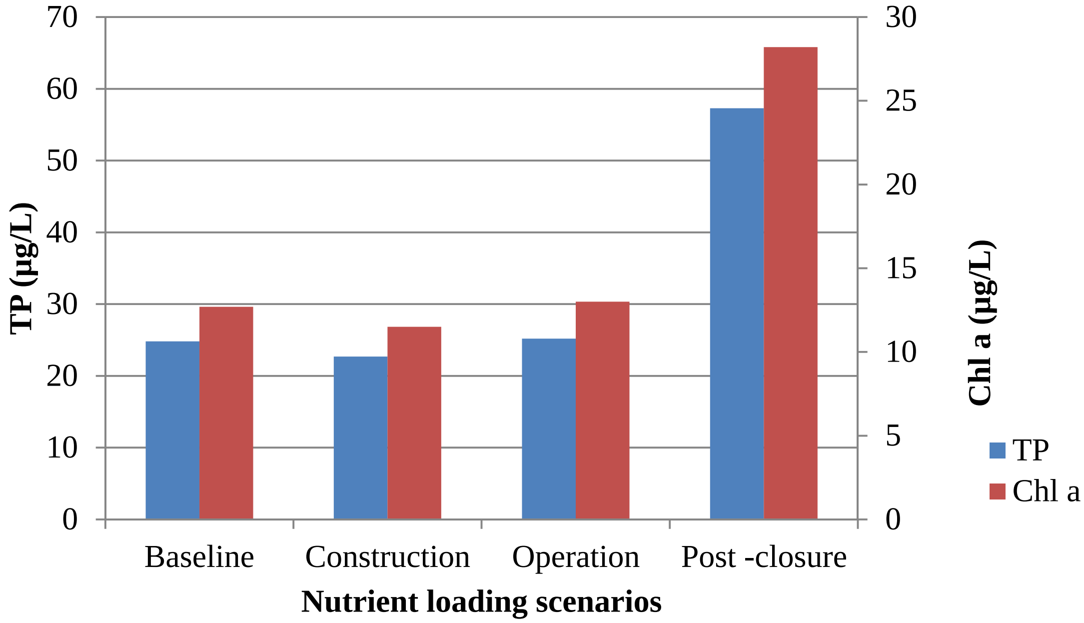


Figure 2.7.2.4B-14 Predicted Fish Lake Phytoplankton Biomass and Total Phosphorus Concentration Under Different Nutrient Loading Scenarios

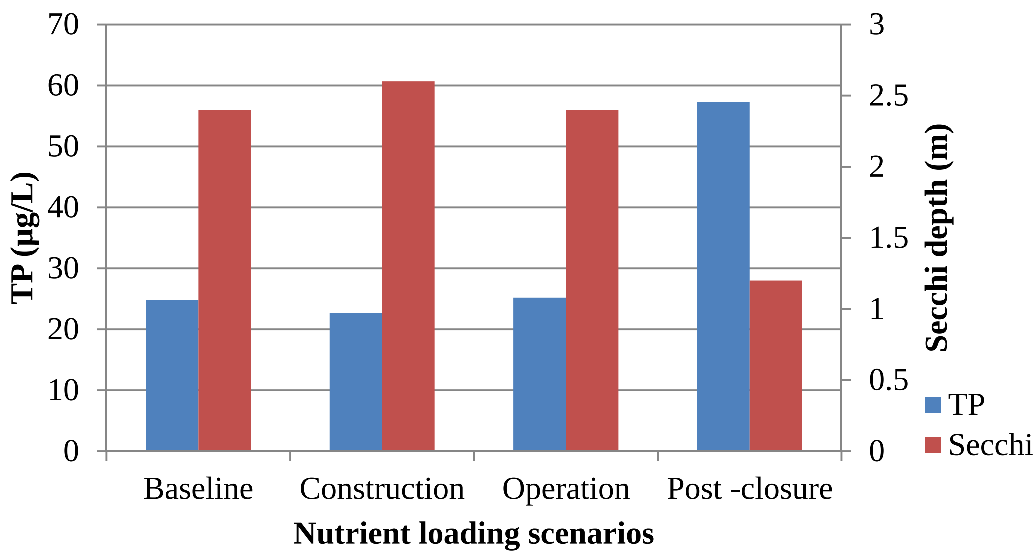


Figure 2.7.2.4B-15 Predicted Fish Lake Total Phosphorus Concentrations and Secchi Depth Under Different Loading Scenarios

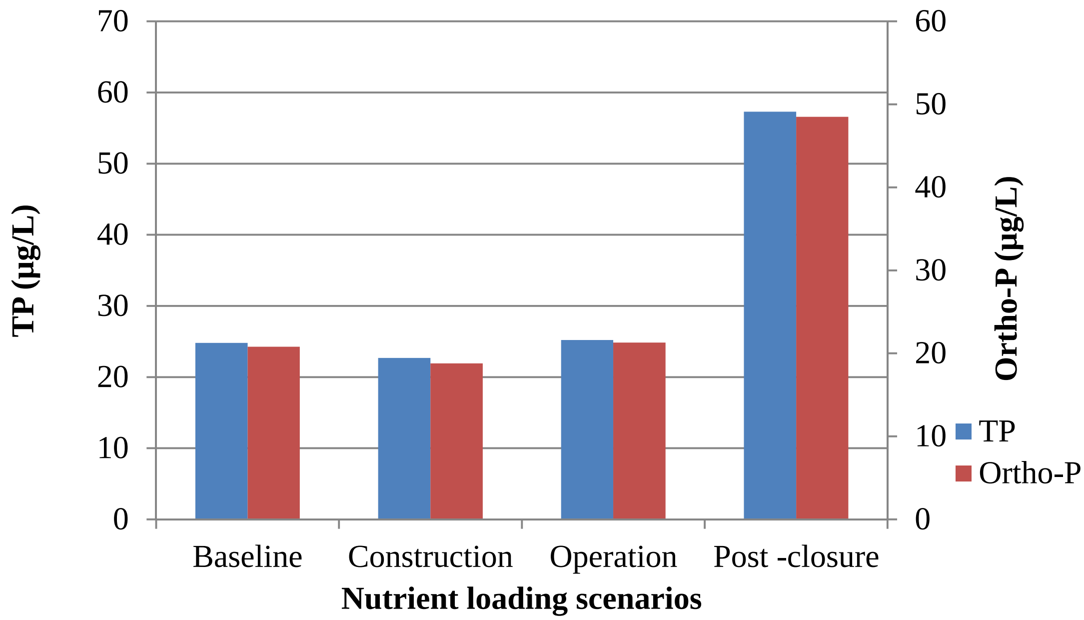


Figure 2.7.2.4B-16 Predicted Fish Lake Total Phosphorus and Ortho-phosphate Concentrations Under Different Nutrient Loading Scenarios

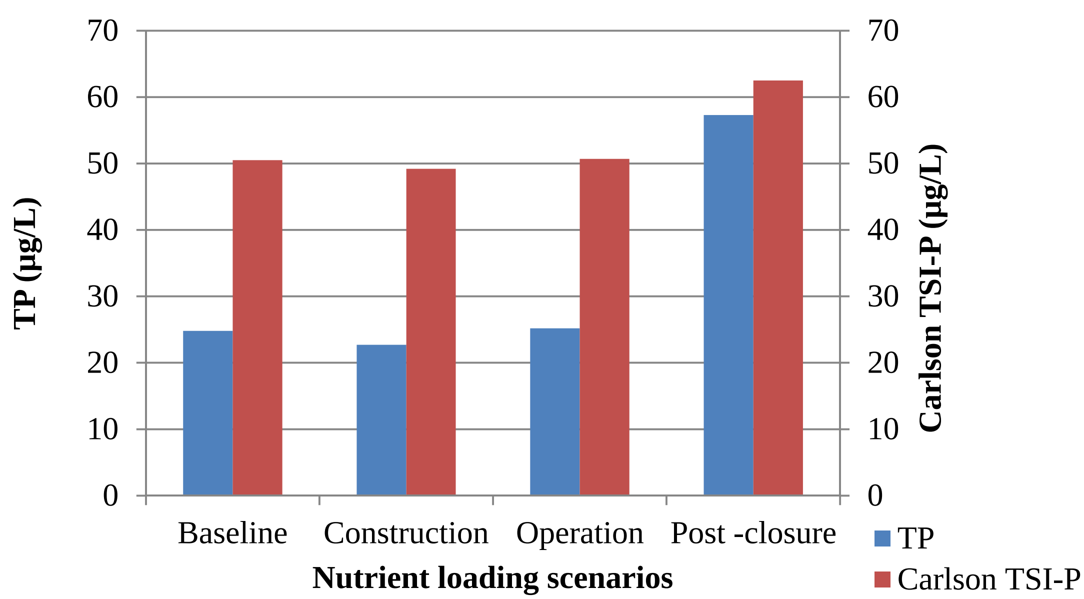


Figure 2.7.2.4B-17 Predicted Fish Lake Total Phosphorus Concentrations and Carlson TSI-P Index Under Different Nutrient Loading Scenarios

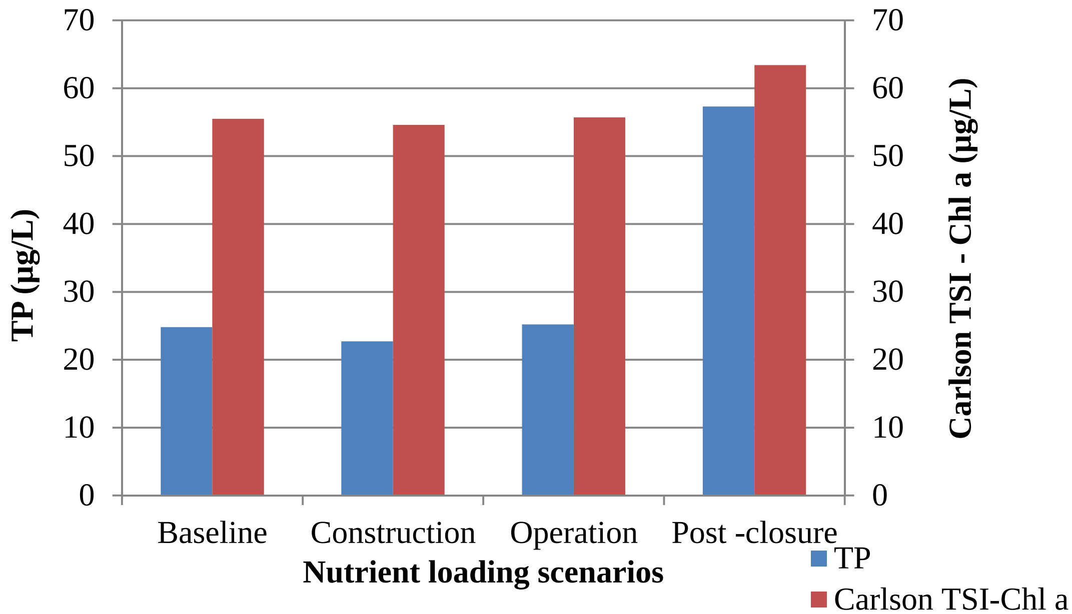


Figure 2.7.2.4B-18 Predicted Fish Lake Total Phosphorus Concentrations and Carlson TSI-Chl *a* Index Under Different Nutrient Loading Scenarios

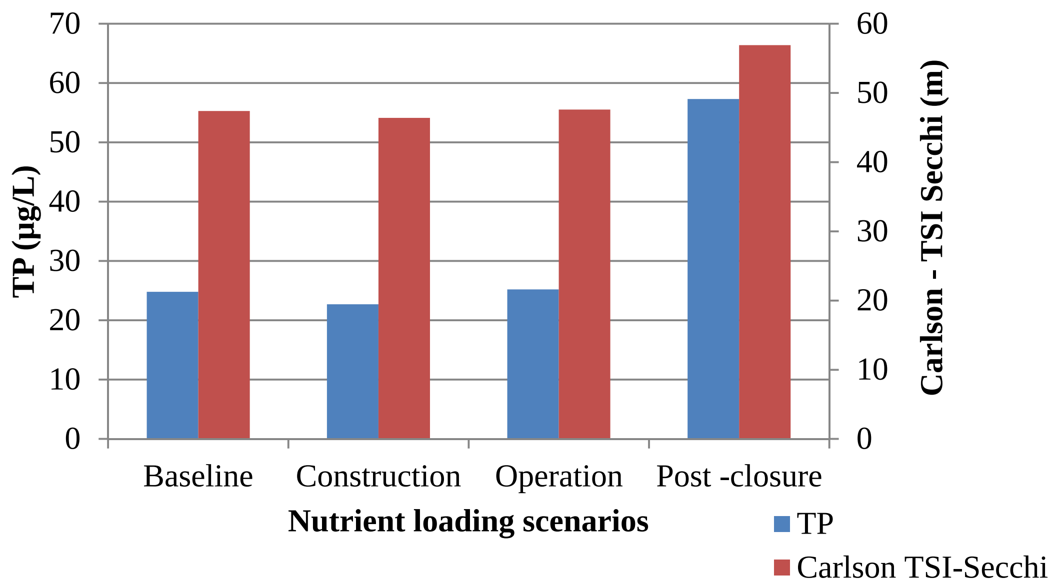


Figure 2.7.2.4B-19 Predicted Fish Lake Total Phosphorus Concentrations and Carlson TSI-Secchi *a* Index Under Different Nutrient Loading Scenarios

Effects Prediction – Phase Specific Effects – Aquatic Ecology

As highlighted in Table 2.7.2.4B-3, some Project activities associated with open pit construction, fisheries compensation works (constructions and operations), Fish Lake water management controls and operation, and TSF starter dam construction (flooding of the upper Fish Creek drainage), will alter the hydrologic conditions in Fish Lake. In addition, other activities such as seepage management and discharge of TSF water have the potential to adversely affect the growth, abundance and composition of plankton and benthic invertebrate communities. Many of the Project effects already described for Fish Lake water and sediment quality are equally applicable to plankton and benthic invertebrate communities. However attempts are made to describe briefly the three key elements identified with the Project construction, operations and mine closure that may potentially impact plankton and benthic invertebrates. They are reduced flow to Fish Lake, potential sediment loading from construction activities, and TSF seepage chemistry.

All proposed construction activities have the potential to cause short-term effects to water quality, plankton and benthic invertebrate communities. One of the greatest of these would be the interception of approximately 60% of Fish Lake inflow by the TSF. Specifically, the reduction in average flows of Fish Creek upstream of Fish Lake will result in increased water or hydraulic residence time (HRT). As described earlier in this section, an increased HRT may provide relatively more time for algae to take up nutrients, both from external sources and internally regeneration from lake-sediment. Fish Lake productivity model prediction indicates that post-closure there is the possibility of a shift in lake productivity from the current meso-trophic to more eutrophic system (Nordin, 1985). Potential effects of eutrophication include increased algal blooms, macrophyte growth, and periodic winter fish kills (Schindler 2006).

The release of sediments or sediment-laden water to Fish Lake Sediment during construction has the potential to affect plankton and benthos. Apart from the obvious impact of reducing water clarity and thus affecting primary productivity, considerable sediment loading may have an adverse effect on some of the relatively sensitive benthos such as Ephemeroptera, Trichoptera, or Plecoptera. Additional levels of metals and or nutrients in sediment laden water may contribute to Fish Lake eutrophication.

During mine operations, the small volume of potentially un-captured tailings seepage could eventually report to Fish Lake. Since TSF seepage may contain elevated concentrations of metals, which can negatively impact downstream environments including Fish Lake, efforts were undertaken to evaluate seepage chemistry. According to water quality predictions, several of the parameters including cadmium and mercury surpassed both the BCWQG and CCME guideline during the operational and post-closure phases. Other elements including copper, selenium, sulfate, iron were also assessed to be elevated and where predicted to exceed both guidelines post-mine closure under the modelling assumptions.

Mitigation Measures – Aquatic Ecology

It should be noted that the mitigations measures recommended for the protection of water and sediment quality equally applies to Fish Lake productivity. These measures have been discussed earlier in this section. In this section, key mitigation measures to that are specifically designed to minimize the potential Project effects on Fish Lake productivity will be emphasized. Detailed descriptions of proposed mitigation measures and adaptive management plan for Fish Lake and adjacent upper Fish Creek are described earlier in this section.

Mitigation measures to address changes in flow to Fish Lake have been previously described for water quality and sediment quality. Those measures will be implemented to maintain flow and as well as the HRT. In addition, the Proponent is committed to ensuring that routine and intensive monitoring program is implemented. Should there be any sign of water quality deterioration from monitoring, appropriate mitigation measures and treatment will be implemented.

To minimize the introduction of sediment into Upper Fish Creek, Fish Lake or other adjoining waterbodies during construction, the Proponent will develop and implement a surface sediment and erosion control plan to prevent release of sediments or sediment-laden water. In addition, the Proponent is committed to training work crews in the proper installation, use and maintenance of sediment and erosion control methods. The water quality program will be monitored during construction to ensure compliance with BC Approved water quality guidelines for the protection of aquatic life (TSS and turbidity).

Cumulative Effects Assessment for Aquatic Ecology

As described in Section 2.7.1, cumulative environmental effects were only assessed if all three of the following conditions were met for the environmental effect:

- The Project results in a measurable, demonstrable or reasonably-expected residual environmental effect on a component of the environment
- The Project-specific residual environmental effect does, or is likely to, act in a cumulative fashion with the environmental effects of other past or future projects and activities that are likely to occur, and
- There is a reasonable expectation that the Project's contribution to cumulative environmental effects will affect the viability or sustainability of the resource or value.

The Project inclusion list (Table 2.7.1.4-1) identifies past, present and reasonably foreseeable projects and activities that could interact cumulatively with the Project. The locations of each of the 22 projects and activities are shown on Figure 2.7.1.4-1. As indicated in Table 2.7.1.4-1, eight of these project and activities are new since 2009. Of the eight new projects, only one, the Newton Mountain mine development, is located west of the Fraser River and, therefore, considered potentially able to interact cumulatively with the Project's residual effects on aquatic ecology. However, it should be noted the while Newton Mountain constitutes an active exploration program, there is no defined resource and the likelihood that it will develop into a mining project is far from likely.

In regards to cumulative assessment to aquatic ecology, the first condition is met there is potential for Project-specific residual effects in the Fish Creek and Beece Creek watersheds. However, the combination of the relative unlikelihood of the development of the Newton Mountain Project and the spatial separation of the two projects do not constitute a reasonable expectation of cumulative effects between the projects. Therefore the predicted residual effects on the sediment quality resulting from cumulative effects are not anticipated to be significant.

Determination of the Significance of Residual Effects for Aquatic Ecology

The assessment methodology for the characterization of residual effects and determination of significance is described in Section 2.7.1.5. The findings of the residual effects assessment for aquatic ecology for Fish Lake and adjacent lakes are summarized in Tables 2.7.2.4B-47 and 48. While nutrients, metals and sulphate concentrations in may increase in Fish Lake and adjacent lakes during mine operation and through closure phases, no significant residual adverse effects to Fish Lake and adjacent lakes are anticipated to aquatic ecology with proposed mitigation and application of environmental management plans.

Note re Determination of Significance

The determination of significance tables and rationale for significance that follow for all aspects of this section are currently being left blank for purposes of the draft EIS as it is being reviewed by third parties and will be completed in the EIS submitted for panel.

Table 2.7.2.4B-47 Determination of Significance of Residual Effects for Changes in Aquatic Ecology (Fish Lake)

Potential Environmental Effect: to Aquatic Ecology	Proposed and Potential Mitigation Measures/ Compensation Measures	Determination of Significance of Residual Effects Significance ranking assumes effective implementation of the adaptive management plan and actions If predetermined alert or action levels are observed								
		Direction	Magnitude†	Geographical Extent	Duration	Frequency	Reversibility	Ecological context	Significance	Prediction Confidence
Lentic Invertebrates in Fish Lake										
Changes in invertebrate community structure (abundance and composition)	• Implementation of EMP's and BMP's (Section 2.8.1) • Maintenance of stable water levels in Fish Lake • Regulation of temperatures with multi-port water withdrawal • Maintenance of TSF pump back and recirculation to fish habitat until such time as water quality meets acceptable quality objectives • Eutrophication control via hypolimnetic aeration, alum treatment,									

KEY

†Alert – a level or change identified from monitoring that requires precautionary planning should the adverse changes and levels continue.

Action – mitigation designed and planned as part of adaptive management would be implemented and would continue until the levels and/or changes return to manageable and acceptable levels.

***Direction*:**
P: Positive

Geographic Extent:
S: Site-specific
L: Local
R: Regional

Duration:
ST: Short term
MT: Medium Term
LT: Long Term
FF: Far Future or Permanent.

***Frequency*:**
R: Rare - Occurs Once
I: Infrequent - Occurs sporadically at irregular intervals
F: Frequent - Occurs on a regular basis and at regular intervals

Reversibility:
R: Reversible
I: Irreversible

Ecological Context:
U:Undisturbed: Area relatively or not adversely affected by human activity
D:Developed: Area has been substantially previously disturbed by human development or human development is still present
N/A: Not applicable.

Significance:
S: Significant
N: Not Significant

Prediction Confidence:
Based on scientific information and statistical analysis, professional judgment, effective mitigation and adaptive management
L: Low level of confidence
M: Moderate level of confidence
H High level of confidence

N: Neutral **A:** Adverse ***Magnitude:*** **L:** Low–environmental effect occurs that may or may not be measurable, but is within the range of natural variability. **M:** Moderate–environmental effect occurs, but is unlikely to pose a serious risk or present a management challenge. **H:** High– environmental effect is likely to pose a serious risk or present a management challenge.	**C:** Continuous		

The sediment quality effects assessment is largely based upon predictive water quality modelling that considers hydrologic inputs and chemical loadings. These hydrologic inputs are reflective of the various phases of the project. For many of the phases anticipated dates are fairly close to the actual date on which they will occur, others (ie. closure phase II) were selected arbitrarily for modelling purposes.

The selection of the closure phase II period is a very important one to the water quality assessment because this coincides with the TSF Lake being allowed to flow naturally into Fish Lake. In nearly all situations this period exhibited the greatest aqueous elemental concentrations and therefore the greatest potential effect to sediment quality. The actual timing of closure phase II, and subsequently release of water from the TSF Lake into Fish Lake, will actually occur when water quality is deemed suitable.

The rationale for the significance determinations for Fish Lake Aquatic Ecology are as follows:

- xxxxxxxxxxxxxx

Table 2.7.2.4B-48 Determination of Significance of Residual Effects for Changes in Aquatic Ecology (Adjacent Lakes)

Potential Environmental Effect: to Aquatic Ecology	Proposed and Potential Mitigation Measures/ Compensation Measures	Determination of Significance of Residual Effects Significance ranking assumes effective implementation of the adaptive management plan and actions If predetermined alert or action levels are observed								
		Direction	Magnitude†	Geographical Extent	Duration	Frequency	Reversibility	Ecological context	Significance	Prediction Confidence
Lentic Invertebrates adjacent waterbodies										
Changes in invertebrate community structure (abundance and composition)	• Implementation of EMP's and BMP's (Section 2.8.1) • Maintenance of stable water levels in Fish Lake • Regulation of temperatures with multi-port water withdrawal • Maintenance of TSF pump back and recirculation to fish habitat until such time as water quality meets acceptable quality objectives • Eutrophication control via hypolimnetic aeration, alum treatment, water Treatment									

KEY †Alert – a level or change identified from monitoring that requires precautionary planning should the adverse changes and levels continue. Action – mitigation designed and planned as part of adaptive management would be implemented and would continue until the levels and/or changes return to manageable and acceptable levels. ***Direction*:** **P:** Positive **N:** Neutral **A:** Adverse ***Magnitude:*** **L:** Low–environmental effect occurs that may or may not be measurable, but is within the range of natural variability.	***Geographic Extent:*** **S:** Site-specific **L:** Local **R:** Regional ***Duration:*** **ST**: Short term **MT**: Medium Term **LT**: Long Term **FF**: Far Future or Permanent. ***Frequency*:** **R:** Rare - Occurs Once **I:** Infrequent - Occurs sporadically at irregular intervals **F:** Frequent - Occurs on a regular basis and at regular intervals **C:** Continuous	***Reversibility:*** **R:** Reversible **I:** Irreversible ***Ecological Context:*** **U:**Undisturbed: Area relatively or not adversely affected by human activity **D:**Developed: Area has been substantially previously disturbed by human development or human development is still present **N/A:** Not applicable.	***Significance:*** **S:** Significant **N:** Not Significant ***Prediction Confidence:*** Based on scientific information and statistical analysis, professional judgment, effective mitigation and adaptive management **L:** Low level of confidence **M:** Moderate level of confidence **H** High level of confidence

M: Moderate–environmental effect occurs, but is unlikely to pose a serious risk or present a management challenge. **H:** High– environmental effect is likely to pose a serious risk or present a management challenge.			

The sediment quality effects assessment is largely based upon predictive water quality modelling that considers hydrologic inputs and chemical loadings. These hydrologic inputs are reflective of the various phases of the project. For many of the phases anticipated dates are fairly close to the actual date on which they will occur, others (ie. closure phase II) were selected arbitrarily for modelling purposes.

The selection of the closure phase II period is a very important one to the water quality assessment because this coincides with the TSF Lake being allowed to flow naturally into Fish Lake. In nearly all situations this period exhibited the greatest aqueous elemental concentrations and therefore the greatest potential effect to sediment quality. The actual timing of closure phase II, and subsequently release of water from the TSF Lake into Fish Lake, will actually occur when water quality is deemed suitable.

The rationale for the significance determinations for Aquatic Ecology in adjacent lakes are as follows:

- xxxxxxxxxxx

Summary of Effects Assessment – Water / Sediment quality and aquatic ecology

The anticipated effects identified through the water quality and aquatic ecology assessments are summarized beneath in Tables 2.7.2.4B-49 to 2.7.2.4B-55

Table 2.7.2.4B-49 Summary of Water Quality Effects Assessment for Fish Lake

Effects Assessment	Concise Summary of Potential Project Effects on Fish Lake Water Quality
Beneficial and Adverse Effects	xxxxxxxxx
Mitigation and Adaptive Management Measures	xxxxxxxxxx
Potential Residual Effects	xxxxxxxxxxxx
Cumulative Effects	xxxxxxxxxxxxx
Determination of the significance of residual effects	xxxxxxxxxxxxxx
Likelihood of occurrence for adverse effects found to be significant	xxxxxxxxxxxxxx

Table 2.7.2.4B-50 Summary of Water Quality Effects Assessment for Fish Lake Tributaries

Effects Assessment	Concise Summary of Potential Project Effects on Fish Lake Tributaries Water Quality
Beneficial and Adverse Effects	xxxxxxxxxxx
Mitigation and Adaptive Management Measures	xxxxxxxxxxxxx
Potential Residual Effects	xxxxxxxxxxxxx
Cumulative Effects	xxxxxxxxxxxxx
Determination of the significance of residual effects	xxxxxxxxxxxxxx
Likelihood of occurrence for adverse effects found to be significant	xxxxxxxxxxxx

Table 2.7.2.4B-51 Summary of Water Quality Effects Assessment in Adjacent Streams and Rivers

Effects Assessment	Concise Summary of Potential Project Effects on Water Quality in Adjacent Streams and Rivers (Lower Fish Creek, Beece Creek, Taseko River, Chilcotin River, and Fraser River)
Beneficial and Adverse Effects	xxxxxxxxxxxxxx
Mitigation and Adaptive Management Measures	xxxxxxxxxxxxx
Potential Residual Effects	xxxxxxxxxxxxxx
Cumulative Effects	xxxxxxxxxxxxxx
Determination of the significance of residual effects	xxxxxxxxxxxxxx
Likelihood of occurrence for adverse effects found to be significant	xxxxxxxxxxxxxxxx

Table 2.7.2.4B-52 Summary of Water Quality Effects Assessment in Adjacent Lakes

Effects Assessment	Concise Summary of Potential Project Effects on Water Quality in Adjacent Lakes (Wasp, Little Onion and Big Onion)
Beneficial and Adverse Effects	xxxxxxxxxxxxxxx
Mitigation and Adaptive Management Measures	xxxxxxxxxxx
Potential Residual Effects	xxxxxxxxxxx
Cumulative Effects	xxxxxxxxxxxx
Determination of the significance of residual effects	xxxxxxxxxxxxx
Likelihood of occurrence for adverse effects found to be significant	xxxxxxxxxxxx

Table 2.7.2.4B-53 Summary of Effects Assessment for Sediment Quality

Effects Assessment	Concise Summary of Potential Project Effects on Fish Lake Sediment Quality
Beneficial and Adverse Effects	xxxxxxxxxxxx
Mitigation and Adaptive Management Measures	xxxxxxxxxxxxx
Potential Residual Effects	xxxxxxxxxxxx
Cumulative Effects	xxxxxxxxxxxx
Determination of the significance of residual effects	xxxxxxxxxxxxx
Likelihood of occurrence for adverse effects found to be significant	xxxxxxxxxxxx

Table 2.7.2.4B-54 Summary of Effects Assessment for Aquatic Ecology – Lentic Invertebrates

Effects Assessment	Concise Summary of potential effects to Aquatic Ecology-Lentic Invertebrates
Beneficial and Adverse Effects	xxxxxxx
Mitigation and Adaptive Management Measures	xxxxxxxxxxxx
Potential Residual Effects	xxxxxxxxxxxxx
Cumulative Effects	xxxxxxxxxxxx
Determination of the significance of residual effects	xxxxxxxxxxx
Likelihood of occurrence for adverse effects found to be significant	xxxxxxxxxx

Table 2.7.2.4B-55 Summary of Effects Assessment for Aquatic Ecology – Lotic Invertebrates

Effects Assessment	Concise Summary of potential effects to Aquatic Ecology-Lotic Invertebrates
Beneficial and Adverse Effects	xxxxxxxxxxx
Mitigation and Adaptive Management Measures	xxxxxxxxxx
Potential Residual Effects	xxxxxxxxxx
Cumulative Effects	xxxxxxxxxxx
Determination of the significance of residual effects	xxxxxxxxxx
Likelihood of occurrence for adverse effects found to be significant	xxxxxxxxxxx

ADDITIONAL WORK

To address model predictions uncertainties regarding responses of aquatic organisms and the Rainbow Trout population in Fish Lake to decreased inflow and seepage during operations and beyond, a stringent phytoplankton, zooplankton, and benthic invertebrate sampling program, along with water and sediment monitoring plan, will be put in place to monitor potential water quality changes in Fish Lake.

FOLLOW UP MONITORING

A comprehensive monitoring program to evaluate the change the water / sediment quality and aquatic ecology will be an integral part of the operations for the proposed mine, and will be detailed through the permitting process.

C. SEDIMENT QUALITY AND BENTHOS

The information for this section has already been provided in Section 2.7.2.4B in order to maintain consistency with the previous EIS submission.

2.7.2.5 Fish and Fish Habitat

The proposed Project will interact with fish and fish habitat within the Project area. This section evaluates the potential effects of the Project on fish and fish habitat (stream and lake) and the recreational fishery in the Fish Creek watershed. Mitigation measures are described and compensation plans to address the unavoidable harmful alteration or loss of fish habitat are outlined.

Scope of Assessment

This section summarizes the scope, guidance and approach to the assessment of the effects of the Project on fish and fish habitat resources. Section 2.6.1.5 summarizes 1993– 2012 baseline work as required to meet 2012 policies, programs and regulations.

Project development and operation activities will affect fish and fish habitat in the Fish Creek drainage, and may affect fish and fish habitat in the drainages along the Transmission Line Corridor and the access road. As the Gibraltar Mine Concentrate Load-out Facility near Macalister is an existing facility, located a considerable distance from any fish habitat, potential environmental effects at that facility are not considered further in the assessment.

Table 2.7.2.5-1 lists the anticipated routine Project development and operational activities and identifies (Y/N) any changes in those activities and regulatory requirements specific to fish and fish habitat that have been effected since the original Prosperity EIS application. Project activities or physical works identified with a “Y” in either Changes in Project Design or Changes in Regulatory Requirements will be carried forward for assessment of the changes to effects on fish and fish habitat. Project activities or physical works identified with an “N” in both of these columns are not carried forward in this fish and fish habitat assessment, and are greyed out.

Table 2.7.2.5-1 Project Scoping Table

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal (Y/N)	Change in Regulatory Requirements (Y/N)	Regulatory Reference	Comments
Construction and Commissioning				
Open Pit – Pre-production	N	N		
Non-PAG waste stockpile	Y	N		• Location and timing only
PAG Stockpile	Y	N		• Still subaqueous in TSF, just TSF location change
Non-PAG Overburden Stockpile	Y	N		• Combined with Non-PAG (i.e. location and timing)
Ore Stockpile	Y	N		• Location only
Primary Crusher	N	N		• This is considered in 'Plant Site and other facilities'
Overland conveyor	N	N		• This is considered in 'Plant Site and other facilities'
Fisheries compensation works construction	Y	N		• Scope and Timing
Water Management Controls and Operation	Y	Y	EIS Guidelines	• Stipulate that contingency plans be prepared for dealing with "excessive" and "drought" scenarios. Require assessment of water in all water bodies that could be affected.
Construction sediment control	Y	Y	EIS Guidelines	• Require discussion surrounding erosion and sediment control and Best Management

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal (Y/N)	Change in Regulatory Requirements (Y/N)	Regulatory Reference	Comments
				Practices
Access road construction and upgrades	N	N		
Camp construction	N	N		• This is considered in 'Plant Site and other facilities'
Site clearing (clearing and grubbing)	Y	N		• Different areas related to moving of TSF, stockpiles, etc.
Soils handling and stockpiling	Y	N		• Includes overburden removal
Plant Site and other facilities	N	N		
Explosives Plant	Y	N		• Location only
Lake dewatering	Y	N		• Fish Lake retained • Little Fish Lake Drained
Fish Lake Water Management	Y	Y	EIS Guidelines	• Management of inflows and outflows • Stipulate that contingency plans be prepared for dealing with "excessive" and "drought" scenarios. Require assessment of water in all water bodies that could be affected.
Starter dam construction	Y	N		• Location and volume of material
Sourcing water supplies (potable, process and fresh)	Y	N		• Fresh water sources and routing only as a result of reconfigured stockpiles
Site waste management	N	N		

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal (Y/N)	Change in Regulatory Requirements (Y/N)	Regulatory Reference	Comments
Clearing of transmission line ROW	N	N		
Construction/Installation of transmission line	N	N		
Vehicular traffic	Y	N		• Additional haulage trucks and 2 km of added haulage road as a result of TSF relocation.
Concentrate load-out facility near Macalister (upgrades to site)	N	N		
Operations				
Pit production	N	N		
Site clearing (clearing and grubbing)	Y	Y	EIS Guidelines	• Area and relocation of TSF and stockpiles • Require discussion surrounding erosion and sediment control and Best Management Practices
Soils handling and stockpiling	Y	Y	EIS Guidelines	• Area, volume, and relocation of TSF and stockpiles; revised soil stockpile locations • Require discussion surrounding erosion and sediment control and Best Management Practices
Crushing and conveyance	N	N		
Ore processing and dewatering	N	N		

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal (Y/N)	Change in Regulatory Requirements (Y/N)	Regulatory Reference	Comments
Explosive handling & storage	Y	Y	EIS Guideline	• Location only
Tailing storage	Y	N		• Location and embankments changed
Non-PAG waste stockpile	Y			• Location and timing only
PAG Stockpile	Y			• Still subaqueous in TSF, just TSF location change
Overburden Stockpile	Y			• Combined with Non-PAG (i.e. location and timing)
Ore Stockpile management and processing	Y			• Location only
Potable and non-potable water use	N			
Site drainage and seepage management	Y	Y	Y	• Require discussion surrounding erosion and sediment control and Best Management Practices
Water Management Controls and Operation	Y	Y	EIS Guideline	• Includes management of flows in and out of Fish Lake • Stipulate that contingency plans be prepared for dealing with “excessive” and “drought” scenarios. Require assessment of water in all water bodies that could be affected

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal (Y/N)	Change in Regulatory Requirements (Y/N)	Regulatory Reference	Comments
Wastewater treatment and discharge (sewage, site water)	N	N		
Water release contingencies for extended shutdowns (treatment)	N	Y	EIS guidelines	• Stipulate that contingency plans be prepared for dealing with "excessive" and "drought" scenarios. Require assessment of water in all water bodies that could be affected
Solid waste management	N	N		
Maintenance and repairs	N	N		
Concentrate transport and handling	N	N		
Vehicle traffic	Y	N		• Additional haulage trucks and 2 km of added haulage road as a result of TSF relocation.
Transmission line (includes maintenance)	N	N		
Pit dewatering	N	N		
Fisheries Compensation works operations	Y	N		• Scope and Timing
Concentrate load-out facility near Macalister	N	N		
Closure				
Water Management Controls and Operation	Y	N		
Fisheries Compensation operations	Y	N		• Scope and Timing
Site drainage and seepage management	Y	Y	EIS Guidelines	• Require consideration and modeling for all potentially impacted water bodies

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal (Y/N)	Change in Regulatory Requirements (Y/N)	Regulatory Reference	Comments
Reclamation of ore stockpile area	Y	N		• Location only
Reclamation of Non-PAG waste rock stockpile	Y	N		• Location only
Tailing impoundment reclamation	Y	N		
Pit lake, and TSF Lake filling	Y	N		
Plant and associated facility removal and reclamation	N	N		
Road decommissioning	N	N		
Transmission line decommissioning	N	N		
Post-closure				
Discharge of tailings storage facility water	Y	Y		• Require consideration and modeling for all potentially impacted water bodies
Discharge of pit lake water	N	N		• Into Lower Fish Creek
Seepage management and discharge	Y	N		
Ongoing monitoring of reclamation	Y	N		
Interaction of Other Projects and Activities				
Interaction of Other Projects and Activities	Y	N		• Will Involve Update Of Project Inclusion List
Accidents, Malfunctions and Unplanned Events				
Accidents, Malfunctions and Unplanned Events	Y	N		• Two new scenarios (land and water based) due to retention of Fish Lake; other A&Ms would not change– previous A&Ms

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal (Y/N)	Change in Regulatory Requirements (Y/N)	Regulatory Reference	Comments
				would still apply

Regulatory Changes (Since Prosperity)

Governance of Canadian fisheries resources, including protection of fish, fish habitats and the management of fisheries resources is a shared responsibility through both federal and provincial legislation, regulation, polices and resource management programs. Relevant acts, policies and guidelines related to the protection of fish and fish habitat applicable to the March 2009 EIS/Application and still applicable to the New Prosperity Project include the following:

- *Fisheries Act* of Canada
- Metal Mine Effluent Regulation (MMER)
- *Species at Risk Act*
- Policy for the Management of Fish Habitat (DFO, 1986)
- British Columbia *Environmental Management Act*
- *Navigable Waters Protection Act*
- Fish-Stream Crossing Guidebook (MOF, 2002)
- Resource Inventory Standards Committee 1:20,000 Fish and Fish Habitat Inventory (RIC, 2001)
- Fish-Stream Identification Guidebook (MOF, 1998)
- Riparian Management Area Guidebook (MOF, 1995)
- DFO Pacific Region Operational Statement Overhead Line Construction Version 3
- DFO Pacific Region Operational Statement Clear Span Bridges Version 3
- Model Class Screening Report—Embedded Culverts Project in Fish-bearing Streams on Forestry Roads in British Columbia (DFO, 2005), and
- Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopky, 1998).

With the exception of the Minor Works and Waters amendment to the *Navigable Waters Protection Act* which came into force in March 2009, all relevant acts, policies and guidelines remain unchanged since the 2009 EIS Application.

The EIS Guidelines (2009 and 2012) in association with relevant acts, policies, guidelines and directives related to protection and management of fish and fish habitat, provided the guidance for the assessment of the potential for environmental effects and management plans identified in this section.

Regulatory Framework and Policy for Fish Habitat Compensation Planning

This section outlines the legislative requirements and policies considered in developing the Plan. The regulatory setting as it relates to the overall Project is described in detail in the EIS.

Department of Fisheries and Oceans Canada (DFO)

DFO is responsible for the management of First Nation fisheries, commercial and recreational fisheries in tidal waters, and salmon fisheries in non-tidal waters, and has the lead responsibility for fish habitat protection under the federal *Fisheries Act*. Under Section 35(2) of the *Fisheries Act* any project or activity which causes the "harmful alteration, disruption or destruction of fish habitat" (HADD) requires authorization from DFO. The federal *Fisheries Act* defines "fish habitats" as those parts of the environment "on which fish depend, directly or indirectly, in order to carry out their life processes" and defines "fish" to include all the life stages of "fish, shellfish, crustaceans, marine animals and marine plants" (DFO, 1986). The Habitat Policy was developed pursuant to the *Fisheries Act* and provides objective statements against which DFO can measure its performance in fish habitat management (DFO, 1986). The Habitat Policy applies to all projects with the potential to "alter, disrupt or destroy fish habitats", and provides a framework within which these changes can be assessed.

Habitat Policy

The DFO long-term Habitat Policy objective is "to achieve an overall net gain of the productive capacity of fish habitats" (DFO, 1986). To move toward this objective, three main goals are considered including conservation, restoration, and fish habitat development (DFO, 1986). Conservation of fish habitat is the first goal of the Habitat Policy which endeavours to "maintain the current productive capacity of fish habitats supporting Canada's fisheries resource, such that fish suitable for human consumption may be produced" (DFO, 1986). Fish habitat conservation is implemented by using the guiding principle of "No Net Loss" (NNL) of the productive capacity of habitats (DFO, 1986). The NNL principle is fundamental to the habitat conservation goal where DFO strives to balance unavoidable habitat losses with habitat replacement on a project-by-project basis (DFO, 1986).

The second goal of the Habitat Policy is fish habitat restoration: "rehabilitation of the productive capacity of fish habitats in selected areas where economic or social benefits can be achieved through the fisheries resource" (DFO, 1986). Restoration achieves the objectives of the Habitat Policy by increasing the productive capacity of habitat through the restoration of damaged fish habitats.

The third goal of the Habitat Policy is fish habitat development: "improvement and creation of fish habitats in selected areas where the production of fisheries resources can be increased for the social or economic benefit of Canadians" (DFO, 1986). This goal can be achieved through increasing the productive capacity of habitats by manipulating, creating or providing access to new spawning, rearing, and food producing areas (DFO, 1986).

DFO's preference under the Habitat Policy is to avoid HADD. However, if efforts to redesign or relocate the Project are undertaken and residual impacts remain despite this mitigation, then compensation is required (DFO, 1998). Compensation is defined in the Habitat Policy as:

"The replacement of natural habitat, increase in the productivity of existing habitat, or maintenance of fish production by artificial means in circumstances dictated by social and economic conditions, where mitigation techniques and other measures are not adequate to maintain habitats for Canada's fisheries resources" (DFO, 1986).

Where HADD is identified for the Project, habitat compensation under Section 35(2) of the *Fisheries Act* will be used to achieve “no net loss” (NNL) of the productive capacity of fish habitat. DFO (1986) has developed a hierarchy of preferences which provides guidance for compensation planning to achieve NNL of productive capacity. Compensation planning for this Project acknowledges the DFO hierarchy of preferences outlined below:

- Create or increase the productive capacity of like-for-like habitat in the same ecological unit at or near the development site
- Create or increase the productive capacity of unlike habitat in the same ecological unit
- Create or increase the productive capacity of habitat in a different ecological unit, and
- As a last resort, use artificial production techniques to maintain a stock of fish, deferred compensation or restoration of chemically contaminated sites.

Habitat “compensation elements” for the purposes of this document refer to the individual initiatives identified to compensate for the loss of fish and fish habitat from this Project. These compensation elements address the Habitat Policy objective of achieving an overall net gain of productive capacity by following guidance established by the NNL principle and the hierarchy of preferences.

Metal Mining Effluent Regulations (MMER)

The Metal Mining Effluent Regulations (MMER) was enacted in 2002 under the recommendation of the Minister of Fisheries and Oceans, pursuant to sections 34(2), 36(5), and 38(9) of the *Fisheries Act*. The MMER was developed to regulate the deposit of mine tailings and other waste material produced during mining operations into natural fish bearing waters; it is administered by Environment Canada.

Under section 5(1), Authority to Deposit in Tailings Impoundment Areas:

“the owner or operator of a mine may deposit or permit the deposit of waste rock or an effluent that contains any concentration of a deleterious substance and that is of any pH into a tailings impoundment area that is either:

a) A water or place set out in Schedule 2, or

b) A disposal area that is confined by anthropogenic or natural structures or by both, other than a disposal area that is, or is part of, a natural water body that is frequented by fish.”

Loss of fish habitat associated with the ponded area used for storage requires compensation which will be in addition to the non-MMER compensation requirements found in this document. At the request of DFO, MMER effects and associated compensation will be contained within a separate companion document

Additional Responsible Authorities (RA):

Transport Canada

Transport Canada’s (TC) *Navigable Waters Protection Act* (NWPA, 1985) ensures the public right to safe and unobstructed navigation of Canada’s waters. Navigable waters include all bodies of water that are capable of being navigated by any type of floating vessel for transportation, recreation, or commerce. The purpose of the NWPA is to minimize interference of navigation on navigable waters and intends to ensures a balance between the public right to navigate and the need to build structures such as dams, bridges, or docks.

The NWPA provides for the prohibition to build works in navigable waters, unless the works have been approved by the Minister of Transport. In March 2009, amendments to section 13 of the NWPA came into force with a primary objective of streamlining the federal review process for works on navigable waters by establishing classes of waters that are "minor" in nature and therefore not subject to application requirements under the Act. Of the three specific classes of minor navigable waters incorporated into the Act (section 13) by means of the Minor Works and Waters Order, only minor navigable waters has relevance to this Project. (The other two identified minor navigable waters are private lakes, and artificial irrigation channels and drainage ditches).

Several mine infrastructure components identified in the new Project description, including the TSF main embankment, Fish Lake outlet flow control structure, and the mine pit, will obstruct or otherwise adversely affect navigable waters in the upper Fish Creek watershed and Little Fish Lake. Reach 8 (main TSF embankment) may be considered a minor navigable water and is not subject to NWPA approval (i.e., channel width is less than 3.0 m, average high-water level depth is less than 0.6 m, and there are three or more natural obstacles). However, channel widths of reach 6 (4.0 m, flow control structure) and reach 5 (4.5 m, mine pit) preclude these sections as minor navigable waters and are therefore subject to provisions under the NWPA. Accordingly, components have been included to address the NWPA as it relates to the potential loss of the public right to safe navigation in reaches 5 and 6 of Fish Creek and Little Fish Lake.

Ministry of Forests, Lands and Natural Resource Operations (MFLNRO)

The provincial government has primary responsibility for land and water use decisions on provincial Crown lands and utilizes a variety of statutes to manage fish habitat and other environmental values. Through delegated authority under the federal *Fisheries Act*, MFLNRO has responsibility for the province's non-anadromous freshwater fisheries which also include sea-run Steelhead, Cutthroat and Dolly Varden. In this capacity, MFLNRO has the lead on freshwater fish governance, conservation, and recreation. The licencing of freshwater recreational fishing is enabled under the Province's *Wildlife Act*

MFLNRO is also responsible for providing input to DFO on provincial fishery values and fisheries management planning in relation to commercial and recreational fisheries management decisions (MOE, 2007). MFLNRO advises DFO on fish habitat-related issues for freshwater fish, including water management under the provincial *Water Act*, land use impacts related to forestry under the *Forest and Range Practices Act,* and the management of riparian protection in urban areas under the *Fish Protection Act* and Riparian Areas Regulations.

With respect to the Project, MFLNRO staff participated in addressing the adequacy of baseline data and information, provided assistance in identifying a range of potential compensation opportunities to meet the MFLNRO conservation and protection goals, and assisted in the development of the fish and fish habitat compensation framework and plan review (MFLNRO Meeting in William Lake, December 2011).

The compensation measures introduced by this Plan are guided by the aims of the Freshwater Fisheries Program Plan, the regional Small Lakes Management Strategy, and the MFLNRO Benchmark Statement as detailed in the following sections. MFLNRO has indicated it will work with DFO to assist Taseko in the development and implementation of this Plan.

Freshwater Fisheries Program Plan

One of the five corporate goals of the provincial government is to make "British Columbia's fisheries management the best, bar none" and, to achieve this goal, a comprehensive Freshwater Fisheries Program Plan (FFPP) was developed. The Freshwater Fisheries Program is developed and delivered through the Environmental Stewardship Division (ESD) and the Freshwater Fisheries Society of BC (FFSBC), a non-profit organization previously part of the MFLNRO. The ESD, while supported by the other divisions within the MFLNRO, has the overall responsibility and ownership for the Freshwater Fisheries Program (excerpt from MOE, 2007).

Under the mandate of the ESD, MFLNRO has developed a FFPP providing provincial guidance and outlining the strategic direction for freshwater fisheries management in the province. The ESD is responsible for administering the FFPP with support from FFSBC, Fish and Wildlife Branch, Ecosystems Branch, Parks and Protected Areas Branch, and the Regional Operations. The MFLNRO regional operations provide the on-the-ground delivery of the FFPP and act as the main interface between stakeholders and the agency. The regional operations also provide support to projects (e.g., restoration, support to stewardship groups) and provide advice to agencies (excerpt from MOE, 2007).

Objectives of the FFPP pertaining to the Project are (MOE, 2008a):

- Conserve wild fish and their habitats, and
- Optimize recreational opportunities based on fishery resources.

Small Lakes Management Strategy

As part of its Regional Objectives, MFLNRO, Cariboo Region, has developed a Small Lakes Management Strategy to "guide assessment and development of economically viable small lake fisheries for the region" (MOE, 2008a). The goals of the Small Lake Management Strategy include (MOE, 2008a):

- Increase angler participation while ensuring the long-term sustainability of wild stocks
- Promote stocked lake fisheries
- Provide a diversity of opportunities to ensure quality of experience for all anglers
- Evaluate angler preferences for stocked lake fisheries
- Rationalize lake-specific management plans and stocking programs to reflect angler preference and deliver reasonable return on investment, and
- Simplify fishery regulations.

The Small Lake Management Strategy has to date focused on lakes in the region which support, or are capable of supporting, fisheries that contribute to the stability and diversity of the regional economy and opportunities for First Nation fisheries (MOE, 2008a). The Fish Lake fishery contributes a small increment to the regional economic benefit and as such has not yet been included in the Small Lake Management Strategy. MFLNRO therefore produced a Benchmark Statement, specifically for the Prosperity Project, to provide a regional objective statement for Fish and Little Fish lakes to be used for mitigation and compensation planning (MOE, 2008a).

Benchmark Statement

In August 2008, MOE prepared a Benchmark Statement with regard to the fish, fish habitat, and fisheries of Fish and Little Fish lakes in the Taseko watershed (MOE, 2008a). In recent discussions with MFLNRO staff (December 19, 2011), it was determined that the general intent of the 2008 Benchmark Statement was still relevant and therefore will continue to guide habitat compensation planning for the New Prosperity Project with respect to MFLNRO objectives.

The Benchmark Statement recommends there should be a commitment to implement compensation measures that are effective in augmenting MFLNRO fishery management initiatives, to provide enhanced First Nations and public fishing opportunities in small lakes of the Chilko/Taseko watershed (MOE, 2008a). MFLNRO requires the compensation measures to be effective for at least the period of time that either: the lake and fishery does not exist due to mining activities; or, replacement habitat is not fully functional in delivery of a fishery (MOE, 2008a). The Benchmark Statement also communicates the stewardship objectives of the MFLNRO (Cariboo Region) in respect to the fish, fish habitat, and fisheries of Fish and Little Fish lakes. It also establishes the significance of the two lakes and their fisheries in a regional context, and provides a point of reference for mitigation and compensation planning for this Project.

The Benchmark Statement indicates that regional management initiatives for Fish and Little Fish lakes and associated stream habitat should result in the following (MOE, 2008a):

- Maintenance of the genetic line exhibited in the trout population of the Fish Lake system
- Lake and stream environments of similar or better productive capacity for trout as provided by the Fish Lake system now
- A healthy, self-sustaining trout population, and
- A trout fishery for First Nations and the public of at least similar character to what is supported by Fish Lake under current conditions.

First Nations and Public Input

First Nations consultation is the responsibility of the federal and provincial governments with proponent involvement as part of the assessment process of major projects in BC. First Nations participated along with MOE (now MFLNRO) in identifying potential areas suitable for habitat compensation in the development of compensation elements during the initial environmental assessment. Some First Nations and stakeholder consultation has occurred as part of the ongoing development of the Project, and it is anticipated further input on the compensation elements will be received from First Nations and the public as planning proceeds. This is consistent with the MFLNRO's guiding principle under its Freshwater Fisheries Program Plan that "First Nations and stakeholder interests and preferences should be explicitly addressed in fisheries management, restoration, and enhancement plans" (MOE, 2007), and the requirements of the EIS Guidelines. Taseko will indicate how stakeholder discussions were incorporated into the Project design involve Aboriginal groups to determine how the information can best be delivered.

Changes as a Result of New Prosperity EIS Guidelines

With respect to fish and fish habitat, the New Prosperity Project will retain Fish Lake and sections of inlet tributaries that include Rainbow Trout spawning and rearing habitat. This will result in changes to potential direct and indirect effects on fish and fish habitat. As a result of the New Prosperity EIS guidelines, there are changes to fish and fish habitat assessment and compensation considerations compared to the March 2009 EIS/Application, including:

- Species at risk considerations. For those with higher status designation and protection under provincial legislation the Proponent shall provide an overall benefit plan, and
- Time delays between the loss of habitat productive capacity and when replacement habitat is created and becomes functional as well as uncertainty in whether the replacement habitat is likely to function as intended.

Key Changes and Issues

Potential effects arising from interactions between routine Project activities and fish or fish habitat considered in detail in this assessment will be as described in the 2009 EIS/Application, and include:

- Loss/alteration of in-stream habitat quality or quantity as a result of pit construction, fisheries compensation works (constructions and operations), water management controls and operations, starter dam construction, site drainage (erosion and sediment control during construction) and seepage
- Loss/alteration of lake habitat quality and quantity as a result of the attenuation of Little Fish Lake into the tailings impoundment area (TIA) and Fish Lake water management
- Loss/alteration of riparian habitat as a result pit construction, fisheries compensation works (constructions and operations), water management controls and operations, starter dam construction (flooding of the upper Fish Creek drainage, and
- Loss/alteration of fish populations and angling opportunities in the Fish Creek drainage (Fish and Little Fish lakes).

Measurable parameters were selected to quantify potential Project and cumulative environmental effects and to compare baseline conditions with conditions that are predicted to exist during the operations (life-of-mine), closure and post-closure phases. The measurable parameters include:

- Rainbow Trout habitat expressed in terms of the area of available channel (m^2), Habitat Evaluation Procedure (USFWS, 1980), and flow duration in middle and upper Fish Creek watershed (tributary and mainstem Reaches 4–6, 8 and 10; Figure 2.7.2.5-1)
- lake habitat (shoal and pelagic expressed in terms of area [ha] as well as Habitat Evaluation Procedure [USFWS, 1980]) in Little Fish Lake (Reach 9)
- riparian habitat based on Forest and Range Practices Act and Riparian Area Regulations
- .
- The availability or aerial extent of salmonid rearing, overwintering and spawning habitat (m^2) in lower Fish Creek.

Effects in Middle and Upper Fish Creek were further divided into “Direct” and “Indirect” effects. Direct effects are permanent disturbances associated with the project infrastructure such as the pit and tailings embankments. These include a stream or lake component as well as a riparian component. Indirect effects are those associated with flow reduction. There will be no physical disturbance of habitats (aquatic or riparian) at areas of indirect effect and flows will be restored to historic levels during closure. There will be no riparian disturbance associated with indirect effects as sufficient flows will be maintained to ensure riparian function.

Project activities identified as having changed due to Project design or regulatory requirements (Table 2.7.2.5-1) have been brought forward to Table 2.7.2.5-2 and rated according to predicted changes associated with New Prosperity Project interactions and potential effects to fish and fish habitat. The following criteria were used for the interaction ratings:

3. Effect on fish and fish habitat is likely to decrease or stay the same (i.e., no changes to significance conclusions), and there are no required changes to previously proposed mitigation measures, and no additional regulatory requirements have been identified (i.e., from the EAO, Panel, DFO, EIS Guidelines or other applicable regulations). Therefore, no further assessment is warranted, but information is provided to substantiate that the effect is likely to decrease or stay the same.
4. Effect on fish and fish habitat is likely to decrease or stay the same (i.e., no changes to significance conclusions), but some re-evaluation of effect is required due to changes in project design, proposed mitigation measures, and/or additional regulatory requirements have been identified (i.e., from the EAO, Panel, DFO, EIS Guidelines, or other applicable regulations).
5. Effect on fish habitat is likely to increase; therefore, further assessment is warranted.

Table 2.7.2.5-2 Fish and Fish Habitat Potential Environmental Effects Associated with the New Prosperity Project

General Category	Project Activities/Physical Works	Loss/alteration of in-stream habitat quality or quantity	Loss/alteration of lake habitat quality or quantity	Loss/alteration of riparian habitat
Fisheries compensation works (construction)	Fisheries compensation works construction	1	1	1
Overburden and Waste Rock Management	Non-PAG waste stockpile	1	1	1
	PAG Stockpile	1	1	1
	Overburden Stockpile	1	1	1
	Soils handling and stockpiling	1	1	1
Site clearing (clearing and grubbing)	Site clearing (clearing and grubbing)	1	1	1
Starter Dam Construction	Water Management Controls and Operations	1	1	1
	Construction sediment control	0	0	0
	Little Fish Lake attenuation	1	1	1
	Fish Lake Water Management	1	1	1
Vehicular traffic	Vehicular traffic	0	0	0
Fisheries Compensation works (operations)	Fisheries Compensation works operations	1	1	1
Ore Extraction and Stockpiling	Explosive handling and storage	0	0	0
	Ore Stockpile management and processing	1	1	1
Overburden and Waste Rock Management	Non-PAG waste stockpile	1	1	1
	PAG Stockpile	1	1	1
	Overburden Stockpile	1	1	1
Site Water Management	Site drainage and seepage management	1	1	1
	Water Management Controls and Operation	1	1	1
Vehicle traffic	Vehicle traffic	0	0	0

General Category	Project Activities/Physical Works	Loss/alteration of in-stream habitat quality or quantity	Loss/alteration of lake habitat quality or quantity	Loss/alteration of riparian habitat
Fisheries Compensation operations	Fisheries Compensation Operations	1	1	1
Reclamation	Reclamation of ore stockpile area	1	0	1
	Reclamation of Non-PAG waste rock stockpile	1	0	1
	Tailing impoundment reclamation			
Site Water Management	Water Management Controls and Operation	1	1	1
	Site drainage and seepage management	1	1	1
	Pit lake and TSF Lake filling	1	1	1
Site Water Management	Discharge of tailing storage facility water			
	Seepage management and discharge	1	1	1
Monitoring	Ongoing monitoring of compensation and reclamation plans	0	0	0
Interaction of Other Projects and Activities		1	1	1
Accidents, Malfunctions and Unplanned Events		0	0	0

The interactions indicated in grey shading in Table 2.7.2.5-2 are not carried forward in this assessment. Based on past experience and professional judgment, the March 2009 EIS/Application determined that there would be no interaction, the interaction would not result in a significant environmental effect, even without mitigation; or the interaction would not be significant due to application of codified environmental protection practices that are known to effectively mitigate the predicted environmental effects. This has not changed since the March 2009 EIS/Application; details on the justification for this rating are provided in the issues scoping section for each KI in the March 2009 EIS/Application (Volume 5, Section 3). These interactions are not discussed further in this assessment.

The potential for fish or ova mortality associated with the attenuation of Little Fish Lake into the TIA and construction of a flow control structure in Reach 6 at the outlet of Fish Lake is not considered a key issue, as a comprehensive fish salvage plan which incorporates best practices will be implemented in the watershed prior to water diversion, starter dam construction and flow reductions throughout the mainstem and affected tributaries in the Fish Creek watershed.

"Fish" as defined under the *Fisheries Act*, includes all life stages of fish, shellfish, crustaceans and marine animals and marine plants. For the purposes of this assessment the definition refers to fish species and life stages known or suspected to occur within the Local Study Area (LSA). A definition of the LSA is provided in Section 2.3.6. Fish species known or suspected to occur in this area include rainbow and steelhead trout (*Oncorhynchus mykiss*), bull trout (*Salvelinus confluentus*), chinook salmon (*O. tshawytscha*), mountain whitefish (*Prosopium williamsoni*) and white sucker (*Catostomus commersoni*).

The quality of fish habitat, as determined collectively by water supply, chemistry and lake and stream biophysical and riparian attributes, is vital to the integrity of sustainable fish populations. Under the *Fisheries Act*, "fish habitats" are defined as those parts of the environment "on which fish depend, directly or indirectly, in order to carry out their life processes". For the purpose of this assessment fish habitat is considered to be spawning grounds and nursery rearing, food supply and migration areas on which fish depend. These include riparian habitats, biophysical attributes of channels (gradient, width, residual pool depth, etc.) and lakes (shoal areas, depth, substrates, shoreline perimeter, occurrence of inlets and outlets, etc.), biological conditions (invertebrate food production, aquatic vegetation, etc.) and water quality attributes (dissolved oxygen, temperature, pH, turbidity, etc.).

Based on previous studies conducted in the 1990s and the summary of the baseline in this EIS, lower Fish Creek is defined as that section of stream from the confluence with the Taseko River upstream to the anadromous barrier and middle Fish Creek is defined as the section of stream from the barrier upstream to Fish Lake. Upper Fish Creek includes Fish Lake, Little Fish Lake and their respective tributaries (Figure 2.7.2.5-1). For the purposes of the project effects assessment, this reference to middle and upper Fish Creek has been retained for consistency with baseline reports.

Fish and fish habitat were selected as a Valued Ecosystem Component (VEC) as various Project activities throughout the life of the Project in the mine site area will, or in some instances may, directly or indirectly affect fish and fish habitat including:

- Seasonal juvenile salmon, trout and char habitats in lower Fish Creek,
- Lake and stream populations of Rainbow Trout and their habitats in the upper and middle Fish Creek watershed, and
- Angling opportunities.

As detailed in Volume 5 Section 3 of the March 2009 EIS/Application fish habitat in lower Fish Creek provides limited and intermittent habitat for rearing juvenile chinook salmon, steelhead (rainbow) and bull trout. They were selected and assessed as a KI because they are also potentially susceptible to environmental effects of the Project and have different habitat requirements compared to rainbow trout populations. Chinook salmon and steelhead also comprise important downstream recreational, Aboriginal and commercial fisheries. Bull trout are a species of special concern (blue-listed) in British Columbia (BC CDC 2006).

During the review of the previous project in addition to the Benchmark Statement, MOE advanced the position that habitat compensation elements should focus on the productive trout habitat upstream of the falls, and that it was difficult to justify the construction of compensatory stream habitat in Lower Fish Creek. MOE recommended that further consideration of habitat management options remain focused on non-anadromous stocks, and particularly the high value trout habitat in the middle and upper watershed (R. Stewart, pers. comm., MOE 2008). Apart from a slightly increased reduction in intermittent flows to the lower Fish Creek area during life of mine there are no changes to the lower Fish Creek area anticipated as a result of the project. Accordingly no further assessment of potential effects in lower Fish Creek is presented.

No consideration is given to the potential for effects on fish and fish stream habitat along the access road and transmission line corridors as these were fully addressed in the previous EIS and there are no changes to these project components in New Prosperity.

Environmental Impact Statement (EIS) Guidelines were developed and issued in March 2012. The EIS Guidelines stipulate the requirements for fish and fish habitat baseline data, as well as details of mitigation and compensation measures that are required to be developed. Data were also collected to demonstrate that no net loss (NNL) of the productive capacity of fish habitat can be achieved through implementation of Project mitigation and compensation plans consistent with DFO's *Policy for the Management of Fish Habitat* (DFO, 1986).

A Fish Habitat Compensation Plan, developed following the determination of environmental effects has been separated into two plans to address effects associated with the Tailings Impoundment Area (TIA), which are under the jurisdiction of the Metal Mining Effluent Regulation (MMER; Schedule 2), and those outside the TIA, which are under the jurisdiction of the *Fisheries Act*.

The assessment of effects on fish and fish habitat considers aspects of environmental effects of the Project on Water Quality and Aquatic Ecosystems (Section 2.7.2.4B), Hydrology (Section 2.7.2.4A), and Vegetation conditions (Section 2.7.2.7). It also takes into account Best Management Practices (BMP) and methods for constructing and upgrading the access road(s) and transmission line, related to stream crossings, and commitments to environmental protection and management during construction and operation as outlined in the Environmental Management Program (Section 2.8).

Cumulative effects on fish and fish habitat were assessed and are presented in the following sections of this EIS.

An assessment of the environmental effects of possible accidents and malfunctions on fish and fish habitat and other biotic components was completed for the Project and is presented in Section 2.7.6. Section 2.11 provides the results of the overall assessment of residual environmental effects of the Project on fish and fish habitat at a broad scale.

Information from the environmental effects assessment on fish and fish habitat was used to assess potential effects on socioeconomic, cultural and human health (Section 2.7.3) and Aboriginal Interests (Section 2.7.5).

Temporal Boundary Changes

There have been no changes in the temporal boundaries for construction and commissioning, operations, and closure and decommissioning phases between the previously assessed project and the New Prosperity project (see March 2009 EIS/Application Volume 5, Section 3.1.4). The temporal boundaries used for the New Prosperity assessment of potential Project effects on fish and fish habitat includes:

- **Baseline Scenario**: represents fish and fish habitat conditions prior to any Project-specific developments. These baseline conditions incorporate the environmental effects of existing human-caused disturbances (i.e., forest harvesting, road networks, other mine footprints etc.).
- **Construction, Operations, Closure and Post Closure Scenarios**: represents conditions during construction activities, operations and decommissioning/reclamation activities. Due to the integral relationship between fish and fish habitat, water quality, aquatic ecology and the water management plan - the temporal boundaries for the fish and fish habitat assessment are reflective of the principal phases of the Project water management plan (Section 2.6.1.4). This was done because the large majority of the potential residual effects are tied to phases in the water management plan (i.e., TSF spilling, lake-recirculation). For a detailed description of the water management plan please see Section 2.6.1.4 and Section 2.7.2.4a.

Spatial Boundary Changes

See Table 2.7.2.5-3 for the changes to the study areas used, relative to the March 2009 EIS/Application. The Regional Study Area (RSA) (Figure 3-2, Volume 5 of the March 2009 EIS/Application) and the Local Study Area (LSA) (Figure 2.7.2.5-1) for Fish and Fish Habitat remains the same from the previously assessed project. There have been no changes to the study areas for the transmission line corridor and access road as well.

Table 2.7.2.5-3 Mine Site Study Area Comparison

Study Area	Mine Site Study Areas	
	2009 Prosperity	2012 New Prosperity
Regional Study Area (RSA)	Encompasses water bodies and watersheds beyond the LSA where the potential for environmental effects of the Project development and activities can be assessed in a wider context. It also provides a suitable reference area for identifying and assessing fish and fish habitat mitigation and compensation options within the Project area, and the potential for cumulative effects. The RSA is the area within the boundary of the MOE Management Unit 5-4.	No change in the RSA for the New Prosperity Project.
Local Study Area (LSA)	Encompasses the Fish Creek watershed including Fish Lake, Little Fish Lake and all mainstem and tributary habitats down to and including the confluence of Fish Creek with the Taseko River; the Taseko River in the vicinity of the Fish Creek confluence; the lower Beece Creek drainage; and the Taseko River in the vicinity of the confluence of Beece Creek.	No change in the LSA for the New Prosperity Project.
Maximum Disturbance Area (MDA)	A buffer of 100 m on the mine footprint. The mine site MDA had a total area of 4,419 ha	A buffer of 100 m on the proposed mine footprint, to represent a "worst case" for development. The MDA has a total area of 2,601 ha

Updates to Consultation on the Assessment

First Nations consultation is the responsibility of the federal and provincial governments and the proponent as part of the assessment process of major projects in BC. First Nations participated along with MOE (now MFLNRO) in identifying potential areas suitable for habitat compensation in the development of compensation elements during the initial environmental assessment. First Nations and stakeholder consultation has occurred as part of the ongoing development of the Project, and is detailed in the EIS. It is anticipated further input on the compensation elements will be received from First Nations and the public as planning proceeds. This is consistent with the MFLNRO's guiding principle under its Freshwater Fisheries Program Plan that "First Nations and stakeholder interests and preferences should be explicitly addressed in fisheries management, restoration, and enhancement plans" (MOE, 2007).

Project Impact Assessment for Fish and Fish Habitat

For the purposes of the effects assessment lower Fish Creek is defined as that section of stream from the confluence with the Taseko River upstream to the fish barrier (Reaches 1–3) and middle Fish Creek is defined as the section of stream from the barrier upstream to Fish Lake (Reaches 4–6). Upper Fish Creek (Reaches 7–10) includes Fish Lake, Little Fish and their respective tributaries (Figure 2.7.2.5-1). The effects of the Project on middle and upper Fish Creek are considered together as Rainbow Trout is the only species of fish present and the effects of the Project on fish and fish habitat (e.g., loss and alteration) are similar in these sections of the watershed.

Middle and Upper Fish Creek

For the purpose of this environmental assessment, middle and upper Fish Creek is defined as all mainstem and tributary (in-stream), riparian and lake habitats (ephemeral and perennial) upstream from an impassable fish migration barrier at the Reach 3–4 break (Figure 2.7.2.5-1). In-stream habitat consists of spawning, rearing and overwintering areas in wetland and stream environments. Lake habitat consists of the aquatic portions of Fish and Little Fish lakes. Riparian habitat refers to the land adjacent to the top-of-bank along a stream or lake whose soil and vegetation are influenced by the presence of the ponded or channelized water[25]. Riparian Reserve Zones (RRZs) are administratively-defined strips of land adjacent to streams or lakes where harvesting is prohibited, the widths of which are established on the basis of fish presence/absence and channel width.

[25] Modified from MOELP 1997. Fish Habitat Rehabilitation Procedures. Watershed Restoration Technical Circular No. 9.

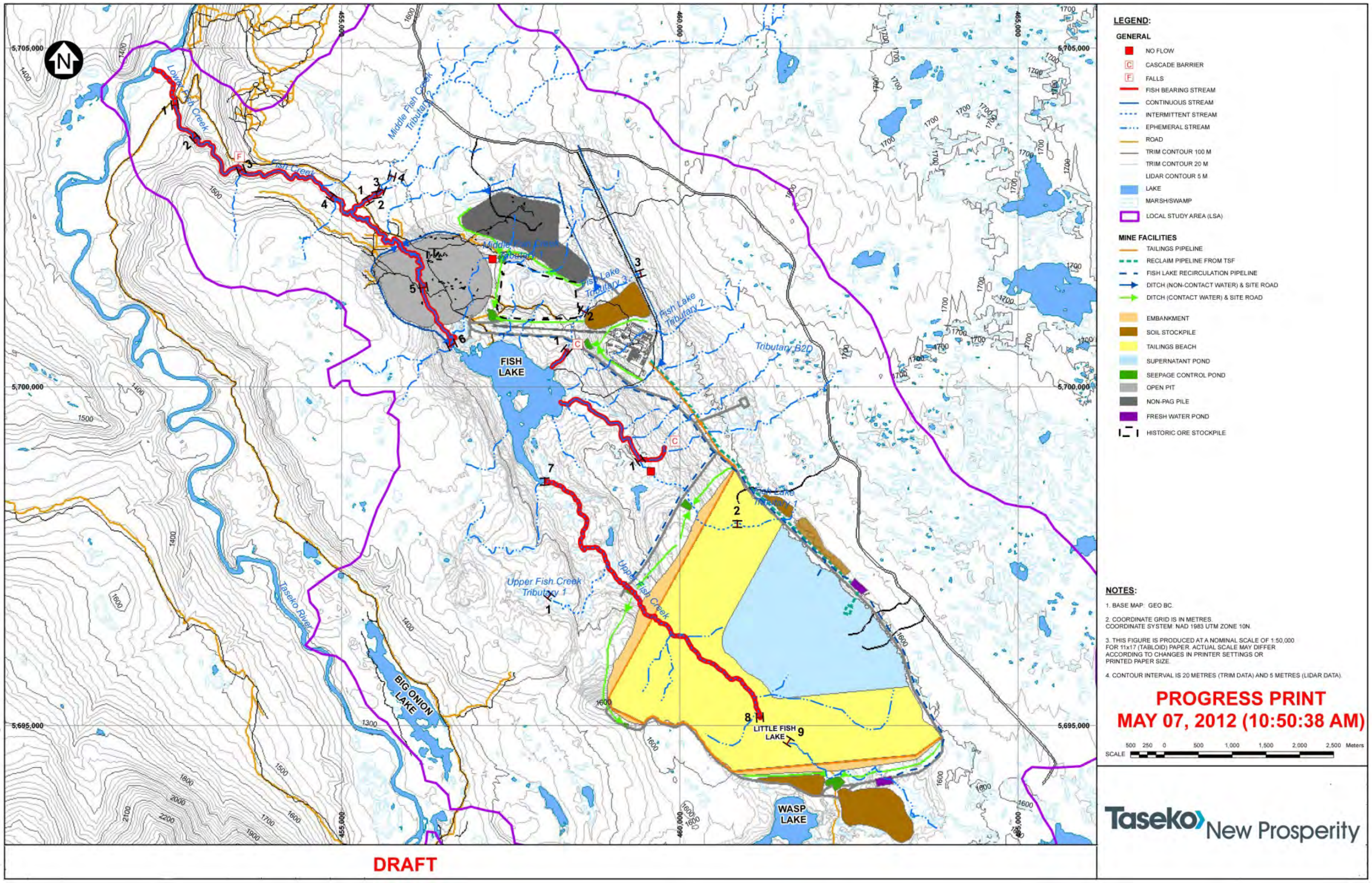


Figure 2.7.2.5-1 General Layout with Local Study Area (LSA) Boundary, Stream Reaches and Fish Distribution

All life stages of Rainbow Trout found in the lakes and stream within Middle and Upper Fish Creek, are considered geographically isolated from any lower watershed populations, based on the lack of recruitment from the lower watershed.

Effects Assessment Methods for Habitat Quality and Quantity

The area of Rainbow Trout instream and lake habitats predicted to be directly and indirectly affected by the Project was determined by multiplying the length of the impacted reach by the bank-full channel width as provided in Triton (1999).

The Habitat Evaluation Procedure (HEP) was developed by the U.S. Fish and Wildlife Service (USFWS 1980). The HEP is a habitat-based approach and has been widely used across North America for the assessment of environmental impacts of proposed aquatic and terrestrial resource development projects. It is a structured approach that provides a means of assessing both the quantity and quality of habitats by combining the area of various habitat types with a habitat suitability index (HSI) for the various life history requirements (e.g., spawning). The HSI value ranges between 0.0 (0% probability-of-use) and 1.0 (100% probability-of-use) and are derived primarily from scientific literature. The value of the approach is that it produces a dimensionless habitat unit which standardizes the relative importance of habitats with different physical characteristics (i.e. riffle vs. pool vs. lake).

The stream flow duration assessment takes into account how many months a stream typically flows and adjusts the effects accordingly. For example, ephemeral streams affected by the Project flow only during spring thaw and storm events, and would therefore contribute to downstream productivity only during those times. Similarly, riparian vegetation would only be functional during those times when the streams are wetted. This approach has been applied to effect assessments within BC and specifically at a mine in northwestern BC (Gartner Lee, 2008). In 2011, all ephemeral (and most intermittent) streams within the Project area were dry (Triton, 2011). More recent studies (Triton 2012 in prep.) determined that upper Fish Creek (Reach 8) was also dry with a few stagnant pools (< 30 cm depth) during the winter period. In 1996, Triton (1999) determined that all ephemeral tributaries were dry during the critical stream flow period (CSFP) in late summer. Therefore, estimates of effects on habitat (aquatic and riparian) can be weighted according to the number of months per year the habitat is functional and available to fish.

The area of riparian vegetation predicted to be affected by the Project was determined by multiplying the length of the stream directly impacted by the riparian buffer width and doubling the result to account for both sides of the stream. Impacts to the riparian vegetation were not predicted for those stream reaches indirectly affected by the Project due to decreased flows (e. g., Lower Fish Creek), as the riparian would continue to function per baseline conditions.

For Little Fish Lake the lake perimeter was multiplied by the buffer width. To determine an appropriate riparian buffer to apply to the directly affected habitats, the value and functionality of the riparian reserve zone (RRZ) was considered. Riparian vegetation serves several direct and indirect functions for aquatic habitat. These include:

- Large Woody Debris (LWD) – provides habitat and influences morphology and channel process.
- Small Organic Debris (SOD) – includes leaf, needle, branch litter as well as terrestrial invertebrates.
- Shade – reduces absorption of solar radiation which decreases summer temperatures.
- Bank Stability – Roots of vegetation play and essential role in the stability of stream banks.

- Allochthonous nutrient delivery from leaf litter and other organic inputs.

The distance from the stream where riparian vegetation can still be considered functional will be dependent of several factors such as composition and height of the vegetation, size of the stream, slope and aspect. Within BC, the two pieces of legislation that address riparian widths are the Forest and Range Practices Act (FRPA) and Riparian Areas Regulation (RAR) of the Fish Protection Act. Both were reviewed in order to determine appropriate buffer widths for the affected habitats within the Project area that reflect the productive value of the riparian vegetation present within the study area.

The FRPA and its regulations govern the activities of forest and range licensees in BC and specifically set the requirements for planning, road building, logging, and grazing in the province. Under FRPA, the Riparian Management Area (RMA) for streams is based on fish presence and channel width (Table 2.7.2.5-4). The RMA consists of a Riparian Reserve Zone (RRZ) immediately adjacent to both sides of the stream and a Riparian Management Zone (RMZ) beyond the RRZ. In general, harvesting within the RRZ is not permitted while there would be constraints to harvesting within the RMZ. Under this classification system those portions of Fish Creek directly affected by the proposed Project would all be categorized as S6 and have a 20 m Total RMA width.

Table 2.7.2.5-4 Specified Minimum Riparian Management Area (RMA) Slope Distances for Stream Riparian Classes (FRPA, 2004)

Riparian class	Average channel width (m)	Reserve zone width (m)	Management zone width (m)	Total RMA width (m)
S1 large rivers	≥100	0	100	100
S1 (except large rivers)	>20	50	20	70
S2	>5≤20	30	20	50
S3	1.5≤5	20	20	40
S4	<1.5	0	30	30
S5	>3	0	30	30
S6	≤3	0	20	20

Fish stream or community watershed

Not fish stream and not in community watershed

The FRPA also provides specifications for lake riparian zones (Table 2.7.2.5-5). Under this classification system Little Fish Lake would be considered an L1 lake.

Table 2.7.2.5-5 Specified Minimum Riparian Management Area (RMA) Slope Distances for Lake Riparian Classes (FRPA, 2004)

Riparian class	Reserve zone width (m)	Management zone width (m)	Total RMA width (m)
L1*	10	0	10
L2	10	20	30
L3	0	30	30
L4	0	30	30

L1 Lakes < 1000 ha in area, have a 10-m reserve zone and a lakeshore management zone established by the district manager. L1 lakes > 1000 ha in area only have a lake shore management zone.

The second method for determining riparian width is based on the RAR. Although the RAR does not apply to the Cariboo Region, it does apply to many other parts of the province and provides an ecologically defensible method of assessing riparian area quality. The purpose of the RAR is to “establish directives to protect riparian areas from development so that the areas can provide natural features, functions, and predictions that support fish life process” (Anonymous, 2007). The RAR provides tables to calculate Zones of Sensitivity (ZOS) for streams depending on the features, functions, and condition of riparian areas. Factors such as riparian vegetation composition (i.e. low cover vs. shrub vs. trees), aspect, slope, and channel type all factor into determination of ZOS width. ZOS determination for large woody debris and bank stability are provided in Table 2.7.2.5-6, while Table 2.7.2.5-7 outlines ZOS determination associated with shade and litterfall/terrestrial insect inputs.

Table 2.7.2.5-6 Widths of the “zone of sensitivity” (ZOS) for large woody debris and bank stability as specified under the Riparian Areas Regulations of the Fish Protection Act

Channel Type	Low Cover	Shrub	Trees
Riffle Pool	3 times channel width to a maximum of 5 m	3 times channel width to a maximum of 20 m	3 times channel width with a minimum of 10 m to a maximum of 30 m
Cascade-Pool	2 times channel width to a maximum of 5 m	2 times channel width to a maximum of 10 m	2 times channel width with a minimum of 10 m to a maximum of 15 m
Step-Pool	1 times channel width to a maximum of 5 m	1 times channel width to a maximum of 10 m	10 m

Table 2.7.2.5-7 Widths of the "zone of sensitivity" (ZOS) for shade and litterfall and terrestrial impacts as specified under the Riparian Areas Regulations of the Fish Protection Act.

Vegetation Type	Shade ZOS	Litterfall and Terrestrial Impacts ZOS
Low Cover	n/a	5 m
Shrub	2 times channel width to a maximum of 5 m	2 times channel width to a maximum of 10 m
Trees	3 times channel width to a maximum of 31 m	3 times channel width to a maximum of 30 m

Following comparison of the FRPA and RAR requirements pertaining to riparian buffer width, it was decided to apply the FRPA RRZ width to all stream and lake habitats affected by the project since this defines the area where harvesting would not be permitted. However, the RRZ for non-fish bearing streams is 0 m which does not reflect the indirect contributions riparian vegetation in those sections make to downstream fish habitat. Therefore, for non-fish bearing streams, the RAR buffers were applied at 5 m for areas dominated by low cover and shrub and 10 m for areas dominated by trees. Vegetation classification was determined from review of the baseline vegetation mapping completed as part of this EIS submission (Section 2.6.1.7)

Potential Project Effect: Loss or Alteration of In-stream Habitat on Rainbow Trout in Middle and Upper Fish Creek

The scope of assessment for the loss or alteration of in-stream habitat in Middle and Upper Fish Creek consists of Rainbow Trout lotic habitat only (i.e., excludes lake habitat) in mainstem and tributary reaches upstream from the barrier at the Reach 3–4 break. The scope of this environmental effects assessment considers all life stages of Rainbow Trout habitat requirements (spawning, migration, rearing and overwintering) in these reaches.

Baseline: In-stream Habitat in Middle and Upper Fish Creek

The environmental effects assessment analyses for Middle and Upper Fish Creek Rainbow Trout considers total in-stream spawning, rearing and overwintering habitat (measured in m^2) in mainstem and tributary reaches, determined as the product of channel width (bankful width) and reach length (measured in linear metres). Physical habitat and fish presence sampling methods for the 1996 and 1997 programs followed DFO standards of that time (1989).

Middle and Upper Fish Creek contains a total of xx m^2 of in-stream habitat (Table 2.7.2.5-8). The majority (xx%; xxx m^2) of in-stream habitat in middle and upper Fish Creek is non-fish bearing. Rainbow Trout occur in eight continuous (perennial) reaches and one intermittent mainstem reach (Reach 8). Most of the fish-bearing habitat in middle and upper Fish Creek (xxx m^2) occurs in mainstem Reach 5 (xxx m^2) and Reach 8 (xxx m^2). A total of xxx m^2 of riparian habitat is contained within middle and upper Fish Creek.

Within Middle and Upper Fish Creek, stream habitat that falls under the jurisdiction of the MMER totals xxx m^2 including xxx m^2 of fish bearing and xxx m^2 of non-fish bearing. This includes portions of Fish Creek Reach 8, and 10 as well as portions of Fish Lake Tributary 1 (Reaches 2 and 3) and several ephemeral drainages. Little Fish Lake (Fish Creek Reach 10) also occurs within the proposed TIA footprint. Riparian habitat within the TIA footprint totals xxx m^2 including that associated with Little Fish Lake (xxx m^2).

Table 2.7.2.5-8 Baseline Conditions (In-stream Habitat) in Middle and Upper Fish Creek

Reach	Flow Type[1]	Fish Status[2]	Bankful Channel Dimensions[3]			Riparian		MMER vs. Fisheries Act (FA)
			Length (m)	Width (m)	Area (m^2)	RRZ Width (m)	Area (m^2)	
Mainstem								
4	continuous	FB	xx	xx	xx	xx	xx	FA
5	continuous	FB	xx	xx	xx	xx	xx	FA
6	continuous	FB	xx	xx	xx	xx	xx	FA
8	intermittent	FB	xx	xx	xx	xx	xx	Both
Totals/Averages			**xx**	**xx**	**xx**	**xx**	**xx**	
Middle Fish Creek Tributary No. 2								
1	continuous	FB	xx	xx	xx	xx	xx	FA
2	continuous	FB	xx	xx	xx	xx	xx	FA
3	continuous	FB	xx	xx	xx	xx	xx	FA
3	continuous	NFB	xx	xx	xx	xx	xx	FA
4	continuous	NFB	xx	xx	xx	xx	xx	FA
4	intermittent	NFB	xx	xx	xx	xx	xx	FA
Tributaries	intermittent	NFB	xx	xx	xx	xx	xx	FA
mainstem tributaries	ephemeral	NFB	xx	xx	xx	xx	xx	FA
Totals/Averages			**xx**	**xx**	**xx**	**xx**	**xx**	
Middle Fish Creek Tributary No. 1								
	ephemeral	NFB	xx	xx	xx	xx	xx	FA
Totals/Averages			**xx**	**xx**	**xx**	**xx**	**xx**	
Fish Lake Tributary No.1								
1	continuous	FB	xx	xx	xx	xx	xx	FA
Trib B2D	intermittent	FB	xx	xx	xx	xx	xx	FA
2	continuous	NFB	xx	xx	xx	xx	xx	FA
2	intermittent	NFB	xx	xx	xx	xx	xx	Both

Reach	Flow Type[1]	Fish Status[2]	Bankful Channel Dimensions[3]			Riparian		MMER vs. Fisheries Act (FA)
			Length (m)	Width (m)	Area (m^2)	RRZ Width (m)	Area (m^2)	
3	ephemeral	NFB	xx	xx	xx	xx	xx	MMER
Totals/Averages			**xx**	**xx**	**xx**	**xx**	**xx**	
Fish lake Tributary No. 3								
1	continuous	FB	xx	xx	xx	xx	xx	FA
2	intermittent	NFB	xx	xx	xx	xx	xx	FA
3	ephemeral	NFB	xx	xx	xx	xx	xx	FA
Totals/Averages			**xx**	**xx**	**xx**	**xx**	**xx**	
Upper Fish Creek Tributary No. 1								
1	intermittent	NFB	xx	xx	xx	xx	xx	FA
1	ephemeral	NFB	xx	xx	xx	xx	xx	FA
Totals/Averages			**xx**	**xx**	**xx**	**xx**	**xx**	
Ephemeral Streams								
All (includes reach 10)	ephemeral	NFB	xx	xx	xxx	xx	xx	Both
Totals/Averages			**xx**	**xx**	**xx**	**xx**	**xx**	
Grand Totals			**xx**		**xx**		**xx**	

NOTES:

[1] **Ephemeral:** ephemeral streams have well-defined, continuous channels but flow for only part of the year, usually in spring, early summer and the autumn in interior watersheds. Seasonal streams accessible to fish are important because they may provide overwinter shelter in coastal systems, and early spring spawning and rearing habitat in both interior and coastal drainages.

Intermittent: intermittent streams do not dry up completely during seasonal periods of low rainfall, but retain water in separated pools along the channel. Intermittent tributaries that contain water all winter, but are reduced to isolated pools in summer, can support salmonids all year in both coastal and interior watersheds. These tributaries are commonly used by coho salmon juveniles, trout and char (adapted from *Fish Stream Identification Guidebook*, MOF 1998).

[2] **FB**: fish-bearing; **NFB**: non fish-bearing

[3] **Bankful** channel width and area measurements reflect maximum values

SOURCE:

Modified from Appendix 5-3-A from the March 2009 EIS/Application. Fish Creek Fish and Fish Habitat Surveys (summer 1996 and 1997)

The environmental effects assessment for Rainbow Trout in-stream habitat also considers differences between the availability of habitat during spring (bankful stream flow) and late summer (critical stream flow) periods (Table 2.7.2.5-9).

The wetted area in spring (bankful width) was considered the maximum area available for trout spawning. The wetted area in late summer was the maximum area for juvenile trout rearing and over wintering during the critical stream flow period. The following section specifically addresses fish-bearing habitats (quantity and quality) as they relate to the loss or alteration of in-stream habitat in Middle and Upper Fish Creek and potential habitat mitigation and compensation requirements.

Reach 10 was the only mainstem reach where fish were not observed or captured. Three tributaries were identified as supporting trout spawning and rearing: Middle Fish Creek tributary No. 2, and Fish Lake Tributaries No.'s 1 and 3. All other tributaries flowed during the freshet period only and had limited potential to support incubating eggs or rearing fry except during extreme freshets, and only then in the lower sections adjacent to Fish Lake or Fish Creek (Appendix 5-3-A from the March 2009 EIS/Application).

Table 2.7.2.5-9 Baseline Conditions (In-stream Habitat Attributes for Fish-Bearing Reaches) in Middle and Upper Fish Creek

Reach[1]	Bankful Area (m^2)	Wetted Channel Area (m^2) During CSFP	Habitat Composition[2] Pool (%)	Riffle (%)	Run (%)	Other (%)	Percent Gravel (%)	Percent Total Fish Cover (%)
Mainstem								
4	xx	xx	xx	xx	xx	xx	xx	xx
5	xx	xx	xx	xx	xx	xx	xx	xx
6	xx	xx	xx	xx	xx	xx	xx	xx
8	xx	xx	xx	xx	xx	xx	xx	xx
Totals:	xx	xx						
Middle Fish Creek Tributary No. 2								
(reaches 1-3)	xx	xx	xx	xx	xx	xx	xx	xx
Fish Lake Tributary No. 1								
(reach 1)	xx	xx	xx	xx	xx	xx	xx	xx
Fish Lake Tributary No. 3								
(reach 1)	xx	xx	xx	xx	xx	xx	xx	xx
Totals:	xx	xx						

NOTES:

[1] Fish-bearing reaches only

[2] **Pool:** a portion of a stream with reduced current velocity, often with water deeper than the surrounding areas, and which is frequently used by fish for resting or cover.

Riffle: a shallow rapids where the water flows swiftly over completely or partially submerged obstructions to produce surface agitation, but standing waves are absent.

Run: an area of swiftly flowing water, without surface agitation or waves, which approximates uniform flow and in which the slope of the water surface is roughly parallel to the overall gradient of the stream reach.

Other: includes sections of steeper habitat such as cascade or step-pool morphology.

Total Fish Cover: total contribution (%) of one or more attributes such as large woody debris (LWD), boulders, undercut banks, deep pools and in-stream vegetation (adapted from MOELP 1997. Fish Habitat Rehabilitation Procedures. Watershed Restoration Technical Circular No. 9)

SOURCE: modified from Appendix 5-3-A. Fish Creek Fish and Fish Habitat Surveys (summer 1996 and 1997)

Rearing juvenile Rainbow Trout generally require deep pool or low velocity run type habitats during the late summer critical stream flow and overwintering periods. As such, deep pool habitat type is relatively more important for Rainbow Trout sustainability during these seasons than in the late winter-early spring spawning period.

Based on habitat type composition, most pool habitat (xx%) occurs in mainstem Reach 8. Pool habitats in this reach provide about xxx m^2 overwintering habitat during the late winter-early spring flow period and xxx m^2 of juvenile rearing habitat during the late summer critical stream flow period. Mainstem Reach 4 (xx%; xxx m^2) and Fish Lake Tributary 1 (xx%; xx m^2) also provide substantial amounts of pool habitat during the late summer critical flow period.

Rainbow Trout generally spawn in gravel-bottom riffles; therefore this habitat type is relatively more important during the spring spawning period than during the late summer rearing period.

Riffle habitats in mainstem reaches comprise xx% (Reach 5) to xx% (Reach 6).. Based on the total amount of available habitat during the spring (May to July) spawning period, Reach 8 provides the most riffle habitat (xx%; xxx m^2), followed by Reach 6 (xx%; xxx m^2 riffle habitat). Fish Lake Tributary No. 1 contains the most tributary riffle type habitat (xx%) during the late winter-spring spawning (xx m^2) and late summer critical stream flow (xx m^2) periods.

Previous studies determined that Rainbow Trout spawning in Middle and Upper Fish Creek is associated with gravel substrate composition (2 to 64 mm) and riffle type habitat, predominantly in mainstem Reaches 5, 6 and 8 (Table 2.7.2.5-10; Triton, 1999a). Based on this analysis, between 17 and 35% of bankful channel area provides preferred spawning habitat.

Table 2.7.2.5-10 Baseline Conditions (Rainbow Trout Spawning Habitat) in Middle and Upper Fish Creek

Reach	Bankful Channel Area (m^2)	Riffle Composition (%)	Gravel Composition (%)	Total Spawning Area (m^2)	
				Based on Riffle Habitat	Based on Gravel Substrates
5	xxx	xx	xx	xxx	xxx
6	xxx	xx	xx	xxx	xxx
8	xxx	xx	xx	xxx	xxx
Total	**xxx**			**xxx**	**xxx**

SOURCE:
Modified from Appendix 5-3-A from the March 2009 EIS/Application. Fish Creek Fish and Fish Habitat Surveys (summer 1996 and 1997)

Information on baseline water quality and primary and secondary productivity levels in creek and lake habitats in middle and upper Fish Creek watershed are presented and discussed in the Water Quality and Aquatic Ecology, Section 2.7.2.4B.

Project Effects Assessment: In-stream Habitat in Middle and Upper Fish Creek

Project activities associated with open pit construction, water management, and starter dam construction is expected to eliminate flows and the availability of Rainbow Trout habitat in portions of Middle and Upper Fish Creek watershed. Collectively, mine facilities and operation, and diversion channels will create a closed mine site which will restrict the local flow of water, thereby eliminating a proportion of in-stream fish habitat availability in the middle and upper Fish Creek watershed. The following section provides a breakdown of project effects (direct and indirect) on in-stream habitat in Middle and Upper Fish Creek for the MMER (TIA footprint) and those outside of the TIA (*Fisheries Act*; HADD).

Direct Effects (HADD)

Direct effect to fish bearing habitat in Middle and Upper Fish Creek outside of the TIA footprint will total xxxx m^2 of stream habitat including xxxx m^2 of fish-bearing stream and xxxx m^2 of non-fish bearing habitat. This includes portions of Reaches 5 and 6 of Fish Creek where the proposed pit will be located, and Reach 8 where a small portion (287 m) will be lost under the main embankment (Table 2.7.2.5-11). Direct effects to non-fish bearing habitats include Middle Fish Creek Tributary 1, which will be affected by the pit at the downstream end and the non-PAG waste pile at the upstream end. In addition, a small portion of Fish Lake Tributary 1 will be lost under the tailings embankment. Lastly, xxx m^2 of first order, ephemeral stream channel is predicted to be affected by the south tailings embankment (Fish Creek reach 10) and non-PAG waste pile (unnamed tributaries to Fish Creek reach 5 and Middle Fish Creek Tributary 1). Table 2.7.2.5-11 also provides an estimate of the riparian losses associated with each stream effect which total xxxx m^2.

Indirect Effects (HADD)

Indirect effects associated with the Project in Middle and Upper Fish Creek total xxxx m^2 of stream habitat including xxxx m^2 of fish-bearing stream and xxxx m^2 of non-fish bearing stream. Indirect effects are limited to Reach 4 and portions of reach 5 of Fish Creek, located downstream from the pit, and a portion of Reach 8 of Fish Creek and Reach 1 of Fish Lake Tributary 1, located downstream from the tailings storage facility (TSF). Indirect effects to non-fish bearing habitats will include a portion of Middle Fish Creek Tributary 1 and Fish Lake Tributary 1 (Table 2.7.2.5-12). As previously discussed there are no predicted riparian losses associated with indirect effects.

Direct Effects (MMER: Schedule 2)

Direct effects within Middle and Upper Fish Creek associated with the TIA footprint total xxxx m^2 of stream habitat (Table 2.7.2.5-13) including xxxx m^2 of fish-bearing stream limited to a portion of Reach 8, and xxxx m^2 of non-fish bearing stream including portions of Reach 10 of Fish Creek, Reaches 2 and 3 of Fish Lake Tributary 1, and several first order, ephemeral tributaries. In addition, Little Fish Lake will be lost resulting in an additional xxxx m^2 of fish bearing lake habitat that will be affected. Table 2.7.2.5-13 also provides an estimate of the riparian losses which total xxxx m^2 (xxxx m^2 associated with streams and xxxx m^2 associated with Little Fish Lake).

Table 2.7.2.5-11 Predicted direct effects (HADD) of the New Prosperity project on Fish and Fish Habitat in Middle and Upper Fish Creek

Stream	Reach	Baseline Area (m^2)	Description of Effects	Effect Area (m^2)	Riparian Description	Buffer (m)	Length (m)	Riparian Effect (m^2)
Upper Fish Creek	**5**	xxx	Fish bearing. Upper 50% (xxx m) of reach directly affected (Pit)	xxxx	Riparian dominated by low cover/shrub	xx	xxxx	xxx
	6	xxx	Fish bearing. Lower 40% of reach direct effect (Pit); upper 60% will have 100% loss of flow (direct).	xxxx	Riparian consists of mix of old forest (>10 m) and shrub/wetland.	xx	xxxx	xxx
	8	xxx	Fish bearing. Direct effects limited to xxx m under TSF embankment.	xxx	Riparian consists of forest (< 10 m), shrub and wetland	xx	xxx	xxx
	Totals	**xxx**		**xxxx**				**xxxx**
Middle Fish Creek Tributary 1	All	xxx	Non-fish bearing. Lower 16% (xxx m) directly affected by Pit; upper 6% (xxx m) directly affected by non-PAG pile. Tribs (xxx m) impacted by non-PAG also included.	xxxx	Riparian consists of mix of old forest (>10 m) and shrub/low cover. Length includes directly affected sections (1790 m) as well as stream between non-PAG and pit (1567 m).	xx	xxxx	xxxx
	Totals	**xxx**		**xxxx**				**xxx**
Fish Lake Tributary 1	2	xxx	Non-fish bearing. Section under TSF embankment (xxx m).	xxx	Primarily low cover/shrub veg	x	xxx	xx
	Totals	**xxx**		**xxx**				**xx**
Ephemeral Streams	All	xxx	Ephemeral, non-fish bearing habitat. Includes Fish Creek reach 10 (portion lost under tailings dam xxx m), and Fish Lake Trib 2 (xxx m).	xxxx	Primarily low cover/shrub veg	x	xxxx	xx
	Totals	**xxx**		**xxxx**				**xxx**
Stream Totals	**FB**	**xxx**		**xxxx**				**xxx**
	NFB	**xxx**		**xxxx**				**xxxx**
	Total	**xxx**		**xxx**				**xxxx**

Table 2.7.2.5-12 Indirect effects (HADD) of the New Prosperity Project on Fish and Fish Habitat in Middle and Upper Fish Creek

Stream	Reach	Baseline Area (m^2)	Effect Description	Effect Area (m^2)
Upper Fish Creek	**4**	xxx	Fish bearing. Indirect effects through a reduction of 90% of source flow ; baseline flows will be restored following pit infilling	xx
	5	xxx	Fish bearing. Lower 50% (xxx m) of reach will have indirect effect through flow reduction of 90%	xxx
	8	xxx	Fish bearing. Lower 58% (xxx m) will have indirect effect through 86% flow reduction.	xxx
	Totals	**xxx**		**xxx**
Middle Fish Creek Tributary 1		xxx	Non-fish bearing. 25% (xxx m) will have indirect effects associated with non-PAG pile (includes 2 tribs).	xx
	Totals	**xxx**		**xx**
Fish Lake Tributary 1	**1**	xxx	Fish bearing. 45% reduction in flow.	xxx
	2	xxx	Non-fish bearing. 45% reduction in flow	xxx
	2	xxx	Non-fish bearing. Lower 70% (xxx8 m) will have 45% reduction in flow.	xxx
	Totals	**xxx**		**xxx**
Stream Totals	**FB total**	**xxx**		**xxxx**
	NFB Total	**xxx**		**xxx**
	Grand Totals	**xxx**		**xxx**

Table 2.7.2.5-13 Predicted direct effects under Metal Mining Effluent Regulation (Schedule 2) of the New Prosperity Project on Fish and Fish Habitat in Middle and Upper Fish Creek

Stream	Reach	Baseline Area (m^2)	Effect Description	Effect Area (m^2)	Riparian Description	Riparian Buffer (m)	Length (m)	Riparian Effect (m^2)
Upper Fish Creek	8	xxx	Fish bearing. Lost under TIA	xxx	Young forest (< 10 m), shrub and wetland dominated.	xx	xxx	xxx
	Totals	**xxx**		**xxx**				**xxx**
Fish Lake Tributary 1	2	xxx	Non-fish bearing. Lost under TIA	xxx	Primarily low cover/shrub veg	xx	xxx	xxx
	3	xxx	Non-fish bearing. Lost under TIA	xxx	Primarily low cover/shrub veg	xx	xxx	xxx
	Totals	**xxx**		**xxx**				**xxx**
Ephemeral Streams	All	xxx	Ephemeral, non-fish bearing habitat directly affected by TIA	xxxx	Wetland, shrub and young forest (< 10 m tall) dominated.	xx	xxx	xxx
	Totals	**xxx**		**xxx**				**xxx**
Stream Totals	**FB total**	**xxx**		**xxx**				**xxx**
	NFB Total	**xxx**		**xxx**				**xxx**
	Grand Totals	**xxx**		**xxx**				**xxx**
Little Fish Lake		xxx	Lost under TIA.	xxx	L1 lake (perimeter xxx m). Shrub, low cover and young forest (< 10 m) dominated.	xx		xxx
Stream and Lake Totals		**xxx**		**xxx**				**xxx**

Table 2.7.2.5-14 provides a summary of the predicted direct and indirect effects to stream and lake habitat in Middle and Upper Fish Creek including riparian areas.

Table 2.7.2.5-14 Summary of predicted effects to fish and fish habitat in Middle and Upper Fish Creek of the New Prosperity project

Category	Direct Effects (HADD; m^2)	Direct Effects (MMER; m^2)	Indirect Effects (HADD; m^2)	Total (m^2)
Fish Bearing Stream	xxx	xxx	xxx	xxx
Non-Fish Bearing Stream	xxx	xxx	xxx	xxx
Stream Total	xxx	xxx	xxx	xxx
Lake	xx	xxx	xx	xxx
Riparian (Stream and Lake)	xxxx	xxx[1]	xx	xxxx

[1]Includes xxx m^2 associated with stream effects and 13,000 m^2 associated with lake effects.

Habitat Evaluation Procedure (HEP)

The HEP approach was used to assess the productivity of the affected stream habitats in Upper Fish Creek. HSI values for Rainbow Trout are summarized in Table 2.7.2.5-15. The HSI values shown here are estimates of probability-of-use and have been equally applied to the productivity gains associated with the compensation elements. Details on the derivation of the HSI values used is included in the detailed *Fisheries Act Metal Mining Effluent Regulation (MMER)* compensation plans.

Table 2.7.2.5-15 Estimated habitat suitability indices (HSI) for Rainbow Trout by life history stage within a stream habitat type, Taseko Mines Ltd., April 2012

Habitat Type	Spawning	Juvenile Rearing	Adult Rearing	Overwintering	Production
Pool	0.25	1.0	1.0	1.0	0
Riffle	1.0	0.75	0.25	0	0
Run	0.25	0.5	0.5	0.25	0
Ephemeral	0	0.1	0	0	0.25

The percent habitat type composition for fish bearing and non-fish bearing (continuous and intermittent flow) reaches was determined by Triton (1997). The percent habitat unit type composition was multiplied by the total area (length (m) x width (m)) of each reach to provide an estimate (m^2) of available pool, riffle, run and ephemeral habitat types for each reach. The habitat type area (m^2) was then multiplied by the HSI value for the various life-history requisites of Rainbow Trout to determine Habitat Units (Table 2.7.2.5-16). The same process was used for Chinook salmon in Lower Fish Creek to determine habitat units associated with that species (Table 2.7.2.5-28).

Table 2.7.2.5-16 Summary of predicted effects (habitat units) on Rainbow Trout stream habitat in Middle and Upper Fish Creek

Habitat Type	HADD Area (m^2)	MMER Area (m^2)	Life History Stage	HSI Value	HADD Habitat Units	MMER Habitat Units	Total Habitat Units
Pool	xxx	xxx	Spawning	0.25	xxx	xxx	xxx
			Juv. Rearing	1	xxx	xxx	xxx
			Adult Rearing	1	xxx	xxx	xxx
			Overwintering	1	xxx	xxx	xxx
			Production	0	x	x	x
Total					xxx	xxx	xxxx
Riffle	xxx	xxx	Spawning	1	xxx	xxx	xxx
			Juv. Rearing	0.75	xxx	xxx	xxx
			Adult Rearing	0.25	xxx	xxx	xxx
			Overwintering	0	xx	xx	xx
			Production	0	xx	xx	xx
Total					xxx	xxx	xxx
Run	xxx	xxx	Spawning	0.25	xxx	xxx	xxx
			Juv. Rearing	0.5	xxx	xxx	xxx
			Adult Rearing	0.5	xxx	xxx	xxx
			Overwintering	0.25	xxx	xxx	xxx
			Production	0	xxx	xx	xx
Total					xxx	xxx	xxx
Ephemeral[1]	xxx	xxx	Spawning	0	xx	xx	xx
			Juv. Rearing	0.1	xxx	xxx	xxx
			Adult Rearing	0	x	x	x
			Overwintering	0	xx	xx	xx
			Production	0.25	xxx	xxx	xxx
Total					xxx	xxx	xxx
Totals	**xxx**	**xxx**			**xxx**	**xxx**	**xxx**

[1] Includes 1,597 m^2 of steep cascade/step-pool habitat

A total of xxx stream habitat units in Upper Fish Creek will be affected by the project. The total MMER effect in habitat units will be xxxx, while the Fisheries Act (HADD) effect will be xxx.

<u>Stream Flow Duration</u>

In regards to stream flow duration, the area of each affected reach was adjusted according to the number of months per year the habitat is functional and available to fish. Based on historic and recent data, and within the non-MMER effects area, Fish Creek Reach 1 is wetted 2 months/year (17%), Fish Creek Reach 8 is wetted a maximum of six months/per year (50%), and, all ephemeral reaches including Fish Creek

Reach 10 and Middle Fish Creek Tributary 1, a maximum of four months/year (33%). The remaining reaches (Fish Creek 2-6, Fish Lake Tributary 1) are wetted a maximum of 12 months/year (100%)

Based on the annual duration of wetted channel area, the adjusted effects on stream habitats outside of the TIA footprint (i.e., HADD) are estimated at xxx m^2, or about xx% of the value that assumes year-round stream flows (Table 2.7.2.5-17). Riparian effects adjusted by stream flow duration are estimated at xxx m^2, or about xx% of the year-round flow value.

Table 2.7.2.5-17 Summary of predicted non-MMER effects on stream habitats based on stream flow duration, Taseko Mines Ltd., April 2012

Waterbody	Reach	Stream Effects Area (m^2)	Riparian Effects Area (m^2)	Proportion of Year Channel is Wetted	Flow Adjusted Aquatic Effects Area (m^2)	Flow Adjusted Riparian Effects Area (m^2)
Fish Creek	4-6	xxx	xxx	1.0	xxx	xxx
Fish Creek	8	xxx	xxx	0.50	xxx	xxx
Ephemeral Streams	all	xxx	xxx	0.33	xxx	xxx
Fish Lake Trib. 1	all	xxx	xxx	1.0	xxx	xxx
Totals		**xxx**	**xxx**		**xxx**	**xxx**

[1] Indirect effect only therefore no riparian effects anticipated.

Within the MMER effects area (i.e., TIA footprint) Reach 8 of Fish Creek is wetted a maximum of six months/per year (0.5), Reach 2 of Fish Lake Tributary 1 and Little Fish Lake, a maximum of year-round (1.0), and, all ephemeral reaches, a maximum of four months/year (0.33).

Based on the annual duration of wetted channel area, the adjusted MMER effects on stream habitats in Middle and Upper Fish Creek are estimated at xxxx m^2, or about xx% of the value that assumes year-round stream flows (Table 2.7.2.5-18). The adjusted MMER effects on riparian habitat are estimated at xxxx m2, or approximately xx% of the year-round flow value. The majority of the difference (xx%) occurs within the ephemeral waterbody class.

Table 2.7.2.5-18 Summary of predicted MMER effects on Rainbow Trout stream and lake habitats based on stream flow duration, Taseko Mines Ltd., March 2012

Waterbody	Reach	Steam Effects Area (m^2)	Riparian Effects Area (m^2)	Percent of Year Channel is Wetted	Flow Adjusted Aquatic Effects Area (m^2)	Flow Adjusted Riparian Effects Area (m^2)
Upper Fish Creek	8	xxx	xxx	0.5	xxx	xxx
Fish Lake Tributary 1	2	xxx	xxx	1.0	xxx	xxx
	3	xxx	xxx	0.33	xxx	xxx
Ephemeral Streams	all	xxxx	xxx	0.33	xxx	xxx
Totals		**xxx**	**xxx**		**xxx**	**xxx**

Table 2.7.2.5-19 summarizes and compares the results of the three different approaches used to evaluate Project effects on stream and riparian habitats in Middle and Upper Fish Creek. For non-MMER effects (HADD) the area of effect ranges from xxxx m^2 assuming year-round flow to xxx m^2 when seasonal flow conditions are taken into account. For MMER effects, the decrease in area from year-round flow (xxxxx m^2) to seasonal flow (xxx m^2) is substantial and highlights the fact that most of the effected stream habitat associated with the TIA is ephemeral.

Table 2.7.2.5-19 Comparison of aquatic effects of the New Prosperity Project on Middle and Upper Fish Creek

Habitat Type	Area (m^2)		HEP (Habitat Unit)		Flow Duration (by % of year channel is wetted; m^2)	
	HADD	**MMER**	**HADD**	**MMER**	**HADD**	**MMER**
Stream Habitat	xxx	xxx	xxx	xxx	xxx	xxx
Riparian Habitat	xxx	xxx	n/a	n/a	xxx	xxx

<u>Potential Project Effect</u>: Loss or Alteration of Lake Habitat on Rainbow Trout in Middle and Upper Fish Creek

The scope of assessment for the loss or alteration of lake and associated riparian habitat in Middle and Upper Fish Creek considers Rainbow Trout lacustrine habitat (i.e., excludes in-stream habitat) in Fish and Little Fish lakes. Lacustrine habitat consists of pelagic (>6 m depth) and shoal (littoral; <6 m depth) habitat types.

<u>Baseline</u>: Lake Habitat in Middle and Upper Fish Creek

<u>Fish Lake and Little Fish Lake Habitat</u>

The environmental effects assessment for Middle and Upper Fish Creek Rainbow Trout considers changes in the availability of total lake habitat due to Little Fish Lake inundation, physical habitat disruption, water diversion and sourcing activities. Lake habitat and basic limnological surveys were conducted in Fish Lake and potential compensation lakes between 1993 and 1998 (Appendix 5-3-E [Part 1 and 2], Appendix 5-3-H and Appendix 5-3-C in the March 2009 EIS/Application).

Fish Lake bathymetric surveys completed in the early to mid-1990s followed methods described in the *Draft Lake Survey Manual* (MOELP, 1992). Subsequent lake habitat surveys (Appendix 5-3-C in the March 2009 EIS/Application) including volume and area calculations for hardcopy (digital planimeter) and digital maps (ArcInfo) followed methods described *in Bathymetric Standards for Lake Inventories* (RIC 1997). These studies enabled the determination of maximum depth, lake-bottom gradients, shoreline development indices and amounts of shoal (<6 m depth) and pelagic areas. Detailed bathymetric surveys were not conducted in Little Fish Lake; however, previous fish presence studies indicated that the lake is 100% shoal (<6 m depth) habitat (Appendix 5-3-E Part 1 and 2 in the March 2009 EIS/Application).

Fish Lake has a catchment area of 6,490 ha and a surface area of 111 ha, about 17 times larger than Little Fish Lake (Table 2.7.2.5-20). Fish Lake has a maximum depth of 13 m, shoreline perimeter of 11.7 km and volume of 4.4 Mm3, about 33 times that of Little Fish Lake. Fish Lake contains 83.5 ha shoal area, approximately 75% of total surface area.

Table 2.7.2.5-20 Baseline Conditions (Lakes Physical Habitat) in Upper Fish Creek

Property	Fish Lake	Little Fish Lake
Elevation (m)	1,457	1,527
Drainage area (ha)	6,490	1,470
Surface area (ha)	111	6.6
Volume (m^3)	4,438,446	133,280
Shoreline perimeter (m)	11,756	1,300
Shoal area (ha)	83.5	6.6
Maximum depth (m)	13	4.4
Mean depth (m)	4	2
Lake length (m)	2,050	560
Mean breadth (m)	541	118
Secchi depth (m)	>10	4
Shoreline development Index[2]	3.15	1.43
No. of inlets	10	3
No. of outlets	1	1
No. of islands	5	0
Perimeter of islands	1,700	n/a
Fish presence	Rainbow Trout	Rainbow Trout

NOTES:
[1] Shoreline Development Index (DL): is a comparative figure relating the shoreline perimeter (L) to the circumference of a circle that has the same area (A) as the lake: $DL = L(m)/2\sqrt{\pi A}(m^2)$

SOURCE: modified from Appendix 5-3-C. Lakes Physical Habitat

<u>Project Effects Assessment</u>: Lake Habitat in Middle and Upper Fish Creek

Lake habitat in Middle and Upper Fish Creek which will be affected as a result of the project is limited to Little Fish Lake which will be inundated by the TSF (Table 2.7.2.5-21).

Table 2.7.2.5-21 Summary of Project Effects on Baseline Conditions (Rainbow Trout Lake Habitat) in Middle and Upper Fish Creek

	Total Area (ha)	Total Volume (x $10^6 m^3$)	Shoal Area (ha)	Pelagic Area (ha)	Shoreline Perimeter (km)	Riparian Habitat (m^2)
Little Fish Lake	xx	xxx	xxx	xxx	xxx	
Total	xx	xxx	xxx	xxx	xxx	

The effect of the Project on the availability of Rainbow Trout lake habitat in upper Fish Creek will be greatest beginning in year 1when Little Fish Lake becomes inundated by the TSF.

Habitat Evaluation Procedure (HEP)

The habitat evaluation procedure has also been applied to lakes. Bradbury et al. (2001) developed habitat suitability indices for Rainbow Trout rearing (fry, juveniles and adults) and spawning based on the availability of littoral (< 2 m depth) habitat, substrate composition and presence/absence of submerged and emergent aquatic vegetation (Table 2.7.2.5-22). This approach is used to estimate the habitat unit loss associated with the incorporation of Little Fish Lake into the TIA and assumes:

1. Dominant silt/muck substrates
2. 50% of littoral area < 2 m and 50% >2 m
3. 50% of <2 m littoral has vegetation (half emergent and half submerged)

Table 2.7.2.5-22 Habitat suitability indices (HSI) for Rainbow Trout by life history stage within a lake habitat type (from Bradbury et al. 1999)

Habitat Type	Spawning	Fry Rearing	Juvenile Rearing	Adult
<2 m depth with emergent vegetation	0.44	0.44	0.44	0.5
<2 m depth with submerged vegetation	0.44	0.44	0.44	0.5
<2 m depth with no vegetation	0.5	0.5	0.5	0.5
>2 m depth	0.17	0.5	0.5	0.5

Based on the above HSI values, Little Fish Lake provides about 118,140 of lake habitat units (Table 2.7.2.5-23). The majority (47%) of the lake habitat units occur at depths greater than two meters, followed by depth less than two meters with no vegetation (28% of total).

Table 2.7.2.5-23 Summary of predicted MMER effects (habitat units) on Rainbow Trout lake habitat (Little Fish Lake), Taseko Mines Ltd., March 2012

Habitat Type	Affected Area (m2)	Life History Stage	HSI Value	Affected Habitat Units
<2 m depth with emergent vegetation	xxx	Spawning	0.44	xxx
		Young-of-the –year (fry)	0.44	xxx
		Juvenile	0.44	xxx
		Adult	0.5	xxx
Total				xxx
<2 m depth with submerged vegetation	xxx	Spawning	0.44	xxx
		Young-of-the –year (fry)	0.44	xxx
		Juvenile	0.44	xxx
		Adult	0.5	xxx
Total				xxx
<2 m depth with no vegetation	xxx	Spawning	0.5	xxx
		Young-of-the –year (fry)	0.5	xxx
		Juvenile	0.5	xxx
		Adult	0.5	xxx
Total				xxx
>2 m depth	xxx	Spawning	0.17	xxx
		Young-of-the –year (fry)	0.5	xxx
		Juvenile	0.5	xxx
		Adult	0.5	xxx
Total				xxx

Mitigation Measures

Upper Fish Creek Rainbow Trout Habitat

Flow Augmentation

In order to maintain the Rainbow Trout spawning habitat found in Fish Creek Reach 8 and Fish Lake Tributary 1 and mitigate the indirect effects of flow reduction in those two areas as a result of the TSF, pumps will be used to augment flows during the life of mine and closure. The pumps will operate during the critical spawning period which was determined to be from mid-April to the end of August during the Fish Lake Spawner Study (Triton, 1997). This encompasses the pre-spawning/staging period (April 8th to May 5th), spawning period (May 6th to June 30th), incubation and emergence (July 1st to August 25th; consistent with a 56 day incubation and emergence period). Flow augmentation volumes were calculated based on existing discharge information, channel morphological data (Triton, 1999), and available habitat suitability data. Specifically the water depths required to accommodate: pre-spawn (7.5 cm – 15 cm; to allow for staging at the mouth of the creeks), spawning (20 cm), and incubation and emergence (10 cm) (Mitigation Flow Technical Appendix).

The resulting flow augmentation will mitigate for the indirect effects anticipated for Reach 8 of Fish Creek and Reach 1 and 2 of Fish Lake Tributary 1 downstream of the TSF. Reach 8 of Fish Creek downstream of the TSF provides 9,513 m^2 of seasonal Rainbow Trout habitat, primarily limited to spawning and rearing, which will be indirectly affected by the project through flow reduction. The system is typically dry during the late summer and winter (Triton, 1999; Triton, 2012 in prep.) and as a result does not provide overwintering habitat. Therefore the augmentation will maintain flow during the period when it would naturally be wetted, thus mitigating the project effects.

Fish Lake Tributary 1 contains 7,374 m^2 of Rainbow Trout habitat including 4,403 m^2 of fish-bearing and 2,972 m^2 of non-fish bearing stream. The fish-bearing section is typically wetted year-round and does provide limited overwintering habitat (Triton, 2012 in prep). The non-fish bearing section is seasonal. Flow reductions within the system are expected to be less than that of Fish Creek Reach 8 (45% reduction vs. 86% reduction, respectively) due to the majority of the tributaries to Fish Lake Tributary 1 remaining undisturbed. As a result, while flow augmentation will mitigate project effects during the critical summer spawning period, natural flow via undisturbed tributaries should ensure the fish-bearing section remains wetted through the winter. Adaptive management involving flow augmentation through the winter may be employed using existing infrastructure to ensure overwintering habitat in Fish Lake Tributary 1 is not adversely affected. Post closure natural flow volumes will be restored to downstream habitats to enable restoration of natural flow regimes and productive habitat use.

Mitigation in Fish Creek Reach 8 and Fish Lake Tributary 1 associated with flow augmentation will result in a reduction in indirect effects of xxx m^2 and xxx habitat units (Table 2.7.2.5-24). Habitat units were calculated from Rainbow Trout HIS values as presented in Table 2 14). The breakdown of the total habitat based on percent composition of pool, riffle and run is from Triton (1999).

Table 2.7.2.5-24 Summary of reduction of indirect effects (m^2 and habitat units) associated with flow augmentation mitigation strategy for Fish Creek Reach 8 and Fish Lake Tributary 1

Waterbody	Areal (m^2)				Habitat Units			
	Pool	Riffle	Run	Total	Pool	Riffle	Run	Total
Fish Creek Reach 8	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx
Fish Lake Tributary 1	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx
Total	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx

Middle and Upper Fish Creek Lake Habitat

The inundation of Little Fish Lake will occur as a result of the proposed mine, and there are several options for the removal and subsequent relocation or disposal of the estimate 5,000 Little Fish Lake Rainbow Trout. Taseko anticipates discussing possible options with regulatory agencies, First Nations and the public before it is decided exactly what to do with the estimated 5,000 fish in Little Fish Lake..

Compensation for the loss or alteration of lake habitat in Middle and Upper Fish Creek is provided for in the MMER Compensation Plan.

Compensation

The principal changes compared with the previous project are retention of Fish Lake and it's associated opportunities for utilization for fishing and navigation and the removal of Prosperity Lake as a compensation element. Administratively, the unavoidable losses of fish and fish habitat associated with the construction and operation of a TSF will require the development of one habitat compensation plan for MMER purposes and another plan for unavoidable HADD of fish habitat elsewhere within the project footprint. During the review and assessment of this project, specific details of the overall fish and fish habitat compensation plan will be finalized and only after further consultation and input is received from regulatory agencies, First Nations and the Public. At this time it is appropriate to provide the reader with an overview of Taseko's current thinking and plans for fish and fish habitat compensation plans.

Compensation Planning

The purpose of Fish and Fish Habitat Compensation Plans (the Plans) are to demonstrate the feasibility and scientific rationale for the successful compensation of unavoidable fish and fish habitat impacts associated with the New Prosperity Project (the Project). As the upper Fish Creek watershed habitats affected by the Project support a monoculture of Rainbow Trout, the principal focus of compensation planning will be on changes (losses) related to this species' habitat, populations, and use (Figure xx;). Compensation planning will also address loss of salmonid habitat in lower Fish Creek.

Compensation Planning will be reflective of Fisheries and Oceans Canada (DFO) Policy for the Management of Fish Habitat (DFO 1986), as well as the Metal Mining Effluent Regulation (MMER; Schedule 2). In addition the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO; formerly Ministry of Environment, MOE) Benchmark Statement for fish, fish habitat, and fisheries of the Fish Lake watershed (MOE, 2008a), and along with the Navigable Waters Protection Act (NWPA) as administered by Transport Canada. Lastly, the needs of local First Nations and the public within and around the Project will also be considered.

The principal change compared with the previous project is retention of Fish Lake with the intention of it maintaining suitable water quality for the preservation and sustainability of the monoculture rainbow trout in Fish Lake. The previous project included development of Prosperity Lake which would have functioned as a lake capable of supporting rainbow trout starting in the early years of operations and continuing post closure. The TSF for the new Project will result in the loss of Little Fish Lake and its tributaries and while providing the same function and capacity of the previously proposed TSF it is different in configuration and design. Preservation of the lake will also allow for continued navigation on the lake which would not have been possible for many years in the previous project.

1. The TSF associated with the new Project will require development of a compensation plan for those impacts related to Schedule 2 of the Metal Mining Effluent Regulations (MMER) under the Fisheries Act. Habitat impacts associated with the Harmful Alteration, Disruption or Destruction (HADD) of fish habitat will require compensation under Section 35(2) of the Fisheries Act. The EIS guidelines and DFO have explicitly indicated the compensation plans will be outlined in separate fish habitat mitigation and compensation plans. Mitigation is discussed earlier in this document and the current sections address compensation plans under the MMER and Section 35(2) of the Fisheries Act. While both plans reflect provisions of the Fisheries Act, Environment Canada administers Schedule 2 with the merits of the both plans being reviewed and commented upon by DFO. Details for these two compensation plans may be found in Appendices x and y

respectively. The plans speak specifically to the nature of habitat losses and impacts and provide conceptual elements for achieving No Net Loss.

Elements of the Plans may be undertaken prior to initiation of construction activities to minimize potential short-term temporal losses of habitat productive capacity between habitat losses from construction and effective functionality of the habitat compensation. This will be a preferred strategy wherever it can be achieved as it will provide confidence to Taseko and others particularly DFO, the habitat works are functioning as designed.

Although the current project arrangement results in a notable reduction in effects to fish and fish habitat, the detailed alternatives assessment as described in the EIS determined it would not be feasible to relocate, redesign, or otherwise completely mitigate the Project so as to avoid a HADD. As a result compensation plans are being designed to achieve:

1. DFO's Policy for the Management of Fish Habitat (DFO, 1986) guiding principle of no net loss (NNL) of habitat productive capacity; and
2. Address and compensate for the effects of the TIA on fish and fish habitat as per Schedule 2 of the MMER.

In addition to these primary objectives, components of additional value that do not fit under the umbrella of DFO's Policy but which are of inherent value to the region are also being considered to address the goals of the other RA's. These include:

- Maintaining productive capacity of Fish Creek watershed habitat
- Maintaining genetic integrity of Fish Creek watershed Rainbow Trout
- Maintaining First Nation and recreational fishing opportunities

Achieving No Net Loss for the scope and nature of the effects described earlier will require more than one compensation element and a number of these elements will need to be located outside of the local project area. This is because there is not adequate area or resources on site which could accommodate compensation projects of a scale to offset impacts. In addition, the following guiding principles will be used to assess the adequacy of each compensation element:

- Quantitative and measurable over time;
- Demonstrated technical feasibility based on experience and proven techniques as described in manuals and guidelines;
- Adequate funding for implementation, follow-up and monitoring for success, long-term management and maintenance; and,
- Feasible, practical and achievable.

In accordance with the EIS Guidelines development and implementation of compensation plans will address the need to minimize time delays between loss of habitat productive capacity, uncertainty in whether the replacement habitat is likely to function as intended and the extent to which compensation measures are demonstrated to be biologically sound, reasonable and based upon practical and proven techniques. Accordingly, the compensation plans will be developed in consultation with DFO, First Nations, stakeholders and other RAs as required to comply with legislation and to achieve No Net Loss of the productive capacity of fish habitat.and in consideration of provincial goals and objectives and Aboriginal interests.

Fisheries Act 35(2) Compensation Overview

Direct and indirect effects of the Project outside of the TIA will result in the loss of xx m^2 of stream habitat equivalent to xx stream habitat units (taking into account both Rainbow Trout and Chinook Salmon). In addition, xx m^2 of riparian habitat will be lost. As discussed earlier these unavoidable losses will be compensated for by implementing compensation elements reflective of the nature and magnitude of the HADD (Appendix x).

MMER Schedule 2 TIA Compensation Overview

Direct effects of the Project associated with the TIA will result in the loss of x m^2 of Rainbow Trout stream habitat equivalent to xx habitat units. The TIA will also result in the loss of 66,000 m^2 Rainbow Trout lake habitat (Little Fish Lake), equivalent to xx lake habitat units. A further xx m^2 of stream and lake riparian habitat will be lost (Appendix y).

A summary or unavoidable habitat impacts is provided in Table xx

Table xx: Summary of Project Effects on Habitat

Habitat Loss (m^2)	**Instream**	**Riparian**
HADD 35(2)Direct	xx	xx
HADD 35(2)Indirect	xx	
MMER Schedule 2 TIA Direct	xx	xx
MMER (Little Fish Lake; Sch. 2 TIA)	xx	xx
Totals	**xx**	**xx**

Achievement of Compensation Goals

Development of compensation plans will consider the legislative requirements and policy outlined above, the timeframes for compensation (Pre-Implementation, construction, operations, closure) and the inclusion of other essential aspects of compensation planning (defined below) which together aim to present a scientifically sound plan supported within the regulatory setting. Consultation with regulators is an important aspect to the development and identification of compensation elements and it is recognized as a critical path item for compensation planning. Consultation with First Nations and the public will also provide important input for refining and shaping the final compensation elements.

At this time (Appendices x & y), Taseko has identified a number of potential compensation elements that, in aggregate, will achieve No Net Loss. The nature of these compensation elements are summarized in Table xy and are located within the local and regional study areas of the new Project. The ultimate selection and implementation of compensation elements will reflect further discussions and consultation with the public, First Nations, other interested parties and responsible authorities (DFO, Environment Canada and Transport Canada.

Table xy: Potential Compensation Elements

Elements	Description
Taseko Lake Off-Channel	5km groundwater fed off-channel project
Fish Lake Tributary Enhancement	1.5km channel excavation & habitat features
Fish Passage Enhancement	culverts, barrier removal, enhancement (15 candidate sites identified - more possible)
Watercourse Improvement #1	diversion/berm upgrades, channel improvements (fish passage and habitat)
Watercourse Improvement #2	diversion/berm upgrades, channel improvements (fish passage and habitat)_

The nature of the compensation elements are such that there will be additional benefits accrued that are not necessarily limited to achieving No Net Loss of habitat productive capacity including:

- Maintaining the genetic integrity of Fish Lake rainbow trout;
- Preserving heritage and archaeological values of islands and adjacent perimeter lands of Fish Lake;
- Maintaining recreational and First Nations' fishing opportunities;
- Maintaining navigation opportunities on Fish Lake; and,
- Providing the potential for collaborative project development in the local and regional project areas to benefit fish and compensate for habitat impacts.

The above discussion is focussed on fish and fish habitat compensation as it relates to the requirements under Schedule 2 of the MMER for a TIA and the HADD [Section 35(2)] of the Fisheries Act. In addition to these regulatory provisions Taseko is prepared and committed to working with Provincial agencies, First Nations, the public and other interested parties to provide meaningful projects and initiatives for benefits beyond the strict requirements of the Fisheries Act. For example, Taseko has met with personnel from the Ministry of Forests, Lands and Natural Resource Operations (MFLRNO) to discuss regional issues and priorities that Taseko could participate in the development and delivery of programs to improve fishing opportunities. The underlying principles behind this assistance are articulated in the MFLRNO (then Ministry of Environment) Benchmark Statement for objectives pertaining to the management of rainbow trout fisheries in the region.

The Benchmark Statement also includes a commitment to implement compensation measures effective in augmenting the MFLRNO's fishery management objectives and provide enhanced enhanced First Nations and public fishing opportunities in small lakes within the Chilko/Taseko watershed. Taseko recognizes it is in a position to participate and perhaps manage some of these initiatives that will have broader benefits than just those associated with the regulatory and Fisheries Act aspect of the compensation plans.

One of the five goals of the Provincial government is to make "British Columbia's fisheries management the best bar none" and to achieve this goal a comprehensive Freshwater Fisheries Program Plan (FFPP) was developed. This program is delivered through the Freshwater Fisheries Society of BC and Taseko will assist and contribute to this program where it can. In addition to the above, Taseko has identified a number of other possible initiatives that it could facilitate in the region related to operating a local fish hatchery (training, genetic preservation), outplanting and stocking of lakes in the region and assisting the public and First Nations with projects they would like to see undertaken. The nature of these projects do not specifically address the provisions of the Fisheries Act and compensation but they could be valuable additions to comprehensive compensation plans that otherwise may not be implemented if it were not for the proposed Project.

Cumulative Effects Assessment

It is anticipated that habitat compensation and mitigation elements will compensate for losses and alteration of fish-bearing and non fish-bearing habitat associated with the Project. Assuming that all aspects of the Compensation Plan are successful, the residual environmental effects of the Project on Middle and Upper Fish Creek in-stream habitat is not expected to be significant.

The residual environmental effects (positive) are predicted to be regional in geographic extent, permanent in duration, with no requirement to be reversible. The implementation of compensation elements associated with the loss of Rainbow Trout stream habitat can be initiated immediately, pending further baseline or feasibility study requirements, to achieve temporal gains in productive capacity (i. e, compensation plan implementation can begin pre-project construction) and to eliminate any potential temporal losses in productivity.

Based on a review of the projects identified on the Inclusion List, none of past, present or reasonably-foreseeable projects and activities in the RSA are expected to result in temporary or permanent losses of in-stream fish habitat. Therefore, the environmental effects of the Project on in-stream habitat in Middle and Upper Fish Creek are not anticipated to act in a cumulative manner with similar environmental effects from other projects or activities in the RSA.

As shown in Table 2.7.2.5-32, the environmental effects of the Project on lake habitat will be mitigated through the implementation of the compensation elements. Given the known types of past, present and reasonably-foreseeable projects and activities in the RSA, it is not expected that other projects and activities will result in spatial or temporal losses of lake habitat that will overlap with those associated with the Project. Therefore, cumulative effects were not considered further in relation to losses or changes in lake habitat availability in Middle and Upper Fish Creek.

Angling success and fishing experience while fishing for Rainbow Trout in Fish Lake may be affected by Project activities (e.g., increased noise and traffic associated with routine mine operations). While the opportunity to fish in Fish Lake will remain throughout all phases of mine development the Cariboo-Chilcotin Region contains many lakes offering similar remote fishing experience that are available should potential anglers chose not to fish at Fish Lake. As details of the fish compensation plan are finalized, it is conceivable that should it be found to be both desired and appropriate, specific additional fishing opportunities may be created though the implementation of options to be discussed with MFLNRO staff and First Nations representatives.

Based on the range of past, present and reasonably foreseeable projects and activities, none are expected to substantially alter recreational fishing in the region. As a result, the environmental effects of the Project on recreational angling for rainbow trout are not anticipated to act in a cumulative manner with other past, present or reasonably foreseeable future projects in the RSA.

Determination of the Significance of Environmental Effects

The assessment methodology for environmental effect characterization and determination of significance is as described in Section 2.7.1.5.

The findings of the Project effects assessment for fish and fish habitat for New Prosperity are summarized in Table 2.7.2.5-25. The rationale for the significance determinations are as follows:

- For loss/alteration of in-stream habitat quality or quantity, although the magnitude is high and the area is presently relatively undisturbed and the effect is permanent and irreversible, with implementation of the described mitigation and compensation measures, the conclusion is that the environmental effects are not significant because the effect is local, occurs once, and is nuetral in direction.
- For loss/alteration of lake habitat quality and quantity, specifically Little Fish Lake, although the area is presently relatively undisturbed and the effect is permanent and irreversible, the magnitude is low and with implementation of the described mitigation measures, the conclusion is that the environmental effects are not significant because the effect is local, occurs once, and is neutral in direction.
- For loss/alteration of riparian habitat, although the magnitude is high and the area is presently relatively undisturbed and the effect is long-term, with implementation of the described mitigation measures, the conclusion is that the environmental effects are not significant because the effect is local, occurs once, is reversible.

Table 2.7.2.5-25 Determination of Significance of Residual Effects

Potential Environmental Effect	Proposed Mitigation/Compensation Measures	Determination of Significance of Residual Effects						Significance	Prediction Confidence
		Direction	Magnitude	Geographical Extent	Duration/ Frequency	Reversibility	Ecological Context		
Loss/alteration of in-stream habitat quality or quantity	Maintenance of spawning and summer rearing flows in tributaries to Fish Lake (Mitigation) Implementation of compensation Application of Best Practices for In-stream Works (MWLAP 2004) during construction to avoid/minimize bank erosion, excessive run-off over disturbed land and downstream sedimentation	N	High	L	R	I	U	N	H
Loss/alteration of lake habitat quality and quantity	Maintenance of spawning and summer rearing flows in tributaries to Fish Lake (Mitigation) Implementation of compensation elements Application of Best Practices for In-stream Works (MWLAP 2004) during construction to avoid/minimize bank erosion, excessive run-off over disturbed land and downstream sedimentation	N	High	L	R	I	U	N	H
Loss/alteration of riparian habitat	Implementation of compensation elements Avoid vegetation loss; minimize disturbance Maintain natural drainage patterns where practicable	N	High	L	LT/R	R	U	N	H

KEY

Direction:
P Positive
N Neutral
A Adverse

Magnitude:
Defined for each potential effect individually. In general:
L Low–environmental effect occurs that may or may not be measurable, but is within the range of natural variability.
M Moderate–environmental effect occurs, but is unlikely to pose a serious risk or present a management challenge.
H High–environmental effect is likely to pose a serious risk or present a challenge.

Geographic Extent:
S Site-specific
L Local
R Regional

Duration:
ST: Short term
MT: Medium Term
LT: Long Term
FF: Far Future or Permanent.

Frequency:
R Rare - Occurs Once
I Infrequent - Occurs sporadically at irregular intervals
F Frequent - Occurs on a regular basis and at regular intervals
C Continuous

Reversibility:
R Reversible
I Irreversible

Ecological Context:
U Undisturbed: Area relatively or not adversely affected by human activity
D Developed: Area has been substantially previously disturbed by human development or human development is still present
N/A Not applicable.

Significance:
S Significant
N Not Significant

Prediction Confidence:
Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation
L Low level of confidence
M Moderate level of confidence
H High level of confidence

Summary of Effects Assessment

Table 2.7.2.5-26 provides a fish and fish habitat-specific summary of the effects assessment.

Table 2.7.2.5-26 Summary of Effects Assessment for Fish and Fish Habitat

Effects Assessment	Concise Summary
Beneficial and Adverse Effects	The New Prosperity Project has redesigned the mine site layout to include the conservation of Fish Lake, several fish and non-fish bearing tributaries and associated riparian habitat and a smaller maximum disturbance area. This is expected to reduce losses for all Project effects on fish and fish habitat.
Mitigation and Compensation Measures	A wide variety of methods for avoiding and/or mitigating potential environmental effects have been proposed for project-related activities. The Fish and Fish Habitat Compensation Plan will be finalized in consultation with DFO, additional RAs and First Nations and will meet the NNL Policy Objective. Successful implementation of the Fish and Fish Habitat Compensation Plan together with mitigation measures will result in an overall net increase in the productive capacity of fish habitat within the Regional Study Area..
Potential Residual Effects	The Fish and Fish Habitat Compensation Plan is mitigation that when implemented will ensure that there are no residual environmental effects on fish and fish habitat..
Cumulative Effects	As there are no adverse residual effects predicted on fish and fish habitat as a result of implementation of the Compensation Plan, any residual effects from past, present or reasonably foreseeable future projects included in the Inclusion List could not act in a cumulative manner with this Project.
Determination of the significance of residual effects	The combined residual environmental effects of the Project on the sustainability of fish and fish habitat are predicted to be not significant. This assessment is predicated on the implementation of proposed mitigation and the development of a Habitat Compensation Plan.
Likelihood of occurrence for adverse effects found to be significant	As no significant residual effects are predicted, there is no likelihood of occurrence. There is the possibility that the prediction of significant adverse effects is incorrect, whereby an adverse effect deemed to be not significant may have an adverse effect. The likelihood of this remains low.

Table 2.7.2.5-34 presents the summary of effects assessment for fish and fish habitat. Considering the updated findings of the Project, mitigation measures, and cumulative residual effects on fish and fish habitat presented in this document, the overall significance determination for the New Prosperity Project, including all three major components (mine site, access road, transmission line), is unchanged from 2009. That is, the effect of the Project on the viability and sustainability of the fish and fish habitat resource is considered to be not significant.

Additional Work

No additional work is proposed as part of this environmental assessment.

Follow-up and Monitoring

A brief outline of follow-up and monitoring associated with fish and fish habitat is presented in the following sections, with additional details to be provided in the final Compensation Plans.

- To determine the accuracy of environmental effects predictions and the effectiveness of the proposed compensation elements, a comprehensive follow-up program will be implemented. The follow-up program will follow the CEAA guidelines and adhere to methods established in the Guidelines for In-stream and Off-channel Routine Effectiveness Evaluations (REE; FIA, 2003) and will focus on the biological effectiveness (e.g., seasonal use by fish species) and physical integrity of constructed habitats. Routine effectiveness evaluations enable qualitative and quantitative assessment (numeric ranking and variation estimates) of specific water quality, biological and physical attributes associated with the measurable parameter.
- Remedial or adaptive measures will be applied immediately following any evaluation that determines a reduction in functionality or integrity of any biological or physical channel attribute as specified in as-built design criteria and based on a quantitative trigger value.
- To ensure habitat compensation elements are constructed to design specifications, construction environmental monitoring and supervision will be scheduled at regular intervals throughout the construction period. The construction monitoring schedule will generally follow recommendations described in Standards and Best Practices for In-stream Works (MWLAP, 2004).
- A follow-up program and proposed schedule to determine the accuracy of Project effect predictions and the effectiveness and functionality of the proposed compensation element has been described above (Routine Effectiveness Evaluations (REE; FIA, 2003).
- To ensure the compensation element is constructed to design specifications, compliance monitoring will be scheduled at regular intervals throughout the construction and closure period. The construction monitoring schedule will generally follow the in-stream habitat monitoring described in *Standards and Best Practices for In-stream Works* (MWLAP, 2004[26]). The measurable parameters that will be assessed include but are not be limited to: assessments of pool depth, areas and volumes.
- An angler interview and creel census follow-up program for recreational angling use can be conducted periodically throughout the life-of-mine and closure phases, as a basis for confirming the success of the compensation plan. The creel census methods and schedule would likely be similar to previous programs as described above.
- Recreational angling opportunities will be measured (angler-days) during the life-of-mine. Should the measurable parameter values decline significantly (t = test; $p = \leq 0.05$) compared to baseline values, or existing values in adjacent, non-affected lakes with similar use and catch rates, adaptive management strategies (e.g., increase/decrease in stocking numbers or biomass, signage showing stocked lakes, advertising in local newspapers) will be considered for implementation..
- Angler use surveys will be undertaken in the compensation areas developed to offset the potential loss of angling and camping opportunities.

[26] Ministry of Water, Land and Air Protection. MWLAP 2004. *Standards and Best Practices for In-stream Works*

2.7.2.6 Terrain and Soil

This section identifies how the Project has changed from the previous project proposal and whether changes would result in changes to the environmental effects previously predicted for terrain and soils. Assessment of terrain and soils is presented separately.

Terrain

A detailed assessment of baseline terrain stability as outlined in the EIS Guidelines and listed in Table 2.7.2.6-2 has been completed.

Scope of Assessment

This section outlines the scope of the assessment of potential environmental effects of the New Prosperity Project on terrain. The scope of the assessment is only for changes from the Prosperity Project based on the New Prosperity Mine Development Plan. Terrain is defined by Allaby and Allaby (1999) as "an area of the ground with a particular physical character; an area or region with characteristic geology". For the purpose of this study, terrain includes landforms, surficial materials, material texture, surface expression, slope and geomorphic processes (as defined by Howes and Kenk, 1997).

The Project Activities and Physical Works for New Prosperity are displayed in Table 2.7.2-6-1. Table 2.7.2.6-1 shows whether each activity or physical work has changed from the original Prosperity submission, and whether there are any applicable statutory regulatory changes related to the Project activity (VEC specific regulatory changes). Project activities or physical works (rows in Table 2.7.2.6-1) identified with a "Y" in either the Project Activities/Physical Works or Regulatory changes will be carried forward in this assessment. Project activities or physical works identified with an "N" in both of these columns are not carried forward in this vegetation assessment, and are greyed out.

Table 2.7.2.6-1 Project Components, Features and Activities Changed from Previous Project Proposal

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Construction and Commissioning		
Open Pit – Preproduction	N	
Non-PAG waste stockpile	Y	Location and timing only
PAG Stockpile	Y	Still subaqueous in TSF; just TSF location changed
Non-PAG Overburden Stockpile	Y	Location only
Ore Stockpile	N	
Primary Crusher	N	
Overland conveyor	N	
Fisheries compensation works construction	Y	
Water Management Controls and Operations	Y	
Construction sediment control	Y	
Access road construction and upgrades	N	
Camp construction	N	In mine site
Site clearing (clearing and grubbing)	Y	Different areas related to moving of TSF, stockpiles, etc.
Soils handling and stockpiling	Y	Includes overburden removal
Plant site and other facilities	N	Not emissions; not location
Explosives Plant	N	
Lake dewatering	Y	Only Little Fish Lake
Fish Lake Water Management	Y	Management of inflows and outflows
Starter dam construction	Y	
Sourcing water supplies (potable, process and fresh)	Y	
Site waste management	N	
Clearing of transmission line ROW	N	
Construction/Installation of transmission line	N	
Vehicular traffic	Y	2km more road requires more and larger trucks
Concentrate load-out facility near Macalister (upgrades to site)	N	

Operations		
Pit Production	N	
Site clearing (clearing and grubbing)	N	
Soils handling and stockpiling	N	
Crushing and conveyance	N	
Ore processing and dewatering	N	
Explosive handling and storage	Y	Location only
Tailing storage	Y	Location changed
Non-PAG waste stockpile	Y	Location and timing only
PAG Stockpile	Y	Still subaqueous in TSF; just TSF location changed
Overburden Stockpile	Y	Combined with Non-PAG (i.e. location and timing)
Ore Stockpile management and processing	Y	Location only
Potable and non-potable water use	N	
Site drainage and seepage management	Y	
Water Management Controls and Operation	Y	Includes management of flows in and out of Fish Lake
Wastewater treatment and discharge (sewage, site water)	N	
Water release contingencies for extended shutdowns (treatment)	N	
Solid waste management	N	
Maintenance and repairs	N	
Concentrate transport and handling	N	
Vehicle traffic	Y	PAH NO_x; within mine site only
Transmission line (includes maintenance)	N	
Pit dewatering	N	
Fisheries Compensation works operations	Y	
Concentrate load-out facility near Macalister	N	
Closure		
Water Management Controls and Operation	Y	
Fisheries Compensation Operations	Y	
Site drainage and seepage management	Y	
Reclamation of ore stockpile area	Y	Location only

Reclamation of Non-PAG waste rock stockpile	Y	Location only
Tailing impoundment reclamation	Y	
Pit lake and TSF Lake filling	Y	
Plant and associated facility removal	N	
Road decommissioning	N	
Transmission line decommissioning	N	
Post-closure		
Discharge of tailing storage facility water	Y	
Discharge of pit lake water	N	Into lower fish creek
Seepage management and discharge	Y	
Ongoing monitoring of reclamation	Y	

Regulatory Changes (since Prosperity)

There have been no changes in federal or provincial regulations pertaining to terrain since the March 2009 EIS/Application (Volume 5, Section 4.1.1, Regulatory Setting for Terrain Resources). The regulations that pertain to the New Prosperity Project as well as the Prosperity Project for terrain remain:

- BC Mines Act - Section 9.7.1 of the *Mines Act* addresses terrain issues and Section 10.1.4(g) identifies terrain-related information that is required for the mine plan and reclamation program, including baseline information requirements. Section 10.7.9 applies to terrain-related reclamation and closure objectives. The *Mines Act* also outlines best management practices for mining activities and outlines the risks to terrain stability. It also provides the necessary steps and information required in the event of slope failures
- BC Forest and Range Practices Act (FRPA) - (FRPA) provides a legal framework and guiding principles that govern best management practices which may be applicable for mitigating Project-related effects on terrain resources. The main aspect of the FRPA that applies to the Project is the assessment of potential landslide risks. Landslides, following timber removal and road construction, can adversely affect human life and property, water, fish, soil, timber and visual values. In recognition of this risk, the *BC Forest Practices Code* (the Code) established an elaborate system of professional landslide hazard mapping, site assessment and road engineering procedures. Under the new FRPA, the low tolerance for landslide risk continues; specifically the stated objective is the prevention of landslides that will have a material adverse effect on resources and values. The FRPA indicates the primary method of predicting the likelihood of landslides is to conduct geologic investigations of areas proposed for development and complete assessments of the likelihood of post-harvest or road construction related landslides. These investigations, referred to as Terrain Stability Field Assessments (TSFAs), are used to modify and adjust preliminary harvesting and road construction plans to reduce the potential for landslide activity. The general standard of practice for TSFAs is outlined in the Mapping and Assessing Terrain Stability Guidebook (1995/1998).

EAO Certification Commitments

The commitments in the EAO Certificate relevant to terrain are commitments 16.1 and 16.2 to carry out monitoring and follow-up in accordance with Volume 3 Section 9 of the March 2009 EIS/Application.

Monitoring and follow-up actions for terrain stability discussed in Volume 3 Section 9 of the March 2009 EIS/Application were:

- To survey slopes greater than 60% prior to construction activities, and adjust the alignment of the access road, transmission line and mine features to avoid unstable terrain where possible
- Install strain gauges or other monitoring equipment in areas of unstable terrain near the pit prior to blasting, and
- Monitor areas of unstable terrain in areas of predicted groundwater increase.

All of the commitments are still relevant to New Prosperity, and as part of this EIS and the federal EA process, we confirm our intention to implement those commitments, with no revision necessary, with the exception of the commitments pertaining to the areas where terrain stability monitoring will be required on the mine site. (see Section 2.8.3 for suggested follow-up and monitoring).

The location and size of area with unstable terrain that requires stability monitoring is re-assessed under the New Prosperity mine site LSA and groundwater models.

Prosperity Project Federal Review Panel Comments

The Prosperity Federal Review Panel (Panel) finding for terrain were to complete additional field studies for terrain stability:

- In areas of the transmission line right-of-way
- Areas of slope instability on the access road at the Tete Angela Creek crossing, and
- Within the mine site for areas of mapped instability.

Monitoring and mitigation activities recommended by the Panel for terrain were an investigation of the pit wall stability prior to closure to minimize any post-closure stability problems, and development of a revised emergency response plan before mine closure to address a possible embankment failure. These recommendations will be incorporated in the detailed geotechnical study that will form part of the Mines Act Permit Application when detailed engineering is available. The Panel recommendations were incorporated into this assessment by updating follow-up and monitoring commitments.

Changes as a Result of the New Prosperity EIS Guidelines

There are no changes to the assessment as a result of New Prosperity EIS Guidelines; the Guidelines for terrain remain unchanged, with the exception of the Panel recommendations.

Key Changes and Issues

The key issue for terrain has not changed from the Prosperity EIS. The key issue for terrain resources associated with the Project is the potential for change or alteration of terrain stability resulting in increased incidence of mass wasting events (such as debris flows, slumps, earth flows, and other forms of slope instability) related to Project activities such as site clearing and contouring, road construction, trenching and blasting, and development of infrastructure components (March 2009 EIS/Application Volume 5, Section 4.1.2, Key Issues for Terrain Resources).

The measurable parameters and key indicator for terrain have not changed since the Prosperity EIS; the measurable parameters of the key indicator of terrain stability are:

- Evidence of mass wasting as noted by geomorphic processes, and
- Potentially unstable slopes as measured by slopes over 60%.

All potential effects to terrain stability as determined through the increased risk of mass wasting events will be re-assessed.

Physical works and activities identified as changed as a result of the New Prosperity Project (Table), have been carried forward and given project environmental effects rating criteria. The following interaction rating criteria were used:

Project Environmental Effect Rating Criteria:

6. Effect on terrain is likely to decrease or stay the same (i.e., no changes to significance conclusions), and there are no required changes to previously proposed mitigation measures, and no additional regulatory requirements have been identified (i.e., from the EAO, Panel, or other applicable regulation). Therefore, no further assessment is warranted.
7. Effect on terrain is likely to decrease or stay the same (i.e., no changes to significance conclusions), but some re-evaluation of effect is required due to changes in project design, proposed mitigation measures, and/or additional regulatory requirements have been identified (i.e., from the EAO or Panel). Refer to Section **Error! Reference source not found.**.
8. Effect on terrain is likely to increase; therefore, further assessment is warranted.

Table 2.7.2.6-2 Potential Environmental Effects on Terrain Associated with New Prosperity

General Category	Project Activities/Physical Works	Increase in Mass Wasting
Construction		
Fisheries compensation works (construction)	Fisheries compensation works construction	1
Overburden and Waste Rock Management	Non-PAG waste stockpile	1
	PAG Stockpile	1
	Overburden Stockpile	1
	Soils handling and stockpiling	1
Site clearing (clearing and grubbing)	Site clearing (clearing and grubbing)	1
Site waste management	Water Management Controls and Operations	1
	Construction sediment control	1
	Lake dewatering	1
	Fish Lake Water Management	1
	Starter dam construction	1
Vehicular traffic	Vehicular traffic	0
Water Sourcing and Use	Sourcing water supplies (potable, process/TSF)	0
Operations		
Fisheries Compensation works (operations)	Fisheries Compensation works operations	0
Ore Extraction and Stockpiling	Explosive handling and storage	0
	Ore Stockpile management and processing	0
	Crushing and conveyance	0
Overburden and Waste Rock Management	Non-PAG waste stockpile	0
	PAG Stockpile	0

General Category	Project Activities/Physical Works	Increase in Mass Wasting
	Overburden Stockpile	0
Site Water Management	Site drainage and seepage management	2
	Water Management Controls and Operation	2
	Pit dewatering	2
Tailings Management	Tailing storage	2
Vehicle traffic	Vehicle traffic	0
Fisheries Compensation operations	Fisheries Compensation Operations	0
Closure		
Reclamation	Reclamation of ore stockpile area	0
	Reclamation of Non-PAG waste rock stockpile	0
	Tailing impoundment reclamation	0
Site Water Management	Water Management Controls and Operation	2
	Site drainage and seepage management	2
	Pit lake and TSF Lake filling	2
Post-Closure		
Site Water Management	Discharge of tailing storage facility water	2
	Seepage management and discharge	2
Monitoring	Ongoing monitoring of reclamation	0
Interaction of Other Projects and Activities		**0**
Accidents, Malfunctions and Unplanned Events		**1**

The interactions indicated in grey shading in Table 2.7.2.6-2 are not carried forward in this assessment. The only Project activities being carried forward in the environmental assessment (rated as 2) for increasing mass wasting are seepage management, pit dewatering and water diversion which could affect unstable and potentially unstable slopes outside of the mine footprint due to changes in surface groundwater. Two scenarios will be used: operations and post-closure.

Project activities rated as 1 are those activities which were given ratings of ‘1’ or ‘2’ for the 2009 Prosperity EIS. Those activities that were rated ‘1’ (such as soil salvaging and stockpiling and overburden and waste rock management activities) can be effectively managed through mine design or environmental management measures, and that has not changed for the New Prosperity Project. Those activities that were rated ‘2’ for the Prosperity EIS and are rated ‘1’ for the New Prosperity EIS include the fisheries compensation works construction and site clearing and construction activities; the activities are rated ‘1’ for the New Prosperity Project as they have not changed since the March 2009 EIS/Application, which found the environmental effects of those activities to be not significant. The change in the mine configuration and the size of the LAA will result in changes in the locations of mitigations and monitoring for terrain stability; however, the changes in monitoring locations do not result in changes to the significance of the effects, as the LAA has decreased due to the smaller footprint, and fewer geohazards are intersected.

All other Project effects will result in no change to terrain stability (rated as 0), as the interaction of the activity with terrain has already occurred during the previous mine phase (e.g. operations of fisheries compensation works and overburden and waste rock management) or does not interact with terrain (e.g. water sourcing and use and vehicular traffic).

Effects from blasting, road access and transmission line construction will not be carried forward in the assessment as no anticipated changes in design have occurred from Prosperity to New Prosperity. However, these activities intersected areas of unstable terrain. The same follow-up and monitoring and Panel recommendations for monitoring terrain stability related to these activities will apply for the New Prosperity Project.

Temporal Boundary Changes

There have been no changes in the temporal boundaries for construction and commissioning, operations, and closure and decommissioning phases between the Prosperity and New Prosperity Projects (see March 2009 EIS/Application Volume 5, Section 4.1.4). However, the closure and decommissioning phase for the New Prosperity Project will be divided into two phases: phase I, which will last approximately 10 years following closure (Years 21 to 30) when the Fish Lake catchment will continue to be isolated from mine water; and phase II (Years 31-44), when the TSF will be allowed to begin to spill to Fish Lake Tributaries. The post-closure phase is still anticipated to begin in Year 45, when the Pit Lake will have reached maximum elevation and begun to spill to Lower Fish Creek. Permanent groundwater interception and surface seepage ponds below the main TSF embankment will continue to operate post-closure.

The changes in the phases of the closure period are captured in the groundwater changes relative to terrain stability.

Spatial Boundary Changes

Three study area boundaries are used for the terrain assessment: the RSA, the LSA and the mine footprint. The mine footprint has changed for the New Prosperity Project, which results in changes to the LSA, but not the RSA. The mine footprint (area of direct disturbance) has been altered to account for mine plan changes and the preservation of Fish Lake. The LSA is still a 100 m buffer on the mine footprint, but the area of the LSA has also changed due to the changes in the mine footprint. See Table 2.7.2.6-3 for more detail, and Figure 2.7.2.6-1 for study area boundaries.

Table 2.7.2.6-3 Study Area Comparison

VEC		Study Areas	
	Mine Footprint	**Mine Site LSA**	**Mine Site RSA**
Terrain	The mine footprint includes all mine features where ground will be directly disturbed, displaced, or buried. The mine footprint does not account for any clearing where ground is left intact. This area is excluded from the terrain stability assessment and is addressed in the geotechnical section of the mine plan (Section XXX).	Prosperity LSA: Mine site LSA contained the "physical footprint of the mine site" that includes "all areas that are to be physically altered as a result of resource extraction and tailings storage" (Prosperity EIS Volume 5, Section 4.1.5, Spatial Boundaries). The soils and terrain LSA is a 100 m buffer on the physical footprint of the mine site to account for small changes to mine site feature locations and construction clearing. Size is 4407 ha. New Prosperity LSA:	The RSA is the "TEM Mapping area" or "TEM extent" (Vol. 5, Section 4.1.5). The RSA for soils and terrain has not changed from the Prosperity EIS, and is approximately 18,267 ha

		The LSA for terrain has changed for New Prosperity; it has decreased in size, due to the smaller TSF and avoidance of Fish Lake. Using the smaller LSA of New Prosperity relative to Prosperity will result in decreased direct effects to the soils and terrain. Size is 2967 ha.	

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.6-1 Comparison of Prosperity and New Prosperity Study Areas for Terrain and Soils

Updates to Consultation on the Assessment for Terrain

Since the March 2009 EIS/Application the consultation has consisted of Panel proceedings. No public issues related to terrain and terrain stability were recorded during the Prosperity Gold-Copper Mine Project CEAA #09-05-44811 proceedings of March 24, 2010.

Project Impact Assessment for Terrain

There is one potential environmental effect identified for terrain, and that is the potential for increased mass wasting to affect terrain stability.

Mass Wasting

Only project effects that have changed from the March 2009 EIS/Application have been carried forward for assessment. The potential project effects on mass wasting for the Prosperity Project are described in detail in the March 2009 EIS/Application, Volume 5, Section 4.3.1.3, Project Effects on Mass Wasting.

The Project activities that have changed due to design changes for the New Prosperity Project are listed in Table 2.7.2.6-6. The Project activities that were re-assessed were effects due to the site water management and tailings management.

Table 2.7.2.6-6 Potential Environmental Effects on Terrain Associated with New Prosperity

General Category	Project Activities/Physical Works	Increase in Mass Wasting
Operations		
Site Water Management	Site drainage and seepage management	2
	Water Management Controls and Operation	2
	Pit dewatering	2
Tailings Management	Tailings storage	2
Closure		
Site Water Management	Water Management Controls and Operation	2
	Site drainage and seepage management	2
	Pit lake and TSF Lake filling	2
Post-Closure		
Site Water Management	Discharge of tailing storage facility water	2
	Seepage management and discharge	2

Effects Assessment Methods for Mass Wasting

The methods for effects assessment of mass wasting have not changed since the March 2009 EIS/Application. Baseline inventory statistics for evidence of existing mass wasting and slopes that are susceptible to a mass wasting were calculated for the mine site LSA. This information was then used to predict potential Project-related effects on mass wasting and to provide guidance on mitigation.

Changes in Baseline Conditions for Mass Wasting

Some 99.6% of the mine site LSA is characterized by low gradient slopes which show no evidence of instability. Just under 0.5 percent of the entire mine site LSA shows any evidence of either instability or steep slopes that may be susceptible to mass wasting (Table 2.7.2.6-5). The New Prosperity has a reduced area of instability due to the removal of Fish Lake from the LSA. Approximately 13.0 ha, or 0.4% of the total area contains terrain that exhibits evidence of rapid mass movements. Areas exhibiting evidence of instability are concentrated at the northwest end of the LSA where debris slides and rockfalls have occurred on steep bedrock and colluvial slopes. These geohazard areas will be encompassed by the open pit. Debris slides were also mapped on the north side of Little Fish Lake. These geohazard areas will eventually be encompassed by the Tailings Storage Facility (TSF).

Slopes steeper than 60% (i.e., potentially unstable slopes) occupy 1.3 ha or 0.04% of the mine site (Table 2.7.2.6-5). These areas correspond with the unstable terrain located on the eastern margins of the mine site (Figure 2.7.2.6-2).

Table 2.7.2.6-5 Summary of Areas Exhibiting Evidence of Instability within Individual Local Study Areas

	Prosperity LSA			New Prosperity LSA		
	Total Area (ha)	**Area Exhibiting Evidence of Instability (ha)**	**Percent of Total Area Exhibiting Evidence of Instability**	**Total Area (ha)**	**Area Exhibiting Evidence of Instability (ha)**	**Percent of Total Area Exhibiting Evidence of Instability**
Area of Mapped Instability (rapid mass movements)	4,419.2	17.4	0.39	2,967.2	13.0	0.44
Area of slopes (>60%)	4,419.2	0.7	0.02	2,967.2	1.3	0.04

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.6.2 Potentially Unstable Slopes and Mass Wasting Areas for the Mine Site Local Study Area and the Regional Study Area

Project Effects on Mass Wasting

The majority of the LSA consists of low gradient, stable terrain with a low likelihood of mass wasting. In the few areas exhibiting evidence of unstable and potentially unstable terrain, the likelihood of Project activities triggering mass wasting can be effectively minimized or eliminated through the implementation of best management practices during construction and engineering, including the removal of unstable materials, or simply by avoidance of high hazard areas.

Groundwater changes during the operations phase through to the post-closure phase may increase the risk of failure for areas of potentially unstable and unstable terrain. Figure 2.7.2.6-3 and Figure 2.7.2.6-4 show the approximate locations and magnitude of groundwater changes in the LSA at operations and post-closure, respectively. Pit dewatering at operations may increase the risk of failure in areas where rapid mass movement or slow mass movement have been observed, particularly in coarse-textured soils. The effect of dewatering is expected to last approximately 50 years after pit dewatering ceases (into the post-closure period) while groundwater rebounds. Filling of the TSF is expected to increase groundwater levels under the TSF and result in increased groundwater recharge to streams below the TSF; the risk of mass wasting events increases in areas of mass movement within these increased groundwater recharge areas, particularly in fine-textured soils.

Areas of observed mass movements around the pit are all within the pit boundary, and so will be removed during operations, so there will be no residual effect of pit dewatering on mass wasting. Areas of observed mass movements that may be affected by the TSF filling exist in the undulating terrain west of the West Embankment, and in the southern end of the valley below the Main Embankment; these areas are outside the mine footprint, and so may experience residual effects on mass wasting.

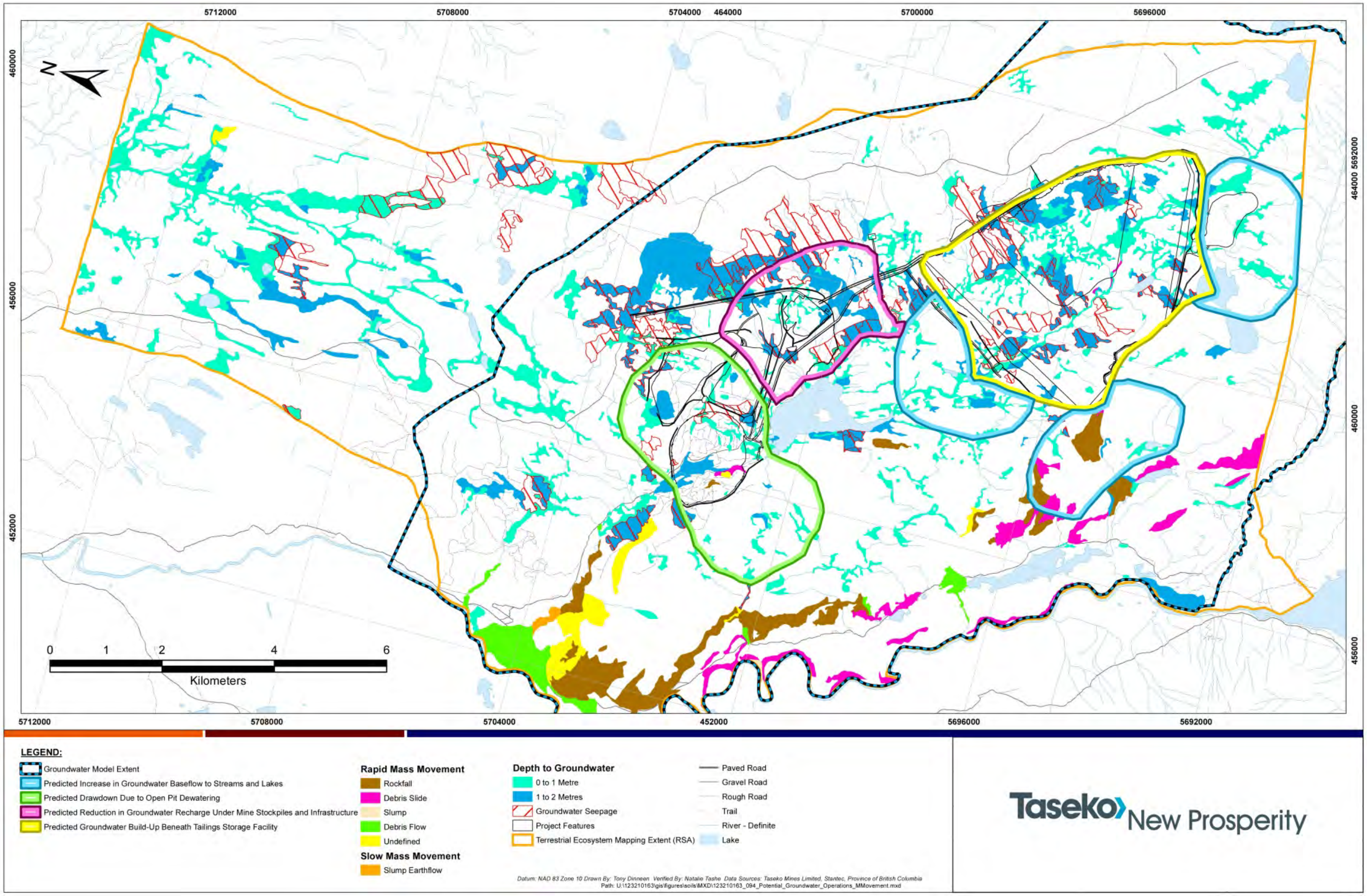
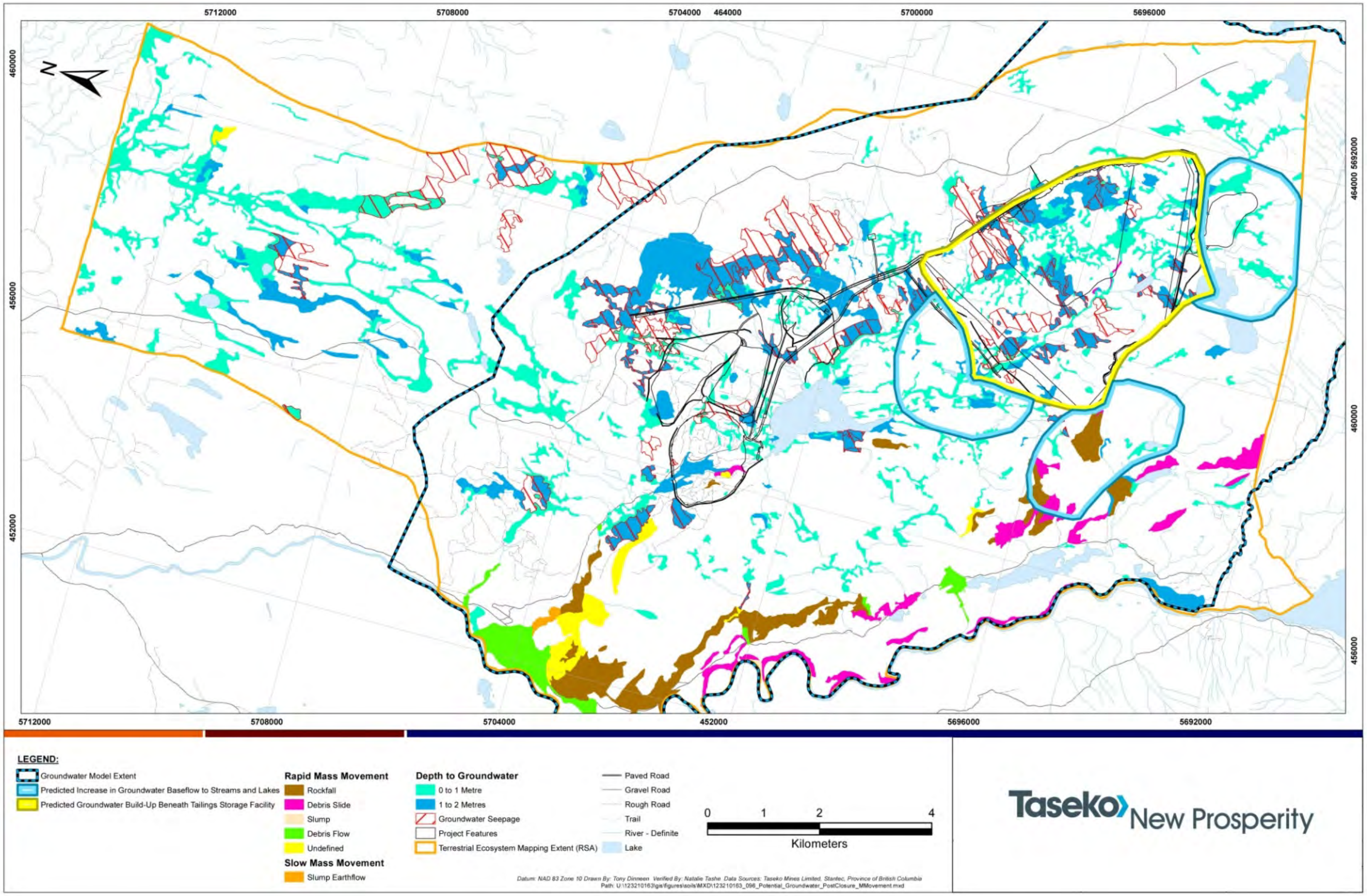


Figure 2.7.2.6-3 Potential Groundwater Changes at Operations in Areas of Rapid Mass Movement

Figure 2.7.2.6-4 Potential Groundwater Changes at Post-Closure in Areas of Rapid Mass Movement



Mass Wasting Mitigation Measures

The mitigations proposed to reduce the potential for mass wasting events on the New Prosperity Project are unchanged from those proposed for the Prosperity Project. The mitigations for terrain are described in the March 2009 EIS/Application Volume 5, Section 4.4.1, Summary of Mitigation for Terrain, and in Section 4.1.3.1.

During pit and TSF filling, signage will be installed for any ground crews that may have access to areas where mass wasting may occur as a result of changes in groundwater. Where feasible, potentially unstable slope materials adjacent to areas of human activity will be cleared away and the material used in mine site construction.

Cumulative Effects Assessment

As described in Section 2.7.1, cumulative environmental effects were only assessed if all three of the following conditions were met for the environmental effect:

- The Project results in a measurable, demonstrable or reasonably-expected residual environmental effect on a component of the environment
- The Project-specific residual environmental effect does, or is likely to, act in a cumulative fashion with the environmental effects of other past or future projects and activities that are likely to occur, and
- There is a reasonable expectation that the Project's contribution to cumulative environmental effects will affect the viability or sustainability of the resource or value.

The Project inclusion list (Table 2.7.1.4-1) identifies past, present and reasonably foreseeable projects and activities that could interact cumulatively with the Project. The locations of each of the 22 projects and activities are shown on Figure 2.7.1.4-1. As indicated in Table 2.7.1.4-1, eight of these project and activities are new since 2009. Of the eight new projects, only one, the Newton Mountain mine development, is located west of the Fraser River and, therefore, considered likely to interact cumulatively with the Project's residual effects on terrain. Climate change and mountain pine beetle remain additional considerations for the Project that will potentially interact with terrain stability by increasing the risk of erosion on existing unstable areas (see March 2009 EIS/Application, Volume 5, Section 4.4.4, Additional Considerations for Terrain). One of the mechanisms by which mountain pine beetle may affect terrain stability is through increasing logging in the area. The effect of these two factors, including increased logging, has not changed conclusions for the amended terrain assessment for the New Prosperity Project.

For terrain, the first condition is met; that is, there are Project-specific residual effects on terrain. With respect to the second condition, the one new future project since 2009, the Newton Mountain mine development, may cause changes to groundwater, and in turn increase the potential for mass wasting events. However, the groundwater changes predicted for the New Prosperity mine site are all restricted to within 2 km of the mine footprint. Consequently, there is no potential for a cumulative interaction on mass wasting due to the large distance between the new Prosperity Project and the nearest proposed project that may affect groundwater. Thus, as was the case for the March 2009 EIS/Application, with respect to the third condition, it is concluded that the Project's contribution to cumulative effects on terrain is not significant.

Determination of the Significance of Residual Effects

The assessment methodology for residual effect characterization and determination of significance is as described in Section 2.7.1.5.

Mass wasting events may be triggered due to changes in groundwater due to pit dewatering and the TSF filling. All potential residual effects for terrain are effects on mass wasting due to groundwater increases around the TSF. The geographic extent of effects for mass wasting events is within the RSA, but only within the sites identified to the west and northwest of the TSF where rapid mass movement events have been recorded at baseline.

There are no changes in the predicted residual or cumulative effects for the New Prosperity project. With the proposed mitigation and environmental protection measures outlined in the March 2009 EIS/Application Volume 5 Section 4.4, Summary of Effects on Terrain, and appropriate mine design including a smaller footprint for the New Prosperity Project, the effect of the Project on terrain is considered to be not significant. The change in groundwater levels in the LSA will not result in increased area of unstable terrain, it increases the likelihood of a mass wasting event; however, a mass wasting event is still unlikely. As there is uncertainty in the predictions, follow-up and monitoring will need to be undertaken to determine the extent, if any, to which groundwater changes influence terrain stability.

The findings of the Project residual effects assessment for terrain for New Prosperity are summarized in Table 2.7.2.6-7.

Table 2.7.2.6-7 Project Residual Effects Assessment Summary for Terrain for New Prosperity

Project Residual Effects	Proposed Mitigation Measures	Residual Effects Characterization			Significance	Prediction Confidence
		Direction	Magnitude	Geographic Extent		
Increase in potential mass wasting due to changes in groundwater	Unchanged from the Prosperity Project. See March 2009 EIS/Application Volume 5, Section 4.4.1, Summary of Mitigation for Terrain. Mitigations to prevent mass wasting events are: • completing a detailed on-site terrain stability assessment in any areas identified as unstable prior to the commencement of construction activities in each area. • conducting further studies on potentially unstable areas with slopes greater than 60% in gradient prior to construction on slopes. • locating the transmission line on stable terrain, wherever possible	A	M	R	N	L

KEY

Direction:
P Positive
N Neutral
A Adverse
U Uncertain

Magnitude:
L Low: Effect occurs and reduces the extent of terrain instability
M -Medium: Effect occurs but does not increase the extent of terrain instability
H High: Effect occurs and increases the extent of terrain instability

Geographic Extent:
S Site-specific: Effect of mass wasting is confined to a specific site within the Local Study Area
L Local: Effect of mass wasting is confined to the Local Study Area
R Regional: Effect of mass wasting extends beyond the Local Study Area

Significance:
S Significant
N Not significant

Prediction Confidence:
Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation
L Low level of confidence
M Moderate level of confidence
H High level of confidence

Table 2.7.2.6-8 provides a concise summary of the effects assessment for terrain.

Table 2.7.2.6-8 Summary of Effects Assessment for Terrain

Effects Assessment	Concise Summary
Beneficial and Adverse Effects	The New Prosperity Project has redesigned the mine site layout to create a smaller footprint, which is expected to reduce the area of interaction of the Project with unstable terrain. There are still potential adverse effects remaining due to pit dewatering and subsequent groundwater recharge, and the permanent change in groundwater levels associated with the TSF filling.
Mitigation and Compensation Measures	A number of mitigation and Project design measures will be employed to: 1) minimize groundwater flows from the TSF towards Big Onion Lake; and 2) ensure that the TSF and adjacent slopes are constructed to minimize the potential for mass wasting. The measures designed to control groundwater flows and ensure proper slope construction of the reclaimed landscape are outlined in the Geotechnical Stability Monitoring Plan and Tailings Impoundment Operating Plan.
Potential Residual Effects	Areas of observed mass movements may experience increased mass wasting due to the changes in groundwater due to the TSF filling. These areas exist in the undulating terrain west of the West Embankment, and in the southern end of the valley below the Main Embankment.
Cumulative Effects	There were no cumulative effects predicted for the Prosperity Project, and there are still none predicted for the New Prosperity Project.
Determination of the significance of residual effects	The potential residual effects on mass wasting due to the TSF filling are not significant. The effect does not increase the area of unstable terrain, and the geographic extent of effects for mass wasting is limited to sites to the west and northwest of the TSF where rapid mass movement events have been recorded at baseline.
Likelihood of occurrence for adverse effects found to be significant	No adverse effects on mass wasting were found to be significant.

Table 2.7.2.6-8 presents the summary of effects assessment for terrain. Considering the updated findings of the Project, mitigation measures, and cumulative residual effects on terrain presented in this document, the overall significance determination for the New Prosperity Project, including all three major components (mine site, access road, transmission line), is unchanged from 2009. That is, the effect of the Project on the viability and sustainability of the terrain resource is considered to be not significant.

Additional Work

Additional terrain mapping requested by the Panel will be conducted prior to completion of a *Mines Act* Permit Application. The commitments for additional work for terrain are:

- Terrain stability mapping will be conducted on the transmission right-of-way and access road prior to submission of the *Mines Act* Permit Application, particularly in the Tete Angela Creek watershed
- Detailed terrain stability mapping will be completed for areas mapped as unstable within the mine footprint prior to construction, and

- A terrain stability assessment will be conducted on the pit walls during closure to identify any mitigation or monitoring required to address terrain stability issues that may affect stability of the site, or affect successful reclamation.

Follow-Up and Monitoring

Follow up and monitoring activities for terrain described in the March 2009 EIS/Application in Volume 5, Section 4.4.3, Follow-up and Monitoring for Terrain remain applicable to the New Prosperity Project. There was one specific commitment incorporated in the EAO Certificate granted for the Prosperity Project for monitoring for terrain:

- A geohazard specialist will monitor unstable or potentially unstable areas using strain gauges or other terrain stability monitoring devices. Of particular concern is the commencement of pit development as that is when detrimental vibrations to terrain stability can be most far reaching as blasting is occurring at the ground surface. Monitor terrain stability in the area of unstable terrain where groundwater increases are anticipated.

The location of unstable terrain where groundwater increases are anticipated has changed since the Prosperity EIS; monitoring for terrain stability is required in the area of rapid mass movement to the west and northwest of the final location of the West Embankment, where groundwater increases are anticipated when the TSF begins to fill in the early years of operations. Suggested monitoring will consist of visual observation by a geohazard specialist (professional geologist or terrain scientist) in areas where the consequence of a failure would be low; and with strain gauges, vibrating wire piezometers or other appropriate monitoring equipment in areas where a potential failure could result in effects to sensitive ecosystems (e.g. wetlands, stream headwaters), people (e.g. above a trail or work site) or infrastructure (e.g. in areas where a failure could affect the West Embankment).

Soils

A detailed assessment of baseline soil resources as outlined in the EIS Guidelines and listed in Table 2.7.2.6-9 has been completed.

Scope of Assessment

The assessment of the environmental effects of the New Prosperity Project on soils focuses on the direct effects of the Project on soil distribution, quantity and quality. The scope of the assessment is only for changes from the Prosperity Project based on the New Prosperity Mine Development Plan.

Other soils-related issues such as environmental effects on surface-water and ground-water hydrology, including flooding hazards, are addressed in Section 2.7.4 – Impact Assessment for Aquatic Resources. Additional information on measures to conserve and restore soils is provided in the mine plan including geotechnical work and mine design is provided in Section 2.2.4 – mine plan and geotechnical design. Erosion and sediment control are discussed in Section 2.8.1 – erosion and sediment control plan. Further details on soil salvage, handling and replacement methods are presented in the Conceptual Reclamation Plan (Section 2.8.2).

The Project Activities and Physical Works for New Prosperity are displayed in Table 2.7.2.6-8. This table shows whether each activity or physical work has changed from the original Prosperity submission, and whether there are any applicable statutory regulatory changes related to the project activity (VEC specific regulatory changes). Project activities or physical works (rows in Table 2.7.2.6-8) identified with a “Y” in either the Project Activities/Physical Works or Regulatory changes will be carried forward for assessment in the amendment. Project activities or physical works identified with an “N” in both of these columns are not carried forward in this soils assessment, and are greyed out.

Table 2.7.2.6-8 Project Components, Features and Activities Changed from Previous Project Proposal

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Construction and Commissioning		
Open Pit – Preproduction	N	
Non-PAG waste stockpile	Y	Location and timing only
PAG Stockpile	Y	Still subaqueous in TSF; just TSF location changed
Non-PAG Overburden Stockpile	Y	Location only
Ore Stockpile	N	
Primary Crusher	N	
Overland conveyor	N	
Fisheries compensation works construction	Y	
Water Management Controls and Operations	Y	
Construction sediment control	Y	
Access road construction and upgrades	N	
Camp construction	N	In mine site
Site clearing (clearing and grubbing)	Y	Different areas related to moving of TSF, stockpiles, etc.
Soils handling and stockpiling	Y	Includes overburden removal
Plant site and other facilities	N	Not emissions; not location
Explosives Plant	N	
Lake dewatering	Y	Only Little Fish Lake
Fish Lake Water Management	Y	Management of inflows and outflows
Starter dam construction	Y	
Sourcing water supplies (potable, process and fresh)	Y	
Site waste management	N	
Clearing of transmission line ROW	N	
Construction/Installation of transmission line	N	

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Vehicular traffic	Y	2km more road requires more and larger trucks
Concentrate load-out facility near Macalister (upgrades to site)	N	
Operations		
Pit Production	N	
Site clearing (clearing and grubbing)	N	
Soils handling and stockpiling	N	
Crushing and conveyance	N	Although no change in mine design, soils surrounding Fish Lake may receive dust on soil and were not previously assessed.
Ore processing and dewatering	N	
Explosive handling and storage	Y	Location only
Tailing storage	Y	Location changed
Non-PAG waste stockpile	Y	Location and timing only
PAG Stockpile	Y	Still subaqueous in TSF; just TSF location changed
Overburden Stockpile	Y	Combined with Non-PAG (i.e. location and timing)
Ore Stockpile management and processing	Y	Location only
Potable and non-potable water use	N	
Site drainage and seepage management	Y	
Water Management Controls and Operation	Y	Includes management of flows in and out of Fish Lake
Wastewater treatment and discharge (sewage, site water)	N	
Water release contingencies for extended shutdowns (treatment)	N	
Solid waste management	N	
Maintenance and repairs	N	
Concentrate transport and handling	N	
Vehicle traffic	Y	PAH NO_x; within mine site only
Transmission line (includes maintenance)	N	

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Pit dewatering	N	
Fisheries Compensation works operations	Y	
Concentrate load-out facility near Macalister	N	
Closure		
Water Management Controls and Operation	Y	
Fisheries Compensation Operations	Y	
Site drainage and seepage management	Y	
Reclamation of ore stockpile area	Y	Location only
Reclamation of Non-PAG waste rock stockpile	Y	Location only
Tailing impoundment reclamation	Y	
Pit lake and TSF Lake filling	Y	
Plant and associated facility removal	N	
Road decommissioning	N	
Transmission line decommissioning	N	
Post-closure		
Discharge of tailing storage facility water	Y	
Discharge of pit lake water	N	Into lower fish creek
Seepage management and discharge	Y	
Ongoing monitoring of reclamation	Y	

Regulatory Changes (since Prosperity)

There have been no changes in federal or provincial regulations pertaining to soils since the March 2009 EIS/Application (Volume 5, Section 4.5.1, Regulatory Setting). The regulations that pertain to the New Prosperity Project as well as the Prosperity Project remain:

- BC Mines Act - Section 9.6.1 of the *Mines Act* addresses soil conservation. Section 10.1.4 (h) identifies soil-related information that is required for the mine plan and reclamation program, including baseline information requirements. Section 10.7.8 outlines reclamation standards for soils. The regulations and associated appendices provide guidance on baseline data to gather for the

Environmental Assessment, recommendations on soil characterization, soil survey, mapping standards, in addition to land capability, soil salvage and stockpile requirements.

- BC Forest and Range Practices Act (FRPA) – FRPA governs best management practices for the management of soils that may be applicable for guiding Project activities. The objectives of soil conservation under the British Columbia Government's new *Forest and Range Practices Act* are to limit the extent of soil disturbance that negatively affects the physical, chemical, and biological properties of the soil.
- Soil Disturbance Hazard Ratings for Compaction, Displacement, and Surface Soil Erosion (BCMOF, 1999). This guidebook, developed under the former *Forest Practices Code* and adopted under the more current FRPA, was used as the basis to assess compaction and erosion.

A change in provincial guidelines (not statutory regulations) will be used for the soil contamination assessment. The assessment of soil contamination due to deposition of metals used the Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines for the Protection of the Environment and Human Health for agricultural end land uses. The British Columbia Contaminated Sites Regulation (BC CSR) soil quality guidelines for agricultural end land use was compared to the CCME guidelines, and presented in an appendix (Appendix 5.4-N of the March 2009 EIS/Application). The CCME guidelines were used for the Prosperity assessment, as they were the lowest (most conservative) guidelines at that time.

The BC CSR agricultural guidelines have been updated since then (the latest update in May 2011), and several of the parameter guideline limits have decreased below the level used for CCME (barium, chromium, mercury and zinc - see Appendix 5.4 from the March 2009 EIS/Application - Na- Soil Quality Guidelines Limits Comparison Tables)., so the BC CSR guidelines will now be included in the assessment; again taking the lower of CCME or BC CSR guidelines for each trace element of concern.

EAO Certification Commitments

Commitments in the EAO Certificate (16.1 and 16.2) relevant to soils agree to carry out monitoring and follow-up in accordance with Volume 3 Section 9 of the March 2009 EIS/Application. All of the commitments are still relevant to New Prosperity, and as part of this EIS and the federal EA process, we confirm our intention to implement those commitments, with no revision necessary, with the exception of those pertaining to metal deposition monitoring locations which have been updated (see Section 2.7.3.2 Human Health).

Prosperity Project Federal Review Panel Comments

The Panel suggestion for soils was to complete additional field studies to collect paired soil and vegetation samples for trace element uptake baseline, to increase the confidence in predictions of risk due to contamination.

The panel recommendation for soils was incorporated into this assessment by updating follow-up and monitoring commitments.

Changes as a Result of New Prosperity EIS Guidelines

There are no changes to the assessment as a result of New Prosperity EIS Guidelines; the Guidelines for soils remain unchanged, with the exception of the panel recommendations described.

Key Changes and Issues

The key issues for soils have not changed from the Prosperity EIS.

The key issues for soils are:

- Changes in soil physical properties, and
- Changes in soil chemical properties.

Soil physical properties are estimated through admixing, compaction, rutting, erosion and soil loss. Soil chemical changes are estimated through soil contamination or long-term stockpiling which can alter the fertility of soils (see the March 2009 EIS/Application Volume 5, Section 4.5.2 Key Issues for Soils; Table 2.7.2.6-9).

For the Prosperity EIS, the key issues for soils were assessed using the key indicators reclamation suitability and agricultural capability. Agricultural capability was used for the soils in the Agricultural Land Reserve area along the transmission corridor (see March 2009 EIS/Application, Volume 5, Section 4.5.3 Selection of Key Indicators for Soils). Since the transmission corridor has not changed for the New Prosperity Project, agricultural capability will not be included as a key indicator for the New Prosperity assessment.

Table 2.7.2.6-9 Scope of Assessment Summary for Reclamation Suitability

Project Component	Potential Effects	KIs Potentially Affected	Pathways for Effects
Mine Site	Change in Soil Physical Properties	Reclamation Suitability	Mining and removal of soils from site clearing and grubbing, which may result in admixing, compaction and rutting, erosion and soil loss Changes in drainage patterns and groundwater changes related to mining activities which may result in soil moisture changes
	Change in Soil Chemical Properties		Soil and Overburden Handling: Natural elevated metals in some of the topsoil and elevated metals and sodicity in overburden which may result in soil contamination Metal deposition from mining activities during construction and operation, which may result in soil contamination Long-term soil stockpiling which may result in changes to soil fertility

Physical works and activities identified as changed as a result of the New Prosperity Project (Table 2.7.2.6-10) have been carried forward and given project environmental effects rating criteria. The following interaction rating criteria were used:

KI Potential Effect Rating Criteria:

0. Effect related to KI is likely to decrease or stay the same (i.e., no changes to significance conclusions), and there are no required changes to previously proposed mitigation measures, and no additional regulatory requirements have been identified (i.e., from the EAO, Panel, or other applicable regulation). Therefore, no further assessment is warranted.
1. Effect related to KI is likely to decrease or stay the same (i.e., no changes to significance conclusions), but some re-evaluation of effect is required due to changes in project design, proposed mitigation measures, and/or additional regulatory requirements have been identified (i.e., from the EAO or Panel).

2. Effect related to KI is likely to increase; therefore, further assessment is warranted.

- All KI potential effects listed as a '0' are not carried forward further in this assessment
- All KI potential effects listed as a "1" are described and related information/justification presented in the Environmental Assessment, and
- All KI potential effects listed as a "2" are to be carried forward and re-assessed in the Environmental Assessment.

Table 2.7.2.6-10 Potential Environmental Effects on Soils Associated with New Prosperity

General Category	Project Activities/Physical Works	Change in Soil physical properties	Change in soil chemical properties
Construction			
Fisheries compensation works (construction)	Fisheries compensation works construction	1	1
Overburden and Waste Rock Management	Non-PAG waste stockpile	1	1
	PAG Stockpile	1	1
	Overburden Stockpile	1	1
	Soils handling and stockpiling	1	1
Site clearing (clearing and grubbing)	Site clearing (clearing and grubbing)	1	1
Site waste management	Water Management Controls and Operations	1	0
	Construction sediment control	1	0
	Lake dewatering	1	0
	Fish Lake Water Management	1	0
	Starter dam construction	1	0
Vehicular traffic	Vehicular traffic	0	0
Water Sourcing and Use	Sourcing water supplies (potable, process/TSF)	0	0
Operations			
Fisheries Compensation works (operations)	Fisheries Compensation works operations	0	0
Ore Extraction and Stockpiling	Explosive handling and storage	0	0
	Ore Stockpile management and processing	1	2
	Crushing and conveyance		2
Overburden and Waste Rock Management	Non-PAG waste stockpile	0	0
	PAG Stockpile	0	0
	Overburden Stockpile	0	0
Site Water Management	Site drainage and seepage management	2	0
	Water Management Controls and Operation	2	0
	Pit dewatering	2	0

General Category	Project Activities/Physical Works	Change in Soil physical properties	Change in soil chemical properties
Tailings Management	Tailing storage	2	0
Vehicle traffic	Vehicle traffic	1	0
Fisheries Compensation operations	Fisheries Compensation Operations	0	0
Closure			
Reclamation	Reclamation of ore stockpile area	1	1
	Reclamation of Non-PAG waste rock stockpile	1	1
	Tailing impoundment reclamation	1	1
Site Water Management	Water Management Controls and Operation	2	0
	Site drainage and seepage management	2	0
	Pit lake and TSF Lake filling	2	0
Post-Closure			
Site Water Management	Discharge of tailing storage facility water	2	0
	Seepage management and discharge	2	0
Monitoring	Ongoing monitoring of reclamation	0	0
Interaction of Other Projects and Activities		0	0
Accidents, Malfunctions and Unplanned Events		**1**	**1**

The interactions indicated in grey shading in Table 2.7.2.7-3 are not carried forward in this assessment. The Project effects being carried forward in the assessment (rated as 2) for soil physical properties are related to changes in surface groundwater from seepage management, water diversions and pit dewatering and pit infilling during operations and the 2 phases of post closure. These changes could permanently alter soil moisture conditions outside of the mine site and result in soil productivity changes.

Project activities that could permanently alter soil chemical properties are related to dust deposition related to crushing and conveyance and dust from waste rock stockpiles during operations (rated as 2). For this assessment the change in soils addresses intact soils surrounding Fish Lake, which was not completed for the March 2009 EIS/Application. The predicted dust levels have not changed; however, guideline levels for trace elements in soils have been changed provincially and thresholds for some elements are now more sensitive. Project activities that generate dust during construction have been ruled out of this assessment as the previous Prosperity assessment showed that the construction phase is too short (less than 2 years) to have an effect on soil chemistry.

Activities rated as “1” are for mine features that have changed in position and size from the Prosperity Project. New soil salvage, mitigation and monitoring will be required to account for mine plan changes, but significance ratings will not change for Prosperity, and so are not applied.

Activities rated as “0” will result in no changes to soil physical or chemical properties. No changes to agricultural capability are anticipated as agricultural land reserve land only occurred along the transmission line, which remains unchanged and are not part of this assessment.

Temporal Boundary Changes

Temporal boundaries for soils are the same as those described for terrain.

Changes in temporal boundaries did not influence the way effects to measurable parameters for soils are quantified.

Spatial Boundary Changes

Study area boundaries for soils are the same as those described for terrain.

Updates to Consultation on the Assessment for Soils

The consultation with First Nations and local community members as related to soil deals solely with contamination. The contamination concerns were both contamination from mine activities and also dust deposition on the landscape. These concerns were expressed during the Panel proceedings from the Chilko and Nemiah Valley residents in Spring 2010.

Project Impact Assessment for Soils

There are two potential environmental effects identified for soils: changes in soil chemical properties and changes in soil physical properties. These environmental effects have the potential to alter soil reclamation suitability, which is used as a metric to describe soil quality. Reclamation suitability is assessed at the level of the soil map unit (SMU).

The measurable parameters for effects to soil reclamation suitability are admixing, compaction and rutting, soil erosion, soil loss, soil moisture changes, soil contamination and soil fertility.

Soil Reclamation Suitability

Only project effects that have changed from the Prosperity Project have been carried forward for assessment. The potential project effects on soil reclamation suitability for the Prosperity Project are described in detail in the March 2009 EIS/Application, Volume 5, Section 4.7.2.4.

The Project effects that have changed due to the Project design changes for the New Prosperity Project are listed in Table 2.7.2.6-21. All of the Project effects that will be re-assessed are effects due to the site water management and tailings management.

Table 2.7.2.6-21 Potential Environmental Effects Associated with New Prosperity

General Category	Project Activities/Physical Works	Change in Soil physical properties	Change in soil chemical properties
Operations			
Ore Extraction and Stockpiling	Ore Stockpile management and processing		2
	Crushing and conveyance		2
Site Water Management	Site drainage and seepage management	2	
	Water Management Controls and Operation	2	
	Pit dewatering	2	
Tailings Management	Tailing storage	2	
Closure and Decommissioning			
Site Water Management	Water Management Controls and Operation	2	
	Site drainage and seepage management	2	
	Pit lake and TSF Lake filling	2	
Post-closure			
Site Water Management	Discharge of tailing storage facility water	2	
	Seepage management and discharge	2	

Changes to soil properties from Project-related activities at the mine site can result in an overall change to reclamation suitability. Changes in physical properties are likely wherever ground disturbance is required, with the exception of soil moisture changes. Soil chemical changes are linked with long-term topsoil storage and atmospheric deposition from mining activities or accidental spills (March 2009 EIS/Application, Volume 9, Section 2). Table 2.7.2.6-22 summarizes which Project activities being carried forward will have an environmental effect on specific measurable parameters of soil properties.

The measurable parameters for soil reclamation suitability that are predicted to be affected by the Project effects carried forward in Table 2.7.2.6-21 are shown in Table 2.7.2.6-22. There were no residual project effects predicted for admixing, compaction, erosion or soil fertility for the Prosperity Project; this has not changed for the New Prosperity Project, as the area of potential soil disturbance has decreased with the smaller mine footprint. These measurable parameters apply to activities that were rated ‘1’ in Table 2.7.2.6-10, and are shaded grey in Table 2.7.2.6-22.The residual Project effects for soil reclamation suitability were measured by soil loss, soil moisture changes and soil contamination.

Table 2.7.2.6-22 Potential Environmental Effects and Associated Parameters for Soil Properties

Project Activities and Physical Works	Potential Environmental Effect						
	Measurable Parameters						
	Physical					Chemical	
	Admixing	Compaction and Rutting	Soil Erosion	Soil Loss	Soil Moisture Changes	Soil Contamination[1]	Soil Fertility
Operations							
Ore Stockpile management and processing					✓	✓	
Crushing and conveyance				✓		✓	
Site drainage and seepage management					✓		
Water Management Controls and Operation					✓		
Pit dewatering					✓		
Tailing storage				✓	✓		
Closure and Decommissioning							
Water Management Controls and Operation					✓		
Site drainage and seepage management					✓		
Pit lake and TSF Lake filling					✓		
Post-closure							
Discharge of tailing storage facility water					✓		
Seepage management and discharge				✓			

NOTES:
[1] Contamination associated with accidental spills along the access road is dealt with in Accidents and Malfunctions (Prosperity EIS, Volume 9, Section 2).

Effects Assessment Methods for Reclamation Suitability

The effects assessment methods for reclamation suitability has not changed since the Prosperity EIS, see March 2009 EIS/Application Volume 5, Section 4.7.2.2, Effects Assessment Methods for Reclamation Suitability for details.

The analytical techniques for the assessment of environment effects to reclamation suitability have not changed from the Prosperity EIS, Volume 5, Section 4.7.2.2, with one exception:

- The thresholds for the effects to soil chemistry due to dust deposition include the agricultural standards from the BC Contaminated Sites Regulation (B.C. Reg. 375/96) as well as the CCME (1999). The BC CSR standards were not used for the Prosperity Project assessment since the CCME (1999) standards were lower; changes to the Schedule 5 thresholds for the BC CSR (B.C. Reg. 375/96) standards resulted in the thresholds for barium, chromium, mercury and zinc being lower than the CCME (1999) standards previously used (Table 2.7.2.6-12).

Table 2.7.2.6-12 Recommended Soil Quality Guidelines for Metal Concentrations

Metal	Symbol	CCME Standard (ppm or mg/kg)	BC CSR Standard (ppm or mg/kg)
Arsenic	As	12	20
Barium	Ba	750	400
Boron	B	2	2
Cadmium	Cd	1.4	2
Chromium	Cr	64	60
Copper	Cu	63	90
Lead	Pb	70	150
Mercury	Hg	6.6	0.6
Molybdenum	Mo	5	5
Nickel	Ni	50	150
Selenium	Se	1	2
Zinc	Zn	200	150
SOURCE: CCME (1999) Soil Quality Guidelines for Agricultural Land Use BC CSR (B.C. Reg. 375/96) Soil Quality Guidelines for Agricultural Land Use			

The metal deposition is linked to the spatial locations provided in Figure X-X of the Human Health Assessment, and within a deposition model boundary (50 m grid spacing) applied over the north end of the mine site including Fish Lake and the surrounding meadows (see Section 2.7.2.1 for discussion of atmospheric dust models).

For the March 2009 EIS/Application, total suspended particulates (TSP) was used to model the dust effects on the human health receptors; however, TSP is overly conservative for effects to soils due to ore dust deposition, as most of the TSP off the mine site will be atmospheric dust not generated by the mine. To model the potential effects to Fish Lake, dust of size 2.5 microns or less was used instead, as dust particles of that size will be small enough to be carried by wind from the ore crusher to Fish Lake and surrounding locations.

Data sources and fieldwork used for reclamation suitability assessment have not changed from the March 2009 EIS/Application, Volume 5, Section 4.7.2.2.

Changes in Baseline Conditions for Soil Reclamation Suitability

The reclamation suitability ratings for the mine site soils did not change for the New Prosperity EIS. Reclamation suitability ratings for the undisturbed mineral soil of the root zone (mineral soil above the C horizon) on the mine site were determined using the methods outlined in Soil Quality Criteria Relative to Disturbance and Reclamation (AAFRD, 1987) (see Table 2.7.2.6-13 and Table 2.7.2.6-14).

Table 2.7.2.6-13 Criteria for Evaluating the Suitability of Root Zone Material in the Eastern Slopes Region

Rating/Property	Good (G)	Fair (F)	Poor (P)	Unsuitable (U)
Reaction (pH)1	5–6.5	4–5; 6.5–7.5	3.5–4; 7.5–9	<3.5 and >9
Salinity (EC)2 (dS/m)	<2	2–4	4–8	>8
Sodicity (SAR)2	<4	4–8	8–12	>123
Saturation (%)2	30–60	20–30; 60–80	15–20; 80–100	<15 and >100
Coarse Fragments[4] (% Vol)	<305; <156	30–505; 15–306	50–705; 30–506	>705; >506
Texture	L, SiCL, SCL, SL, FSL,	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rating/Property	Good (G)	Fair (F)	Poor (P)	Unsuitable (U)
Moist Consistency	very friable, friable	Loose, firm	very firm	extremely firm
CaC03 (%)	<2	2–20	20–70	>70

NOTES:
1 pH values presented are most appropriate for trees, primarily conifers. Where reclamation objective is for other end land uses, such as erosion control, and where other plant species may be more important, refer to Table 6 in Soil Quality Criteria Relative to Disturbance and Reclamation (AARD 1987).
2 Limits may vary depending on plant species to be used.
3 Materials characterized by an SAR of 12 to 20 may be rated poor if texture is sandy loam or coarser and saturation percent is less than 100.
4 0.2 to 25 cm diameter fragments in the soil material.
5 Matrix texture (modal) finer than sandy loam.
6 Matrix texture (modal) sandy loam and coarser.

Table 2.7.2.6-14 Reclamation Suitability Ratings

Rating	Soil Map Unit	Description
Good	No soils with a Good rating were identified in the Mine Site Local Study Area.	None to slight limitations that can affect plant growth
Fair	F1, F2, M1, M4	Moderate to severe limitations; can be overcome by proper planning and good management
Fair to Poor	L1, M3	Contains soils with fair and poor ratings
Poor	M2	Severe soil limitations that make use questionable; careful planning and very good management are required
Unsuitable	C1, C2, D1, FG1, FG2, FG3, FG4, R1, WA, DL	Chemical or physical soil properties are so severe that use in reclamation is not possible or economically feasible
Not Rated	O1, O2	Organic soils are not rated in this system

A little less than one quarter of the area within the mine footprint was rated as fair for reclamation suitability, a further 56% was rated as fair to poor and none was rated as poor (Table 2.7.2.6-15). A small remainder of the area (approximately 6%) was mapped as having unsuitable soil materials for reclamation purposes. Within this category, 46% of the area was mapped as water bodies (WA), disturbed land (DL) or bedrock outcroppings (R1). Thus, only 95.4 ha (or 3.3%) of mineral topsoil within the mine site footprint was deemed unsuitable for reclamation purposes. The main limiting factor for the majority of Soil Map Units (SMUs) was coarse fragment content. Coarse fragment contents were generally high and typically increased with depth.

Organic soils are useful as soil amendments but are not rated for reclamation suitability according to the system employed (AAFRD, 1987), but all are considered suitable for use in blending with mineral soils as a reclamation medium. Approximately 13.5% of the mine site area is covered by organic soil units.

The distribution and extent of reclamation suitability classes are illustrated in Figure 2.7.2.7-1. The reclamation suitability rating for each criterion for each soil plot is shown in Appendix 5-4-M.

Table 2.7.2.6-15 Soil Reclamation Suitability Areas and Percentage for the Mine Site LSA

Reclamation Suitability Class	Symbol	Soil Map Unit(s)	Prosperity LSA		New Prosperity LSA	
			ha	%	ha	%
Fair	F	F2, M1, M4	1,065.8	24.2	734.5	24.8
Fair-Poor	F-P	L1, M3	2,387.3	54.2	1,654.9	55.8
Organic	O	O1, O2, O3	594.2	13.5	400.8	13.5
Unsuitable	U	C1, C2, D1, FG1, FG2, FG3, R1, WA, DL	359.8	8.2	177.0	6.0
Total			**4,407.1**	**100.0**	**2,967.2**	**100.0**

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.6-5 Soil Reclamation Suitability within the Mine Site

The changes in the baseline for the measurable parameters of soil reclamation suitability are described below; see March 2009 EIS/Application, Volume 5, Section 4.7.2.4, Assessment of Soil Physical Properties for a description of the soil compaction and soil erosion hazard keys. There has been no change in the baseline for admixing from the March 2009 EIS/Application, Volume 5, Section 4.7.2.4, Assessment of Soil Physical Properties.

Soil Compaction and Rutting

Each soil map unit was assigned a compaction or rutting rating (Table 2.7.2.6-16). Mineral soils were given a compaction rating, whereas all organic soils were rated as at risk for rutting. The majority of the mine site (71%) is rated as moderate risk for compaction for the top 30 cm of the soil profile (Table 2.7.2.6-17, Figure 2.7.2.6-6). The overall rating provides an indication of bare soil conditions, once vegetation has been removed.

Table 2.7.2.6-16 Compaction and Rutting Risk by Soil Map Unit within the Mine Site

Soil Map Unit	Compaction Rating
C1	L
C2	M
Total Colluvial	
D1	L
Total Residual	
F2	L
Total Fluvial	
FG1	L
FG2	L
FG3	L
Total Glaciofluvial	
L1	VH
Total Lacustrine	
M1	M
M3	M
M4	H
Total Morainal	
O1	Rutting
O2	Rutting
O3	Rutting
Total Organic	
DL	Not Rated
R1	Not Rated
WA	Not Rated
Total Not Rated	
Total	

Table 2.7.2.6-17 Compaction and Rutting Risk within the Mine Site

	Prosperity Project		New Prosperity Project	
Compaction Risk	Area (ha)	Percent	Area (ha)	Percent
Low	164.8	3.7	93.7	3.2
Moderate	2,841.2	64.5	2,114.3	71.3
High	603.8	13.7	373.3	12.6
Very High	1.4	<0.1	0.7	<0.1

Prone to Rutting	594.2	13.5	304.8	10.3
Not Rated	201.7	4.6	80.4	2.7
Total	**4,407.1**	**100.0**	**2,967.2**	**100.0**

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.6-6 Compaction and Rutting Risk for the Mine Site

Soil Erosion Risk

The greatest risk of water erosion occurs for soils with long slopes where water can accelerate and move a large amount of material, particularly on bare soils. Broken short slopes or very gentle slopes (<9%) do not allow water flowing on the surface to gain large momentum, thus reducing the erosive power of water. At this site, steeper slopes are often short or broken and gentler slopes are flat enough to reduce erosion. This area is rated as moderate to low for precipitation factors, reducing the overall erosion risk of the area. In addition, the high coarse fragment content of the soil helps control wind erosion. Over 70% of the mine site is at low risk for soil erosion, and less than 1 percent is at high risk (Table 2.7.2.6-18; Figure 2.7.2.7-7).

Table 2.7.2.6-18 Erosion Hazard Rating for the Mine Site Local Study Area

	Prosperity Project		**New Prosperity Project**	
Soil Erosion Potential	**Area (ha)**	**Percent**	**Area (ha)**	**Percent**
Not Rated[1]	725.7	16.5	413.0	13.9
Low	2,952.9	67.0	2,096.1	70.6
Moderate	654.6	14.9	384.8	13.0
High	3.7	0.1	3.9	0.1
Disturbed Area	70.2	1.6	69.4	2.3
Total	4,407.1	100.0	**2,967.2**	100.0

NOTES:
Ratings use BEC zone, terrain calls and soil map units to assess erosion hazard therefore no summary for each map unit can be provided as they may have more than one rating value assigned.
1Not Rated includes organic soils, water and exposed bedrock.

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.6-7 Soil Erosion Hazards for the Mine Site at Baseline

Soil Loss

Details of where soil stripping, salvage and replacement are to occur are outlined in Section 2.8.1, Soil Salvage and Handling Plan.

Soil loss is estimated by comparing the total volume of topsoil at baseline conditions for the mine site local study area and subtracting what will be salvaged; the remainder will comprise the total soil loss. Each soil map unit was assigned a topsoil depth used to calculate the volume.

Table 2.7.2.7-19 Soil Map Units and the Corresponding Topsoil Depths for the Mine Site

Soil Map Unit(s)	Topsoil Depth (cm)
R1, WA, DL	0
D1, FG1, L1, M1	30
C1, C2, FG3, FG4	35
F1, M2	40
FG2, M3	45
M4	50
F2	80
O2	115
O1	160

The estimated amount of topsoil within the mine footprint at baseline is 17.2 Mm^3 (Table 2 26). The majority of the volume within the mine footprint comes from morainal soil map units (~ 10.5 Mm^3) or organic SMUs (6.0 Mm^3). Approximately 0.7 Mm^3 of topsoil is estimated for all of the remaining map units combined and, of these, both the colluvial and glaciofluvial soil map units are considered unsuitable for reclamation purposes.

Topsoil depths shown in Figure 2.7.2.6-8 include areas with soils rated as unsuitable for reclamation, and soils that occur in areas of mass movement or steep slopes (>60%).

Table 2.2.7.2-20 Estimated Volumes of Topsoil for the Mine Site Local Study Area

Topsoil Layer	Prosperity Project		New Prosperity Project	
	Volume (m^3)	Volume (%)	Volume (m^3)	Volume (%)
C1	2.31E+04	0.1	2.08E+04	0.1
C2	5.67E+04	0.2	5.09E+04	0.3
Total Colluvial	**7.98E+04**	**0.3**	7.17E+04	0.4
D1	5.03E+04	0.2	1.15E+03	<0.1
Total Residual	**5.03E+04**	**0.2**	1.15E+03	<0.1
F2	1.83E+05	0.7	1.76E+05	1.0
Total Fluvial	**1.83E+05**	**0.7**	1.76E+05	1.0
FG1	1.47E+04	0.1	1.48E+04	0.1
FG2	4.62E+05	1.9	2.98E+05	1.7
FG3	3.77E+04	0.2	1.17E+04	0.1
Total Glaciofluvial	**5.15E+05**	**2.1**	3.25E+05	1.9
L1	4.14E+03	0.0	2.20E+03	<0.1
Total Lacustrine	**4.14E+03**	**0.0**	2.20E+03	<0.1
M1	1.31E+06	5.3	7.11E+05	4.1
M3	1.07E+07	43.3	7.44E+06	43.3
M4	3.01E+06	12.2	2.38E+06	13.8
Total Morainal	**1.50E+07**	**60.7**	1.05E+07	61.2
O1	7.41E+06	29.9	5.02E+06	29.2
O2	1.49E+06	6.0	1.00E+06	5.8
O3	2.63E+03	0.0	2.08E+04	0.1
Total Organic	**8.91E+06**	**35.9**	5.09E+04	0.3
Total	***2.48E+07***	***100.0***	**17.2E+06**	**100.0**

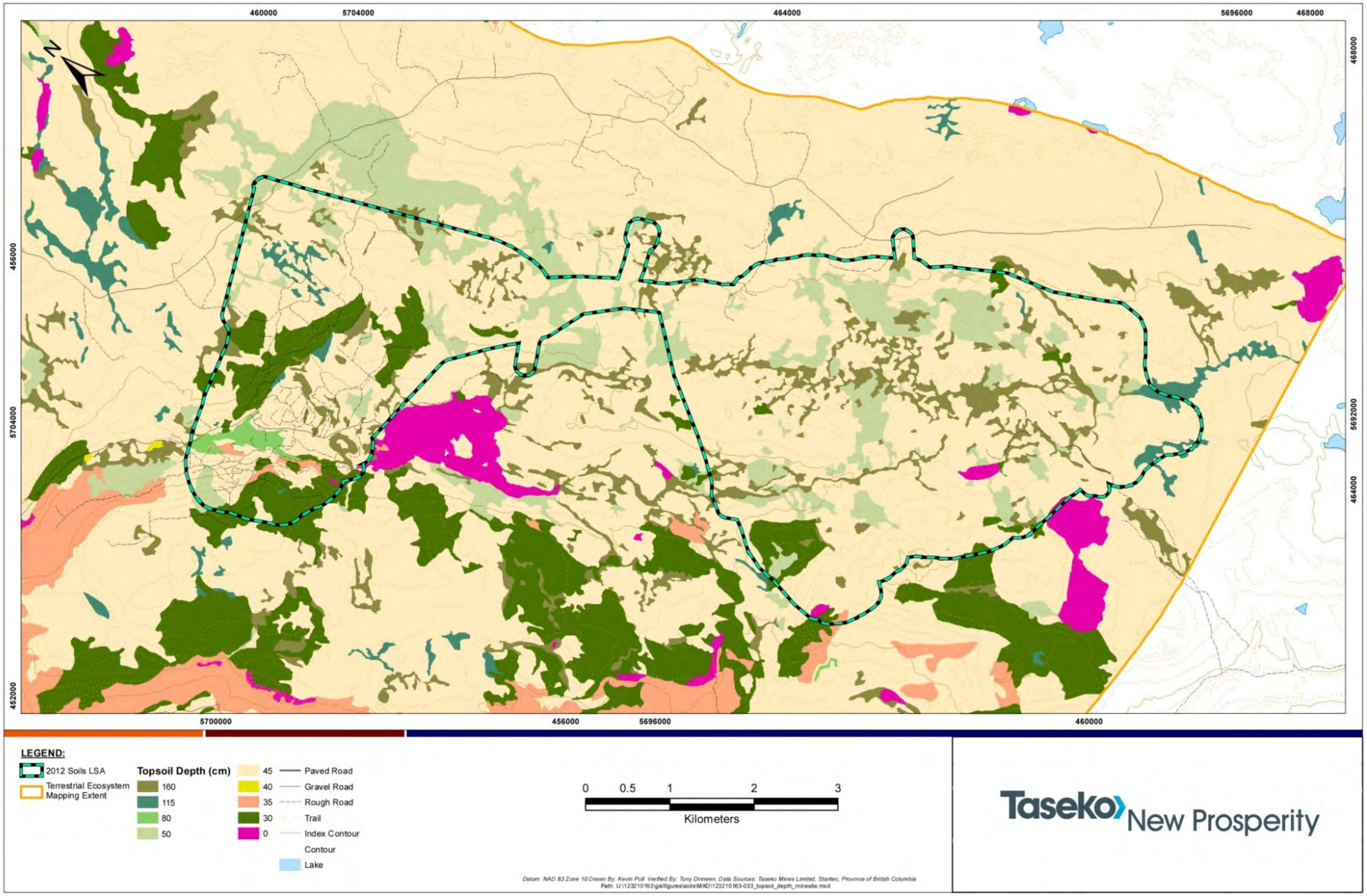


Figure 2.7.2.6-8 Topsoil Depths for the Mine Site

The total terrestrial area, or area with topsoil, in the mine site at baseline is 2885.6 ha – the area of the LSA excluding water, bedrock and anthropogenic features.

Soil Contamination

Arsenic, copper, nickel, selenium and zinc were found to exceed recommended CCME (1999) guidelines in certain existing topsoil and subsoil samples in the Prosperity Project mine footprint. The naturally occurring elevated metals in the soil were not reflected in the vegetation samples taken in 2006 and 2007 (March 2009 EIS/Application, Volume 5, Section 5). Due to the lower BC CSR standard for chromium (60 mg/kg as of May 2011 compared to 64 mg/kg) additional locations now exceed guidelines in the New Prosperity Project at baseline. All soil plots that exceed BC CSR or CCME guidelines at baseline are shown on Figure 2.7.2.6-9.

The elevated metals in soils still do not correlate well with plant metal exceedances at baseline conditions and, therefore, the elevated metals in the soil do not appear to limit the reclamation suitability of the soil.

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.6-9 Locations of Elevated Metals in Soil within the Mine Site for Baseline

Project Effects to Reclamation Suitability

Soil Loss

No salvage will occur on approximately 734.3 ha for a total soil loss volume of 3.5 Mm3 of soil (Table 2.7.2.6-23). The estimated soil loss is 35% of topsoil volume on the areas that will have surface disturbance (Figure 2.7.2.6-11).

Table 2.7.2.6-23 Estimated Soil Loss Associated with Mine Site Development

	Prosperity Project		New Prosperity Project	
Soil Area for Reclaimed Landscape	**Volume of Soil (m^3)**	**Area (ha)**	**Volume of Soil (m^3)**	**Area (ha)**
Mine Site LSA	24,818,000	4407	17,201,200	2,967.2
Proposed Mine features (Volume at Baseline)	12,784,726	2,022	10,048,900	1,919.1
Total volume of soil salvaged for reclamation	5,778,300	979	6,502,400	1,184.8
Total area where no salvage required	7,006,426	1,043	3,546,500	734.3

NOTES:
Areas of baseline disturbance, exposed bedrock and water have been factored out of soil loss and salvage volumes as those areas do not have topsoil. Areas of topsoil that cannot be salvaged include those rated as unsuitable for reclamation, soil occurring in areas of rapid mass movements, and slopes that are greater than 60% that pose a safety risk to ground operators. Soil loss from handling cannot be estimated and is therefore not included in the assessment numbers. The loss associated with handling is assumed to be minimal with proper mitigation. Total reclaimed landscape excludes permanent features and water areas and only includes the area where soil replacement is necessary. Soil volume includes both mineral topsoil and Organic soil.

Project activities will result in a total loss of 22% of topsoil from baseline conditions and a total of 19% of the terrestrial land base will be lost from baseline conditions relative to post-closure conditions for the mine site LSA (Table 2.7.2.6-24; Figure 2.7.2.6-11). These losses cannot be recovered and are a residual effect from Project activities.

Table 2.7.2.7-24 Residual Project Effects Associated with Soil Loss

Project	Baseline Land Base (Mine Site LSA–water features) (ha)	Post-closure Loss of Land Base (ha)	Percent Change at Post-closure from Baseline for Land Base Loss	Baseline Soil Volume for Mine Site LSA (Mm^3)	Post-closure Soil Loss for the Mine Site LSA (Mm^3)	% Change at Post-closure from Baseline for Soil Loss
Prosperity	4,282.2	981.8	23	24.8	7.0	28.2
New Prosperity	2,967.2	554.5	18.7	17.2	3.7	21.6

NOTE:
Total land base at baseline is (total area assessed) – (baseline water features). Post-closure land base loss is (Pit and TSF Lake permanent seepage ponds) – (baseline water features)

The loss of the terrestrial land base is due to the pit walls and pit lake, and the TSF lake. Additional land base loss associated with the Project are permanent mine features that could be decommissioned and reclaimed at some point in time (e.g. the water pumping wells, main embankment seepage ponds); those areas were not factored into the terrestrial land base loss calculations.

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.6-11 Areas of Soil Loss at Post-closure

Soil Moisture

For the operations phase of the Project, soil moisture changes will affect wetland soils, saturated soils and upland soils. Wetland or peat soils will be affected by a decrease of 30 cm to 1 m in the water table. The result is drier conditions that will allow peat to dry and oxidize, thereby influencing the type of vegetation that can be supported. For water saturated soils, a change of greater than 1 m but less than 2 m decrease in the water table may be sufficiently long enough that vegetation adapted to fluctuating water tables near the surface will be affected.

The soils that have formed under well drained conditions could experience the water table within the rooting zone of plants, which is normally within the top 1.5 m of the surface. If the water table increases to reach the rooting zone, then decreased oxygen diffusion in the soil could limit root growth of plants not adapted to anaerobic conditions.

For the operations through post-closure phases of the Project, during pit dewatering and subsequent 50 year recharge, the potential exists for water table decreases in undisturbed soils east and west of the pit. Site water diversion during operations will result in the potential for decreased soil moisture in wetland soils around the plant site (soil table within 1 m of the surface; Figure 2.7.2.6-12); however, this effect will cease at closure when site drainage is restored during reclamation of the ore stockpile and plant site areas (Figure 2.7.2.6-13). Soil moisture may potentially increase in upland soils downstream of the TSF seepage locations (areas where depth to groundwater not shown, implied depth is greater than 2 m; Figure 2.7.2.6-12 and Figure 2.7.2.6-13). Increasing soil moisture around the TSF embankments may result in new seepage sites and shifts in vegetation communities.

A residual Project effect is anticipated for soil moisture. The changes to soil moisture conditions will vary throughout the life of the Project during dewatering at operations, and at closure with pit filling. The pit dewater effect will last for at least 17 years, during active pit dewatering, and will likely extend into post-closure as the water table will take approximately 50 years to rebound. That time is sufficiently long enough to have an environmental effect on soil moisture and the associated ecological receptors such as vegetation and wildlife habitat. The mounding in the water table and associated increase in groundwater recharge to surrounding streams that will occur due to the filling of the TSF will be permanent. The exact extent of the areas that will be affected cannot be determined; they may extend into the RSA, but are anticipated to be localized.

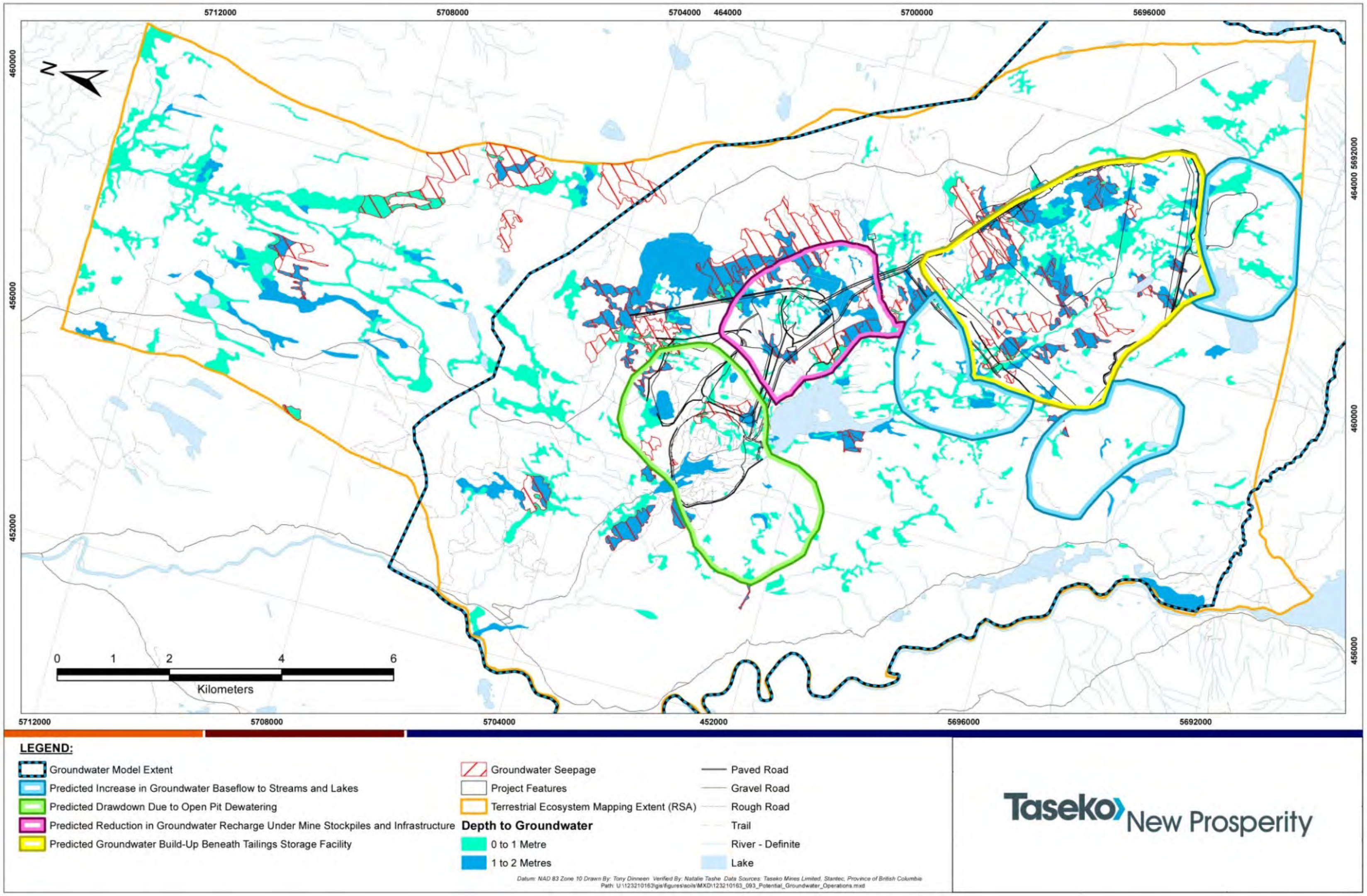


Figure 2.7.2.6-12 Potential Groundwater Change Effects on Soil Moisture at Operations

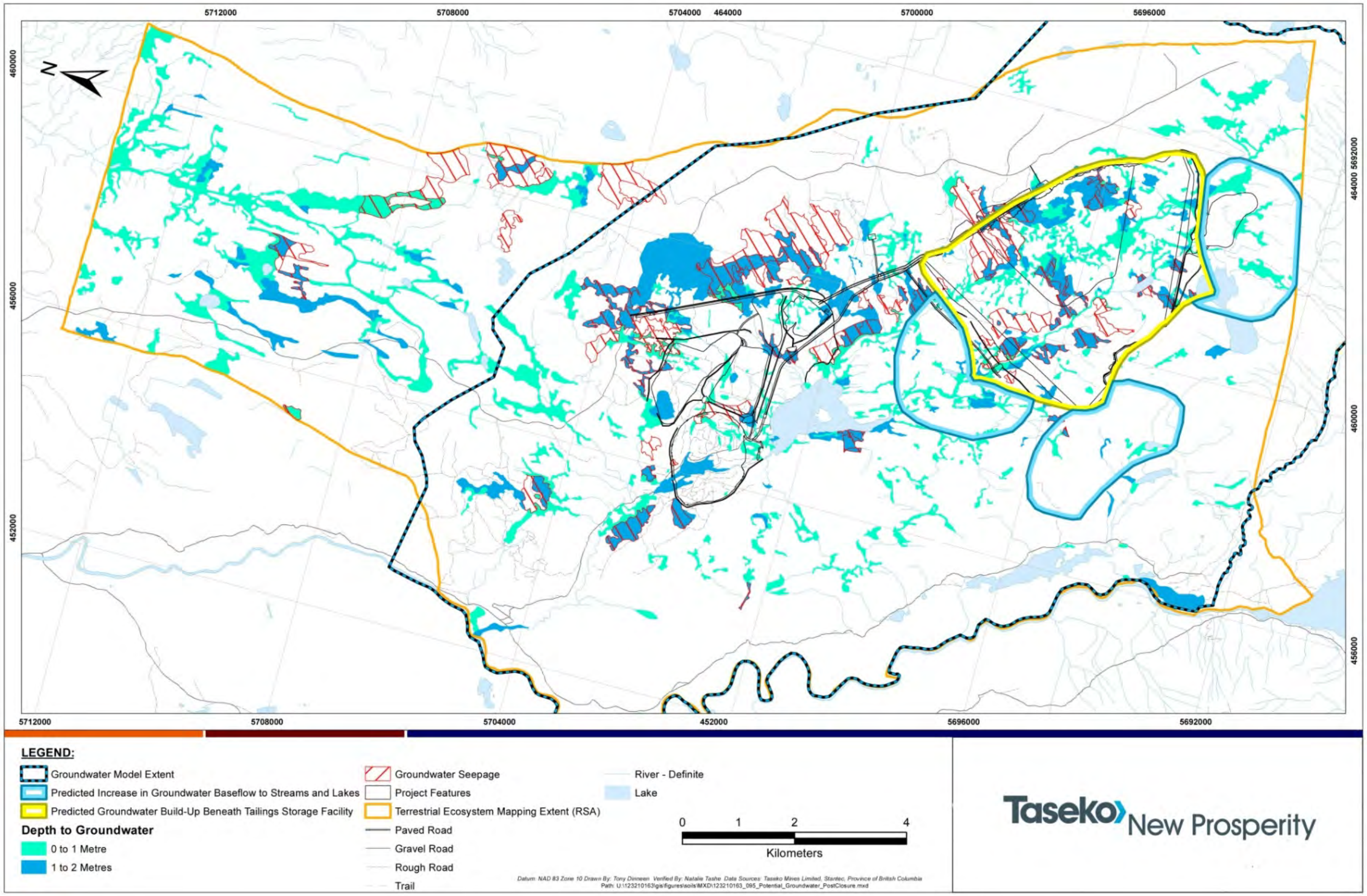


Figure 2.7.2.6-13 Potential Groundwater Change Effects on Soil Moisture at Post-closure

Soil Contamination

There will be no residual effect from ore extraction and processing on soil chemical properties. In the Prosperity EIS, soil contamination from metal deposition that occurs outside the ground disturbance area was assessed as having the potential to exceed critical thresholds for copper and molybdenum levels in soils at the camp; however the models were based on TSP deposition volumes and over-estimated the deposition of metals on the soils (see Appendices 5-4-Qa and 5-4-Ra from the March 2009 EIS/Application for 2007 dust deposition with new CCME and BC CSR thresholds), as the metal speciation used was still that of the 2.5 micron ore dust fraction. When the 2.5 micron model was run over the camp again for the New Prosperity Project, there were no potential changes in the metal concentrations in the soils (Table 2.7.2.6-25). The deposition on the soils around Fish Lake also did not result in soil metal concentrations increasing about guidelines. Some of the organic soils, which occur around the north end of Fish Lake, already exceed guidelines at baseline (see Appendix 2.7-X from the March 2009 EIS/Application).

Table 2.7.2.6-25 Soil Metal Concentrations at the Camp Based on the TSP Model and the PM2.5 Model

Site 96–10 Orthic Eutric Brunisol derived from Till Ah horizon						
Camp Location at Operations						
	Average Deposition Rate		Soil Concentration			
Metal	TSP ($mg/m^2/yr$)	PM2.5 ($mg/m^2/yr$)	Baseline (mg/kg)	Final - TSP (mg/kg)	Final – PM2.5 (mg/kg)	CCME Guideline (mg/kg)
Arsenic	5.5		2.23	4.1		12
Barium	19.0		63	69		400
Cadmium	<0.1		2	2		1.4
Chromium	37.0		23	35		60
Copper	772.1		32	289		63
Lead	1.5		5	5		70
Mercury	0.13		0.014	0.06		0.6
Molybdenum	13.0		4	8		5
Nickel	5.7		35	37		50
Selenium	0.8		0.1	0.4		1
Zinc	9.0		96	99		150

In order to confirm that the soil models are correct, the five locations specified in Section 2.7.3.3 -Human Health and Ecological Risk Assessment will still be monitored for soil contamination and uptake of metals in vegetation (including around the camp and at the north end of Fish Lake within the LSA).

Soil Reclamation Suitability Mitigation Measures

Mitigations for soil reclamation suitability have not changed from the March 2009 EIS/Application, Volume 5, Section 4.7.2.4, Assessment of Soil Physical Properties; 4.7.2.5, Assessment of Soil Chemical Properties; and 4.7.2.8, Summary of Mitigation for Soil Reclamation Suitability.

Table 2.7.2.6-28 provides the cross-references to other sections of the March 2009 EIS/Application and updated sections of the New Prosperity EIS where mitigations for effects to soils are contained.

The mitigations for each Project phase are described in the March 2009 EIS/Application, Volume 5, Section 4.8.1 Summary of Mitigation for Soil. The locations of soil erosion hazards in the post-closure mine site that will require mitigation have changed due to the change in project footprint (see Figure 2.7.2.7-10).

Table 2.7.2.6-28 Mitigation Measures for Effects on Soil

Project Effect	Description of Project Effect	Mitigation Measures
Changes to Physical Properties	Loss of soil physical quality due to admixing, compaction and rutting during construction and operations activities	Prosperity EIS, Volume 5 Section 4.7.2.4, Assessment of Soil Physical Changes. Soil Salvage and Handling Plan (Section 2.8.2.3), including direct placement and prompt progressive reclamation where possible, stockpile design to prevent anaerobic conditions, avoidance of wet conditions during soil salvage, traffic control during soil salvage and other activities on the site to minimize soil compaction Erosion and Sediment Control Plan (Section 2.8.4)
	Soil Loss including mechanical displacement during construction and operation	Salvage and Handling Plan (Section 2.8.2.3
	Change in soil moisture status due to changes in soil drainage regime or changes in water table depth	Prosperity EIS, Volume 5 Section 4.7.2.4, Assessment of Soil Physical Changes.
Changes to Chemical Properties	Changes in soil quality due to spills and leaks of potential contaminants	Section 2.7.6 Accidents and Malfunctions
	Soil Metal Deposition	Prosperity EIS, Volume 5, Section 4.7.2.5, Assessment of Soil Chemical Properties Section 2.7.3.3: Human Health Risk Assessment Section 2.7.2.2: Atmospheric Environment
	Loss of soil fertility (includes biological changes) during storage in soil stockpiles	Prosperity EIS, Volume 5, Section 4.7.2.5, Assessment of Soil Chemical Properties Soil Salvage and Handling Plan (Section 2.8.2.3)

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.6-10 Soil Erosion Hazards for the Mine Site at Post-closure

Cumulative Effects Assessment

As described in Section 2.7.1, cumulative environmental effects were only assessed if all three of the following conditions were met for the environmental effect:

- The Project results in a measurable, demonstrable or reasonably-expected residual environmental effect on a component of the environment
- The Project-specific residual environmental effect does, or is likely to, act in a cumulative fashion with the environmental effects of other past or future projects and activities that are likely to occur, and
- There is a reasonable expectation that the Project's contribution to cumulative environmental effects will affect the viability or sustainability of the resource or value.

The Project inclusion list (Table 2.7.1.4-1) identifies past, present and reasonably foreseeable projects and activities that could interact cumulatively with the Project. The locations of each of the 22 projects and activities are shown on Figure 2.7.1.4-1. As indicated in Table 2.7.1.4-1, eight of these project and activities are new since 2009. Of the eight new projects, only one, the Newton Mountain mine development, is located west of the Fraser River and, therefore, considered likely to interact cumulatively with the Project's residual effects on soil. Climate change and mountain pine beetle remain additional considerations for the Project that will potentially interact with soils by increasing the risk of erosion on existing unstable areas, changing soil moisture regimes, and creating soil compaction during mountain pine beetle forest harvesting (see March 2009 EIS/Application, Volume 5, Section 4.8.4, Additional Considerations for Soils). The effect of these two factors has not changed since the Prosperity EIS, and the conclusions for the amended soil assessment for the New Prosperity Project have not changed.

For soils, the first condition is met; that is, there are Project-specific residual effects on soils. With respect to the second condition, the primary mechanism whereby cumulative effects on soil chemical properties can occur is through the interaction of multiple air sheds contributing air-based contaminants. The cumulative effects assessment for the atmospheric environment for the March 2009 EIS/Application (Volume 4, Section 2, Atmospheric Assessment) showed that the air sheds from current and proposed projects did not overlap with this Project. The one new future project since 2009, the Newton Mountain mine development, is within the boundaries of the New Prosperity air shed. Since there are negligible concentrations of metals in the PM2.5 dust outside the immediate crusher facilities (Section X), there is no potential for a cumulative interaction with respect to contaminant deposition on soils. The Newton Mountain mine development could also result in groundwater changes; however, the groundwater changes predicted for the New Prosperity mine site are all restricted to within 2 km of the mine footprint. Consequently, there is no potential for a cumulative interaction on soil moisture due to the large distance between the New Prosperity Project and the nearest proposed project that may affect groundwater, combined with the limited extent of the groundwater effects due to the Project. Thus, as was the case for the March 2009 EIS/Application, with respect to the third condition, it is concluded that the Project's contribution to cumulative effects on soils is not significant.

Determination of the Significance of Residual Effects

The assessment methodology for residual effect characterization and determination of significance is as described in Section 2.7.1.5.

There is no change in the conclusion of no significant effects for reclamation suitability for the New Prosperity Project. The predicted Project effects on reclamation suitability have decreased for the New Prosperity Project (see March 2009 EIS/Application, Volume 5, Section 4.7.2.7, Summary of Effects to Reclamation Suitability). The Project effects of pit dewatering and metal deposition from mining operations have the potential to change reclamation suitability of soils. The magnitude of the soil contamination effect has decreased from low to negligible due to better modeling methods. The summary of project effects on reclamation suitability for the New Prosperity Project is shown by Project phase in Table 2.7.2.6-26. Only project effects for measurable parameters carried forward for significance assessment are shown.

A 10% loss of the soil resource was considered a high magnitude effect, and the effect is irreversible for topsoil loss due to the slow rate of soil formation. A 22% loss of soil volume is predicted. Based on the significance criteria described in Section 2.7.1, soil loss and terrestrial land base loss within the mine site would be considered significant. However, examining the Project as a whole in conjunction with the soil specific criteria provides a more accurate significance rating. The current soil salvage plan allows for enough soil salvage to occur to reach the required depths for reclaimed areas, and the reclamation plan suggests that topsoil spread will be sufficient to allow for vegetation growth and restoration of baseline land use at closure.

When that information is factored into the significance criteria, then the environmental effect of soil loss is anticipated to be not significant as reclamation suitability and land use is restored at Project closure.

A 19% loss of the terrestrial land base of the mine site LSA is high in magnitude and irreversible. Environmental effects rating criteria indicates a 10% loss associated with Project activities is high magnitude and irreversible, but site-specific. To place the loss of the land base into context, examination of why the loss is occurring and the environmental effects on other ecological receptors is imperative. First, over half the soil in the mine site LSA is primarily fair to poor for reclamation suitability. The area is characterized as till with high coarse fragment content interspersed with organic soils and inclusions of bedrock, fluvial, glacial fluvial and colluviums derived soils. The area as a whole is not considered high yielding soil for either agriculture or forestry. When soils are considered highly productive or rated as good for reclamation, the value of the soil is increased and the importance of losses becomes greater.

The potential change in soil moisture for the New Prosperity Project is still of moderate magnitude and extends just beyond the defined mine site LSA. Changes to soil moisture around the pit are expected to recover over approximately 50 years once dewatering of the pit ceases, so some changes in soil moisture are considered medium term and reversible. At post-closure the Pit and the TSF water bodies will be permanent features on the landscape and therefore some soil moisture changes are considered irreversible. A new equilibrium for areas where soil moisture increases will be attained, and will result in vegetation and wildlife habitat use changes. With land use changes, the environmental effect is manifested in a variety of ways. If the drop in the water table dries out a wetland, it may allow for productive forests to establish. Where the water table is increased, productive forest may be lost, but wetlands may be created. The changes to reclamation suitability are unknown and monitoring will be required where changes in soil moisture may affect sensitive ecological receptors (i.e. wetlands, sensitive ecosystems on dry soils).

The residual environmental effects on soils are meaningful primarily as they relate to effects on post-closure ecosystems and the capacity of the mine site area to sustain productive capability, wildlife habitat, and traditional land and resource uses. Physical changes due to losses of topsoil and the terrestrial land base are considered not significant when placed into context of the Project as a whole. The environmental effects associated with soil moisture changes are difficult to predict, follow-up must take place and future mitigation may be required. Reclamation is expected to restore baseline land use; therefore, the environmental effect is anticipated to be not significant with mitigation.

The findings of the Project residual effects assessment for soils for New Prosperity are summarized in Table 2.7.2.6-27.

Table 2.7.2.6-27 Project Residual Effects Assessment Summary for Soils for New Prosperity

Project Residual Effects	Proposed Mitigation and Compensation Measures	Residual Effects Characterization: Direction	Magnitude	Geographic Extent	Duration and Frequency	Reversibility	Ecological Context	Significance	Prediction Confidence
Soil loss due to loss of terrestrial area	• Soil Salvage and Handling Plan (Section 2.8.2.X), including direct placement and prompt progressive reclamation where possible, stockpile design to prevent anaerobic conditions, avoidance of wet conditions during soil salvage, traffic control during soil salvage and other activities on the site to minimize soil compaction • Erosion and Sediment Control Plan (Section 2.8..X); prevention of soil loss. • covered conveyor belt and covered transport trucks • grinding ore in wet slurries to reduce metal dust emissions	A	H	L	LT/O	I	L	N	M
Changes in soil moisture due to groundwater changes	None.	A	L	S	LT/C	R	L	N	L-M

KEY

Direction
P Positive
N Neutral
A Adverse
U Uncertain

Magnitude
L Low: Effect results in no net loss of the soil resource associated with a Project component. Soil properties may be altered but this will have no measurable effect on soil suitability for reclamation
M Moderate: Effect results in less than 10% loss of the soil resource associated with a Project component. Soil

Frequency
O Once: Effect occurs only once
S Sporadic: Effect occurs more than once but at unpredictable frequencies.
C Continuous: Effect occurs on a continuous basis *Duration*
ST Short term: effect is limited to < 1 year
MT Medium term: effect occurs > 1 year but not beyond the life of the Project
LT Long term: effect extends beyond the life of the Project but is not permanent

Reversibility
R Reversible: effect is reversible over time
I Irreversible: effect is not reversible over time

Ecological Context
L Limited: Limited effect by human activity

Project Residual Effects	Proposed Mitigation and Compensation Measures	Residual Effects Characterization: Direction	Magnitude	Geographic Extent	Duration and Frequency	Reversibility	Ecological Context	Significance	Prediction Confidence

suitability for reclamation is changed by one class
H High: Effect results in greater than 10% loss of the soil resource associated with a Project component. Soil suitability for reclamation is changed by two or more classes

Geographic Extent
S Site-specific: effects are confined to a specific site within the LSA
L Local: effects are confined to the LSA
R Regional: effects beyond the LSA

D Developed: Substantial effect due to alteration by human activity

Significance
S Significant
N Not significant

Prediction Confidence:
Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation
L Low level of confidence
M Moderate level of confidence
H High level of confidence

Table 2.7.2.6-28 presents a concise summary of effects assessment for soils. Considering the updated findings of the Project, mitigation measures, and cumulative residual effects on soils presented in this document, the overall significance determination for the New Prosperity Project, including all three major components (mine site, access road, transmission line), is unchanged from 2009. That is, the effect of the Project on the viability and sustainability of the soil resource is considered to be not significant.

Table 2.7.2.6-28 Summary of Effects Assessment for Soils

Effects Assessment	Concise Summary
Beneficial and Adverse Effects	The beneficial changes to the residual effects for soils for the New Prosperity Project are: • A smaller residual effect for soil loss due to a smaller footprint • No residual effect for soils due to soil contamination due to dust deposition. Adverse project effects on soil loss and soil moisture remain.
Mitigation and Compensation Measures	See Table 2.7.2.6-27.
Potential Residual Effects	Potential changes in soil moisture status due to changes in groundwater cannot be effectively mitigated. These changes are closely linked to alterations of the terrain and surficial geology; more specifically the dewatering of the open pit and the creation of the TSF. At post-closure there will also be permanent alterations in soil map units in the mine site footprint following reclamation. Soil loss and terrestrial land base losses are estimated to be less than 30% of the mine site LSA. The magnitude is considered to be high and irreversible; however, this is compensated somewhat by it being a localized effect.
Cumulative Effects	The prediction of no cumulative effects on soils has not changed for the New Prosperity Project.
Determination of the significance of residual effects	With the proposed mitigation and environmental protection measures outlined in the March 2009 EIS/Application Volume 5 Section 4.8, Summary of Effects on Soils, the effect of the Project on soils is considered to be not significant. Follow-up and monitoring will be required to determine the extent, if any, to which groundwater changes will affect soil moisture. Due to the discrepancy in the predicted effects for the Camp location using a TSP model for the Prosperity Project and a PM2.5 model for the New Prosperity Project, monitoring is still recommended at human health receptor locations to confirm the prediction of no residual effects.
Likelihood of occurrence for adverse effects found to be significant	Adverse effects on soil reclamation suitability were found to be not significant.

Additional Work

In accordance with the Panel recommendations, paired soil and vegetation trace element samples will be collected from the terrain and soils LSA prior to construction to provide a more complete baseline, particularly within the area of modeled dust deposition. The data will be provided as a supplement to the EIS Amendment prior to submission of the Mines Act Permit Application.

Follow-up and Monitoring

The follow-up and monitoring described in the March 2009 EIS/Application Volume 5, Sections 4.7.2.4, 4.7.2.5, and 4.7.2.10 and Section 4.8.3 is still applicable, with the following exceptions:

- Monitoring for shifts in vegetation community and soil moisture changes will be in new sensitive ecosystem locations outside the mine site disturbance area. In areas of groundwater decrease, wetland ecosystems will be monitored. In areas of groundwater increases, sensitive vegetation ecosystems on dry sites will be monitored. Vegetation surveys and soil moisture measurement through operations and for at least five years post-closure (i.e., until groundwater is expected to reach a new equilibrium around the pit). Sensitive communities that should be the focus of monitoring efforts are discussed in Section 2.7.2.7 - Vegetation Impact Assessment. Monitoring at these sites will be for vigor and growth of the vegetation in addition to physical properties of the soil.
- At least one more long-term soil monitoring site will be established at the north end of Fish Lake, in addition to sites that were proposed for the New Prosperity EIS. These monitoring sites will be established prior to construction activities, and sampling will continue until reclamation of the mine site is complete.

2.7.2.7 Vegetation

This section identifies how the Project has changed from the previous project proposal and whether changes would result in changes to the environmental effects previously predicted on vegetation. A detailed assessment of vegetative key indicator (KI) communities and species groups outlined in the EIS Guidelines and listed in Table 2.7.2.7-2 has been completed.

Scope of Assessment

This section outlines the scope of the assessment of potential environmental effects of the New Prosperity Project on vegetation resources. The assessment focusses only on changes relative to the Prosperity Project based on the New Prosperity Mine Development Plan, and is completed in accordance with the New Prosperity EIS Guidelines. Regulatory changes that have occurred since the March 2009 EIS/Application are considered.

The Project activities and physical works for New Prosperity are presented in Table 2.7.2.7-1. This table shows whether each activity or physical work has changed from the original Prosperity submission, and whether there are any VEC specific applicable regulatory changes related to the project activity. Project activities or physical works identified with a "Y" in either Changes in Project Design or Changes in Regulatory Requirements will be carried forward for assessment of the changes to effects on vegetation. Project activities or physical works identified with an "N" in both of these columns are not carried forward in this vegetation assessment, and are greyed out.

Table 2.7.2.7-1 Project Components, Features and Activities Changed from Previous Project Proposal

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Construction and Commissioning		
Open Pit – Preproduction	N	
Non-PAG waste stockpile	Y	Location and timing only
PAG Stockpile	Y	Still subaqueous in TSF; just TSF location changed
Non-PAG Overburden Stockpile	Y	Location only
Ore stockpile	N	
Primary Crusher	N	
Overland conveyor	N	
Fisheries compensation works construction	Y	
Water Management Controls and Operations	Y	
Construction sediment control	Y	

Access road construction and upgrades	N	EIS Guidelines have updated KIs from 2009 EIS. E.g. required to look at red and blue listed communities; definitions of these have changed.
Camp construction	N	In mine site
Site clearing (clearing and grubbing)	Y	EIS Guidelines have updated KIs from 2009 EIS. E.g. required to look at red and blue listed communities; definitions of these have changed.
Soils handling and stockpiling	Y	Includes overburden removal
Plant site and other facilities	N	Not emissions; not location
Explosives Plant	N	
Lake dewatering	Y	Only Little Fish Lake
Fish Lake Water Management	Y	Management of inflows and outflows
Starter dam construction	Y	
Sourcing water supplies (potable, process and fresh)	Y	
Site waste management	N	
Clearing of transmission line ROW	N	EIS Guidelines have updated KIs from 2009 EIS. E.g. required to look at red and blue listed communities; definitions of these have changed.
Construction/Installation of transmission line	N	
Vehicular traffic	Y	2km more road requires more and larger trucks
Concentrate load-out facility near Macalister (upgrades to site)	N	
Operations		
Pit Production	N	
Soils clearing (clearing and grubbing)	N	
Soils handling and stockpiling	N	
Crushing and conveyance	N	
Ore processing and dewatering	N	
Explosive handling and storage	Y	Location only
Tailing storage	Y	Location changed
Non-PAG waste stockpile	Y	Location and timing only
PAG Stockpile	Y	Still subaqueous in TSF; just TSF location changed
Overburden Stockpile	Y	Combined with Non-PAG (i.e. location and timing)
Ore Stockpile management and processing	Y	Location only
Potable and non-potable water use	N	

Site drainage and seepage management	Y	
Water Management Controls and Operation	Y	Includes management of flows in and out of Fish Lake
Wastewater treatment and discharge (sewage, site water)	N	
Water release contingencies for extended shutdowns (treatment)	N	
Solid waste management	N	
Maintenance and repairs	N	
Concentrate transport and handling	N	
Vehicle traffic	Y	PAH NO_x; within mine site only
Transmission line (includes maintenance)	N	
Pit dewatering	N	
Fisheries Compensation works operations	Y	
Concentrate load-out facility near Macalister	N	
Closure		
Water Management Controls and Operation	Y	
Fisheries Compensation Operations	Y	
Site drainage and seepage management	Y	
Reclamation of ore stockpile area	Y	Location only
Reclamation of Non-PAG waste rock stockpile	Y	Location only
Tailing impoundment reclamation	Y	
Pit lake and TSF Lake filling	Y	
Plant and associated facility removal	N	
Road decommissioning	N	
Transmission line decommissioning	N	
Post-closure		
Discharge of tailing storage facility water	Y	
Discharge of pit lake water	N	Into lower fish creek
Seepage management and discharge	Y	
Ongoing monitoring of reclamation	Y	

Regulatory Changes (since Prosperity)

Statutes applicable to the March 2009 EIS/Application and still applicable to the New Prosperity Project include:

- Federal Species at Risk Act
- BC Weed Control Act and Weed Control Regulation, and
- Mines Act Section 10 Permit for Reclamation Plan and Mine Plan.

The Weed Control Regulation has updates to July 21, 2011, and there have been changes to which species are considered noxious provincially and regionally, relative to the March 2009 EIS/Application. See the Invasive Plant Management Plan, for a baseline update on weeds in the Project area.

The following guidance documents were used to inform the March 2009 EIS/Application, and are considered in this assessment:

- Federal Wetland Policy
- BC Forest and Range Practices Act (FRPA)
- Land Use Plans, and
- Sustainable Resource Management Plans (SRMPs).

Since the March 2009 EIS/Application, the Cariboo-Chilcotin Land Use Order (2011) was issued. It sets legal direction for forestry activities under the FRPA with respect to key resource values identified by the SRMPs. The general goals of these SRMPs were addressed in the March 2009 EIS/Application, although the spatial boundaries established by the Order were not. Under Section 14(5) of the Mineral Tenures Act these land use designations and objectives do not preclude approval of mining activities. As in the March 2009 EIS/Application, these land use designations and objectives will be used as guidance in the vegetation assessment.

Changes as a Result of New Prosperity EIS Guidelines

As a result of the New Prosperity EIS Guidelines, there are changes to the vegetation KIs and assessment requirements from the March 2009 EIS/Application. They include:

- Forest capability was a vegetation KI in the March 2009 EIS/Application, but is not included in the requirements for the vegetation assessment in the New Prosperity EIS Guidelines; as such, we will not carry this KI forward in the New Prosperity vegetation assessment. See Section 2.8.2 (Reclamation) for discussion of forest capability in the New Prosperity Project.
- The EIS Guidelines require assessment of the potential effects of the Project on wetland habitat and functions for wetlands in the Project area, with consideration of hydrology, biochemical cycling, wildlife habitat for migratory birds, SARA-listed species, COSEWIC-listed species, and climate. A wetland functional assessment was not conducted as part of the March 2009 EIS/Application; effects to wetland ecosystems in the March 2009 EIS/Application focussed on loss of wetland area. The baseline data for wetlands will be updated to reflect wetland function baseline conditions, and the assessment of effects will address changes to wetland function.
- The March 2009 EIS/Application did not include assessment of traditional use/country food plants. This potential effect was assessed in a Supplemental submission by Taseko (2009). Following the New Prosperity EIS Guidelines, this assessment will include potential effects to country food plants and species identified as important to local and Aboriginal groups.
- The EIS Guidelines require documentation of ambient concentrations of trace elements in wetland and upland vegetation to determine the potential for contamination of vegetation that may be consumed by wildlife or people. See Section 2.6.1.6 (HHERA) and Section 2.6.4 (Aquatics) for this.

- The EIS Guidelines require information on access for harvesting along transmission line corridor. There are no changes to this relative to the March 2009 EIS/Application. Access for harvesting will be addressed during the permitting phase of the Project.
- The EIS Guidelines require assessment of effects to red and blue listed plants and communities. The BC CDC Red and Blue Lists have been updated since the March 2009 EIS/Application, therefore baseline conditions and potential effects will be updated to reflect current listings.

Key Changes and Issues

The key issues for vegetation resources from the March 2009 EIS/Application are also key issues for the New Prosperity Project. As identified in Section 5.1.3 of Volume 5 of the March 2009 EIS/Application, the key issues for vegetation resources associated with the Project include:

- Loss of vegetation due to the direct environmental effects of clearing and the indirect environmental effects of Project activities (e.g., loss of plant species due to clearing)
- Changes in abiotic conditions necessary for vegetation development due to the direct environmental effects of ground disturbance and the indirect environmental effects of changes to soil moisture or nutrient status (e.g., changes in drainage patterns, water quality and quantity), and
- Changes in the structure or composition of vegetation communities due to the direct environmental effects of clearing and a variety of indirect environmental effects occurring in edge areas adjacent to Project disturbance and areas of activity (e.g. dust deposition, windthrow).

An additional key issue specific to wetlands was also identified based on the 2012 New Prosperity EIS Guidelines, as follows:

- Change in wetland function, with consideration of hydrology, biochemical cycling, wildlife habitat for migratory birds, SARA-listed species, COSEWIC-listed species, and climate.

As identified in Section 2.3.5 of this assessment, there are changes to the KIs for vegetation based on the New Prosperity EIS Guidelines. Table 2.7.2.7-2 shows the measurable parameters of the key indicators for vegetation resources for the March 2009 EIS/Application and New Prosperity Projects.

Table 2.7.2.7-2 Measurable Parameters

Key Indicator	Measurable Parameters	
	2009 Prosperity	**2012 New Prosperity**
Old forest	Spatial extent (in hectares) of old forest available at each phase of the Project	Will also quantify the spatial extent (in hectares) of old forest in Old Growth Management Areas
Wetland ecosystems	Spatial extent (area) and distribution of wetland ecosystems Conservation status of the wetland as determined by the BC CDC (i.e., British Columbia rank and listing status) Structural stage of forested wetlands	Will also consider wetland functions, including hydrological, climate, biogeochemical and habitat functions Habitat function measurable parameters include: Area of wildlife habitat for migratory birds, known occurrences of SARA or COSEWIC listed species, and Potential habitat for SARA or COSEWIC listed species.
Riparian ecosystems	Spatial extent (area) and distribution of riparian ecosystems. Conservation status of the riparian ecosystems as determined by the BC CDC (i.e., British Columbia rank and listing status) and, for Structural stage of forested riparian ecosystems	No change
Grassland ecosystems	Spatial extent and distribution of grassland ecosystems at each phase of the Project sensitivity ratings	Also look at the area of grasslands within Grassland Benchmark Areas
Rare plants	Number and distribution of mapped rare plant locations, Size of the population of rare plant species at each site. Rare plants rating (or listing) based on their degree of rarity according to the provincial rank of each species.	No change (will update with current BC CDC listings)
Ecological Communities of Conservation Concern	Spatial extent of mapped polygons containing ecological communities of conservation concern and, in the case of compound polygons, the percentage representation of the ecological community within the polygon. Conservation status of each ecological community as determined by the BC CDC (i.e., British Columbia rank and listing status) Age of forested communities (mature and old forest ecological communities are considered to have higher conservation value than younger stands)	No change (will update with current BC CDC listings)
Forest capability	Spatial extent of productive forest land Level of productivity measured using the Site Index Biogeoclimatic Classification System	Excluded

	(SIBEC)	
Country Food Plants	Old forest, Wetland ecosystems, Riparian ecosystems, Grassland ecosystems Area of direct vegetation loss in the mine site area	In addition, will look at known distribution of country food plants.

Physical works and activities identified as having changed due to Project design or regulatory requirements (Table 2.7.2.7-1) have been brought forward to Table 2.7.2.7-3 and given project environmental effects ratings. The following criteria were used for the interaction ratings:

9. Effect on vegetation is likely to decrease or stay the same (i.e., no changes to significance conclusions), and there are no required changes to previously proposed mitigation measures, and no additional regulatory requirements have been identified (i.e., from the EAO, Panel, EIS Guidelines or other applicable regulations). Therefore, no further assessment is warranted, but information is provided to substantiate that the effect is likely to decrease or stay the same.
10. Effect on vegetation is likely to decrease or stay the same (i.e., no changes to significance conclusions), but some re-evaluation of effect is required due to changes in project design, proposed mitigation measures, and/or additional regulatory requirements have been identified (i.e., from the EAO, Panel, EIS Guidelines, or other applicable regulations).
11. Effect on vegetation is likely to increase; therefore, further assessment is warranted.

Table 2.7.2.7-3 Vegetation Potential Environmental Effects Associated with New Prosperity (Effects Scoping Matrix)

General Category	Project Activities/Physical Works	Vegetation Loss	Change to abiotic conditions	Change in plant community structure and composition	Change in wetland function
Construction and Commissioning					
Construction of Site Utilities/Access	Access road construction and upgrades	1	0	0	0
Construction/Installation of transmission line	Clearing of transmission line ROW	0	0	1	0
Fisheries compensation works (construction)	Fisheries compensation works construction	0	0	0	0
Overburden and Waste Rock Management	Non-PAG waste stockpile	0	0	0	0
	PAG Stockpile	0	0	0	0
	Overburden Stockpile	0	0	0	0
	Soils handling and stockpiling	0	0	0	0
Site clearing (clearing and grubbing)	Site clearing (clearing and grubbing)	1	0	0	2
Site Waste Management	Water Management Controls and Operations	0	0	0	0
	Construction sediment control	0	0	0	0
	Lake dewatering	0	0	0	0
	Fish Lake Water Management	0	0	0	0
	Starter dam construction	0	0	0	0
Vehicular traffic	Vehicular traffic	0	0	0	0
Water Sourcing and Use	Sourcing water supplies (potable, process/TSF)	0	0	0	0
Operations					
Fisheries Compensation works (operations)	Fisheries Compensation works operations	0	0	0	0
Ore Extraction and Stockpiling	Explosive handling and storage	0	0	0	0
	Ore Stockpile management and processing	0	0	0	0
Overburden and Waste Rock Management	Non-PAG waste stockpile	0	0	0	0

General Category	Project Activities/Physical Works	Vegetation Loss	Change to abiotic conditions	Change in plant community structure and composition	Change in wetland function
	PAG Stockpile	0	0	0	0
	Overburden Stockpile	0	0	0	0
Site Water Management	Site drainage and seepage management	0	2	0	0
	Water Management Controls and Operation	0	2	0	0
Tailings Management	Tailing storage	0	0	0	0
Vehicle traffic	Vehicle traffic	0	0	0	0
Closure					
Fisheries Compensation operations	Fisheries Compensation Operations	0	0	0	0
Reclamation	Reclamation of ore stockpile area	0	0	0	0
	Reclamation of Non-PAG waste rock stockpile	0	0	0	0
	Tailing impoundment reclamation	0	0	0	0
Site Water Management	Water Management Controls and Operation	0	2	0	0
	Site drainage and seepage management	0	2	0	0
	Pit lake and TSF Lake filling	0	2	0	0
Post-closure					
Site Water Management	Discharge of tailing storage facility water	0	2	0	0
	Seepage management and discharge	0	2	0	0
Monitoring	Ongoing monitoring of reclamation	0	0	0	
Interaction of Other Projects and Activities					
Interaction of Other Projects and Activities		1	1	1	1
Accidents, Malfunctions and Unplanned Events					
Accidents, Malfunctions and Unplanned Events		0	0	0	0

The interactions indicated in grey shading in Table 2.7.2.7-3 are not carried forward in this assessment. Based on past experience and professional judgment, the March 2009 EIS/Application determined that there would be no interaction; the interaction would not result in a significant environmental effect, even without mitigation; or the interaction would not be significant due to application of codified environmental protection practices that are known to effectively mitigate the predicted environmental effects. This has not changed since the March 2009 EIS/Application; details on the justification for this rating are provided in the issues scoping section for each KI in the March 2009 EIS/Application (see Volume 5, Section 5.3). These interactions are not discussed further in this assessment.

The Project interactions where predicted effects are potentially greater for the New Prosperity Project than the March 2009 EIS/Application (rated as 2 in the above table) require re-assessment. This includes changes to wetland function due to clearing and grubbing for the mine site, which was not previously assessed, and changes to abiotic conditions supporting vegetation. Changes to abiotic conditions relate to potential changes in water conditions from site water management activities which could permanently alter soil moisture conditions, thereby changing the abiotic conditions supporting plant communities. These areas are identified in Section 2.7.2.6 (Soil Moisture).

It is important to note that although changes to abiotic conditions are potentially greater than before, this is because these same areas were subject to complete vegetation loss in the Prosperity Project and are now preserved, but have potential changes to their moisture regimes (abiotic conditions).

Interactions rated as “1” are due to:

- The redesign of the Mine giving a new, smaller, mine site Maximum Disturbance Area, and
- Interactions with potential for effects on KIs whose definitions have changed relative to the March 2009 EIS/Application due to the New Prosperity EIS Guidelines, BC CDC updates and consultation. This includes rare plants, ecological communities of conservation concern, wetland ecosystems, and country food plants.

Table 2.7.2.7-4 provides a summary rating the potential for each effect by KI. The potential changes to abiotic conditions through seepage management, pit dewatering and water diversion are most important for their potential effects to wetland function, and are discussed under the wetland ecosystem KI. Vegetation loss is less for the New Prosperity Project than it was for the Prosperity Project due to the redesign of the mine site, leading to a much smaller MDA and Project footprint.

Table 2.7.2.7-4 VEC - Key Indicator Project Effects Scoping Table

Potential Effect	Vegetation Loss	Change in abiotic conditions	Change in plant community structure and composition	Change in wetland function
Effect Mechanism	Access road construction and upgrades, Mine site clearing and grubbing	Site water management activities	Clearing of transmission line ROW	Mine site clearing and grubbing
Key Indicator				
Old forest	0	0	0	0
Wetland Ecosystems	0	2	1	2
Riparian Ecosystems	0	0	0	0
Grassland Ecosystems	0	0	0	0
Rare Plants	1	0	0	0
Ecological Communities of Conservation Concern	1	0	1	0
Country Food Plants	1	0	1	0

KI Potential Effect Rating Criteria:

0 = Effect related to KI is likely to decrease or stay the same (i.e., no changes to significance conclusions), and there are no required changes to previously proposed mitigation measures, and no additional regulatory requirements have been identified (i.e., from the EAO, Panel, or other applicable regulation).

1 = Effect related to KI is likely to decrease or stay the same (i.e., no changes to significance conclusions), but some re-evaluation of effect is required due to changes in project design, proposed mitigation measures, and/or additional regulatory requirements have been identified.

2 = Effect related to KI is likely to increase; therefore, further assessment is warranted.

Temporal Boundary Changes

There have been no changes in the temporal boundaries for construction and commissioning, operations, and closure and decommissioning phases between the Prosperity and New Prosperity projects (see March 2009 EIS/Application Volume 5, Section 5.1.5). The temporal boundaries used for the New Prosperity assessment of potential Project effects on vegetation KIs remain:

- **Baseline Scenario**: represents vegetation conditions prior to any Project-specific developments. The baseline conditions for vegetation incorporate the environmental effects of existing human-caused disturbances (e.g., forest harvesting, road networks, other mine footprints etc.).
- **Maximum Disturbance Scenario**: represents conditions during construction activities, operations and decommissioning/reclamation activities. While recognizing that development, decommissioning and reclamation will be progressive throughout the construction, operations and decommissioning phases, the maximum disturbance scenario is used to represent the "worst case" (i.e., most conservative) assessment of the environmental effects on vegetation resources, and is assigned at 20 years into the

future. It is assumed that the primary environmental effects on vegetation (direct vegetation loss from clearing) will be similar for each phase, and that the results of reclamation (i.e., re-establishment of viable plant communities) will not be fully manifest until the years following decommissioning.

- **Post-closure Scenario**: represents conditions forecast 20 years into the future following closure (i.e., completion of decommissioning and reclamation) of the mine. This scenario assumes implementation of mitigation recommendations and all components of the Reclamation Plan. Reclaimed ecosystems will be dominated by vegetation species used in reclamation treatments for some time following closure. The degree to which post-closure ecosystems continue to reflect reclamation treatments will be influenced by elevation, types of reclamation species used, and the influence of adjacent vegetation communities.

The closure and decommissioning phase for the New Prosperity Project will be divided into two phases: Phase I, which will last approximately 10 years following closure (Years 21 to 30) when the Fish Lake catchment will continue to be isolated from mine water; and phase II (Years 31-44), when the TSF will be allowed to begin to spill to Fish Lake Tributaries. The post-closure phase is still anticipated to begin in Year 45, when the Pit Lake will have reached maximum elevation and begun to spill to Lower Fish Creek. Permanent groundwater interception and surface seepage ponds below the main TSF embankment will continue to operate post-closure.

Spatial Boundary Changes

See Table 2.7.2.7-5 for the changes to the study areas, relative to the March 2009 EIS/Application. See Figure X for a comparison of the mine site study areas for vegetation between the Prosperity and New Prosperity Projects.

Table 2.7.2.7-5 Mine Site Study Area Comparison

Study Area	Mine Site Study Areas	
	2009 Prosperity	**2012 New Prosperity**
Regional Study Area (RSA)	Encompasses most of the Fish Creek watershed, extending to the top of the bluffs on the east side of the Taseko Valley. The mine site RSA is also the area of 1:20,000 TEM mapping previously developed for the mine site. The mine site RSA had a total area of 18,267 ha.	No changes
Local Study Area (LSA)	A buffer of 500 m on the proposed mine footprint, including the section of new road required at the north end of the mine footprint. This study area is expected to include the maximum area that could be indirectly affected by the Project as a result of dustfall, windfall and localized changes in drainage patterns and is also intended to accommodate any potential for future changes to the mine footprint. The mine site LSA had a total area of 4,812 ha.	Still a buffer of 500 m on the proposed mine footprint, reflecting the changes to the proposed footprint. This leads to small changes relative to the Prosperity LSA boundary at the north end of the study area directly east of Wasp Lake. The mine site LSA has a total area of 4,434 ha.
Maximum Disturbance Area (MDA)	A buffer of 100 m on the mine footprint. The mine site MDA had a total area of 4,419 ha	A buffer of 100 m on the proposed mine footprint, to represent a “worst case” for development. The MDA has a total area of 2,601 ha

Updates to Consultation on the Assessment for Vegetation

Through the Panel process Taseko was provided with a list of plants of traditional importance to the Tsilhqot’in National Government (TNG). This information is used to define the Country Food Plants KI.

Updates to the assessment methods for vegetation due to consultation since the submission of the March 2009 EIS/Application include the consideration of country food plants.

Project Impact Assessment for Vegetation

There are four potential environmental effects identified for vegetation, including vegetation loss, change to abiotic conditions, changes to vegetation structure and composition, and change in wetland function. Based on the above scoping, the applicable potential effects are assessed for each KI.

Old Forest

As outlined in Table 2.7.2.7-4, effects to old forest will be less for the New Prosperity Project than the Prosperity Project. The prior Panel Report determined that effects to old forest were not significant.

Effects Assessment Methods for Old Forest

The effects assessment methods for old forest have not changed since the March 2009 EIS/Application, and are described in Section 5.3.1.2 of Volume 5 of that report. The assessment will focus on the effect of vegetation loss in the mine site due to clearing and grading, as the mine site MDA is the only Project design change affecting old forest. The method used to assess the environmental effect of vegetation loss on old forest is a spatial overlay analysis of the MDA on the VRI-based old forest baseline mapping. The VRI-based old forest baseline mapping from the March 2009 EIS/Application has been updated for recent disturbance, including recent cutblocks and impacts of mountain pine beetle reflected in 2011 VRI data, to determine the area of old forest in the New Prosperity mine site RSA.

The results of this analysis are produced spatially and as a summary data table, and compared to the results reported in the March 2009 EIS/Application.

Change in Baseline Conditions for Old Forest

Baseline information on old forests has been compared to information available through Hectares BC and the most recent (2011) version of the provincial Vegetation Resources Inventory (VRI) dataset to determine the current extent of mountain pine beetle infestation and new cutblocks since Prosperity.

The March 2009 EIS/Application noted several pockets of mountain pine beetle infestation in the mine footprint, and anticipated that most of the mature and old pine in the mine site RSA would be killed by mountain pine beetles within the near future. Current information shows that although the pine beetle infestation has spread somewhat, the mine site RSA still contains intact pine stands. See Table 2.7.2.7-6 for a comparison of old forest in the mine site LSAs and RSAs at baseline for the Prosperity and New Prosperity projects.

Table 2.7.2.7-6 Availability of Old Forest at Baseline–Mine Site

BEC Unit	Leading Species	Prosperity Mine Site RSA (ha)	Prosperity Mine Site LSA (ha)	New Prosperity RSA (ha)	New Prosperity LSA (ha)
MSxv	lodgepole pine	3002.1	489.3	2,430.4	727.5
	spruce	535.7	190.9	503.1	257.5
SBPSxc	poplar	33.1	0	33.1	0.0
	Douglas-fir	6.8	0	6.8	0.0
	lodgepole pine	2475.8	1026.6	2,143.9	445.0
	spruce	140.2	44.6	132.8	49.1
Total (All)		**6,194**	**1,751**	**5,250**	**1,479**
Total (Non Pine)		**716**	**235**	**676**	**307**

Spatial data on old growth management areas (OGMAs) defined under the Sustainable Resource Management Plans, enabled by the Cariboo-Chilcotin Land Use Order, was updated on April 31, 2009, and is shown on Figure X. Table 2.7.2.7-7 summarizes the old forest and old growth management areas within the mine site study areas. Although these OGMAs do not represent statutory restrictions to Project activities (pursuant to Section 14(5) of the *Mineral Tenures Act*) this information is used as guidance in this assessment.

Table 2.7.2.7-7 Old Growth Management Areas for New Prosperity Mine Site

Study Area	Old Forest	OGMAs	Old Forest within OGMAs		
	Area (ha)	Area (ha)	Area (ha)	Percent of Old Forest (%)	Percent of OGMA (%)
RSA	5,250.1	1,747.8	1,021.4	19.5	58.4
LSA	1,479.2	560.5	464.7	31.4	82.9

MDA	925.4	398.2	316.6	34.2	79.5

Potential Project Effects to Old Forest

The loss of old forest in the mine site is less than that predicted by the 2009 Prosperity EIS. The areal extent of the loss of old forest is summarized in Table 2.7.2.7-8.

Table 2.7.2.7-8 Project Effects to Old Forest

Lead Tree Species	BEC Unit	2009 Prosperity					2012 New Prosperity				
		Area in RSA at Baseline	Change at Maximum Disturbance (relative to baseline)		Change at Post-closure (relative to baseline)		Area in RSA at Baseline	Change at Maximum Disturbance (relative to baseline)		Change at Post-closure (relative to baseline)	
		Area (ha)	Area (ha)	Percent (%)	Area (ha)	Percent (%)	Area (ha)	Area (ha)	Percent (%)	Area (ha)	Percent (%)
Lodgepole pine	MSxv	3,002.1	-533.3	-17.8	-3,002.1	-100.0	2,430.4	-463.8	-19.1	-2,430.4	-100.0
	SBPSxc	2,475.8	-705.5	-28.5	-2,475.8	-100.0	2,143.9	-274.5	-12.8	-2,143.9	-100.0
	Total Pl	5,477.9	-1,238.8	-22.6	-5,477.9	-100.0	4,574.2	-738.3	-16.1	-4,574.2	-100.0
Spruce	MSxv	535.7	-192.8	-36.0	80.1	15.0	503.1	-145.9	-29.0	-112.4	-22.3
	SBPSxc	140.2	-33.0	-23.5	-62.2	-44.4	132.8	-41.2	-31.0	-55.5	-41.8
	Total Sx	676.0	-225.8	-33.4	17.8	2.6	636.0	-187.1	-29.4	-167.9	-26.4
Poplar	MSxv	0.0	0.0	0.0	0.0	0.0	33.1	0.0	0.0	-33.1	-100.0
	SBPSxc	33.1	0.0	0.0	14.6	44.1	0.0	0.0	0.0	47.7	-
	Total Ac	33.1	0.0	0.0	14.6	44.1	33.1	0.0	0.0	14.6	44.2
Douglas-fir	MSxv	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.0	-6.8	-100.0
	SBPSxc	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	-
	Total Fd	6.8	0.0	0.0	0.0	0.0	6.8	0.0	0.0	0.0	0.0
Trembling aspen	MSxv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
	SBPSxc	0.0	0.0	0.0	86.8	-	0.0	0.0	0.0	0.0	-
	Total At	0.0	0.0	0.0	86.8	-	0.0	0.0	0.0	0.0	-
Total Old Growth Forest (All Species)		*6,194*	*-1,465*	*-24*	*-5,358*	*-87*	*5,250*	*925*	*-18*	*-4,727*	*-90*
Total Old Growth Forest (Non Pine)		*716*	*-226*	*-32*	*119*	*17*	*676*	*-187*	*-28*	*-153*	*-23*

The Prosperity Project resulted in a predicted loss of 1,465 ha (24%) of old forest in the maximum disturbance scenario, whereas the New Prosperity Project results in a predicted loss of 925 ha (18%) of old forest in the maximum disturbance scenario.

The Prosperity Project, in combination with mountain pine beetle, resulted in a predicted loss of 5,358 ha (87%) of old forest in the maximum disturbance scenario, whereas the New Prosperity Project, in combination with mountain beetle, results in a predicted loss of 4727 ha (90%) of old forest in the maximum disturbance scenario.

Project effects to old forest in the transmission line and access road are predicted to be the same as in the March 2009 EIS/Application. See Sections 5.3.1.5 and 5.3.1.6 for the Volume 5 of the Prosperity EIS for the assessment of effects on old forest in these areas.

Wetland Ecosystems

As outlined in Table 2.7.2.7-9, the aerial extent of wetlands will be less for the New Prosperity Project than the Prosperity Project. The effect of changes in wetland function has not previously been assessed, and will be addressed fully below.

Effects Assessment Methods for Wetland Ecosystems

The effects assessment methods for Wetland Ecosystems have not changed since the March 2009 EIS/Application, and are described in Section 5.3.2.2 of Volume 5 of that report. The assessment will focus on the effect of vegetation loss in the mine site due to clearing and grading, as the mine site MDA is the only Project design change affecting wetland ecosystems. The method used to assess the environmental effect of vegetation loss on wetland ecosystems and function is a spatial overlay analysis of the MDA on the VRI-based baseline mapping. The VRI-based baseline mapping from the March 2009 EIS/Application has been updated for recent disturbance, including recent cutblocks and impacts of mountain pine beetle reflected in 2011 VRI data to determine the area of wetland vegetation in the New Prosperity mine site LSA.

The results of this analysis are produced spatially and as a summary data table, and compared to the results reported in the March 2009 EIS/Application.

Change in Baseline Conditions for Wetlands

Baseline wetland area summaries were provided in the March 2009 EIS/Application. They have been re-summarized below comparing the New Prosperity Project to the Prosperity Project.

Table 2.7.2.7-9 Baseline Wetland Ecosystems—Mine Site

BEC Unit	TEM Map Code	Wetland Class	Structural Stage	Mine Site RSA (ha)	Prosperity Mine Site LSA (ha)	New Prosperity Mine Site LSA (ha)
MSxv	BF	Fen	graminoid	539.4	160.0	179.0
	OW	Open Water	aquatic	26.9	0.9	1.1
	SH	Swamp	shrub	90.9	25.7	31.6
	SH	Swamp	pole/sapling	26.4	2.5	3.0
	SH	Swamp	young forest	25.4	17.5	18.0
	SH	Swamp	mature forest	58.9	6.2	7.3
	SH	Swamp	old forest	40.3	35.6	37.7
	ST	Swamp	young forest	2.9	2.9	2.9
	WM	Shrub-carr	shrub	48.6	35.5	32.0
	WS	Fen	shrub	334.8	135.8	151.5
	YL	Open Water	aquatic	3.0	0.8	0.2
	na	Marsh	NA	6.7	0.2	0.8
	na	Swamp	NA	1.5	0.0	0.0
SBPSxc	BF	Fen	graminoid	203.6	58.9	24.4
	DS	Swamp	shrub	3.7	2.7	2.7
	OW	Open Water	aquatic	13.8	1.5	0.8
	SH	Swamp	shrub	24.8	0.6	0.0
	SH	Swamp	pole/sapling	2.5	0.3	0.1
	SH	Swamp	young forest	16.8	12.6	11.1
	SH	Swamp	mature forest	47.4	3.0	4.8
	SH	Swamp	old forest	9.0	6.2	5.9
	SM	Swamp	shrub	1.3	0.0	0.0
	SM	Swamp	pole/sapling	6.3	0.0	0.0
	SM	Swamp	young forest	10.3	0.0	0.0
	SM	Swamp	mature forest	76.7	0.0	0.0
	WM	Shrub-carr	shrub	124.0	61.9	54.1
	WW	Fen	shrub	304.5	99.7	57.8
	YL	Open Water	aquatic	15.6	14.9	0.0
	na	Marsh	NA	2.1	0.0	0.0
	na	Swamp	NA	3.2	0.0	0.0
Totals				**2,071**	**686**	**623**

Baseline wetland function data was not provided as part of the March 2009 EIS/Application, and is provided here for the mine site study areas. Descriptions of the baseline hydrology, soils and vegetation of the wetlands in the mine site are included in Appendix 5-5-I of the March 2009 EIS/Application.

Wetland function encompasses all the natural processes associated with wetlands, including physical, chemical and biological functions, as well as the derivation of benefits these processes may provide to humans (Lynch-Stewart *et al.,* 1996).

Wetland functions in the mine site were broadly categorized as follows:

- Hydrological
- Biogeochemical, and
- Habitat.

The paragraphs below provide descriptions of these functions and an evaluation of the functions provided by the wetland types that occur in the mine site area.

Hydrological Function

Hydrological function is the capacity of a wetland to store, moderate, and release water in a watershed (i.e., peak flow reduction, downstream erosion reduction, groundwater recharge, and baseflow provision). Wetlands provide peak flow reduction by storing precipitation and surface flows from the contributing watershed during major storm events and releasing this stored water gradually. The wetlands' potential to perform this function is dependent on its size, the amount of water it can hold, the size and elevation of its outlet channel(s) relative to its basin, and its position in the watershed. When wetlands are situated in the floodplain and contain dense woody vegetation they can also dissipate the energy of flood events and reduce the erosive force of peak flows. Groundwater recharge can feed deep aquifers or supplement baseflows of streams depending on the groundwater elevations, soil texture and infiltration rates.

The predominant wetland types within the mine site are fens with either graminoid or shrub dominated vegetation. These fens consist of the Water sedge – Beaked sedge fen ecosystem and Willow-Scrub birch – Sedge fen ecosystem and together represent 67% of the wetlands within the 2012 mine site (Table 2.7.2.7-9). The hydroperiod of the Water sedge – Beaked sedge fen ecosystem is characterized by seasonal inundation that can include areas of open water up to 40cm deep, which gradually dries completely by mid-late summer. These fens are located within groundwater-fed depressions or along the margins of lakes or ponds. Peat accumulations over the mineral horizon are typically >50cm. Based on their hydromorphic setting and soils, the Water sedge – Beaked sedge ecosystem has moderate potential to attenuate peak flows and recharge local or deep groundwater, though it is not apt to reduce the energy or erosive forces of surface water flows due to its vegetation structure. The Willow-Scrub birch – Sedge fen ecosystem is located in groundwater-fed basins, gradual seepage slopes and pond or lake margins. These shrub fens occur on organic veneers within localized depressions. Depending on their individual hydromorphic setting, shrub fens have moderate potential to attenuate peak flows and recharge local or deep groundwater; shrub fens within basins have greater potential to perform these functions than groundwater-discharge areas on slopes, for example. Due to the structure of their woody vegetation, they also have moderate potential to reduce erosive forces of surface water flows.

A variety of swamp ecosystems comprise nearly a quarter of the wetlands in the mine site (Table 2.7.2.7-9). Among these forested or shrub-dominated wetlands, the Drummond's willow-Sedge swamp is most prevalent in the mine site (Table 2.7.2.7-9). This ecosystem occurs along streamside locations on fluvial deposits on level or slightly sloping terrain, typically at the toe of slopes. Soils are regosols. The Drummond's willow-Sedge swamp ecosystem has high potential to reduce peak flows and reduce the erosive force of such flows based on its hydromorphic position and woody vegetation structure. Coarse fluvial soils drain imperfectly but the ecosystem likely contributes to baseflows of adjacent stream channels. Three hybrid-spruce dominated swamp ecosystems occur in the mine site (Table 2.7.2.7-9). These ecosystems are located at wet toe slope positions and depressions, often adjacent to non-forested wetlands or streams. Where these ecosystems occur adjacent to streams or other wetland classes, they have high potential to attenuate peak flows and reduce the erosive force of surface flows due to their hydromorphic setting and vegetation structure. Where seepage water is continuously present (e.g., Sxw-Horsetail-Meadowrue forested wetland), groundwater is discharging, rather than recharging.

The single shrub-carr ecosystem within the mine site is located in groundwater-fed basins where cold air is the limiting-factor to tree establishment. This wetland is considered a transitional community often found between fens and adjacent uplands. It is fed by seepage from upslope areas and soils can be saturated in the early growing season, but surface water is not present. Based on its hydromorphic setting upon slopes, and insufficient basin size location for storing significant amounts of surface water, this ecosystem has low potential to attenuate peak flows or reduce erosive forces of surface flows. The shrub-carr wetland class does have the potential to supplement base flows of adjacent wetlands.

While the wetland classes within the mine site have some potential to provide hydrological functions such as peak flow attenuation, reduction of downstream erosion, and groundwater recharge (deep aquifer or supplement to baseflow), the opportunity to provide these functions is presently limited within this watershed due to the existing conditions of land cover and land use upstream. Since the land cover upstream is essentially in-tact native vegetation, both surface roughness and infiltration capability facilitate reduced run-off potential compared to watersheds with higher impervious surfaces. Development within the watershed is limited, leaving a high percentage of vegetation cover within the watershed to provide interception and evapotranspiration of precipitation. At post-closure remaining wetlands outside the mine footprint will have greater opportunity to provide these functions.

In terms of values provided by the hydrological functions of the wetlands within the mine site, they do not supply water for regional drinking water for residents or industry, nor provide water storage for commercial agriculture purposes.

Biogeochemical Function

Biogeochemical function refers to the biological, geological and chemical processes and reactions that govern the composition of the natural environment as it relates to the recycling chemistry between plants, animals, the earth’s sediments and atmosphere. Wetland functions associated with biogeochemical cycling typically pertain to the maintenance or improvement of water quality. Wetlands can improve water quality by removing sediment, removing nutrients, and removing heavy metals and/or toxic organics. Their potential to improve water quality in these three ways is dependent on their hydromorphic setting (i.e. basin shape, size, inlet/outlet, and location in the landscape), vegetation structure, soils and hydroperiod. In addition, wetlands can provide the biogeochemical function of capturing and sequestering atmospheric carbon. Their potential to provide this function is dependent on rates of primary productivity, export of organic carbon downstream, and rates of decomposition of organic carbon. Indicators of this biogeochemical function include the vegetation type, hydromorphic setting (i.e. degree of surface flow through the wetland), and accumulation of peat soils.

The potential for wetlands within the mine site to remove sediment is largely dependent on their ability to reduce the velocity of surface flows and provide filtration by settling sediments. Attributes of wetlands that provide the hydrological functions of attenuating peak flows and reducing the erosive force of surface waters are the same as the attributes for improving water quality, namely, a basin that stores peak flows and presence of dense, upright vegetation. The mechanisms of both functions are related: as peak flow velocity is reduced, sediments are removed. Therefore, based on the discussion of wetland classes’ and ecosystems’ potential to attenuate peak flows and reduce erosion above: the two fen ecosystems have a moderate potential to improve water quality by removing sediment with the shrub-fen having a greater potential to provide this function. The Drummond’s willow-Sedge swamp ecosystem and hybrid-spruce dominated swamp wetlands that are adjacent to streams have high potential to improve water quality by detaining sediments. Shrub-carr and hybrid-spruce dominated swamp wetlands that are situated on slopes, fed by seeps, without sizeable basins to store water have low potential to improve water quality by retaining sediment.

Wetland classes' and ecosystems' potential to remove nutrients is dependent on their ability to remove sediment and also their hydroperiod. When suspended sediments are removed phosphorus adhered to sediments is also removed from the water column and retained and cycled within the wetland. Therefore the wetland classes' and ecosystems' potential for improving water quality by removing phosphorus parallels the potential discussed above for removing sediment.

The wetland classes' and ecosystems' potential for improving water quality by removing nitrogen are dependent on their cycles of nitrification and denitrification. Wetlands with hydroperiods characterized by alternate wetting and drying periods have the highest potential to provide these biogeochemical cycling processes by supporting alternating oxic and anoxic conditions. Wetlands that are permanently inundated are less capable of supporting these processes. Among the wetlands in the mine site with pronounced seasonal wetting and drying periods, both fens and the swamp ecosystems located adjacent to streams or wetlands (or open water features) have the potential to improve water quality by removing nitrogen. Since the swamps located adjacent to streams receive surface water flows from higher in the watershed, they have high potential to provide this function. Since the fens are more-often groundwater-fed with comparatively less surface water inputs, they have moderate potential to provide this function.

Improvement of water quality by removing heavy metals and toxic organics occurs through adsorption to soil particles and reaction with soil/water pH. Wetlands with clay soils or organic soils have higher capability to adsorb metals, while soils with low pH have higher capability to reduce and precipitate metals than coarse-textured, higher pH, mineral soils. Flooded wetlands that support aerobic conditions also support the precipitation and of toxic compounds. Uptake of metals by vegetation is higher in wetlands with high cover of herbaceous emergent vegetation, than in wetlands dominated by floating aquatic or woody vegetation. Both fen ecosystems have high potential to improve water quality by removing toxic metals due to their organic soils, moderately low pH, and high cover of emergent vegetation. The flood prone swamp ecosystems have moderate potential to improve water quality by removing toxic metals due to their flooded-aerobic conditions. The shrub carr and swamp ecosystems that do not experience flooding and have less organic soil accumulation have low potential to remove metals.

The fen and flood prone swamp ecosystems have the potential to improve water quality by reducing sediments, nutrients and metals; however, the opportunity to improve water quality is limited due to the existing in-tact condition of the watershed. Wetlands that are not directly affected by mining activities that receive run off in the post-closure scenario would have the opportunity to provide this function.

Wetland ecosystems and classes with peat accumulations have the potential to provide the biogeochemical function of carbon capture and sequestration. The fen ecosystems with >50 cm of sedge-peat provide long-term carbon storage. Providing this biogeochemical function contributes to the global carbon balance and to the regulation of global climate.

Habitat Function

Habitat function refers to the manner in which a wetland contributes to biological productivity and diversity of various wetland-associated faunal groups such as invertebrates, amphibians, fish, birds, and mammals. The potential for a wetland to provide food, shelter, breeding conditions, and rest or refuge areas depends on the surface water hydrology, structural attributes of the vegetation, and landscape ecology. For example, the hydroperiod and depth of water are important factors for providing amphibian breeding habitat; the degree of tree canopy closure and ratio of open water to vegetation cover is important to providing bird nesting and foraging habitat; and the connection to adjacent uplands is important to providing movement corridors for mammals.

Invertebrate species generally benefit from permanent surface water, litter fall and woody debris inputs, and aquatic vegetation. Among the wetland ecosystems and classes in the mine site, the Water sedge – Beaked sedge fen ecosystem is noted as having areas of open water and aquatic vegetation present throughout most of the year. Where these conditions persist, these ecosystems have the potential to support the greatest diversity and abundance of invertebrates. The flood prone swamp ecosystems have the potential to provide habitat for invertebrates during flooded conditions. The other swamp and shrub-carr ecosystems are not particularly well suited to support high invertebrate diversity or abundance.

Many native amphibians breed in wetlands and metamorphosed adults live and forage in adjacent uplands, others live in water year round. The eggs and larvae of amphibians are reliant on surface water for their development. Emergent or shrubby vegetation provides cover from predators and a place of attachment for amphibian egg masses. Low pH waters are less likely to support amphibian breeding habitat. Where pH is sufficiently high, the seasonally flooded fen ecosystems have the potential to support amphibian breeding habitat. These fen wetlands have the potential to provide breeding habitat for two SARA-listed amphibian species, western toad and Great Basin spadefoot toad (See wildlife Section for baseline and effects assessment to these species).

Native anadromous fish require a surface water connection between the wetland complex and their migration channels. Vegetation structure can provide cover from predation and substrate for invertebrates, which serve as a food source. Fen and swamp ecosystems that are connected by surface water to streams supporting anadromous (or resident fish) during seasonally flooded conditions have the potential to provide foraging and rearing habitat for fish. In addition, the potential for wetlands to recharge groundwater that sustains baseflow in streams, or to improve water quality by reducing sediment or metals, contributes to the health and maintenance of downstream fish habitat (see Sections 2.6.1.5 and 2.7.2.5).

Nesting, foraging and staging habitat for wetland-associated birds such as waterfowl, migratory birds and shorebirds is provided by relatively open canopy cover, access to open water, varied vegetation structure (i.e. areas of well-interspersed trees, shrubs and emergent vegetation), presence of snags and proximity to larger lakes or open fields. The fen ecosystems have the potential to provide foraging and nesting habitat for waterfowl and migratory birds due to their areas of open water, aquatic vegetation and emergent vegetation. Muddy portions of the fens provide foraging habitat for shorebird species. The Drummond's willow-Sedge swamp ecosystem has the potential to provide nesting habitat for migratory birds that use riparian areas for this purpose. The structure of the hybrid spruce swamps with relatively open tree canopy and lush herbaceous or graminoid ground cover has the potential to provide nesting and foraging habitat for migratory birds and waterfowl when adjacent to open water features. All of the wetland classes are within close proximity to a large lake and open fields, which increases their potential to provide suitable foraging and staging habitat. Wetlands with the potential to provide habitat for invertebrates and fish also provide foraging habitat for waterfowl due to the presence of these prey species. The fen wetlands and flood prone swamp ecosystems have the potential to provide nesting and foraging habitat for the SARA-listed yellow-breasted chat, rusty blackbird and olive-sided flycatcher. These same wetlands have the potential to provide foraging or staging habitat for the following provincially-listed species of conservation concern known to occur within the RSA: American bittern, Western grebe, red-necked phalarope, and sandhill crane (See wildlife Section for baseline and effects assessment to these species).

Wetland-associated mammals such as beaver, muskrat, mink, and otter rely on exposed mud banks, suitable vegetation species and structure and adequate water depth for denning sites and foraging areas. Bats forage over open water wetlands and nest in snags within wetlands. Vegetation provides forage for some species (e.g., moose, beaver), while invertebrates, fish or amphibians supported by wetlands provide prey for carnivores (e.g. mink, otter). The Drummond's willow-Sedge swamp ecosystem and flood prone swamps have the potential to provide foraging and denning sites for wetland-associated large rodents. The Drummond's willow-Sedge swamp ecosystem contains palatable species for beaver, although it does not contain deep permanent water unless adjacent streams are impounded. The fen wetlands and flood prone swamp ecosystems have the potential to provide nesting and foraging habitat for the fringed myotis, which is a provincially-listed species of conservation concern known to occur within the RSA (See wildlife Section for baseline and effects assessment to these species).

In addition to providing habitat for wetland-associated faunal groups and wildlife species of conservation concern, wetlands often support biodiversity by providing habitat for rare plant species or ecological communities of conservation concern. In this instance, the 2012 mine site is not affecting any wetland communities that are ecological communities of conservation concern. The Water sedge –Beaked sedge fen is known to support the blue-listed plant rare plant species, *Ranunculus pedatifidus ssp afinis*.

Potential Project Effects on Wetland Ecosystems

Table 2.7.2.7-10 provides a comparison of the areal extent of Project effects on wetland ecosystems between the two projects. While the Prosperity Project led to a loss of approximately 404 ha of wetland at post-closure, the New Prosperity leads to the loss of 311 ha of wetlands at post-closure.

Table 2.7.2.7-10 Project Effects to Wetland Ecosystems

Wetland Class	Wetland Ecosystem	RSA at Baseline	2009 Prosperity				2012 New Prosperity			
			Change at Maximum Disturbance (relative to baseline)		Change at Post-closure (relative to baseline)		Change at Maximum Disturbance (relative to baseline)		Change at Post-closure (relative to baseline)	
		Area (ha)	Area (ha)	Percent (%)	Area (ha)	Percent (%)	Area (ha)	Percent (%)	Area (ha)	Percent (%)
Fen	Water sedge - Beaked sedge	743.0	-212.1	-28.6	-151.8	-20.4	-146.4	-19.7	-125.4	-16.9
	Willow - Scrub birch - Sedge	639.3	-226.4	-35.4	-123.7	19.4	-127.8	-20.0	-85.0	-13.3
	Fen Total	*1,382.4*	*-438.6*	*-31.7*	*-275.6*	*-19.9*	*-274.2*	*-19.8*	*-210.3*	*-15.2*
Swamp	Sxw - Horsetail – Crowberry	100.5	-19.0	-18.9	-20.2	-20.1	-73.2	-30.2	-51.2	-21.2
	Sxw - Horsetail - Glow moss	94.6	0.0	0.0	0.0	0.0	-14.5	-14.4	-11.9	-11.9
	Sxw - Horsetail - Meadowrue	2.9	-2.9	-100.0	-0.9	-31.0	0.0	0.0	0.0	0.0
	Sxw - Labrador tea – Willow	3.7	-2.6	-70.3	-2.0	-54.1	-2.9	-100.0	-2.9	-100.0
	Drummond's willow – Sedge	241.9	-77.7	-32.1	-27.8	-11.5	-2.7	-71.1	-2.1	-55.8
	Swamp Total	*443.6*	*-110.4*	*-24.9*	*-50.9*	*-11.5*	*-93.2*	*-21.0*	*-68.1*	*-15.4*
Marsh	Beaked sedge	0.0	0.0	0	2.5	-	0.0	-	0.0	-
	Baltic Rush	0.0	0.0	0	0.6	-	0.0	-	0.0	-
	Marsh Total	*0.0*	*0.0*	*0*	*3.2*	-	*0.0*	-	*0.0*	-
Shrub-Carr	Grey-leaved willow - Glow moss	172.6	-92.2	-53.4	-67.5	-39.1	-38.0	-22.0	-31.8	-18.4
	Shrub-Carr Total	*172.6*	*-92.2*	*-53.4*	*-67.5*	*-39.1*	*-38.0*	*-22.0*	*-31.8*	*-18.4*
Other	Open Water	59.3	-18.1	-30.5	-15.9	-26.8	-1.1	-1.8	-0.8	-1.3
	TRIM Marsh	8.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TRIM Swamp	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other Total	*72.8*	*-18.1*	*-30.5*	*-15.9*	*-26.8*	*-1.1*	*-1.4*	*-0.8*	*-1.1*
Wetland Total		***2,071***	***-659***	***-32***	***-404***	***-19***	***-407***	***-20***	***-311***	***-15***

A total of 311 ha of wetlands; including 210.3 ha of fens, 68.1 ha of swamps and 31.8 ha of shrub-carr wetlands; will potentially be lost following reclamation at post-closure (Table 2.7.2.7-10). For these wetland classes (and ecosystems) the potential to provide wetland functions identified in the baseline conditions pertaining to hydrology, biogeochemistry and habitat are summarized as follows:

Hydrological

- 212.4 ha of the 311 ha of wetlands with potential to provide groundwater recharge (to aquifer or base flow).

Biogeochemical

- 87.1 ha of the 311 ha of wetlands with potential to improve water quality by removing sediment
- 127.5 ha of the 311 ha of wetlands with potential to improve water quality by removing nutrients
- 212.4 ha of the 311 ha of wetlands with the potential to improve wetland quality by removing toxic metals, and
- 210.3 ha of the 311 ha of wetlands with the potential to sequester atmospheric carbon.

Habitat

- 125.4 ha of the 311 ha of wetlands with the potential to provide amphibian breeding habitat, including two potential SARA-listed amphibian species
- 2.1 ha of the 311 ha of riparian swamp with potential to support fish habitat
- 212.4 ha of the 311 ha of wetlands with the potential to support waterfowl habitat
- All 311 ha of wetlands with the potential to support migratory bird habitat, including for three SARA-listed species and 1 provincially-listed species, and
- 124.5 ha of the 311 ha of wetlands with the potential to support shorebird habitat..

Wetland functions in areas outside the footprint of mine site clearing may also be affected by water management activities. Changes to abiotic factors such as ground water elevations, surface water flows, or surface or groundwater chemistry could affect wetland hydrological, biogeochemical and habitat functions, even if clearing, grubbing, and excavation of the mine site do not coincide with these locations. These areas represent additional affects to wetland functions that were not necessarily accounted for in the March 2009 EIS/Application.

Groundwater elevations at post-closure are shown in Section 2.7.2.4A. Where groundwater baseflow is increased, the capacity of these wetlands to attenuate flows or recharge baseflows will be reduced. Where groundwater is drawn down more than 2m, wetland vegetation may not persist (see Section 2.7.2.4.A).

Long term accumulations of metals may not directly affect vegetation, but may affect the potential for adjacent wetlands to provide the biogeochemical function of improving water quality by decreasing metal concentrations (see Section 2.7.2.4A).

Riparian Ecosystems

As outlined in Table 2.7.2.7-11 the areal extent of loss to riparian ecosystems will be less for the New Prosperity Project than the Prosperity Project. With the reconfiguration of the mine site to preserve Fish Lake less riparian area is disturbed by project features. The assessment of effects to riparian ecosystems on fish and fish habitat are discussed in Section 2.7.2.5 (Fish and Fish Habitat) of this assessment.

Effects Assessment Methodology for Riparian Ecosystems

The method used to evaluate the effects to riparian ecosystems, described fully in Section 5.3.3.2 of Volume 5 in the March 2009 EIS/Application, is a spatial overlay of the Project footprint on the baseline mapping of riparian ecosystems. The results of this analysis are represented spatially (Figure X) and as a summary table (Table 2.7.2.7-11)

Change in Riparian Ecosystem Baseline Conditions

Data sources and fieldwork used for characterizing the riparian ecosystem baseline conditions have not changed or been updated since the March 2009 EIS/Application.

Table 2.7.2.7-11 provides a comparison of the area of riparian ecosystems in the Prosperity and New Prosperity Mine Site LSAs at baseline, recognizing that no changes are anticipated in the riparian baseline conditions but the mine site LSA for New Prosperity has changed.

Table 2.7.2.7-11 Baseline Riparian Ecosystems—Mine Site

Biogeoclimatic Unit	**Riparian Feature**	**Mine Site RSA**	**Prosperity Mine Site LSA**	**New Prosperity Mine Site LSA**
		(ha)	(ha)	(ha)
MSxv	TRIM rivers, marshes and swamps	734.9	224.8	232.4
	30 m buffer adjacent to wetland ecosystems	1,113.9	426.1	473.9
SBPSxc	TRIM rivers, marshes and swamps	515.8	121.6	75.1
	30 m buffer adjacent to wetland ecosystems	766.4	275.5	142.4
Total		**3,131**	**1,048**	**924**

See Tables 5-36 and 5-37 of Volume 5 of the March 2009 EIS/Application for the baseline conditions of riparian ecosystems in the transmission corridor and access road, which have not changed since the Prosperity project.

Potential Project Effects to Riparian Ecosystems

Table 2.7.2.7-12 summarizes the differences in project effects on riparian ecosystems from the Prosperity and New Prosperity Projects in the mine site.

Table 2.7.2.7-12 Project Effects on Riparian Ecosystems—Mine Site

Riparian Type	RSA at Baseline	2009 Prosperity				2012 New Prosperity			
		Change at Maximum Disturbance (relative to baseline)		Change at Post-closure (relative to baseline)		Change at Maximum Disturbance (relative to baseline)		Change at Post-closure (relative to baseline)	
	Area (ha)	Area (ha)	Percent (%)	Area (ha)	Percent (%)	Area (ha)	Percent (%)	Area (ha)	Percent (%)
TRIM rivers, marshes and swamps	1,250.8	-321.0	-25.7	-126.8	-10.1	-165.1	-13.2	-100.1	-8.0
30 m buffer adjacent to wetland ecosystems[A]	1,880.4	-674.6	-35.9	-254.4	-13.5	-399.3	-21.1	-232.3	-23.3
Riparian Total	**3,131**	**-996**	**-32**	**-353**	**-11**	**-564**	**-18**	**-332**	**-11**

A. For the 2009 Prosperity EIS, buffers were put on Pit Lake and permanent water features (Diversion Ditches, Sed Ponds and TSF Lake)
For the 2012 New Prosperity EIS, buffers were put on permanent water features (Diversion Ditches, Sed Ponds, TSF Lake)

The New Prosperity maximum disturbance scenario will result in a loss of 564 ha (18%) of riparian ecosystems from baseline conditions in the RSA, compared to the 996 ha (32%) loss due to the Prosperity Project. The New Prosperity post-closure scenario will result in a loss of 332 ha (11%) of riparian ecosystems from baseline conditions in the RSA, compared to the 353 ha (11%) loss due to the Prosperity Project.

See Section 5.3.3.5 and 5.3.3.6 of Volume 5 of the March 2009 EIS/Application for assessment of effects to riparian ecosystems in the transmission line and access road, as there have been no changes to potential effects to this KI between the Prosperity and New Prosperity Projects.

Grassland Ecosystems

As outlined in Table 2.7.2.7-13 the areal extent of loss of grassland ecosystems will be less for the New Prosperity Project than the Prosperity Project.

Effects Assessment Methodology for Grassland Ecosystems

The method used to evaluate loss of grassland ecosystems, described fully in Section 5.3.4.2 of Volume 5 in the March 2009 EIS/Application, is a spatial overlay of the Project footprint on the grassland ecosystem mapping at baseline The results of this analysis are represented spatially (Figure XX) and as a summary table (Table 2.7.2.7-14).

Change in Grassland Ecosystem Baseline Conditions

Table 2.7.2.7-13 provides a comparison of the area of grassland ecosystems in the Prosperity and New Prosperity Mine Site LSAs at baseline, recognizing that no changes are anticipated in the grassland baseline conditions, but the mine site LSA has changed for the New Prosperity Project relative to the Prosperity Project.

Table 2.7.2.7-13 Baseline Grassland Ecosystems—Mine Site

BEC Unit	TEM Map Code	Ecosystem Description	RSA Area (ha)	Prosperity LSA Area (ha)	New Prosperity LSA (ha)
MSxv	DT	Dandelion–Timber oat-grass	1.2	1.2	1.2
	JK	Juniper–Kinnikinnick	2.6	1.7	0.4
	WJ	Bluebunch wheatgrass–Junegrass	10.7	0.0	0.0
SBPSxc	DT	Dandelion–Timber oat-grass	24.8	0.0	0.8
	GA	Grass–Large-leaved avens	4.1	0.0	0.0
	JK	Juniper–Kinnikinnick	357.8	11.7	9.6
Total			**400**	**15**	**12**

Since the March 2009 EIS/Application, the Cariboo Chilcotin Land Use Order (2011) has established spatial boundaries for Grassland Benchmark Areas. As shown on Figure X, there are Grassland Benchmark Areas (GBAs) within the MDA northwest of Fish Lake. The CCLUO says that forest harvesting activities within these areas should aim to facilitate restoration of open grassland conditions.

Table 2.8.2.7-14 summarizes the grasslands and GBAs within the mine site study areas. Although these GBAs do not represent statutory restrictions to Project activities, pursuant to Section 14(5) of the *Mineral Tenures Act*, this information is used as guidance.

Table 2.7.2.7-14 Grassland Benchmark Areas for New Prosperity Mine Site

Study Area	Grassland Ecosystems	GBAs	Grassland Ecosystems within Grassland Benchmark Areas		
	Area (ha)	Area (ha)	Area (ha)	Percent of Grassland (%)	Percent of GBAs (%)
RSA	399.9	649.8	215.8	54.0	33.2
LSA	11.3	92.8	2.3	20.4	2.5
MDA	3.7	69.4	1.6	43.2	2.3

See Tables 5-46 and 5-47 of Volume 5 of the March 2009 EIS/Application for the baseline conditions of grassland ecosystems in the transmission corridor and access road, which have not changed since the Prosperity project.

Potential Project Effects to Grassland Ecosystems

Table 2.7.2.7-15 summarizes the differences in project effects on grassland ecosystems from the Prosperity and New Prosperity Projects in the mine site.

Table 2.7.2.7-15 Project Effects on Grassland Ecosystems—Mine Site

Modelling Sensitivity Group	Grasslands			Area in RSA at Baseline	2009 Prosperity				2012 New Prosperity			
	BEC Unit	TEM Map Code	Site Series Name		Change at Maximum Disturbance (relative to baseline)		Change at Post-closure (relative to baseline)		Change at Maximum Disturbance (relative to baseline)		Change at Post-closure (relative to baseline)	
				Area (ha)	Area (ha)	Percent (%)	Area (ha)	Percent (%)	Area (ha)	Percent (%)	Area (ha)	Percent (%)
4	MSxv	JK	Juniper–Kinnikinnick	2.6	-0.7	-26.92	-0.2	-7.69	-0.4	-16.6	-0.2	-6.1
4	MSxv	WJ	Bluebunch wheatgrass–Junegrass	10.7	0	0	0	0	0.0	0.0	0.0	0.0
4	SBPSxc	DT	Dandelion–Timber oat-grass	24.8	0	0	0	0	0.0	0.0	0.0	0.0
3	SBPSxc	GA	Grass–Large-leaved avens	4.1	0	0	0	0	0.0	0.0	0.0	0.0
4	SBPSxc	JK	Juniper–Kinnikinnick	0.5	-0.5	-100	-0.5	-100	0.0	0.0	0.0	0.0
4	SBPSxc	JK	Juniper–Kinnikinnick	357.3	-8.2	-2.29	-6.8	-1.9	-3.3	-0.9	-2.4	-0.7
Total area of Juniper-Kinnikinnick Grasslands				**360.4**	**-9.4**	**-2.61**	**-7.5**	**-2.08**	**-3.7**	**-1.0**	**-2.6**	**-0.7**
Total area of all grasslands				***400***	***-9***	***-2***	***-8***	***-2***	***-4***	***-1***	***-3***	***-1***

The New Prosperity mine site maximum disturbance scenario will result in a loss of 4 ha (1%) of grassland ecosystems from baseline conditions in the RSA, compared to the 9 ha (2%) loss due to the Prosperity Project. The New Prosperity post-closure scenario will result in a loss of 3 ha (1%) of grassland ecosystems from baseline conditions in the RSA, compared to the 8 ha (2%) loss due to the Prosperity Project. See Sections 5.3.4.5 and 5.3.4.6 of Volume 5 of the March 2009 EIS/Application for assessment of effects to grassland ecosystems in the transmission line and access road.

Rare Plants

As outlined in Table 2.7.2.7-17, the areal extent of loss to rare plants will be less for the New Prosperity Project than the Prosperity Project. .

Effects Assessment Methodology for Rare Plants

The method used to evaluate the effects to rare plants, described fully in Section 5.3.5.2 of Volume 5 in the March 2009 EIS/Application, is a spatial overlay of the Project footprint on the baseline mapping of rare plant locations. The results of this analysis are represented spatially (Figure X) and as a summary table (Table 2.7.2.7-17). The EIS Guidelines include assessment of Red and Blue listed species following the BC Conservation Data Centre (CDC) listings, so these listings are updated from the March 2009 EIS/Application. The prior Panel Report found that none of the rare plants identified in, or potentially occurring in, the Project study area are listed on Schedule 1 of the Species at Risk Act (SARA). As such, rare plants were not discussed in the panel report but are discussed here.

Change in Rare Plant Baseline Conditions

The Vascular and Non-Vascular Plant Species List (Appendix 5-5-J of Volume 5 of the March 2009 EIS/Application) was compared against the current BC CDC (2012) listings for vascular and non-vascular plants to determine if there have been any changes to the conservation status of the plant species recorded in the Project area. No previously unlisted species is now considered rare. Of the four rare plants reported in the Prosperity Project areas in the March 2009 EIS/Application, two previously on the Blue List are no longer rare and one has been downlisted from Red to Blue, as summarized in Table 2.7.2.7-16. As in 2009, none of these species is listed by the *Species at Risk Act* (SARA).

Table 2.7.2.7-16 Rare Plant Listing Update

Species	2009 List	2012 List	Location
Arabis holboellii	Blue	--	Access Road
Drepanocladus longifolius	Blue	--	Mine Site
Ranunculus pedatifidus ssp afinis	Blue	Blue	Mine Site
Schistidium heterophyllum	Red	Blue	Mine Site

Because of the changes to the mine site LSA for New Prosperity, as well as the changes to the BC CDC listings, there are now fewer occurrences of rare plants within the mine site LSA. See Table 2.7.2.7-17 for a summary of rare plants in the Prosperity and New Prosperity mine site LSAs and MDAs following current CDC listings (BC CDC, 2012).

Table 2.7.2.7-17 Rare Plant Occurrences within the Mine Site LSA

Rare Plant Species	Plot Number	BEC Unit	Prosperity Mine Site		New Prosperity Mine Site	
			LSA	MDA	LSA	MDA
Ranunculus pedatifidus ssp. affinis	108	SBPSxc	Yes	Yes	Yes	No
	171	SBPSxc	Yes	Yes	Yes	Yes
	190	SBPSxc	Yes	Yes	Yes	Yes
	TRP102	SBPSxc	Yes	Yes	Yes	Yes
	TRP108	SBPSxc	Yes	Yes	No	No
	TRP110	SBPSxc	Yes	Yes	No	No
	TRP118	SBPSxc	Yes	Yes	No	No
Schistidium heterophyllum	TRP105	MSxv	Yes	Yes	Yes	Yes

Based on the changes to the BC CDC listings, there are now no rare plants in the access road, and there are still no rare plants in the transmission corridor.

Potential Project Effects to Rare Plants

The New Prosperity Project has the potential to affect three occurrences of birdfoot buttercup (*Ranunculus pedatifidus ssp. affinis*) and one occurrence of the blue listed moss *Schistidium heterophyllum*..

Project effects on rare plants due to the New Prosperity Project are less than those predicted in the March 2009 EIS/Application due to changes to the BC CDC listings and Project design.

Ecological Communities of Conservation Concern

As outlined in Table 2.7.2.7-19, effects to ecological communities of conservation concern will be less for the New Prosperity Project than the Prosperity Project.

Effects Assessment Methodology for Ecological Communities of Conservation concern

The method used to evaluate the effects to ecological communities of conservation concern, described fully in Section 5.3.6.2 of Volume 5 in the March 2009 EIS/Application, is a spatial overlay of the Project footprint on the baseline mapping of ecological communities of conservation concern. The results of this analysis are represented spatially (Figure X) and as a summary table (Table 2.7.2.8.2-18) The EIS Guidelines include assessment of Red and Blue listed communities following the BC Conservation Data Centre (CDC) listings, so these listings are updated from the March 2009 EIS/Application. The prior Panel Report found that ecological communities of conservation concern were not raised as key issues during the panel review, and they were therefore not discussed in the panel report.

Change in Ecological Community of Conservation Concern Baseline Conditions

Appendix 5-5-E and Tables 5-11, 5-12 and 5-13 in Volume 5 of the March 2009 EIS/Application present all the ecological communities identified in the Project area. These communities were compared against the current BC CDC listings for rare ecological communities to determine if there have been any changes to the conservation status of the communities recorded in the Project area.

There have been no changes to the BC CDC listings for any of the communities identified in the mine site LSA or the access road RSA.

Table 2.7.2.7-18 summarizes the changes to the BC CDC listings in the transmission line RSA. Three of the ecological communities of conservation concern within the transmission line RSA have been downlisted: one from Red to Blue, and two from Blue to unlisted. The Baltic rush-common silverweed community was erroneously omitted from the 2009 Prosperity EIS, and continues to be Red listed.

Table 2.7.2.7-18 Rare Ecosystem Listing Update

Map Code	Rare Ecological Community	BEC classification	2009	2012	Area in Transmission Line RSA	Area in Transmission Line ROW
SS	Hybrid white spruce - Prickly rose - Palmate coltsfoot	IDFxm/08	Red	Blue	42.7	1.2
DR	Douglas-fir - Ricegrass - Step moss	IDFxm/06	Blue	_	1.5	0.0
DJ	Douglas-fir - Rocky Mountain juniper - Saskatoon	IDFdk4/03	Blue	_	23.2	0.3
RM	Baltic Rush-Common silverweed*	IDFdk3/Wm07 IDFdk4/Wm07	Red	Red	4.8	0.0
*this community was unintentionally omitted from the list of rare ecosystems in 2009						

Potential Project Effects to Ecological Communities of Conservation Concern

Effects to ecological communities of conservation concern within the mine site are less than those reported in the 2009 Prosperity EIS due to the changes in the Project design at the mine site, decreasing the area of disturbance.

Table 2.7.2.7-19 summarizes the differences in project effects on ecological communities of conservation concern from the Prosperity and New Prosperity Projects in the mine site.

Table 2.7.2.7-19 Project Effects on Ecological Communities of Conservation Concern—Mine Site

Relative Conservation Status	Rare Ecosystems			RSA at Baseline	2009 Prosperity		2012 New Prosperity	
	BEC Unit	TEM Map Code	Site Series Name		Change at Maximum Disturbance (relative to baseline)		Change at Maximum Disturbance (relative to baseline)	
				Area (ha)	Area (ha)	Percent (%)	Area (ha)	Percent (%)
Red-listed (high)	MSxv/05	LT	Lodgepole pine–Trappers tea–Crowberry	342.3	-6.7	-2.0	-4.4	-1.3
Blue listed (moderate)	SBPSxc/06	SM	White spruce-horsetails-western meadowrue	94.6	0	0	0.0	0.0
Total				**437**	**-7**	**-2**	**-4**	**-1**

NOTE:
No post-closure scenario for ecological communities of conservation concern is provided because it is assumed that these ecosystem types cannot be reliably re-established through reclamation treatments.

The New Prosperity maximum disturbance scenario will result in a loss of 4 ha (1%) of ecological communities of conservation concern from baseline conditions in the RSA, compared to the 7 ha (2%) loss due to the Prosperity Project.

As shown in Table 2.7.2.7-18, the transmission line ROW affects two of the communities with updated listings by the BC CDC: the SS map code and the DJ map code. Both of these have been downlisted, one from red listed to blue listed, the other from blue listed to unlisted. As such, effects to ecological communities of conservation concern within the transmission corridor for the New Prosperity Project are less than those predicted for the Prosperity Project.

Effects to ecological communities of conservation concern within the access road have not changed since the March 2009 EIS/Application, and are summarized in Section 5.3.6.5 of Volume 5 of that report.

Country Food Plants

Country food plants were not addressed in the 2009 Prosperity EIS, but were considered in the supplemental report entitled, "Local and Regional Environmental Effects on Wildlife and Vegetation Resources of Importance to the Tsilhqot'in National Government at the Proposed Mine Site" (Taseko, 2009). The 2012 New Prosperity EIS Guidelines include the assessment of potential effects of the Project on vegetation species known to be important to Aboriginal groups, and specific country foods identified by local and Aboriginal groups as being important. As such, they are included in this KI. As shown in Table 2.7.2.7-4, predicted effects to country food plants are anticipated through vegetation loss due to clearing for the mine site and access road and through changes to plant community structure and composition through clearing for the transmission line corridor.

Effects Assessment Methodology for Country Food Plants

The effects assessment methods for country food plants will be the same as those used in the 2009 Supplemental report. This includes:

- A matrix linking plant species of importance to the TNG with the vegetation effects assessment KIs presented in the March 2009 EIS/Application, and
- Predictions of direct vegetation loss from the mine site area using spatial contexts relevant to the TNG. Two study areas were chosen: the Eastern Trapline Area as defined in the William's Case and the mine site RSA.

In addition, effects are assessed by looking at known occurrences of country food plants in the Project area.

Change in Country Food Plants Baseline Conditions

The Tsilhqot'in National Government provided a list of 52 important plant species (Taseko, 2009x). This list was compared against the list of all species recorded in the Project area during surveys (Appendix 5-5-E of Volume 5 of the March 2009 EIS/Application) to determine which of the country foods of importance to the TNG were identified in the Project area at baseline, as summarized in Table 2.7.2.7-20. Eighteen of these species were found during vegetation surveys in support of the 2009 Prosperity EIS. It is important to note that not reporting a species in the Project area does not mean that it does not occur there.

Table 2.7.2.7-20 Country Food Plant Species

Species	Mine	Transmission	Road
Agoseris glauca		x	x
Alnus tenuifolia (Alnus viridus)			x
Anemone multifida	x	x	x
Aquilegia formosa	x	x	x
Arnica cordifolia	x	x	x
Astragalus miser	x	x	x
Castellija miniata	x	x	
Eleagnus commutata			x
Fragaria virginiana	x	x	x
Medicago sativa		x	x
Mentha arvensis		x	x
Nuphar polysepalum	x		
Ribes hudsonianum			x
Ribes lacustre	x	x	x
Rubus arcticus	x	x	x
Rubus idaeus	x	x	x
Vaccinium caespitosum	x	x	x
Zygadenus venenosus		x	x
An “x” indicates the species was found within the given Project area.			

The potential for country foods were previously assessed through linkages to the KIs of old forest, wetland, riparian and grassland ecosystems.

Potential Project Effects to Country Food Plants

The potential effects to country foods were assessed in the 2009 Supplemental Report through linkages to the KIs of old forest, wetland, riparian and grassland ecosystems. See above for a summary of changes to project effects for these KIs since the March 2009 EIS/Application.

The potential effects to country foods were also assessed in the 2009 Supplemental Report by looking at areas of direct vegetation loss. See Table 2.7.2.7-21 for a comparison of the Prosperity and New Prosperity Projects for changes to direct vegetation loss in the mine site. There have been no changes in the areas of direct vegetation loss for the transmission line and access road between the Prosperity and New Prosperity Projects.

Table 2.7.2.7-21 Project Effects on Country Foods through Direct Vegetation Loss—Mine Site

Biogeoclimatic Unit	RSA at Baseline	2009 Prosperity		2012 New Prosperity	
		Change at Maximum Disturbance (relative to baseline)		Change at Maximum Disturbance (relative to baseline)	
	Area (ha)	**Area** (ha)	**Percent** (%)	**Area** (ha)	**Percent** (%)
SBPSxc	8,998	-2,414	-26.8	-494	-22.1
MSxv	9,258	-705	-7.6	-2044	-5.5
Total	18,267	-3,119	-17.1	-2,539	-13.9

The potential loss of country food plants is also considered by looking at known locations of country food plant species. Table 2.7.2.7-22 summarizes the sites where country food plant species were recorded during baseline field surveys, and determines where they fall relative to the 2009 and 2012 mine site MDAs.

Table 2.7.2.7-22 Project Effects through Loss of Sites Potentially Supporting Country Food Plants—Mine Site

Common Name	Scientific Name	Percent Cover	Baseline Survey Site	2009 Prosperity mine site MDA	2012 New Prosperity mine site MDA
Pacific anemone	*Anemone multifida*	20	HINV26/TRP123	x	x
		30	HRP27/TRP107		
Red columbine	*Aquilegia formosa*	3	HRP23	x	x
Heart-leaved arnica	*Arnica cordifolia*	20	HRP27/TRP107		
Timber milkvetch	*Astragalus miser*	20	HRP27/TRP107		
		NA	HRP30/TRP109	x	
Paintbrush	*Castellija miniata*	5	HRP25/TRP102	x	x
		10	HRP33		x
		NA	HRP34	x	x
Blueleaf wild strawberry	*Fragaria virginiana*	5	HR21/TRP110	x	
		5	HRP25/TRP102	x	x
		20	HINV26/TRP123	x	x
		20	HRP27/TRP107		
		NA	HRP28/TRP111		
		NA	HRP33		x
		NA	HRP34	x	x
		NA	HRP36	x	x
Yellow pond-lily	*Nuphar polysepalum*	NA	HR21/TRP110	x	
Swamp gooseberry	*Ribes lacustre*	5	HRP36	x	x
Dwarf mountain blueberry	*Vaccinium caespitosum*	NA	HRP33		x
		NA	HRP34	x	x
An “x” indicates that the site occurs within the indicated MDA.					

As shown in Table 2.7.2.7-22, the loss of sites recorded as supporting country food plants is roughly the same for both Prosperity and New Prosperity as both lead to the potential loss of 13 occurrences of country food species but at slightly different baseline survey sites.

Vegetation Mitigation Measures

Mitigation measures proposed in Volume 5, Section 5 of the March 2009 EIS/Application for vegetation resources and in the 2009 Supplemental Report will all still apply. In addition, mitigation measures identified in the EAO Assessment Report and Table of Commitments identified below will apply. Measures include a wildlife habitat compensation plan which will compensate for any residual adverse effects following the implementation and evaluation of mitigation measures.

Mitigation measures relating to vegetation resources on the mine site included in the EAO Assessment Report and associated Table of Commitments for EAC M09-02 for the Prosperity Gold-Copper Project, as issued January 14, 2010 were as follows:

- Mitigation measures to protect and conserve wetlands in close proximity to the mine footprint, including minimizing disturbance, avoiding vegetation loss, mitigating against invasive species, and maintaining natural drainage patterns (commitment 12.2)
- Mitigation for the [previously] red-listed moss *Schistidium heterophyllum* includes movement of the boulders on which the moss grows. [Note: this species is blue-listed as of March 31, 2011.]
- Implement an invasive plant management plan (commitment 12.6)
- Mitigate residual effects of mining with respect to wildlife habitat, at-risk plant communities, and the habitat of species at risk through reclamation approach as described in the decommissioning plan (commitment 13.5)
- Employ BMP throughout all Project phases and activities. In particular, prior to construction commencing, undertake all appropriate measures to ensure that sensitive habitat features are identified and all appropriate mitigative measures are implemented to avoid adverse effects (commitment 14.1)
- Identify and quantify Project effects on vegetation at a local level on a scale that enables identification of appropriate mitigation or compensation measures (commitment 14.4), and
- Assess the suitability of reclaimed sites for wildlife use through trace element monitoring in vegetation (commitment 16.3).

Taseko's response to the previous Panel recommendations concerning mitigation measures related to vegetation is detailed in Section 2.10 of this EIS. There are no additional mitigation measures considered necessary or appropriate for New Prosperity.

Cumulative Effects Assessment

As described in Section 2.7.1, cumulative environmental effects were only assessed if all three of the following conditions were met for the environmental effect:

- The Project results in a measurable, demonstrable or reasonably-expected residual environmental effect on a component of the environment
- The Project-specific residual environmental effect does, or is likely to, act in a cumulative fashion with the environmental effects of other past or future projects and activities that are likely to occur, and
- There is a reasonable expectation that the Project's contribution to cumulative environmental effects will affect the viability or sustainability of the resource or value.

The Project inclusion list (Table 2.7.1.4-1) identifies past, present and reasonably foreseeable projects and activities that could interact cumulatively with the Project. The locations of each of the 22 projects and activities are shown on Figure 2.7.1.4-1. As indicated in Table 2.7.1.4-1, eight of these project and activities are new since 2009. In addition, there is more existing disturbance at baseline as the result of logging. Of the eight new projects, only one, the Newton Mountain mine development, is located west of the Fraser River and, therefore, considered potentially able to interact cumulatively with the Project's residual effects on vegetation.

For vegetation, the first two conditions are met; that is, there are Project-specific residual effects on vegetation and these effects could, or are likely to, interact cumulatively with past, present and reasonably foreseeable projects and activities. With respect to the third condition, in the March 2009 EIS/Application it was concluded that for each of the vegetation key indicators the Project's contribution to cumulative effects would not affect either the viability or sustainability of the vegetation resource. The predicted residual effects on the vegetation key indicators for New Prosperity have decreased relative to 2009, and although the amount of existing disturbance (logging) has increased and the Newton Mountain mine development has the potential to interact cumulatively with the Project's residual effects on vegetation it is concluded that the viability or sustainability of the resource would not be affected.

Determination of the Significance of Residual Effects

The assessment methodology for residual effect characterization and determination of significance is as described in Section 2.7.1.5.

The findings of the Project residual effects assessment for vegetation for New Prosperity are summarized in Table 2.7.2.7-23. The rationale for the significance determinations are as follows:

- For non-pine old growth forests although the magnitude is moderate and the area is presently relatively undisturbed and the effect is long term, with implementation of the mitigation measures as detailed in the March 2009 EIS/Application, the conclusion is that the environmental effects are not significant because the effect is local, occurs once and is reversible.
- For wetland ecosystems, although the magnitude is moderate and the effect is far future or permanent and irreversible, with implementation of the mitigation measures as detailed in the March 2009 EIS/Application including the Habitat Compensation Plan, the conclusion is that the environmental effects are not significant because the effect is local and occurs only once.
- For riparian ecosystems, although the magnitude is moderate and the effect is far future or permanent and irreversible, with implementation of the mitigation measures as detailed in the March 2009 EIS/Application including the Fish and Fish Habitat and the Habitat Compensation Plan, the conclusion is that the environmental effects are not significant because the effect is local and occurs only once.
- For grassland ecosystems, given that magnitude is low and the effect is medium term, occurs once and is local and reversible, with implementation of the mitigation measures as detailed in the March 2009 EIS/Application including the Habitat Compensation Plan, the conclusion is that the environmental effects are not significant.
- For rare plants, given the changes to the BC CDC listings and the finding that there is potential for only three occurrences of blue listed buttercup and one occurrence of blue listed moss within the Prosperity MDA and given that although any effect would be far future or permanent and irreversible, with implementation of the mitigation measures as detailed in the March 2009 EIS/Application including the Habitat Compensation Plan, the conclusion is that the environmental effects are not significant because the effect is site specific, and occurs once.
- For ecological communities of conservation concern, although the effect is far future or permanent and irreversible, given that the magnitude is low and occurs only once, with implementation of the mitigation measures as detailed in the March 2009 EIS/Application including the Habitat Compensation Plan, the conclusion is that the environmental effects are not significant.
- For Project effects on country foods, although the magnitude is high and the effect is medium term, with implementation of the mitigation measures as detailed in the March 2009 EIS/Application including the Habitat Compensation Plan, the conclusion is that the environmental effects are not significant because the effects are local, occur once and are reversible.

Table 2.7.2.7-23 Project Residual Effects Assessment Summary for Vegetation for New Prosperity

Potential Environmental Effect: Loss of Vegetation KI	Proposed Mitigation/Compensation Measures	Residual Effects Characterization						Significance	Prediction Confidence
		Direction	Magnitude	Geographical Extent	Duration/ Frequency	Reversibility	Ecological Context		
Old Forest	Protect existing non-pine old and mature forest Implement reforestation measures described in the Reclamation Plan. Remove any green felled or wind thrown spruce from the site to avoid build-up of spruce bark beetle populations Notify MOFR of outbreaks of mountain pine beetle, do not remove "green attack" trees from site except under MOFR direction	A	Moderate (Post-closure loss of 153 ha non-pine old forest; 23%)	L	MT/ R	R	U	N	H
Wetland Ecosystems	Avoid vegetation loss Minimize disturbance Mitigate against invasive species Maintain natural drainage patterns Develop a compensation plan following the draft Habitat Compensation Framework	A	Moderate (Post-closure loss of 311 ha; 15%)	L	LT/R	I	U	N	H
Riparian Ecosystems	Avoid vegetation loss Minimize disturbance Mitigate against invasive species Reduce windthrow risk Protect forest health Maintain natural drainage patterns Develop a compensation plan following the draft Habitat Compensation Framework	A	Moderate (Post-closure loss of 332 ha; 11%)	L	LT/R	I	U	N	H
Grassland Ecosystems	Avoid vegetation loss and site disturbance Mitigate against invasive species by following the Invasive Plant Management Plan (Appendix 2.8.x)	A	Low (Post-closure loss of 3 ha; 1%)	L	MT/ R	R	U	N	H
Rare Plants	The blue-listed birdfoot buttercup occurs in wetlands habitats; therefore, follow all mitigation measures for wetland and riparian ecosystems. Avoid vegetation loss Share locations of rare plants with other agencies	A	Low (3 occurrences of one blue-listed species and one	S	FF/R	I	U	N	L

	Minimize disturbance Mitigate against invasive species Transplant boulders on which *Schistidium heterophyllum* occurs		occurrence of another blue-listed species)							
Ecological Communities of Conservation Concern	Avoid vegetation loss Minimize disturbance Reduce windthrow risk Mitigate against invasive species Protect forest health Maintain natural drainage patterns	A	Low (Maximum disturbance loss of 4 ha; -1%)	L	FF/R	I	U	N	H	
Country Food Plants	Avoid vegetation loss Minimize disturbance Mitigate against invasive species	A	High (Maximum disturbance loss of 2,539 ha; 13.9%)	L	MT/ R	R	U	N	M	

KEY *Direction*: P Positive N Neutral A Adverse *Magnitude:* Defined for each KI individually. In general: L Low–environmental effect occurs that may or may not be measurable, but is within the range of natural variability. *M* Moderate–environmental effect occurs, but is unlikely to pose a serious risk or present a management challenge. *H* High–environmental effect is likely to pose a serious risk or present a management challenge.	*Geographic Extent:* S Site-specific L Local R Regional *Duration:* ST: Short term MT: Medium Term LT: Long Term FF: Far Future or Permanent.	*Frequency:* R Rare - Occurs Once I Infrequent - Occurs sporadically at irregular intervals F Frequent - Occurs on a regular basis and at regular intervals C Continuous *Reversibility:* R Reversible I Irreversible *Ecological Context:* U Undisturbed: Area relatively or not adversely affected by human activity D Developed: Area has been substantially previously disturbed by human development or human development is still present N/A Not applicable.	*Significance:* S Significant N Not Significant *Prediction Confidence:* Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation L Low level of confidence M Moderate level of confidence H High level of confidence

Table 2.7.2.7-24 provides a concise summary of the effects assessment for vegetation.

Table 2.7.2.7-24 Summary of Effects Assessment for Vegetation

Effects Assessment	Concise Summary
Beneficial and Adverse Effects	The New Prosperity Project has redesigned the mine site layout to include the conservation of Fish Lake and associated riparian habitat and a smaller maximum disturbance area. This is expected to reduce vegetation loss for all vegetation KIs
Mitigation and Compensation Measures	A wide variety of methods for avoiding and/or mitigating potential environmental effects have been proposed for project-related activities, include both KI specific and general vegetation mitigation measures (see Table x). A draft Habitat Compensation Reference Document has been developed which addresses vegetation-related compensation planning; see Appendix 2.7.1.3 – A.
Potential Residual Effects	Several residual effects on vegetation resources are predicted. See Table X for a full summary of project residual effects. The Project is expected to have high residual effects on riparian ecosystems; 411 ha (13%) of riparian ecosystems within the RSA are expected to be lost. We predict a high residual effect on rare plants, with 3 of 16 occurrences of *Ranunculus pedatifidus ssp. affinis* lost. A moderate residual effect is expected on ecological communities of conservation concern, with 4 ha (1%) lost.
Cumulative Effects	Twenty-two past, present or reasonably foreseeable projects were identified and assessed for potential cumulative effects with residual effects of the Project. The predicted residual effects on the vegetation key indicators for New Prosperity have decreased relative to 2009, and although the amount of existing disturbance (logging) has increased and the Newton Mountain mine development has the potential to interact cumulatively with the Project's residual effects on vegetation it is concluded that the viability or sustainability of the resource would not be affected.
Determination of the significance of residual effects	The combined residual environmental effect of the Project on the sustainability of the vegetation resource is predicted to be not significant. This assessment is predicated on the implementation of proposed mitigation and the development of appropriate compensation measures.
Likelihood of occurrence for adverse effects found to be significant	As no significant residual effects are predicted, there is no likelihood of occurrence. There is the possibility that the prediction of significant adverse effects is incorrect, whereby an adverse effect deemed to be not significant may have an adverse effect. The likelihood of this remains low.

Table 2.7.2.7-24 presents the summary of effects assessment for vegetation. Considering the updated findings of the Project, mitigation measures, and cumulative residual effects on vegetation presented in this document, the overall significance determination for the New Prosperity Project, including all three major components (mine site, access road, transmission line), is unchanged from 2009. That is, the effect of the Project on the viability and sustainability of the vegetation resource is considered to be not significant.

Additional Work

No additional work is proposed as part of this environmental assessment.

Follow-up and Monitoring

Follow up and monitoring will be required to:

- Determine the extent of effects requiring compensation (wetland KI), and
- Determine whether there are changes to wetland functions due to changes in soil moisture conditions in areas where groundwater levels are predicted to change.

2.7.2.8 Wildlife

This section describes the procedures undertaken to assess any potential environmental effects and associated mitigation and compensation measures for wildlife resources within the region in regards to the changes for the New Prosperity Project.

This section identifies how the Project has changed from the previous project proposal and whether changes would result in changes to the environmental effects previously predicted on wildlife. An assessment of wildlife and wildlife habitat, as outlined in the EIS Guidelines and listed in Table 2.7.2.7-2 has been completed.

Scope of Assessment

This section outlines the scope of the assessment of potential environmental effects of the New Prosperity Project on wildlife and wildlife habitat. The scope of the assessment is solely regarding changes from the Prosperity Project based on the New Prosperity Mine Development Plan, and is completed in accordance with the New Prosperity EIS Guidelines. Regulatory changes that have occurred since the March 2009 EIS/Application are considered. The results of the assessment of Project and cumulative effects on wildlife are summarized and the approach for mitigation, monitoring and follow-up related to wildlife issues are presented.

The Project activities and physical works for New Prosperity are presented in Table 2.7.2.8-1. This table shows whether each activity or physical work has changed from the original Prosperity submission, and whether there are any applicable statutory regulatory changes related to the Project activities. The physical activities/physical works with a “Y” in either Changes in Project Design or Changes in Regulatory Requirements are indicated in white in Table 2.7.2.8-1 and are carried forward as potential effect mechanisms for consideration in the environmental effects scoping in the following section. Project activities or physical works identified with an “N” in both of these columns are not carried forward in this wildlife and wildlife habitat assessment, and are greyed out.

Table 2.7.2.8-1 Project Components, Features and Activities Changed from Previous Project Proposal

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Construction and Commissioning		
Open Pit – Preproduction	N	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Non-PAG waste stockpile	Y	Location and timing only Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
PAG Stockpile	Y	Still subaqueous in TSF; just TSF location changed Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Non-PAG Overburden Stockpile	Y	Location only Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Ore Stockpile	N	
Primary Crusher	N	
Overland conveyor	N	
Fisheries compensation works construction	Y	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Water Management Controls and Operations	Y	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Construction sediment control	Y	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Access road construction and upgrades	N	
Camp construction	N	In mine site Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Site clearing (clearing and grubbing)	Y	Different areas related to moving of TSF, stockpiles, etc. Additional species w/in Project area listed under federal SARA since the Prosperity

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
		EIS (2009).
Soils handling and stockpiling	Y	Includes overburden removal Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Plant site and other facilities	N	Not emissions; not location Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Explosives Plant	N	
Lake dewatering	Y	Only Little Fish Lake Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Fish Lake Water Management	Y	Management of inflows and outflows Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Starter dam construction	Y	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Sourcing water supplies (potable, process and fresh)	Y	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Site waste management	N	
Clearing of transmission line ROW	N	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Construction/Installation of transmission line	N	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Vehicular traffic	Y	2km more road requires more and larger trucks Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Concentrate load-out facility near Macalister (upgrades to site)	N	
Operations		
Pit Production	N	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Site clearing (clearing and grubbing)	N	
Soils handling and stockpiling	N	
Crushing and conveyance	N	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Ore processing and dewatering	N	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Explosive handling and storage	Y	Location only Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Tailing storage	Y	Location changed Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Non-PAG waste stockpile	Y	Location and timing only Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
PAG Stockpile	Y	Still subaqueous in TSF; just TSF location changed Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Overburden Stockpile	Y	Combined with Non-PAG (i.e. location and timing) Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Ore Stockpile management and processing	Y	Location only Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Potable and non-potable water use	N	
Site drainage and seepage management	Y	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Water Management Controls and Operation	Y	Includes management of flows in and out of Fish Lake Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Wastewater treatment and discharge (sewage, site water)	N	
Water release contingencies for extended shutdowns (treatment)	N	
Solid waste management	N	
Maintenance and repairs	N	
Concentrate transport and handling	N	
Vehicle traffic	Y	PAH NO_x; within mine site only Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Transmission line (includes maintenance)	N	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Pit dewatering	N	
Fisheries Compensation works operations	Y	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Concentrate load-out facility near Macalister	N	
Closure		
Water Management Controls and Operation	Y	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Fisheries Compensation Operations	Y	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Site drainage and seepage management	Y	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Reclamation of ore stockpile area	Y	Location only Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Reclamation of Non-PAG waste rock stockpile	Y	Location only Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Tailing impoundment reclamation	Y	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Pit lake and TSF Lake filling	Y	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Plant and associated facility removal	N	
Road decommissioning	N	
Transmission line decommissioning	N	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Post-closure		
Discharge of tailing storage facility water	Y	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Discharge of pit lake water	N	Into lower fish creek
Seepage management and discharge	Y	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).
Ongoing monitoring of reclamation	Y	Additional species w/in Project area listed under federal SARA since the Prosperity EIS (2009).

The Project descriptions for the activities listed above that have not changed since 2009 can be found in Project Description and Scope, Volume 3, Sections 6 and 8, and Additional Requirements Pursuant to CEAA, Volume 9, Section 2, of the March 2009 EIS/Application. Project activities and works that have changed since the March 2009 EIS/Application are described in Section 2.2.3.

Regulatory Changes (since Prosperity)

Statutes applicable to the March 2009 EIS/Application, as identified in Volume 5, Section 6.1.1, and still applicable to the New Prosperity Project include:

- Federal Species at Risk Act (SARA)
- Federal Migratory Birds Convention Act
- BC Wildlife Act
- BC Weed Control Act
- BC Fisheries Act
- BC Mines Act, and
- BC Forest and Range Practices Act.

There have been four additional species designated as SARA Schedule 1 since the submission of the March 2009 EIS/Application (2009): Band-tailed pigeon, Common nighthawk, Olive-sided flycatcher and Rusty blackbird. These species were previously identified at the provincial level as being of species of concern and were assessed within the March 2009 EIS/Application (Section 6.1.3.1, Table 6-4).

Additional guidance on interpretation of regulatory changes includes the federal Environmental Code of Practice for Metal Mines (2009) containing recommended practices within a wildlife context for environmental management including; waste management, access road planning, ambient noise limitations for mining operations and additional phase-specific mining activities. The report Addressing Species at Risk Act Considerations under the Canadian Environment Assessment Act for Species under the Responsibility of the Minister responsible for Environment Canada and Parks Canada (SARA-CEAA Guidance Working Group Canada, 2010) provides guidance on the integration of species at risk considerations within the EIA process.

Changes as a Result of New Prosperity EIS Guidelines

The scope of the New Prosperity Guidelines focuses on aspects of the Project that have changed or are new from the March 2009 EIS/Application. Based on the New Prosperity EIS Guidelines, this assessment will:

- Identify how wildlife-related commitments, mitigation measures and recommendations that were made as part of the 2009/2010 provincial and federal review were incorporated into the Project design (including the July 2010 Panel Report).
- Identify how the Project has changed from the previous proposal and whether design updates will result in alterations to the effects on wildlife key indicators.
- Evaluate the need for developing a management strategy for potential human-bear and human-wolf conflicts.
- Assess the potential effects of the Project on wetland habitat with specific consideration of migratory birds, SARA-listed species and COSEWIC-listed species.
- Propose compensation measures for adverse residual effects on wildlife, wildlife habitat, and habitat for species at risk.
- Address issues related to species at risk which are potentially affected by the Project, including any species added to Schedule 1 of SARA and COSEWIC-listed species since the 2009/2010 review (see Section 2.1.4).
- Re-evaluate potential effects for wildlife based on Project changes and cumulative effects including any new information on reasonably-foreseeable projects or activities within the study areas (with a focus on Grizzly bears and waterfowl).

Key Changes and Issues

The critical project change related to wildlife for the New Prosperity Project is related to the redesign of the mine site. The mine footprint has been retracted and redesigned to accommodate the preservation of Fish Lake and surrounding riparian and wetland habitat.

The key issue for wildlife and wildlife habitat associated with the Project remains the potential for effects on biodiversity at the species, community/ecosystem and landscape level.

The interaction of the Project with wildlife may result in four potential effects on wildlife and wildlife habitat (March 2009 EIS/Application, Section 6.1.2):

- Effects on habitat availability—resulting from direct habitat loss or alteration, and/or indirect loss or alteration from sensory disturbance (e.g., noise, human activity), and reduction of habitat patch size (i.e., increased habitat fragmentation).
- Disruption of movement patterns—resulting from increased habitat/landscape fragmentation (e.g., increased density of access corridors, increased cleared area) or higher road use levels limiting daily or seasonal wildlife travel.

- Increase in direct mortality risk—resulting from site development, vehicle collisions, transmission lines strikes, increased hunting/poaching, lethal control of problem wildlife, or reduction in secure habitat availability due to habitat fragmentation.
- Reduction in animal health—resulting from contamination of air, soil, water or food sources (vegetation, prey species) or changes in food source abundance/composition.

Physical works and activities identified as having changed due to Project design or regulatory requirements (Table 2.7.2.8-1) have been brought forward to Table 2.7.2.8-2 and given project environmental effects ratings. The following interaction rating criteria were used to determine which of these potential effect mechanisms are to be considered in further in the New Prosperity EIS:

0. Effect on VEC is likely to decrease or stay the same (i.e., no changes to significance conclusions), and there are no required changes to previously proposed mitigation measures, and no additional regulatory requirements have been identified (i.e., from the EAO, Panel, or other applicable regulation). Therefore, no further assessment is warranted.
1. Effect on VEC is likely to decrease or stay the same (i.e., no changes to significance conclusions), but some re-evaluation of effect is required due to changes in project design, proposed mitigation measures, and/or additional regulatory requirements have been identified (i.e., from the EAO or Panel).
2. Effect on VEC is likely to increase; therefore, further assessment is warranted.

Table 2.7.2.8-2 Wildlife Potential Environmental Effects Associated with New Prosperity

Project Activities/Physical Works	Loss or alteration of habitat	Disruption of movement patterns	Increase in direct mortality risk	Reduction in animal health
Construction and Commissioning				
Open Pit – Preproduction	1	0	0	0
Non-PAG waste stockpile	0	0	0	0
PAG Stockpile	0	0	0	0
Overburden Stockpile	0	0	0	0
Fisheries compensation works construction	1	0	0	0
Water Management Controls and Operations	0	0	0	0
Construction sediment control	0	0	0	0
Camp construction	0	0	0	0
Site clearing (clearing and grubbing)	1	0	0	0
Soils handling and stockpiling	0	0	0	0
Construction: plant site and other facilities	0	0	0	0
Lake dewatering	1	0	0	0
Fish Lake Water Management	0	0	0	1
Starter dam construction	0	0	0	0
Sourcing water supplies (potable, process/TSF)	0	0	0	0
Clearing of transmission line ROW	1	0	0	0
Construction/Installation of transmission line	1	0	0	0
Vehicular traffic	0	0	0	0
Operations				
Pit Production	1	0	0	0
Crushing and conveyance	1	0	0	0
Ore processing and dewatering	1	0	0	0
Explosive handling and storage	0	0	0	0
Tailing storage	0	0	0	0
Non-PAG waste stockpile	0	0	0	0
PAG Stockpile	0	0	0	0
Overburden Stockpile	0	0	0	0
Ore Stockpile management and processing	1	0	0	0
Site drainage and seepage management	0	0	0	2
Water Management Controls and Operation	0	0	0	0
Vehicle traffic	0	0	0	0
Transmission line (includes maintenance)	0	0	0	0
Fisheries Compensation works operations	0	0	0	0

Project Activities/Physical Works	Loss or alteration of habitat	Disruption of movement patterns	Increase in direct mortality risk	Reduction in animal health
Closure				
Water Management Controls and Operation	0	0	0	0
Fisheries Compensation Operations	0	0	0	0
Site drainage and seepage management	0	0	0	2
Reclamation of ore stockpile area	0	0	0	0
Reclamation of Non-PAG waste rock stockpile	0	0	0	0
Tailing impoundment reclamation	0	0	0	0
Pit lake and TSF Lake filling	0	0	0	0
Transmission line decommissioning	0	0	0	0
Post-closure				
Discharge of tailing storage facility water	0	0	0	1
Seepage management and discharge	0	0	0	2
Ongoing monitoring of reclamation	0	0	0	0
Interaction of Other Projects and Activities				
Interaction of Other Projects and Activities	0	0	0	0
Accidents, Malfunctions and Unplanned Events				
Accidents, Malfunctions and Unplanned Events	0	0	0	1

The physical activities/physical works indicated in grey shading in Table 2.7.2.8-2 are not carried forward in this assessment. Based on past experience and professional judgment, the March 2009 EIS/Application determined that either there would be no interaction; the interaction would not result in a significant environmental effect, even without mitigation; or the interaction would not be significant due to application of codified environmental protection practices that are known to effectively mitigate the predicted environmental effects. The justifications for these determinations are provided for each Project component in the key issues section of the March 2009 EIS/Application (Volume 5, Section 6.1.2). These interactions are not discussed further in this assessment.

Interactions rated as “1” in Table 2.7.2.8-2 are due to the location changes of Project features due to the redesign of the mine giving a new, smaller mine site Maximum Disturbance Area. This will be addressed for potential effects on wildlife habitat availability and reduction in animal health.

Interactions rated as “2” in Table 2.7.2.8-2 are for Project interactions where predicted effects are potentially greater for the New Prosperity Project than the March 2009 EIS/Application (rated as 2 in the table above), and therefore require re-assessment. This includes water management activities with the potential to affect animal health.

The interaction of the New Prosperity Project within the regional context with other previous, active and planned projects and activities is provided below within the cumulative effects assessment.

There are no expected changes to the previous assessment for potential accidents, malfunctions and unplanned events provided in March 2009 EIS/Application Section 6.1.2 and Table 6-1. These included; fuel/chemical spill, failure or major leakage from tailings or reclaim pipeline, concentrate haul spill, road culvert failure, excessive water in TSF and loss of power to TSF seepage recovery (March 2009 EIS/Application, Volume 9, Section 2.2.2). Two of which were identified as potential environmental effects on wildlife; fuel/chemical spill on land and/or water and concentrate spill on land and/or water. With implementation of appropriate mitigation measures, no long-term impacts are expected.

Table 2.7.2.8-3 lists all the wildlife key indicators considered previously (March 2009 EIS/Application, Volume 5, Section 6.3) and indicates the potential for each effect and summarizes the mechanisms for each effect. The following interaction rating criteria was used for this scoping exercise:

0. Effect related to KI is likely to decrease or stay the same (i.e., no changes to significance conclusions), and there are no required changes to previously proposed mitigation measures, and no additional regulatory requirements have been identified (i.e., from the EAO, Panel, or other applicable regulation). Therefore, no further assessment is warranted.
1. Effect related to KI is likely to decrease or stay the same (i.e., no changes to significance conclusions), but some re-evaluation of effect is required due to changes in project design, proposed mitigation measures, and/or additional regulatory requirements have been identified (i.e., from the EAO or Panel).
2. Effect related to KI is likely to increase; therefore, further assessment is warranted.

Table 2.7.2.8-3 Wildlife Key Indicator Scoping Table

Potential Effect	**Loss or alteration of habitat**	**Disruption of movement patterns**	**Increased direct mortality risk**	**Reduction in animal health**
Effect Mechanisms (from Table 2.7.2.8-2)	Fish compensation works, site clearing, lake dewatering, clearing of transmission line ROW, construction/installation of transmission line (due to direct loss of habitat); various construction and operations activities (due to sensory disturbance)	Fish compensation works and site clearing (due to direct loss of habitat); various construction and operations activities (due to sensory disturbance)	Site clearing (C&C*); lake dewatering (C&C); vehicular traffic (C&C, O*); transmission line (O)	Fish Lake water management (C&C); site drainage and seepage management (O, C*, D*, PC*); discharge of TSF water (PC)
Key Indicator or Wildlife Group (from 2009)				
California Bighorn Sheep	0	0	0	0
Mule Deer	1	0	0	0
Moose	1	0	0	2
Grizzly Bear	1	0	0	2
Black Bear	1	0	0	2
Fisher	1	0	0	0
American Badger	0	0	0	0
Townsend's Big-eared Bat	0	0	0	0
Great Blue Heron	1	0	0	2
Mallard	1	0	0	2
Barrow's Goldeneye	1	0	0	2
Sandhill Crane	0	0	0	0
Long-billed Curlew	0	0	0	0
Lewis's Woodpecker	0	0	0	0
Yellow-breasted Chat	0	0	0	0
Sagebrush Brewer's Sparrow	0	0	0	0

Sharp-tailed Grouse	0	0	0	0
Prairie Falcon	1	0	0	0
Short-eared Owl	1	0	0	0
Flammulated Owl	0	0	0	0
Amphibians	1	0	0	2

Notes:

* The phases of the Project: C&C: Construction and Commissioning, O: Operations, C: Closure, D: Decommissioning, PC: Post-closure

The species indicated in white in Table 2.7.2.8-3 are carried forward as key indicators of potential effect effects for consideration in this assessment. The rationale for not carrying the other key indicators in grey is provided in Table 2.7.2.8-4.

Table 2.7.2.8-4 Key Indicators which are not Assessed Further

Key Indicators	Comments	Reference Prosperity (2009)
California Bighorn Sheep	Potential environmental effects from the new mine site layout will not affect this species because this species is unlikely to utilize the mine site. The only potential environmental effect identified previously was changes to habitat availability within the transmission line.	Volume 5, Section 6.3.1
American Badger		Volume 5, Section 6.3.7
Townsend's Big-eared Bat		Volume 5, Section 6.3.8
Lewis's Woodpecker		Volume 5, Section 6.3.14
Yellow-breasted Chat		Volume 5, Section 6.3.15
Sagebrush Brewer's Sparrow		Volume 5, Section 6.3.16
Flammulated Owl		Volume 5, Section 6.3.20
Sandhill Crane	Potential environmental effects from the new mine site layout will not affect this species because this species is unlikely to utilize the mine site. The two potential environmental effects identified previously were changes to habitat availability and direct mortality risk within the transmission line.	Volume 5, Section 6.3.12
Long-billed Curlew		Volume 5, Section 6.3.13
Sharp-tailed Grouse		Volume 5, Section 6.3.17

Of the 47 listed vertebrate wildlife species at risk identified as occurring within the Prosperity Project area, all are still considered to have the potential to occur within the New Prosperity Project area, based on current available information. Fifteen of these were selected as KIs for the Prosperity Project, and will be used as KIs in this assessment. For those wildlife species not selected as KIs but considered likely to interact with the Prosperity Project, the assessment of Project effects was either addressed directly but qualitatively; or not specifically addressed, but inferable from the results of the effects assessment for an umbrella KI[27], for a KI that is related or similar in behaviour and habitat use pattern, or for an appropriate vegetation (i.e., habitat type) KI. These linkages are presented in Table 6-4 of the March 2009 EIS/Application, Volume 5, Section 6. This approach will also be used for this assessment.

Temporal Boundary Changes

There have been no changes in the temporal boundaries for construction and commissioning, operations, and decommissioning and post-closure phases between the Prosperity and New Prosperity projects (see March 2009 EIS/Application Volume 5, Section 6.1.4). The three temporal boundaries used for the New Prosperity assessment of potential Project effects on the wildlife KIs remain:

- **Baseline Scenario**: Represents conditions prior to any Project-specific developments. The effects of existing human-caused disturbances are reflected in the baseline conditions. Baseline conditions for this assessment are set as May 2006.
- **Maximum Disturbance Scenario**: Represents the potential worst-case conditions that could occur during the construction and operations phases of the Project. It is recognized that development and reclamation will be progressive and that traffic volumes will fluctuate somewhat over the construction and operations periods; however, the maximum disturbance scenario is used to provide a conservative assessment of the effects on wildlife (i.e., worst case). Further, this scenario assumes that the primary effects on wildlife (direct and indirect habitat loss, and mortality risk) will be similar for construction and operations activities. The only exception is the transmission line, for which construction and operations are considered separately with respect to direct mortality risk.
- **Post-closure Scenario**: Represents conditions following the decommissioning and closure phases. Specifically for the mine site, this scenario assumes Pit Lake is filled to the predicted capacity, and that all mitigation measures and the Reclamation Plan have been implemented. The closure and decommissioning phase for the New Prosperity Project will be divided into two phases: Phase I, which will last approximately 10 years following closure (Years 21 to 30) when the Fish Lake catchment will continue to be isolated from mine water; and phase II (Years 31-44), when the TSF will be allowed to begin to spill to Fish Lake tributaries. The post-closure phase is still anticipated to begin in Year 45, when the Pit Lake will have reached maximum elevation and begun to spill to Lower Fish Creek. Permanent groundwater interception and surface seepage ponds below the main TSF embankment will continue to operate post-closure.

Spatial Boundary Changes

The study area boundaries for wildlife were described for each project component and key indicator in the Prosperity EIS (Volume 5, Section 6.1.5 and in each KI subsection within Section 6.3). The only study area boundary for wildlife that has changed for New Prosperity is the Maximum Disturbance Area (MDA) for the mine site. The wildlife MDA is the same as the 2012 vegetation mine site LSA, except that the boundary has been modified to exclude Fish Lake and Wasp Lake which will not be physically disturbed (Figure 2.7.2.8-1). This is consistent with the approach used in 2009. The total area of the 2012 wildlife MDA is 4372.9 ha. The mine site LSA was not re-delineated for this assessment for two reasons: 1) the 2012 wildlife MDA is generally located within the 2009 LSA boundary (Figure 2.7.2.8-1) and as indicated above, baseline conditions for habitat were considered to be the same so the descriptions of habitat availability within the LSA are the same as well; and 2) project effects are characterized and assessed relative to the RSA. The mine site RSA has not changed.

[27] *Sensu* “umbrella species” – an umbrella species is a species with broad habitat and resource requirements that can be managed to also provide habitats and resources for other species (Dunster and Dunster, 1996)

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.7.2.8-1 Comparison of Prosperity and New Prosperity Study Areas for Wildlife

Updates to Consultation on the Assessment for Wildlife

Following the submission of the March 2009 EIS/Application, additional information and analysis was provided in response to consultation through the Panel regarding potential project effects on wildlife and vegetation species included within the Williams Court case at the local/sub-regional scale. Therefore, the Supplemental Report (2009) was provided to address these considerations. Findings from the Supplemental Report are discussed in the next section and under 'Project Impact Assessment for Wildlife' below.

William Court Case Wildlife Species

Twenty-four species were identified in the William Case as being of particular importance to the Tsilhqot'in National Government (TNG). Six of these species (Moose, Mule deer, California bighorn sheep, Grizzly bear, Black bear and Fisher) have been identified as wildlife KIs and were assessed for the New Prosperity EIS. (2012). For the remaining 18 species not identified as KIs, the New Prosperity EIS assessment for potential effects of the mine site area is considered to be inferable from the results of the effects assessment for an appropriate umbrella KI or for an appropriate vegetation (i.e., habitat type) KI. These linkages between non-KI species and KIs were presented in the Supplemental Report (Section 3.1.1, Table 2). No significant residual effects were predicted for any of the 24 William Case species in the Supplemental Report (Section 3.1.2, Table 3). As the amount of available habitat has increased for most species with the redesign of the mine footprint, the potential for residual effects is expected to remain not significant. For two of the species (mule deer and moose), predicted loss of available habitat has increased slightly, this is discussed under 'Project Impact Assessment for Wildlife' below.

Project Impact Assessment for Wildlife

There are four potential environmental effects identified for wildlife, including loss or alteration of habitat, disruption of movement patterns, increased direct mortality risk, and reduction in animal health. Loss or alteration of habitat and reduction in animal health are assessed for the KIs indicated through the above scoping. As indicated in the above scoping, the other potential effects will be less for New Prosperity than for Prosperity, and there are no relevant regulatory changes. Discussion is provided to substantiate this.

Loss or Alteration of Habitat

Eleven key indicators identified in Table 2.7.2.8-3 are carried forward to the assessment of Project effects on loss or alteration of habitat: Mule deer, Moose, Grizzly bear, Black bear, Fisher, Great blue heron, Mallard, Barrow's goldeneye, Prairie falcon, Short-eared owl and amphibians. Waterfowl were also considered for this effect based on the outcome of the review of the March 2009 EIS/Application, particularly with respect to comments received from Environment Canada.

Effects Assessment Methods for Loss of Alteration of Habitat

The New Prosperity (2012) project uses the same measurable habitat parameters employed for the Prosperity (2009) project (March 2009 EIS/Application Volume 5, Section 6.2.2.5). The parameters applied were winter feeding and shelter for mule deer and moose, natal denning for fisher, denning (hibernation) for black bear and spring, summer and fall feeding for grizzly bear. For birds, measurable parameters were feeding and/or nesting habitat. Amphibian and waterfowl habitat assessments were based on the amount of wetland habitat within the RSA. A post-closure habitat availability assessment was also conducted involving the availability of moderate or better value/use/suitability/capacity habitat from baseline to post-closure.

The potential project effects on loss or alteration of wildlife habitat were assessed based upon the same methodology as previously used (see March 2009 EIS/Application, Section 6.2.2.5). The areas of moderate or higher valued habitat available in the mine site RSA were assessed and then compared to the previous Prosperity (2009) project based on the maximum disturbance area (MDA) for both projects.

Change in Baseline Conditions for Habitat

As the same mine site RSA and LSA used by the March 2009 EIS/Application are used here, baseline conditions for habitat availability have not changed. See Section 6.2 of Volume 5 of the March 2009 EIS/Application for baseline conditions for wildlife habitat.

Extent of Loss or Alteration of Habitat

For most key indicators with TEM-based habitat models, loss or alteration of habitat of the mine site has decreased for New Prosperity (2012) when compared to Prosperity (2009) (Table 2.7.2.8-5). The decreases ranged from 8 ha (3.6%) for mule deer winter feeding habitat to 231 ha (15.6%) for grizzly bear summer feeding habitat (Table 2.7.2.8-5). These deccreases indicate that the predicted residual loss of habitat in each of these cases has decreased from what was predicted in the March 2009 EIS/Application. Thus, further assessment was not required—the effect characterizations and determinations of significance were not considered to have changed from the findings presented in the March 2009 EIS/Application. However, given the concerns expressed during the review of the Prosperity Project with respect to project-related effects on grizzly bear habitat, this key indicator was discussed further under ‘Detailed Assessment’ below.

In two cases, the amount of habitat available in the RSA at maximum disturbance decreased with the New Prosperity (2012) MDA when compared to the Prosperity (2009) MDA: mule deer winter shelter habitat and moose winter feeding habitat (Table 2.7.2.8-5). These two cases are discussed further under ‘Detailed Assessment’ below.

For the two key indicators that use non-TEM models, the amount of habitat available in the RSA at maximum disturbance is either the same (Prairie falcon) or increased (amphibians) with the New Prosperity (2012) MDA when compared to the Prosperity (2009) MDA. More specifically for the Prairie falcon, as in the March 2009 EIS/Application, there is no overlap of the 2012 MDA with potential falcon nesting habitat (i.e., the cliffs to the west of the MDA, above the Taseko River). With respect to amphibians, the amount of wetlands directly affected by New Prosperity has decreased. Given the focus on wetlands by Environment Canada during the review of the March 2009 EIS/Application, the effect of New Prosperity on waterfowl will be discussed further under ‘Detailed Assessment’ below.

The end land use and capability objectives described in Section 2.8.2 (Conceptual Reclamation and Decommissioning Plan) are the key drivers for determining what the post-closure wildlife habitat conditions will be. The primary end land use objective will be wildlife habitat in support of traditional use (Section 2.8.2). Key species for which habitat capability is specifically targeted on the New Prosperity reclamation landscape are: great blue heron, Barrow's goldeneye, mallard, short-eared owl, olive-sided flycatcher, mule deer, moose, black bear, and grizzly bear. General reclamation practices and specific techniques to improve site suitability for wildlife are described in detail in Section 2.8.2. A comparison of wildlife habitat capability within the mine footprint pre- and post-closure is presented in Table X (Section 2.8.2). The area with no wildlife habitat capability will increase (by 677 ha) at post-closure due to the creation of the TSF Lake, pit walls and Pit Lake. Outside these areas, the majority of the mine footprint will have moderately high to low wildlife habitat capability for at least one of the key reclamation species.

Table 2.7.2.8-5 Comparison of Habitat Availability in Regional Study Area at Maximum Disturbance between Prosperity and New Prosperity for Key Indicators with TEM-based Habitat Models

Key Indicators	Season/Life Requisite	New Prosperity (2012)		Prosperity (2009)		Difference in Available habitat between New Prosperity (2012) & Prosperity (2009)		Prosperity (2009) Reference
		Available habitat (ha) within the RSA at Maximum Disturbance	New Prosperity (2012) Figure Reference	Available habitat (ha) within the RSA at Maximum Disturbance	Prosperity (2009), Vol. 5, Sec. 6.3, Figure Reference	ha	%	
Mule deer	Winter feeding	226.0	Figure X-X	217.9	Figure 6-4	8.1	3.6	Vol. 5, Sec. 6.3.2
	Winter shelter	1903.3	Figure X-X	2088.4	Figure 6-5	**-185.1**	-9.7	Vol. 5, Sec. 6.3.2
Moose	Winter feeding	445.6	Figure X-X	457.8	Figure 6-9	**-12.2**	-2.7	Vol. 5, Sec. 6.3.3
	Winter shelter	4105.8	Figure X-X	3944.0	Figure 6-10	161.8	3.9	Vol. 5, Sec. 6.3.3
Grizzly bear	Spring feeding	407.1	Figure X-X	362.4	Figure 6-17	44.7	11.0	Vol. 5, Sec. 6.3.4
	Summer feeding	1484.4	Figure X-X	1253.4	Figure 6-18	231.0	15.6	Vol. 5, Sec. 6.3.4
	Fall feeding	805.9	Figure X-X	767.2	Figure 6-19	38.7	4.8	Vol. 5, Sec. 6.3.4
Black bear	Denning (hibernation)	2131.9	Figure X-X	1923.8	Figure 6-23	208.1	9.8	Vol. 5, Sec. 6.3.4
Fisher	Natal denning	234.2	Figure X-X	225.1	Figure 6-25	9.1	3.9	Vol. 5, Sec. 6.3.8
Great Blue Heron	Feeding	108.2	Figure X-X	79.3	Figure 6-30	28.9	26.7	Vol. 5, Sec. 6.3.9
Mallard	Feeding	147.6	Figure X-X	107.5	Figure 6-33	40.1	27.2	Vol. 5, Sec.

								6.3.10
Barrow's Goldeneye	Nesting	159.4	Figure X-X	28.7	Figure 6-38	130.7	82.0	Vol. 5, Sec. 6.3.11
Short-eared Owl	Feeding	196.5	Figure X-X	161.6	Figure 6-50	34.9	17.8	Vol. 5, Sec. 6.3.19

Detailed Assessment

For the two KIs for which habitat loss increased with the New Prosperity Project (see Table 2.7.2.8-5), the following detailed assessment was conducted. This included winter sheltering for Mule deer and winter feeding for Moose. In addition, given the findings of the review panel and comments received during the review process, Grizzly bear and Waterfowl are also addressed in detail.

Mule Deer

The habitat model predicts a 37.8% (1155 ha) reduction in the availability of effective winter shelter habitat in the mine site RSA at maximum disturbance (Table 2.7.2.8-6). This is 6.1% higher than predicted in the Prosperity EIS (2009). Fish Lake and the surrounding area that is no longer part of the 2012 wildlife MDA does not have any moderate or higher value winter shelter habitat and the parts of the 2012 wildlife MDA that extend beyond the original wildlife MDA happen to include areas of effective winter shelter habitat (Figure X-X). As in 2009, the reduction in winter shelter habitat is due almost entirely to direct habitat loss, with some decrease in habitat value also associated with sensory disturbance around the mine site.

Table 2.7.2.8-6 Project-related Changes in Mule Deer Winter Shelter and Moose Winter Feeding Habitat Availability in Mine Site Regional Study Area at Maximum Disturbance

Key Indicator/Measurable Parameter	Project Design Year	Available Area (ha) at Baseline	Available Area (ha) at maximum disturbance	Change in Area from Baseline to maximum disturbance (ha)	Percent Change from Baseline to maximum disturbance %
Mule Deer Effective Winter Shelter Habitat	2009	3058.4	2088.4	-970	-31.7
	2012	3058.4	1155.1	-1155	-37.8
Moose Effective Winter Feeding Habitat	2009	646.9	457.8	-189	-29.2
	2012	646.9	445.6	-201	-31.1

[To be included in Final EIS: summary of post-closure conditions for mule deer] At the same time; however, there is a permanent loss of 469.0 ha of upland habitat[28] at post-closure, some of which may have had mule deer winter habitat capability. This is 376.1 ha less than the 845.1 ha loss that was predicted in the March 2009 EIS/Application. The permanent loss occurs primarily because of the Pit Lake, pit walls and TSF Lake (see Figure X-X).

Although the loss of mule deer winter habitat at maximum disturbance is a relatively large portion of that available within the mine site RSA, and there is some permanent loss of potential winter habitat capability at post-closure, the mine site LSA is not considered to be regionally important as mule deer winter range and there are no designated mule deer UWRs within the RSA (see March 2009 EIS/Application Volume 5, Sections 6.3.2.3 and 6.3.2.4). As in the March 2009 EIS/Application (Volume 5, Figure 6-3), the Project does not affect any designated mule deer Ungulate Winter Range polygons. Further, the habitat loss

[28] That is non-aquatic and non-wetland (as defined in Prosperity EIS, Volume 5, Section 5.4.2) habitat

predicted at maximum disturbance is a worst case scenario. The actual habitat loss will be less than predicted as only 43.9% (1919 ha) of the 2012 wildlife MDA is likely to be physically disturbed. This can be clearly seen by comparing the baseline and post-closure figures for mule deer winter shelter habitat (Figures X-X and X-X).

Moose

The habitat model predicts a 31.1% (201 ha) reduction in the availability of effective winter feeding habitat in the mine site RSA at maximum disturbance (Table 2.7.2.6). This is 1.9% higher than predicted in the March 2009 EIS/Application. Although there is some effective winter feeding habitat in the part of upper Fish Creek that is no longer part of the 2012 wildlife MDA; the parts of the 2012 wildlife MDA that extend beyond the original wildlife MDA happen to include areas of effective winter feeding habitat; primarily in association with a large, moderate suitability cutblock in the southeast corner of the new MDA (Figure X-X). As in 2009, this reduction is due almost entirely to direct habitat loss, with some decrease in habitat value also associated with sensory disturbance around the mine site.

[To be included in Final EIS: summary of post-closure conditions for moose and discussion of permanent habitat loss]

Although the loss of moose winter feeding habitat at maximum disturbance is a relatively large portion of that available within the mine site RSA, and there is some permanent loss of potential winter habitat capability at post-closure, the mine site LSA is not considered to be regionally important as moose winter range (March 2009 EIS/Application Volume 5, Section 6.3.3.4). Further, the model predictions do not incorporate natural disturbance patterns such as fire; therefore, as it is likely that over decades there would be some natural disturbances to create early seral habitat, the predicted loss of winter feeding habitat and increase in mature forest area at post-closure will not be as pronounced. Finally, as discussed for mule deer above, the actual direct loss of habitat will be less than predicted as only a little over half of the mine footprint is likely to be physically disturbed. This qualifier is more applicable to winter shelter habitat than to winter feeding habitat, as can clearly be seen by comparing the baseline and post-closure figures for moose winter shelter habitat (Figures X-X and X-X).

Grizzly Bear

Loss or alteration of habitat in the mine site has been previously identified as a key issue for Grizzly bear (Prosperity EIS, Section 6.3.4.1). With the redesign of the mine site, the habitat model predicts an increase of 11.0% (44.7 ha), 15.6% (231.0 ha) and 4.8% (38.7 ha) of effective grizzly bear spring, summer and fall feeding habitat, respectively, in the mine site RSA at maximum disturbance (Table 2.7.2.8-5) when compared to the Prosperity EIS (2009). The increase is a result of the removal of Fish Lake and the surrounding area from the 2012 MDA, which included a moderate amount of spring and fall habitat and a large amount of summer feeding habitat.

In the March 2009 EIS/Application a larger RSA was used to put the mine site Project effects on grizzly bear habitat in a regional context more appropriate to this species (Volume 5, Section 6.3.4.4). The mapping for this larger RSA was based on remote sensing and the model used a typical habitat suitability rating scheme applied to the broad vegetation classes defined for that product. During the review process the provincial regulators were not satisfied with the regional scale used for grizzly bear and suggested several different RSAs to use, and they provided grizzly bear habitat mapping product developed by the Province for use in the Supplemental Report assessment. These analyses are considered to supersede the grizzly bear regional assessment presented in the March 2009 EIS/Application. An update of the

Supplemental Report assessment for grizzly bear habitat using the 2012 wildlife MDA is provided later in this section.

[To be included in Final EIS: summary of post-closure conditions for grizzly bear and discussion of permanent habitat loss]

[To be included in Final EIS: core secure habitat analysis update]

Considering the effects of the mine and transmission line development together with respect to the RSA, the residual loss of grizzly bear feeding habitat at maximum disturbance is a relatively small portion of that available; however, there is some permanent loss of potential foraging habitat at post-closure. In general, the RSA has relatively low grizzly bear capability, and the mine site LSA is in an area of moderate to very low capability (Volume 5, Section 6.3.4.3). As discussed for the mule deer and moose above, the actual direct loss of habitat will be less than predicted as less than half of the 2012 wildlife MDA is likely to be physically disturbed. This can be clearly seen by comparing the baseline and post-closure figures for grizzly summer foraging habitat (Figures X-X and X-X).

Waterfowl

Waterfowl as a group was not assessed for the March 2009 EIS/Application, although two waterfowl species (Mallard and Barrow's goldeneye) were assessed as key indicators. As discussed above, given the focus on wetlands by Environment Canada during the review of the March 2009 EIS/Application, the effect of New Prosperity on waterfowl is discussed in more detail here.

A key difference between the Prosperity and New Prosperity Projects is that a smaller area of wetlands will be affected. The New Prosperity Project results in the permanent loss of 311 ha of wetlands at post-closure. This is 93 ha less than what was predicted in the Prosperity EIS (2009). A detailed discussion of the effects of New Prosperity on wetlands and wetland function, including a discussion of its role as wildlife habitat, is provided in Section 2.7.2.7 (Vegetation). Although not necessarily representative to waterfowl as a group, habitat availability for Mallard and Barrow's Goldeneye, respectively, is greater within the New Prosperity (2012) MDA when compared to the Prosperity (2009) MDA (Table 2.7.2.8-6).

Based on a survey conducted by CWS in 2008 (Breault, 2009) and a series of discussions with CWS, Taseko conducted an analysis to determine the number of Indicated Breeding Pairs (IBPs[29]) potentially displaced through loss of wetland habitat associated with the Project. An estimated potential loss of 123 IBPs was determined, 52 of which were directly related to the removal of Fish Lake (Stantec, 2010). The preservation of Fish Lake for the New Prosperity Project; therefore, may reduce the potential loss of IBPs by 42%.

[To be included in Final EIS: incorporation of findings of health assessment and discussion related to waterfowl]

Taseko produced a draft *Habitat Compensation Reference Document* in 2010 which recognized CWS Prosperity (2009) project effects concern for 20 waterfowl species and suggested that compensation plans should include wetland habitat types. Specific compensation for the wetland and riparian habitats affected by New Prosperity (2012) will require further discussion between Taseko, regulators, First Nations and stakeholders to determine specific compensation targets.

[29] Define

The New Prosperity (2012) mine plan reduces the amount of wetland habitat lost and increases habitat availability for two waterfowl key indicators when compared to the Prosperity Project. Based on these factors, in combination with mitigation measures and continued development of a habitat conservation plan, no significant effects with respect to the sustainability of waterfowl species populations within Region 5 are expected.

Disruption of Movement Patterns

No key indicators identified in Table 2.7.2.8-3 are carried forward to the assessment of Project effects on movement patterns. Disruption of movement patterns can occur through increased habitat and/or landscape fragmentation (e.g., increased density of access corridors, increased cleared area) or an increase in road use which may limit daily or seasonal wildlife travel. The potential for the Project to affect movement patterns of the Key Indicator taxa was assessed previously and considered not to be of concern (see March 2009 EIS/Application, Volume 5, Section 6.3). Further, the findings of the Federal Panel were that disruption of mule deer movement patterns was not of concern “given the location of the proposed mine site, mule deer would likely still disperse around the mine site to continue their migration” (Panel Review, Section 6.7.5).

With the revised mine plan, the potential for disruption of movement patterns for wildlife in general is reduced relative to the original mine plan. That is, physical impediments to movements across the LSA are less because of the decrease in the extent of the TSF. It is now possible for wildlife to physically move between the open pit and TSF, although sensory disturbance from adjacent operations and the TSF access road will still reduce wildlife use of this area.

Increased Direct Mortality Risk

No key indicators identified in Table 2.7.2.8-3 are carried forward to the assessment of Project effects on direct mortality risk. Increased direct mortality risk can result from site clearing, vehicle collisions, transmission lines strikes, increased hunting/poaching, lethal control of problem wildlife, or reduction in secure habitat availability due to habitat fragmentation.

The potential for the Project to affect an increase in direct mortality risk was previously assessed for all KI species and subsequently Grizzly bears were identified as at risk for a potential effect. No concerns were identified within the mine site and thus changes to the mine site footprint are not expected to have any measurable effect to direct mortality risk. The risk of direct mortality risk for Grizzly bears remains due to the possibility of collisions with Project-related traffic along the transmission line and access road (see March 2009 EIS/Application, Section 6.3.4.5). This possible pathway of mortality was also acknowledged as a concern within the Report of the Federal Review Panel (see Panel Review, Section 6.7.1); therefore, additional mitigations measures have been proposed to address this concern.

Clearing and other project activities have the potential to introduce mortality risk for groups such as songbirds and amphibians. With adherence to best management practices and identified mitigation measures, the mortality risk will be reduced. In addition, there is an expected reduction in direct mortality as the total area requiring clearing at the mine site will be reduced.

Reduction in Animal Health

Effects to wildlife health can occur through a variety of pathways including contamination of air, soil, water or food resources or alterations in food source abundance or composition. The potential for the Project to affect the health of the key indicators was assessed previously and considered to be not significant for any wildlife species (see March 2009 EIS/Application, Volume 5, Section 6.3).

Concerns related to the post-closure water quality within Fish Lake that could potentially affect animal health have been identified for the New Prosperity Project (see Section 2.7.2.X). Therefore, assessment of these water quality changes is required to determine the potential effect on wildlife health. Seven key indicators identified in Table 2.7.2.8-3 are carried forward to the assessment of Project effects on animal health. In addition to these species, additional representative species were selected in order to capture the full range of potential effects to all wildlife groups.

Table 2.7.2.8-7 summarizes the key indicators and representative species (within the main wildlife groups) to be included in a qualitative wildlife health assessment with a focus on water quality in Fish Lake, Fish Creek, and an unnamed Fish Lake tributary (Tributary 1). Rationale for their selection is provided and is based upon presence/abundance in the area, use of Fish Lake (or associated water bodies), life history characteristics that predispose the species to elevated metal exposures (e.g., diet, egg-laying) and whether the species is concurrently assessed in the Ecological Risk Assessment (see Section X).

Table 2.7.2.8-7 Rationale for Selection of Wildlife Species for Inclusion in the Assessment of Project Effects on Wildlife Health

Wildlife Group	Representative Species	Included in Ecological Risk Assessment	Rationale for Selection
Ungulates	Moose	yes	• Common in spring/summer but present throughout the year • Habitat includes wetlands containing browse species (around Fish Lake, and alluvial flats by Taseko River) • Observed feeding in Fish Lake, cows/calves observed on shoreline • While does not consume aquatic prey, aquatic plants associated with Fish Lake (e.g., willow), metals can be taken up by plants and become available to moose (e.g., copper, cadmium)
Small Mammals	n/a	yes	• Little to no reliance on aquatic food web • *Cinereus* shrew and Snowshoe hare health effects will be assessed as part of the ERA
Carnivores	Grizzly Bear Black Bear	yes	• Both bear species observed at the proposed mine site and near Fish Lake • Large home ranges • Potentially prey upon spawning rainbow trout in the spring that use Fish Creek • Grizzly bear health effects will be assessed as part of the ERA
Song Birds	Red-winged Blackbird	no	• Utilizes wetlands for nesting and foraging •
Raptors and Owls	Bald Eagle	yes	• Diversity of raptors high due to fish-bearing lakes • Eagles regularly prey upon fish in Fish Lake in the spring, move to salmon streams in the fall • Oviparous – susceptible to selenium-related deformities and developmental and reproductive effects • Short-eared owl health effects will be assessed as part of the ERA
Game Birds	n/a	yes	• Uplands game species • No aquatic food web reliance • Willow ptarmigan health effects will be assessed as part of the ERA
Waterfowl/ Water-related Birds	Great Blue Heron Mallard Barrow's Goldeneye	yes	• Limited nesting habitat for waterfowl, but nests, breeding pairs and offspring have been observed for some species • Observed feeding in Fish Lake • Heron consumes fish (higher trophic level) • Waterfowl species are herbivorous, but can be exposed to metals in aquatic plants, invertebrates and water • Oviparous – susceptible to selenium-related

Wildlife Group	Representative Species	Included in Ecological Risk Assessment	Rationale for Selection
			deformities and developmental and reproductive effects • Canada Goose health effects will be assessed as part of the ERA
Amphibians	Western Toad Columbia Spotted Frog Chorus Frog	no	• Productive amphibian habitat and observed individuals (3 species confirmed) along shoreline and in Fish Lake, along Fish Creek, and at the inlet and outlet of Fish Lake • Physiology and life cycles create susceptible conditions to health and reproductive effects related to water quality • Oviparous – susceptible to selenium-related deformities and developmental and reproductive effects

The assessment of Project effects on wildlife health will be provided in the final EIS submission

Local Population Effects from Supplemental Report

An assessment characterizing the local effect of the Project was provided within the Supplementary Report (Section 3.1.1). Specifically, the assessment provided an estimate of the number of animals potentially affected by specific Project components as well as the characterization of the nature of any effects (where possible). One of the study areas used for the assessment (as applicable to the New Prosperity EIS.), was the Mine Site Local Study Area defined in the March 2009 EIS/Application (Volume 5, Section 6.1.5.1). The analysis utilized a relatively simple calculation to determine number of individual animals potentially affected (Supplemental Report, Section 2.3.1):

Area of habitat loss (ha) x species density (individuals/ha) = number of individuals potentially affected (directly or indirectly).

Table 2.7.2.8-8 provides a summary comparison of the potential effects of the permanent area lost at the Mine Site in reference to 11 species which had been identified by the BC Ministry of Environment for further assessment.

[To be included in Final EIS: discussion of results presented in Table 2.7.2.8-8]

Table 2.7.2.8-8 Local Population Effect Predictions for Wildlife Species in Reference to the Mine Site

Key Indicator	Density Estimate/Home Range Size/Territory Size[30]	Prosperity (2009)		New Prosperity (2012)		Comments
		Area Permanently Lost	Local Population Effect	Area Permanently Lost	Local Population Effect	
Mule deer	MU 5-04 (mine site): density = 0.16 deer/km^2 (range 0.11-0.23)	Upland: 845.1 ha (8.5 km^2)	1.4 deer displaced (range 09-0.2)	Upland: 469 ha (4.7 km^2)	0.7 deer displaced (range 0.5-1.1)	Density derived from MOE population estimate for MU 5-04. Possibly an underestimate.
Moose	Winter density = 0.35 moose/km^2	Upland: 845.1 ha Wetlands: 403.5 ha Combined: 1248.6 ha (12.5 km^2)	4.4 Moose displaced (winter)	Upland: 469 ha Wetlands: 311 ha Combined: 780 ha (7.8 km^2)	2.7 moose displaced (winter)	Used same density estimate for length of RoW although east of Fraser River the density is lower (see Stalberg 2005).
Grizzly bear	Was to be determined in consultation with BC MOE	Pending	Pending	Pending	Pending	
Black bear	Unknown (as per BC MOE)	Upland: 845.1 ha Wetlands: 403.5 ha Combined: 1248.6 ha (12.5 km^2)	Unknown (as per BC MOE)	Upland: 469 ha Wetlands: 311 ha Combined: 780 ha (7.8 km^2)	Unknown	Black bears are not considered a conservation concern regionally (as per BC MOE)
Fisher	Density: 7.9-13.1 animals per 1000 km^2	Upland habitat: 845.1 ha (8.5 km^2)	0.07-0.12 fishers displaced	Upland: 469 ha (4.7 km^2)	0.04-0.06 fishers displaced	Density is for habitat in general, not natal denning habitat specifically so area loss predicted by habitat suitability mapping is not applicable.
Great blue heron (interior subspecies)	Territory size: 0.6 ha (freshwater marsh, Oregon)	Wetlands: 403.5 ha	242.1 herons displaced	Wetlands: 311 ha	186.6 herons displaced	Very likely an over-estimate. Herons have not been reported in such high

[30] Citations for information sources available upon request

Key Indicator	Density Estimate/Home Range Size/Territory Size[30]	Prosperity (2009)		New Prosperity (2012)		Comments
		Area Permanently Lost	Local Population Effect	Area Permanently Lost	Local Population Effect	
						numbers during any project-related field surveys.
Mallard	From CWS	Wetlands: 403.5 ha	Pending	Wetlands: 311 ha	Pending	Calculate using IBP method from CWS
Barrow's goldeneye	From CWS	Fish Lake area: 116.7 ha; Little Fish Lake area: 6.5 ha	Pending	Little Fish Lake area: 6.5 ha	Pending	Calculate using IBP method from CWS
Short-eared owl	Density: 1 pair/5.5 ha (Montana) Territory size: 73.9 ha (Manitoba)	Model: Moderate feeding habitat: 146 ha	26.6 pairs displaced 2 Territories	Model: Moderate feeding habitat: XX ha	Pending	Probable over-estimate using the pair density estimate.
Bald eagle	Nest density: 9 active nests/100 km of shoreline (Nechako River)	Fish Lake shoreline: 9.4 km; Little Fish Lake shoreline: 1.4 km **Total 10.8 km**	1 active nest predicted based on shoreline length; spring 2009 site visit by BC MOE estimate 5-10 active nests and 50-100 birds feeding in the Project area[31]	Little Fish Lake shoreline: 1.4 km	No more than 1 active nest based on shoreline length	Shoreline length estimate includes islands
Amphibian	Unknown[32]	Wetlands: 403.5 ha	Unknown	Wetlands: 311 ha	Unknown	

Habitat Loss from Supplemental Report

Table 2.7.2.8-9 provides a summary and comparison of predicted available habitat at maximum disturbance for selected key indicators for Prosperity (Supplemental Report, Section 3.1.3) and New Prosperity (2012). The models were predicated upon habitat suitability for all indicators except Grizzly bears, for which a habitat capability model was also used (see Supplemental Report, Section 2.3.2 for

[31] BC MOE 2009, unpublished data (R. Packham, J. Youds)

[32] No appropriate density estimate is available from the literature and the BC MOE does not have a regional density estimate to provide. Project-related field data collected in 2006 was focused on species inventory and presence/absence rather that the development of density estimates.

methodology). The assessments were completed over three areas in order to provide additional relevant and local contexts with which to evaluate and assess potential habitat loss (Supplemental Report, Section 1.2, Figure 1). These are:

- Regional Study Area: combined area of the Taseko River and Big Creek Watersheds
- Rights and Title Study Area (SBPSxc and MSxv only): area defined in the William Case, and
- Eastern Trapline Area: area defined in the William Case.

Table 2.7.2.8-9 Change in Habitat Availability from Baseline to Maximum Disturbance

Key Indicators	Season/Life Requisite	New Prosperity (2012) Available habitat (ha) at Maximum Disturbance*	Prosperity (2009) Available habitat (ha) at Maximum Disturbance*	Difference in Available habitat between New Prosperity (2012) & Prosperity (2009) ha	Difference %	Supplemental Report (2009), Section 3.1.3 Reference
Regional Study Area						
Mule deer	Winter shelter	200,139	200,169	-30	-	Table 5
Moose	Winter feeding	59,725	59,582	143	-	Table 4
Grizzly bear	Habitat Capability	136,296	136,259	37	-	Table 8
	Habitat Suitability	88,481	88,490	-9	-	Table 9
Black bear	Denning	165,746	165,867	-121	-	Table 7
Fisher	Natal denning	80,792	80,507	285	-	Table 6
Rights and Title Study Area (SBPSxc and MSxv only) [To be included in Final EIS: GIS analysis ongoing]						
Mule deer	Winter shelter	-	28,841	-	-	Table 5
Moose	Winter feeding	-	18,949	-	-	Table 4
Grizzly bear	Habitat Capability	-	125,289	-	-	Table 8
	Habitat Suitability	-	58,727	-	-	Table 9
Black bear	Denning	-	87,178	-	-	Table 7

Key Indicators	Season/Life Requisite	New Prosperity (2012)	Prosperity (2009)	Difference in Available habitat between New Prosperity (2012) & Prosperity (2009)		Supplemental Report (2009), Section 3.1.3 Reference
		Available habitat (ha) at Maximum Disturbance*	Available habitat (ha) at Maximum Disturbance*	ha	%	
Fisher	Natal denning	-	14,982	-	-	Table 6
Eastern Trapline Study Area [To be included in Final EIS: GIS analysis ongoing]						
Mule deer	Winter shelter	-	11,221	-	-	Table 5
Moose	Winter feeding	-	1,694	-	-	Table 4
Grizzly bear	Habitat Capability	-	19,281	-	-	Table 8
	Habitat Suitability	-	3,930	-	-	Table 9
Black bear	Denning	-	5,312	-	-	Table 7
Fisher	Natal denning	-	885	-	-	Table 6

*: Area calculation includes the accumulation of moderate, moderate high and high habitat suitability rating classes.

The habitat loss predicted at maximum disturbance represents the worse-case scenario; thus, the magnitude of the effects is likely to be tempered somewhat at the local scale. With the implementation of the mitigation measures summarized below, the residual loss of wildlife habitat is not predicted to be significant with respect to the sustainability of the key indicator populations in the Regional and Rights and Title study areas (conclusion to be reconfirmed following completion of analysis in Table 2.7.2.8-9).

Wildlife Mitigation Measures

Mitigation measures for the New Prosperity Project include a variety of methods for avoiding and/or mitigating potential environmental effects of project-related activities. This includes the commitments related to the EAO Certificate relevant to wildlife, which we confirm our intention to implement as part of this EIS and the federal EA process, all previous applicable wildlife-related mitigation measures for the Project as described in the March 2009 EIS/Application (Volume 5, Section 6.4.1, Table 6-67 (mine), Table 6-68 (transmission line) and Table 6-69 (access road). Alterations to the Project since the March 2009 EIS/Application include a redesigned mine footprint which is both smaller in size and less potentially harmful to wildlife. Therefore, no new mitigation measures are proposed for loss or alteration of habitat. Table 2.7.2.8-10 presents a summary of the mitigation measures applicable to the mine site; presented here as a subset of committed measures applicable to the New Prosperity Project.

Table 2.7.2.8-10 Mitigation Measures Applicable to New Prosperity Activities

Resource	Project Phase*	Mitigation Measures	
		Prosperity EIS (2009)	
		General	Reference
Wildlife	C&C, O	• Site clearing area will be minimized. Minimization of the site clearing area can be achieved by carefully considering (and clearly delineating) clearing boundaries, so that the cleared areas are practical, in that they comfortably allow for the construction and placement of facilities and Project components, but are not excessive. In practice, this may result in the retention of patches or strips of intact vegetation cover within the Project footprint (e.g., between the camp and the plant). Even if small, these patches will have benefits to wildlife and wildlife habitat (e.g., landscape connectivity through "stepping stones"[33], seed sources for post-closure re-establishment of vegetation cover) and should be protected from further disturbance during the life of the mine • Site clearing will avoid non-pine forests of any age wherever possible • Mitigation measures for other VECs/KIs are applicable: Old forest (Section 5.4.1); Wetland ecosystems (Section 5.4.2); Riparian ecosystems (Section 5.4.3); Fish habitat (Section 3); Aquatic ecosystems (Section 2.3.3) • Other management plans are applicable: Water Quality Management Plan (Vol. 3, Sect. 9); Fish Protection and Management Plan (Vol. 3, Sect. 9) • Prior to and during site clearing for mine site facilities (e.g., camp, parking lot, processing plant), any wildlife habitat features (e.g., mineral licks, dens, nest trees, snags, rock outcrops, small ponds/seepages) that are identified will be evaluated for potential mitigation measures (e.g., avoidance). Identification of these features will occur as they are encountered (either by boundary flagging crew or clearing crew). The draft *Wildlife Habitat Features: Summary of Management Guidelines–Northern Interior Forest Region* (BCMWLAP 2004q) is useful in the identification of wildlife habitat features and proposes mitigation measures that would be applicable in the Project area • Retain actual or potential wildlife trees (i.e., dead or dying trees and snags, and living or dead deciduous trees) wherever possible and safe to do so (as per provincial guidelines[34]) • Best practice is adherence to region-specific breeding bird timing windows for site clearing and any subsequent vegetation management activities (BCWLAP 2004r). An alternative to this best practice is searching for and flagging off nest sites in advance of vegetation clearing (BCWLAP	Prosperity EIS Volume 5, Section 6.4.1 New Prosperity Project Description Appendix C

[33] Stepping stones are small habitat patches or habitat features (e.g., remnant trees) within a disturbed matrix that provide connectivity among larger habitat patches.
[34] http://www.for.gov.bc.ca/hfp/values/wildlife/WLT/Publications/policies/WT-Guidance-05-2006.pdf

Resource	Project Phase*	Mitigation Measures — Prosperity EIS (2009) — General	Reference
		2004r). Timing window dates and any alternatives to best practice should be confirmed in consultation with BC Ministry of Environment Region 5 staff.	
Wildlife	C&C,O, D, PC	• Wildlife protection measures to apply to Project personnel travelling to and from Project including prohibition of firearms, no littering, no feeding or harassment of wildlife, no hunting or fishing on the Project site and Project related traffic restricted to designated access roads and trails (including vehicles and snowmobiles).	EAO Table of Commitments
Wildlife	C&C, O, D, PC	• Minimize bear/worker interaction at mine site through the development of mine site policies/guidelines and Bear Aware and Safety training. A problem wildlife prevention and response plan will be developed.	New Prosperity Project Description Appendix C
Wildlife	C&C, O, D, PC	• Minimize acoustic disturbance from helicopter over-flights by restricting altitude and avoiding use during the big horn sheep lambing period (start and end dates to be determined in consultation with regional BC MOE staff)	New Prosperity Project Description Appendix C
Wildlife	C&C, O, D, PC	• Wildlife mortality on roads will be minimized through driver training, road maintenance, following posted speed limits and where possible, using radios to notify others of wildlife on the road	New Prosperity Project Description Appendix C
Wildlife	C&C, O, D, PC	• Taseko Mines Ltd. will evaluate the feasibility of fencing, fully or partially (depending on size and accessibility), mine site water features with compromised water quality • Mitigation measures that may minimize or eliminate adverse Project effects on wildlife health are included in the assessments for a number of other VECs, principally: Human Health and Terrestrial Ecological Risk Assessment (Volume 6, Section 6) and Water Quality and Aquatic Ecology (Volume 5, Section 2)	Prosperity EIS Volume 5, Section 6.4.1
Wildlife	PC	• Sections of the Reclamation Plan that pertain to the reclamation of wildlife habitat (Volume 3, Section 9.4)	Prosperity EIS Volume 5, Section 6.4.1
Wildlife	C&C,O, D	• Develop and establish an Environmental Management System (EMS) to provide guidance on all	EAO Table of

Resource	Project Phase*	Mitigation Measures — Prosperity EIS (2009) — General	Reference
		environmental aspects of Project phases including mitigation measures, Best Management Practices (BMPs) and EAO-based and Panel Commitments. EMS to be based on the EMPs presented in the Application, Volume 3 and finalized prior to construction (where relevant, or else prior to operations) and implemented by Standard Operating Procedures (SOPs).	Commitments
Wildlife	C&C,O	• Implement BMP and methods for constructing and upgrading the access road(s) and transmission line, and related stream crossing (Volume 3, Section 9.2.1. in the Application).	EAO Table of Commitments
Migratory Birds	C&C	• Design and construct a transmission line consistent with BCTC's standard practices to mitigate potential transmission live electrocution/collision impacts to migratory birds.	EAO Table of Commitments
Species	**Project Phase**	**Species-Specific**	**Reference**
Mule deer	C&C, O, D, PC	• No species specific mitigation measures proposed for mule deer habitat. However, the general wildlife mitigation measures (e.g. minimize clearing area) listed above and those identified for other KIs (e.g. old forest, Section 5.4.1) are applicable.	Prosperity EIS Volume 5, Section 6.3.2.4
Moose	C&C, O, D, PC	• No species-specific mitigation measures are proposed for moose habitat. However, the general wildlife mitigation measures (e.g., minimize clearing area) listed above, and those identified for other KIs (e.g., old forest [Volume 5, Section 5], wetlands [Volume 5, Section 5]) are applicable.	Prosperity EIS Volume 5, Section 6.3.3.4
Grizzly bear	C&C, O, D, PC	• General wildlife mitigation measures listed above (e.g. minimize site clearing area) and those identified for other KIs (e.g. old forest, Volume 5, Section 5.4.1) are applicable	Prosperity EIS Volume 5, Section 6.3.4.4
	C&C, O, D	• Taseko Mines Ltd. will provide Bear Aware and Bear Safety information and training for all Project personnel • Taseko Mines Ltd. will develop a problem wildlife prevention and response plan as part of the Vegetation and Wildlife Management Plan • Taseko Mines Ltd. will only employ non-lethal deterrent methods in the unlikely event a problem bear situation develops, unless otherwise instructed, and fully supported, by the BC Ministry of Environment	Prosperity EIS Volume 5, Section 6.4.1

Resource	Project Phase*	Mitigation Measures	
		Prosperity EIS (2009)	
		General	Reference
		• All waste that may be an attractant to bears (e.g., food waste) will be handled in accordance with strict permit conditions (yet to be determined) that eliminate the potential for bear management concerns	
	C&C, O, D, PC	• Work with Ministry of Environment to develop an education and awareness program on Grizzly bears and develop a Grizzly bear population monitoring program.	New Prosperity Project Description Section 2.5.2.4
	C&C, O, D, PC	• Work with Ministry of Environment to develop a Grizzly bear population monitoring program.	New Prosperity Project Description Section 2.5.2.4
Black bear	C&C, O, D	• Avoid site clearing of moderate or higher quality denning habitat in mid-winter to reduce the risk of destroying or disturbing active dens • Should clearing of moderate or higher quality denning habitat occur in the winter, conduct a pre-clearing den survey to identify bear dens within the proposed mine site. Any identified dens will be clearly marked with a 50m setback and avoided until bears have left the area. • General wildlife mitigation measures listed above and those identified for other KIs (e.g. old forest, Section 5.4.1) are applicable.	Prosperity EIS Volume 5, Section 6.3.5.4
	C&C, O, D	• Taseko Mines Ltd. will provide Bear Aware and Bear Safety information and training for all Project personnel • Taseko Mines Ltd. will develop a problem wildlife prevention and response plan as part of the Vegetation and Wildlife Management Plan • Taseko Mines Ltd. will only employ non-lethal deterrent methods in the unlikely event a problem bear situation develops, unless otherwise instructed, and fully supported, by the BC Ministry of Environment • All waste that may be an attractant to bears (e.g., food waste) will be handled in accordance with strict permit conditions (yet to be determined) that eliminate the potential for bear management concerns	Prosperity EIS Volume 5, Section 6.4.1
	C&C, O, D, PC	• General wildlife mitigation measures (e.g. minimize clearing area) listed above and those identified for other KIs (e.g. old forest, Section 5.4.1) are applicable	Prosperity EIS Volume 5,

Resource	Project Phase*	Mitigation Measures	
		Prosperity EIS (2009)	
		General	Reference
			Section 6.3.5.4
Fisher	C&C, O, D, PC	• No species-specific mitigation measures proposed. General wildlife mitigation measures listed above and those identified for other KIs (eg. Old forest, Section 5.4) are applicable.	Prosperity EIS Volume 5, Section 6.3.6.4
Great blue heron	C&C, O, D, PC	• No specific heron mitigation measures are proposed; however, the general wildlife mitigation measures (e.g., minimize clearing area) listed above, and those identified for other KIs (e.g., wetlands [Section 5.4], grasslands [Section 5.4]) are applicable.	Prosperity EIS Volume 5, Section 6.3.9.4
Mallard	C&C, O, D, PC	• No Mallard-specific mitigation measures are proposed; however, the general wildlife mitigation measures (e.g., minimize clearing area, timing windows) listed above, and those identified for other KIs (e.g., wetlands, Section 5.4) are applicable.	Prosperity EIS Volume 5, Section 6.3.10.4
Barrow's goldeneye	C&C, O, D, PC	• General wildlife mitigation measures (e.g., minimize clearing area, retention of deciduous trees) listed above, and those identified for other KIs (e.g., old forest [Section 5.4.1], wetlands [Section 5.4.2]) are applicable.	Prosperity EIS Volume 5, Section 6.3.11.4
	C&C	• Minimize loss or alteration of Barrow's Goldeneye nesting habitat by retaining wildlife trees where possible.	New Prosperity Project Description Appendix C
Prairie falcon	C&C, O, D, PC	• No species-specific mitigation measures are proposed for prairie falcon habitat. This is based on the current understanding of the Project which requires no use of aircraft during any phase of mine development. However, if it became necessary to use aircraft, a no-fly zone around the "nesting cliff" and a 500 m minimum altitude over any other cliffs would be implemented.	Prosperity EIS Volume 5, Section 6.3.18.4
Short-eared owl	C&C, O, D, PC	• No species-specific mitigation measures are proposed; however, the general wildlife mitigation measures (e.g., minimize clearing area) listed above, and those identified for other KIs (e.g., grasslands, Section 5.4.4) are applicable.	Prosperity EIS Volume 5, Section

Resource	Project Phase*	Mitigation Measures	
		Prosperity EIS (2009)	
		General	Reference
			6.3.19.4
Amphibians	C&C, O, D, PC	• No species-specific mitigation measures are proposed for amphibian habitat; however, the general wildlife mitigation measures (e.g., minimize clearing area) listed above, and those identified for other KIs (e.g., wetlands, Volume 5, Section 5.3) are applicable.	Prosperity EIS Volume 5, Section 6.3.21.4
Notes: * C&C: Construction and Commissioning, O: Operations, C: Closure, D: Decommissioning, PC: Post-closure.			

Measures include a wildlife habitat compensation plan which will compensate for any residual adverse effects following the implementation and evaluation of mitigation measures. A draft Habitat Compensation Reference Document has been developed which addresses a suite of wildlife-related concerns. These include but are not limited to:

- Abiding by the environmental management strategies of the region
- Inclusivity of recovery strategies and management plans for species at risk
- Setting compensation targets for wildlife and wildlife habitat, and
- Promoting long-term sustainability of wildlife habitats, functions and population.

The Proponent will work with BC MOE and Environment Canada in consultation to prepare the final habitat compensation plan.

Cumulative Effects Assessment

As described in Section 2.7.1, cumulative environmental effects were only assessed if all three of the following conditions were met for the environmental effect:

- The Project results in a measurable, demonstrable or reasonably-expected residual environmental effect on a component of the environment
- The Project-specific residual environmental effect does, or is likely to, act in a cumulative fashion with the environmental effects of other past or future projects and activities that are likely to occur, and
- There is a reasonable expectation that the Project's contribution to cumulative environmental effects will affect the viability or sustainability of the resource or value.

The Project inclusion list (Table 2.7.1.4-1) identifies past, present and reasonably foreseeable projects and activities that could interact cumulatively with the Project. The locations of each of the 22 projects and activities are shown on Figure 2.7.1.4-1. Eight of these project and activities are new since 2009. In addition, there is more existing disturbance at baseline as the result of logging (see Section X). Of the eight new projects, only one, the Newton Mountain mine development, is located west of the Fraser River and, therefore, considered likely to interact cumulatively with the Project's residual effects on wildlife.

For wildlife, the first two conditions are met; that is, there are Project-specific residual effects on wildlife and these effects do, or are likely to, interact cumulatively with past, present and reasonably foreseeable projects and activities. With respect to the third condition, in the March 2009 EIS/Application it was concluded that for each of the wildlife key indicators the Project's contribution to cumulative effects would not affect either the viability or sustainability of the wildlife resource. While the predicted residual effects on wildlife for New Prosperity have generally either decreased (habitat) or remained the same (mortality risk) relative 2009, the amount of existing disturbance (logging) has increased and the Newton Mountain mine development is likely to interact cumulatively with the Project's residual effects on wildlife. [To be included in Final EIS: determine and discuss the relative contribution of the Project to cumulative effects on wildlife, considering the increased baseline disturbance and the additional future project and then revaluate New Prosperity with respect to the third condition]

[To be included in Final EIS: inclusion of health in discussion of cumulative effects]

Determination of the Significance of Residual Effects

The assessment methodology for residual effect characterization and determination of significance is as described in Section 2.7.1.5.

The findings of the Project residual effects assessment for wildlife for New Prosperity are summarized in Table 2.7.2.8-11. [This is a summary for the Project in its entirety; summary for mine site only is still to be completed based on findings presented above]

[Add a statement on cumulative effects when assessment is finalized]

There are no changes in effects prediction confidence from the Prosperity Project (March 2009 EIS/Application, Volume 5 Section 6.1.6). The overall confidence in predicting significant environmental effects on wildlife related to New Prosperity Project activities remains moderate. The overall rating is based on combining the ratings for all phases of the Project, which range from low to high (Table 2.7.2.8-12).

Table 2.7.2.8-11 Project Residual Effects Assessment Summary for Wildlife for New Prosperity

Potential Environmental Effect	Proposed Mitigation/Compensation Measures	Residual Effects Characterization: Direction	Magnitude	Geographical Extent	Duration/ Frequency	Reversibility	Ecological Context	Significance	Prediction Confidence	Recommended Follow-up and Monitoring
Loss or alteration of habitat										
Construction, operations and decommissioning	See Prosperity EIS (2009), Volume 5, Section 6.4.1	N	M	R	LT	R/I	D	N	M	See Prosperity EIS (2009), Volume 5, Section 6.4.3 and Follow-up and Monitoring section (this document)
Post-closure		N	M	R	LT/ P	R/I	D	N	M	
Residual environmental effects for all phases		N	M	R	LT/ P	R/I	D	N	M	
Increased direct mortality risk										
Construction, operations and decommissioning	See Prosperity EIS (2009), Volume 5, Section 6.4.1	N	M	R	LT	R	D	N	M	See Prosperity EIS (2009), Volume 5, Section 6.4.3 and Follow-up and Monitoring (this document)
Post-closure		N	L	R	LT	R	D	N	M	
Residual environmental effects for all phases		N	M	R	LT	R	D	N	M	
Reduction in Animal Health [To be included in Final EIS]										
Construction, operations and decommissioning		-	-	-	-	-	-	-	-	-
Post-closure		-	-	-	-	-	-	-	-	

Residual environmental effects for all phases		-	-	-	-	-	-	-	-	
Combined residual environmental effects [To be included in Final EIS]										
Construction, operations and decommissioning		-	-	-	-	-	-	-	-	-
Post-closure		-	-	-	-	-	-	-	-	
Residual environmental effects for all phases		-	-	-	-	-	-	-	-	

Table 2.7.2.8-12 provides a concise summary of the effects assessment for wildlife.

Table 2.7.2.8-12 Summary of Effects Assessment for Wildlife

Effects Assessment	Concise Summary
Beneficial and Adverse Effects	The New Prosperity Project has redesigned the mine site layout to include the conservation of Fish Lake and associated riparian habitat. This is expected overall to reduce potential effects to wildlife in terms of habitat availability. There is still uncertainty regarding the potential adverse effects on animal health related to water quality within the lake [final assessment pending and to be submitted with final EIS].
Mitigation and Compensation Measures	A wide variety of methods for avoiding and/or mitigating potential environmental effects have been proposed for project-related activities, include both species-specific and general wildlife mitigation measures (see Table 2.7.2.5-10). Compensation initiatives address the ecological and wildlife management priorities within the regions. A draft Habitat Compensation Reference Document has been developed which addresses wildlife-related compensation planning; see (Appendix 2.7.2.5-2a).
Potential Residual Effects	No potential residual effects are expected related to change in wildlife habitat with implantation of associated mitigation and compensation measures. There is still uncertainty regarding the potential adverse effects on animal health related to water quality within the lake [final assessment pending and to be submitted with final EIS].
Cumulative Effects	[To be completed when CE section is finalized and to be submitted with final EIS]
Determination of the significance of residual effects	While there is still uncertainty regarding the potential adverse effects on animal health related to water quality within the lake [final assessment pending and to be submitted with final EIS], the combined residual environmental effects of the Project on the sustainability of wildlife in Region 5 is predicted to be not significant. This assessment is predicated on the implementation of proposed mitigation and appropriate compensation measures.
Likelihood of occurrence for adverse effects found to be significant	As no significant residual effects are predicted, there is no likelihood of occurrence. There is the possibility that the prediction of significant adverse effects is incorrect, whereby an adverse effect deemed to be not significant may have an adverse residual effect. The likelihood of this remains low.

Considering the updated findings of the Project and cumulative residual effects on wildlife presented in this document, the overall significance determination for the New Prosperity Project, including all three major components (mine site, access road, transmission line), is unchanged from 2009. That is, the effect of the Project on the viability and sustainability of the wildlife resource is considered to be not significant. [Draft statement, pending final assessment for CE, health and combined effects summary to be submitted with final EIS].

Additional Work

No additional work is proposed as part of this environmental assessment.

Follow-up and Monitoring

Follow up and monitoring activities for wildlife are described in the March 2009 EIS/Application in Volume 5, Section 6.4.3, these activities remain applicable to the New Prosperity Project. Additional activities related to the outcome of the federal panel review recommendation process include developing:

- Habitat Compensation Reference Document
  - This document will be finalized to ensure incorporation of mule deer habitat considerations with regulatory agencies and affected First Nations.
- Public Access
  - Taseko will develop a public-access plan to address concerns related to increased public access related to Project activities in order to protect wildlife and heritage values.
- Human-Bear Conflicts
  - Taseko will develop a management strategy addressing, ameliorating and avoiding human-bear conflicts related to the Project area.
- Grizzly bear Monitoring Program
  - Contribute to the Province's grizzly bear population research and monitoring program currently under way. The program could be expanded to include monitoring the population of Grizzly bears within the Project area in relation to Project activities.
- Grizzly Bear Education and Awareness Program
  - Taseko commits to an education and awareness initiative in order to support ongoing dialogs, education and information sharing the South Chilcotin GBPU. Addressing methods of reducing and eliminating avoidable mortalities of Grizzly bears within Region 5 will be a key component.

These follow-up programs will be detailed as part of the permitting process and will be finalized in consultation with regulatory agencies and First Nation communities. Where applicable, the follow-up programs will be conducted utilizing an adaptive management approach, and will be integral to the evaluation and refinement of the Environmental Management Plans (EMPs) where applicable.

2.7.3 Socio-Economics, Culture and Human Health

The EIS Guidelines state that this EIS shall:

- Identify how the Project as proposed has changed from the previous project proposal
- Identify whether changes will result in changes to the environmental effects previously predicted
- Demonstrate a rationale for that conclusion that environmental effects remain as identified in the previous project proposal, and
- Clearly identify which social, economic and cultural issues relate to changes the Project is likely to cause in the environment. (EIS Guidelines, 2012).

Specific consideration was to be given to the following sub-sections:

- Effects on resource uses
- Navigable waters, and
- Human health (EIS Guidelines, 2012).

This section will evaluate change in the three valued components noted above and will not assess economic issues, social issues and health services wherein all of which were assessed for the Prosperity Project and reported in the March 2009 EIS/Application.

2.7.3.1 Effects on Resource Uses

For effects on resource uses, the EIS is to address changes to the environmental effects previously predicted on resource uses, and more specifically how the Project as proposed addresses significant adverse effects determined in the previous review (EIS Guidelines, 2012).

The previous review found that the Project would not result in a significant adverse effect on the following resource uses:

- Forestry
- Ranching and grazing along the transmission corridor
- Hunting in the region
- Trapping in the region
- Tourism, and
- Recreation (including fishing).

Significant adverse effects, however, were deemed to exist for individuals, including the owners of Taseko Lake Lodge, Sonny Lulua trapline and for individuals grazing cattle at the meadows near Fish Lake. (Panel Review, 2010)

The EIS Guidelines direct an assessment of the following key indicators:

- Land use
- Fishing
- Outdoor recreation and tourism
- Hunting, trapping and guiding
- Forestry, and
- Specific consideration for Taseko Lake Lodge, Sonny Lulua trapline and individuals grazing cattle at the meadows at Fish Lake.

Each of these indicators are evaluated for changes in previously predicted effects due to changes in the environment resulting from the Project. A comparison of the spatial disturbances of the current and previous mine footprints is made and observations offered about changes to baseline conditions and project effects since the previous review was conducted in 2010. Mitigation is identified and conclusions about significant residual project effects made.

Regulatory Setting

The management, use and protection of resources considered in this section are subject to numerous legislative, statutory and policy instruments, primarily at the provincial level in relation to Crown land and resources. Major pieces of legislation are as follows:

- General–*Land Act*
- Forestry, Range, Public Recreation–Forest Act, Forest and Range Practices Act, Range Act
- Mining–Mineral Tenures Act, Mines Act
- Agriculture–Agriculture Land Reserve Act
- Tourism–*Tourism Act*, and
- Trapping and Guide Outfitting–*Wildlife Act.*

The acts are the primary authority for issuing tenures to government, its agencies and private-sector companies for the use and development of Crown land and resources. While the acts discuss how licensees may use Crown land, most do not spell out remedies for situations where multiple users of the same land are in conflict. Generally speaking, for new project developments that might result in effects to one or more existing licensees, those remedies are negotiated and agreed upon by the licensees themselves in cooperation with the appropriate government ministries, often at the regional or local level.

In the Project setting, the Cariboo Chilcotin Land Use Plan (CCLUP) and associated Chilcotin and Williams Lake Special Resource Management Plans (SRMPs) are higher level plans that broadly define land use zones, establish objectives that guide management of natural resources, and outline strategies for achieving those objectives. The implications of the CCLUP and SRMPs are discussed in greater detail in the Land Use section of this chapter.

Key Issues for Resource Uses

The Project is expected to interact with the several resource values during construction, operations and closure/post-closure. These interactions will vary among the resource uses in terms of magnitude and direction (e.g., beneficial or adverse effect). Most of the issues related to resource uses will occur at the mine site. The transmission line, roads and load out facilities will not adversely affect resource uses.

Interactions with other existing and possible future mine development in the region were considered for cumulative effects, but were not found to be potentially significant. Similarly, accidents and malfunctions will not create incremental effects on other resource uses.

The Project activities that are expected to change resource values are summarized in (Table 2.7.3.1-1).

Effects on project components outside the MDL, including the transmission line, access roads and load out facilities, are not addressed here because they were not linked to significant adverse effects as determined in the Federal Panel Review.

Table 2.7.3.1-1 Potentially Significant Interactions of the Project with Resource Uses

Project Activities/Physical Works	Previous Project Assessment	New Prosperity Interaction
Construction and Commissioning		
Mine site	Significant adverse effects	2
Transmission line ROW	No significant adverse effects	1
Vehicular traffic	No significant adverse effects	1
Operations		
Mine site	Significant adverse effects	2
Interaction of Other Projects and Activities		
Mining and gravel extraction	No significant adverse effects	1

NOTES:
1 = Interaction occurs; however, based on past experience and professional judgment the interaction would not result in a significant environmental effect, even without mitigation; or interaction would not be significant due to application of codified environmental protection practices that are known to effectively mitigate the predicted environmental effects. Details on justification for this rating are provided in the issues scoping section
2 = Interaction may result in a significant environmental effect; potential effects are considered further in the EA

Key Indicators

Key indicators and measurable parameters used to quantify change in land and resource use are similar to those presented in the March 2009 EIS/Application (Volume 6, Section 5.1.3, Table 5-3). These are summarized in Table 2.7.3.1-2.

Table 2.7.3.1-2 Key Indicators for Resource Uses and Measurable Parameters

KI	Measurable Parameters
Land Use Objectives	• Land use zones in the mine site • Tenures in the mine site • Restrictions in land uses pursuant to a higher level land use plan
Forestry	• Productive forest land base • Site productivity • Contribution to AAC
Agriculture/ Ranching	• Tenures in the mine site
Fishing	• Tenures (angling territories) in the mine site • Use levels • Harvest levels • Expenditures
Hunting	• Tenures (i.e., guiding territories) in the mine site • Use levels • Harvest levels • Expenditures
Public Recreation	• Key activities (e.g., kayaking, canoeing) • Features • Use levels • Expenditures
Tourism	• Tenures (i.e., commercial recreation) in the mine site • Key activities • Use levels • Expenditure
Trapping	• Tenures (i.e., trap lines) in the mine site • Harvest • Revenues

Temporal Boundaries

Project effects on resource uses will occur immediately following the commencement of Project construction and the restriction of public access to the mine site. It is expected that existing, non-compatible tenures will be modified to align with the Project boundaries, and that these changes will persist for the life of the Project or longer. The effect on the availability and quality of a specific resource will also commence during construction and, for some KIs, may increase during operations. Post-closure, effects on land access and resource availability and quality are expected to diminish.

Spatial Boundaries

The LSA is the area within which Project effects can be predicted with a reasonable degree of accuracy and confidence, and where effects are likely to be most concentrated. Since resource uses are often closely connected to the land base, its resources or its attributes, the effects are closely associated with the Project footprint. As potentially significant effects on the transmission right-of-way, roads and load out are not anticipated, the Project footprint in this assessment is the mine site as measured by the Maximum Disturbance Area (MDA).

The RSA is a broader area within which, depending on conditions, Project effects may be more wide reaching. Effects may occur because of the displacement of activities to other locals (e.g., hunters shift to another area) or because of some interdependency to the management of the regional land base or resource. While this assessment presents updated baseline information for the LSA and the RSA, the assessment of potential effects is focused on the LSA, where the Federal Panel Review found significant adverse effects.

The LSA and RSA boundaries are summarized in (Table 2.7.3.1-3) and illustrated in Figure 2.7.3.1-1.

Table 2.7.3.1-3 Summary of Spatial Boundary Definitions

Key Indicator	LSA		RSA	
	Previous Project Assessment	**New Prosperity**	**Previous Project Assessment**	**New Prosperity**
Land Use Objectives	Project footprint all components	MDA	Williams Lake Timber Supply Area	Williams Lake Timber Supply Area
Forestry	Project footprint all components	MDA	Williams Lake Timber Supply Area	Williams Lake Timber Supply Area
Agriculture/Ranching	Project footprint all components	MDA	Cariboo Regional District (areas K & E)	Cariboo Regional District (areas K & E)
Fishing	Project footprint all components	MDA	Cariboo Regional District	Cariboo Regional District
Hunting and Trapping	Project footprint all components	MDA	Management Units 5-2 to 5-5, 5-12 to 5-14	Management Units 5-2 to 5-5, 5-12 to 5-14
Public Recreation	Project footprint all components	MDA	Cariboo Regional District	Cariboo Regional District
Tourism	Project footprint all components	MDA	Cariboo Regional District	Cariboo Regional District

Note:
MDA – Maximum Disturbance Area

Environmental Effects Rating Criteria for Assessing Effects Significance

Project effects on resource uses are characterized using seven criteria: direction, magnitude, geographic extent, frequency, duration, reversibility and socio-economic context. Where possible, quantitative measures are used to characterize each effect on resource use. Where quantitative measures could not be used, the qualitative categories used are the same as in the March 2009 EIS/Application (Volume 6, Section 5.1.6).

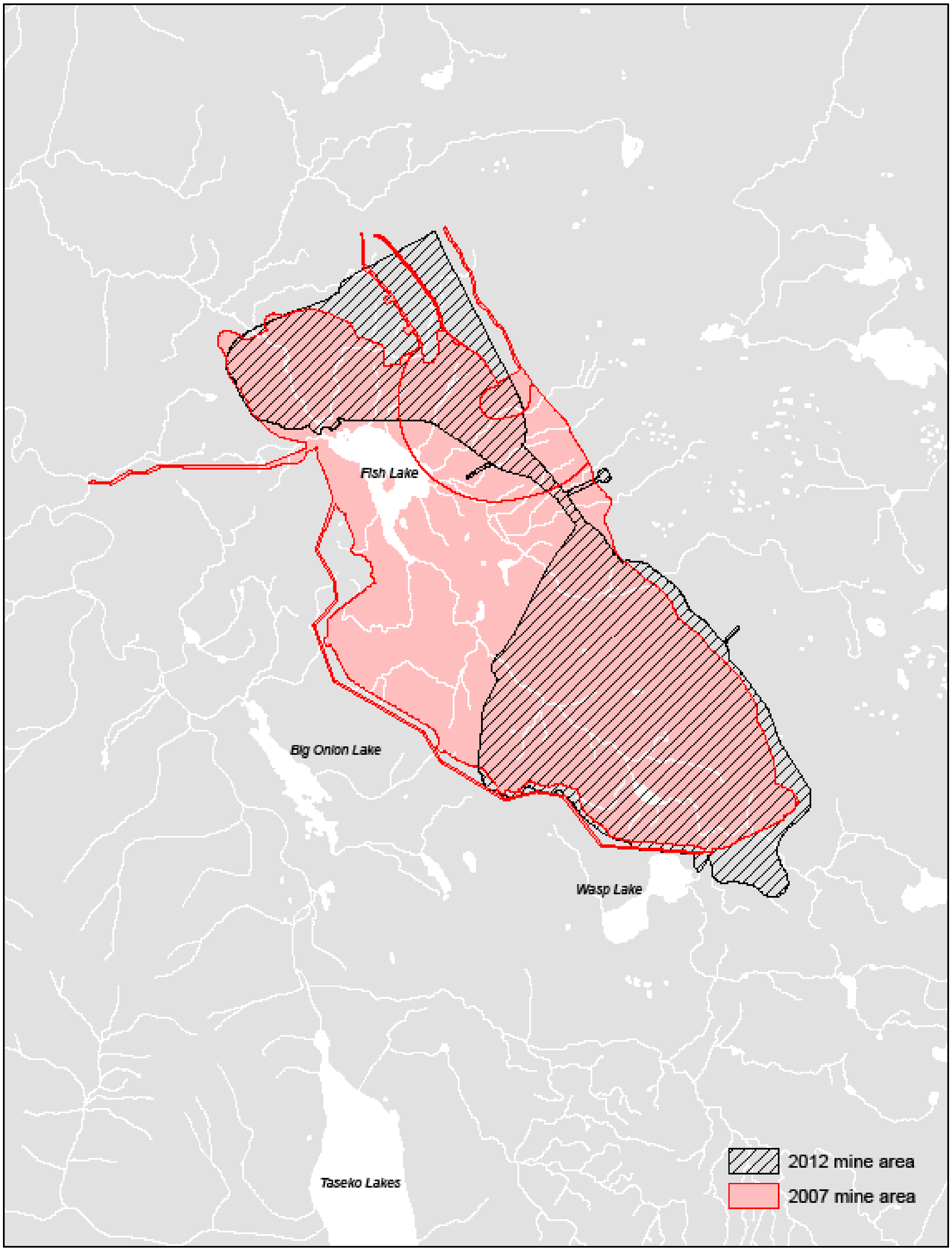


Figure 2.7.3.1-1 Local Study Areas for New Prosperity and Previous Project

Influence of Consultation on the Assessment

This assessment has updated the baseline and the effects assessment from the previous project assessment with guidance from a review of the recommendations by the province (BC Environmental Assessment Office, 2009) and the panel (Federal Review Panel, 2010) as to key indicators and effects. The new Project Description and designed mitigation was also reviewed.

A Geographic Information System (GIS) analysis of Crown land values and interests within the proposed mine's MDA was undertaken in April, 2012. The other Project components, including the transmission right-of-way, roads and load out, were not assessed. The GIS results are summarized in Appendix A, Table A2.2-10, with data presented in sections that follow, where relevant.

Telephone interviews and discussions were undertaken with eight key informants to determine changes in baseline conditions and potential effects in comparison to the previous project assessment.

Land Use

For Land Use, the guidelines direct the EIS to:

- Compare current and forecasted land tenure and land uses within the proposed MDA, and
- Determine ancillary land uses/site developments that will be placed on Crown land and that are not covered by the permits, licenses or approvals issued by the province.

With respect to second bullet, for all ancillary uses and site developments associated with the Project on provincial Crown land, the appropriate approvals will be obtained before undertaking the activity. For uses/developments that may occur in the absences of the Project, such as public recreation, the matter is addressed in the context of that value.

Indicators for land use include land ownership, and use/access tenures issued over Crown land in the MDA. It also includes the ability to attain the Crown's land management objectives on the land base. The Project effect on this value is the displacement of existing tenures, or the reduced capacity to obtain certain land use objectives.

The inventory of resource tenures in the MDA is summarized **Error! Reference source not found.**. Compared to the previous project assessment, the land base overlap of the New Prosperity MDA is reduced by some 1,818 ha., consequently the magnitude of the land use effect is either unaffected or reduced in magnitude. The table summarizes tenure types that allow use or access for several KIR's, such as timber harvesting, grazing, guide outfitting and trapping. In these instances, the Project's effect on land use is addressed in the effects assessment of the respective value.

The MDA is within area subject to the Cariboo Chilcotin Land Use Plan (CCLUP). The CCLUP provides the framework for managing Crown land and resources in a manner that:

> "addresses long-term concerns around sustaining the region's economy: access to timber for the local forest industry, certainty for the mining, ranching and tourism industries, and job security. It sustains the region's environment by permanently protecting the natural landscapes that make the Cariboo unique. Secure access to resources provides economic and social stability and increased opportunities for growth and investment throughout the region" (ILMB, 2007).

Following completion of the CCLUP, lower level planning (sustainable resource management plans (SRMP)) was completed to obtain plan objectives. The MDL is within the Chilcotin SMRP planning area. The plan sets legal direction for forestry activities under the *Forest and Range Practices Act.* The MDL (in the absence of the Project) would remain available for a broad range of land uses (i.e. it is not proposed for protected area status). Forest companies, in developing their Forest Stewardship Plan are required to adhere to the SRMP's prescriptions. Broadly, the plan define three zones, expressed in terms of rate-of-harvest . These are:

- **No Harvest Zone**: This zone is designated to conserve special ecological and cultural values. Protection of those values is paramount and encompasses the maintenance of natural processes such as endemic levels of natural disturbance.
- **Extended Harvest Zone**: The extended harvest zone requires higher levels of stand retention to protect sensitive habitats, species, provide connectivity among land units and visual quality objectives.
- **Harvest in One Rotation**: Non-timber values are adequately represented or protected given general management prescriptions.

Other tenure holders on the land base, such as a mineral tenure holder, are not bound this legal requirement but they do provide stewardship guidance (Hoffos, 2012, pers. comm.)35

Forest lands that have the "one-rotation" management prescription that are reclaimed to forest post-closure is comparable to industrial timber production with slightly extended regeneration delay.

The distribution of the MDA among the three zones is summarized in Table 2.7.3.1-4 for the previous mine site and the current MDA. The Project will create the greatest divergence with expressed land management prescriptions with respect to the "no-harvest" and "extended harvest" strategies. Land in the "no harvest" prescription (by implication, land with special values) is reduced from 320 ha to 185 ha.

Table 2.7.3.1-4 Distribution of Project Footprint in SRMP Land Units (hectares)

Harvest prescription	Previous Project Assessment	New Prosperity
No harvest	320	185
Extended harvest	1670	932
Harvest within one rotation	2430	1,484
Total footprint	4419	2,601

Source: Hillcrest Geographics (2012)

Post closure, reclamation of the MDA to native forest cover where practical to do so mitigates the Project's long term impact. It is also noted that government is considering relaxing some constraints to timber harvesting to offset the expected drop in allowable harvest following liquidation of the beetle killed volume (MFLNRO, 2012).

The previous project assessment found the Project's effect on Land Use to be not significant because of its small effect of relatively limited duration and it did not operate cumulatively to affect the viability or sustainability of the values the land use plans are intended to manage. Given that the New Prosperity mine concept has lower magnitude effect on the land it is concluded that the Project's effect on Land Use is not significant,

Forestry

The EISG directs the EIS to identify the effect of the Project footprint on forestry in terms of:

35 A discussion of the plan may be found at http://www.ilmb.gov.bc.ca/slrp/lrmp/williamslake/cariboo_chilcotin/index.html#finalLUOR

- Values and targets identified in regional and local resource management plans for the project area such as local and landscape affects to the Cariboo-Chilcotin Land Use Plan and the Community Forest.
- How all phases of the Project will affect both current and future forest resources and uses.
- How the assessment will include a determination of current and future forest resources and activities in the project area. These operations will be quantified to the extent practicable to provide a measure of the scale of activities.

The Project's implications to the CCLUP were addressed in the Land Use section above.

In the absence of the Project, the commercial stands available for harvest in the MDA would probably be harvested by companies operating in the general area. However, as discussed above, the commercial value of the timber on the MDA is low, because of low site productivity, and may have been further impaired by mountain pine beetle damage.

The Project has the immediate effect of increasing harvest volume and the associated economic activity when the footprint is cleared. A site survey is required to determine how much merchantable volume might be made available. This is a beneficial effect to the regional forest industry.

Subsequently, while the Project is operating there is a reduction in the forest land base that contributes to the Williams Lake AAC determination. The reduction in AAC due to the land base withdrawal is estimated at 4,000 m^3/yr., or 0.07% of the William Lake TSA's AAC of 5.7 million cubic metres (or .14% of the pre-uplift AAC). Post-closure, site reclamation will return a large proportion of the footprint to productive forest status.

The Project's effect on forest industry is relatively short in duration and not large in the regional context. The residual effects of the Project on forestry are determined to be not significant.

Fishing

The guidelines direct the EIS to provide an assessment of the effects of all phases of the Project on the commercial, recreational, and/or cultural lake and stream fisheries affected by the Project, and present mitigation and/or compensation plans. The assessment will provide results of visitor and creel surveys conducted to examine lake and streams use, catch success and evaluate the importance of the lake and streams in a local, regional and provincial context. (EIS Guidelines, 2012)

Project effects will be less substantial than in the previous project assessment because Fish Lake will be preserved as will the opportunities to continue sport fishing. Fishers will not have to shift their effort to other lakes in the region, although those affected by the proximity to the MDA may wish to do so. Overall sport fishing activity in the RSA (Cariboo Chilcotin) will not be affected. There is no commercial recreation tenure in the MDA and thus no effects on guided fishing are anticipated.

With the preservation of Fish Lake and implementation of a new fisheries compensation plan, and other mitigation measures, the opportunities for recreational fishing will be preserved at Fish Lake and the Project will not result in significant adverse effects on either local or regional sport fishing. The BC EAO and the Federal Panel did not find any significant effects on sport fishing in their respective reviews of the previous project, which included the loss of Fish Lake. The reduction in overall effects from the previous project and commitment to fish compensation programs gives us a high degree of confidence in this conclusion.

Outdoor Recreation and Tourism

The guidelines state that in assessing potential effects on outdoor recreation and tourism, the EIS should:

- Identify commercial recreation tenures and activities affected by the Project
- Identify areas that have high wilderness recreational value affected by the Project
- Assess the importance of the areas affected, relative to regional use by residents and visitors, and
- Provide an estimate of the value of recreation and tourism in both the project area and in the broader area, and assess the effect of the Project on park and recreation features and on tourism and recreation opportunities. (EIS Guidelines, 2012)

The guidelines also requested specific attention be given to effects on the operation of Taseko Lake Outfitters' "ecotourism" business. This operation consists of a guide outfitting component, for which the federal Panel did not find any adverse effects, and a ecotourism component, which the panel concluded "would not likely be able to continue" (Review Panel, 2010)

Spatial interactions between the Project and key recreation indicators are reduced at the MDA, when compared to the previous project, as seen in Table A2.2-10. The province's Recreation Opportunity Spectrum (ROS) shows the MDA to be a combination of semi-primitive and roaded resource land, with no primitive lands. The MDA was not identified as a critical tourism and recreation area in the Cariboo-Chilcotin Land Use Plan and was not identified as a backcountry area in the Chilcotin Sustainable Resource Management Plan (MNRO, 2007). The available information, in combination with low use levels and lack of recreational features other than sport fishing at Fish Lake, do not demonstrate the existence of "high wilderness recreation values" at the MDA.

The construction and operation of the mine will have a positive effect on accommodation, food, beverage and miscellaneous services such as rentals due to business travel in the RSA (Williams Lake) and the LSA. Road improvements and the potential for increased mine-related business could result in increased revenues for operators in the LSA.

Overall, the adverse effects on recreation and tourism in the LSA and RSA by the Project will be minor. There may be some displacement of visitors to Fish Lake, but substitute experiences are available at other lakes in the Cariboo-Chilcotin, notably Chaunigan and Vedan. There is reasonable expectation for increased use of Fish Lake as a recreation site due to improved road conditions to the site. The use of the Bootjack saw increased use from fishers once the road was improved to handle ore trucks at the nearby Mt. Polley mine (Cheverie, 2012, pers. comm.). The tourism industry as a whole will benefit from increased hospitality spending by the mine and its contractors.

Mitigation proposed in the wildlife assessment and fisheries compensation plan will offset potential losses of recreation and tourism opportunities at the MDA. The no fishing and hunting policy for employees while residing in the on-site camp will help with controlled use of recreation sites and areas, while mitigation options being considered under the Fisheries compensation Plan include more and better recreation site access than is now the case.

With the proposed mitigation, opportunities for public recreation and tourism within the LSA are not expected to change. The Project may displace some recreation activity by boaters and hikers, but based on discussions with government agencies and some user groups, use levels are very low and there is believed to be ample capacity at other recreation sites and parks in the LSA.

The Project is not expected to alter the opportunities for engaging in a quality recreation or tourism experience in the LSA or the RSA, or adversely affect values. Therefore, effects will not be significant.

It is recognized that the Project could adversely affect one commercial recreation tenure that has part of its licence area within the MDA (Table 2.7.3.1-5). The licensee is doing business as Taseko Lake Outfitters.[36] However, the magnitude of the potential effects are unknown. The company's licence area within the MDA is 748 hectares, which represents 0.58% of its total licence area of 128,078 hectares. The licence area is predominantly south of the MDA, and there are no satellite camps or base camps near the mine site. Satellite camps are considered intensive use areas where clients are frequently taken.

The previous project assessment estimated the total number of user days for the all licensees near the MDA at approximately 1000 client days with total revenues of roughly $76,000 annually. The numbers of user days and revenues attributable to Taseko Lake Outfitters is less than these amounts and the proportion directly dependent on the MDA lower still.

Table 2.7.3.1-5 Commercial Recreation Tenures in the MDA

Licensee	Tenured Activity	Total Tenure Area (ha)	Tenure Area in MDA		Intensive Use Sites
			Hectares	% of Total	
Reuter	Pack trips, hiking, wildlife viewing, x-country skiing	128,078	748	0.58%	0

Discussions with Taseko Lake Outfitters would focus on determining potential losses and remedies. All licensees must report annually to MLNRO use levels associated with the licence of occupation and remit day fees accordingly. This information, though confidential and not reported publicly, is a matter of record, and can be used to quantify potential losses. These losses would be linked to the MDA and associated with the ecotourism business as the Panel had already concluded that no adverse effects were anticipated for guide outfitting operations.

Mitigation discussions would also take into account the province's *Commercial Recreation Policy* under which the licensee obtained his licence of occupation. The licence gives general permission to the company to operate on extensive areas of Crown land for a specific purpose. Commercial recreation tenures usually do not convey exclusive rights to extensive areas of Crown land. Even though the licence of occupation exists on part of the MDA, the Province may and will issue commercial tenures to other operators for the same land, as had occurred at the MDA where multiple Crown tenures spatially overlap. Generally, licences of occupation and temporary use permits administered by the provincial government include provisions permitting the termination of contracts due to public interest or if the government requires the land for their own use, without compensation. The province does issue other tenures for what it considers higher and better uses of the land base. These potential uses are articulated and mapped in both the *Cariboo-Chilcotin Land Use Plan* and the *Chilcotin Sustainable Resource Management Plan*. The latter did not assign backcountry recreation status to the MDA and moreover ensured access for mineral exploration and potential development (MNRO 2007). The issuance of all Crown tenures are

36 One of the owners of Taseko Lake Outfitters is also a licensed guide outfitter. The implications for guide outfitting are discussed in the next section on Hunting and Guiding. The discussion here is limited to ecotourism operations, which are permitted through the *Land Act* (commercial recreation policy) as distinct from guide outfitting licences and guiding territory certificates issued under the *Wildlife Act*.

made in consideration of the spirit and intent of both plans and do not confer exclusive use by any licensee. unless expressly provided.

It would be Taseko Mines intention to discuss mitigation/compensation that is fair and reasonable in the context of verifiable losses. Therefore, no significant residual effects on the company's ecotourism business are anticipated.

Hunting and Guiding

The EIS Guidelines direct Taseko to provide an assessment of the effects of all phases of the Project on hunting and guiding, including:

- Identify the number of guiding territories affected by the Project and describe the nature of the effect in terms of the specific guiding area affected
- Assess the importance of the areas affected relative to overall area of guiding territories and, to the extent possible, quantify the effect on guide outfitters
- Propose mitigation measures for diminished wildlife and wilderness values of the guide outfitter territories, where appropriate, and
- Identify potential effects on recreational hunting opportunities in the immediate and adjacent areas. (EISG, 2012).

The MDL will overlap with four registered guide-outfitters territories. The 2,601 ha affected by the mine footprint represents between 0% and 2.2% of any one individual territory. (Table 2.7.3.1-6). The previous project assessment estimated total guide outfitter revenues in the LSA to be approximately $2 million. The increase in guided hunters for the 2008 season has likely increased these revenues over 2005 but activity levels nevertheless remain within the range of annual variations going back to 1996.

Table 2.7.3.1-6 Guide Territories in the MDA

Guide-Outfitter	Tenure Area	Area within MDA	% Within MDA
Lancaster	290,138.1	0.2	0.0%
Reuter	152,174.5	670.6	0.4%
Hoessl	57,417.5	1284.2	2.2%
Emmelkamp	85,525.0	646.4	0.8%

Source: Hillcrest Geographics (2012)

Hunting and guiding are undertaken in the area and thus will be affected by the mine construction and operation of the mine components. Once the mine permit is issued, a no-hunting ban will be instituted around the MDA for human safety reasons. For resident hunters, the loss of the MDA as a no-hunting zone represents a negligible part of the hunting area in the RSA and hunting pressure will shift to adjacent areas. Three guide outfitters will lose access to part of their registered territories, but in all cases this loss is minimal in proportion to each licence area. Wildlife studies show that the mine area is not high value winter range so overall the effect on populations of key target species such as moose and Mule deer in the area surrounding the mine will be minimal.

Proposed wildlife mitigation will minimize potentially adverse effects on the populations of target species and opportunities for hunting. A hunting ban for mine employees during the construction and operations phases of the mine will reduce hunting pressure in the LSA.

With the mitigation strategies, the effect on wildlife habitat and populations is expected to be low and extend only to the LSA. The land area lost to the no-hunting zone at the MDA and the contribution of the MDA area to big game harvest is considered minor and it is unlikely the FLNRO will reduce quotas and issue fewer tags for limited entry hunts. Resident hunters and guided non-resident hunters will have to make small spatial adjustments to their hunting behaviour to avoid the no-hunting zone. Given the proposed Project design and mitigation measures, and the limited spatial extent of effects on recreational and guided hunting, the Project should not result in significant negative effects on hunting.

Trapping

The EIS Guidelines direct Taseko to provide an assessment of the effects of all phases of the Project on trapping, including:

- Identify the number of trapping territories affected by the Project and describe the nature of the effect in terms of the specific trapping area affected
- Assess the importance of the areas affected relative to overall area of trapping territories and, to the extent possible, quantify the effect on trappers, and
- Propose mitigation measures for diminished wildlife and wilderness values of the trapping territories, where appropriate (EISG, 2012).

As seen in Table 2.7.3.1-7, two trapping areas are affected by the mine site. The MDA area will occupy an area of 1,722 ha within the Nemaiah (trap line TR0504T004) trap line area, down from 2,782 hectares in the previous project description and 879 ha within the Gutfructht's trap line (trap line TR0504T005), which represents a slight increase from 758 ha. Licensees will lose access to their territories in the MDA.

Table 2.7.3.1-7 Trap Lines Located in the MDA

Trap Line ID	Licensee	Residency	Tenure Area (ha)	Area within MDA (ha)	% Within MDA
TR0504T003	Nemiah Band/Sonny Lulua	Nemiah Valley	44,865.26	1,722.5	3.84%
TR0504T005	Heidi Gutfrucht	Williams Lake	55,926.03	878.9	1.57%

Source: Hillcrest Geographics (2012)

While the area from the MDA would be lost for trap lines and fur-bearing habitat, in general, the wildlife assessment from March 2009 EIS/Application (Volume 5, Section 6) examined Fisher as a leading indicator species for all fur-bearers, while general comments on other small fur-bearers were also offered. The overall conclusions were that significant effects on furbearers in the LSA and RSA were not anticipated.

Mitigation specific to wildlife habitat and outlined in the previous project assessment (Volume 5, Section 6) will minimize potentially adverse effects on the populations of target species and opportunities for trapping of fur-bearing animals. Restrictions on hunting for mine employees during the construction and operation phases of the mine will also reduce pressure on fur-bearing populations in the LSA.

Negotiations with the Nemiah band licensee may find a suitable solution to effects on his trap line.

The effects on the two trap lines at the mine site and in the mine buffer will experience the loss of a portion of their trap line when construction starts. The average harvest value of licensees is well below $500. Negative effects on trapping in the MDA will occur during construction and continue until mine closure when site reclamation for fur bearer habitat will be restored.

The potential for cumulative effects on trapping due to an overlap with similar effects from other projects is low. The fur-bearers currently trapped in the LSA inhabit localized home ranges that have a low likelihood of overlapping with other projects during the lifetime of the proposed mine.

The MDA and associated buffer area represents a small portion of both the habitat and the harvest of fur-bearers among the two licensees, although some minor effects are anticipated. The Project's contribution to residual and cumulative effects on trapping activities is expected to be not significant.

Grazing

The EIS Guidelines did not give specific direction with respect to an assessment of effects on agriculture but indicated that particular attention be paid to the effects on the users of the meadows within the Fish Creek watershed due to the loss of grazing land, as an issue in panel judgement. The panel otherwise did not find any significant adverse effects on agriculture in the LSA or the RSA.

The main agricultural activity in the Central Cariboo and Chilcotin is beef cattle production with contributions also made by dairy, sheep, game farming, horse, poultry, horticultural crops and forage production. The number of farms in the region dropped slightly between 2001 and 2006 although the total area farmed increased. The number of cattle and calves, and other livestock populations, remained relatively constant during this period. (BC Ministry of Agriculture and Lands, 2008) Data from the 2011 Census of Agriculture is not yet available to confirm trends since 2006, but anecdotally the industry remains unchanged since the previous project assessment.

Cattle ranches are highly dependent on Crown range, which is managed by the Ministry of Forests and Natural Resource Operations. Animal Units Months, the measure by which grazing tenures are issued, are fully utilized in the Cariboo-Chilcotin Forest District (Armes, 2012 pers. comm.).

The Project will have no effect on agriculture activity in the region. As noted in Table 2.7.3.1-8, the MDA has no agricultural land reserve designation and little agricultural capability. The Vegetation assessment (Section 2.7.2.7) shows no grasslands present but there are areas of marshland and meadows.

Table 2.7.3.1-8 Agricultural Capability within Project Components

Area (ha)	Previous Project	New Prosperity	Difference
Agricultural land reserve	0	0	0
Agricultural capability			
Forage crops–improvement practices feasible	46	11	35
Forage crops–improvement practices not feasible	4,373	1407	2,966
No capability for arable culture or permanent pasture	0	520	-520
Organic soils	0	664	-664
Range Tenures			
Number of range grazing licences	2	2	0
Number of range grazing permits	0	0	0
Number of range non replaceable grazing permits	0	0	0
Number of range hay cutting licences	0	0	0

Source: Hillcrest Geographics (2012)

Some effects on range activity are anticipated, however. The MDA will have a minor effect on overall regional forage availability, although grazing does occur with the proposed MDA. The two grazing licences affected are shown in Table 2.7.3.1-9. In the case of licence RAN076872 the area affected is just over 1 hectare out of a total tenure area of 20,832 hectares. There will be no effects on this licence by the Project.

The other licence RAN076752 has 1853.2 or 12.3% of its licence area in the MDA. This licensee is allowed to graze in the area between Fish Lake and Wolftrack Lake between July 16 and October 16.

The Xeni Gewt'in rancher referred to in the panel report does not have a registered range agreement with the Ministry of Forests and Natural Resource Operations and is believed to have approximately 30 cattle/calf pairs in the Fish Lake and Onion Lake area.

The licensee and the Xeni Gewt'in rancher who are grazing their animals at the meadows at Fish Lake will have to alter their grazing patterns. The MDA is within the Bullion Range Unit and incremental AUMs are limited for cattle but there is more flexibility for repositioning horses. (Armes, 2012, pers. comm.)

Table 2.7.3.1-9 Range Tenures in the MDL

File ID	Licence Type	Authorized Grazable Forage (AUM)	Tenure Area (ha)	Area within MDL (ha)	% Within MDL
RAN076872	Grazing Licence	316	20,382.2	1.3	0.0%
RAN076752	Grazing Licence	n/a	15,033.0	1853.2	12.3%

Source: Hillcrest Geographics (2012)

The company will work with the Ministry, the one licensee and the First Nations' rancher who used the meadows in the MDA to access replacement forage elsewhere in the area, or discuss mitigation/ compensation for lost productivity if the Ministry of Forests, Lands and Natural Resource Operations is unable to offer replacement opportunities.

The Project will exert an adverse effect on the one range licensee and one First Nations rancher by removing productive range within the MDA when site clearing begins. However, with mitigation the Project will have a minimal effect on range and forage availability. The effect is reversible after closure when range land is again available for use. Therefore, the Projects effects on agriculture and range will not be significant.

2.7.3.2 Navigable Waters

PROJECT COMPONENTS AFFECTING WATERWAYS

Waterways and Water Bodies at the Mine Site - Fish Creek and Fish Lake

The mine site will be constructed over a 2-year period and the mine will operate for a total of 20 years. Once the mine ceases operation there will be an estimated 24 year closure period during which the pit will fill with water before discharging to Fish Creek. The sections below further describe the waterways in the Fish Creek watershed affected during mine construction, operations and closure.

<u>Construction</u>

In the initial stages of the construction period, two coffer dams will be placed across Fish Creek, at the north end of Fish Lake near the natural outlet as part of outlet control structure defined as the Fish Lake Flood Control Dam (FCD). The outlet of Fish Lake is located on the north-east corner of the lake approximately 300 m upstream of the proposed ultimate open pit rim. Fish Creek currently flows through the area to be developed for the open pit, shown on the general arrangement of the New Prosperity site on Figure 2.7.3.2-1. Starting in construction, the water flowing out of Fish Lake will be managed on site to provide a safe working environment within the open pit. The location of the FCD cofferdams has been optimized to avoid impacts on Fish Lake and nearby archeological sites while maintaining a buffer zone between the FCD and the open pit. The proposed FCD is situated approximately 100 m downstream of the Fish Lake outlet and 200 m upstream of the ultimate open pit rim.

Operations

The proposed TSF footprint is located in the upper reaches of Fish Creek and will expand to include Little Fish Lake, as shown on Figure 2.7.3.2-2. During operations, the water flowing out of Fish Lake will be used to supplement flow to the inlets of Fish Lake, with any excess being pumped to the supernatant pond within the TSF until the end of Year 16 (Figure 2.7.3.2-3). As of Year 17 to the end of mining operations in Year 20, any excess outflow leaving Fish Lake, that is not required for supplemental flow to the Fish Lake inlets, will be pumped to the open pit to aid in pit filling (Figure 2.7.3.2-4).

Closure

During the first phase of closure (phase I), the outflow from Fish Lake will continue to be pumped to the inlets of Fish Lake, with excess going to the open pit (Figure 2.7.3.2-5). Approximately 10 years after the end of mining operations in Year 31, pumping to the Fish Lake inlets will cease and all the outflow from Fish Lake will be directed to the open pit (Figure 2.7.3.2-6).

Post-closure

At the commencement of the post-closure period, the open pit is assumed to be full and discharging to Lower Fish Creek (Figure 2.7.3.2-6).

Summary of Impact on Fish Creek Watershed's Navigable Waters

The Panel for review of the previous project concluded that navigation in the Fish Creek watershed would be adversely affected due to the loss of Fish Lake, Little Fish Lake and portions of Fish Creek in the absence of agreed upon mitigation. As stated in the Panel report, Transport Canada indicated during the previous review that, in addition to extinguishing boating activity, the Project would eliminate all fishing at the mine site, and a viable trout fishery was a central strategy to minimize the effects on the character of navigation currently found in Fish Lake.

Taseko proposed to mitigate the loss of navigation in the Fish Creek watershed with navigation in the Prosperity Lake and to enhance access to other navigable lakes in the area as an interim measure until Prosperity Lake was constructed. Based on testimony from aboriginal groups, the Panel viewed that recreational fishing experience could be mitigated by the provision of increased access to other lakes as an interim measure and the ultimate development of Prosperity Lake; however, this could create additional pressure on other lakes that are also used by First Nations.

With the revised mine development for New Prosperity, Fish Lake is preserved, including the island which Transport Canada noted during the panel review as being an important site for First Nations. Access through the mine site plant site and administration area, managed in accordance with the Health, Safety and Reclamation Code of BC under the BC Mines Act, can enable boating and fishing activities during operations as well as at closure. At closure, additional boating opportunities will be available with the inclusion of the TSF pond and the pit lake in the closure plan, expanding navigation opportunities for future generations within the Fish Creek watershed beyond what it currently provides today.

Transmission Line River and Stream Crossings - Fraser River and Big Creek

The centreline for the proposed 30–80 m transmission line ROW within the 500 m wide corridor has not yet been finally determined nor has the detailed design of the line been completed. A feasibility study completed in 1999 by Ian Hayward International Ltd has provided a general concept for the crossing of the Fraser River (Figure 2.7.3.2-6). It is anticipated that during the final design phase the crossing will need to be reviewed by Transport Canada's Aerodromes and Air Navigation Branch to determine if lighting or marking of transmission line structures will be required to meet standards for air safety. Taseko will submit information on the planned vertical clearance, alignment, and slope stability for the Fraser River crossing of the line; and will submit a completed Aeronautical Obstruction Clearance form once final design details become available.

Although no specific concept for the crossing of the 20 m wide Big Creek has been prepared it is understood that the average span between poles will be in the order of 230 m and it is anticipated that for the crossing at Big Creek and at all 125 definite and indefinite stream or river crossing sites the transmission line will span all crossing sites and thus will not have any direct effect on navigable waters.

The Panel for the previous project concluded that navigation in the Fraser River, Big Creek and some 125 small stream crossings were not predicted to be impeded by the Project's transmission line.

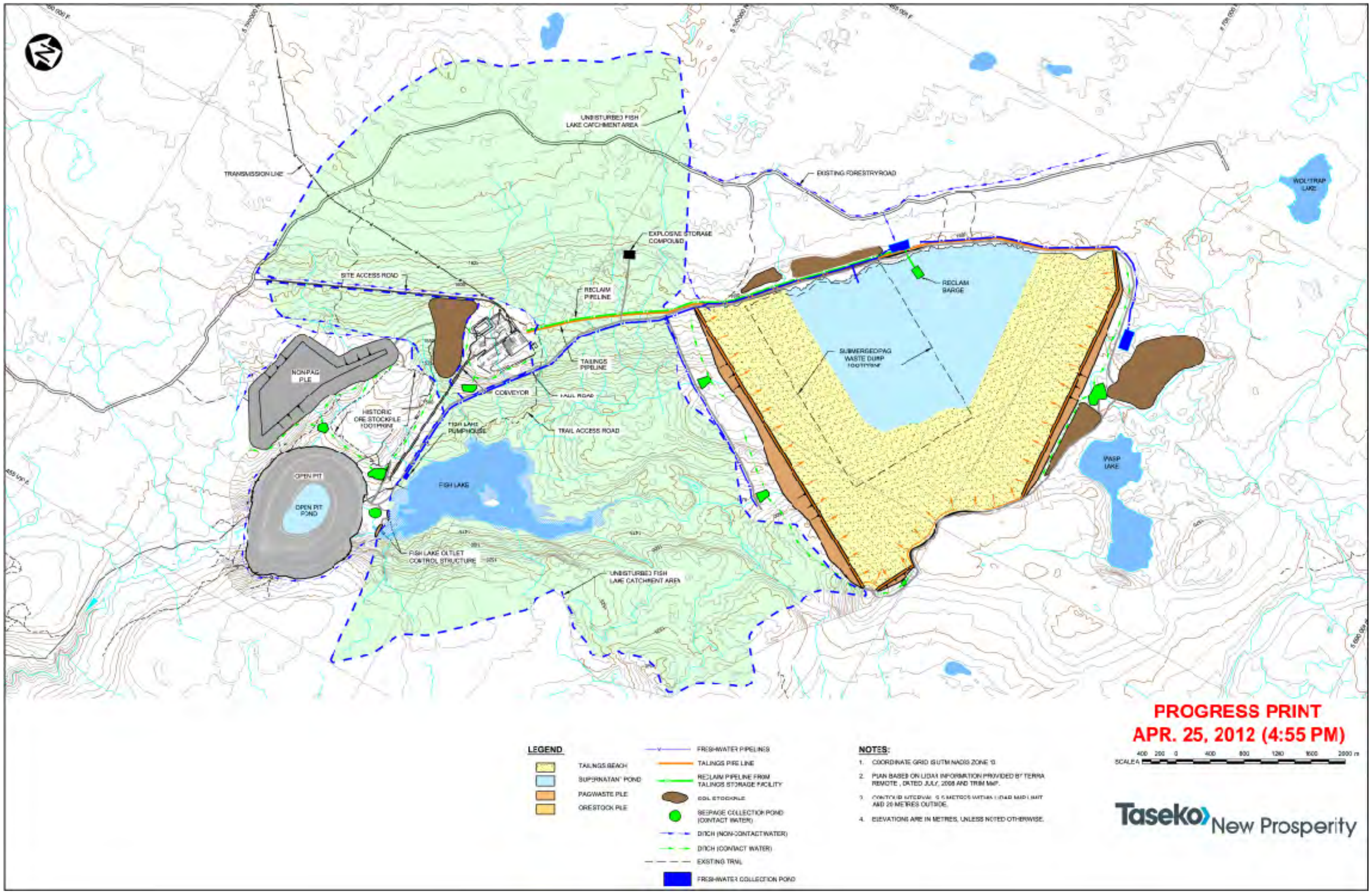


Figure 2.7.3.2-1 General Arrangement – Water Management Structure

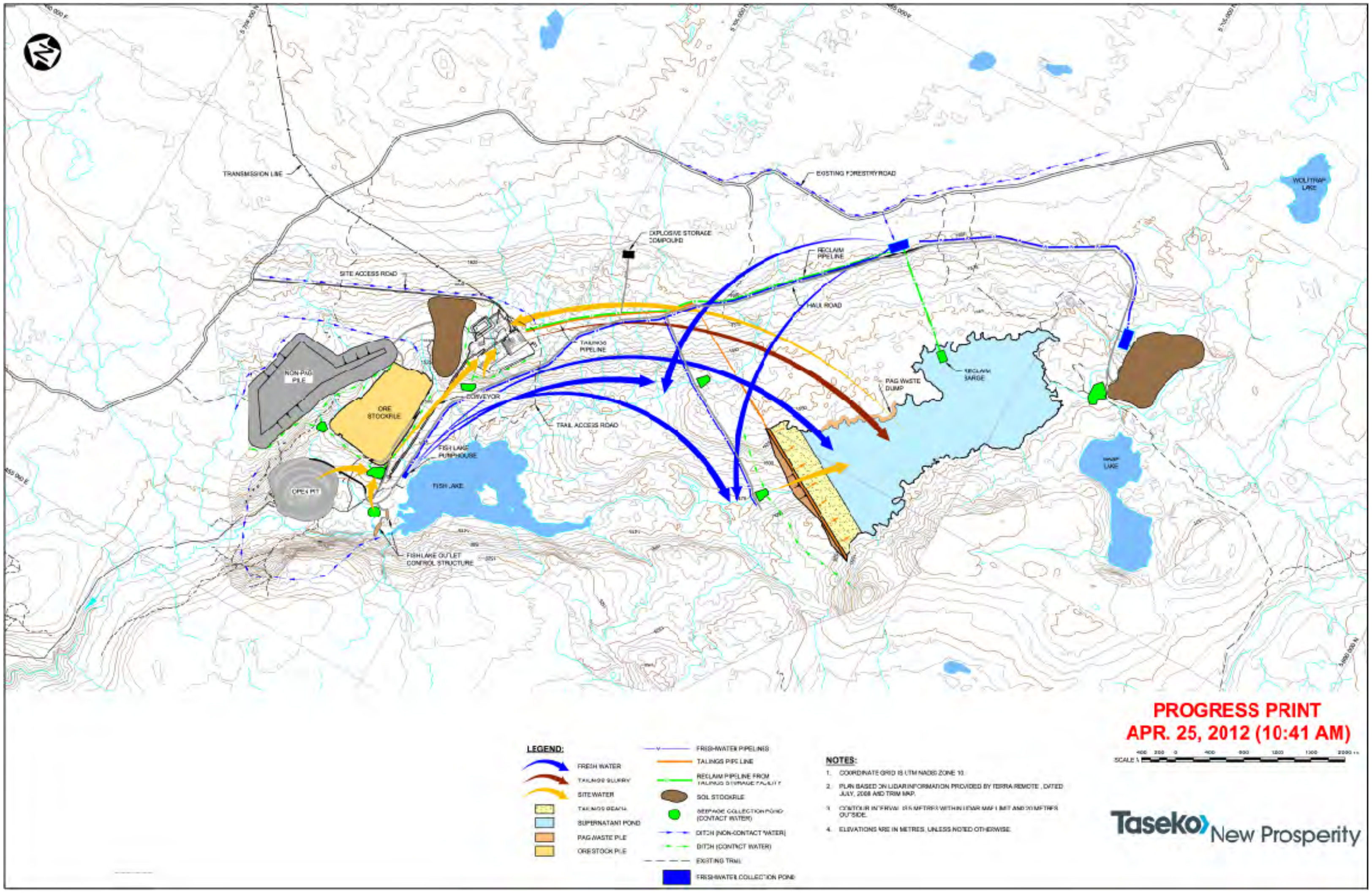


Figure 2.7.3.2-2 **Water Management – End of Year 1**

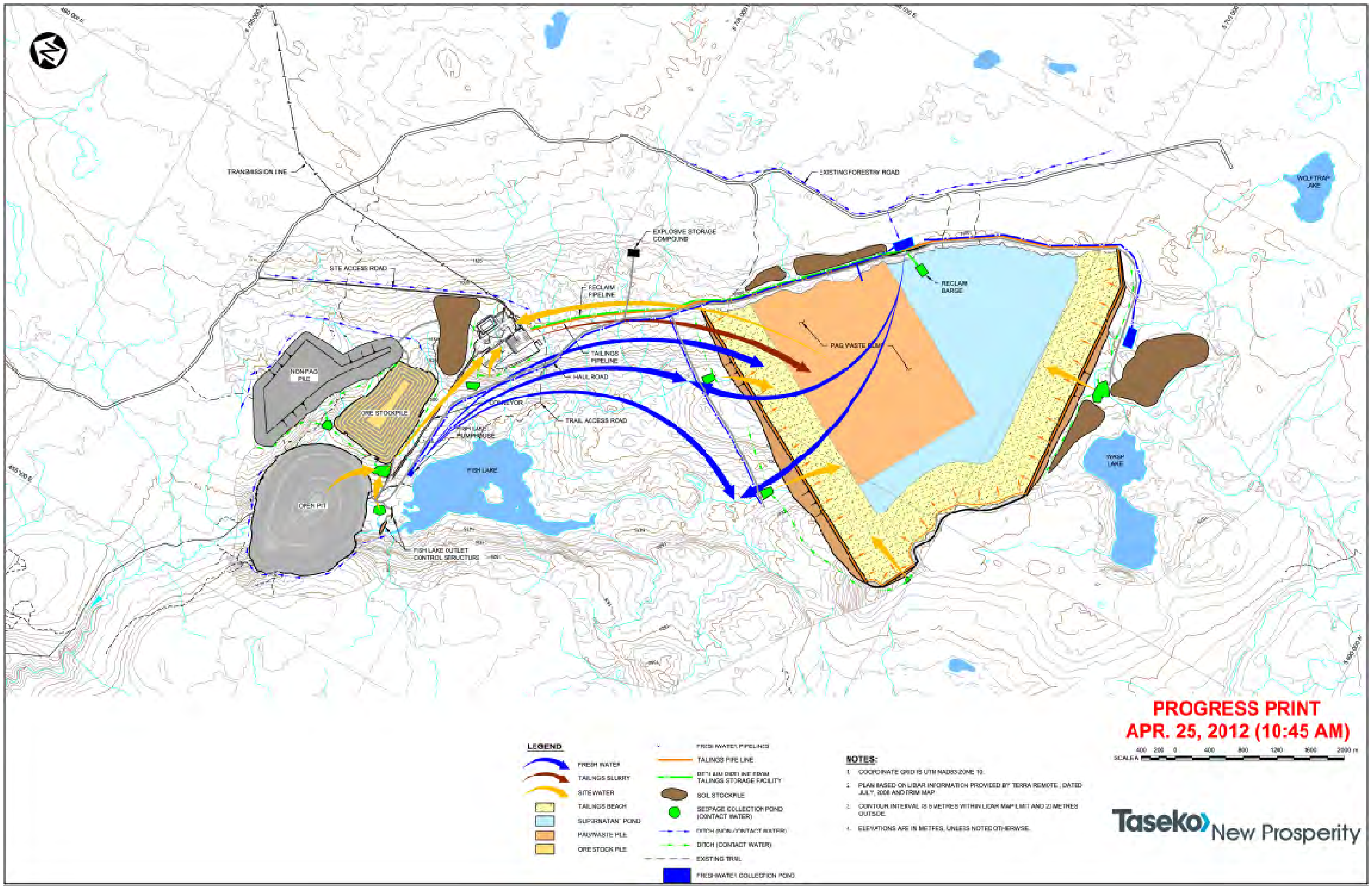


Figure 2.7.3.2-3 Water Management – End of Year 16

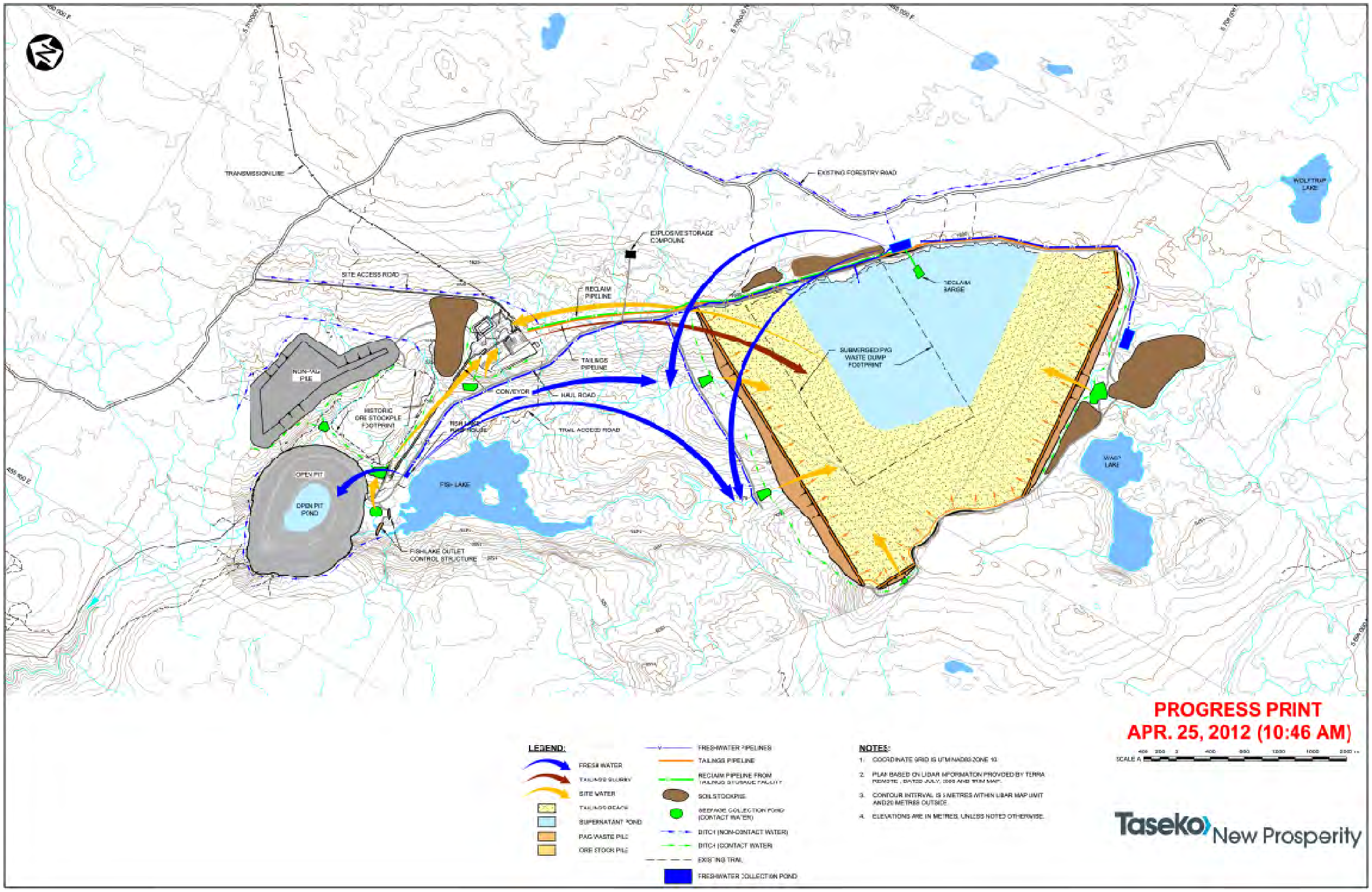


Figure 2.7.3.2-4 Water Management – End of Year 20 (Ultimate)

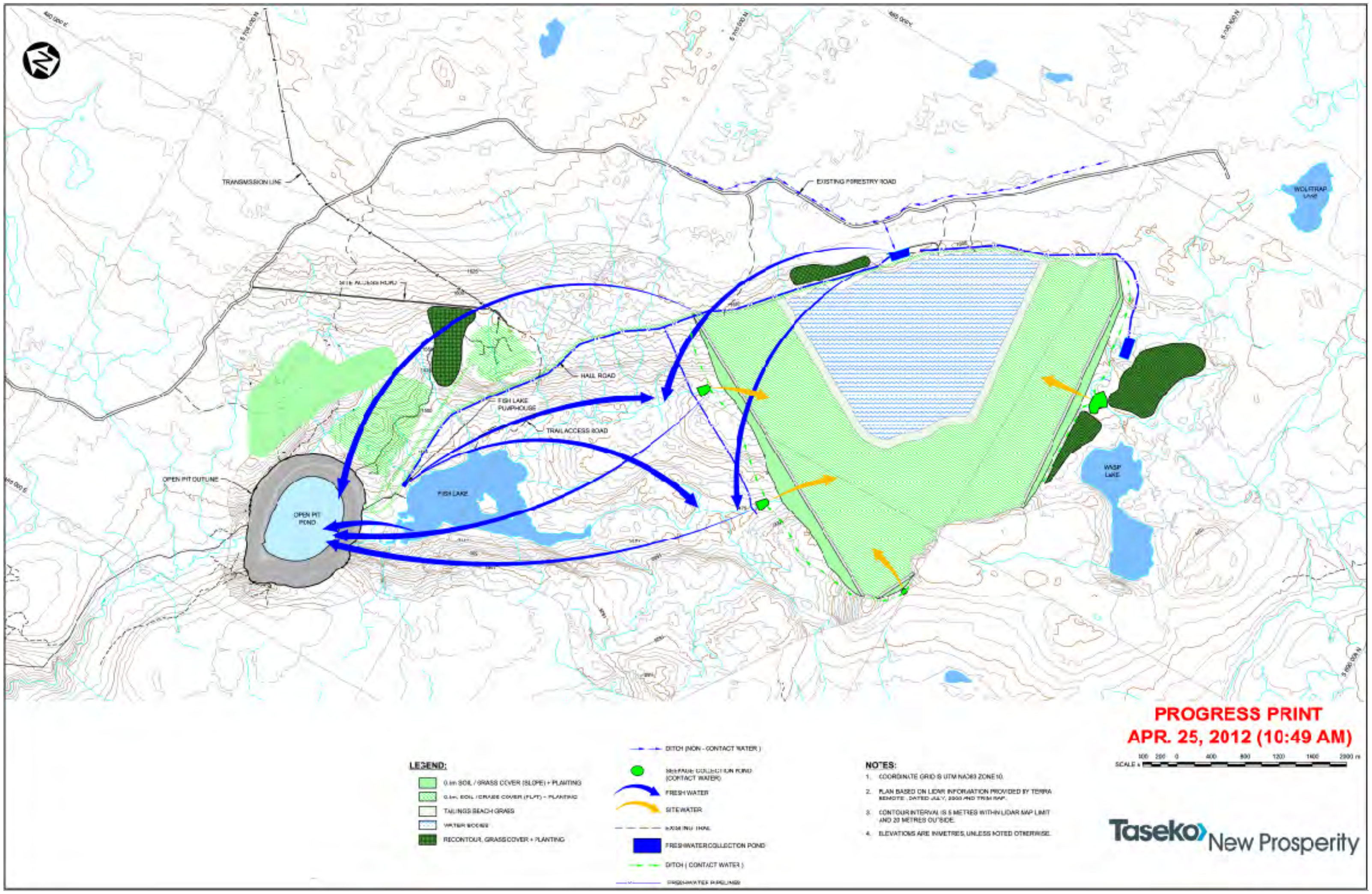


Figure 2.7.3.2-5 Water Management – Closure Phase I (Years 21-30)

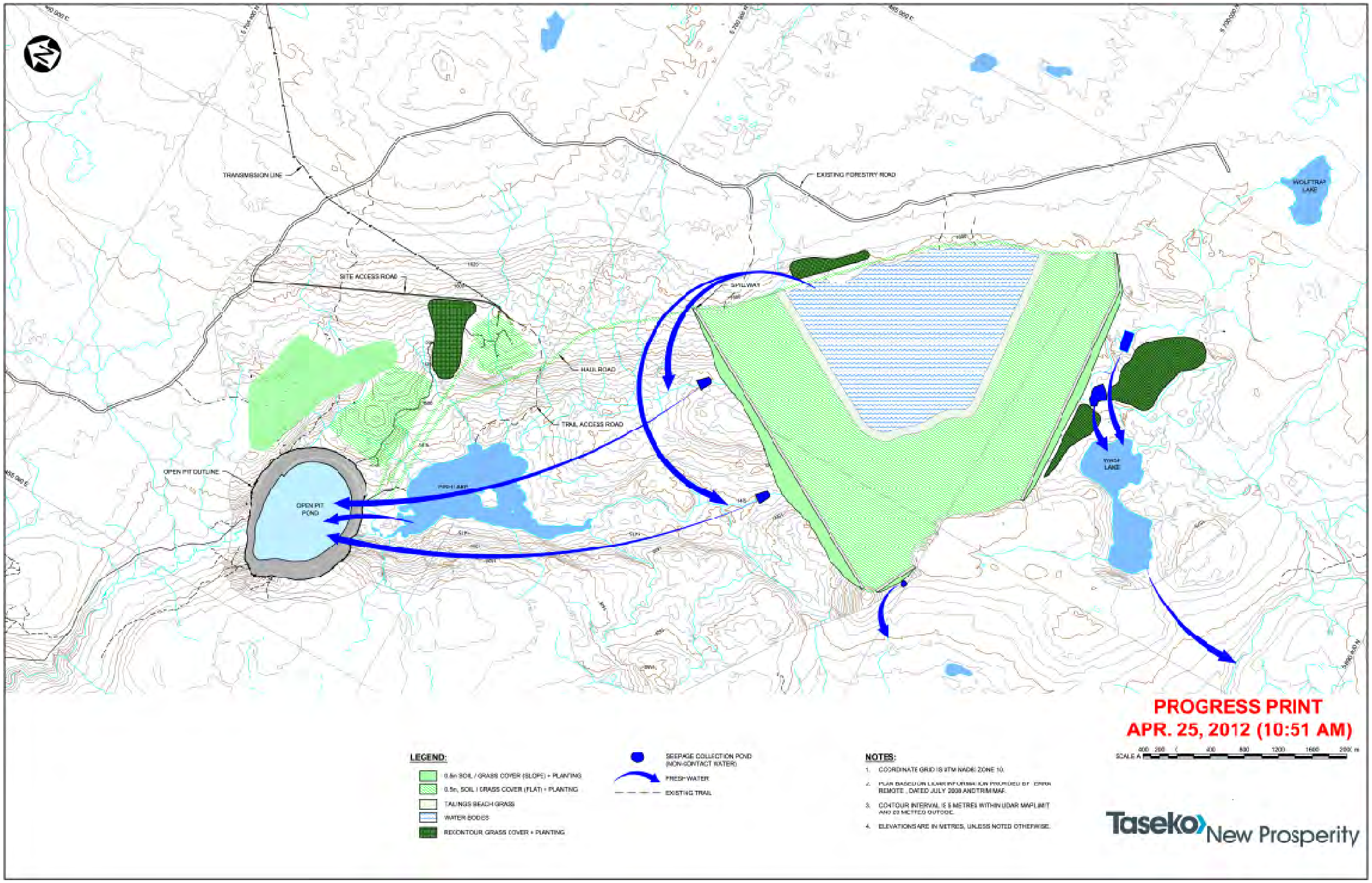


Figure 2.7.3.2-6 Water Management – Closure Phase II (Years 31-44)

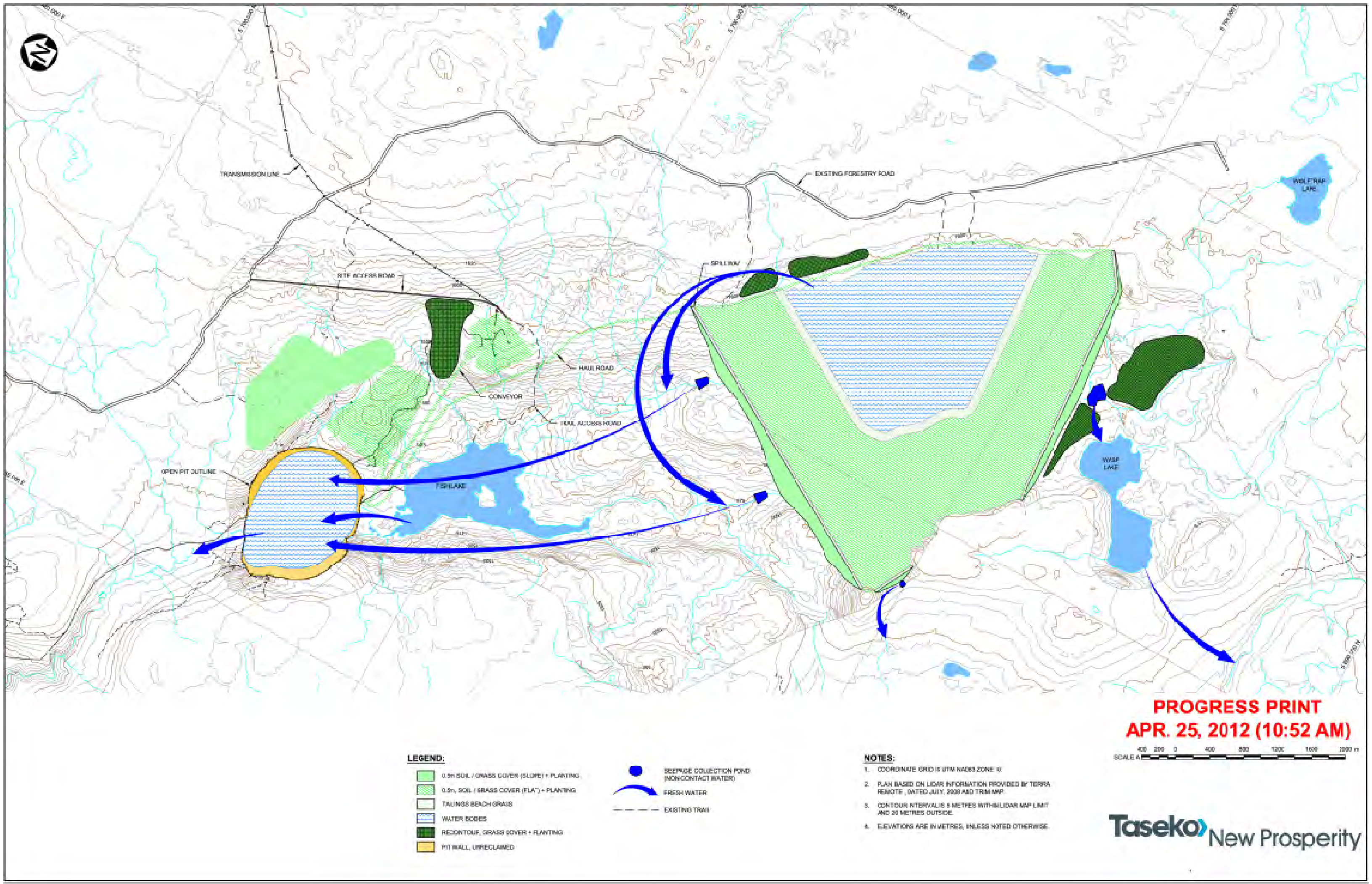
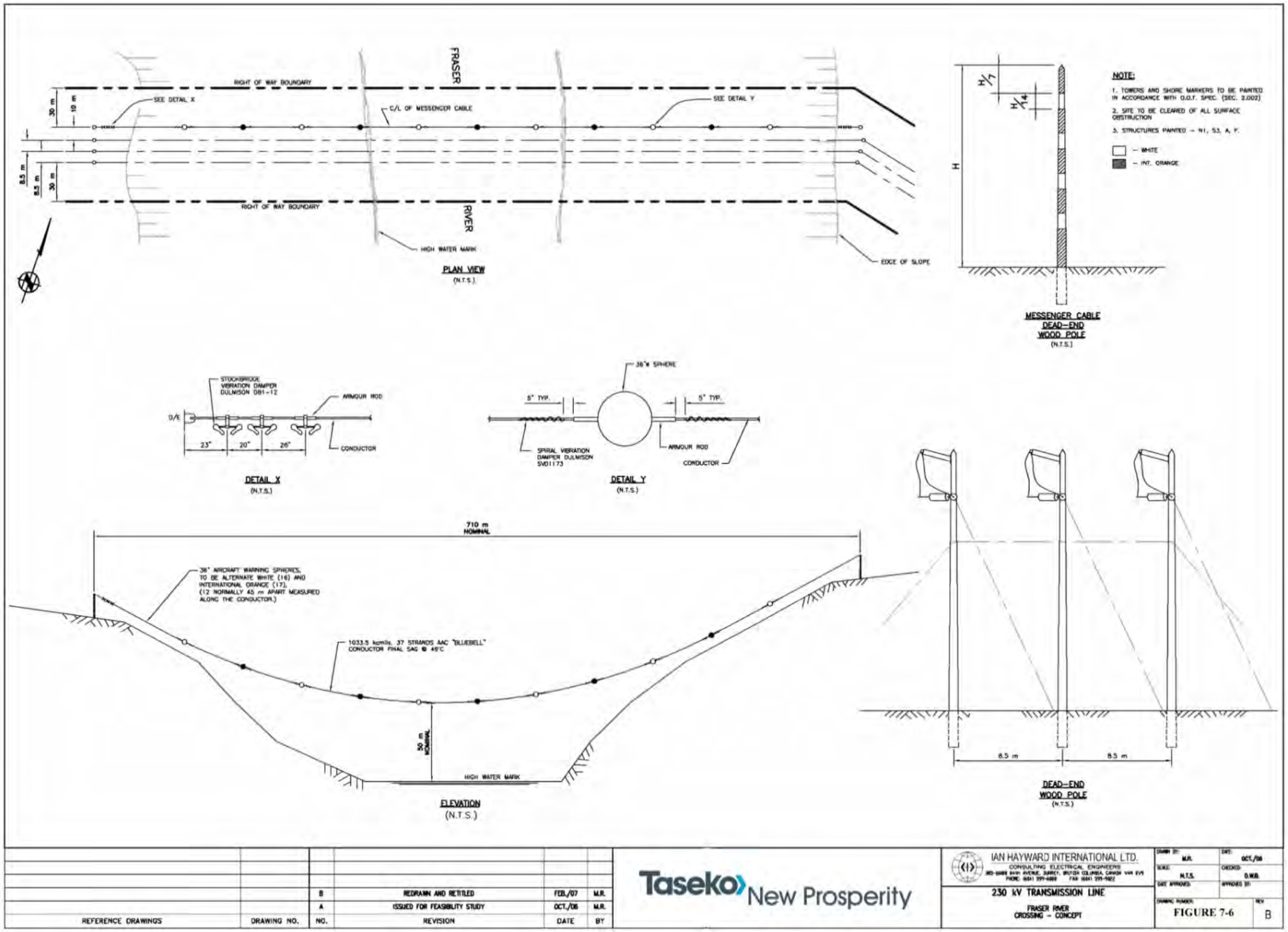


Figure 2.7.3.2-7 Water Management – Final Reclamation Plan

Figure 2.7.3.2-8 Fraser River Crossing Concept



2.7.3.3 Human Health

This section identifies how the Project has changed from the previous project proposal and whether changes would result in changes to the environmental effects previously predicted on human health and ecological risks. A detailed assessment of potential human health and ecological risks associated with baseline conditions as outlined in the EIS Guidelines and listed in Table 2.7.3.3-2 has been completed.

Scope of Assessment

This section outlines the scope of the assessment of potential environmental effects of the New Prosperity Project on human health and ecological risks. The assessment focusses only on changes relative to the Prosperity Project based on the New Prosperity Mine Development Plan, and is completed in accordance with the New Prosperity EIS Guidelines. Regulatory changes that have occurred since the March 2009 EIS/Application are considered.

The Project activities and Physical Works for New Prosperity are presented in Table 2.7.3.3-1. This table shows whether each activity or physical work has changed from the original Prosperity submission, whether there are any Human Health and Ecological Risk Assessment (HHERA)- specific applicable regulatory changes related to the Project activity and whether the activity or physical work would alter human and terrestrial receptor exposure assumptions from those of the original submission. Project activities or physical works identified with a “Y” in either Changes in Project Design, Changes in Regulatory Requirements, or Changes in HHERA Exposure Assumptions will be carried forward for assessment of the changes to effects on humans and/or terrestrial receptors. Project activities or physical works identified with an “N” in all three of these columns are not carried forward in this HHERA, and are greyed out.

Table 2.7.3.3-1 Project Components, Features and Activities Changed from Previous Project Proposal

Project Work (Elements, Components, Features) / Activities	Change from Previous Project Proposal	Comments
Construction and Commissioning		
Open Pit – Preproduction	N	
Non-PAG waste stockpile	Y	Changes in location and timing will not alter HHERA exposure assumptions
PAG Stockpile	Y	
Non-PAG Overburden Stockpile	Y	Changes in the location will not alter HHERA exposure assumptions
Ore Stockpile	N	
Primary Crusher	N	
Overland conveyor	N	
Fisheries compensation works construction	Y	Fish Lake would be a source of potential exposure
Water Management Controls and Operations	Y	Fish Lake would be a source of potential exposure
Construction sediment control	Y	Changes will not alter HHERA exposure assumptions
Access road construction and upgrades	N	
Camp construction	N	
Site clearing (clearing and grubbing)	Y	Changes will not alter HHERA exposure assumptions
Soils handling and stockpiling	Y	Changes will not alter HHERA exposure assumptions
Plant site and other facilities	N	
Explosives Plant	N	
Lake dewatering	Y	HHERA exposure assumptions shift to Fish Lake
Fish Lake Water Management	Y	Fish Lake will be a source of potential exposures for HHERA
Starter dam construction	Y	Changes will not alter HHERA exposure assumptions
Sourcing water supplies (potable, process and fresh)	Y	Changes will not alter HHERA exposure assumptions
Site waste management	N	
Clearing of transmission line ROW	N	
Construction/Installation of transmission line	N	

Vehicular traffic	Y	Changes will not alter HHERA exposure assumptions
Concentrate load-out facility near Macalister (upgrades to site)	N	
Operations		
Pit Production	N	
Site clearing (cleatring and grubbing)	N	
Soils handling and stockpiling	N	
Crushing and conveyance	N	
Ore processing and dewatering	N	
Explosive handling and storage	Y	Changes will not alter HHERA exposure assumptions
Tailing storage	Y	Fish Lake will be a source of potential exposures for the HHERA
Non-PAG waste stockpile	Y	Changes will not alter HHERA exposure assumptions
PAG Stockpile	Y	Changes will not alter HHERA exposure assumptions
Overburden Stockpile	Y	Changes will not alter HHERA exposure assumptions
Ore Stockpile management and processing	Y	Changes will not alter HHERA exposure assumptions
Potable and non-potable water use	N	
Site drainage and seepage management	Y	Fish Lake will be a source of potential exposures for the HHERA
Water Management Controls and Operation	Y	Fish Lake will be a source of potential exposures for the HHERA
Wastewater treatment and discharge (sewage, site water)	N	
Water release contingencies for extended shutdowns (treatment)	N	
Solid waste management	N	
Maintenance and repairs	N	
Concentrate transport and handling	N	
Vehicle traffic	Y	Changes will not alter HHERA exposure assumptions
Transmission line (includes maintenance)	N	
Pit dewatering	N	
Fisheries Compensation works operations	Y	Fish Lake will be a source of potential exposures for the HHERA
Concentrate load-out facility near Macalister	N	
Closure		

Water Management Controls and Operation	Y	Fish Lake will be a source of potential exposures for the HHERA
Fisheries Compensation Operations	Y	Fish Lake will be a source of potential exposures for the HHERA
Site drainage and seepage management	Y	Fish Lake will be a source of potential exposures for the HHERA
Reclamation of ore stockpile area	Y	Changes will not alter HHERA exposure assumptions
Reclamation of Non-PAG waste rock stockpile	Y	Changes will not alter HHERA exposure assumptions
Tailing impoundment reclamation	Y	Fish Lake will be a source of potential exposures for the HHERA
Pit lake and TSF Lake filling	Y	Fish Lake will be a source of potential exposures for the HHERA
Plant and associated facility removal	N	
Road decommissioning	N	
Transmission line decommissioning	N	
Post-closure		
Discharge of tailing storage facility water	Y	Fish Lake will be a source of potential exposures for the HHERA
Discharge of pit lake water	N	Fish Lake will be a source of potential exposures for the HHERA
Seepage management and discharge	Y	Fish Lake will be a source of potential exposures for the HHERA
Ongoing monitoring of reclamation	Y	Fish Lake will be a source of potential exposures for the HHERA

Regulatory Changes (since Prosperity)

There have been no changes in federal or provincial regulations pertaining to the human health and ecological risk assessment since the original Prosperity EIS submission (Volume 6, Section 6.1.1). The regulations that pertained to the HHERA component of the Prosperity EIS also pertain to the HHERA component of the New Prosperity EIS.

Changes as a Result of New Prosperity EIS Guidelines

As a result of the New Prosperity EIS Guidelines, there are changes to the HHERA KIs and assessment requirements from the March 2009 EIS/Application. They include:

- Risks to human health from effects on water supply and quality for local residents and communities relating to both drinking water and recreational use (Fish Lake) and for drinking water at the mine site, taking into account potential health risks from discharges, if any
- Effects of the Project on air quality around the mine site through use of dispersion models including worker camps, and in the broader study area where human receptors may be present (Fish Lake) and potential human health risks from proposed air emissions and dust generated at the mine site and by traffic related to the mine
- Accepted standards or guidelines for protection so human health for the CACs

- Effect of noise duration and character due to project activities during all phases and evaluation of the severity of predicted changes in noise levels and how they may affect human health including for users of Fish Lake, including the impacts of blasting activities on human receptors
- Mitigative measures and monitoring of air quality, water quality, noise and country foods, as appropriate
- Standards/guidelines for noise and blasting shall be referenced. Noise impacts on Aboriginal cultural and spiritual activities in the Project area and Fish Lake in particular shall be identified and assessed
- Risks to human health from current and post-closure consumption of country foods (fish, wildlife, plants, traditional medicines etc.) by any potential stakeholders in the Project area who may be exposed to:
  - Pesticides/herbicides
  - Seepage/runoff or effluent
  - Metal contaminated soil and dust
  - Contaminated vegetation
  - Metal levels in fish in all watersheds within the Project area
- Collection of baseline data on metals in tissues of wild game with data assessed for risks to human health
- Identification of the most sensitive human receptors, particularly those that are the most susceptible to potential changes in air quality, drinking water and recreational water quality, noise and chemical contaminants in country foods, and
- Quantification of the human health risks from contaminated country foods taking into account Aboriginal people as a special sub-population with unique consumption patterns and risk sensitivities.

Key Changes and Issues

The key issues for the HHERA from the March 2009 EIS/Application are also key issues for the New Prosperity Project. As identified in Section 6.2.1 of Volume 6 of the March 2009 EIS/Application, the Key issues for the HHERA associated with the Project include:

- Changes in air quality as it relates to human health
- Changes in water quality as it related to human health
- Country food quality as it relates to human health, and
- Changes in chemical concentrations in the environment (soil, sediment, surface water and vegetation) as it relates to terrestrial ecological receptors.

As identified in Section 2.3.5 of this assessment there are changes to the KIs for the HHERA based on the New Prosperity EIS Guidelines. Table 2.7.3.3-2 shows the measurable parameters of the key indicators for the HHERA for the March 2009 EIS/Application and New Prosperity Projects.

Table 2.7.3.3-2 Measurable Parameters

Key Indicator	Measurable Parameters	
	2009 Prosperity	**2012 New Prosperity**
Air quality related to human health	24-hour and annual average concentrations of metals, CACs and HAPs in air.	24-hour and annual average concentrations of metals, CACs and HAPs in air.
Water quality related to human health	Metal concentrations in Lower Fish Creek, Taseko River and other watershed components	Metals concentrations in Fish Lake and Fish Lake water shed in addition to Lower Fish Creek and Taseko River
Country foods quality related to human health	Metal concentrations in vegetation and game from regional area and fish tissue from Lower Fish Creek	Metal concentrations in vegetation and game from regional area and fish tissue from Lower Fish Creek with the addition of fish tissue from Fish Lake.
Soil Quality	Metal concentration s in soil	Metal concentrations in soil
Vegetation Quality	Metal concentrations in vegetation in the LSA	Metal concentrations in vegetation in the LSA

Physical works and activities identified as having changed due to Project design or regulatory requirements (Table 2.7.3.3-1) have been brought forward to Table 2.7.2.7-3 and given project environmental effects ratings. The following criteria were used for the interaction ratings:

12. Effects on human health or terrestrial ecological receptors are likely to decrease or stay the same (i.e., no changes to significance conclusions), and there are no required changes to previously proposed mitigation measures, and no additional regulatory requirements have been identified (i.e., from the EAO, Panel, EIS Guidelines or other applicable regulations). Therefore, no further assessment is warranted, but information is provided to substantiate that the effect is likely to decrease or stay the same.

13. Effects on human health or terrestrial ecological receptors are likely to decrease or stay the same (i.e., no changes to significance conclusions), but some re-evaluation of effect is required due to changes in project design, proposed mitigation measures, and/or additional regulatory requirements have been identified (i.e., from the EAO, Panel, EIS Guidelines, or other applicable regulations).

14. Effects on human health or terrestrial ecological receptors are likely to increase; therefore, further assessment is warranted.

Table 2.7.3.3-3 HHERA Potential Environmental Effects Associated with New Prosperity (Effects Scoping Matrix)

General Category	Project Activities/Physical Works	Human Health Air Quality	Human Health Surface water & Soil Quality	Country Food Quality	Terrestrial Ecological Effects
Construction and Commissioning					
Construction of Site Utilities/Access	Access road construction and upgrades	0	0	0	0
Construction/Installation of transmission line	Clearing of transmission line ROW	0	0	0	0
Fisheries compensation works (construction)	Fisheries compensation works construction	0	0	0	0
Overburden and Waste Rock Management	Non-PAG waste stockpile	0	0	0	0
	PAG Stockpile	0	0	0	0
	Overburden Stockpile	0	0	0	0
	Soils handling and stockpiling	0	0	0	0
Site clearing (clearing and grubbing)	Site clearing (clearing and grubbing)	0	0	0	0
Site Waste Management	Water Management Controls and Operations	0	0	0	0
	Construction sediment control	0	0	0	0
	Lake dewatering	0	0	0	0
	Fish Lake Water Management	0	0	0	0
	Starter dam construction	0	0	0	0
Vehicular traffic	Vehicular traffic	0	0	0	0
Water Sourcing and Use	Sourcing water supplies (potable, process/TSF)	0	0	0	0
Operations					
Fisheries Compensation works (operations)	Fisheries Compensation works operations	0	0	0	0
Ore Extraction and Stockpiling	Explosive handling and storage	0	0	0	0
	Ore Stockpile management and processing	0	0	0	0
Overburden and Waste Rock Management	Non-PAG waste stockpile	0	0	0	0

General Category	Project Activities/Physical Works	Human Health Air Quality	Human Health Surface water & Soil Quality	Country Food Quality	Terrestrial Ecological Effects
	PAG Stockpile	0	0	0	0
	Overburden Stockpile	0	0	0	0
Site Water Management	Site drainage and seepage management	0	1	0	0
	Water Management Controls and Operation	0	0	0	0
Tailings Management	Tailing storage	0	0	0	0
Vehicle traffic	Vehicle traffic	0	0	0	0
Closure					
Fisheries Compensation operations	Fisheries Compensation Operations	0	0	0	0
Reclamation	Reclamation of ore stockpile area	0	0	0	0
	Reclamation of Non-PAG waste rock stockpile	0	0	0	0
	Tailing impoundment reclamation	0	0	0	0
Site Water Management	Water Management Controls and Operation	0	0	0	0
	Site drainage and seepage management	0	0	0	0
	Pit lake and TSF Lake filling	0	0	0	0
Post-closure					
Site Water Management	Discharge of tailing storage facility water	0	1	1	0
	Seepage management and discharge	0	1	1	0
Monitoring	Ongoing monitoring of reclamation	0	0	0	
Interaction of Other Projects and Activities					
Interaction of Other Projects and Activities		0	0	0	0
Accidents, Malfunctions and Unplanned Events					
Accidents, Malfunctions and Unplanned Events		0	0	0	0

The interactions indicated in grey shading in Table 2.7.3.3-3 are not carried forward in this assessment. Based on past experience and professional judgment, the March 2009 EIS/Application determined that there would be no interaction, the interaction would not result in a significant environmental effect, even without mitigation; or the interaction would not be significant due to application of codified environmental protection practices that are known to effectively mitigate the predicted environmental effects. This has not changed since the March 2009 EIS/Application; details on the justification for this rating are provided in the issues scoping section for each KI in the March 2009 EIS/Application (see Volume 6 Section 6.2). These interactions are not discussed further in this assessment.

The evaluation presented in Table 2.7.3.3-3 shows that none of the listed activities are expected to results in effects that are greater for the New Prosperity Project than the original Prosperity Project. Interactions rated as “1” are due to:

- The retention of Fish Lake and the Fish Lake watershed as undisturbed lands that will be open to recreational activities, and
- The retention of Fish Lake as fish habitat.

Table 2.7.3.3-4 provides a summary rating the potential effect for each KI. The potential changes to metal deposition to soil and surface water are the most important for their potential effects on human health, country food quality and terrestrial receptors.

Table 2.7.3.3-4 VEC - Key Indicator Project Effects Scoping Table

Potential Effect	Human Health Air Quality	Human Health Surface water & Soil Quality	Country Food Quality	Terrestrial Ecological Effects
Effect Mechanism	Air quality in the vicinity of Fish Lake	Deposition of metals to soil & surface water in Fish Lake vicinity	Alterations metal concentrations in country foods (game, fish vegetation) in vicinity of fish lake	Deposition of metals to soil & surface water in vicinity of Fish Lake
Key Indicator				
Air quality	1	0	0	1
Water quality	0	1	1	1
Country foods quality	0	0	1	0
Soil Quality	0	1	1	1
Vegetation Quality	0	0	1	1

KI Potential Effect Rating Criteria:

0 = Effect related to KI is likely to decrease or stay the same (i.e., no changes to significance conclusions), and there are no required changes to previously proposed mitigation measures, and no additional regulatory requirements have been identified (i.e., from the EAO, Panel, or other applicable regulation).

1 = Effect related to KI is likely to decrease or stay the same (i.e., no changes to significance conclusions), but some re-evaluation of effect is required due to changes in project design, proposed mitigation measures, and/or additional regulatory requirements have been identified.

2 = Effect related to KI is likely to increase; therefore, further assessment is warranted..

Temporal Boundary Changes

The temporal boundaries for the HHERA component of the New Prosperity project have not changed from those considered in the HHERA for the Prosperity Project and encompass baseline, construction, operation, closure and post-closure conditions.

Spatial Boundary Changes

The spatial boundaries for the LSA for the New Prosperity project remain essentially unchanged original Prosperity submission. However, the land-use patterns within the LSA have changed and now encompass a protected or undisturbed area around Fish Lake. Potential exposures to dust and contaminants in the Fish Lake area have been considered for human and ecological receptors that may be in the Fish Lake area during all phases of the mine life as well as post-closure. See Table 2.7.3.3-5 for the changes to the study areas used, relative to the March 2009 EIS/Application. See Figure X for a comparison of the mine site study areas for the HHERA between the Prosperity and New Prosperity Projects.

Table 2.7.3.3-5 Mine Site Study Area Comparison

Study Area	Mine Site Study Areas	
	2009 Prosperity	**2012 New Prosperity**
Regional Study Area (RSA)	Encompasses most of the Fish Creek watershed, extending to the top of the bluffs on the east side of the Taseko Valley. The mine site RSA is also the area of 1:20,000 TEM mapping previously developed for the mine site. The mine site RSA had a total area of 18,267 ha.	No changes
Local Study Area (LSA)	A buffer of 500 m on the proposed mine footprint, including the section of new road required at the north end of the mine footprint. This study area is expected to include the maximum area that could be indirectly affected by the Project as a result of dustfall, windfall and localized changes in drainage patterns and is also intended to accommodate any potential for future changes to the mine footprint. The mine site LSA had a total area of 4,812 ha.	Still a buffer of 500 m on the proposed mine footprint, reflecting the changes to the proposed footprint. This leads to small changes relative to the Prosperity LSA boundary at the north end of the study area directly east of Wasp Lake. The mine site LSA has a total area of 4,434 ha.
Maximum Disturbance Area (MDA)	A buffer of 100 m on the mine footprint. The mine site MDA had a total area of 4,419 ha	A buffer of 100 m on the proposed mine footprint, to represent a “worst case” for development. The MDA has a total area of 2,601 ha

Updates to Consultation on the Assessment for the HHERA

Through the Panel process Taseko was provided with a list of plants of traditional importance to the Tsilhqot'in National Government (TNG). This information is used to define the Country Food Plants KI.

Updates to the assessment method for vegetation due to consultation since the submission of the March 2009 EIS/Application include the consideration of country food plants.

Project Impact Assessment for HHERA

There are five potential environmental effects identified for the HHERA including changes in air, soil, surface water and country food quality and effects on terrestrial ecosystem receptors. These are discussed below.

Soils Around Fish Lake

Aerial desposition modelling was re-evaluated to provide estimates of dust and metal loading to soil in the vicinity of Fish Lake. This reassessment focused on the area of highest predicted deposition (***Polygon O1***). The metal loadings to soil were estimated following a predicted 20 years of operation (1 year of construction and 19 years of mine operation). The predicted metal concentrations in soil at the 20 year mark, and the baseline (preconstruction) metal concentrations in soil from Polygon O1 are provided in the Table 2.7.3.3-6. The table also provides an indication of the magnitude of the increase in metal concentrations over the 20-year anticipated life of the mine. The concentrations presented in the following table are based on the assumption that metal accumulation occurs in the top 5 cm of soil and that there is no loss of metal from that lay over time.

Table 2.7.3.3-6: Changes in Soil Quality at Worst Case Site (O1) as a Result of Project Activities to Assess Human Health Risk

Metal	CCME Soil Quality Guideline	Baseline		Predicted[1]	
		Mean	95th Percentile	Mean	95th Percentile
Antimony	20	0.97	0.97	0.97	0.97
Arsenic	12	99.9	99.9	99.9	99.9
Barium	400	249	249	249	249
Boron	2*	8.9	23	9.4	24
Cadmium	1.4	1	1	1	1
Chromium	60	63	63	63	63
Cobalt	40	22	22	22	22
Copper	63	68	68	68	68
Lead	70	4	4	4	4
Mercury	0.6	0.095	0.095	0.095	0.095
Molybdenum	5	2	2	2	2
Nickel	50	66	66	66	66
Selenium	1	1.2	1.2	1.2	1.2
Silver	20	0.2	0.2	0.2	0.2
Zinc	150	63	63	63	63
all values in mg/kg dry weight					
*hot water soluble guideline 1: Predicted for Polygon O1.					

The baseline data for polygon O1 was incorporated into the statistical assessment of baseline conditions for the LSA and RSA completed for the original Prosperity submission and thus, would have contributed to the mean and 95th percentile concentration estimates in the original baseline. As can be seen from the data, deposition over a 20 year period is not expected to result in measureable increases in metal concentrations in the soil in the Fish Lake area over the life of the mine. For the majority of the metals listed, 20-year soil concentrations are below the applicable CCME soil quality guidelines and thus, would not represent a potential concern for human health or ecological receptors. Several metals, arsenic, boron, chromium, copper, and nickel are present in baseline soils at concentrations that exceed their respective CCME guidelines. Based on deposition rates calculated by the air dispersion modeling, it has been determined that the concentrations of these metals are not expected to increase above the baseline concentrations in the area.

The HHERA for the Prosperity Project determined that direct contact exposures to metals in soils in the LSA were not a concern for human health or ecological receptors based on the fact that metal concentrations in the soil were either below their respective CCME criterion or the concentrations in post-closure soils were not measurably different than baseline conditions. The reworked air deposition modelling completed for the New Prosperity Project is based on the worst-case deposition in the vicinity of Fish Lake (***Polygon O1***). The results of this new assessment are similar to those of the original

HHERA. Metal concentrations in soil in the vicinity of Fish Lake are not expected to increase measurably above baseline conditions and thus, direct exposures to metals in soils would not be a concern for humans or terrestrial ecological receptors (wildlife and vegetation) in the vicinity of Fish Lake.

The terrestrial ecological receptors (wildlife and plants) considered in the HHERA for the original Prosperity Project were carried over to the HHERA for the New Prosperity Project. The finding that even under worst-case assumptions, metals concentrations in soil would not be expected to increase measurably above baseline, means that the conclusions of the previous risk assessment remain valid for the New Prosperity Project as well. Therefore, the post-closure concentrations of metals in the soils do not represent health concerns for terrestrial animal receptors in the LSA in the vicinity of Fish Lake and beyond. The initial HHERA did identify potential concerns for plants associated with the levels of boron and copper reported in soils. A summary of the expected changes in soil quality for boron and copper is provided in Table 2.7.3.3-7 and the phytotoxicity Hazard Quotients (HQs) associated with the concentrations in baseline soils and post-closure soils are shown in Table 2.7.3.3-8. The results show that metal deposition to soil after 20 years of operation will not appreciably increase the calculated HQs above those predicted for baseline conditions. Based on this, it is reasonable to conclude that metal deposition to soil, under worst-case conditions in the vicinity of Fish Lake, will not represent a health concern for vegetation in the area.

Table 2.7.3.3-7 Changes in Soil Quality at Worst Case Site (O1) as a Result of Project Activities to Assess Ecological Risk

Metal	CCME Soil Quality Guideline		Baseline		Predicted	
	Agricultural Land Use (soil contact)	Residential Park Land Use (soil contact)	Mean	95th Percentile	Mean	95th Percentile
Boron	2 (2)	2 (2)	8.9	23	9.4	24
Copper	63 (63)	63 (63)	68	68	68	68
All values in mg/kg dry weight						

Table 2.7.3.3-8 Hazard Quotients for Plants

Metal	Phytotoxicity Benchmark	HQ for Phytotoxicity			
		Mean Soil Concentration		95th Percentile Soil Concentration	
		Baseline	Predicted	Baseline	Predicted
Boron	0.5	18	19	47	48
Copper	225	0.30	0.30	0.30	0.30
All values in mg/kg dry weight					

Water Quality in Fish Lake

Mean post-closure water quality results for Fish Lake were provided in Water Quality and Quantity (Section 2.7.2.4A). Table 2.7.3.3-9 provides a summary of the post-closure mean water concentrations for the 4 points of concern (A, B, C and D) in the original submission for the Prosperity project and for a post-closure average year scenario for Fish Lake. The table also lists the CCME Canadian Drinking Water Guideline (CDWG) and Fresh Water Aquatic Life (FWAL) screening values used to identify contaminants of potential concern.

Points A and D represent locations in the Taseko River upstream (point A) and downstream (point D) of the confluence of the Lower Fish Creek and the Taseko River. Points B and C are located on Lower Fish Creek between Fish Lake and the Taseko River. The data show that the concentrations of most metals are lower than the CDWG and FWAL guidelines and therefore do not represent potential concerns for human or ecological health. The data also show that under an average year scenario, metal concentrations in Fish Lake, post-closure, are below both the CDWG and FWAL screening values. Manganese is the only metal in Fish Lake that is predicted to be present at concentrations that exceed the CDWG under post-closure conditions. However, it should also be noted that the post-closure manganese concentrations in Fish Lake are predicted to be lower than the baseline concentrations. The data also show that post-closure water quality in Fish Lake is expected to be better than the post-closure water quality in Lower Fish Creek (metal concentrations are expected to be lower).

The change in project footprint for the New Prosperity Project to retain Fish Lake and the Fish Lake watershed, shifts the focus of the water quality component of the HHERA (drinking water sources for human health and fish and fish habitat for ecological receptors) from Lower Fish Creek and the Taseko River to Fish Lake. Given that post-closure water quality in Fish Lake is anticipated to be better than what was considered for Lower Fish Creek, the change in project design would not be expected to alter the conclusions of the HHERA. Water quality in Fish Lake is not expected to a concern for human health or ecological receptors.

Table 2.7.3.3-9: Changes in Water Quality as a Result of Project Activities

Constituent	CCME [4]		Baseline Regional Water Quality		Post-closure Mean Water Concentration				
	Canadian Drinking Water Guideline	Fresh Water Aquatic	Mean	95th Percentile	A [1]	B [1,2]	C [1,2]	D [1,2]	Fish Lake [3]
Units	(mg/L)		(mg/L)		(mg/L)				
Antimony	0.006	0.02	0.00014	0.0006	0.0001	0.027	0.0268	0.0008	0.0014
Arsenic	0.025	0.005	0.0008	0.003	0.0005	0.008	0.008	0.0007	0.0021
Barium	1	5	0.01	0.026	0.01	0.05	0.04	0.01	0.008
Beryllium	-	0.0053	0.0004	0.0025	0.0005	0.002	0.002	0.0005	0.0005
Boron	5	-	0.02	0.073	0.01	0.06	0.06	0.01	0.06
Chromium (Total)	0.05	0.001	0.0004	0.0011	0.0005	0.002	0.002	0.0005	0.0001
Cobalt	-	0.11	0.0003	0.0009	0.0002	0.002	0.002	0.0002	0.0003
Copper	0.5	varies with hardness	0.0015	0.0037	0.0008	0.014	0.014	0.0011	0.0054
Lead	0.05	varies with hardness	0.0001	0.0005	0.0001	0.0016	0.0015	0.0001	0.0002
Manganese	0.05	0.7	0.14	0.44	0.0037	0.63	0.65	0.019	0.083
Nickel	-	0.25	0.0011	0.0033	0.0003	0.0103	0.0101	0.0005	0.0040
Selenium	0.01	0.002	0.0003	0.0005	0.0005	0.007	0.006	0.0007	0.002
Silver	-	-	0.00001	0.0004	0.00001	0.0001	0.0001	0.00001	0.000034
Zinc	5	0.003	0.0021	0.013	0.0011	0.0143	0.0144	0.0014	0.0013

NOTE:
1. Concentrations as presented in March 2009 Prosperity EIS.
2. Predicted concentrations are expected to change slightly based on revised modelling for New Prosperity EIS. However, it is anticipated that no appreciable increase will occur.
3. Predicted water concentration in Fish Lake based on revised modelling for New Prosperity EIS.
4. CCME - Canadian Council of Ministers of the Environment, Updated 2007

Exceeds both CDWG and FWAL	
Exceeds FWAL	
Exceeds CDWG	

Country Foods Quality

The original HHERA evaluated the potential risks associated with the consumption of country foods collected from the RSA. Although changes in the development footprint mean that people will have opportunities to collect country foods (wildlife and vegetation) from the undisturbed area around Fish Lake, the underlying assumptions regarding country food consumption patterns and rates will remain unchanged. As a result, differences in the potential risks associated with country food consumption that exist between the Prosperity and New Prosperity projects will be related strictly to potential difference in metal concentrations in the country foods considered in the assessment. The original assessment considered consumption of vegetation, willow ptarmigan, muskrat and moose (fish consumption was also considered and is discussed below). As noted above, metal loading to soil following 20 years of operation are not predicted to be measurably different from baseline conditions. As a result, metals levels in tissue would not differ from those used in the Prosperity project HHERA to estimate the risks associated with the consumption of country foods.

In reviewing the predicted post-closure metal concentrations in soil in the vicinity of Fish Lake (***Polygon O1***), the greatest increase in concentration was noted for copper, where the concentration after 20 years was estimated to be 2.6% higher than the the copper concentration in soil in Ploygon O1 under baseline conditions. To provide a worst-case estimate of changes in exposures for people and ecological receptors that may result from the change in project footprint, this 2.6 % increase in metal concentration was assumed to apply to all the metals considered as COCs in the orignial Prosperity submission. Using this approach, it is possible to provide a wosrt-case estimate of potential increases in calculated HQs associated with the consumption of country foods for the New Prosperity Project. The HQs provided in the table 2.7.3.3-10 have been calculated from the HQs provided in the original HHERA for the Prosperity project by increaseing the HQs reported in the initial assessment by 2.6%. Results are provided for baseline and operations condiitons. The data show that even when the HQs are increased by 2.6% for the toddler and adult receptors, the consumption of country food does not alter the potential health risks above what would be predicted for a baseline condition.

It must be stressed that the HQ values provided below represent the worst-case potential increases. Given that, for the majority of the metals, the predicted concentrations in soil following 20 years of operation represent increases of less tha 0.1%, the HQ values would be lower than those presented in the table. Based on these results, it is reasonable to conclude that the development plan for the New Prosperity Project will not alter the conclusions of the HHERA.

The HHERA for the Prosperity project identified potential cancer risks that exceeded the risk acceptability benchmark of 10^{-5} (one additional cancer per 100,000 population) associated with arsenic exposure for people who may consume moose taken from the LSA (Volume 6- Section 6). The elevated cancer risks were noted for both the baseline and operations conditions and showed that the cancer risks associated with the consumption of moose were actually lower post-closure than for baseline conditions. Given that arsenic concentrations are not predicted to increase measurably beyond baseline, predicted cancer risks for arsenic associated with the consumption of moose would not change from those presented in the original report, and the conclusion that these cancer risks would be no different than those for others in British Columbia eating food from their grocery stores, would not change. Therefore, the proposed change in project footprint to retain Fish Lake will not change the original conclusion.

Table 2.7.3.3-10 Predicted Hazard Quotients for Toddlers and Adults Consuming Country Foods in the Local Study Area Assuming a Conservative 2.6% Increase in Modelled Concentrations[1]

Metal	Hazard Quotients (non-carcinogenic risk)[2]							
	Toddler				Adult			
	Baseline		Operations		Baseline		Operations	
	Mean	95th Percentile	Mean	95th Percentile	Mean	95th Percentile	Mean	95th Percentile
Vegetation								
Arsenic	0.021	--	0.095	--	0.010	--	0.012	--
Chromium (Total)	0.112	--	0.031	--	3.48E-05	--	2.57E-06	--

Copper	0.023	--	0.037	--	0.011	--	0.005	--
Willow Ptarmigan								
Arsenic	0.003	0.008	0.004	0.007	0.002	0.005	0.002	0.004
Chromium (Total)	0.009	0.046	0.020	0.030	0.005	0.024	0.011	0.016
Copper	0.006	0.012	0.007	0.008	0.003	0.007	0.004	0.005
Muskrat								
Arsenic	0.001	0.003	0.002	0.003	0.001	0.002	0.001	0.002
Chromium (Total)	0.004	0.018	0.008	0.012	0.002	0.010	0.004	0.007
Copper	0.002	0.005	0.003	0.003	0.001	0.003	0.002	0.002
Moose								
Arsenic	0.047	0.119	0.059	0.095	0.025	0.065	0.032	0.052
Chromium (Total)	0.128	0.636	0.275	0.425	0.070	0.347	0.150	0.231
Copper	0.080	0.173	0.101	0.118	0.043	0.094	0.055	0.064

NOTE:
1. Shaded cells indicate an exceedance of the associated government benchmark value.
2. Calculated HQ values with a percentage increase of 2.6% applied to estimate worst-case increase based on revised soil deposition concentrations in the New Prosperity EIS baseline data.

Consumption of Fish from Fish Lake

The HHERA completed for the Prosperity Project submission, evaluated the potential risks associated with the consumption of fish collected from Lower Fish Creek. The retention of Fish Lake in the New Prosperity submission necessitated consideration of the consumption of fish taken from Fish Lake rather than Lower Fish Creek. The data provided in Table 2.7.3.3.-9 shows that water quality in Fish Lake is not expected to differ from that predicted for the two mixing points on Lower Fish Creek (Points B & C) considered in the HHERA for the Prosperity project submission. As a result, it is reasonable to conclude that the similarities in water quality would result in similar predicted metal concentrations in fish tissue. Metal concentrations in Fish Tissue from Lower Fish Creek (Points B & C) are provided in Table 2.7.3.3-11 as a comparison for metals levels in fish tissue from Fish Lake (data to be included in Final EIS). Based on these results, it is reasonable to conclude that the potential human exposures and health risks associated with the consumption of fish from Fish Lake would not differ from those predicted for Lower Fish Creek in the previous submission. These conclusions are based on the assumption that the fish consumption rates would not differ from those assumed for the previous evaluation. Tables 2.7.3.3-12 and 2.7.3.3-13 provide the Hazard Quotient (HQs) calculated for toddlers and adults consuming fish from Lower Fish Creek (points B & C) and Fish Lake (data to be included in Final EIS). The original HHERA also concluded that the incremental increase in life-time cancer risk associated with the consumption of arsenic in fish tissue could be as high as 4.0 x 10^{-4}. Although this exceeds the risk acceptability benchmark of 10^{-5}, the prior HHERA noted that the predicted risks were consistent with the risks associated with the consumption of supermarket foods. Based on these findings the HHERA for the Prosperity project concluded that fish consumption was likely and over-estimate potential risks associated with fish consumption in the study area. Given that water quality in Fish Lake is not expected to differ from what was used to assess fish tissue levels in Lower Fish Creek, it is reasonable to expect that consumption of fish from Fish Lake would not alter the risk estimates or the conclusions from those provided in the prior HHERA.

Based on these results, it can be concluded that the proposed changes in the mine development plan would not alter the conclusions related to the potential human health effects associated with fish consumption.

Table 2.7.3.3-11 Changes in Metal Concentrations in Fish Tissue as a Result of Post-closure Water Discharges to the Taseko River and Fish Lake

Metal	Fish Tissue Concentrations						
	Baseline (Measured data)		Post Closure (Predicted Concentrations at Mixing Points)				
	Mean	95th %	A	B	C	D	Fish Lake
	mg/kg wet weight						
Arsenic	0.035	0.09	0.05	0.81	0.78	0.05	NEC
Chromium (total)	-	0.25 (DL)	0.10	0.46	0.44	0.1	NEC
Copper	0.53	0.70	0.98	3.3	3.3	1.1	NEC
Selenium	0.24	0.40	0.09	1.1	1.1	0.12	NEC

NOTE:
NEC - not expected to change

Table 2.7.3.3-12 Predicted Hazard Quotients for Toddlers Consuming Fish in the LSA[1]

Metal	Fish Consumption Hazard Quotients						
	Baseline (Measured data)		Post Closure (Predicted Concentrations at Mixing Points)				
	Mean	95th Percentile	A	B	C	D	Fish Lake
	mg/kg wet weight						
Arsenic	0.3	0.78	0.07	1.14	1.14	0.10	NEC
Chromium (total)	ND	ND	0.04	0.20	0.19	0.04	NEC
Copper	0.046	0.060	0.01	0.05	0.05	0.02	NEC
Selenium	0.13	0.20	0.01	0.10	0.09	0.01	NEC

NOTE:
1. Shaded cells indicate an exceedance of the associated threshold value.
NEC - not expected to change

Table 2.7.3.3-13 Predicted Hazard Quotients for Adults Consuming Fish in the LSA[1]

Metal	Fish Consumption Hazard Quotients						
	Baseline (Measured data)		Post Closure (Predicted Concentrations at Mixing Points)				
	Mean	95^{th} Percentile	A	B	C	D	Fish Lake
	mg/kg wet weight						
Arsenic	0.16	0.42	0.04	0.63	0.62	0.06	NEC
Chromium (total)	ND	ND	0.02	0.11	0.10	0.02	NEC
Copper	0.025	0.033	0.01	0.03	0.03	0.01	NEC
Selenium	0.068	0.11	0.001	0.05	0.05	0.01	NEC

NOTE:
1. Shaded cells indicate an exceedance of the associated threshold value.
NEC - not expected to change

Air Quality in the Vicinity of Fish Lake

The HHERA completed for the Prosperity project submission evaluated the potential risks associated with changes in air quality and the levels of Criteria Air Contaminants (CACs) for the Nemaiah Valley, the closest community to the proposed development. The New Prosperity project includes the retention of the Fish Lake watershed as an undisturbed area that will be used for recreational puposes. This change in project design necessitated a re-evaluation of air quality in the immediate vicinity of the planned development. Table 2.7.3.3-14 provides a summary of predicted air concentrations for the CACs in the vicinity of Fish Lake and in the Nemaiah Valley. The data show that for the majority of the CACs (Dustfall (DF), NO_2, CO, SO_2 and lead (Pb)) predicted concentrations are well below their esatblishe air quality criteira. The data also show that particulate concentrations in the Nemaiah Valley would be below their respective regulatory standard or objective. For these CACs, the change in project footprint would not result in health concerns related to inhalation exposures for human or ecological receptors.

The maximum 24-hour concentration of $PM_{2.5}$ is mraginally higher than the regulatory objective of 25 $\mu g/m^3$ and thus, exposure to $PM_{2.5}$ is unlikely to be a concern for human or ecological receptors. Similar results are seen for the annual average total Suspended Particulate (TSP) concentrations. Therefore, $PM_{2.5}$ and TSP are unlikely to represent a potential concern for human or ecological receptors in the Fish Lake area. The data do suggest that, during the construction phase, the maximum PM_{10} levels may exceed regulatory objectives on an intermittent basis. The data also suggest that the maximum PM_{10} , $PM_{2.5}$ and TSP levels may exceed regulatory levels on an intermittent basis during the operations phase. It must be stressed that these concentrations represent maximum or worst-case conditions and are not expected to occur on a continual basis over the life of the operation. Therefore, particulate matter is not expected to be a concern for human or ecological receptors in the Fish Lake area on an occasional basis.

Table 2.7.3.3-14 Maximum Predicted CAC Concentrations at Fish Lake and Nemaiah Valley throughout the Project

Substance	Averaging Period	Lowest Regulatory Objective or Standard	Maximum Predicted Concentration at Fish Lake (g/m^3)			Maximum Predicted Concentration at Nemaiah Valley (g/m^3)		
			Background	Construction Alone	Operation Alone	Background	Construction Alone	Operation Alone
$PM_{2.5}$	24-hour	25[a] 15[d]	7.0	4.07	26.6	7.0	0.080	0.27
PM_{10}	24-hour	50[a] 25[d]	18.5	52.5	345	18.5	0.73	2.4
TSP	24-hour	120[b]	18.5	57.1	357	18.5	0.73	2.4
	Annual	60[b]	18.5	22.7	62.2	18.5	0.03	0.08
DF (mg/dm^2/d)	30 day	1.7–2.9 [c]	0.2			0.2	0.01	0.04
NO_2	1-hour	400[b]	26.8	104	171	26.8	13.2	20.5
	24-hour	200[b]	17.1	49.8	96.8	17.1	1.9	4.1
	Annual	60[b]	17.1	8.8	20.3	17.1	0.1	0.1
CO	1-hour	14,300[a]	NV	179	882	NV	6.5	14.9
	8-hour	5,500[a]	NV	99.1	495	NV	3.3	7.7
SO_2	1-hour	450[a]	NV	0.27	0.98	NV	0.0	0.00
	24-hour	150[b]	NV	0.068	0.26	NV	0.0	0.00
	Annual	25[a]	NV	0.011	0.022	NV	0.0	0.00
Pb	24-hour	4[a]	NV	0.0023	0.012	NV	0.000049	0.00016
	Annual	2[a]	NV			NV	0.0000017	0.0000036

NOTES:
NV: no value
DF: dustfall
Exceeds air quality objective
a BC MOE Air Quality Objectives and Standards (BC MOE, 2009). Available at: http://www.bcairquality.ca/reports/pdfs/aqotable.pdf
b National Ambient Air Quality Objectives (Health Canada, 2007). Available at: http://www.hc-sc.gc.ca/ewh-semt/pubs/air/naaqo-onqaa/index-eng.php
c Pollution Control Objectives for the Mining, Smelting, and Related Industries (BC MOE, 1979). The Dustfall Objective (DF) is a daily rate, referenced to a 30 day sampling interval.
d National Ambient Air Quality Objectives for Particulate Matter (Health Canada, 1998). Available at: http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/air/naaqo-onqaa/particulate_matter_matieres_particulaires/summary-sommaire/98ehd220.pdf

Baseline Conditions for Effects

The baseline conditions for the New Prosperity project have not changed from those that applied to the original Prosperity project.

Mitigation Measures

The original HHERA noted that mitigation measures to address issues of the release of air contaminants, soil loading of metals and discharge of Pit Lake and TSF water into the Fish Lake and surrounding watersheds would adequaltey address concerns identified in the HHERA and that no additional mitigative measures, specific to the HHERA would be required. This recommendation has not changed with the New Properity project.

Cumulative Effects Assessment

As described in Section 2.7.1, cumulative environmental effects were only assessed if all three of the following conditions were met for the environmental effect:

- The Project results in a measurable, demonstrable or reasonably-expected residual environmental effect on a component of the environment

- The Project-specific residual environmental effect does, or is likely to, act in a cumulative fashion with the environmental effects of other past or future projects and activities that are likely to occur, and
- There is a reasonable expectation that the Project's contribution to cumulative environmental effects will affect the viability or sustainability of the resource or value.

The Project inclusion list (Table 2.7.1.4-1) identifies past, present and reasonably foreseeable projects and activities that could interact cumulatively with the Project. The locations of each of the 22 projects and activities are shown on Figure 2.7.1.4-1. As indicated in Table 2.7.1.4-1, eight of these project and activities are new since 2009. In addition, there is more existing disturbance at baseline as the result of logging (see Section X). Of the eight new projects, only one, the Newton Mountain mine development, is located west of the Fraser River and, therefore, considered likely to interact cumulatively with the Project's residual effects on human health and terrestrial ecological receptors.

For human health and terrestrial ecological receptors, the first two conditions are met; that is, there are Project-specific residual effects on this VEC and these effects do, or are likely to, interact cumulatively with past, present and reasonably foreseeable projects and activities . With respect to the third condition, in the March 2009 EIS/Application it was concluded that the Project's contribution to cumulative effects would not affect human health conditions in a regional context.

Determination of Significance of Residual Effects

The assessment methodology for residual effect characterization and determination of significance is as described in Section 2.7.1.5.

The findings of the Project residual effects assessment are summarized in Table 2.7.3.3-16. As noted in the discussions provided above, the change in the development plan between the Prosperity and New Prosperity projects is not expected to alter the conclusions of the human health or ecological risk assessment. The conclusion that the Project would not be expected to have a significant effect on human or ecological health in the area remains unchanged. The rationale for the significance determinations are as follows:

- For Air Quality, the magnitude of a potential impact on air quality that would affect human health or terrestrial ecological receptors is low, the area is presently relatively undistrubed and the effect is long term; with the implementation of mitigation measures for dust control, as detailied in the March 2009 EIS/Application, the conclusion is that environmental effects are not significant because the effect is local, occurs only once and is reversible.
- For Water Quality, the magnitude of a potential impact on water quality, when considered as a source of drinking water that would affect human health or terrestrial ecological receptors, is low and the effect is far future or permanent and irreversible, with implementation of the mitigation measures as detailed in the March 2009 EIS/Application, the conclusion is that the environmental effect not significant because the effect is local and occurs only once.
- For Country Foods, the magnitude of a potential impact on Country Food quality (metal concentrations in country foods), is low, and the effect is far future or permanent and irreversible, with implementation of the mitigation measures as detailed in the March 2009 EIS/Application; the conclusion is that the environmental effect not significant because the effect is local and occurs only once.
- For soil, the mangitude of a potential impact on soil quality, is low, and the effect is far future or permanent and irreversible; with implementation of the mitigation measures as detailed in the March 2009 EIS/Application, the conclusion is that the environmental effect not significant because the effect is local and occurs only once.

- For vegetation, the magnitude of a potential impact on vegetation quality (metals concentrations in vegetation), is low, and the effect is far future or permanent and irreversible; with implementation of the mitigation measures as detailed in the March 2009 EIS/Application, the conclusion is that the environmental effect not significant because the effect is local and occurs only once.

The confidence in the predictions of human and ecological exposures and the associated risks is high given the confidence in the predictions in changes to metals concentrations in soil and water across the study area. In addition, the HHERA has been conducted using conservative country food consumption rates for humans and ingestion rates for ecological receptors. Also conservative toxicity reference values have been used to ensure that, if anything, potential risks for human and ecological receptors are over estimated.

Table 2.7.3.3-16 Project Residual Effects Assessment Summary for Human Health for New Prosperity

Potential Environmental Effect: Human Health KI	Proposed Mitigation/Compensation Measures	Residual Effects Characterization						Significance	Prediction Confidence
		Direction	Magnitude	Geographical Extent	Duration/ Frequency	Reversibility	Ecological Context		
Air quality	Mitigation measures proposed to maintain air quality and limit dust will provide the necessary protection for human health and terrestrial ecological receptors	N	Low (Post-closure - limited potential for dust migration)	L	ST/L	R	U	N	H
Water quality	Mitigation measures proposed to maintain water quality in the Fish Lake watershed will provide necessary protection for human health and terrestrial ecological receptors.	N	Low (Post-closure – drinking water quality essentially unchanged from baseline conditions)	L	FF/L	I	U	N	H
Country foods quality	Mitigation measures proposed to maintain air and water quality and limit dust migration by other disciplines will provide the necessary protection for country food quality	N	Low (Post-closure soil quality unchanged from baseline conditions)	L	FF/L	I	U	N	H
Soil quality	Mitigation measures proposed to maintain air quality and limit dust will provide the necessary protection for human health and terrestrial ecological receptors	N	Low (Post-closure soil quality unchanged from baseline conditions)	L	FF/L	I	U	N	H
Vegetation quality	Mitigation measures proposed to maintain air quality and limit dust will provide the necessary protection for human health and terrestrial ecological receptors	N	Low (Post-closure soil quality unchanged from baseline conditions)	L	FF/L	I	U	N	H

KEY *Direction*: P Positive N Neutral A Adverse *Magnitude:* Defined for each KI individually. In general: L Low–environmental effect occurs that may or may not be measurable, but is within the range of natural variability. *M* Moderate–environmental effect occurs, but is unlikely to pose a serious risk or present a management challenge. *H* High–environmental effect is likely to pose a serious risk or present a management challenge.	*Geographic Extent:* S Site-specific L Local R Regional *Duration:* ST: Short term MT: Medium Term LT: Long Term FF: Far Future or Permanent.	*Frequency:* R Rare - Occurs Once I Infrequent - Occurs sporadically at irregular intervals F Frequent - Occurs on a regular basis and at regular intervals C Continuous *Reversibility:* R Reversible I Irreversible *Ecological Context:* U Undisturbed: Area relatively or not adversely affected by human activity D Developed: Area has been substantially previously disturbed by human development or human development is still present N/A Not applicable.	*Significance:* S Significant N Not Significant *Prediction Confidence:* Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation L Low level of confidence M Moderate level of confidence H High level of confidence

Table 2.7.3.3-17 presents a concise summary of the effects assessment for human health.

Considering the updated findings of the Project, mitigation measures, and cumulative residual effects on human health presented in this document, the overall significance determination for the New Prosperity Project, including all three major components (mine site, access road, transmission line), is unchanged from 2009. That is, the effect of the Project on human health conditions in a regional context is considered to be not significant.

Table 2.7.3.3-17 Summary of Effects Assessment for Human Health

Effects Assessment	Concise Summary
Beneficial and Adverse Effects	The New Prosperity Project has redesigned the mine site layout to include the conservation of Fish Lake and associated riparian habitat and a smaller maximum disturbance area. This is expected to reduce the loss of areas where country foods can be obtained in the area.
Mitigation and Compensation Measures	A wide variety of methods for avoiding and/or mitigating potential environmental effects have been proposed for project-related activities. These activities will be protective of human health and terrestrial ecological receptors. No HHERA specific mitigation measures are required, nor have compensation measures, specific to the HHERA been proposed.
Potential Residual Effects	Residual effects related to human health and terrestrial ecological receptors are expected to be low. A summary of the anticipated effects is provided in Table 2.7.3.3-15.
Cumulative Effects	The cumulative effects predicted in the 2009 assessment for human health and terrestrial ecological receptors are expected to still apply to the New Prosperity Project. The incremental contribution of the combined cumulative environmental effect in the LSA and RSA, including the Prosperity Project with respect to human health and terrestrial ecological receptors are predicted to be not significant.
Determination of the significance of residual effects	The combined residual environmental effects of the Project on human health and terrestrial ecological receptors are predicted to be not significant. This assessment is predicated on the implementation of proposed mitigation and the development of appropriate compensation measures.
Likelihood of occurrence for adverse effects found to be significant	As no significant residual effects are predicted, there is no likelihood of occurrence. There is the possibility that the prediction of significant adverse effects is incorrect, whereby an adverse effect deemed to be not significant may have an adverse effect. The likelihood of this remains low.

Additional Work

Given the proximity of Fish Lake to the New Prosperity Project, and the potential human health concerns associated with the consumption of fish from Fish Lake it is recommended that the follow-up monitoring program detailed below be implemented if the Project proceeds.

Follow-up Monitoring

The recommendations for follow-up monitoring for human and ecological health are not expected to differ from the recommendations contained in the HHERA prepared for the original Prosperity project with the following exception:

- Although chemical changes in air, water, and soil quality in the vicinity of Fish Lake are expected to be minor in nature throughout the life of the Projects, it is recommended that the monitoring programs planned for 2, 5 10 and 15 years include sampling of soil, water, sediment, vegetation and fish tissue from Fish Lake and the vicinity.

This will provide the information necessary to confirm the conservative nature of the predictions contained in the risk assessment.

2.7.3.4 Project Benefits

Gross Domestic Product

The Project will produce a range of beneficial economic effects, with the commencement of construction activities in 2013 until mine closure scheduled for 2032. The beneficial effects include its contribution to economic growth (gross domestic product), and increases to employment, incomes and government revenue. These beneficial effects will be evident locally, across BC, and nationally.[37]

The Project's contribution to British Columbia's economy is measured by the increase in goods and services sourced provincially as a consequence of building and operating the mine. Over its construction and operating phases the Project will add a total of $11 billion dollars to the provincial economy. The annual contribution in each year is substantial, generally exceeding $500 million of "new" production, as summarized in Figure 2.7.3.4-1.

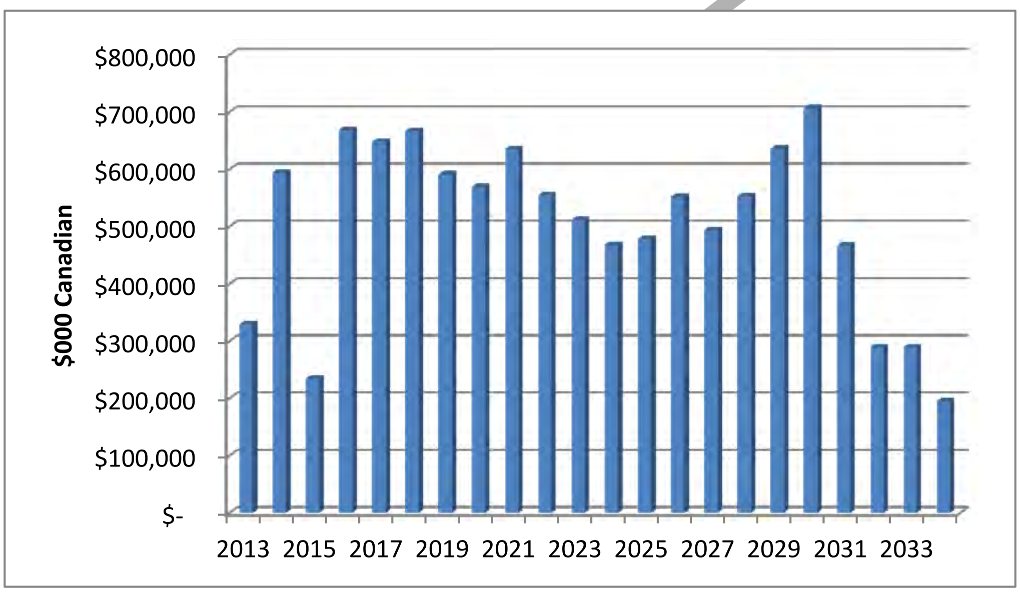


Figure 2.7.3.4-1 Contribution to Gross Domestic Product

Source: Table 2.7.3.4-1

[37] The quantitative estimates of beneficial economic effects for British Columbia are from Centre for Spatial Economics (2011). The economic effects reported for the William Lake area are derived by applying "multipliers" whose specific values are reported in BC Stats (2008a, 2008b). Project data and coefficients for government revenue are from BC Stats (2008b). Economic impacts at the national level are not reported.

Employment

The Project is expected to support a total of 57,000 person years of employment in BC summed over the construction and operating periods. On a yearly basis, the peak employment is in the second year of construction and the first years of operations (Figure 2.7.3.4-2). Best efforts will be made to qualify and hire as many local persons as practical. The expected tight labour market in BC will temper these efforts, and the Project will likely draw persons to the province seeking improved economic opportunities. It is estimated that the Project will add 5,400 persons to the BC population.

Direct employment peaks at about 1,000 person years in year two of construction. During operations the on-site labour force exceeds 400 persons most years. Those working directly for the mine will be encouraged to live in the region. Spending by the Project on goods and services, as well as purchases by its workforce stimulates additional spending and employment in the Williams Lake area. This local “spin-off” employment totals 6,200 person-years over the term of the project, and averages nearly 300 full time equivalent jobs annually. It is shown in Figure 2.7.3.4-2 as the gap between Direct employment and William Lake total employment. The “spin-off” employment stimulated by the Project in the rest of BC is substantial, as shown in the figure.

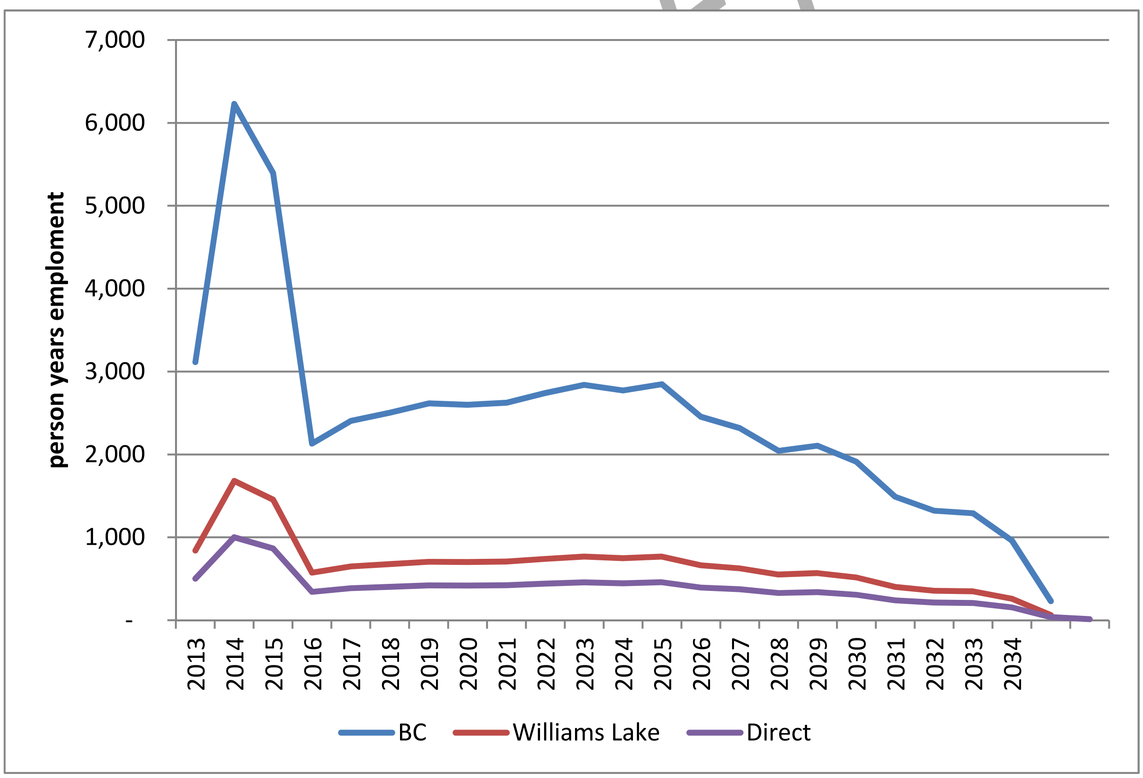


Figure 2.7.3.4-2 Total Employment BC and Williams Lake Local Area

Source: Table 2.7.3.4-1

Employment Income

The Project's beneficial effect can also be measured in wages and salaries paid. The aggregate dollar values of the payments to labour are shown in Figure 2.7.3.4-3. The pattern is similar to the profile of man-years of employment, with a peak in the construction phase, and relatively steady annual value over most of the operations phase. Note however that the Williams Lake area receives a higher proportion of the total payment. This is because the relatively higher annual wages (over $110,000/year on average) paid to direct employees, who will likely choose to live in the region, is much higher than the average wage earned provincially for work related to the Project (i.e. average BC earnings in 2009 was $43,500) (BC Stats and Statistic Canada, 2009).

The industries (excluding Mining and Construction industries) whose outputs will be substantially increased because of the Project include: Government Services, Wholesale and Retail Trade, Finance and Real Estate, Professional Scientific and Management Services, and Transportation. Government services outputs increase largely in response to the increase in provincial population. The in-migrants will require health, education and government services.

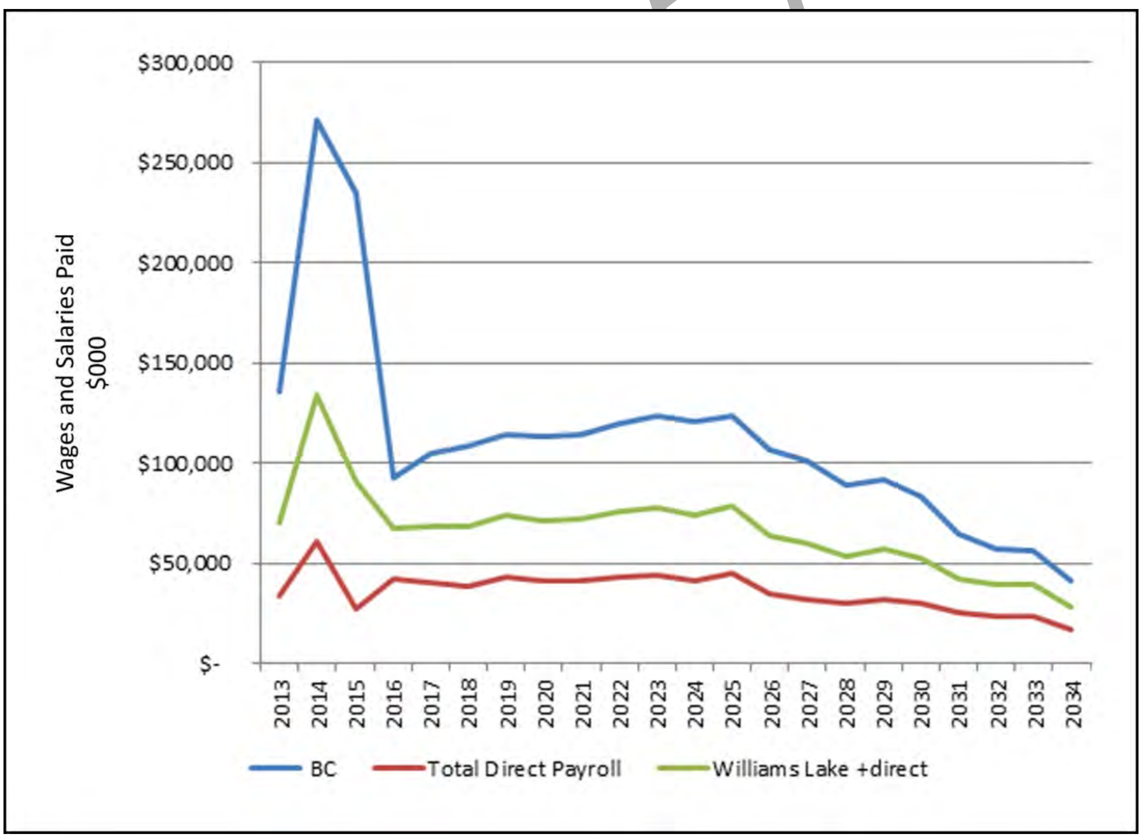


Figure 2.7.3.4-3 Wages and Salaries Paid

Source: Table 2.7.3.4-3

Government Revenues

The Project will pay taxes to the three levels of government. The taxes directly levied on the Project include the provincial Minerals Tax and various corporate taxes. Individuals will also remit personal income tax to Canada and BC. An estimate of the annual tax payments is presented in Figure 2.7.3.4-4. Over the life of the Project, the total taxes paid are approximately $ 2 billion. Corporate taxes amount to 55% of the tax revenue, mineral tax 35% and personal income tax 10%. Approximately $1.2 billion accrues to BC and local government and the remainder to Canada.

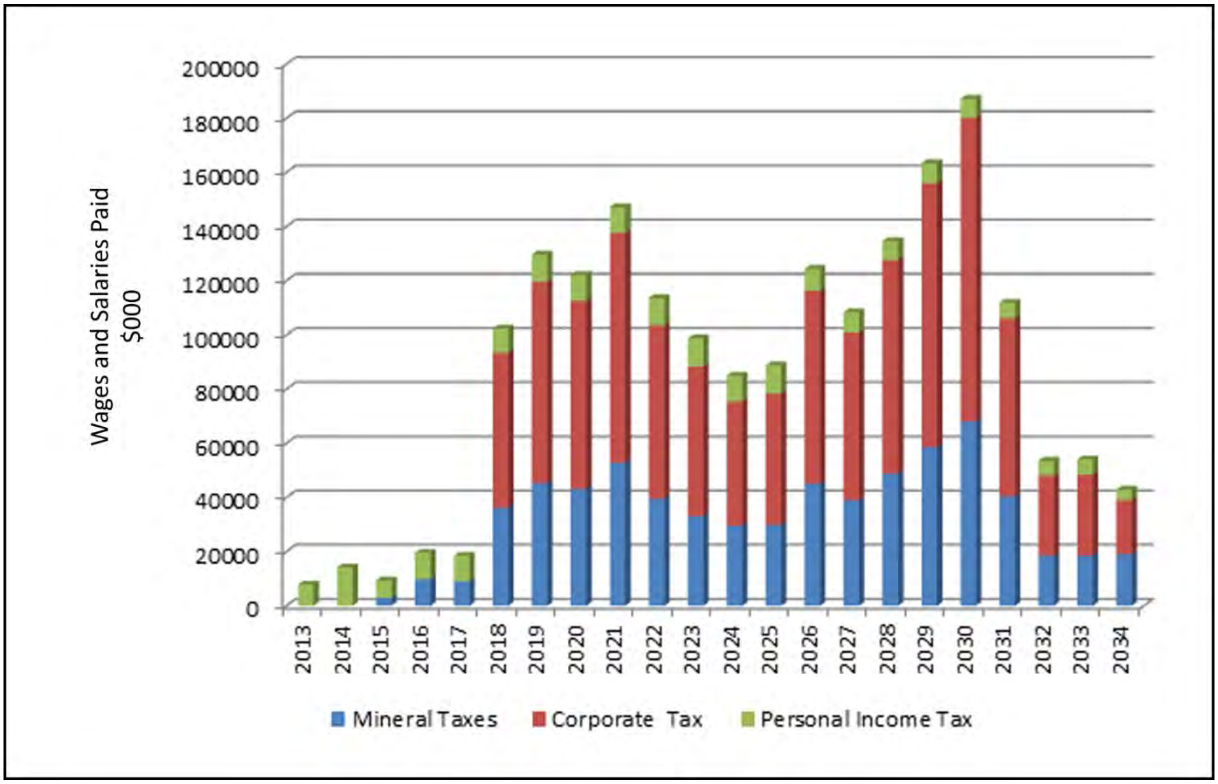


Figure 2.7.3.4-4 Payments to Government

Source: Table 2.7.3.4-1

There are public values and benefits generated by New Prosperity that reach far beyond just the taxes directly levied on the Project itself. The development of New Prosperity will act as a significant long term economic stimulus to the Cariboo-Chilcotin Region, British Columbia, and Canada as a whole. Specifically it is estimated the construction and operation of the New Prosperity over the period 2013 to 2036 will result in the following:

- A direct expenditure for construction and sustaining capital by Taseko Mines in excess of $1.5 billion
- Generate production revenues in excess of $11.0 billion.
- Increase employment in BC by 71,000
- An increase in Real GDP of $11.0 billion
- The GDP increase on a per capita basis is $2,200
- Consumer spending will increase in BC by $9 billion

- Residential investment expenditure increase by $786 million
- Non-residential construction investment increases by $1.03 billion
- Investment in machinery and equipment (by others) increases by $1.38 billion
- The population of BC rises by 5,400
- Disposable income per household in BC rises $1,157
- Federal government revenues rise by $4.30 billion, and
- Provincial government revenues rise by $5.52 billion.

All scenarios are detailed further in Table 2.7.3.4-1.

Table 2.73.4-1 Economic Benefits Data

	Fiscal Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	Project Year	-2	-1	1	2	3	4	5	6	7	8	9
Indicator	Project Life											
GNP ($ 000)	$ 11,138,965	$ 329,494	$ 594,799	$ 234,629	$ 669,459	$ 648,433	$ 667,107	$ 591,547	$ 569,321	$ 635,370	$ 555,129	$ 511,924
Employment (person years)												
Direct	9,103	500	1000	866	342	386	402	420	417	421	440	456
William Lake	15,293	840	1680	1455	575	648	675	706	701	707	739	766
Total BC	56,701	3,114	6,229	5,394	2,130	2,404	2,504	2,616	2,597	2,622	2,741	2,840
Wages & Salaries ($000)												
Direct	$ 792,855	$ 33,865	$ 61,132	$ 27,284	$ 42,060	$ 40,436	$ 38,609	$ 43,548	$ 40,899	$ 41,346	$ 43,273	$ 44,540
William Lake (excludes direct)	$ 666,263	$ 36,596	$ 73,192	$ 63,384	$ 25,032	$ 28,252	$ 29,423	$ 30,740	$ 30,521	$ 30,814	$ 32,204	$ 33,375
Total BC	$ 2,470,261	$ 135,684	$ 271,368	$ 235,005	$ 92,808	$ 104,748	$ 109,090	$ 113,974	$ 113,160	$ 114,246	$ 119,402	$ 123,744
Government Revenue												
BC												
Mineral Tax	$ 687,981	$ -	$ -	$ 3,061	$ 9,858	$ 9,169	$ 36,131	$ 45,304	$ 43,147	$ 52,913	$ 39,454	$ 33,141
Corporate Taxes	$ 426,402	$ -	$ -	$ -	$ -	$ -	$ 22,925	$ 29,705	$ 27,807	$ 33,864	$ 25,657	$ 22,100
Personal Income Tax	$ 73,292	$ 3,130	$ 5,651	$ 2,522	$ 3,888	$ 3,738	$ 3,569	$ 4,026	$ 3,781	$ 3,822	$ 4,000	$ 4,117
Canada												
Corporate Taxes	$ 639,602	$ -	$ -	$ -	$ -	$ -	$ 34,388	$ 44,558	$ 41,711	$ 50,796	$ 38,485	$ 33,150
Personal Income Tax	$ 109,937	$ 4,696	$ 8,477	$ 3,783	$ 5,832	$ 5,607	$ 5,353	$ 6,038	$ 5,671	$ 5,733	$ 6,000	$ 6,176

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
	10	11	12	13	14	15	16	17	18	19	20
GNP ($ 000)	$ 468,432	$ 478,362	$ 552,347	$ 494,166	$ 553,524	$ 636,317	$ 707,077	$ 467,315	$ 289,575	$ 289,575	$ 195,064
Employment (person years)											
Direct	445	457	394	372	328	338	307	239	212	207	154
William Lake	748	768	662	625	551	568	516	402	356	348	259
Total BC	2,772	2,847	2,454	2,317	2,043	2,105	1,912	1,489	1,321	1,289	959
Wages & Salaries ($000)											
Direct	$ 41,700	$ 44,920	$ 35,127	$ 32,405	$ 29,823	$ 32,185	$ 30,045	$ 25,104	$ 23,799	$ 23,990	$ 16,765
William Lake (excludes direct)	$ 32,570	$ 33,449	$ 28,837	$ 27,227	$ 24,007	$ 24,739	$ 22,470	$ 17,493	$ 15,517	$ 15,151	$ 11,272
Total BC	$ 120,759	$ 124,015	$ 106,919	$ 100,949	$ 89,009	$ 91,722	$ 83,310	$ 64,857	$ 57,530	$ 56,173	$ 41,791
Government Revenue											
BC											
Mineral Tax	$ 29,636	$ 29,957	$ 45,113	$ 39,018	$ 48,806	$ 58,528	$ 68,131	$ 40,417	$ 18,577	$ 18,583	$ 19,036
Corporate Taxes	$ 18,289	$ 19,379	$ 28,482	$ 24,757	$ 31,578	$ 38,989	$ 44,837	$ 26,288	$ 11,795	$ 11,959	$ 7,990
Personal Income Tax	$ 3,855	$ 4,152	$ 3,247	$ 2,995	$ 2,757	$ 2,975	$ 2,777	$ 2,321	$ 2,200	$ 2,218	$ 1,550
Canada	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Corporate Taxes	$ 27,433	$ 29,069	$ 42,724	$ 37,136	$ 47,367	$ 58,484	$ 67,255	$ 39,431	$ 17,693	$ 17,938	$ 11,984
Personal Income Tax	$ 5,782	$ 6,229	$ 4,871	$ 4,493	$ 4,135	$ 4,463	$ 4,166	$ 3,481	$ 3,300	$ 3,327	$ 2,325

2.7.4 Physical and Cultural Heritage Resources

The act and guidelines require consideration of how the project may cause changes to the environment that in turn affect "physical and cultural heritage”. That term is not defined in the act and the specific meaning does not appear to have been clarified in any prior panel decisions or judicial consideration to date. CEAA has a 1996 "Reference Guide on Physical and Cultural Heritage Resources” but the guide itself clearly documents its limitations. In particular, it states:

> As the practice of environmental assessment (EA) evolves, it will be necessary to update and revise both the RA Guide and the individual reference guides. These guides should be seen as “evolving documents” rather than as static textual materials

The Guide goes on to state:

> For the purpose of this guide, a cultural heritage resource is a human work or a place that gives evidence of human activity or has spiritual or cultural meaning, and that has historic value. Cultural heritage resources are distinguished from other resources by virtue of the historic value placed on them through their association with an aspect(s) of human history. This interpretation of cultural resources can be applied to a wide range of resources, including, cultural landscapes and landscape features, archaeological sites, structures, engineering works, artifacts and associated records…
>
> Examples of Cultural Heritage Resources
>
> - Historical monuments, structures, buildings or groups of buildings (e.g. Halifax Citadel in Nova Scotia; Bethune-Thompson House in Ontario; Quebec City's walls and fortifications; Christ Church Cathedral in New Brunswick; Parliament Buildings in Ottawa)
> - Archaeological sites (e.g. Port-aux-Choix in Newfoundland; Archaeological sites along the Chilkoot Trail in British Columbia; Wanuskewin Heritage Park in Saskatchewan)
> - Cultural landscapes (e.g. Stanley Park in British Columbia; the Percé Rock in Gaspé; urban cultural landscape of Lunenburg, Nova Scotia)
> - Paleontological sites (e.g. Dinosaur Provincial Park in Alberta; Burgess Shale of Yoho National Park), and
> - Underwater sites (e.g. Shipwreck sites in Red Bay, Labrador and in Fathom Five, Ontario).

Although the Act identifies “physical and cultural heritage” as a component of the definition of "environmental effect" distinct from "any structure, site or thing that is of historical, archaeological, paleontological or architectural significance”, or “the current use of lands and resources for traditional purposes by aboriginal person”, in practice, there can be overlap between these. In fact, even the CEAA Guide referenced above (which titled only in relation to Physical and Cultural Heritage Resources” appears to conflate these and states:

> The *Canadian Environmental Assessment Act* requires that consideration must be given to cultural heritage resources in federal environmental assessments. The Act specifically refers to “physical and cultural heritage” in the definition of “environmental effect”:
>
> > *“any change that the project may cause in the environment, including any effects of such change..., on physical and cultural heritage, on the current use of lands and resources for*

> *traditional purposes by aboriginal persons, or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance" (Section 2(1)).*

Recognizing the lack of complete clarity on this point, this section will deal with archaeological resources as noted in the EIS Guidelines (2.7.4.1). Further, Section 2.7.5 deals with potential impacts on physical and cultural heritage resources of interest to First Nations and with the current use of lands and resources for traditional purposes by aboriginal persons.

2.7.4.1 Archaeology

Overall, the Project as proposed will result in a significant reduction (84%) in the number of archaeological sites potentially affected as compared to the previously proposed project.

For the previously proposed project, given the quantity of sites and variety of site types identified during the AIA, a scientific low, moderate, and high significance ranking system was developed for the purpose of developing a mitigation plan. Thirty-nine (49%) of the archaeological sites identified were assessed as having a low scientific value and as these site types were considered to be widespread and well-represented throughout the region and the amount of scientific data that could be obtained from such sites was considered negligible, the provincial Archeology Branch recommended that no further work at these sites be undertaken.

Twenty-nine (37%) of the archaeological sites identified within the mine footprint were assessed as having a moderate scientific value and eleven (14%) were assessed as having high scientific value. As outlined in Section 24.0 of the Table of Commitments, if the previously proposed project were to proceed Taseko was required to implement archaeological resource management measures throughout the Project area to avoid or mitigate adverse effects on identified resources and culturally sensitive areas as outlined in the Ministry of Tourism, Culture and the Arts' letter of 22 May 2009. The mitigation program, details of which would have been specified in subsequent permit applications, was to include but not be limited to:

- Systematic excavation of 16 of the 79 archaeological sites identified within the mine footprint of which 6 are to be subject to intensive investigation
- Survey of the lake basin after draining and the gathering and analysis of palaeo-environmental data from the lake basin, and
- Lithic sourcing.

With the currently proposed project and its modified mine development plan, all but four (EiRv-34, EiRv-33, EiRv-29 and EiRv-30) of the thirty-nine low scientific value sites and all but one (EiRv-18) of the twenty-nine archaeological sites having a moderate scientific value have been avoided and therefore will no longer be disturbed or lost (Figure 2.7.4.1-1). All five sites are located within the area of the proposed pit development and thus cannot be avoided. The four sites assessed as having low scientific value were found to contain lithics, all of which have already been recovered and preserved. The one moderate value site was found to contain formed tools which have already been recovered and preserved is located in the vicinity of the proposed pit and cannot be avoided. It was not one of the sites recommended for further systematic data recovery by the provincial Archaeology Branch and, hence, no further mitigation measures are proposed.

Three (EiRv-5, EiRv-37 and EiRv-3) of the eleven sites assessed as having high scientific value remain within the Maximum Disturbance Area (MDA) of the proposed mine development plan leaving the remaining eight sites totally outside the area and thus they will no longer be disturbed or lost. All three of the sites remaining within the MDA will not be directly impacted or disturbed by any clearing or grubbing or the placement of permanent structures but rather they form part of the buffer areas round mine features that may be subject to potential indirect effects associated with mine activities. Special monitoring and mitigation measures, such as the clear marking of boundaries around each of these three sites, are included in the Cultural and Heritage Protection Plan (Section 2.8.1) and will be implemented to help ensure that they will not be disturbed throughout all phases of mine development activity. Final details of this and any other such measure will form part of an Impact Management Plan approved by the Archaeology Branch and attached to all subsequent permits and authorizations.

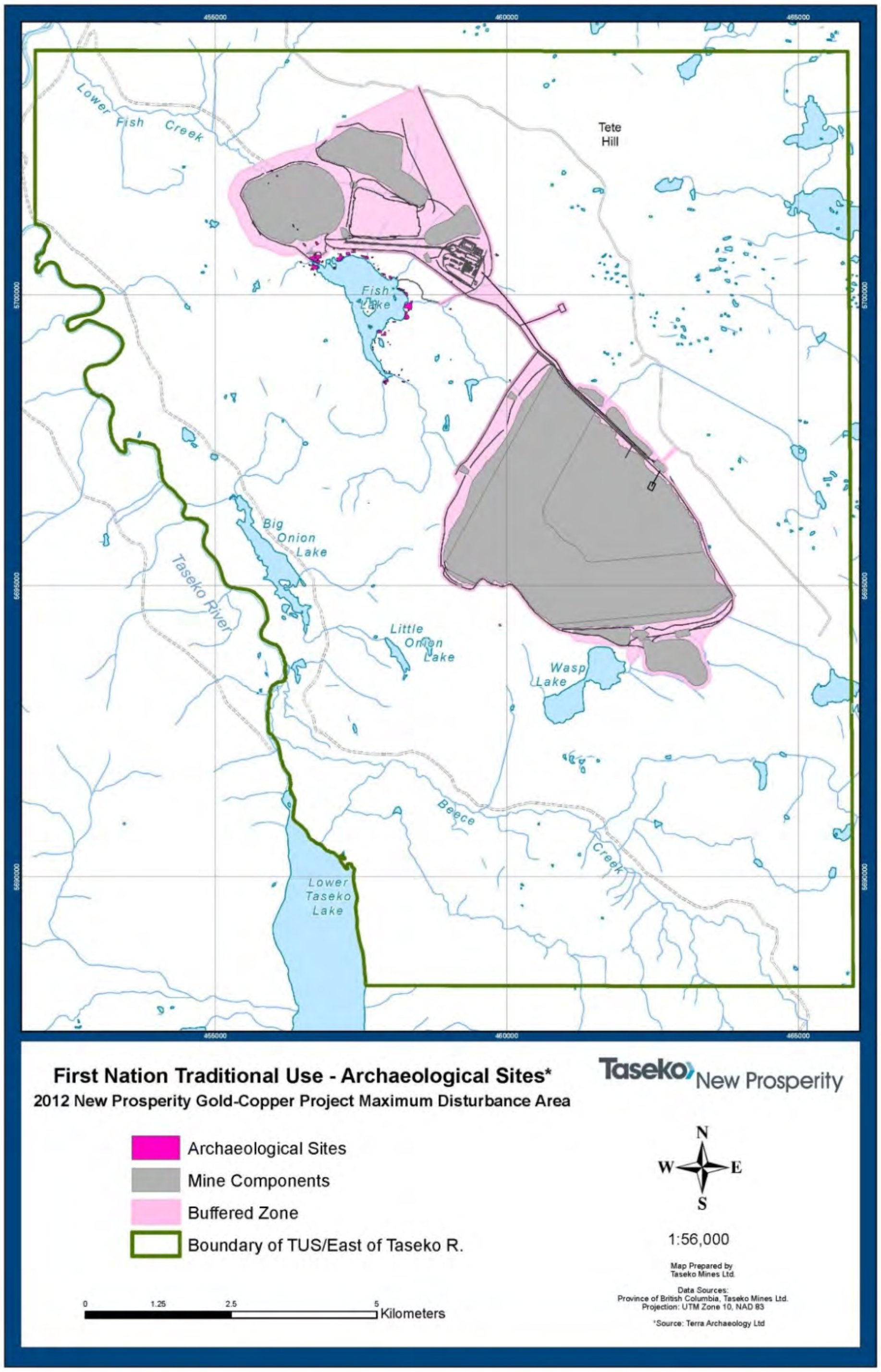


Figure 2.7.4.1-1 First Nation Traditional Use – Archaeological Sites

2.7.5 Aboriginal Interests

The EIS guidelines direct Taseko to identify how the Project as proposed has changed from the previous project proposal and whether these changes will result in environmental effects that could adversely impact potential or established Aboriginal rights or title. Project changes from the previous proposal are identified in Section 2.2.3, environmental effects are presented in section 2.7.2, and the impact on potential or established Aboriginal rights or title is summarized in section 2.7.5.2 below.

Section 2.7.5 will consider how such changes might impact upon aboriginal interests that are within the scope of the panel's mandate.[38]

This effects analysis has drawn from the extensive information gained through oral and written submissions to the previous panel during community hearings, the conclusions of the previous panel in their report, and the information reviewed during the prior panel review including: the transcripts from *William* case, the two cultural/heritage studies commissioned by Taseko in the 1990s (Ehrhart-English 1994 and 1993, Appendix 2.5.1-4). Despite Taseko's best efforts to communicate directly with First Nations on the New Prosperity Project as described in Section 2.5.1.1 of this document, new information on aboriginal interests relative to the redesign of the proposed mine site area has been obtained only through letters from the Tsilhqot'in National Government (TNG), or their legal counsel, directed to either Taseko or the Federal Government as documented in Section 2.5.1.1, or the public statements that the TNG or elected representatives within the TNG have made. Recent Tsilhqot'in concerns focus on the new project's proposal for preservation of Fish Lake, and continued loss of Little Fish Lake and adjacent areas in the watershed.

In describing key issues or concerns raised by Aboriginal groups, Taseko has provided the issues raised in the previous EA in section 2.5.1. Responses to these issues are found in the previous EIS and the previous panel transcripts. Key issues or concerns raised since the previous panel review and responses are discussed Section 2.7.5.3, and include the Tsilhqot'in National Government's (TNG's) publicized '10 facts why resubmitted Prosperity Mine Proposal cannot be approved". In describing how the Project addresses the findings of the previous panel regarding significant adverse impacts to potential or established Aboriginal rights or title, Taseko provided the issues in table format in Section 2.5.1.1 (Engagement and Consultation), and provides further discussion in Section 2.7.5.2. Where relevant, new mitigation measures proposed for New Prosperity are described throughout Section 2.7.5. Note that the proposed changes and mitigation measures are not necessarily considered adequate by all First Nations and as such, issues should not be considered as being resolved between the company and the aboriginal groups.

Section 2.7.5 of the EIS further specifically requests that Taseko provide:

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38 For the purposes of sections 2.7.5.1 and 2.7.5.2 below, we use the terminology of the original panel related to the findings of significant adverse effects on aboriginal rights and title interests or other aboriginal interests. For reasons noted in section 2.5, we believe that this is not the appropriate mode of analysis for the present panel, having regard to its mandate, and as such our assessment in the sections regarding the impact of the project on such matters is undertaken in accordance with the structure contemplated by the panel terms of reference and the EIS guidelines. More specifically, any assessment of environmental effects related to use of lands by aboriginal persons for traditional purposes (which results from change to the environment) is assessed using the CEAAA policy for assessing the significance of potential adverse effects. Any matters which do not fall within the above category, but are instead aboriginal rights and title issues, are not assessed under that policy, but the potential impact on such rights is identified, and any mitigation or accommodation measures are noted. In any case where an aboriginal interest appears to fall within both of these categories, comments and assessments are made in relation to each test.

- Specific issues and concerns raised by Aboriginal groups in relation to the Project - these are summarized in Table 2.5.1.1 and are discussed throughout this entire section 2.7.5.
- Any potential impacts that the Project may have on potential or established Aboriginal rights or title and the measures to prevent or mitigate these potential impacts- this is discussed in Section 2.7.5.2.
- Resolution of issues and concerns raised by Aboriginal peoples - issues raised and addressed in the previous EA are summarized in Section 2.5.1, concerns relative to previous findings of no significant adverse effect are discussed in Section 2.7.5.1 and alterations to the project and any new mitigation measures to resolve Aboriginal interests for which the previous panel found significant adverse effects are described in Section 2.7.5.2.
- Any potential social and/or economic impacts or benefits to Aboriginal groups that may arise as a result of the Project - this is provided in Section 2.7.5.4.
- Any potential effects on current uses of land and resources by Aboriginal groups for traditional purposes including, but not limited to, hunting, fishing, trapping, cultural and other traditional uses of the land (e.g. collection of medicinal plants, use of sacred sites) - this is discussed in Section 2.7.5.2.
- Measures to avoid, mitigate, or accommodate effects on the current use of lands and resources for traditional purposes by Aboriginal peoples - this is discussed in Section 2.7.5.2.
- Any effects of alterations to access into the area on Aboriginal groups - this is discussed in sections 2.7.5.1 and 2.7.5.2.
- Any effects of the Project on heritage and archaeological resources in the project area that are of importance or concern to Aboriginal groups - this is discussed in Section 2.7.5.1 and 2.7.5.2.
- The residual impacts of any effects identified above on potential or established Aboriginal rights and title - this is discussed in section 2.7.5.2.

In order to provide a logical structure to Section 2.7.5 while meeting the specific requirements of the Guidelines, Taseko has assembled the requested information related to Aboriginal interests in the following four sub-sections:

2.7.5.1 Interests identified in the original panel report for which no significant adverse impact was found but require further consideration in light of the proposed project changes;

2.7.5.2 Interests identified in the original panel report that were subject to a finding of significant adverse effect;

2.7.5.3 Additional aboriginal interests identified since the time of the original panel report and not otherwise covered by 2.7.5.1 or 2.7.5.2 above; and,

2.7.5.4 Potential social and economic impacts to aboriginal groups.

2.7.5.1 Aboriginal interests identified in the original panel report for which no significant adverse impact was found, but which require further consideration in light of the proposed project changes

There were a number of aboriginal interests considered in the original panel process for which the panel did not find the project would have significant adverse effects. Some of those related to established or asserted aboriginal rights or title, and some of them related to potential impacts on use of land by aboriginal people for traditional purposes as well as effects on heritage and archaeological resources.

Of these findings, many are not affected in any way by the proposed redesign of the project (for example impacts of the proposed power line on aboriginal hunting in that area); however, there were some such findings for which the conclusions were based on aspects of the project design which have changed, and for which further consideration is warranted.

The following aboriginal interests are discussed in detail in various sub-sections of Section 2.7.2 but the findings of the previous panel, changes in effect as a result of alterations to the project, and any new mitigation measures are summarized here:

a. Vegetation
b. Wildlife
c. Atmospheric Environment and Human Health
d. Acoustic Effects
e. Water Quality and Quantity and Impact on Off-Site Fisheries, and
f. Archaeology.

a. Vegetation

Issues of Concern and Findings on the Previous Project

The Tsilhqot'in expressed the concern that the construction and operation of the previous Prosperity project would end the use of the Fish Lake and the Fish Creek watershed area for gathering purposes. Concerns raised by the participants in the original panel review focused largely on issues related to loss of old growth forest habitats, effects of invasive plants on grasslands, loss of wetland and riparian habitats, and loss of plants of importance to First Nations.

The original panel concluded that the previous project would not result in a significant adverse effect on old growth forest or grassland ecosystems, and that although the Project would result in adverse impacts to wetlands and riparian habitat, implementation of a wildlife compensation plan for the loss of wetland and riparian habitats would be an important component for offsetting the effects. The Panel further concluded the project would not result in a significant adverse cumulative effect on vegetation.

Results from Alterations to the Project

Section 2.7.2.7 summarizes the effects of New Prosperity on vegetation VECs and KIs, and the species of interest to First Nations. The overall vegetation loss and effects to ecological communities of conservation concern and rare plants within the mine site are less those reported in the 2009 Prosperity EIS due to the changes in the Project design at the mine site and the decreased area of disturbance.

Mitigation Measures

Mitigation measures proposed in the 2009 EIS and committed to through the EAO process and summarized in Table 2.7.2.8-20 remain relevant to the 2012 New Prosperity project. There are no new mitigation measures proposed for vegetation associated with New Prosperity.

b. Wildlife

Issues of Concern and Findings on the Previous Project

For the previous project, the Tsilhqot'in expressed concern at the loss of habitat for wildlife, wildlife health and mortality, and these potential impacts on animal abundance and diversity for hunting and trapping. The original panel, which focused its attention on effects on mule deer migration and ungulate winter habitat, increased accessibility to the land, and issues surrounding the wildlife habitat compensation plan to address effects on wetlands and riparian habitats, concluded no significant adverse effects on mule deer, moose and, provided a wildlife habitat compensation plan is developed and implemented, on migratory birds. The original Panel also concluded that disruption of mule deer movement patterns was not of concern given the location of the proposed mine site, mule deer would likely still disperse around the mine site to continue their migration. The Panel further concluded the project would not result in a significant adverse cumulative effect on deer, moose, and other wildlife, with the exception of the South Chilcotin grizzly bear population (refer to section 2.7.2.8 for a discussion on grizzly bear).

Results from Alterations to the Project

Section 2.7.2.8 summarizes the effects of New Prosperity on wildlife VECs and KIs, and the species of interest to First Nations. With the reduction in land disturbance associated with New Prosperity relative to the previous project, the amount of habitat affected either did not materially change or was reduced for all species/KIs/KI groups.With the implementation of the proposed mitigation measures, the residual loss of habitat is predicted to be not significant with respect to the sustainability of the deer moose populations.

With regards to wildlife travel routes, the potential for movement disruption for species such as mule deer will be further reduced in New prosperity in comparison to the previous project due to improvements in the design of the mine site; for example, it is likely that mule deer and other mammals will be able to move along the north-west to south-east axis of the Mine site between the open pit and TSF.

With adherence to best practices and identified mitigation measures, the mortality risk will be reduced and there is an expected reduction in direct mortality as the total area requiring clearing at the mine site will be reduced.

Mitigation Measures

Mitigation measures proposed in the 2009 EIS and committed to through the EAO process and summarized in Table 2.7.2.9-10 remain relevant to the 2012 New Prosperity project. With the exception of mitigation measures relevant to grizzly bear (see section 2.7.2.8), there are no new mitigation measures proposed for wildlife associated with New Prosperity.

c. Atmospheric Environment and Human Health

Issues of Concern and Findings on the Previous Project

Concern with regard to the previous Prosperity Project and air contaminants was expressed by the Tsilhqot'in; specifically, that dust and other air pollutants would be adsorbed by animals and plants impacting country foods and human health. The previous panel concluded that emissions of particulate matter from the Project would not result in significant adverse effect. The Panel further concluded that the Project would not result in a significant adverse effect on human health from consuming fish, moose meat and drinking water.

Results from Alterations to the Project

Section 2.7.2.2 summarizes the effects of New Prosperity on Atmospheric Environment and Section 2.7.3.3 on Human Health.

Considering the conservative nature inherent in the air contaminant dispersion modelling, and the location and limited areas over which predicted concentrations are in exceedance of the objectives and/or standards, it is concluded that the residual project effects for all phases of the Project are not significant. The duration and frequency for most activities is regular and medium term; however, concentrations above the objectives and/or standards are expected to be very rare, local, short in duration and reversible.

The data show that for the majority of the CACs, predicted concentrations are well below their established air quality criteria. The data also show that particulate concentrations in the Nemaiah Valley would be below their respective regulatory standard or objective. For these CACs, the change in project footprint would not result in health concerns related to inhalation exposures for human or ecological receptors.

With regards to human health, the changes in the development plan between the Prosperity and New Prosperity projects is not expected to alter the conclusions of the human health assessment.

Mitigation Measures

Mitigation measures proposed in the 2009 EIS and committed to through the EAO process remain relevant to the 2012 New Prosperity project and include: Implement management practices to reduce smoke during brush burning and incorporating BATEA into project design wherever possible. Other mitigation measures are listed in Table 2.7.2.2-7.

The original HHERA noted that mitigation measures to address issues of the release of air contaminants, soil loading of metals and discharge of Pit Lake and TSF water into the Fish Lake and surrounding watersheds would adequatley address concerns identified in the HHERA and that no additional mitigative measures, specific to the HHERA would be required. This recommendation has not changed with the New Properity project.

d. Acoustic Environment and Impact on Residents

Findings on the Previous Project

Concern with regard to the previous Prosperity Project was expressed by the Tsilhqot'in that noise and light will be seen and heard from Nemiah. The previous Panel concluded that light pollution from the Project would not result in a significant adverse effect.

Results from Alterations to the Project

Section 2.7.2.3 summarizes the effects of New Prosperity on the Acoustic Environment. The changes are mainly associated with locations of the stockpiles and the new tailing locations. The new stockpile locations result in a longer haul distance (2-3 km per trip); however, the decrease in project footprint results in the reduction of land clearing area. There is no change in residual effects due to blasting noise. There is a marginal change in vehicular traffic internal to the mine site for the New Prosperity Project; and it is expected that the conclusions with respect to residual effects due to vehicular traffic will not change from those in the previous EA.

Mitigation measures

A number of Project design features and mitigation measures proposed in the 2009 EIS and committed to through the EAO process (summarized in Table 2.7.2.3-8) remain relevant to the 2012 New Prosperity project. There are no new mitigation measures associated with New Prosperity.

e. Water Quality and Quantity and Impact on Off-Site Fisheries

Issues of Concern and Findings on the Previous Project

Groundwater seepage effects on aquifers and springs, the Taseko River and salmon were concerns expressed by the Tsilhqot'in on the previous project. The previous panel concluded that the Project would not result in a significant adverse effect on surface water quality or fish health in the Taseko River. The Panel further concluded that seepage from the tailings storage facility would not result in a significant adverse effect on water quality in Big Onion Lake. The panel further concluded that the project would not result in a significant adverse cumulative effect on surface water and groundwater.

Results from Alterations to the Project

Section 2.7.2.4 summarizes the effects of New Prosperity on Water Quality and Quantity.

Mitigation Measures

Mitigation measures proposed in the 2009 EIS and committed to through the EAO process and summarized in Section 2.7.2.4 remain relevant to the 2012 New Prosperity project. New mitigation measures for New Prosperity are as proposed in Section 2.7.2.4.

f. Archaeology and Alteration of Sites

Issues of Concern and Findings on the Previous Project

First Nations have expressed concern with regard to the disturbance of heritage and archaeological sites, the lack of preservation of sites under BC law, and lack of First Nations ownership of artifacts found. The previous panel concluded that, provided the recommendation identified by the Panel is implemented, the Project would not result in a significant adverse effect on physical heritage and sites of archaeological importance.

Results from Alterations to the Project

Section 2.7.4.1 summarizes the effects of New Prosperity on Archaeological resources.

Twenty-nine of the archaeological sites identified within the previous mine footprint were assessed as having a moderate scientific value and eleven were assessed as having high scientific value. With the currently proposed project and its modified mine development plan, all but four of the thirty-nine low scientific value sites and all but one of the twenty-nine archaeological sites having a moderate scientific value have been avoided and therefore will no longer be disturbed or lost. All five sites are located within the area of the proposed pit development and thus cannot be avoided. The four sites assessed as having low scientific value were found to contain lithics, all of which have already been recovered and preserved.

Mitigation Measures

The one moderate value site found to contain formed tools which have already been recovered and preserved is located in the vicinity of the proposed pit and cannot be avoided. It was not one of the sites recommended for further systematic data recovery by the provincial Archaeology Branch and, no additional mitigation measures are proposed.

Special monitoring and mitigation measures, such as the clear marking of boundaries around each of these three sites, are included in the Cultural and Heritage Protection Plan (Section 2.8.1) and will be implemented to help ensure that they will not be disturbed throughout all phases of mine development activity.

A chance-find procedure has been developed and opportunities to input have been provided to FN

Remain committed to discussing any additional mitigation measures.

2.7.5.2 Aboriginal concerns identified in the original panel report that were subject to a finding of significant adverse effect[39]

The original panel found the following significant adverse effects in the previously proposed Prosperity Project in relation to aboriginal interests:

2.7.5.2.1 Tsilhqot'in Nation's current use of lands and resources for traditional purposes (including the local effect on the Xeni Gwet'in and cultural heritage resources;

- Current use of land and resources for traditional purposes
- Cultural heritage resources

2.7.5.2.2 Potential or Established Rights and Title

- Tsilhqot'in Aboriginal rights as defined in the *William* case.
- Fish and fish habitat, cumulative effect on fish and fish habitat, and the potential Tsilhqot'in Aboriginal right to fish in Fish Lake.
- Tsilhqot'in Aboriginal title that could be granted.
- Title that could be granted to the Esketemc (Alkali Lake Band) and the Stswecem'c/Xgat'tem (Canoe Creek Band).

These subsections will consider how and to what extent the modifications to project design and/or additional or updated mitigation measures address these findings.

[39] It is not in all cases clear how or to what extent the previous panel applied the CEAA Reference Guide for determining significant adverse effects when reaching these conclusions, although it stated in Section 4.2 that it intended to do so. For example, the panel found a "locally significant" adverse effect on the users of meadows, but it is not clear how that decision was appropriate to reach when relevant policy requires consideration of geographic extent as one of the factors for determining whether the project as a whole will have a significant adverse effect. Similarly, the panel at times referred to some aspects the CEAA policy (e.g. high magnitude and irreversible effects on navigation) to support a finding of significant adverse effect, without commenting on other factors that may have also had relevance and which may have mitigated against such a conclusion (geographic extent, duration and frequency and ecological context). Finally, the panel made findings regarding significance of adverse effects in respect of asserted or established aboriginal rights and title even though such matters do not fall within the definition of "environmental effect" under Canadian Environmental Assessment Act but rather relate to the Crown's duty to consult and accommodate, which must be assessed under a different methodology prescribed by the Supreme Court of Canada.

For the purposes of the EIS, Taseko is, as required by the Guidelines, providing information in respect of each of these findings by the prior panel but Taseko does so without prejudice to its position that the present panel must consider and expressly apply the objective test for determination of significance of adverse effects as set out in that Guide in relation to "environmental effects", and that it is not to apply that test to consideration of aboriginal rights and title and the Crown's duty to consult.

2.7.5.3 Tsilhqot'in Nation's current use of lands and resources for traditional purposes and cultural heritage resources

a. Current Use of Lands and Resources for Traditional Purposes

Findings on Previous Project

The Tsilhqot'in have expressed how the land and resources of the Fish Lake and Fish Creek watershed areas are still being used by the Tsilhqot'in for traditional purposes. Information was submitted during the original panel review on the previous project regarding the number of Tsilhqot'in members who continued to use the area of the proposed mine site for activities such as hunting, fishing, gathering of berries, plants and medicines. Loss of access to the area during construction and operations was a concern, as was the perception of contamination even after closure and reclamation.

The Tsilhqot'in stated that different areas are used in their territory depending on the season and the subsistence resources available to support their current use activities, and that many of the resources in these areas may be under increasing pressure from other activities such as forestry, grazing and private land ownership.

The previous panel determined that the loss of the Fish Lake and Fish Creek watershed areas for current use activities would be irreversible, of high magnitude and have a long-term effect on the Tsilhqot'in. Relative to Aboriginal interests and current use for traditional purposes, the previous panel concluded the previous project would have a significant adverse effect on fish and fish habitat in the watershed, navigation (assumed to be connected to fishing).

The results of altering the mine development plan on current use for traditional purposes are discussed below under the headings: fishing, hunting and trapping, plant gathering, and other uses. Where possible, comparisons between the 2009 and 2012 mine development areas (MDA) are provided using the current use for traditional purposes mapping in the Ehrhart-English study (Appendix 2.6.4-4).40 Cumulative effects and conclusions on impact on current use for traditional purposes is provided at the end of this section.

g. Fishing

Section 2.6.4 of this EIS provides a summary of current use of the proposed mine site area, including that Fish Lake is used by the Tsilhqot'in as a reserve food supply in the event of poor salmon runs. During the panel hearings for the previous project, many of the Tsilhqot'in indicated that they had gone, and continue to go, to Fish Lake to fish. While fishing for food purposes in Fish Lake was identified as an important activity, it was stated to be strongly connected to other cultural practices that occurred there, such as gatherings of Elders and youth and recreation. The Tsilhqot'in noted that they used other lakes in the region for fishing as well, and expressed the concern that if Fish Lake was not available there would be increased competition for resources in those other lakes.

Based on traditional use information, it is understood that a portion of the Tsilhqot'in First Nations total annual fishing activities comes from lake fishing, though the bulk of their annual catch likely comes from

[40] A Traditional Use submission was made by the Tsilhqot'in during the panel hearings on the previous project and it included results from a 2001 traditional use study to supplement the Ehrhart-English study; however, the geographic area for the 2001 study was large and the greatest level of detail for traditional use locations relative to the proposed mine site remains in the Ehrhart-English study, hence mapping from the latter was used for this analysis.

salmon fishing. The loss of Fish Lake and its inlet and outlet spawning habitat and populations in the previously proposed project would have eliminated one of the lake fishing sources, and their ability to navigate for the purposes of fishing on this lake.

Results from Alteration to the Project

The effects of the Project on Fish and Fish Habitat, as well as mitigation strategies are provided in Section 2.7.2.5. The New Prosperity mine development plan includes the preservation of Fish Lake resulting in maintaining fishing opportunities, and navigation for fishing, for current and future generations. New Prosperity enables access to Fish Lake during all mine phases.

Figure 2.7.5-1 and 2.7.5-2 illustrate the change in the MDA between the 2012 New Prosperity proposal and the 2009 project. While the loss of stream habitat and Little Fish Lake still occurs with New Prosperity, the new mine development plan retains 55% of the fish bearing and non-fish bearing streams and 94% of the lake habitat compared to the previous project. Opportunities to navigate for fishing in Fish Lake are retained through all phases of mining.

The previous Prosperity Project included a new lake above the TSF to compensation for the loss of fishing in the watershed. A compensation plan for New Prosperity will be different given that Fish Lake will not be lost. Compensation elements being investigated to offset the stream and Little Fish Lake losses in the watershed are those currently known to be of interest to locals, including First Nations, for increasing fishing opportunities in the region, including creating new habitat for spawning and rearing, and restoring habitat.

Mitigation Measures

Mitigation measures for the 2012 New Prosperity project are summarized in Section 2.7.2.5.

Taseko is open to discussing with the Tsilhqot'in elements of a Fish Compensation Plan that are of interest to Aboriginal people in the territory that improve fish populations, habitat, and opportunities for fishing.

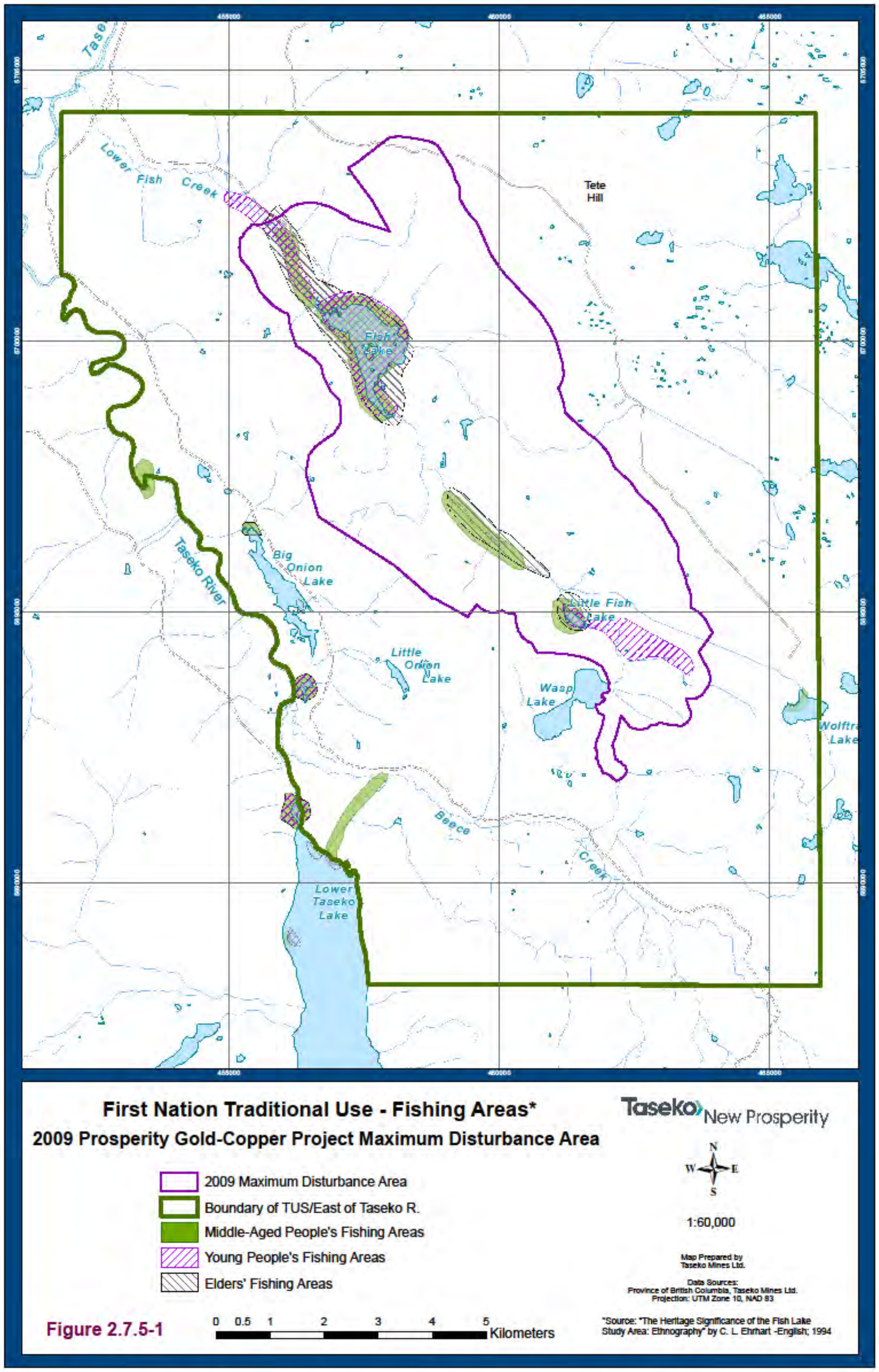

Figure 2.7.5-1 First Nation Traditional Use – Fishing Areas – 2009

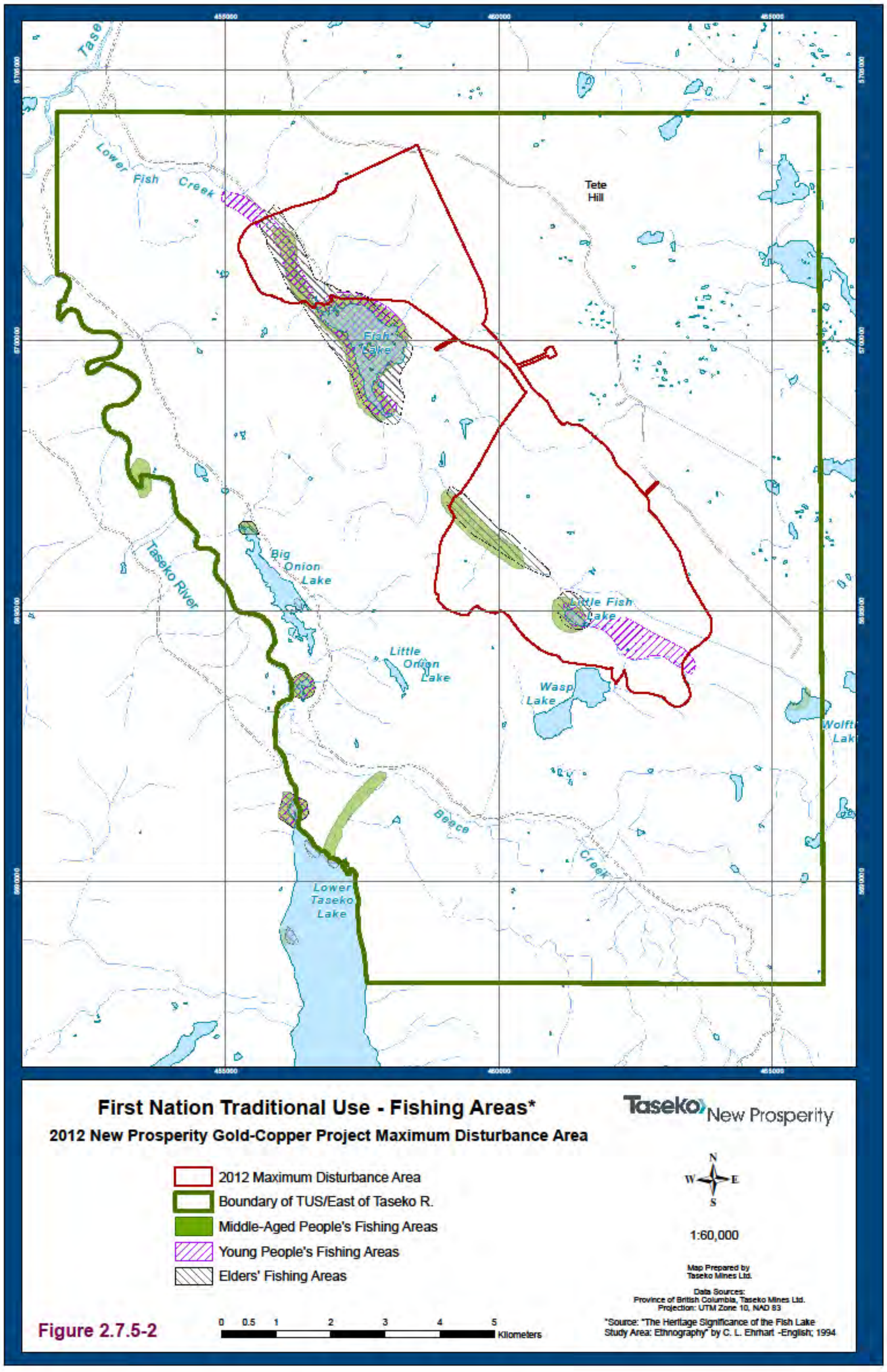

Figure 2.7.5-2 First Nation Traditional Use – Fishing Areas – 2012

h. Hunting and Trapping

Section 2.6.4 of this EIS provides a summary of current use of the proposed mine site area for hunting. Hunters in the Tsilhqot'in communities indicated that the area surrounding Fish Lake and in Fish Creek watershed were excellent hunting and trapping territories. Species known to be of interest to the Tsilhqot'in from the *Williams* case, including grizzly bear, are referred to in the wildlife assessment provided in Section 2.7.2.8.

Results from Alteration to the Project

Land disturbance proposed for New Prosperity is less than that proposed for the previous project. As a result, habitat losses associated with New Prosperity are either materially unchanged or reduced with New Prosperity. Grizzly bear habitat impacted by the 2012 New Prosperity MDA is less than that predicated to be impacted by the previous proposal.

As a result of less hectares being proposed for disturbance in the New Prosperity project relative to the 2009 proposal, less impact on local wildlife populations is expected, which is relevant to those species historically targeted for trapping in the Fish Lake watershed. Figure 2.7.5-3, 4, 5, and 6 illustrate the hunting and trapping areas east of the Taseko River impacted by the previous 2009 project's MDA in comparison to the 2012 New Prosperity MDA. With the preservation of the Fish Lake area, trapping areas for all species assessed by Ehrhart-English are less impacted, with the exception of the cougar trapping area which is thought to be limited to an area immediately downstream of Little Fish Lake both the 2009 and 2012 MDA's encompass the location (Table 2.7.5-1). Marten, coyote, beaver and muskrat trapping areas are substantially less affected in the 2012 MDA. Likewise, hunting areas for all species assessed are less impacted, with the exception of squirrel whose hunting area blankets both the 2012 and 2009 project MDAs (Table 2.7.5-2).

Table 2.7.5-1 Comparison of 2009 and 2012 Mine Development Areas (MDA) for Trapping Areas identified by Ehrhart-English

Trapping Areas	Total ha of Activities within TUS /East of Taseko R. Bdry	Total ha of Activities within 2009 MDA	% of Activities Impacted by 2009 MDA	Total ha of Activities within 2012 MDA	% of Activities Impacted by 2012 MDA
Muskrat (Ondatra zibethica)	537.3	263.4	49.0	23.5	4.4
Beaver (Castor canadensis)	989.0	446.1	45.1	318.9	32.2
Coyote (Canis latrans)	3767.5	1474.1	39.1	1773.7	47.1
Marten (Martes americana)	364.9	308.6	84.6	199.1	54.6
Lynx (Lynx canadensis)	2261.3	1624.2	71.8	1251.7	55.4
Weasel (Mustela sp.)	1996.4	1474.1	73.8	1121.1	56.2
Squirrel (Tamiasciurus hudsonicus)	1921.3	1422.9	74.1	1120.1	58.3
Rabbit (Lepus americanus)	489.0	404.0	82.6	298.4	61.0
Wolverine (Gulo gulo)	106.5	77.8	73.1	84.4	79.2
Fisher (Martes pennanti)	106.5	77.8	73.1	84.4	79.2
Bobcat (Lynx rufus)	35.1	28.7	81.8	34.1	97.2
Cougar (Felis concolor)	24.3	24.3	100.0	24.3	100.0

Table 2.7.5-2 Comparison of 2009 and 2012 Mine Development Areas (MDA) for Hunting Areas identified by Ehrhart-English

Hunting Areas	Total ha of Activities within TUS /East of Taseko R. Bdry	Total ha of Activities within 2009 MDA	% of Activities Impacted by 2009 MDA	Total ha of Activities within 2012 MDA	% of Activities Impacted by 2012 MDA
All Ages' Geese (many species)	601.8	61.4	10.2	0.0	0.0
All Ages' Goat (Oreamnos americanus)	0.0	0.0	0.0	0.0	0.0
All Ages' Groundhog (Marmota caligata)	0.0	0.0	0.0	0.0	0.0
All Ages' Grouse (many species)	3123.9	558.8	17.9	241.7	7.7
All Ages' Deer (Odocoileus hemionus)	12823.6	3918.1	30.6	2281.0	17.8
All Ages' Moose (Alces alces)	12401.3	3906.1	31.5	2269.7	18.3
All Ages' Squirrel (Tamiasciurus hudsonicus)	74.4	74.4	100.0	74.4	100.0
Middle Aged Peoples' Hunting	11374.6	3773.5	33.2	2216.6	19.5
Young Peoples' Hunting	8782.2	3258.3	37.1	1830.0	20.8
Elders' Hunting	6767.5	2318.3	34.3	1468.4	21.7

As a result of the reduction in hectares proposed for disturbance, the area to be designated as a no-hunting zone in accordance with the Health, Safety and Reclamation Act of BC is reduced from that required with the previous project design. Access to Fish Lake will be provided during construction and operations, enabling opportunities for trapping in the immediate area of Fish Lake and the adjacent meadows during all phases of mining.

No potential residual effects are expected related to change in wildlife habitat with implementation of associated mitigation and compensation measures.

Section 2.7.3.1 summarizes the effects on resources users, including trapping and the trap line held by Nemiah Band/Sonny Lulua. While there is no significant adverse effect on furbearers in the LSA or RSA, there will be local effects on trapping in the MDA during construction and continue until mine closure when reclamation for fur-bearer habitat is restored. As noted in Section 2.7.3.1, the average harvest of licensees is well below $500; approximately 4% of the Nemiah/Sonny Lulua trapline is within the 2012 MDA.

Mitigation Measures

Mitigation measures proposed in the 2009 EIS and committed to through the EAO process and summarized in Table 2.7.2.8-10 for wildlife. Negotiations with the Nemiah Band licenses may find a suitable solution to the local effects on the trapline.

Taseko is open to discussing with the Tsilhqot'in additional mitigation measures, as part of the New Prosperity Habitat Compensation Plan, that enhance wildlife and waterfowl habitat, and improve abundance and diversity of wildlife species that are of interest to Aboriginal people.

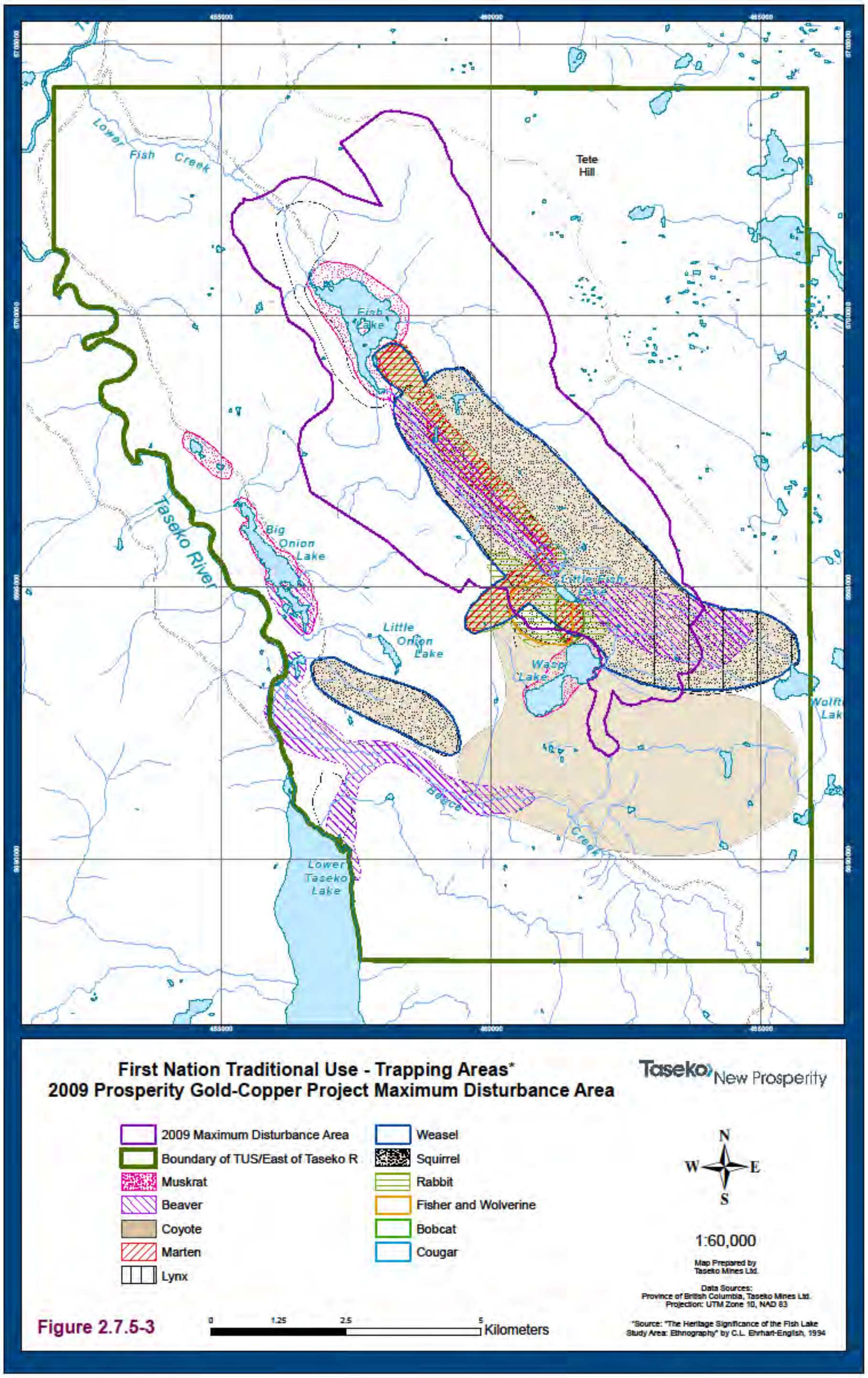

Figure 2.7.5-3 First Nation Traditional Use – Trapping Areas – 2009

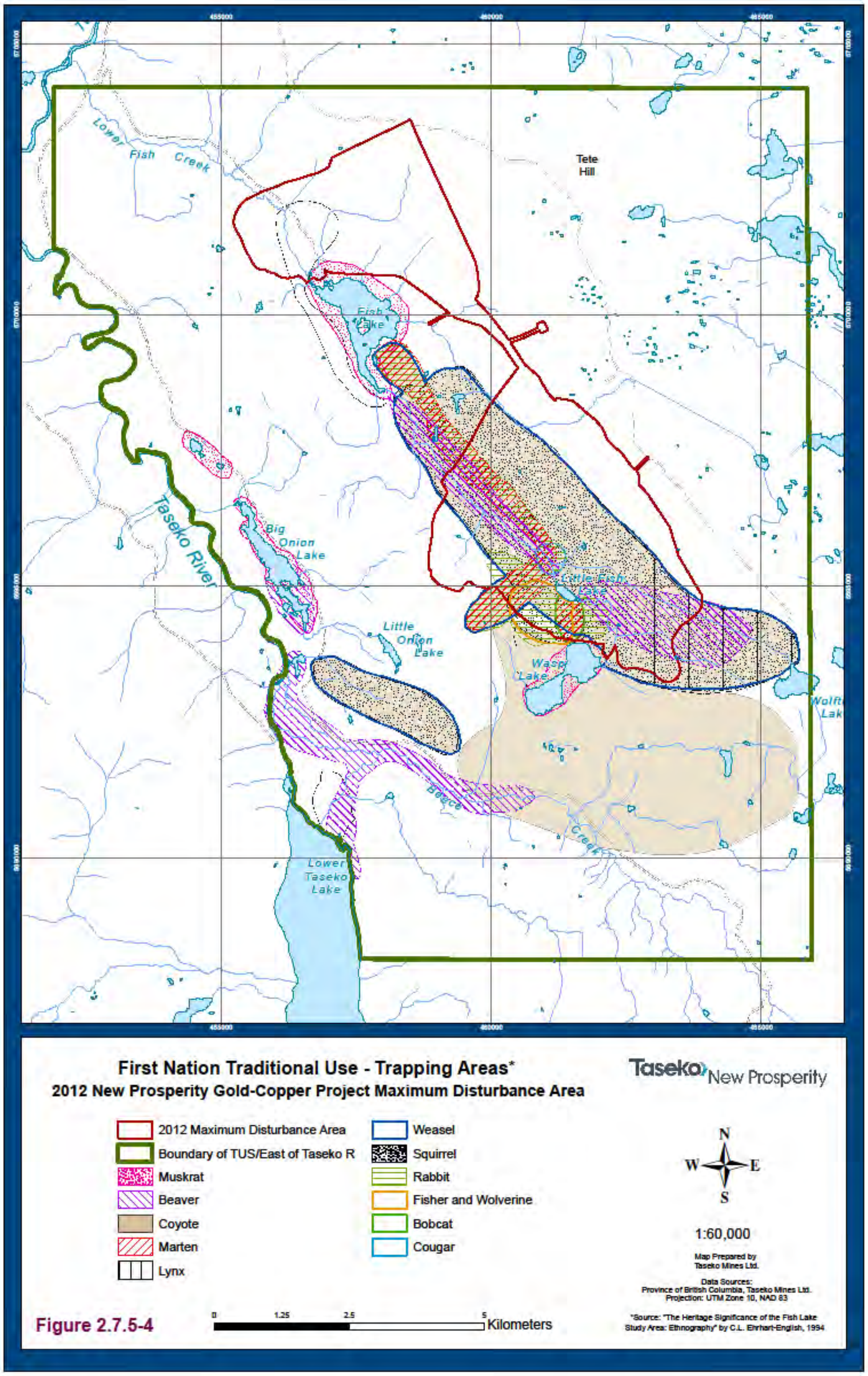

Figure 2.7.5-4 First Nation Traditional Use – Trapping Areas – 2012

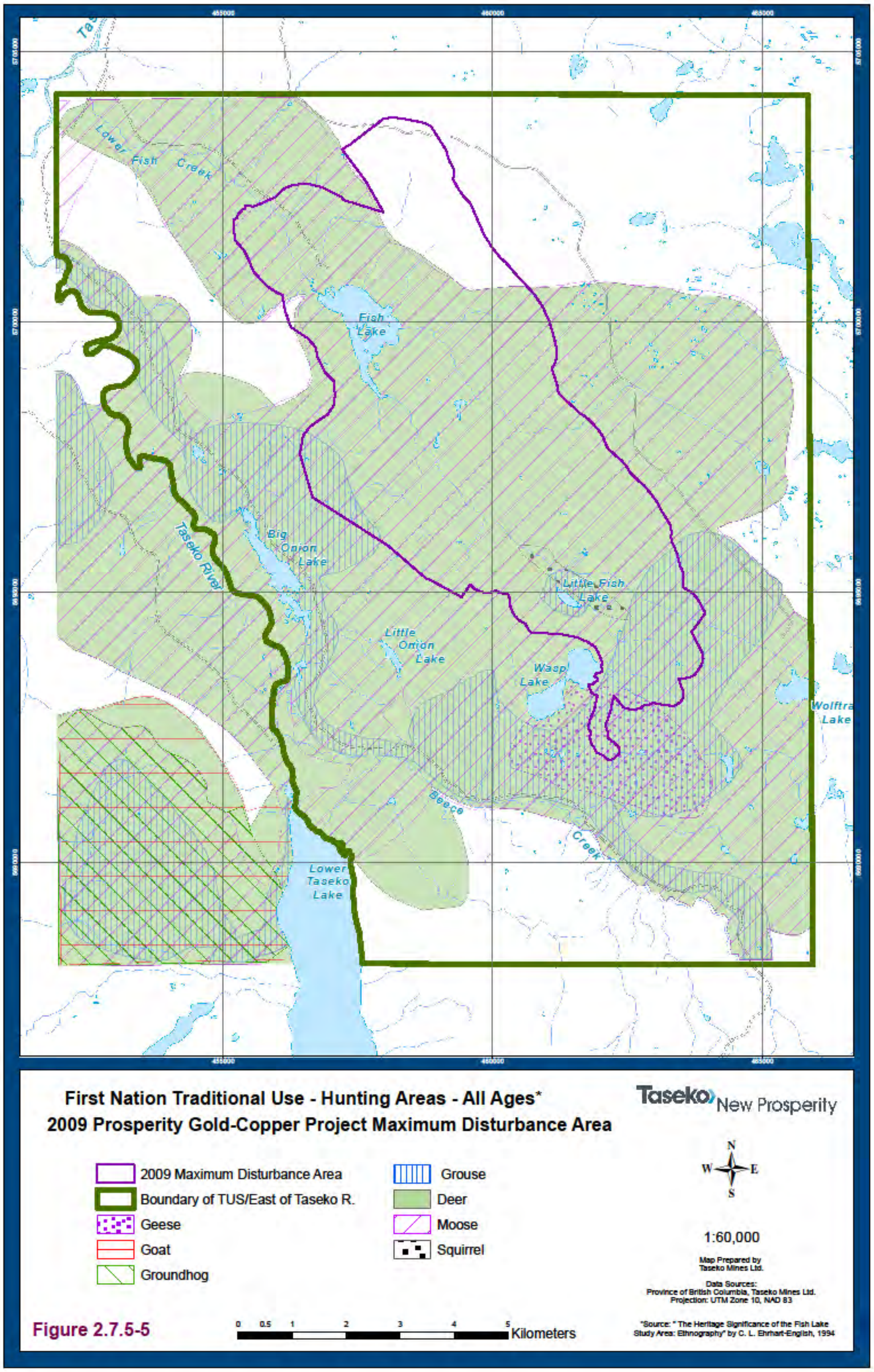

Figure 2.7.5-5 First Nation Traditional Use – Hunting Areas – 2009

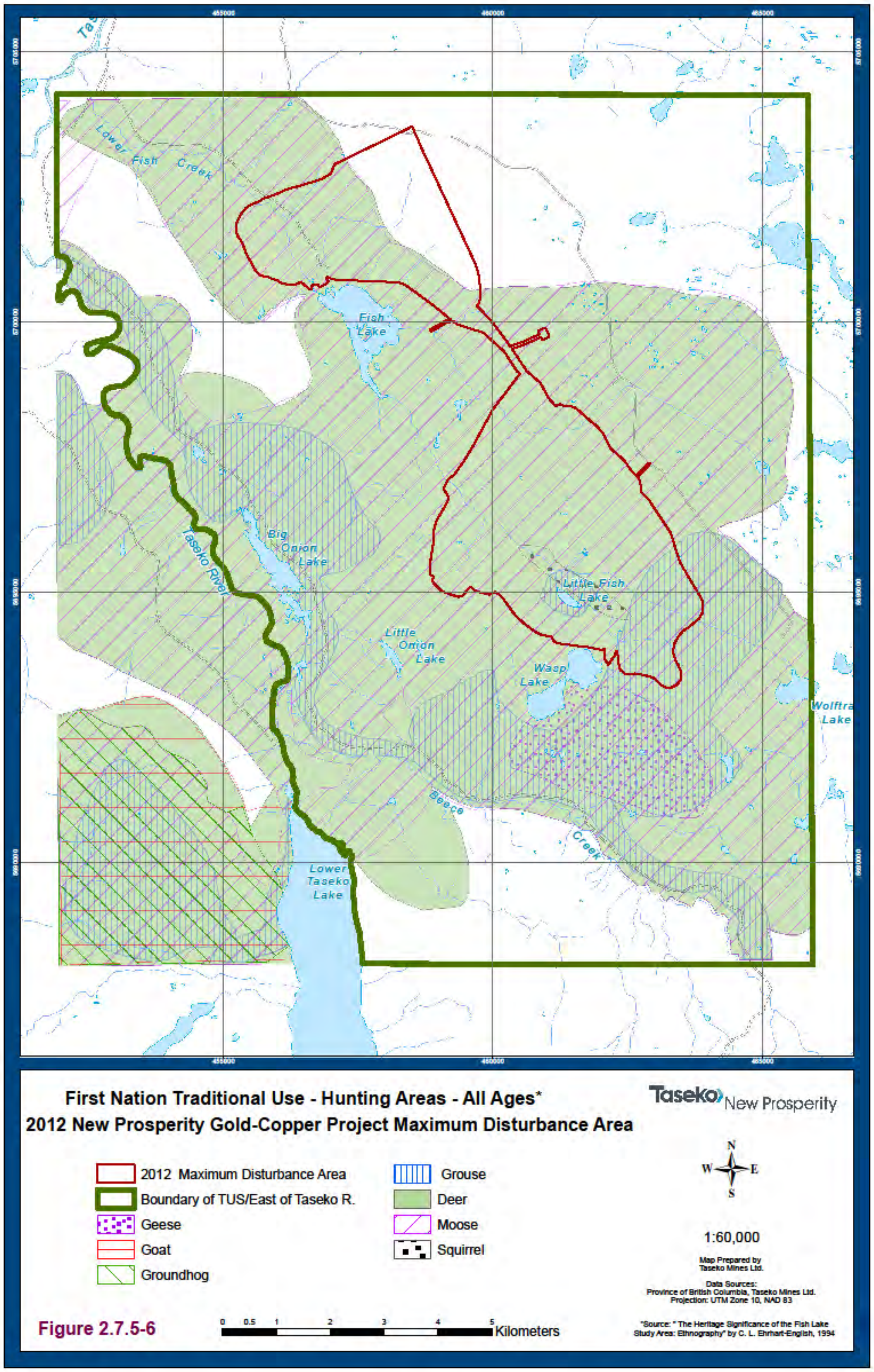

Figure 2.7.5-6 First Nation Traditional Use – Hunting Areas – 2012

i. Plant Gathering

Section 2.6.4 of this EIS provides a summary of current use of the proposed mine site area for plant gathering. During the course of the public hearing for the previous project, the Tsilhqot'in Nation provided specific information on how the Project would impact on gathering and harvesting as a result of:

- Displacement of the Tsilhqot'in people from the area around Fish Lake, Little Fish Lake, and Fish Creek watershed during mine construction, operation and decommissioning, the permanent loss of the area, and
- Tsilhqot'in avoidance of areas due to perceptions of contamination.

Project effects on vegetation may impact First Nations both through loss of vegetation species of interest or value and through the loss or alteration of vegetation communities that provide species of interest/value.

In the Fish Lake area, many Tsilhqot'in members, especially members from the Xeni Gwet'in (Nemiah Band) confirmed the use of the Fish Creek watershed for plant gathering, including:

- Berry picking (blueberries, chokecherries, crowberries, frog berries, huckleberries, raspberries, saskatoon berries, soap berries, strawberries)
- Medicine gathering (Indian Hellebore, pine pitch, dark willow, scrub birch or dwarf birch, alder, juniper and aspen, Fireweed root), and
- Other harvesting (balsam fir, bear tooth, kinnikinnick, Labrador tea, pine mushrooms, wild onion and wild potatoes).

Some of the species identified are very common (e.g., lodgepole pine, which is used for cambium stripping and firewood, and balsam fir, used for medicine). A few of the species noted to be of interest in the do occur in the MDA but are associated with specific habitat types that are minimally impacted by the project; for instance Allium cernuum (nodding onion) is found in some of the grassland associations locally common on the west facing bluffs above the Taseko River where only 12 hectares of the 400 hectares will be disturbed from mine construction and operations. A variety of berry species were also noted in the Ehrhart-English study; several of these species were included in sampling for baseline vegetation metals through the previous project, and will be part of the ongoing reclamation and monitoring programs.

Results from Alteration to the Project

Project effects to old forest, wetlands and grasslands in the mine site are less than those predicted by the 2009 Prosperity EIS. Table 2.7.2.8-120 summarizies that the overall vegetation loss is less due to the New Prosperity Project than in the previous Prosperity Project; the effects to country foods are generally less than those predicted for the Prosperity Project.

Figures 2.7.5-7, 8, 9, and 10 illustrate berry picking and harvesting sites within the MDA for the 2012 New Prosperity and 2009 Prosperity projects. There are less hectares proposed for disturbance with New Prosperity and as a result, areas for plant gathering species of interest to First Nations are less impacted than with the previous project.

Based on the Ehrhart-English mapping, significantly less Saskatoon, gooseberry, raspberry, soopalallie thimbleberry and laborador tea are impacted by the new MDA (Tables 2.7.5-3 and 2.7.5-4). Lily pad harvesting is identified as occurring almost entirely in the Fish Lake area, and is preserved in the new MDA. There is little change to the impact on balsam, cottonwood, blueberry, strawberry and crowberry; these species will be includ in the reclamation planning for mine disturbances.

Table 2.7.5-3 Comparison of 2009 and 2012 Mine Development Areas (MDA) for Harvesting Areas Identified by Ehrhart-English

Harvesting Areas	Total ha of Activities within TUS /East of Taseko R. Bdry	Total ha of Activities within 2009 MDA	% of Activities Impacted by 2009 MDA	Total ha of Activities within 2012 MDA	% of Activities Impacted by 2012 MDA
Wild Onion (Allium cernuum)	855.3	0.0	0.0	0.0	0.0
Mountain Potato (Claytonia lanceolata)	110.3	0.0	0.0	0.0	0.0
Willow (Cornus stolonifera)	330.7	0.0	0.0	0.0	0.0
Aspen (Populus tremuloides)	507.4	0.0	0.0	0.0	0.0
Juniper (Juniperus communis)	145.0	0.0	0.0	0.0	0.0
Pine (Pinus albicaulis)	6.8	0.0	0.0	0.0	0.0
Wild Rhubarb (Heracleum lanatum)	0.0	0.0	0.0	0.0	0.0
Bear Tooth (Erythronium grandiflorum)	0.0	0.0	0.0	0.0	0.0
Lily Pad (Nuphar polysepalum)	29.4	18.9	64.3	1.1	3.7
Labrador Tea (Ledum glandulosum)	136.3	102.0	74.8	70.1	51.4
Balsam (Veratrum viride)	179.7	151.6	84.4	125.8	70.0
Cottonwood (Populus trichocarpa)	118.3	86.5	73.1	86.2	72.9

Table 2.7.5-4 Comparison of 2009 and 2012 Mine Development Areas (MDA) for Berry Picking Areas Identified by Ehrhart-English

Berry Picking Areas	Total ha of Activities within TUS _East of Taseko R. Bdry	Total ha of Activities within 2009 MDA	% of Activities Impacted by 2009 MDA	Total ha of Activities within 2012 MDA	% of Activities Impacted by 2012 MDA
Saskatoon (Amelanchier alnifolia)	519.4	60.3	11.6	0.0	0.0
Gooseberry (Ribes irreguum)	703.0	122.5	17.4	0.0	0.0
Huckleberry (Vaccinium sp.)	0.0	0.0	0.0	0.0	0.0
Raspberry (Rubus idacus)	1267.4	190.4	15.0	61.6	4.9
Soopalallie (Shepherdia canadensis)	2155.3	755.2	35.0	445.0	20.6
Kinnickinnick (Aretostaphylos uva-ursi)	81.5	29.4	36.1	28.5	35.0
Thimbleberry (Rubus parviflorus)	520.6	378.9	72.8	237.7	45.7
Blueberry (Vaccinium myrtilloides)	758.0	469.8	62.0	437.3	57.7
Strawberry (Fragaria virginiana)	513.3	349.6	68.1	319.6	62.3

Crowberry (Empetrum nigrum)	288.8	281.9	97.6	265.1	91.8

Mitigation Measures

The New Prosperity Project has redesigned the mine site layout to include the conservation of Fish Lake and associated wetland habitat and a smaller maximum disturbance area. A wide variety of methods for avoiding and/or mitigating potential environmental effects have been proposed for project-related activities. Mitigation measures proposed in the 2009 EIS and committed to through the EAO process and summarized in Section 2.7.2.7.

Taseko is open to discussing with the Tsilhqot'in additional mitigation measures of interest to Aboriginal people, such as providing or improving access to other areas in the territory for harvesting and gathering, or, as part of the New Prosperity Habitat Compensation Plan, installing infrastructure for managing water, cattle or horses, as a form of biodiversity offsetting that would increase opportunities for plant harvesting or gathering for Aboriginal people.

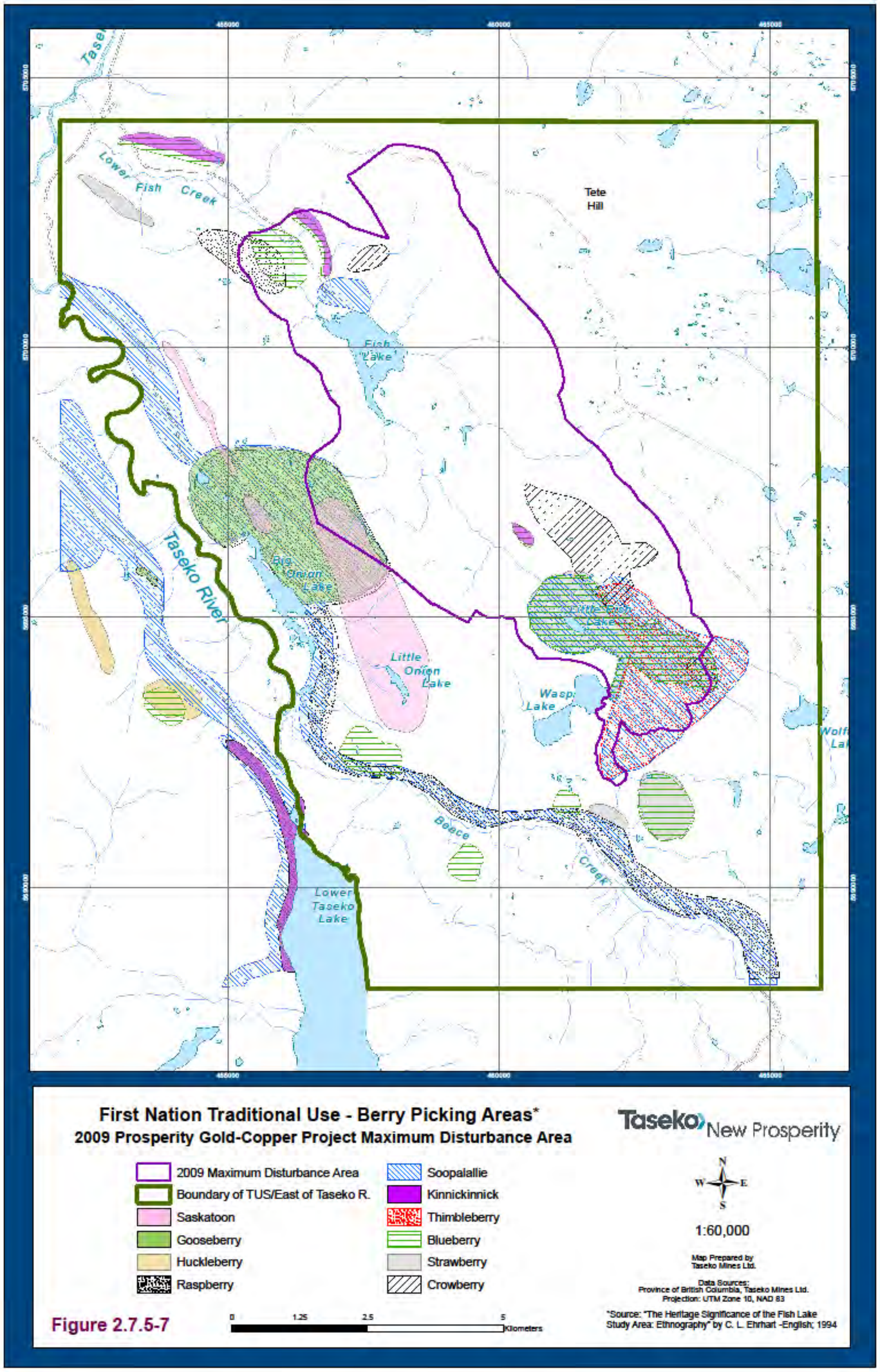

Figure 2.7.5-7 First Nation Traditional Use – Berry Picking Areas – 2009

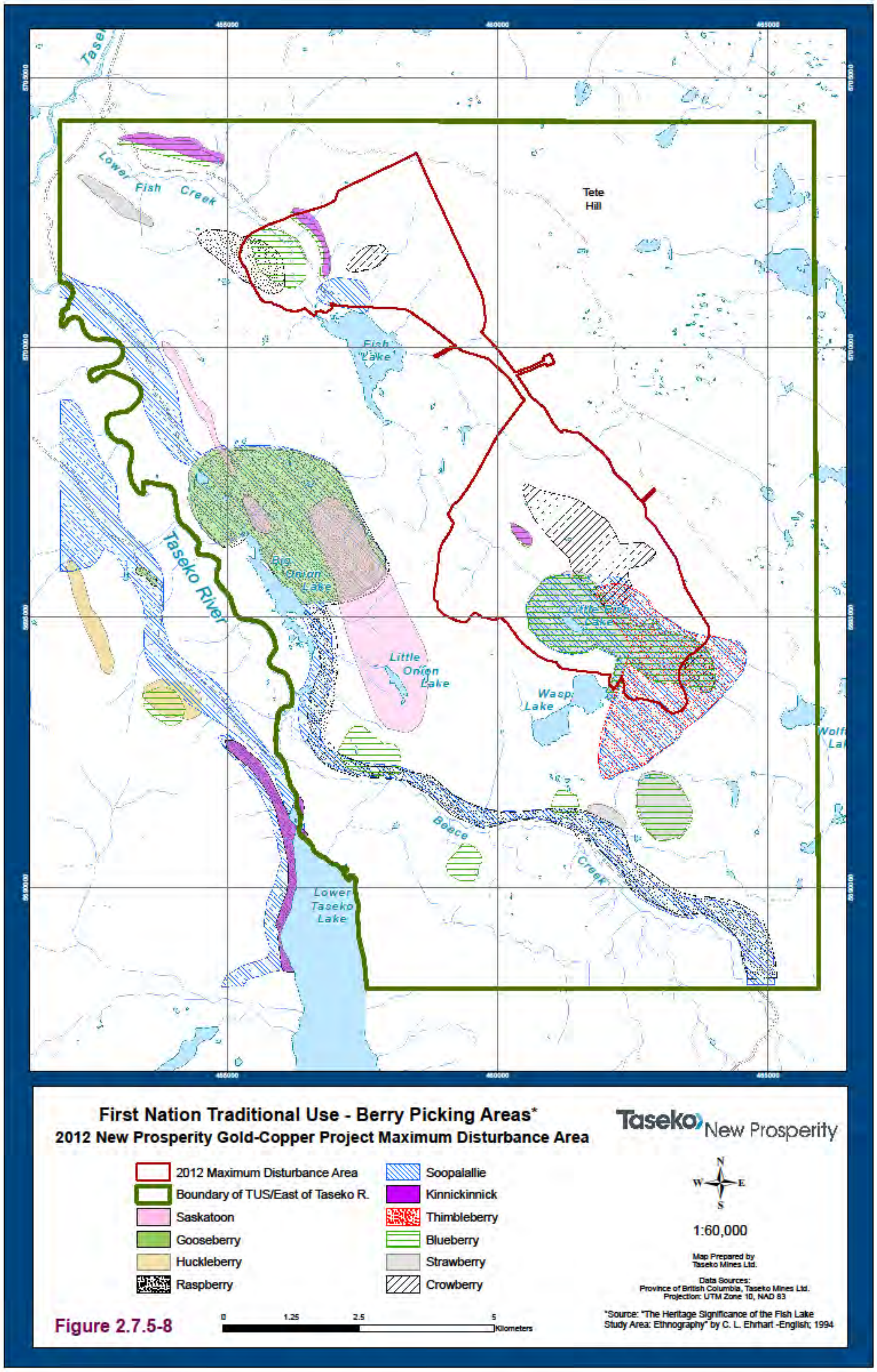

Figure 2.7.5-8 First Nation Traditional Use – Berry Picking Areas – 2012

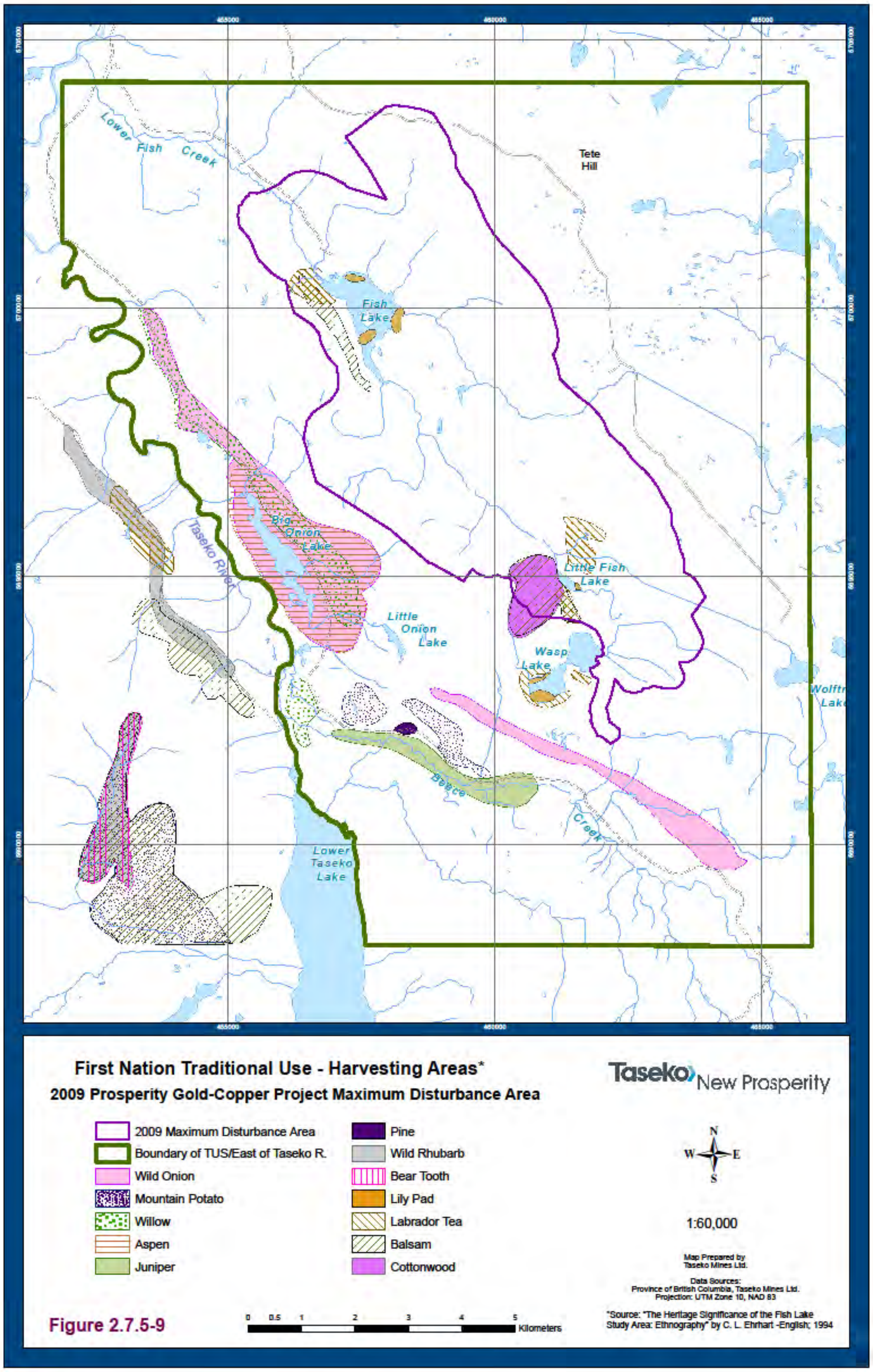

Figure 2.7.5-9 First Nation Traditional Use – Harvesting Areas – 2009

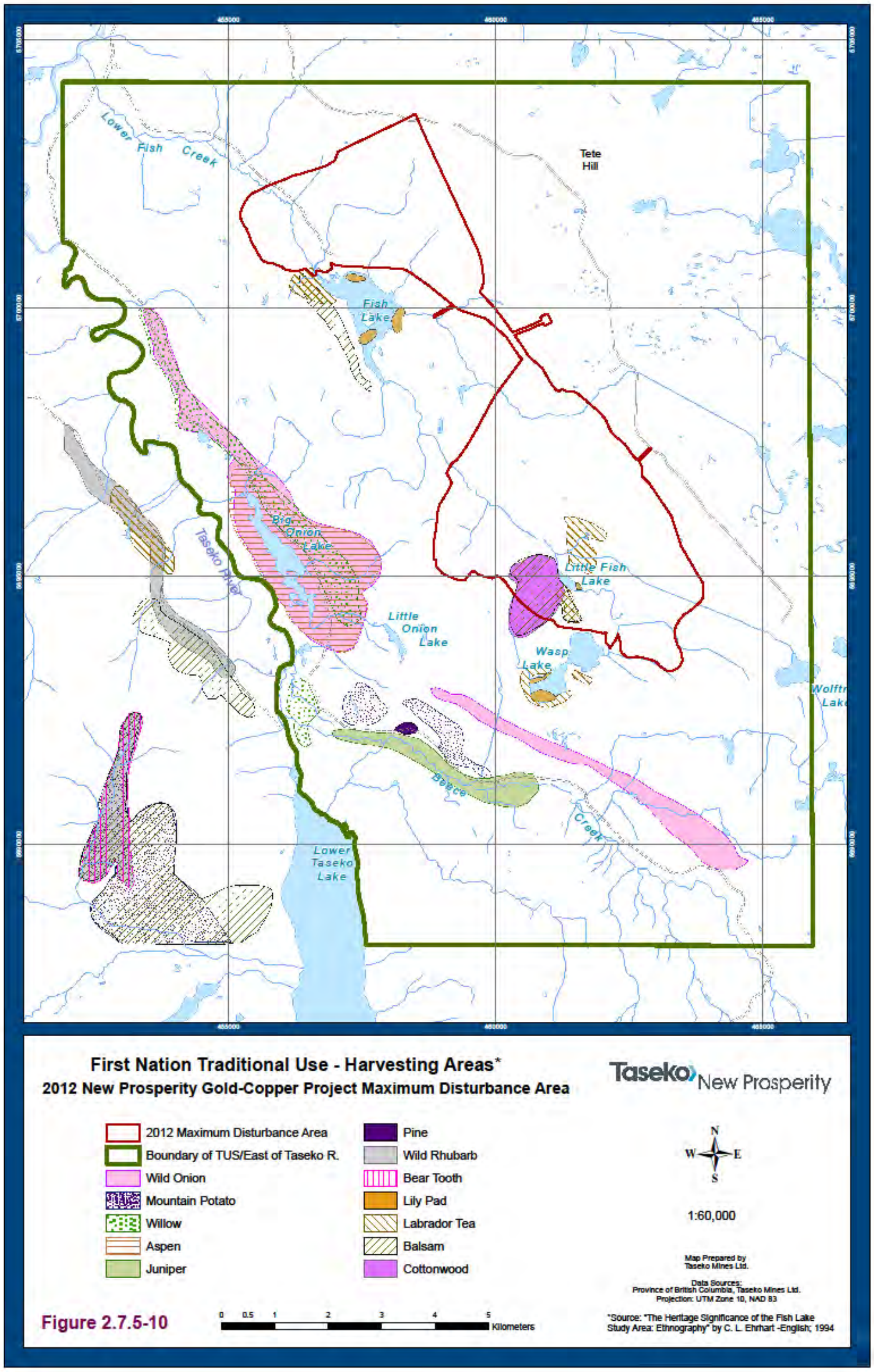

Figure 2.7.5-10 First Nation Traditional Use – Harvesting Areas – 2012

j. Other Uses

The Fish Lake watershed is utilized by the Tsilhqot'in for other purposes that may or may not not fall within the meaning of traditional use under the Act, but in the interest of completeness those activities are discussed below. These uses include: camping, recreation, teachings, gatherings and occupation while ranching and haying.

Results from alteration to the Project

Meadows and campsites used around Fish Lake previously within in the 2009 MDA, are now preserved in the 2012 MDA as illustrated on Figure 2.7.5-11 and 2.7.5-12,respectively. Known camp sites and water use sites in the vicinity of Little Fish Lake remain within the 2012 MDA. While the current Fish Lake camp site, previously a BC Forest Service recreation site, at the northwest end of Fish Lake is not within the 2012 MDA, access to this site will be removed and access will be developed on the northeast side of Fish Lake to enable use, including navigation. Use of the area for recreation, teachings and gatherings will be modified with New Prosperity in light of adjacent mine operation activities and local effects on noise and aesthetic values.

With New Prosperity, there would still be a loss of cabins near Little Fish Lake, and uses associated with those cabins; although occupation of the cabins and uses associated with the cabin occupation, such as haying, has not occurred in over 20 years[41].

Table 2.7.5-5 Comparison of 2009 and 2012 Mine Development Areas (MDA) for Camping and Watering Areas identified by Ehrhart-English

	Total # within TUS/East of Taseko R. Bdry	Total # within 2009 MDA	Total # within 2012 MDA
Occasional Camp	16	4	2
Yearly Use Camp	28	10	6
Water Source	3	1	1

Mitigation Measures

With access to Fish Lake preserved through all phases of mining, opportunities for gathering, teaching can be maintained; while the experience may be altered from the traditional gatherings previously conducted on site, there may be other opportunities provided for teaching and engaging youth in with regards to environmental management and monitoring.

Taseko is open to discussing with the Tsilhqot'in the option of providing or improving access to a recreation site in their territory as a form of compensation for modifying the use the Fish Lake area; a measure that can be integrated into the Fish Compensation Plan.

Taseko remains open to discussing with the Tsilhqot'in or the Williams family their interest in moving the cabins currently at Little Fish Lake to another site as part of plan to enhance the value of such a site for purposes of occupancy, recreation, or gathering.

[41] While cabins were noted to be in disrepair for years leading up to 2009, some reconstruction has been observed to have occurred during late summer months of 2009. Recent occupation of the area has not been documented.

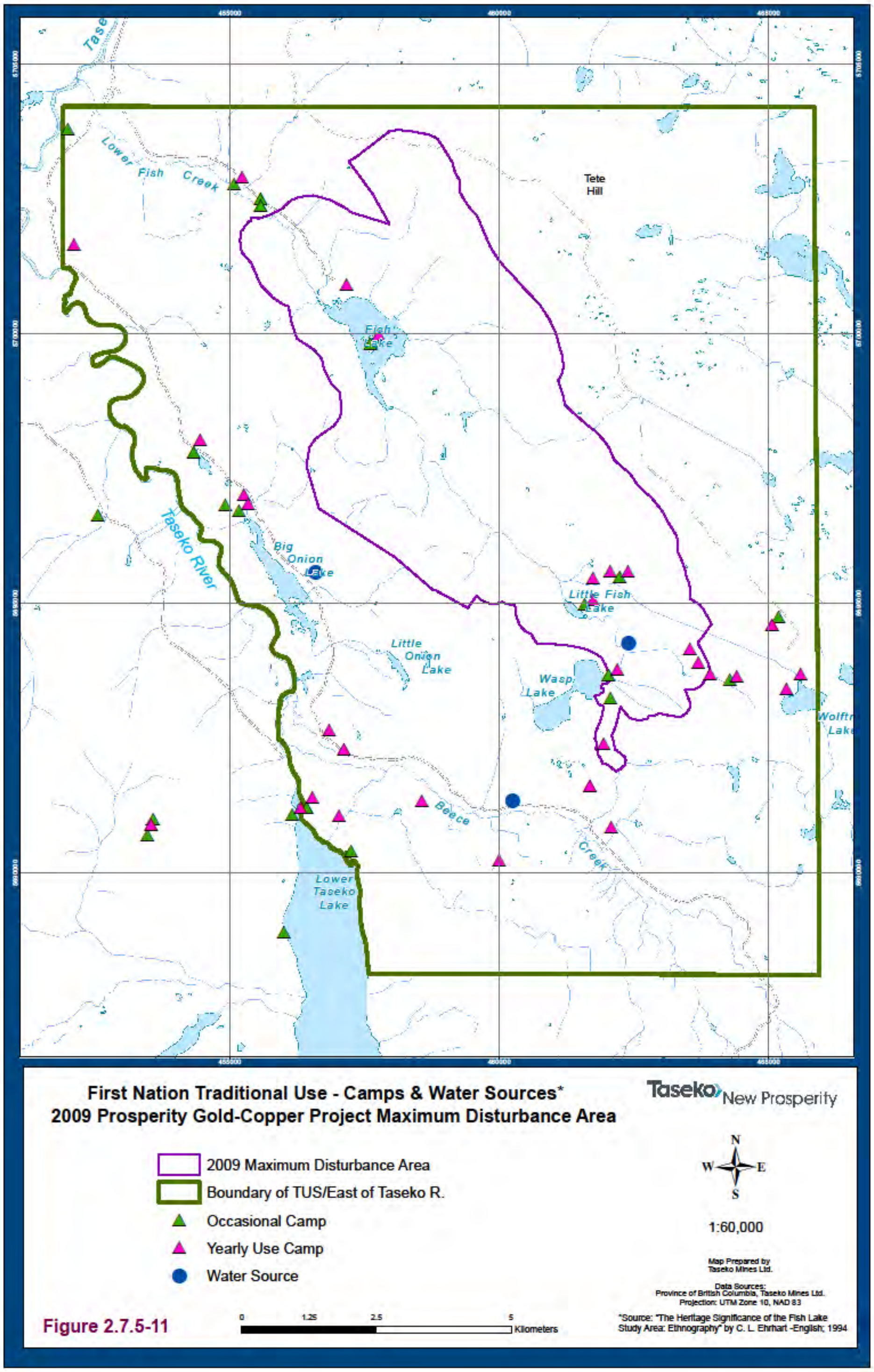

Figure 2.7.5-11 First Nation Traditional Use – Camps & Water Sources - 2009

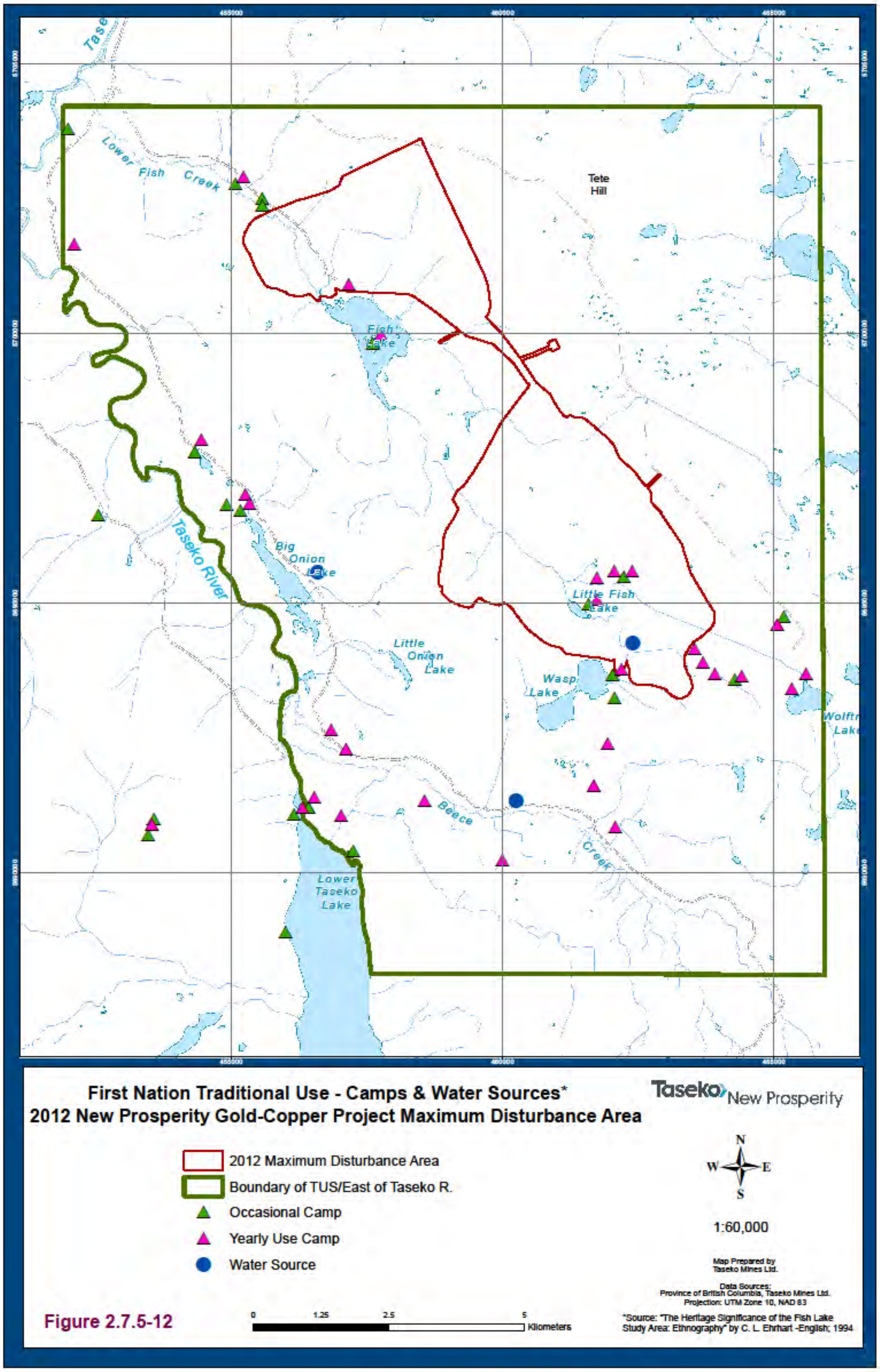

Figure 2.7.5-12 First Nation Traditional Use – Camps & Water Sources – 2012

Cumulative Effects Assessment

As described in Section 2.7.1, cumulative environmental effects were only assessed if all three of the following conditions were met for the environmental effect:

- The Project results in a measurable, demonstrable or reasonably-expected residual environmental effect on a component of the biophysical or human environment (i.e., is there an environmental effect that can be measured or that can reasonably be expected to occur?)
- The project-specific residual environmental effect does, or is likely to, act in a cumulative fashion with the environmental effects of other past or future projects and activities that are likely to occur (i.e., is there overlap of environmental effects–i.e., a cumulative environmental effect?), and
- There is a reasonable expectation that the Project's contribution to cumulative environmental effects will affect the viability or sustainability of the resource or value.

As described in Section 2.7.1.4 a Project Inclusion List (Table 2.7.1.4 -1) describing all past, present and reasonably foreseeable projects with potential residual environmental effects that could overlap spatially and temporally with the potential residual environmental Project effects being assessed was prepared. The location of each of the 22 projects and activities identified is shown on Figure 2.7.1.4 – 1.

As shown in Table 2.7.5-6 for each of the current use for traditional purposes indicators assessed the Project is predicted to have some measurable residual effect following the implementation of planned mitigation measures. In turn, however, for each Project residual effect, either due to spatial or temporal separation, no mechanism for interaction was found to exist for any of the potential residual environmental effects potentially arising from the 22 projects and activities assessed. Consequently it was concluded that the Project's contribution to cumulative effects would not affect either the viability or sustainability of the land and resource upon which current use for traditional purposes relies. Accordingly it was concluded that the Project would not have any significant cumulative effect on current use for traditional purposes.

Table 2.7.5-6 …

Potential Environmental Effect	Indicator for Current Use for Traditional Purposes	Measurable Parameter/Effect	Measurable Residual Effect (Y/N)	Mechanism for Interaction with other Projects (Y/N)	Reasonable expectation Project contribution will effect viability or sustainability of resource
Effect on Fish and Fish Habitat	Fishing	Spatial Extent of loss	Y	N	N
Effect on Wildlife	Hunting and Trapping	Spatial Extent of loss	Y	N	N
Effect on Vegetation	Plant Gathering	Spatial Extent of loss	Y	N	N
Presence of a Mine	Other Uses – camping, recreation, teachings, gatherings	Spatial Extent of loss	Y	N	N

Conclusions on Impact on Current Use for Traditional Purposes

The significance of any residual adverse environmental effects for both project related and cumulative effects is assessed having regard to the CEAA Reference Guide: Determining Whether A Project is Likely to Cause Significant Adverse Environmental Effects - The Requirements of the Canadian Environmental Assessment Act (http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=D213D286-1&offset=2&toc=show).The assessment methodology applied is as detailed in Section 2.7.1.5. The conclusions concerning the significance of any residual adverse environmental effects are as shown in Table 2.7.5-7 below.

For Project effects on aboriginal use for fishing, as affected by project effects on fish and fish habitat and access, the magnitude is permanent but site specific with the loss of Little Fish Lake. With the implementation of mitigation measures and reclamation, the conclusion is that the effects are not significant because the effects are site specific, of low magnitude, and with the implementation of fish compensation, neutral in direction

For Project effects on aboriginal use for hunting and trapping, as affected by project effects on wildlife and access, the magnitude is low and the effect is short term, with implementation of the mitigation measures and reclamation, the conclusion is that the effects are not significant because the effects are local, occur once and are reversible.

For Project effects on aboriginal use for plant gathering, as affected by effects on vegetation, including country foods, and access, although the magnitude is low and the effect is medium term, with implementation of the mitigation measures and reclamation, the conclusion is that the effects are not significant because the effects are local, occur once and are reversible.

For Project effects on other aboriginal uses as affected by access, the magnitude is low and the effect is medium term, with implementation of the mitigation measures and reclamation, the conclusion is that the effects are not significant because the effects are local, occur once and are reversible.

Table 2.7.5-7 Determination of Significance of Residual Effects on Current Use of Lands and Resources

Potential Environmental Effect	Current Use of Lands and Resources	Proposed Mitigation/Compensation Measures	Determination of Significance of Residual Effects						Significance	Prediction Confidence
			Direction	Magnitude	Geographical Extent	Duration/ Frequency	Reversibility	Ecological Context		
Effect on Fish and Fish Habitat – loss of habitat	Fishing	Mine design preserves Fish Lake and fishery Protection of water quality and salmon fisheries through a one watershed project design with zero discharge during operations Mitigation measures as specified in Sections 2.7.2.4 and 2.7.2.5 Implementation of water management plan, including sediment and erosion control measures Application of reclamation practices to restoration disturbed aquatic systems. Implementation of Fish Compensation Plan to enhance fish and fish habitat, and fishing opportunities in the region.	N	L – Salmon fisheries sites are unaffected by the project. Fish Lake remains accessible to provide back-up food source if required is unaffected; loss of 6 ha Little Fish Lake and some fish-bearing streams providing seasonal fishing; fish compensation plan results in NNL	S	FF/ C	I	U	N	H
Effect on Wildlife – loss of habitat, loss of access to areas disturbed by mine components	Hunting and Trapping	Implement Vegetation and Wildlife mitigation measures as specified in 2.7.2.7 and 2.7.2.8. Implement Wildlife and Vegetation Management Plan as outlined in 2.8.1 Apply reclamation practices to restore land capability and land use. Develop and implement a	A	M – No residual effects on wildlife are predicted, as summarized in table 2.7.2.8-11 and 12; access lost to 2,539 ha during mining operations.	L	ST	R	U	N	H

such as TSF, plant site and pit plus other infrastructure		compensation plan following the Habitat Compensation Framework								
Effect on Vegetation - loss of plant communities, loss of access to areas disturbed by mine components such as TSF, plant site and pit plus other infrastructure	Plant Gathering	Implement Vegetation mitigation measuares as specified in 2.7.2.7. Implement Wildlife and Vegetation Management Plan as outlined in 2.8.1 to minimize disturbance and vegetation loss, and mitigating against invasive species. Maintain natural drainage patterns. Apply reclamation practices to restore land capability and land use. Develop and implement a compensation plan following the draft Habitat Compensation Framework	A	M – Residual effects on vegetation are summarized in Table 2.7.2.7-23; maximum disturbance loss of country food plants is 2,539 ha	L	MT	R	U	N	M
Presence of Mine – loss of access to components covered by TSF, plant site and pit plus other infrastructure	Other Uses	Enable access to Fish Lake during all phases of mining If of interest to the Tsilhqot'in, elements can be included in Fish or Habitat Compensation plans that relate to improving access to other sites of interest in the territory to offset temporary loss of access	N	M – access to 2,539 hectares lost during mining; 82% of seasonal and yearly camp sites retained	L	ST	R	U	N	H

KEY	Geographic Extent:	Frequency:	Significance:
Direction: P Positive N Neutral A Adverse Magnitude: Defined for each use individually. In general: L Low–environmental effect occurs that may or may not be measurable, but is within the range of natural variability. M Moderate–environmental effect occurs, but is unlikely to pose a serious risk or present a management challenge. H High–environmental effect is likely to pose a serious risk or present a management challenge.	S Site-specific L Local R Regional Duration: ST: Short term MT: Medium Term LT: Long Term FF: Far Future or Permanent.	R Rare - Occurs Once I Infrequent - Occurs sporadically at irregular intervals F Frequent - Occurs on a regular basis and at regular intervals C Continuous Reversibility: R Reversible I Irreversible Ecological Context: U Undisturbed: Area relatively or not adversely affected by human activity D Developed: Area has been substantially previously disturbed by human development or human development is still present N/A Not applicable.	S Significant N Not Significant Prediction Confidence: Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation L Low level of confidence M Moderate level of confidence H High level of confidence

Table 2.7.5.-8 provides a concise summary of the effects assessment for Current Use for Traditional Purposes

Table 2.7.5-8 Summary of Effects Assessment for Current Use for Traditional Purposes

Effects Assessment	Concise Summary
Beneficial and Adverse Effects	The New Prosperity Project has redesigned the mine site layout to include the conservation of Fish Lake and associated riparian habitat and a smaller maximum disturbance area. This is expected to reduce impacts on fish and fish habitat as wells as reduce restrictions on fishing opportunities, reduce vegetation loss for plant gathering and harvesting, and reduce wildlife habitat losses as well as reduce restrictions on hunting and trapping.
Mitigation and Compensation Measures	A wide variety of methods for avoiding and/or mitigating potential environmental effects have been proposed for project-related activities, include both KI specific and general fish habitat, water, vegetation and wildlife mitigation measures. Environmental Management Plans are to be developed for water management, and vegetation and wildlife management, including invasive weed management strategy and measures for reducing animal-human interaction. Implementation of Habitat Compensation and Fish Compensation Plans are proposed. Reclamation measures include consideration of species of interest to the Tsilhqot'in.
Potential Residual Effects	The predicted residual effects on current use for traditional purposes for New Prosperity have decreased relative to 2009. Residual effects from the permanent loss of habitat within the mine development area can be offset with compensation plans.
Cumulative Effects	Twenty-two past, present or reasonably foreseeable projects were identified and assessed for potential cumulative effects with residual effects of the Project. In light of the lack of development proposed for the asserted Tsilhqot'in territory, it is concluded that the viability or sustainability of the land and resources on which current use for traditional purposes rely would not be affected.
Determination of the significance of residual effects	The combined residual environmental effect of the Project on the sustainability of the land and resources is predicted to be not significant. This assessment is predicated on the implementation of proposed mitigation and the development of appropriate compensation measures.
Likelihood of occurrence for adverse effects found to be significant	As no significant residual effects are predicted, there is no likelihood of occurrence. There is the possibility that the prediction of significant adverse effects is incorrect, whereby an adverse effect deemed to be not significant may have an adverse effect. The likelihood of this remains low.

Table 2.7.5-8 presents the summary of effects assessment for current use for traditional purposes. Considering the updated findings of the Project, including the preservation of Fish Lake, the reduced impact on total hectares of water and land, including fish and fish habitat, vegetation, wildlife habitat, plus with fish and habitat compensation, and the continued commitments for environmental management, reclamation and monitoring, and cumulative residual effects on current use presented in this document, the overall significance determination for the New Prosperity Project, including all three major

components (mine site, access road, transmission line), is changed from 2009. That is, the effect of the Project on the viability and sustainability of the current use for traditional purposes is considered to be not significant.

b. Cultural Heritage Resources

Findings on Previous Project

Section 2.6.4 of this EIS provides a summary of cultural heritage values as previously indicated through consultation with the Tsilhqot'in. Known physical archaeological resources are summarized in Section 2.6.3.1.

During the original panel review for the previous project, the Tsilhqot'in stated that the Fish Lake area had substantial cultural value. Since the landscape itself would be substantially altered by the Project even after closure and reclamation, the panel determined that the spiritual and cultural connection to the Fish Lake area for the Tsilhqot'in would likely be irreversibly lost.

The Tsilhqot'in indicated that there are cremation sites, burial sites and pit houses in the area of the proposed mine site, particularly on the island in Fish Lake, and that there was uncertainty regarding whether sites with no physical evidence were identified. The participants in the hearings for the previous project stated that this island was a site of spiritual power where present-day and past generations of Tsilhqot'in conducted ceremonies to receive their spiritual powers. In addition to this, the Tsilhqot'in noted the presence of a cache pit and a pit house on the island as evidence of the island's historic and cultural importance.

The previous panel determined that the loss of the Fish Lake and Fish Creek watershed areas for cultural and spiritual practices would be irreversible, of high magnitude and have a long-term effect on the Tsilhqot'in. It further concluded a significant adverse effect on navigation, given the use of Fish Lake by First Nations.

Results from Alteration to the Project

The 2012 New Prosperity MDA preserves Fish Lake, and the immediate vicinity where archaeological resources are the most abundant. Archaeological resources preserved are summarized in Sections 2.7.4.

The 2012 New Prosperity MDA also preserves the island in Fish Lake, which is of significant cultural and historical value to First Nations, and preserves the ability for First Nations to navigate to the island.

In the 2012 MDA, there portions of the Fish Lake watershed, referred to by Tsilhqot'in as *Nabas,* are still lost to the TSF and related infrastructure. Physical features with cultural values in *Naba* include the cabins near Little Fish Lake.

Mitigation Measures

Access to Fish Lake, and the island, will be maintained during all phases of mining.

Cumulative Effects Assessment

As described in Section 2.7.1, cumulative environmental effects were only assessed if all three of the following conditions were met for the environmental effect:

- The Project results in a measurable, demonstrable or reasonably-expected residual environmental effect on a component of the biophysical or human environment (i.e., is there an environmental effect that can be measured or that can reasonably be expected to occur?)
- The project-specific residual environmental effect does, or is likely to, act in a cumulative fashion with the environmental effects of other past or future projects and activities that are likely to occur (i.e., is there overlap of environmental effects–i.e., a cumulative environmental effect?), and
- There is a reasonable expectation that the Project’s contribution to cumulative environmental effects will affect the viability or sustainability of the resource or value.

As described in Section 2.7.1.4 a Project Inclusion List (Table 2.7.1.4 -1) describing all past, present and reasonably foreseeable projects with potential residual environmental effects that could overlap spatially and temporally with the potential residual environmental Project effects being assessed was prepared. The location of each of the 22 projects and activities identified is shown on Figure 2.7.1.4 – 1.

As shown in Table 2.7.5-9, the Project is predicted to have some measurable residual effect following the implementation of planned mitigation measures. In turn however, due to spatial separation, no mechanism for interaction was found to exist for any of the potential residual environmental effects potentially arising from the 22 projects and activities assessed. Consequently it was concluded that the Project contribution to cumulative effects would not affect either the viability or sustainability of physical cultural or archaeological resources; accordingly it was concluded that the Project would not have any significant cumulative effect on cultural heritage.

As shown in Table 2.7.5-9, the Project is predicted to have some measurable residual effect following the implementation of planned mitigation measures. In turn however, due to spatial separation, no mechanism for interaction was found to exist for any of the potential residual environmental effects potentially arising from the 22 projects and activities assessed. Consequently it was concluded that the Project contribution to cumulative effects would not affect either the viability or sustainability of physical cultural or archaeological resources; accordingly it was concluded that the Project would not have any significant cumulative effect on cultural heritage.

Table 2.7.5-9 …

Potential Environmental Effect	Indicator for Cultural Heritage	Measurable Parameter/Effect	Measurable Residual Effect (Y/N)	Mechanism for Interaction with other Projects (Y/N)	Reasonable expectation Project contribution will effect viability or sustainability of resource
Presence of a Mine	Physical cultural resources; archaeological resources	Spatial Extent of loss	Y	N	N

Conclusion on the Impact on Cultural Heritage Resources

The significance of any residual adverse environmental effects for both project related and cumulative effects is assessed having regard to the CEAA Reference Guide: Determining Whether A Project is Likely to Cause Significant Adverse Environmental Effects - The Requirements of the Canadian Environmental Assessment Act (http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=D213D286-1&offset=2&toc=show).The assessment methodology applied is as detailed in Section 2.7.1.5. The conclusions concerning the significance of any residual adverse environmental effects are as shown in Table 2.7.5-10 below.

For Project effects on cultural heritage as affected by disturbance or access, the magnitude is low but permanent and irreversible; however, in light of the characterization of the heritage resources actually impacted and the limited number in a site-specific area, the conclusion is that the effects are not significant.

Table 2.7.5-10 Determination of Significance of Residual Effects on Cultural Heritage Resources

Potential Environmental Effect Cultural Heritage resources	Proposed Mitigation/Compensation Measures	Determination of Significance of Residual Effects: Direction	Magnitude	Geographical Extent	Duration/ Frequency	Reversibility	Ecological Context	Significance	Prediction Confidence
Physical and Cultural Heritage Resources	Preservation of Fish Lake including the island Access to Fish Lake and the island during all phases of mining Preservation of archeological resources in the vicinity of Fish Lake, as identified in Section 2.7.4 Mitigation Plan to avoid disturbance of archaeological sites within MDA as specified in Section 2.8.1	A	L – 85% of known archaeological sites retained; loss of cabin and camping areas in the vicinity of Little Fish Lake	S	FF/ C	I	U	N	H

KEY Direction: P Positive N Neutral A Adverse Magnitude: Defined for each individually. In general: L Low–environmental effect occurs that may or may not be measurable, but is within the range of natural variability. M Moderate–environmental effect occurs, but is unlikely to pose a serious risk or present a management challenge. H High–environmental effect is likely to pose a serious risk or present a	Geographic Extent: S Site-specific L Local R Regional Duration: ST: Short term MT: Medium Term LT: Long Term FF: Far Future or Permanent.	Frequency: R Rare - Occurs Once I Infrequent - Occurs sporadically at irregular intervals F Frequent - Occurs on a regular basis and at regular intervals C Continuous Reversibility: R Reversible I Irreversible Ecological Context: U Undisturbed: Area relatively or not adversely affected by human activity D Developed: Area has been substantially previously disturbed by human development or human development is still present	Significance: S Significant N Not Significant Prediction Confidence: Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation L Low level of confidence M Moderate level of confidence H High level of confidence

management challenge.		N/A Not applicable.	

Table 2.7.5.-11 provides a concise summary of the effects assessment for Cultural Heritage

Table 2.7.5-11 Summary of Effects Assessment for Cultural Heritage

Effects Assessment	Concise Summary
Beneficial and Adverse Effects	The New Prosperity Project has redesigned the mine site layout to include the conservation of Fish Lake and archaeological resources in the vicinity, as well as the Fish Lake island. This is expected to reduce impacts on cultural heritage.
Mitigation and Compensation Measures	Mitigation measures include implementation of an Archaeological Management Plan.
Potential Residual Effects	The predicted residual effects on cultural heritage for New Prosperity have decreased relative to 2009. Residual effects include the loss of cabins in the vicinity of Little Fish Lake.
Cumulative Effects	Twenty-two past, present or reasonably foreseeable projects were identified and assessed for potential cumulative effects with residual effects of the Project. In light of the lack of development proposed for the asserted Tsilhqot'in territory, it is concluded that the viability or sustainability of cultural heritage rely would not be affected.
Determination of the significance of residual effects	The combined residual environmental effect of the Project on the sustainability of the land and resources is predicted to be not significant. This assessment is predicated on the implementation of proposed mitigation and the development of appropriate compensation measures.
Likelihood of occurrence for adverse effects found to be significant	As no significant residual effects are predicted, there is no likelihood of occurrence. There is the possibility that the prediction of significant adverse effects is incorrect, whereby an adverse effect deemed to be not significant may have an adverse effect. The likelihood of this remains low.

Table 2.7.5-11 presents the summary of effects assessment for cultural heritage. Considering the updated findings of the Project, mitigation measures, reduced impact on archaeological resources as summarized in Section 2.7.4., and cumulative residual effects on cultural heritage presented in this document, the overall significance determination for the New Prosperity Project, including all three major components (mine site, access road, transmission line), is changed from 2009. That is, the effect of the Project on the viability and sustainability of cultural heritage is considered to be not significant.

2.7.5.4 Potential or Established Rights and Title

a. Tsilhqot'in Aboriginal rights as defined in the *William* case

Findings on Previous Project

The mine site would be located in the area known as the Claim Area in *Tsilhqot'in Nation vs. British Columbia,* 2007 SCBC 1700 (the *William* case). In that case, the Supreme Court of British Columbia found that the Tsilhqot'in have a right to hunt and trap birds and animals throughout the Claim Area, to trade in skins and pelts, and capture and use horses for transportation and work.

During the course of the public hearing for the previous project, the Tsilhqot'in Nation provided specific information on how the Project would infringe on its established or potential Aboriginal rights, including:

- Loss of access to key cultural hunting and trapping areas in Fish Creek watershed and the surrounding areas, including Fish Creek watershed Dzelh (Anvil Mountain), Nadilin Yex (mouth of the Taseko River at the north end of Taseko Lake), Gwetex Natel?as (Red Mountain), Cheetah Meadows, Jidizay Biny (Big Onion Lake) and Bisqox (Beece Creek);
- Impacts on the populations and habitats of birds, wildlife, fish and plants that support the exercise of Tsilhqot'in rights, such as wild horses, deer, moose, grizzly bears and migratory birds;
- Displacement of the Tsilhqot'in people from the area during mine construction, operation and decommissioning for decades and eventual permanent displacement from these same areas due to the permanent loss of lakes, streams and wetlands;
- Tsilhqot'in avoidance of areas due to perceived concerns about ongoing contamination

The original panel noted that the established Tsilhqot'in rights to hunt and trap in the mine site area would be directly affected as they would no longer be able to exercise those rights until after the mine closed and the land was reclaimed. Even then, the restored landscape would be permanently altered. The Tsilhqot'in also stated that they would likely not use the area to exercise their Aboriginal rights due to the perception of contamination. The original panel determined that the effect of the Project on the established Tsilhqot'in Aboriginal rights would be irreversible.

The original panel has also considered Taseko's proposed mitigation measures including the establishment of a no hunting zone for the Project area. The Panel stated that this proposed mitigation would limit the ability of First Nations to practice their established Aboriginal right to hunt and trap in the Project area and may impact their Aboriginal rights to hunt and trap in other areas within the territory due to increased pressures on wildlife populations elsewhere.

Results from Alteration to the Project

As previously discussed in Sections 2.7.2.8 Wildlife, and Aboriginal Interests Sections 2.7.5.1 b.Wildlife, and 2.7.5.2 a. Current Use for Traditional Purposes, relative to the previous project reviewed in 2009, New Prosperity results in less hectares proposed for disturbance, a reduced impact on wildlife habitat, a reduced area to which hunting restrictions apply during mine construction and operations, and increased access to trapping areas in the vicinity of Fish Lake during all phases of mining.

Mitigation Measures

The mitigation measures proposed to minimize or eliminate the residual Project effects on wildlife are many, but include the wildlife and wildlife habitat mitigation measures in Section 2.7.2.8. Wildlife and Vegetation

Management as described in Section 2.8.1 Environmental Management Plans, reclamation as described in 2.8.2 Reclamation and Closure and commitments for a Habitat Compensation Plan.

Conclusions

As a result of the reduced impact on the wildlife habitat and with the mitigation measures, and the continued commitments for environmental management, reclamation and monitoring, the conclusion of effects of New Prosperity on the established Tsilhqot'in rights as defined by the *William Case* for New Prosperity is Low.

b. The potential Tsilhqot'in Aboriginal right to fish in Fish Lake

Findings on Previous Project

Although in the William decision the court did not make a finding regarding a Tsilhqot'in right to fish, the Tsilhqot'in assert an aboriginal right to fish in Fish Lake. The original panel for the previous project concluded that the adverse effects on this asserted Aboriginal right would be significant as the lake and its fishery would be destroyed and replaced with a waste rock storage area, and therefore the right to fish could no longer be exercised.

Results from Alteration to the Project

The mine development plan for New Prosperity preserves Fish Lake. As previously discussed in Sections 2.7.2.5 Fish and Fish Habitat, and Aboriginal Interests Sections 2.7.5.2 a. Fishing under Current Use for Traditional Purposes, relative to the previous project reviewed in 2009, New Prosperity results in less disturbance of aquatic systems and fish habitat in the Fish Lake watershed, a reduced area to which access for fishing applies in the watershed during all phases of mining.

Mitigation Measures

The mitigation measures proposed to minimize or eliminate the residual Project effects on access, fishing, fish and fish habitat in the watershed are many, but include the fish and fish habitat mitigation measures in Section 2.7.2.5, water quality and quantity mitigation measures in Section 2.7.2.4, and Water Management Plan measures in 2.8.1.

Conclusions

As a result of the preservation of Fish Lake, reduced impact on the fish and fish habitat in the watershed, and with the mitigation measures and the continued commitments for environmental management, reclamation and monitoring, the conclusion of effects of New Prosperity on the potential Tsilhqot'in right as to fish in Fish Lake is Low.

c. Tsilhqot'in Aboriginal title claims

The original panel concluded that the previous project would result in a significant adverse effect on the potential Tsilhqot'in Aboriginal right to fish in Fish Lake.

Aboriginal title is an interest in land. It includes the right to determine the use to which land is put. In order for land to be subject to aboriginal title it must have been the subject of regular and exclusive occupation by First

Nations people at the time of assertion of British sovereignty (1846 in BC). Seasonal or periodic use of land for the exercise of aboriginal rights is not enough to meet the test for aboriginal title.

As a result of the *William* case, the Tsilhqot'in have established Aboriginal rights, but do not have established Aboriginal title. While the Court found that Aboriginal title could not be granted in the *William* case due to the way the case was argued, the Court indicated that had the case been pleaded differently, it probably would have found Aboriginal title for the Tsilhqot'in to almost half of the Claim Area; however, the land to which title would have been granted did not include the Project area, and is referred to in paragraph 893 of the judgment: *"I am not able to find that any portion of the Eastern Trapline Territory was occupied at the time of sovereignty assertion to the extent necessary to ground a finding of Tsilhqot'in Aboriginal title."*

The decision is under appeal by all parties and the Tsilhqot'in assert aboriginal rights in the area of the proposed project.

If aboriginal title were found to exist in relation to the proposed mine site, then the development of the New Prosperity project would constitute an infringement of aboriginal title, particularly during the period up to and until mine closure. Any such infringement would therefore need to be justified by the Crown, having regard to principles established by the Supreme Court of Canada. In Delgamuukw v. British Columbia [1997] 3 S.C.R. 1010 then Chief Justice Lamer stated:

> 165 The general principles governing justification laid down in *Sparrow*, and embellished by *Gladstone*, operate with respect to infringements of aboriginal title. In the wake of *Gladstone*, the range of legislative objectives that can justify the infringement of aboriginal title is fairly broad. Most of these objectives can be traced to the reconciliation of the prior occupation of North America by aboriginal peoples with the assertion of Crown sovereignty, which entails the recognition that "distinctive aboriginal societies exist within, and are a part of, a broader social, political and economic community" (at para. 73). In my opinion, the development of agriculture, forestry, mining, and hydroelectric power, the general economic development of the interior of British Columbia, protection of the environment or endangered species, the building of infrastructure and the settlement of foreign populations to support those aims, are the kinds of objectives that are consistent with this purpose and, in principle, can justify the infringement of aboriginal title. Whether a particular measure or government act can be explained by reference to one of those objectives, however, is ultimately a question of fact that will have to be examined on a case-by-case basis.

The assessment as to whether the Crown had met all the tests relevant for justification would be one for the Crown to make, not the panel. That assessment would be undertaken in accordance with principles spelled out in *Delgamuukw* and related case law. It would not be the subject of the same analysis that applies to assessing whether a project would have significant adverse environmental effects for environmental assessment purposes

d. Secwepemc Aboriginal Title Claims

The Secwepemc nation and member bands claim aboriginal title to areas that would be impacted by the proposed transmission line. No finding of Secwepemc title has been established by any court.

The previous review panel did not make any findings related to the asserted title claim of the Secwepemc nation generally. However, it did find that the project would have a direct effect on the aboriginal title claims of the Esketemc (Alkali Lake Band) and the Stswecem's/Xgat'tem (Canoe Creek Band) as the transmission line would reduce the availability of land for selection during the treaty process. Ultimately, the previous panel concluded that depending on the size of the land settlement through the treaty process, the Project may result in a significant adverse effect on any such title that could be granted to the Esketemc (Alkali Lake Band) and the Stswecem'c/Xgat'tem (Canoe Creek Band).

In making these findings, the panel did not identify any specific information concerning the exclusive occupancy of particular areas as of 1846 (the relevant legal test). Further, the panel did not explain why it was commenting on the aboriginal title claims of two Secepemc nation bands when Mr. Justice Vickers held in the William case that any such rights would be held at the nation level and not that of individual bands. Finally, the previous panel did not indicate the basis upon which a reduction in land available for treaty negotiations would constitute a direct effect on a title claim.

As previously noted, the mandate of the present panel is to assemble information relevant to government in assessing aboriginal strength of claim to rights and title, and to make findings concerning how the project may impact upon such claims. However, the resulting assessment of strength of claim and the resulting assessment of whether the Crown's duty to consult and accommodate has been met must be made by the Crown. That analysis is to be undertaken in accordance with the Haida principles discussed earlier, and is not to be assessed under the traditional methodology of environmental assessment related to whether there is a "significant adverse effect".

For all the foregoing reasons, the proponent submits that the previous panel's findings regarding aboriginal title claims of the Secwepemc nation or member bands is a limited applicability to the present environmental assessment.

To the extent that the transmission will exist on Crown lands that could potentially meet the test for aboriginal title (something which has not been proven to date, and recognizing that aboriginal title is not synonymous with the entire claimed traditional territory of a first nation) then the project could impact on asserted aboriginal title. The extent of such impact would depend on the degree to which the transmission line limited the Secwepemc right to otherwise determine the use of any title land, during the period of time that the powerline remains in place and before decommissioning. Any such impact on asserted aboriginal title would need to be assessed by the Crown, using the Haida analysis, including the balancing of interests that this test requires. Ultimately, the Crown would need to satisfy itself that the honor of the Crown has been met in relation to any such decision.

2.7.5.5 Additional aboriginal issues or concerns identified since the time of the original panel report and not otherwise covered by 2.7.5.1 and 2.7.5.2 above

Tsilhqot'in concerns, as stated in media and correspondence to Taseko and government agencies, focus on the new project's proposal for preservation of Fish Lake and continued loss of other areas in the Fish Creek watershed, referred to as Nabas. Issues of concern can be summarized in the Tsilhqot'in's publicized ten reasons why New Prosperity should not be approved, May 11, 2012 (see www.xenigwetin.com and link to Protect Fish Lake or http://protectfishlake.ca/letters/2012-05/tsilhqot-in-confident-that-new-panel-s-work-will-result-in-rejection-of-new-prosperity-mine.php). These "ten facts why resubmitted Prosperity Mine Prosposal cannot be approved", and Taseko's responses are provided below:

1. *The CEAA review panel process was very different from the BC EAO rubber-stamp decision. Its report found immitigable, devastating impacts to the local fish stocks and endangered grizzly populations, and to the existing and future rights of the Tsilhqot'in and its youth. Then Environment Minister Jim Prentice described the report's findings as "scathing" and "probably the most condemning I have ever read."*

   Both the CEAA process and the BCEAO process found significant adverse environmental effects from the original Prosperity proposal although the Province found that those effects were justified by the positive effects on social and economic consideration. The New Prosperity proposal addresses the significant effects found in both Provincial and Federal EA. Refer to Sections 2.7.2.8 and 2.7.2.5 for details.

2. *The company knows its new option is worse than its first plan. TML's V.P. Corporate Affairs, Brian Battison, was clear in his Mar. 22, 2010, opening presentation to the CEAA hearings, when he stated: "Developing Prosperity means draining Fish Lake. We wish it were otherwise. We searched hard for a different way. A way to retain the lake and have the mine. But there is no viable alternative. The lake and the deposit sit side by side. It is not possible to have one without the loss of the other."*

   The statement in the first sentence is untrue; in fact the truth is quite the opposite. The New Prosperity mine development plan is significantly different than the original Prosperity proposal in that it preserves Fish Lake in its current location. Mr. Battison's statement refers to the viability of alternatives at the time. The New Prosperity plan that will undergo this Environmental Assessment was not a viable alternative based on long term copper and gold prices at the time that the original Prosperity plan was submitted. When Taseko submitted the New Prosperity plan the long term price of copper and gold had risen to levels which now make it feasible, or viable, to absorb the additional cost of relocating the tailings pond and installing ground water control systems. Long term prices of commodities are determined through a "street consensus" which takes the mean of the projections provided by dozens of established banks and analysts.

3. *The point was emphasised by TML's VP of engineering, Scott Jones, who stated: "What happens to the water quality in Fish Lake, if you try and preserve that body of water with the tailings facility right up against it, is that over time the water quality in Fish Lake will become equivalent to the water quality in the pore water of the tailings facility, particularly when it's close."*

   Mr. Jones statement does not refer to the New Prosperity mine development plan. He was explaining one of the reasons why, in the original Prosperity proposal where the tailings facility was located immediately adjacent to Fish Lake, the company proposed to drain the lake rather than attempt to maintain it. The New Prosperity mine development plan relocates the tailings facility two kilometers upstream of Fish Lake specifically in order to provide the ability to control water quality in the remaining spawning habitat and in the lake. Subsequent testing and modeling have shown that this is an effective solution.

4. *This proposal does not address the issues that led to the rejection of the first bid last year. Fish Lake will be affected by the toxic waste and eventually die, and it will be surrounded by a massive open pit mine and related infrastructure for decades. The Tsilhqot'in people will not have access to their spiritual place, and the area will never be returned to the current pristine state.*

   This statement contains several points that are not true. 1. The New Prosperity proposal does address the issues that were determined to be significant adverse environmental effects in the previous environmental assessment. 2. The tailings storage facility does not contain "toxic waste" in the sense that it is presented. Certain elements of low toxicity are dissolved in the water in the facility which could cause a significant adverse environmental effect in Fish Lake if they were introduced in high volumes but the lake would not "die". However, as a result of moving the tailings storage facility two kilometers upstream, utilization of currently proven technology allows Fish Lake water quality to be maintained with no significant adverse environmental effect. 3. With the new configuration of the New Prosperity mine development plan, the Tsilhqot'in people will have access to Fish Lake during the all phases of mining from mine development, to active mining, and finally closure. 4. Although it is not realistic to return the immediate area of the mine into its original configuration, modern progressive reclamation methods allow for the capability of the land to be recovered relatively quickly after mine closure.

5. *It is not even new. It is "Mine Development Plan 2." TML states on page 20 of its project submission: "Option 2 is the basis for the New Prosperity design …The concepts that lead to the configuration of MDP Option 2 have been utilized to develop the project description currently being proposed."*

   This statement is correct. As responded to under point number 2 above, the MDP 2 option was not viable at the time of the original Prosperity project environmental assessments.

6. *This option was looked at and rejected last year by the company, Environment Canada and the CEAA review panel. For example, page 65 of the review report states: "The Panel agrees with the observations made by Taseko and Environment Canada that Mine Development Plans 1 and 2 would result in greater long-term environmental risk than the preferred alternative."*

   The statement that the CEAA review panel and Environment Canada rejected the option is untrue, rather they were commenting on relative risk between alternatives. "Long-term environmental risk" is a technical term. In the original Prosperity proposal a new lake was built upstream of the tailings pond to compensate for the loss of Fish Lake. Technically therefore there was no risk at all to Fish Lake as it no longer existed. By preserving Fish Lake an element of risk is introduced and the New Prosperity EIS addresses those risks. MDP Option 2, which is the basis for the New Prosperity project proposal, was deemed not viable by the company in the original Prosperity EIS as a result of the economic conditions at that time, not due to technical or environmental risk factors.

7. *The new $300 million in proposed spending is to cover the costs of relocating mine waste a little further away. There is nothing in the 'new' plan to mitigate all the environmental impacts identified in the previous assessment. TML states in its economic statement: "The new development design, predicated on higher long term prices for both copper and gold, would result in a direct increase in capital costs of $200 million to purchase additional mining equipment to relocate the tailings dam and to move the mine waste around Fish Lake to new locations. This redesign also adds $100 million in direct extra operating costs over the*

20-year mine life to accomplish that task." In fact, this new spending is actually $37 million less than the company said last year it would have to spend just to go with the option that it and the review panel agreed would be worse for the environment.

This statement is not true. The new plan addresses the mitigation of the environmental impacts identified in the previous assessment.

8. *The federal government is required under the Constitution to protect First Nations, which have been found to be under serious threat in this case, and is internationally committed to do so under the United Nations Declaration on the Rights of Indigenous Peoples. These duties are every bit as clear regarding this resubmitted proposal.*

   We believe that the federal government is fully aware of its constitutional obligations to aboriginal groups, and in particular its obligations to consult and accommodate where appropriate in respect of impacts on established or potential aboriginal rights and title. The information provided in the EIS as it relates to aboriginal groups is intended to assist the federal government in meeting such duties, as per the EIS Guidelines and panel terms of reference.

9. *Approving this mine would show the Environmental Assessment process is meaningless, and would demonstrate that governments are ignoring their obligations - as the Assembly of First Nations national chiefs-in-assembly made this crystal clear this summer in their resolution of support for the Tsilhqot'in.*

   This is a statement of position or opinion and not a comment related to any environmental effects of the project.

10. *The federal Department of Fisheries and Oceans has opposed this project since it was first raised in 1995. It soundly rejected it again last year. It has no reason to support it now. Nor does Environment Canada, which, as the CEAA report noted last year, also found option 2 to be worse than the original bid.*

    The statements that “the federal Department of Fisheries and Oceans has opposed this project since it was first raised in 1995” and “soundly rejected it again last year” are untrue. Nor did the CEAA report at any time find “Option 2 to be worse than the original bid”. This project has been under study for many years and there has been substantial correspondence around it but, for DFO, it always comes down to whether Taseko has developed an acceptable plan regarding fish and fish habitat that the agencies can support to government, not a rejection of the project itself.

    This message from both Provincial and Federal government agencies has been consistent. The following quotes are provided to illustrate this:

    - “Since 1993 we have remained willing to review plans that would avoid or mitigate the impacts on these valuable fisheries resources.” Louis Tousignant, Director General, Pacific Region, DFO, October 7, 1996 letter to John Allan, Deputy Minister, MELP, BC.
    - “I believe that everyone concerned is aware that DFO has always been prepared to rejoin the provincial Fish Lake Project Review Committee that was struck to review Taseko’s Prosperity mine proposal. DFO’s participation in a joint review, though, has always been dependent on there being the potential to preserve Fish Lake and to adequately compensate for lost fish habitat of Fish Creek, thereby preserving the fisheries resources.” Fred J. Mifflin, Minister, DFO, June 6, 1997 letter to Cathy McGregor, Minister, MELP, BC.
    - “Under both federal and provincial legislation, the decisions regarding the acceptability of these projects are not in the hands of government staff but are left to elected officials who must, in an

> open and accountable manner, weight the potential benefits and costs of a project in determining whether it is, on balance, beneficial in the public interest." John Allen, Deputy Minister, MELP, August 15, 1996 letter to Louis Tousignant, Director General, Pacific Region, DFO.

Over many years Taseko has diligently worked with government agencies, technical experts, communities, and First Nations to find acceptable solutions to the complexities inherent in construction and operation of a mine at the Prosperity deposit. The original Prosperity project introduced the concept of a man-made lake of similar size and productivity as Fish Lake as compensation and mitigation for that loss. This approach was found to be acceptable by the Province but was turned down by the federal government. Worldwide economic conditions have changed to the point that a different and preferred proposal, New Prosperity, has become a viable alternative and Taseko is submitting that for review by the Environmental Assessment processes.

2.7.5.6 **Potential effect on socioeconomic conditions**

a. Potential adverse social or economic effects caused by changes to the environment

As noted previously, the panel's mandate related to adverse social or economic effects is limited, by virtue of the definition of "environmental effects" in the act, to any changes to socioeconomic conditions resulting from a change to the biophysical environment, and not as a result of the project generally.

In the previous panel process, the panel's report addressed social and economic conditions generally and did not in all cases indicate precisely whether or how such matters being assessed for changes resulting from a change to the biophysical environment. In any case, the following is a summary of the social and economic implications of the project on aboriginal groups, as described by the prior panel. This information is provided at present for the purposes of transparency but should not be taken as acceptance by Taseko that all such matters fall within this panel's mandate under its terms of reference and the *Canadian Environmental Assessment Act.*

Socio-economic issues raised by First Nations during the review of the previous project included:

- Economic impact of store-bought food from the avoidance of country foods due to perceived contamination
- Increased costs for travelling to other locations for harvesting and hunting
- Impact on their ability to develop a tourism business
- Impact on women faced with new challenges in their roles in the family due to inequities in employment or separation from family
- Increased wealth lead to drugs and alcohol

The previous panel made no conclusions on the socio-economic effects of the project on aboriginal people other than the statement: *Given the reliance on traditional foods and the communities' commitment to improved health and traditional well-being, the previous panel determined that the Project's impacts on the physical and mental health of the Tsilhqot'in communities would be long term, and that since the landscape itself would be substantially altered by the Project even after closure and reclamation, the spiritual and cultural connection to the Fish Lake area would likely be irreversibly lost.*

The socio-economic environment indicates that the New Prosperity project would create new employment opportunities, including direct and indirect employment, available to members of both Aboriginal and non-Aboriginal communities. Project expenditures on payroll will generate business activity through household spending. Purchasing of goods and services will generate business activity. For Aboriginal Communities, individuals, families or households, employment and the income generated through business activity provides quality of life, a sense of personal security and has a symbolic value which contributes to a person's own self-image and their status within their community. This contributes to the sustainability and long-term health and overall well-being of Aboriginal communities.

Taseko does not anticipate the project will have any different socioeconomic impacts on First Nations, and that most of the socioeconomic impacts on aboriginal people would be similar to the impacts on others within the region.

None of the changes to the project design in New Prosperity would have any impact on the above matters. More specifically, no significant adverse impacts are likely to occur in relation to aboriginal people in terms of changes to socioeconomic conditions resulting from changes to the environment.

Taseko remains open to discussing with the Tsilhqot'in mitigation measures that may resolve outstanding issues for Aboriginal people, such as:

- Supporting community social programs for employees, spouses and families
- Building new or improving existing access to harvesting and hunting areas within the territory to compensate for the loss of opportunity in the Little Fish Lake area
- Discussing and supporting business plans that may be impacted by or benefit from the mining operation.

b. Potential social or economic benefits

This information is not required for the purposes of assessing the potential significant adverse effects of a project, but rather is included for the purposes of potentially helping government consider whether the project may be considered justified, even if a significant adverse environmental effect is found. For this reason, there is no need for discussion of benefits to be limited to those benefits that are channeled through a change to the environment. This section will therefore summarize the economic and social benefits of the project as they may benefit aboriginal groups.

Economic benefits of the proposed Project would include the following:

- An average of approximately 375 person years of employment annually during construction (2 years) and operations (20 years);
- Jobs provided by the Proponent would be high-paying, averaging over $110,000 per year plus benefits;
- During operations, the proposed Project's annual payroll is expected to be approximately $32 million, with $29 million paid locally;
- Indirect employment and incomes increases as a result of the procurement of goods and services for the proposed Project from local and regional suppliers; and,
- Spending benefits over the life of the project.

This economic activity would benefit a region that has above-average unemployment relative to the rest of the province. The Cariboo-Chilcotin Region is one of the most forest product dependent regions of the province and impacts of the mountain pine beetle have been severe. The proposed Project would help diversify the economic base and create new opportunities for contractors and suppliers, including First Nations. Direct benefits would flow to different communities within the region for the anticipated 22 years. The development of New Prosperity will act as a significant long term economic stimulus to the Region, including in the aboriginal communities of the Chilcotin. Benefits would also accrue to the future generation as a consequence of community development.

Revenue Sharing with the Province – For aboriginal groups interested in concluding a revenue sharing agreement with the provincial government, a portion of the provincial mineral tax generated by the project during its period of operation will be shared with them. Since the 2009 review of the Prosperity Project, the BC Provincial Government has signed two Economic and Development Agreements (ECDAs) with aboriginal groups for revenue sharing, wherein which up to 37.5% of the provincial mineral tax paid by the mine would be transferred to the group that indicate a desire to see the mining project proceed. Revenue sharing represents a direct tangible and significant benefit in a form that can be put to a wide range of uses as determined by aboriginals themselves and could potentially include the creation of a community development fund, the financial resources needed to help with the teaching and preservation of language and culture, education and training opportunities, scholarships, resource stewardship and other priority areas of interest.

Benefits Agreement with Taseko – During the original panel review for the previous project, a number of participants commented on the fact that Taseko had not entered into a Benefit Agreement with aboriginal groups. Early in the review process, Taseko had raised the subject of Benefit Agreements with the Tsilhqot'in National Government and Taseko is of the understanding that the position of the Tsilhqot'in National Government continues to be that they do not wish to have such a discussion until after the environmental assessment process is concluded.

It is the philosophy of Taseko that working in a positive and responsible manner with local communities will provide the maximum mutual benefit. In order to be consistent and to build long term relationships it is important to establish Principles and Guidelines at the outset of the project for directing the way Taseko intends to do business long into the future. Taseko's legal commitments include matters that could be considered s key components of a benefit agreement, such as:

Employment

During the public hearing, the original panel repeatedly documented that the average annual income in the Tsilhqot'in and Secwepemc communities was extremely low, and that those on income assistance received approximately $200 per month. Ms. Titi Kunkel reported that within the Cariboo region, Aboriginal people living on reserves faced higher than average unemployment. Of the 9,000 Aboriginal peoples in the Cariboo region, approximately 2,600 were reported to not be in the labour force. The on-reserve female population was stated to be about 991, of which more than 30% were reported to be unemployed.

As identified in Section 2.7.3.4, annual wages paid to direct employees on average are $93,600/year. Achieving employment as a result of the project could include either direct employment or employment with contractors and suppliers:

Direct Employment

Taseko's hiring practices shall be consistent with the goal of delivering maximum economic value and social benefit—locally, regionally and provincially. Creating a safe, healthy and productive work environment is a top priority. Taseko's success will be highly dependent on those working on site and their ability to conduct their responsibilities with care and efficiency.

Taseko's first preference is to hire locally. A local employment candidate shall be defined as someone who lives in the Cariboo-Chilcotin region. A special effort will be made to hire local Aboriginal candidates by ensuring employment opportunities are communicated. We will undertake to inform local communities of the employment positions and opportunities available at Prosperity before expanding the search for potential employees beyond the Cariboo-Chilcotin region.

Since candidates will be required to meet certain standards commensurate with the employment position in order to be successful, efforts will be made to ensure local people with motivation have the opportunity for training to be eligible for hiring and career advancement (see Training below).

If two candidates with similar qualifications seek employment at Prosperity, but there is only one position available, the local candidate will be given preference. Taseko will encourage our suppliers, contractors, and consultants to do the same.

Whatever the area of activity and whatever the degree of responsibility, employees are expected to act in a manner that will enhance TKO's reputation for honesty, integrity and the faithful performance of undertakings and obligations.

<u>Contracting for Suppliers or Services</u>

In the procurement of goods and services to build and operate the mine, Taseko's decisions will be guided by their desire to deliver maximum economic value and social benefit—locally, regionally and provincially.

Taseko believes that their success as a company is tied to the success of the local communities in which they invest and operate.

Taseko cultivates an entrepreneurial spirit which is reflected in their procurement practices. Their approach is to develop lasting relationships with suppliers based on cost competitiveness, continuous innovation, service and productivity improvement, employee health and safety, and environment protection. Taseko will work with Aboriginal groups and individuals to encourage the formation and development of locally owned businesses that provide supplies or services to Prosperity. Taseko expects their contractors to share their commitment to investing in local community success through their respective purchasing, hiring, contracting and logistical support practices.

Education and Training

Taseko recognizes that not all Aboriginal individuals who are eager to work will have the experience or the qualifications necessary to work. To underscore the company's commitment to maximize local benefits and give first preference to local hires, Taseko will set in place policies to help potential candidates gain required qualifications. Furthermore, through Taseko's education and training initiatives, the company will ensure that motivated individuals have the opportunity for further training for career advancement.

Patt Larcombe, on behalf of the Tsilhqot'in National Government, indicated that First Nation employment in the mining sector remained low, with Aboriginals people typically employed in low-paying jobs, despite improvement in training and skill opportunities and development in recent years. A properly qualified and trained workforce is essential to a safe and productive workplace. The health, safety and productivity of workers is linked to the care and conduct exercised by fellow employees. The more training and experience an employee gains, the greater their degree of care, safe conduct and efficiency in their performance.

With respect to aboriginal education and training programs, Taseko is actively seeking partnerships with aboriginal groups and education institutes to develop regional training programs to support individuals interested in careers in mining and the industry. Taseko will continue to investigate regional training programs that:

- Assist the company in meeting its current and future employment needs
- Help address the projected shortage of local skilled workers that Taseko will need in the coming years
- Create local awareness of opportunities and skill requirements in the mining industry
- Demonstrate corporate commitment to maximizing local employment opportunity
- Specific targets and tasks of the training initiatives:
- Increase the hiring of local people in all departments at Taseko's operations without compromising their need to hire the best available talent.
- Increase the number of high school graduates in the region to move on to formal education and training for a career in mining to specifically fill employment needs at Taseko's operations.
- Elevate college-level student interest in mining by increasing the focus on mining at the local colleges.
- Increase local college and high school career counselors' awareness of the specific career areas that are challenging for the mining industry to fill, such as instrumentation, heavy duty mechanics, engineering.

Training programs will be developed with the general population of the Cariboo-Chilcotin in mind; however, special effort will be made to communicate these opportunities to aboriginal communities and individuals. This effort can result in a significant benefit to both Taseko and aboriginal communities since there are 14 aboriginal communities located in the Cariboo-Chilcotin within 300 km of the Prosperity site. Taseko believes that, following training, there is a higher likelihood of aboriginal people staying within the region to work and raise families in contrast to non-aboriginal people who statistically are more mobile from community to community or Province to Province.

Taseko is committed to ensure that aboriginal youth be made aware of opportunities in their operations. The education and training program will be communicated by:

- Conducting evening presentations in rural and aboriginal communities for students, parents and interested individuals
- Making presentations in community schools
- creating an employment and training website that will include job descriptions and education requirements
- Advertising opportunities at open houses and events in the local and community newspapers and radio
- Providing a career counselling to work with individuals on a one-on-one basis to formulate a training and career strategy, research all sources of funding
- Meeting regularly with aboriginal leadership, economic development personnel and education administrators

2.7.6 Accidents and Malfunctions

The following section of the EIS describes potential accidents and malfunctions that might occur during the life of the Project. The primary objectives of this section were to determine the potential range of environmental effects that might occur in the unlikely event of an accident or malfunction, as well as to identify:

- The procedures that will be put in place by Taseko to minimize or avoid the potential for these events to occur
- The range of measures that are likely to be employed by Taseko to initially contain and respond to different types of accidents and malfunctions
- Additional measures that would be employed by Taseko to further contain and clean-up any accidental spills or releases
- Techniques that would be used by Taseko to rehabilitate affected areas or compensate for these effects, and
- Follow-up and monitoring programs that would be implemented by Taseko should certain types of accidents and malfunctions occur during the life of the Project.

Regulatory Requirements and Guidelines

In relation to accidents and malfunctions, the CEAA states that “every screening or comprehensive study of a project and every mediation or assessment by a review panel shall include a consideration of the following factors:

a. The environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out, and

b. The significance of the effects referred to in paragraph (a)”.

The EIS requires:

- Identification of the probability of potential accidents and malfunctions related to the Project, including an explanation of how those events were identified, potential consequences (including the potential environmental effects), the worst case scenarios and impacts
- A description of the sensitivity of receptors in the project area to potential accidents and malfunctions;
- An explanation of the potential magnitude of an accident and/or malfunction, including the quantity, mechanism, rate, form and characteristics of the contaminants and other materials likely to be released into the environment during the malfunction and/or accidental event
- Identification of the capabilities, resources and equipment available to safely respond to any accidents and malfunctions, and
- A description of the planned response such as communication between stakeholders, and alerting and warning personnel working on the mine site. The EIS will also describe the contingency, clean-up or

restoration work that would be required immediately following or in the long-term after the postulated malfunctions and accidents.

The assessment of the environmental effects of potential accidents and malfunctions shall include, but is not limited to those considerations associated with the following project activities or eventualities:

- Waste management and disposal (solid and liquid);
- Transportation of construction materials and Project personnel if changed from previously assessed project
- Handling and use of chemicals on-site
- Evaluation of worst case scenarios (e.g. tailings impoundment structural failure, accidental explosion, earthquake, or landslide into the tailings impoundment)
- Premature closure of the Project during any phase
- Controlled and uncontrolled discharges to surface water and groundwater (e.g. seepage loss reporting to surface water via groundwater, and
- Any other Project component or system that has the potential, through accident or malfunction, to adversely affect the natural environment.

APPROACH

Determination of Potential Accidents and Malfunctions

To focus the assessment of potential accidents and malfunctions, the following three step process was followed to develop a suite of scenarios that were then assessed by each of the environmental disciplines:

1. Potential accidents, malfunctions, and unplanned events that might occur during the life of the New Prosperity Mine were identified using historical performance data for other similar projects (Appendix 9-2-A from the March 2009 EIS/Application). These events included potential risks to the environment, as well as health and safety risks for workers. Using this list of events, a suite of possible events involving releases of chemicals, effluents and other products that might be perceived to pollute or contaminate land or water resources was identified. Given the minor nature of atmospheric emissions associated with the Project and the types of chemicals and products that will be used in the concentrate process, no accidental events involving releases of emissions were considered further in this assessment. However, effects on the atmospheric environment from some accidental events were considered.
2. The possible accidents and malfunctions were then screened in terms of whether they could possibly result in a release to the environment based on the proposed Project design.
3. For each remaining event, one or more scenarios were developed that described how the event could potentially result in a release to the environment. For example, two scenarios were developed for a diesel fuel spill; one on land and one directly into a watercourse as a result of a highway accident.

Seven types of accidents, malfunctions or unplanned events that, while unlikely to occur during the life of the New Prosperity Project, were considered in this EIS as required by the EIS guidelines. Details on these accidental events are provided in Table 2.7.6-1.

Table 2.7.6-1 Description of Possible Accident and Malfunction Scenarios

Risk Events – Description of Possible Scenario	Potential Effect	Mitigation			Monitoring/ Residual Effects
		Preventative Measures	Emergency Response	Clean-up	
1.a Fuel Spill – Land: Loaded fuel (gas or diesel) truck over-turns on dry land along main access road	Localized impacts to soil	• Ensure proper construction and maintenance of site access roads by MOT, including regular inspection of guard rails on bridges and berms/concrete abutments on roads adjacent to water courses that prevent over-turning and/or capture load loss • Enforce speed limits by all mine traffic on roads • Ensure qualified trucking/hauling contractors with appropriate driver training, radio contact capabilities vehicle maintenance plan, clean-up kits, and an emergency response plan • Provide haul monitoring and supervision, and a driver feedback plan • Maintain and implement appropriate emergency response and spill contingency training, equipment, materials and procedures at the site to limit the consequences of such spills by prompt containment and clean up actions	• Conduct initial response and notification (mine supervisor, PEP, RCMP) as per emergency response plan. PEP would coordinate additional external notification • Activate emergency response groups	• Activate spill handling procedures including fuel containment, soil clean-up, reporting and soil disposal as identified in spill contingency plans • Complete reporting and disposal procedures • Mobilizing hydro-vacuuming units as appropriate	• Implement soil and groundwater monitoring procedures to assess requirement for additional soil clean-up and disposal • Ensure successful re-vegetation and weed control as required • No residual effect
1.b Fuel Spill – Water: Loaded fuel (gas or diesel) truck over-turns and releases load into water body, such as a) low flowing tributary to Taseko River or b) high flowing Chilcotin River	Release of petroleum products to water body /ways affecting water quality, aquatic habitat degradation		• As above, and include DFO in emergency contacts • Initiate immediate monitoring and assessment procedures	• Assess feasibility of containment and clean-up based on water body and flow rates. Activate spill handling procedures including: diverting fuel away from water; absorbent booming; pumpback to tanker/ alternate storage unit, and soil clean-up as identified in spill contingency plans • Complete reporting and disposal procedures	• Implement water quality and soil monitoring procedures to assess any short and long term effects on water quality and habitat, and mitigation requirements • Monitoring would include benthic invertebrate community surveys, collecting mortalities, and comparing with data from control sites upstream • A specific monitoring program for amphibians and their habitat would be considered in some circumstances • No residual effects
2. Failure or major leakage from tailings or reclaim pipeline	Release of tailings and/or reclaim (process) water to the environment affecting downstream aquatic habitat and water quality	• Install pressure and flow monitoring systems with auto shutdown • Situate pipelines in locations that ensure any accidental releases of tailings or mine water flow into the, concentrator, the TSF or secondary conatinment • Ensure proper construction and maintenance of tailings delivery and reclaim water systems to maintain closed and contained system • Install secondary containment in the form of ditches, berms and emergency tailings containment ponds to capture and contain tailings in the event of a pipeline break to ensure that in the event of an equipment failure all material would be contained and there would not be a release to the receiving environment • Conduct routine inspections of tailings delivery, reclaim water, and monitoring systems • Maintain and implement appropriate emergency response and spill contingency training, equipment, materials and procedures at the site to limit the consequences of such releases by prompt containment and clean up actions • Ensure proper tailings line inspection training and supervision	• Conduct initial response and notification (mine supervisor, on-scene coordinator) as per emergency response plan • Shut-down source of spill by implementing emergency shut-down procedures • Activate emergency response groups • Assess if spill of tailings/reclaim water is internal (likely) or would have external effects • Notify PEP and/or MOE and/or DFO in accordance with Emergency Response Plan	• If internal, activate containment, clean-up, and reporting and disposal procedures as appropriate	• If release is outside containment of the TSF, implement water quality and soil monitoring procedures as appropriate to assess effects and mitigation required for longer term effects on water quality and habitat • No residual effect if release contained internally • If release outside TSF containment occurs, short term effects would be addressed by cleanup activities • Residual effects anticipated to be minimal

Risk Events – Description of Possible Scenario	Potential Effect	Mitigation			Monitoring/ Residual Effects
		Preventative Measures	**Emergency Response**	**Clean-up**	
3. a Concentrate haul spill – Land: Loaded truck overturns on dry land along main access road.	Release of concentrate to dry landscape.	• Ensure proper construction and maintenance of site access roads by MOT, including regular inspection of guard rails on bridges and berms/concrete abutments on roads adjacent to water courses that prevent over-turning and/or capture load loss • Enforce speed limits by all mine traffic on roads • •Ensure qualified trucking/hauling contractors with appropriate driver training, radio contact capabilities vehicle maintenance plan, clean-up kits, and an emergency response plan • Provide haul monitoring and supervision, and a driver feedback plan • Concentrate containers will be designed such that there is no wind loss • Maintain and implement appropriate emergency response and spill contingency training, equipment, materials and procedures at the site to limit the consequences of such spills by prompt containment and clean up actions	• Conduct initial response and notification (mine supervisor, PEP, RCMP, MOE, and adjacent land owners) as per emergency response plan • Activate emergency response groups	• Assess integrity (leakage) of container • Assess feasibility of diverting any surface water away from truck/load • Activate containment/clean-up procedures, reporting and disposal as identified in spill contingency plans. • Complete reporting and disposal procedures.	• Implement soil and groundwater monitoring procedures to assess requirement for additional soil clean-up and disposal • No residual effect.
3. b Concentrate haul spill – Water: Loaded truck over-turns and releases load into water body via bridge, ditch or culvert crossing to either a) low flowing tributary to Taseko River or b) high flowing Chilcotin River	Release of concentrate to water body affecting water quality, aquatic habitat degradation.		• As above, and include DFO in emergency contacts • Initiate immediate monitoring and assessment procedures as appropriate • Provide containment of spill in transport container, stop source if safe and possible, cover spilled material to protect from rainfall, prevent egress of spilled material from vicinity	• Assess integrity (leakage) of container. Assess feasibility of containment and clean-up based on water body and flow rates. Assess feasibility of diverting water away from truck/load • In low flow water body, activate containment/clean-up procedures, reporting and disposal as identified in spill contingency plans • Complete reporting and disposal procedures	• If release is into a fast-moving body of water and loss of concentrate is suspected, implement water quality, habitat and fish monitoring procedures as appropriate to assess short and long term effects and mitigation required • Riparian habitat cleared to facilitate the cleanup would be restored as required. • Some level of residual effect would be expected
4. Road culvert failure: Blocked culvert across Taseko Lake Road causes ponding above the road, bank erosion, and increased sedimentation release into Fish Creek or Taseko Rivers.	In the event of a road failure, there is the potential for sediment from the road erosion to be released into the receiving environment affecting downstream water quality and aquatic habitat degradation.	• Ensure regular road maintenance • Design and install culverts to accommodate frequent extreme storm events, and include engineered debris gates in front of culverts • Conduct appropriate monitoring of the condition of culvert and debris traps (if present) • Assess culvert condition during and after storm events	• Conduct initial response and notification (mine supervisor, PEP, MOE, MOT, RCMP) as per emergency response plan • If sufficient water is ponded above the road as a result of blockage, notification of immediate downstream or adjacent residents may be required. • Activate emergency response groups, including mine site contractors for remediation • Unblock culvert or provide bypass to relieve stored water • Develop action plan to reinstate culvert, flow and normal access	• Activate sediment and erosion control contingency plans. • Re-establish culvert using best management practices for erosion control	• Implement water quality monitoring procedures as appropriate to assess effects and mitigation required for longer term effects on water quality, terrain stability, soil, and habitat • No residual impacts would be expected

Risk Events – Description of Possible Scenario	Potential Effect	Mitigation			Monitoring/ Residual Effects
		Preventative Measures	Emergency Response	Clean-up	
5. Excessive water in TSF due to storm events have the potential to affect downstream aquatic habitat and water quality if excess water results in off-spec volumes being discharged to environment	Minimal environmental effect if containment is maintained. If release is necessary, potential for Increased sedimentation and flow rates to downstream watercourses	• Conduct annual reviews by an engineer of tailings hydrological model, operation/ construction of the tailings complex, and water balances based on site collected meteorological data • Ensure all dams are built to maintain annual volumes of tailings release as well as the maximum potential storm events while maintaining a design freeboard criterion • Ensure upstream diversion structures for fresh water can accommodate maximum storm events with safeguards in place to minimize blockage • Maintain a water treatment contingency plan • Ongoing monitoring of TSF water levels, freeboard and TSF integrity to reduce risks	• Conduct an initial response and notification (mine supervisor). • If water quality is suitable for release to the environment, and release is necessary, notify MOE for authorization • If water quality is not suitable, the tailings water may be bypassed to the open pit for temporary containment • It is unlikely that water of unsuitable quality would be released to downstream environments; however, if it is, conduct initial response and notification (mine supervisor, PEP, MOE, DFO) as per emergency response plan, including downstream users; activate emergency response groups; and, initiate immediate monitoring and assessment procedures	• Implement the water treatment contingency plan	• No residual effect if excess is into the pit, pump back system would return water to tailings under normal operating conditions • If release is into the downstream environment, Implement water quality, bioassay, habitat and fish monitoring procedures as appropriate to assess effects and mitigation required for longer term effects. <u>Short term impacts may be possible</u>
6. Loss of power to TSF seepage recovery: Due to storm event, tailings seepage overflows from the seepage collection ponds and into the Fish Lake inlets	Downstream water quality and aquatic habitat alteration could arise if water is discharged to the environment.	• Conduct annual reviews by an accredited consultant of tailings hydrological model, operation/ construction of tailings complex, and water balances based on site collected meteorological data • Ensure sufficient reserve capacity in the pond to hold excessive run-off and seepage to withstand storm events for the number of days recommended by hydrological model • Provide access to backup (diesel) power generation and pumping capacity including regular maintenance and testing	• Conduct initial response and notification (mine supervisor) • Initiate immediate assessment of potential health and safety effects • It is possible that water of unsuitable quality would be released to downstream environments; if it is, conduct initial response and notification (mine supervisor, PEP, MOE, DFO) as per emergency response plan, including downstream users; activate emergency response groups; and, initiate immediate monitoring and assessment procedures	• Implement spill contingency plans	• No residual effect if pond sizing for storm events and/or outages of power/equipment failure is sufficient; or if back-up diesel pumping system is available, thereby preventing a release. • If release is into the downstream environment, implement water quality, bioassay, habitat and fish monitoring procedures as appropriate to assess effects and mitigation required for longer term effects. <u>Some residual effect would be expected</u>
7. Storm event in excess of the design event for the Fish Lake Flood Control Dams has the potential to affect pit operations	Human safety issues may arise as water flows to the pit. Storm water from Fish Lake would not impact downstream water quality and aquatic habitat any differently than a storm event under baseline conditions.	• Flood control dams at the outlet of Fish Lake would manage the design event, and pumping systems would divert flows around the pit to lower fish creek, providing further management of the storm event.	• Fish Lake pumping system would commence near the start of the storm event. • Open pit operations would be temporarily suspended, with ore being fed from the ore stockpile, thereby removing personnel and equipment from the pit. • Additional portable pumping capacity may be brought in to convey flood waters around pit.	• Dewater open pit to TSF, if required, prior to resumption of mining activities.	• Monitor stability of Fish Lake Flood Control Dams • <u>No residual impacts would be expected.</u>

Identification of Potential Interactions with Valued Ecosystem Components

For each scenario, each discipline conducted a preliminary screening to determine if the scenario was likely to affect the Valued Ecosystem Component (VEC) and/or Key Indicators (KIs) for that discipline. Potential interactions between the VECs for the Project and the seven potential accidents, malfunctions and unplanned events were assessed using the same ranking system as used for Project environmental effects for the VEC. Interactions between the VECs and the seven potential accident and malfunction events are summarized in Table 2.7.6-2. Based on the screening of potential interactions with the various VECs it was determined that neither Noise nor Socio Economic Issues had the potential to be affected by accidents and malfunctions. Noise would be generated during any clean-up events but they would be localized and short-term and therefore are considered not significant.

Table 2.7.6-2 Interaction of Project Related Accidents, Malfunctions and Unplanned Events with the Environment

Project Activities/ Physical Works	Project Description Reference for Activity	Atmospheric	Hydrology and Hydrogeology	Water Quality and Aquatic Ecology	Fish and Fish Habitat	Terrain Stability	Soil	Vegetation	Wildlife	Archaeology	Human Health and Ecological Risk	Traditional Land Use	Non-Traditional Land Use
1a. Fuel Spill—Land	Loaded (50,000 Ls) fuel (gas or diesel) truck upset on dry land along main access road	1	2	1	1	0	2	1	1	1	1	2	1
1a. Fuel Spill—Water	Loaded (50,000 Ls) fuel (gas or diesel) truck upset and release of load into water body, such as a) low flowing tributary to Taseko River or b) high flowing Chilcotin River	1	1	2	2	0	1	1	2	1	2	2	1
2. Pipeline Failure	Release of tailings and/or reclaim (process) water to the environment affecting downstream aquatic habitat and water quality	1	1	1	0	1	0	1	1	0	1	1	1
3a. Concentrate Spill—Land	Loaded truck (40 tonnes) of concentrate upset on dry land along main access road	1	1	0	0	0	1	1	2	1	1	1	1
3b. Concentrate Spill—Water	Loaded (40 tonnes) truck upset and release of concentrate load into water body from bridge across or along road adjacent to either a) low flowing tributary to Taseko River or b) high flowing Chilcotin River	1	1	2	2	0	1	1	1	1	2	2	1
4. Road culvert failure	Blocked culvert across Taseko Lake Road causing ponding above the road, bank erosion, and increased sedimentation release into Fish Creek or Taseko Rivers	1	1	1	1	2	2	1	1	1	0	1	1

Project Activities/ Physical Works	Project Description Reference for Activity	Atmospheric	Hydrology and Hydrogeology	Water Quality and Aquatic Ecology	Fish and Fish Habitat	Terrain Stability	Soil	Vegetation	Wildlife	Archaeology	Human Health and Ecological	Traditional Land Use	Non-Traditional Land Use
5. Excessive water in TSF	Dam construction delay combined with storm events	0	0	1	1	0	0	0	0	0	0	0	0
6. Loss of Power to TSF Seepage Recovery	Due to storm event, tailings seepage overflow into the inlets of Fish Lake	0	0	1	1	0	0	0	0	0	0	0	0
7. Storm Event in Excess of Fish Lake FCD design	A larger-than-designed flood event overtopping the Fish Lake Flood Control Dams, directing flood waters to the open pit, thereby affecting pit operations.	0	1	0	0	0	0	0	0	0	0	0	0

NOTES:
Project-Environment Interactions
0 = No interaction
1 = Interaction occurs; however, based on past experience and professional judgment the interaction would not result in a significant environmental effect, even without mitigation; or interaction would not be significant due to application of codified environmental protection practices that are known to effectively mitigate the predicted environmental effects
2 = Interaction could result in an environmental effect of concern even with mitigation; the potential environmental effects are considered further in environmental assessment

Assessment of Potential Environmental Effects

For interactions that were ranked as “2”, potential environmental effects of the accident, malfunction or unplanned event on the VEC or KI were assessed in a similar fashion to Project environmental effects. Specifically, for each environmental effect resulting from the accident or malfunction, the potential environmental effects were assessed as follows:

- To ensure that the assessment was conservative, each discipline framed the potential scenario so as to maximize the potential environmental effect of the VEC or KI. This could include selection of a product that is most harmful to the VEC or KI, as well as the specific time of year and location of the event
- The mechanisms through which the accident, malfunction or unplanned event could result in an environmental effect on the VEC or KI were described
- The project design measures that would minimize the risk of the accident or malfunction, as well as emergency response measures and other mitigation measures that would help minimize the environmental effect were described
- The potential residual environmental effect, taking into account the emergency response by Taseko, was described or quantified using the measurable parameter(s) and other effect characterization terms, as necessary
- The significance of the predicted effect or change was evaluated using the same significance criteria for the VEC or KI as for Project environmental effects, and
- If required, any follow-up and/or monitoring program that might be required if this event occurred as described.

FUEL SPILL ON LAND

Description of the Possible Event

There is a low probability that during the life of the Project a fuel truck could overturn along the main access road during transport of fuel (gasoline or diesel) to the mine site, thereby releasing fuel onto land. Nonetheless the impacts and potential responses are considered here as required by the EIS guidelines.

For the purpose of considering this scenario, a fuels spill of up to 50,000 Ls (~10,000 IGals) of gasoline or diesel fuel was assumed to occur on dry land along the main access road during daylight hours.

Project Design Measures to Minimize Risk of a Fuel Spill on Land

To minimize the potential for fuel spills onto land, Taseko will implement the following suite of measures in cooperation with the Ministry of Transportation (MOT), contractors and subcontractors and other road users:

- Ensure proper construction and maintenance of access roads by MOT and Taseko, including installation and regular inspection of guard rails on bridges and berms/concrete abutments on roads adjacent to water courses that prevent overturning and/or capture load loss
- Enforce speed limits for all mine traffic on roads

- Ensure trucking/hauling contractors have appropriate driver training and radio contact capabilities, engage in appropriate vehicle maintenance and carry appropriately sized emergency clean-up kits
- Provide haul monitoring and supervision and a driver feedback plan, and
- Ensure appropriate emergency response and spill contingency training and knowledge, maintenance of equipment, materials and procedures to limit the consequences of such spills by prompt containment and clean up actions.

If the preventive measures did not prevent an accident, an emergency response protocol would immediately be initiated.

Taseko Emergency Response Approach for Fuel Spills on Land

If all precautionary and preventative measures did not prevent a land-based fuel spill, an emergency response protocol would be initiated that involves:

- Notification of all agencies and responders (mine supervisor, Provincial Emergency Program [PEP], RCMP) as per the emergency response plan
- Activation of spill handling procedures including assessing feasibility of containment and clean-up
- Implementation of spill handling procedures including: diverting fuel away from water; deployment of absorbent booming; pumpback fuel to a tanker/alternate storage unit as quickly as possible, and soil/environmental clean-up as identified in spill contingency plans, and
- Completion of reporting and disposal procedures.

Potential Environmental Effects

Based on the screening of potential interactions between a land-based fuel spill and VECs (Table 2.7.6-2), the VECs that are most likely to be detrimentally affected are:

- Hydrology and Hydrogeology (groundwater flow rate and groundwater quality)
- Soils
- Wildlife
- Human and Ecological Health, and
- Traditional Land Use.

Interactions with all remaining VECs, apart from terrain stability that was ranked as a “0”, were ranked as “1” for reasons described below.

Atmospheric: Under calm conditions the area within which CACs would disperse in the event of a spill would be limited (less than 1 km^3) and short-term (4–8 hours). Under windy conditions the time to for dissipation would be significantly reduced. As a result, atmospheric concerns associated with a fuel spill are low.

Water quality and fish and fish habitat: The extent of a spill on land would not likely result in direct spillage into a watercourse or water body. In addition, initial spill containment methods and subsequent spill clean-up measures would help minimize the potential for seepage of fuel into watercourses or water bodies (as these would be key areas to protect).

Vegetation: A spill would largely occur on a disturbed area within the road right-of-way where sensitive vegetation KIs are not likely to occur.

Archaeology: Potential land disturbances that are part of the spill response program would likely be restricted to a small area in the direct vicinity of the road right-of-way (i.e., an already disturbed area); as a result, the potential to affect archaeological sites would be low. In addition, if fuel did spread beyond the road right-of-way (ROW), land disturbances associated with the spill response program would be minimized until an archaeologist has determined that artifacts and sites would not be disturbed by clean-up activities.

Human Health Risk Assessment: The potential human and ecological health effects from a fuel spill on land would be dependent on effects to soil and groundwater and, in turn, their effects on terrestrial biota that occur in the immediate area (e.g., plants, soil invertebrates, burrowing animals). Effects on groundwater, soil and wildlife are assessed elsewhere in the EIS. Based on these assessments, it is expected that proposed mitigation and emergency response measures, including active spill handling procedures, would be sufficient to avoid any long term effects. As a result, it is also unlikely that there would be long term human and ecological health effects.

Non-traditional land use (including forestry, mining, range, trapping and tourism): In the event of a spill licensees would continue to abide by their license agreements with the province or, in the event that a spill interacted with their activities, negotiate work-arounds at the operational level. Non-licensee activities, including public recreation, hunting and fishing, would be expected to respond in a similar fashion. Users would avoid a spill area and avail themselves of substitute routes or use areas. Commercial and public users of Crown land already adapt, both spatially and temporally, to changes brought about by forest harvesting, fires, pestilence, community development and industrial development. In this context, a land fuel spill is unlikely to induce changes in measurable parameters that are distinguishable from the base case.

Hydrology and Hydrogeology

The effects of a 50,000 L fuel spill on groundwater underlying a spill area could be locally significant depending on the rate and quantity of fuel that infiltrates into the subsurface, as well as the type of fuel spilled. Certain components of diesel and gasoline fuels (e.g. benzene) are comparatively soluble and can migrate as dissolved contaminants in groundwater for several tens to hundreds of metres, and sometimes further if conditions are appropriate. The rate of contaminant migration, total distance and concentrations of the various fuel-derived contaminants in the groundwater would depend to a large degree on a spill site hydrogeology (soil type, topography, depth to groundwater, depth to bedrock, soil/rock permeability, geochemical environment, etc.).

Initial spill response typically begins in the first several hours following a spill, or sometimes days depending on the time and location of a spill, and would typically recover a substantial portion of the spilled fuel. Recovery is done by, for instance, deploying spill containment or absorbent materials and mobilizing hydro-vacuuming units toa spill site to recover free phase fuels. Subsequent source removal excavations would likely occur over the next several weeks to remove soils with free phase fuel in the pore space. It is possible that, even after remediation, soil and groundwater containing residual gasoline or diesel contamination could remain in an area (e.g., worst case free-phase fuel penetrates into a locally important fractured bedrock aquifer). This residual fuel can persist in the subsurface for years to decades, or longer if conditions permit. As a result, environmental monitoring and possibly ongoing remediation and treatment could be required.

Post-emergency response techniques commonly used for spills of this nature would quickly provide containment of groundwater via excavation, dewatering sumps and on-site treatment, thereby limiting the distance and magnitude of impacts in the vicinity of a spill.

Given mitigation and emergency response measures, residual effects of a spill on hydrology and hydrogeology would be short term, reversible, sporadic in frequency and site specific. The overall rating of the residual effect is not significant as groundwater quality can be re-established within a short time line.

Soil

A fuel spill has the potential to affect soil quality due to contamination. The amount of contamination and the mitigation required would depend on the physical state of the soil and clean-up response time. The physical state of the soil, including soil texture, bulk density, cation exchange capacity, organic matter content and depth to restricting layers, influences the amount and depth of fuel that is absorbed into the environment. For instance, the depth of fuel absorption would be greater in sandy soils versus soils that have a higher clay or organic matter content. The response time is critical because the longer the response time, the more fuel that would be released and dispersed into the environment.

For any type of spill event, the first priority is to control the fuel leakage at the source and recover as much of a spill as possible. The contaminated soil would be dug out as soon as possible and taken to an approved facility for remediation.

For agricultural lands, the soil that is used to replace the contaminated soil must be of equivalent agricultural capability as the site prior to the contamination. Stakeholder input would be required. The soil must be from the same region to prevent introduction of new pests or invasive plants to the agricultural area. The method of soil placement is also critical to prevent further degradation of the soil. If subsoil and topsoil need to be replaced, minimizing admixing of the two soil types is essential as is reducing compaction and erosion.

Given mitigation and emergency response measures, residual effects of a spill on soil quality would be short term, reversible, sporadic in frequency and site-specific for the land event. The magnitude is considered low if the aerial extent of soil contamination is remediated and equivalent land capability is returned. The overall rating of the residual effect is not significant as prior land uses can be re-established within a one year timeline.

A land based spill would be confined to the vicinity in which a spill occurred; as a result, the mitigation would likely be able to be applied readily. The probability of a spill occurring in agricultural areas is low as those lands intersect less than 10% of the access road.

In the event of an accidental spill of fuel oil or diesel, the following monitoring progress would be undertaken:

- ensure successful revegetation of remediated sites occurs within a growing season

- where fill or topsoil has been used, ensure that weed control is implemented. Seeds of invasive plants may have been harbored in the replaced soil or invasive plants may have revegetated the site due to bare soil conditions at time of fill replacement
- further soil amendments such as organic matter incorporation could be required to aid in re-establishing agricultural land capability in agricultural areas. Stakeholder input would be required
- for soil that is remediated in situ due to low concentrations of fuel contamination, ongoing monitoring would be required to ensure complete remediation. (i.e., minimum two years of monitoring)

Wildlife

The interaction between wildlife and a land-based fuel spill is ranked as a “1” for most wildlife because a spill would largely occur on an already disturbed area within the road ROW and the areal extent of a spill would be small relative to the habitat requirements of most wildlife. Further, larger, more mobile wildlife could readily avoid a spill area. For soil invertebrates and other smaller, less mobile wildlife (e.g., burrowing animals); however, the interaction is ranked as a “2”. The assessment of this wildlife interaction is addressed under the human health and ecological risk assessment. Impacts would be expected to be short duration and very localized. Post emergency response would mitigate the risks beyond any directly impacted spill area.

Traditional Land Use

It is unlikely there would be any effects to traditional land use under this spill scenario. The impacts to soil would be localized. Short-term minor impacts to traditional land use are possible in the immediate vicinity while access restrictions are in place. Emergency response and post-emergency response would address the risk to human health and the environment. No impacts to VECs associated with traditional land use would be anticipated. Standard site restoration techniques used in these circumstances would be sufficient. No ongoing monitoring post-clean up would be required.

FUEL SPILL IN WATER

Description of the Possible Event

There is a low probability that during the life of the Project that a fuel truck could overturn along the main access road during transport of fuel (gasoline or diesel) to the mine site and release all or part of its load into a watercourse or water body. Nonetheless the impacts and potential responses are considered here as required by the EIS guidelines.

For the purpose of considering this scenario, it was assumed that up to 50,000 Ls of fuel (gas or diesel) was released from a truck into a watercourse such as a low flowing tributary to Taseko River or a high flowing watercourse such as the Chilcotin River. A spill is assumed to occur during daylight hours.

Project Design Measures to Minimize Risk of a Fuel Spill in Water

To minimize the potential for fuel spills into a watercourse or water body, Taseko will implement the following suite of measures in cooperation with the MOT, contractors and subcontractors and other road users:

- Ensure proper construction and maintenance of access roads by MOT and Taseko, including installation and regular inspection of guard rails on bridges and berms/concrete abutments on roads adjacent to water courses that prevent overturning and/or capture load loss
- Enforce speed limits for all mine traffic on roads
- Ensure trucking/hauling contractors have appropriate driver training, radio contact capabilities, engage in appropriate vehicle maintenance and carry appropriately sized emergency clean-up kits
- Provide haul monitoring and supervision and a driver feedback plan
- Ensure appropriate emergency response and spill contingency training and knowledge, maintenance of equipment, materials and procedures to limit the consequences of such spills by prompt containment and clean up actions

If the preventive measures did not prevent an accident, an emergency response protocol would immediately be initiated.

Taseko Emergency Response Approach for Fuel Spills in Water

In the event of a spill, an emergency response protocol would be initiated that involves:

- Notification of all agencies and responders (mine supervisor, PEP, RCMP) as per the emergency response plan
- Activation of spill handling procedures including assessing feasibility of containment and clean-up based on water body and flow rates
- Implementation of spill handling procedures including: diverting fuel away from water; deployment of absorbent booming; pumpback fuel to a tanker/alternate storage unit as quickly as possible, and soil/environmental clean-up as identified in spill contingency plans, and
- Completion of reporting and disposal procedures.

If the release was into a fast-moving body of water, water quality, habitat and fish monitoring procedures would be implemented to assess short- and long-term effects and the required mitigation.

Potential Environmental Effects

Based on the screening of potential interactions between a water-based fuel spill and VECs (Table 2.7.6-2), the VECs that would most likely be detrimentally affected are:

- Water Quality and Aquatic Ecology
- Fish and Fish Habitat
- Wildlife
- Human and Ecological Health, and
- Traditional Land Use.

Interactions with all remaining VECs, apart from terrain stability that was ranked as a “0”, were ranked as “1” for reasons described below.

Atmospheric: It is expected that a spill would result in a very localized release of CACs and therefore potential atmospheric effects are expected to be low.

Hydrology and Hydrogeology: The volume of spilled material is not likely to affect surface water or ground water flow. As most streams and ponds are groundwater discharge zones, a spill would not affect ground water quality either.

Archaeology: Potential land disturbances as part of the spill response program would likely be restricted to a small area in the direct vicinity of the road right-of-way (i.e., an already disturbed area); as a result, the potential to affect archaeological sites would be low.

Soil: The risk of soil contamination along the riverbanks and soil disturbance during clean-up operations is low. For a water spill event, soil contamination could occur along the riverbanks and the dilution and dispersion resulting from a spill being in water would make it difficult to assess the amount of soil contamination that could occur. Soil would likely be disturbed during spill response and clean-up operations. However, the areal extent of disturbed soil would be expected to be localized. Remediation efforts outlined in the land spill scenario could also be applied, if necessary, to a water spill scenario to help restore pre-spill conditions. Interactions with hydrology and hydrogeology were ranked as 1 as the booms used to collect fuel are hydrophobic and therefore do not remove much water from the stream. Furthermore, as surface water bodies are typically groundwater discharge areas, little interaction with groundwater would occur.

Vegetation: Petroleum fuel products such as gasoline and diesel have the capacity to chemically burn vegetation and to disrupt nutrient cycling processes. Effects vary depending on length of exposure, time of year (dormancy) and the characteristics of the plant species affected.

In the event of a fuel spill from a fully loaded fuel truck into water, the release of as much as 50,000 Ls of gasoline or diesel fuel has the potential to cause adverse environmental effects to vegetation in wetland or riparian ecosystems. The magnitude and extent of these effects would vary depending on whether or not the receiving water body were slow moving or stagnant (e.g., wetland or back channel of a river or creek), or fast moving (e.g., Taseko or Chilcotin rivers).

In fast moving river currents, gas and diesel fuels would be diluted, emulsified by the action of the moving water and rapidly transported downstream. The turbulent action of a flowing river or stream would be expected to separate diesel into fine droplets that are then suspended in the water column and eventually adhere to particulates in the water and settle out, which rarely leads to appreciable contamination as most natural environments have microbes that break down diesel in one to two months. More acute effects could occur in slower moving backwater areas where riparian vegetation could come into sustained contact with fuels. Generally speaking, because of the dispersion of fuel in a fast moving system combined with dilution and evaporation, it is not anticipated that substantial amounts of fuel would enter soil substrates on the banks of the river or stream and effects to riparian vegetation are expected to be localized.

The effects of a spill into a fast flowing river are not easily contained, but it is expected that fuels would be dissipated by the action of the moving water. A fuel spill into a slower moving system provides better opportunities for containment and clean-up, and assuming mitigation measures are implemented promptly and effectively, the effects of this scenario would be minimized. In either situation, some residual adverse environmental effects to vegetation are predicted to occur but, assuming implementation of prescribed mitigation measures; the effects would be expected to be adverse, localized, short term and reversible over time and not considered significant.

Non-traditional land: A fuel spill in water is unlikely to affect measurable parameters for commercial activity (e.g. forestry, range, trapping, guide outfitting) even without mitigation while tourism and public recreation (including hunting and fishing) are primarily lake and land-based activities where a spill would not interfere or where a spill area could be avoided until conditions are normalized.

Water Quality and Aquatic Ecosystems

The risk of fuel spills into water bodies along the access roads are minimized through Project design, mitigations and emergency responses. With these precautions in place, and given that the proportion of road near or over water is very low, the probability of such an event occurring is considered to be very low. However, should such an event occur, it could have short-term effects on water quality and could lead to sublethal or lethal effects on sensitive species of aquatic organisms.

Literature on the effects of fuel spills in streams and rivers indicates both short and long-term effects on benthic invertebrate communities (Lytle and Peckarsky 2001; Crunkilton and Duchrow 1990; Pontasch and Brusven 1988; Miller and Stout 1986). For example, Lytle and Peckarsky (2001) documented benthic invertebrate community responses to a 26,500 L diesel fuel spill into a small stream in New York, including immediate impacts on benthic invertebrate communities throughout the 12 km study area. Substantially lower abundance (90% lower) and taxon richness (50% lower) were measured immediately and three months after the spill in impact areas 5 km downstream of the spill compared to reference areas. After one year, abundance levels had recovered, in part by recolonization by upstream invertebrates, but taxon richness and other differences in community structure were still apparent.

It is likely that a spill within the Project area would result in similar effects. The worst case scenario is of a fully loaded fuel truck overturning and releasing its entire 50,000 L load into a slow flowing tributary of the Taseko River or a faster flowing river such as the Chilcotin River during the late summer low flow period. General considerations for this scenario include:

- A slow rather than immediate release of the entire 50,000 L
- Retention of some fuel constituents in periphyton and shoreline substrates
- Physical processes, such as volatilization and dilution of fuel, in addition to spill cleanup, that would reduce the volume of fuel actually released to the water
- Differences in behaviour of gasoline (quick volatilization) and the denser diesel fuel (slower volatilization and weathering), resulting in longer persistence of diesel in the aquatic environment
- Quick volatilization of toxic constituents such as BTEX (benzene, toluene, ethylbenzene and toluenes), and
- Slower weathering (up to several years) of toxic compounds such as polycyclic aromatic hydrocarbons (PAHs).

Most of the fuel product would remain on the water surface, where it would be exposed to rapid volatilization and dilution downstream. Toxic components such as BTEX would volatilize quickly but while present in water could have acute effects. Surface-dwelling organisms would be the most exposed to the fuel. Longer term effects and chronic contamination would be associated with the PAHs, which would accumulate in depositional areas downstream, take up to several years to degrade and involve exposure of benthic organisms to the compounds.

Among the tributaries of the Taseko River crossed by the access road, Tête Angela Creek would be considered the most sensitive location for such an accident, given the relatively short distance of approximately 4 km between the road crossing and the Taseko River. Assuming that summer low flows in Tête Angela Creek are similar to flows in Fish Creek (0.03 m^3/s), the volume of fuel released (50 m^3) could be large in relation to stream flow, although instantaneous release of the entire volume would not be expected. As a result, effects on water quality and acute effects on aquatic life could extend through the 4 km of stream down to the Taseko River, and perhaps beyond. In addition, PAHs would likely settle in slow flowing depositional areas of Tête Angela Creek and possibly in the Taseko River. With freshet and other high flow events in the stream, PAHs in the sediment would be redistributed downstream over time. Benthic invertebrates from upstream would likely recolonize the area within one year. Thus a short-term, high magnitude and local to regional effect could result from such a fuel spill.

For the fast-flowing Chilcotin River, a fuel spill at the crossing near Hanceville during the late summer low flow period would result in rapid transport of fuel downstream, also with rapid dilution and volatilization. Although the higher volume of water in a larger watercourse would provide dilution, and reduce the magnitude of any acute effects on aquatic life, this volume and velocity would move the fuel downstream further and faster than in a small stream. Low concentrations of contaminants would be transported longer distances (e.g., several kilometres). Benthic invertebrates from upstream would likely recolonize the area within one year. Thus, a short-term, medium to high magnitude and regional effect could result from such a fuel spill.

The geographic extent and magnitude of the environmental effects of a fuel spill to water could be significant. However, the temporal effects can be reduced and managed with the application of a well-defined emergency response plan, complemented by additional mitigation and compensation measures as identified in follow-up and monitoring plans.

For either scenario, residual effects would be anticipated, although they would be considered not significant, given that the benthic community would recover much of its productivity within one year.

Follow-up water quality, sediment, and biota monitoring would be conducted to assess short- and long-term effects and to identify any additional mitigations required. Analysis of PAH in sediment from downstream depositional habitat would be useful in determining geographic extent of the effect and in monitoring improvement over time. This would be conducted in conjunction with a benthic invertebrate community survey to assess biological responses.

Fish and Fish Habitat

A fuel spill of 50,000 L could have different effects on fish and fish habitat, depending on the size and flow rate of the receiving water body, the weather conditions during and immediately after a spill and any fire suppression chemicals used to prevent the spilled fuel from igniting.

For example, in a larger, faster moving water body, spilled fuels could be substantially diluted and moved several kilometers downstream. Some acute effects could be expected in a spill area, such as localized areas of sediment contamination, and in downstream, slower moving reaches.

In a smaller, slow moving stream, direct fish and invertebrate mortality could be expected along with more widespread and likely higher levels of sediment contamination than spills to a larger system. Heavy rainfall immediately following a fuel spill would help dilute concentrations and ideally reduce subsequent sediment contamination, but could carry spilled product farther downstream than on a dry day. Fire suppressants, like CHEMGUARD, which contain ethylene glycol, could have their own effects on fish in spill-affected areas depending on the size and flows of the receiving water body.

Characterizing the potential effects on water and sediment quality would begin during the cleanup phase and would include the following:

- Identifying the downstream limit of fuel migration
- Collecting mortalities (e.g., fish and amphibians)
- Characterizing habitats in spill-affected areas, and
- Analysis of water and sediment samples for benzene, ethylbenzene, toluene and xylenes (BTEX), polycylic aromatic hydrocarbons (PAH), volatile hydrocarbons (VH), volatile petroleum hydrocarbons (VPH) and extractable petroleum hydrocarbons (EPH).

Mitigation and clean up measures to protect fish and fish habitat would begin with containing a spill, both at the source and at accessible downstream locations. Sediment removal would likely be required at a spill site and could also be required at accessible downstream areas.

Water quality monitoring would continue until the concentrations of BTEX and PAH dropped to BC approved and working water quality guideline levels. Sediment quality monitoring would be conducted on an ongoing basis in clean up areas, until the combination of field observations and sampling data demonstrated the contaminated sediments were successfully removed, or remaining sediments were consistent with the BC working sediment quality guidelines. Sediment monitoring would continue in other areas affected by a spill, like machine inaccessible locations, to confirm the natural attenuation of PAH and BTEX.

Fish and fish habitat monitoring programs would help determine how long it takes for fish to return to a spill-affected area, as well as the changes in species diversity and abundance in spill-affected areas over time. The data from spill-affected reaches would be compared with data collected from one or more control sites upstream of a spill site. If upstream reaches were inaccessible, control sites in nearby drainages of similar size, and providing similar habitats, would be chosen for comparison with spill-affected reaches.

The residual effects of a fuel spill could include the temporary loss of fish and benthic invertebrates and localized areas of sediment contamination in spill affected reaches. Depending on sediment concentrations of parameters of concern like PAH, this could adversely affect invertebrates, which are in direct contact with the sediment and pore water. Fish feeding on invertebrates in these areas could also be adversely affected, again depending on the contaminant levels in the sediments and invertebrates. The potential for adverse effects would be determined as part of the sediment monitoring program. Adverse effects could persist until the sediments are covered or re-distributed through channel processes, or until natural attenuation results in lower concentration of the parameters of concern.

The geographic extent and magnitude of the environmental effects of a fuel spill to water could be significant. However, the temporal effects can be reduced and managed with the application of a well-defined emergency response plan, complemented by additional mitigation and compensation measures as identified in a follow-up and monitoring plan. It is anticipated the effects would be temporary (zero to four years) and reversible.

Wildlife

The assessment of an in-water fuel spill in water event on wildlife is directly related to the effects of such a spill on water quality and aquatic ecosystems, fish and fish habitat, and human health and ecological risk assessment.

Wildlife as a whole is addressed in the human health and ecological risk assessment section, while strictly aquatic organisms (fish, benthic invertebrates) are addressed in the other two sections.

The mechanisms for environmental effects associated with a fuel spill include chemical changes to the water and sediment quality resulting in biological damage to stream biota and aquatic and semi-aquatic wildlife habitat, sensory disturbance (odour), and possible health effects as the result of ingestion or direct contact with the fuel.

The mitigation measures described in general for this event (Table 2.7.6-1) and specifically for fish and fish habitat, water quality and aquatic ecosystems, and human health and ecological risk assessment (e.g., containment, sediment removal) minimize the effects of a spill on wildlife.

The geographic extent and magnitude of any environmental effect on aquatic and semi-aquatic wildlife and wildlife habitat depends on a variety of factors (e.g., fuel type, size and flow rate of receiving environment, weather conditions, success and type of response). The residual effects of a fuel spill could include the loss or displacement of fish, amphibians and benthic invertebrates, disruption of stream habitat, localized areas of sediment contamination and general avoidance of the affected area by wildlife. Depending on sediment concentrations of parameters of concern (e.g., PAH) there could be adverse effects on benthic invertebrates. In turn, fish and other animals (e.g., waterfowl) feeding on invertebrates in these areas could also be adversely affected.

It is anticipated that the residual environmental effect of a fuel spill into water would be temporary (zero to four years) and reversible. This residual effect could be significant; however, the magnitude and duration of the effect can be reduced and managed with the application of a well-defined emergency response plan, complemented by additional mitigation and compensation measures.

Monitoring and follow-up programs for water quality, sediment, biota, and fish and fish habitat would be conducted to assess the short- and long-term effects of a spill, and to identify any additional mitigations required. A specific monitoring program for amphibians and amphibian habitat would be considered in some circumstances (e.g., spill into lentic environment). However, in general, the monitoring and follow-up programs proposed for fish and fish habitat and water quality and aquatic ecosystems are considered adequate to address wildlife concerns. No long term impact is anticipated.

Human Health and Ecological Risk

Potential effects of an in-water fuel release on ecological and human health would be dependent on the physical parameters of the water body (e.g., stream flow rate, depth, width). Acute effects to ecological health could occur if wildlife and avian species were to come into contact with the hydrocarbon free-product. No acute health effects would be expected for humans given that the water bodies in the area are not used as potable water sources.

Downstream ecological effects are possible given that these water bodies are used as a source of drinking water by terrestrial and avian wildlife species. Potential effects would be dependent on the dilution of the hydrocarbons in the waterway as this affects the concentration of hydrocarbons that a species would be exposed to.

Free-product recovery from water bodies should be completed to the best of the ability of the emergency response team; its success would be highly dependent on stream velocity and weather conditions at the time. Water samples would be collected immediately from the source area of a spill. These measures detailed in Table 2.7.6-1 would ensure the protection of human and ecological health.

Overall, there would be a potential for acute (short-term) effects to both terrestrial and avian species in the event of a fuel spill to water. Depending on the volume of the fuel spilled and the physical characteristics of the receiving water body, there is the potential that effects on aquatic resources and the concentration of hydrocarbons in the water could have residual effect on fish tissue (for consumption).

In the event of an accidental spill of fuel oil or diesel, the follow-up and monitoring steps detailed in Table 2.7.6-1 would be sufficient for the protection of human and ecological health. Depending on the magnitude of a spill this would include the implementation of water quality, and potentially sediment quality, monitoring in the affected water body. Assuming contaminant concentrations remain below conservative risk-based water quality objectives then there would not be a risk to either ecological or human health.

As a result, it is expected that effects of a water-based fuel spill on ecological health and human health would be not significant.

Traditional Land Use

There is a potential risk to traditional land use in the event of a spill to water. These risks and the response measures to address the release are the same as those described in the previous sections. It is anticipated that the impacts would be short duration and pose little long term risk to human health or the environment associated with traditional land use.

FAILURE OR MAJOR LEAKAGE FROM TAILINGS OR RECLAIM PIPELINES

Scenario Description

There is a low probability over the life of the Project that the tailings or reclaim pipelines could develop a major leak or fail thereby releasing tailings or reclaim (process) water to the environment. Nonetheless the impacts and potential responses are considered here as required by the EIS guidelines.

The project has been designed in such a way that should such an event occur, any released tailing or process water would be restricted to the mill site, TSF, tailings/reclaim pipeline containment ditches, or the TSF seepage collection ponds / ditches. As a result, no release of tailings or mine water to area watercourses would occur.

For the purpose of considering this scenario, a release of tailings and/or reclaim (process) water from the normal operating condition (i.e. within the closed pipelines) and into the secondary containment systems (i.e. ditches, ponds, mill site and TSF) has been assumed, and further that this release has the potential to affect hydrology and hydrogeology as well as downstream aquatic habitat and water quality.

Project Design Measures to Minimize Risk of a Failure or Major Leakage from Tailings or Reclaim Pipelines

Preventative measures to mitigate effects related to the tailings or reclaim pipelines include the following:

- Situate pipelines in locations that ensure any accidental releases of tailings or reclaim water flow into the concentrator, TSF, tailings/reclaim containment ditches, or the TSF seepage collection ponds/ditches
- Ensure proper construction and maintenance of tailings delivery and reclaim systems to maintain a closed system
- For the tailings/reclaim lines between the concentrator and the TSF, place them within ditches to capture and contain tailings/reclaim water in the event of a pipeline break to ensure full secondary containment
- For the tailings line along the embankment crests, place them on the internal crest line, so that tailings from a spill would be contained within the TSF
- Ensure proper tailings/reclaim line inspection training and supervision
- Conduct routine inspections of tailings delivery and reclaim systems, and
- Maintain spill response procedures and implement appropriate emergency response.

If the preventive measures did not prevent an accident, an emergency response protocol would immediately be initiated.

Taseko Emergency Response Approach for a Failure or Major Leakage from Tailings or Reclaim Pipelines

If all precautions and preventative measures did not prevent a failure or major leakage from the tailings or reclaim pipeline, an emergency response protocol would be initiated that involves:

- Conducting an initial response and notification (mine supervisor, on-scene coordinator) as per emergency response plan
- Shutting down source of spill (tailings/reclaim water) by implementing emergency shut-down procedures
- Activating the emergency response groups
- Assessing if a spill of tailings/reclaim water is internal (likely) or would have external effects, and
- Notify the PEP office and the Ministry of Environment (MOE) as precautionary measure even if internal.

In the unlikely event that there is an external discharge of tailings or reclaim water beyond the TSF or concentrator, DFO would be notified (in addition to PEP and MOE), and monitoring and assessment procedures would be immediately initiated.

Potential Environmental Effects

Based on the screening of potential interactions between VECs and a failure or major leakage from tailings or reclaim pipelines (Table 2.7.6-2), no VECs are likely to be detrimentally affected. Interactions with all remaining VECs, apart from soil, fish and fish habitat and archaeology, which were ranked as a “0”, were ranked as “1” for reasons described below.

Atmospheric Environment: A release of tailings water could result in the generation of some particulates, however, it is not expected to result in a substantial release of evaporates.

Hydrology and Hydrogeology: A spill would not affect stream flow due to containment within the secondary structures, and is not likely to affect groundwater flow or quality. The locations for tailings to possibly reach the environment as a result of a spill would be from the pipeline corridor between the plant site and the TSF, as well as from each of the Main, South and West Embankments. Should this occur in the pipeline corridor between the plant site and the TSF, tailings and reclaim water would ultimately be intercepted by containment ditches which the pipelines are located within, directing it to the concentrator where it can be recovered and placed back in the TSF. Tailings downstream of the three embankments would ultimately be captured by the collection ditches and ponds, where it could be recovered and placed back into the TSF. The water component of the tailings would be primarily surface drainage to the concentrator or seepage collection ponds, leaving very little water to reach the groundwater system.

Water Quality and Aquatic Ecology: A spill would interact with other sources of contact water that reports to the secondary containment ditches and ponds, thereby remaining separated from the non-contact surface water and aquatic environment. As such, there would be no off-site contact between spilled tailings/reclaim water and the natural aquatic environment.

Terrain Stability, Vegetation and Wildlife: effects on these VECs would be minimal as a result of spill response measures and codified environmental protection practices. The Environmental Management Plan has measures that are known to effectively mitigate the predicted environmental effects from a pipeline failure. Measures specific to reducing soil contamination include ditches and berms to contain the leakage from the pipeline, and diversion of a spill towards the concentrator, TSF and seepage collection ponds. Also, the mine site will have topsoil stockpiled away from contamination sources.

Human Health and Ecological Risk: A rupture or major leakage from the tailings or a reclaim pipeline would result in the release of tailings and/or reclaim (process) water to the environment. Effects on water quality are not expected because the release would be restricted to the secondary containment systems.

If a leak occurred to soil, it is unlikely that the concentrations of metals would be high enough to pose an acute (short-term) risk to either human or ecological health. This is based on the qualitative understanding that acute toxicity requires exposure to very high concentrations of metals in soil. In addition, the soil in the affected area would be remediated in a short period of time.

Traditional Land Use: There is a low potential risk to traditional land use in the event of a tailings release as a release would most certainly occur within the mine footprint. These risks, and the response measures to address the release, are the same as those described in the previous sections. It is anticipated that any impacts would be short duration and pose little long term risk to human health or the environment associated with traditional land use.

Non-traditional Land Use: Commercial land users have access to large license areas for extended periods of time. Public users have access to a Crown land base that offers opportunities for multiple, substitute locations and experiences. A major leakage is unlikely to affect measurable parameters for commercial activity (e.g. forestry, range, trapping, guide outfitting) even without mitigation while tourism and public recreation (including hunting and fishing) are primarily lake and land-based activities where a leakage would not interfere or where a spill area could be avoided until conditions are normalized. While we are mindful of the potential adverse effects on downstream aquatic habitat and the sport fishery, we also recognize the preponderance of lake fishing, and alternative river sites, in the Regional Study Area (RSA) and the opportunities that would continue to exist should a leakage occur.

CONCENTRATE HAUL SPILL ON LAND

Scenario Description

There is a low probability that during the course of the Project a concentrate truck could upset on dry land thereby releasing concentrate to the dry landscape. Nonetheless the impacts and potential responses are considered here as required by the EIS guidelines.

For the purpose of considering this scenario a loaded truck (40 tonnes) upset along the main access road has been assumed.

Project Design Measures to Minimize Risk of a Concentrate Spill on Land

Preventative measures to mitigate effects related to land-based concentrate haul spill are similar to those outlined for mitigating fuel spills. These include:

- Ensuring proper construction and maintenance of access roads by MOT and Taseko, including installation and regular inspection of guard rails on bridges and berms/concrete abutments on roads adjacent to water courses that prevent overturning and/or capture load loss
- Enforcing speed limits for all mine traffic on roads
- Ensuring trucking/hauling contractors have appropriate driver training, radio contact capabilities, engage in appropriate vehicle maintenance and carry appropriately sized emergency clean-up kits
- Providing haul monitoring and supervision and a driver feedback plan, and
- Ensuring appropriate emergency response and spill contingency training and knowledge, maintenance of equipment, materials and procedures to limit the consequences of such spills by prompt containment and clean up actions.

In addition, Project concentrate containers will be designed such that there is no wind loss (i.e., sealed hard covers). However, in the event of a truck upset, it is assumed that concentrate could be released from the container and be spilled onto the land surface.

If the preventive measures did not prevent an accident, an emergency response protocol would immediately be initiated.

Taseko Emergency Response Approach for a Concentrate Spill on Land

As per above, the emergency response approach for a land-based concentrate haul spill are similar to those outline for fuel spills. These include:

- Notification of all agencies and responders (mine supervisor, PEP, RCMP) as per the emergency response plan
- Notify MOE and (adjacent) land owners
- If the driver is not injured, the driver would notify Taseko and request assistance. The driver would then implement initial and immediate containment activities using on-board containment equipment
- Activate emergency response groups, and
- Completion of reporting and disposal procedures.

Potential Environmental Effects

Based on the screening of potential interactions between a land based concentrate haul spill and VECs (Table 2.7.6-2), the VECs that are most likely to be detrimentally affected are: Wildlife.

Interactions with all remaining VECs, apart from water and aquatic ecosystems, fish and fish habitat and terrain stability, which were ranked as a “0”, were ranked as “1” for reasons described below.

Atmospheric Environment: It is expected that a spill would result in a very localized release of particulates. Additional particulates could be generated during clean-up activities.

Hydrology and Hydrogeology: small quantities of concentrate could be washed into a watercourse or water body (e.g., during a rain storm), but effects would be highly localized.

Soil and Vegetation: the areal extent of a spill would be very small and clean-up activities are expected to remove spilled concentrate within a short period (days). Rehabilitation of the site would help restore soil and vegetation and, eventually, wildlife use.

Archaeology: potential land disturbances as part of a spill response program would likely be restricted to a small area in the direct vicinity of the road right-of-way (i.e., an already disturbed area) as a result, potential to affect archaeological sites would be low. In addition, if concentrate did spread beyond the road ROW, land disturbances as part of a spill response program would be minimized until an archaeologist had determined that artefacts and sites would not be disturbed by clean-up activities.

Human Health Risk Assessment: The potential human and ecological health effects from a concentrate spill on land would be dependent on the aerial extent of effects on soil and groundwater. Although ore concentrate contains elevated concentrations of metals (e.g., copper), it would likely not result in acute (short-term exposure) chemical effects on ecological or human health. This is based on the qualitative understanding that acute toxicity requires exposure to very high concentrations of metals in soil. In addition, the soil in the affected area would be cleaned-up in a short period of time and thus humans and terrestrial ecological receptors would experience limited exposure to these elevated metal concentrations.

If through soil monitoring (Table 2.7.6-1), concentrations of metals in soils and vegetation were elevated over background concentrations, Taseko would undertake a risk assessment to ascertain if the levels were of a sufficient concentration to pose a potential risk.

Traditional Land Use: There is a low potential risk to traditional land use in the event of a tailings release as the release would most certainly occur within the mine footprint. These risks, and the response measures to address the release, are the same as those described in the previous sections. It is anticipated that any impacts would be short duration and pose little long term risk to human health or the environment associated with traditional land use.

Non-traditional Land Use (including forestry, mining, range, trapping and tourism): These activities are licensed for commercial use and managed by government over large land areas and for extended periods of time. Similarly, public recreation, including hunting and fishing, has access to a Crown land base that offers opportunities for multiple, substitute locations and experiences for enjoying those activities. A concentrate spill on land would be a site specific event with short-term effects once preventative and emergency response measures are considered. We would not expect measurable parameters to be adversely affected. Licensees would continue to abide by their license agreements with the province and at the very worst would negotiate work-arounds at the operational level where a spill happened to interact with those activities. Public recreation, hunting and fishing activity would also be expected to respond in a similar fashion. Users would avoid a spill area and avail themselves of substitute routes or use areas. Commercial and public users of Crown land already adapt, both spatially and temporally, to changes brought about by forest harvesting, fires, pestilence, community development and industrial development. In this context, a land concentrate spill is unlikely to induce changes in measurable parameters that are distinguishable from the base case.

Wildlife

The interaction with a land-based concentrate spill is ranked as a “1” for most wildlife, since a spill would largely occur on an already disturbed area within the road right-of-way, the areal extent of a spill would be small relative to the habitat requirements of most wildlife, and clean-up activities would be expected to remove any spilled concentrate within a short period (days). Further, larger, more mobile wildlife could readily avoid a spill area.

CONCENTRATE HAUL SPILL IN WATER

Scenario Description

There is a low probability that during the course of the Project a concentrate truck could overturn and release its load into a water body. Such a release could affect water quality and result in aquatic habitat degradation. Nonetheless the impacts and potential responses are considered here as required by the EIS guidelines.

For the purpose of considering this scenario a loaded truck (40 tonnes) upset with concentrate released from a bridge or along a road that is adjacent to either: a) a low flowing tributary to Taseko River; or b) high flowing Chilcotin River has been assumed.

Project Design Measures to Minimize Risk of a Concentrate Spill in Water

Preventative measures to mitigate effects related to an in water concentrate haul spill are similar to those outlined for mitigating fuel spills. These include:

- Ensuring proper construction and maintenance of access roads by MOT and Taseko, including installation and regular inspection of guard rails on bridges and berms/concrete abutments on roads adjacent to water courses that prevent overturning and/or capture load loss. This could also include design features such as the use of berms or concrete abutments on roads to prevent trucks from over-turning, and to help contain load loss. Maintenance plans would include routine inspections of signage condition, bridges, ditches, culverts and running surfaces to identify potential driving hazards
- Enforcing speed limits for all mine traffic on roads
- Ensuring trucking/hauling contractors conduct and record regular vehicle maintenance, have Transportation of Dangerous Goods (TDG) training, radio contact capabilities, spill response training and response kits, personal protective equipment and copies of the project emergency response communication protocols and plans
- Ensuring trucking/hauling contractors have appropriate driver training, radio contact capabilities, engage in appropriate vehicle maintenance and carry appropriately sized emergency clean-up kits
- Providing haul monitoring and supervision and a driver feedback plan, and
- Ensuring appropriate emergency response and spill contingency training and knowledge, maintenance of equipment, materials and procedures to limit the consequences of such spills by prompt containment and clean up actions.

In addition, Project concentrate containers will be designed such that there is no wind loss (i.e., tarpaulin covered trailers). However, in the event of a truck upset on a bridge or adjacent to a watercourse, it is likely that concentrate would be released from the trailer and that concentrate could be spilled into the water body or watercourse.

If the preventive measures did not prevent an accident, an emergency response protocol would immediately be initiated.

Taseko Emergency Response Approach for a Concentrate Spill in Water

As per above, the emergency response approach for an in water concentrate haul spill are similar to those outline for fuel spills. These include:

- Notification of all agencies and responders (mine supervisor, PEP, RCMP) as per the emergency response plan
- Activation of spill handling procedures including assessing feasibility of containment, diverting of water away from truck/load and clean-up based on water body and flow rates, and
- Initiate immediate monitoring and assessment procedures.

In addition to the above, because the assumed spill is in water DFO would be notified and water quality, habitat and fish monitoring procedures would be implemented to assess short- and long-term effects and mitigation required.

Potential Environmental Effects

Based on the screening of potential interactions between an in water based concentrate haul spill and VECs (Table 2.7.6-2), the VECs that are most likely to be detrimentally affected are:

- Water Quality and Aquatic Ecosystems
- Fish and Fish Habitat
- Wildlife
- Human Health and Ecological Risk, and
- Traditional Land Use.

Interactions with all remaining VECs, apart from terrain stability that was ranked as a “0”, were ranked as “1” for reasons described below.

Atmospheric Environment: Expected that a spill wouldl result in a very localized release of particulates. Additional particulates would be generated during clean-up activities.

Hydrology and Hydrogeology: The volume of spilled material is not likely to affect surface water or ground water flow. As most streams and ponds are groundwater discharge zones, a spill would not affect ground water quality either.

Soil and Vegetation: The areal extent of a spill would be very small and clean-up activities would be expected to remove spilled concentrate within a short period (days). Rehabilitation of the site would help restore soils and vegetation and, eventually, wildlife use.

Archaeology: potential disturbances would likely be restricted to a small area in the direct vicinity of the road right-of-way (i.e., an already disturbed area); as a result, potential to affect archaeological sites would be low. In addition, if concentrate did spread beyond the road ROW, disturbances of land and riparian areas would be minimized until an archaeologist had determined that artefacts and sites would not be disturbed by clean-up activities.

Traditional Land Use: Impacts would be expected to be temporary and in the immediate vicinity of a spill. Effects to water quality are possible which could result in restrictions on cattle watering from the impacted water body until the concentrate source is removed by emergency and post-emergency cleanup activities. Notification to the nearby ranchers would be sufficient during this period.

Non-traditional Land Use: Commercial land users have access to large license areas for extended periods of time. Public users have access to a Crown land base that offers opportunities for multiple, substitute locations and experiences. A concentrate spill in water would be unlikely to affect measurable parameters for commercial activity (e.g. forestry, range, trapping, guide outfitting) even without mitigation while tourism and public recreation (including hunting and fishing) are primarily lake and land-based activities where any spill would not be expected to interfere or where a spill area could be avoided until conditions are normalized. While we are mindful of the potential adverse effects on downstream aquatic habitat and the sport fishery, we also recognize the preponderance of lake fishing, and alternative river sites, in the RSA and the opportunities that would continue to exist should a spill occur.

Water Quality and Aquatic Ecosystems

In the event that a fully loaded concentrate truck overturns and released its load into either a slow-flowing tributary of the Taseko River or a faster flowing river such as the Taseko or Chilcotin, the released concentrate could affect water quality and, through that mechanism, could affect aquatic organisms, including mortality of sensitive species.

There are no mitigations specific to water quality, although spill clean-up measures would be related to containment and removal of concentrate in addition to any vehicle fuels. The emergency response for a tributary would be to divert the watercourse around a spill area, and remove the concentrate using an excavator and vacuum truck where possible. Alternative or larger scale strategies would be needed for the Chilcotin River.

Similar to fuel spills, there is be a very low probability of such an event, given that the proportion of road near or over water is very low, However, such an event could have residual environmental effects.

Since ore concentrate has the consistency of sand, the immediate effect of a spill would be localized smothering of benthic habitat. However, because of the high levels of copper and other metals, and its fine texture, metals could start leaching into the water quickly. In addition, in the fast-flowing Chilcotin River, the concentrate could be moved downstream in the current. As a result, there could be acute effects downstream of a spill, and potentially longer term chronic effects downstream. Elevated copper levels in water and physical smothering of habitat could lead to lower abundance of benthic organisms and loss of sensitive species (lower biodiversity). Productivity in the affected area would be reinstated through recolonization from upstream, in as little as one year (depending on success of the clean-up).

Among the tributaries of the Taseko River crossed by the access road, Tête Angela Creek would be considered a worst case location for such an accident, given the relatively short distance of approximately 4 km between the road crossing and the Taseko River. During summer, the affected area could be isolated by redirecting stream flows around it, allowing machine access for the clean-up. With a quick response, it might be possible to limit the effects to Tête Angela Creek, with some transport of dissolved copper into the Taseko River. However, clean-up efforts would be more challenging during high flow (spring freshet), and movement of copper downstream into the Taseko River would be expected. Thus a short-term, high magnitude and local to regional effect could result from such a concentrate spill.

For a spill at the crossing of the fast flow Chilcotin River, the same physical smothering effects would occur in the immediate vicinity of a spill. However dissolved copper and particulate concentrate would be transported further downstream before clean-up could be completed, and the clean-up would be exacerbated by the volume and velocity of water. As a result, several kilometres of river habitat could be affected by the released. The area would be colonized by benthic organisms from upstream areas, although, depending on success of the remediation, effects could last for several years. Thus, a short to medium duration, high magnitude and regional effect could result from such a fuel spill, which would eventually be reversible. Such an event would not be considered significant, given that the benthic community would recover much of its productivity within a few years.

Follow-up water quality, sediment, biota monitoring would be conducted to assess short- and long-term effects and to identify any additional mitigations required. Analysis of metals in water and sediment from downstream areas would be useful in determining geographic extent of the effect and in monitoring changes over time. This would be conducted in conjunction with a benthic invertebrate community survey to assess biological responses.

Fish and Fish Habitat

A spill of concentrate to a large, fast moving river would likely result in the quick and widespread distribution of concentrate in a downstream direction. Some elevation in turbidity and total suspended solids (TSS) would occur until containment and diversion measures were in place.

A spill to a smaller, slower moving watercourse would likely result in localized smothering of bed material, with the gradual movement of concentrate downstream until containment and diversion measures were in place. Given the 24.55% copper in the concentrate, localized areas of elevated copper levels in sediment might also result from a spill. Turbidity and TSS would be expected to increase in a smaller receiving water body until containment and diversion measures were implemented.

Elevated TSS can affect behaviour and cause physiological stress in fish. For example, (Noggle 1978) reported 45% reduced feeding rates for Coho at 100 mg/L and cessation of feeding at 300 mg/L (Berg and Northcote 1985). Physiological stress and behavioural changes have been observed at 53.5 mg/L (Berg 1993).

The BC working sediment quality guidelines for copper are 35.7 ppm (threshold effect level [TEL]) and 197 ppm (probable effect level [PEL]). The TEL is the concentration below which adverse effects are rarely expected to occur, whereas the PEL is the concentration above which adverse effects are frequently expected to occur. Sediment copper levels resulting from concentrate spills above the TEL could have some adverse effects on aquatic life. Roman et al. (2007) reported a predicted No Effect Concentration (PNEC) for sediment of 3.3 to 47.1 mg copper/dry wt for five invertebrate species (*Gammarus pulex, Lumbriculus variegates, Hyalella azteca, Chironomus Riparius* and *Tubifex tubifex*) Roman et al. (2007) also identified median LC_{50} copper concentrations of 151 to 327 mg/kg dry wt.

Characterizing the potential effects on water and sediment quality would begin during the cleanup phase with in situ and analytical sample collection. In situ parameters would include pH, turbidity, total dissolved solids and conductivity. Analytical parameters would emphasize total and dissolved metals in water, and metals and pH in sediments.

TSS and turbidity monitoring would continue until these parameters reached background levels in the receiving water body (e.g., upstream from a spill site) or were consistent with the BC Approved water quality guidelines (2006) In situ and analytical sample collection would also continue until pH, metals and any other parameters of interest reached background levels, BC approved and working water and sediment quality guidelines (2006) or site-specific objectives agreed to by MOE.

Mitigation measures to limits impact on fish habitat would emphasize the physical removal of any spilled concentrate from accessible riparian and instream habitats. Instream habitats covered in spilled concentrate, or containing contaminated sediments resulting from a spill, would have to be physically restored (e.g., new pools excavated, or new spawning substrate added. Riparian habitat cleared to facilitate cleanup efforts would have to be replanted, with follow up monitoring programs to ensure the success of riparian restoration programs.

Residual effects of a concentrate spill to water could occur in areas that could not be accessed for cleanup, or where spilled concentrate has accumulated and resulted in elevated copper in sediments. This could result in localized areas causing sub-lethal effects on aquatic invertebrates, as they are in direct contact with sediment and would also be exposed to copper in pore water. These localized areas would remain a potential exposure route until the sediments were eroded and washed downstream, or were covered through natural sediment accumulation processes.

The residual effects could be significant on a temporal and spatial basis (0–4 years) and reversible with the appropriate mitigation plans to be implemented during spill clean-up and from a follow-up and monitoring program.

Wildlife

The assessment of a concentrate spill in water event on wildlife is directly related to the effects of such a spill on water quality and aquatic ecosystems, fish and fish habitat, and human health and ecological risk assessment. The results of these assessments are summarized in brief in this section. Wildlife as a whole is addressed in the human health and ecological risk assessment, while strictly aquatic organisms (fish, benthic invertebrates) are addressed in the other two sections.

The mechanisms for environmental effects associated with such an event include physical smothering of stream biota and stream and riparian habitat, physiological changes in fish behaviour and stress levels due to elevated TSS and turbidity, and the potential adverse (lethal and sublethal) effect of elevated copper levels on aquatic organisms.

There are no wildlife-specific mitigation measures. The mitigation measures described in general for this event (Table 2.7.6-1) and for fish and fish habitat, water quality and aquatic ecosystems, and human health and ecological risk assessment specifically would be applicable (e.g., removal of spilled concentrate, stream habitat restoration, temporary stream diversion).

The geographic extent and magnitude of the environmental effect on aquatic and semi-aquatic wildlife and wildlife habitat depends on a variety of factors (e.g., size and flow rate of receiving environment, weather conditions, success and type of response). The residual effects of a concentrate spill could include the loss or displacement of fish, amphibians and benthic invertebrates, reduced diversity of stream biota (through loss of sensitive species), destruction of stream habitat, localized areas of sediment contamination and general avoidance of the affected area by wildlife. Elevated copper levels in surface water are unlikely to be high enough to pose a potential acute risk to terrestrial wildlife consuming the water, or alter fish tissue copper levels over time.

It is anticipated the residual environmental effect of a concentrate spill into water would be temporary (zero to four years) and reversible. This residual effect could be significant. However, the magnitude and duration of the effect can be reduced and managed with the application of a well-defined emergency response plan, complemented by additional mitigation and compensation measures.

Water quality, TSS, turbidity, sediment, habitat restoration, and biota monitoring and follow-up programs would be conducted to assess the short- and long-term effects of this type of spill, and to identify any additional mitigations required. However, in general, the monitoring and follow-up programs proposed for fish and fish habitat and water quality and aquatic ecosystems are considered adequate to address wildlife concerns.

Human Health and Ecological Risk

If the concentrate was spilled into a water body, there would be a potential increase in surface water metal concentrations. It is unlikely that the resulting concentrations would be high enough to pose a potential acute risk to terrestrial wildlife consuming the water, or even if humans were in the area hunting and were to drink water from the affected water body. This is based on the qualitative understanding that acute toxicity requires exposure to very high concentrations of metals in water.

Given the assumption that such a spill would result in 40 tonnes of concentrate being deposited into the water body, it is not known how this would alter fish body burden concentrations over the long-term. Therefore, chronic effects to human and ecological health could not be quantitatively predicted.

Clean-up procedures would be similar to those described above for leakage of tailings or reclaim pipeline to water and are detailed in Table 2.7.6-1. If possible, containment and clean-up of concentrate in the water body would be conducted and potentially consideration of diverting water away from truck / load would occur.

Overall, it is unlikely that there would be an acute effect to either terrestrial or avian species in the event of a concentrate spill to water. Depending on the volume spilled and the physical characteristics of the receiving water body, there is a potential that effects on aquatic resources and the concentration of metals in the water could have a long-term residual effect on fish tissue (for consumption) and drinking water in the area.

In the event of an accidental spill of concentrate to water, the follow-up and monitoring steps detailed in Table 2.7.6-1 would be sufficient for the protection of human and ecological health. Depending on the magnitude of a spill this would include the implementation of water quality, and potentially sediment quality, monitoring in the affected water body. If metal concentrations remain below conservative risk-based water and/or sediment quality objectives then there would be no significant risk to ecosystems or human health.

If through monitoring, concentrations of metals in water and/or fish were elevated over background concentrations, Taseko would undertake a risk assessment to ascertain if the levels were of a sufficient concentration to pose a potential risk.

ROAD CULVERT FAILURE

Scenario Description

There is a low probability that during the life of the Project a road culvert could fail resulting in bank erosion and increased sedimentation that could affect downstream water quality and aquatic habitat. Nonetheless the impacts and potential responses are considered here as required by the EIS guidelines.

For the purpose of evaluating this scenario, it was assumed that a culvert across Taseko Lake Road was blocked, causing ponding above the road, bank erosion, and increased sedimentation release into Upper Fish Creek and Taseko Rivers.

Project Design Measures to Minimize Risk of a Road Culvert Failure

To minimize the potential for a road culvert failure that could result in bank erosion and increased sedimentation, Taseko will implement the following suite of measures:

- Ensure regular road maintenance
- Design and install culverts to accommodate frequent extreme storm events, and include engineered debris gates in front of culverts
- Conduct monitoring of the condition of culvert and debris traps (if present), and
- Assess culvert condition during and after storm events.

If the preventive measures did not prevent an accident, an emergency response protocol would immediately be initiated.

Taseko Emergency Response Approach for a Road Culvert Failure

If all precautionary and preventative measures did not prevent a road culvert failure, an emergency response protocol would be initiated that involves:

- Conduct initial response and notification (mine supervisor, PEP, MOE, MOT, RCMP) as per emergency response plan
- Activate emergency response groups, including mine site contractors for remediation, and
- If sufficient water is ponded above the road as a result of the blockage, notification of immediate downstream or adjacent residents could be required.

Potential Environmental Effects

Based on the screening of potential interactions between a road culvert and VECs (Table 2.7.6-2), the VECs that are most likely to be detrimentally affected are: Terrain Stability and Soil.

Interactions with all remaining VECs, apart from human health and ecological risk that was ranked as a "0", were ranked as "1" for reasons described below.

Atmospheric Environment: it is expected that some particulates could be generated during clean-up activities.

Hydrology and hydrogeology: Any flooding associated with a blocked culvert would not result in substantial changes to surface hydrology or hydrogeology outside of the immediate area of the blockage.

Water Quality, Aquatic Ecology and Fish and Fish Habitat: effects are expected to be low given that the area of any effect would be highly localized. In addition, effects on these VECs would be minimized through spill response measures and codified environmental protection practices (Section 2.8.1: Environmental Management Plans) that are known to effectively mitigate the predicted environmental effects.

Vegetation, Wildlife, Traditional Use and Non-traditional Land Use: while localized effects could occur, these effects would only affect a small area and would only persist for days after the culvert blockage is remedied.

Archaeology: potential disturbances would likely be restricted to a small area in the direct vicinity of the road right-of-way (i.e., an already disturbed area); as a result, potential to affect archaeological sites would be low. In addition, land disturbance during restoration of the culvert would be minimized until an archaeologist had determined that artefacts and sites would not be disturbed by clean-up activities.

Terrain Stability and Soil

The potential for road culvert failure can happen due to unpredicted events such as heavy rainfall or rapid snowmelt. The likelihood of such a failure occurring is low due to the relatively subdued nature of the topography coupled with preventative measures including:

- Regular road maintenance
- Appropriate sizing of culverts (design stage)
- Monitoring of debris traps and culvert condition

- Assessing culvert condition during and after storm events, and
- Regular maintenance.

However, terrain stability could become compromised when preventative measures are unable to prevent ponded water above the road as a result of a culvert blockage or damage. The ponded water can cause increased pore pressure in the sediment resulting in a change in natural terrain stability upslope from the road.

Areas where culverts are required often are associated with incised landscape features including gullies, seepage areas and natural drainages including creeks and rivers. In this scenario the area is near Fish Creek and Taseko River. These areas inherently have slope conditions and geomorphic processes that could make them predisposed or at risk of mass wasting.

The most effective way to mitigate the effects of mass wasting is in proper road design. Detailed terrain assessments prior to road construction allow for the identification of material type, stratigraphy, depth to bedrock, slopes, topography and locations of hazardous terrain. This information allows for the proper design of roads including appropriate culvert size, and if possible, the avoidance of hazardous terrain. Once the road is constructed preventative measures as outlined above further reduce the probability and scale of a mass wasting event.

In the event of a road culvert failure, re-establishing terrain stability is one of the first requirements to protect human safety, water supplies, water quality, fish habitat, and re-establish landscape aesthetics, vegetation and recreational use of the area. For this reason, the timely response in the event of a road culvert failure is to act on stabilizing the terrain.

The *Mines Act* is very explicit in the mitigation measures to be followed in the event of a mass wasting event. These mitigation measures also are effective in the event of road culvert failures. The measures include:

1. Restorative activities would be designed and implemented by a qualified person to minimize further mass wasting events such as landslides, channelized debris or mud flow, and gully bank destabilization.
2. Mitigation measures that would be implemented after a road culvert failure has occurred to address terrain stability include:
   - Stabilize any disturbed areas, and
   - Ensure a geotechnical engineer prepares a terrain remediation plan in a timely manner (e.g., within 30 days).

If a mass wasting event does occur due to compromised terrain stability, which in this scenario could result from failure of a road culvert resulting in bank erosion, a residual effect is anticipated. With preventative mitigation, the likelihood of a mass wasting event is minimal. However, with unforeseen storm events, a change in terrain stability can occur within hours to days. If mass wasting did occur, there could be changes from baseline conditions. The change is non-reversible, sporadic in frequency and is site specific. The magnitude is considered low if the area of terrain stability is not increased and stabilization efforts are effective.

The changes to terrain stability are permanent, but a new equilibrium for terrain stability can be established and allow for the previous land use to occur. Modifications to road design may be required, but overall rating of the effect is not significant as prior land uses can be re-established quickly.

In the event that an event such as a road culvert failure occurs follow-up and monitoring would be appropriate to:

1. Determine whether the preventative and mitigation measures employed have achieved terrain stability
2. Check for renewed erosion or instability (frequency of monitoring program would depend on effectiveness of mitigation), and
3. Inspect revegetation progress (effectiveness would be visible within one growing season, if not deemed successful, additional inspections could be required).

EXCESSIVE WATER IN TAILINGS STORAGE FACILITY

Scenario Description

There is a low probability that during the life of the mine storm events could result in excessive water in the TSF. Nonetheless the impacts and potential responses are considered here as required by the EIS guidelines.

If this situation resulted in off-spec volumes of water discharged into the environment there could be an effect on downstream aquatic habitat and water quality.

Project Design Measures to Minimize Risk of Excessive Water in TSF

To minimize the potential for excessive water in the TSF resulting in off-spec volumes of water being discharged to the environment, Taseko will implement the following suite of measures:

- Conduct annual reviews by an accredited consultant of tailings hydrological model, operation/construction of the tailings complex, and water balances based on site collected meteorological data
- Ensure all dams are built to maintain annual volumes of tailings release as well as the maximum potential storm events while maintaining a design freeboard criterion
- Ensure upstream diversion structures for fresh water accommodate maximum storm events with safeguards in place to minimize blockage, and

If the preventive measures did not prevent ongoing accumulation of water in the TSF, an emergency response protocol would immediately be initiated.

Taseko Emergency Response Approach for Excessive Water in Tailings Storage Facility

If all precautionary and preventative measures did not prevent excessive water in the TSF, an emergency response protocol would be initiated that involves:

- Conduct an initial response and notification (mine supervisor, MOE)
- Conduct monitoring of TSF to ensure containment is maintained
- If discharge is necessary to maintain integrity of TSF, initiate MOE notification process and implement next phase of emergency response plan, and

- If water quality is suitable to release to the environment, then by-pass to downstream environment into Fish Creek. If water quality is not suitable, the tailings water should be bypassed to the open pit, which could require some short-term rescheduling of mining sequences.

Potential Environmental Effects

Based on the screening of potential interactions between excessive water in the TSF and VECs (Table 2.7.6-2), none of the VECs are likely to be detrimentally affected. For ten VECs the effect of this event was ranked as a "0" and, therefore, was scoped out of this assessment. Interactions with the two remaining VECs were ranked as "1" for reasons described below.

Water Quality and Aquatic Ecology: Under the most likely scenario, excess water would remain contained within the TSF and no impacts would occur to human health or the environment. However, considering the case where an emergency discharge from the TSF containing excess water is necessary to maintain structural integrity of the TSF, short duration water quality impacts are possible. Dilution of tailings water by the large inflow necessary to cause this issue to arise is expected to reduce concentrations of contaminants of concern in the discharge. With notification to applicable agencies, regulating the discharge rate and limiting the duration of the discharge is expected to result in no detrimental impact to the receiving waters and their biota.

Fish and Fish Habitat: The impact to fish and fish habitat is expected to be minimal, as described above.

LOSS OF POWER TO TAILINGS STORAGE FACILITY SEEPAGE RECOVERY

Scenario Description

There is a possibility that during the life of the mine a storm event could result in loss of power resulting in a temporary loss of the ability to reclaim seepage from the TSF seepage collection ponds and the potential to overflow into the inlets to Fish Lake.

Project Design Measures to Minimize Risk of Loss of Power to Tailings Storage Facility Seepage Recovery

To minimize the potential for a loss of power to TSF seepage recovery Taseko will implement the following suite of measures"

- Conduct annual reviews by an accredited consultant of tailings hydrological model, operation/construction of tailings complex, and water balances based on site collected meteorological data
- Ensure sufficient reserve capacity in the pond to hold excessive run-off and seepage to withstand storm events for the number of days recommended by hydrological model, and
- Access to backup (diesel) power generation and pumps.

If the preventive measures did not prevent an accident, an emergency response protocol would immediately be initiated.

Taseko Emergency Response Approach for Loss of Power to Tailings Storage Facility Seepage Recovery

If all precautionary and preventative measures did not prevent a loss of power to TSF seepage recovery, an emergency response protocol would be initiated that involves:

- Conduct initial response and notification (mine supervisor, MOE), and
- Initiate immediate assessment of potential health and safety effects.

In the possible event that unsuitable water is released to downstream environments an initial response and notification (mine supervisor, PEP, MOE, DFO) would be initiated as per the emergency response plan, including notification of downstream users; activation of emergency response groups; and initiation of monitoring and assessment procedures.

Potential Environmental Effects

Based on the screening of potential interactions between a loss of power to TSF seepage recovery and VECs (Table 2.7.6-2), none of the VECs are likely to be detrimentally affected. Details of preventative measures that deal with stability and potential erosion are addressed in the mine design plan.

Any excessive water should be contained in retention ponds and collection ditches, therefore 10 interactions have all been ranked as “0”. Interactions with the two remaining VECs were ranked as “1” for reasons described below:

Water Quality and Aquatic Ecology: Under most conditions, the loss of power would be temporary and existing containment in the TSF and seepage collection ponds would be sufficient to maintain a closed system. In the unlikely event that power is not restored and emergency power and pumping cannot maintain containment, there is the potential for a release to the environment to occur. While the quality of this water is expected to be satisfactory, as a result of the significant dilution provided by a large rainfall event or snow melt, it would be necessary to monitor the quality of the water and evaluate the conditions further. If impacts were determined to be possible, a high priority would be placed on reinstatement of the containment.

Fish and Fish Habitat: The impact to fish and fish habitat would be expected to be minimal, as any release of water under these circumstances would have dilute concentrations of metals and nutrients, and would be of a short duration, preventing water quality effects on fish in the receiving waters.

STORM EVENT IN EXCESS OF THE DESIGN EVENT FOR THE FISH LAKE FLOOD CONTROL DAMS

Scenario Description

There is a low probability that during the life of the mine a storm event in excess of the design event for the Fish Lake Control Dams could result in water being released from Fish Lake into the pit, thereby potentially affecting pit operations. Nonetheless the impacts and potential responses are considered here as required by the EIS guidelines.

Project Design Measures to Minimize Risk of a Storm Event exceeding the Fish Lake Flood Control Dams

To minimize the potential for a storm event exceeding the Fish Lake Flood Control dams and potentially affecting pit operations, Taseko will implement the following suite of measures:

- Conduct annual reviews by an accredited consultant of hydrological modelling and water balances based on site collected meteorological data
- Ensure sufficient pumping capacity in the pond to manage a greater flood event through pumping of the excess water around the pit to Fish Creek
- Observe the weather closely and increase pumping for the Lake prior to an anticipated event in order to increase storm storage capacity, and
- Access to backup (diesel) power generation and pumps to increase temporary pumping capacity.

If the preventive measures did not prevent an accident, an emergency response protocol would immediately be initiated.

Taseko Emergency Response Approach for a Storm Event exceeding the Fish Lake Flood Control Dams

If all precautionary and preventative measures did not prevent a storm event from exceeding the Fish Lake Flood Control dams, an emergency response protocol would be initiated that involves:

- Conduct initial response and notification (mine supervisor, MOE), and
- Initiate immediate assessment of potential health and safety effects.

In the possible event that water is released to downstream environments an initial response and notification (mine supervisor, PEP, MOE, DFO) would be initiated as per the emergency response plan, including notification of downstream users; activation of emergency response groups; and initiation of monitoring and assessment procedures.

Potential Environmental Effects

Based on the screening of potential interactions between a storm event exceeding the Fish Lake Flood Control Dam and VECs (Table 2.7.6-2), none of the VECs are likely to be detrimentally affected. Details of preventative measures that deal with stability and potential erosion are addressed in the mine design plan.

Any excessive water should be contained in retention ponds and collection ditches, therefore 11 interactions have all been ranked as “0”. Interactions with the one remaining VEC was ranked as “1” for reasons described below:

Water Quality and Aquatic Ecology: The Fish Lake Flood Control Dams are designed to contain a 1:200 year return period storm event. With a mine life of only 20 years, the probability is already low that this event would occur in the mine life stated. Regardless, should a storm event exceed this threshold, the excess water would be pumped around the pit to Fish Creek. This management of the water would allow for flows in the creek to increase temporarily. Since there are substantial operational and closure flow reductions in Lower Fish Creek due to the mine plan, this temporary pumping of the excess flood water in Fish Lake would likely restore creek flows closer to baseline values while the pumps are operating.

2.7.7 Effects of the Environment on the Project

The definition of an “environmental effect” under CEAA includes any change to the Project that may be caused by the environment.

A significant effect on the Project is considered to be one that results in:

- Damage to site infrastructure (e.g. tailings storage facility, transmission line, waste storage sites) that may result in risk to public health and safety, and
- A long-term interruption in service.

Minor effects are considered to be ones that result in:

- Significant alterations to the construction schedule
- Increased operating or maintenance costs, and
- A short-term interruption in service.

The Application considers the following types of natural environmental issues or events that could have an effect on the Project:

- Extreme weather (severe rainstorms, snow storms, wind, drought), and the potential of climate change to increase rainfall
- Forest fires and the potential amplifying effect of Mountain Pine Beetle (MPB), and
- Seismic activity.

Details of a number of planning, design, construction, and management strategies intended to minimize the potential environmental effects of the environment on the Project are described throughout the EIS. A summary of these considerations is provided below. If an accident, malfunction, or unplanned event occurs as a result of effects of the environment on the Project, clean-up procedures and measures to protect workers and the public in the vicinity of the Project will be put into place.

EXTREME WEATHER EVENTS

Severe Rainstorms

The extreme daily rainfall for the area is 34.3 mm (July 1964). Catastrophic rainstorms could cause accumulation of several centimetres of precipitation in a 24-hour period, resulting in several million cubic metres of water being rapidly added to the catchment. Severe rainstorms and related surface runoff could trigger debris flows on the over-steepened valley walls of the mine area and access corridor.

Mitigations for such an event include:

- The TSF will be designed to contain the Inflow Design Flood (IDF) volume from a 72-hour storm event, defined as 2/3 between the 1/1000 flood and the Probable Maximum Flood (meeting the Dam Classification design criteria, as defined by the Canadian Dam Association “Dam Safety Guidelines 2007). In addition, this IDF event is considered sufficient to manage any net increases in precipitation due to climate change.
- Newly constructed water management structures (ditches, ponds, etc.) will be designed to manage a return-period event longer than the duration of the mine operation (>20 years). The effect of climate change on the duration curves will be evaluated and the new values applied to the design of the water management structures.

- The proponent will work with the lease holder and Ministry of Highways as necessary to address the impact of severe rainstorms on existing small bridges and culverts.

Snow Storms

Extreme daily snowfall for the area is 42.7 mm (December 1968). High levels of snowfall could impede the movement of mobile equipment on the access road and at the mine site. Related problems could include reduced traction by vehicles and reduced visibility during snowstorms. Fog could also reduce visibility at the mine site. Buildings exposed to large accumulations of snow could experience structural damage, or collapse.

Mitigations for snowstorms include:

- As appropriate designs will follow Part 4 of the Building Code.
- The proponent will work with the lease holder and Ministry of Highways to remove excess snow from existing roadways and will remove excess snow from active mining areas as necessary. The mine production fleet will include equipment, such as snow plows, sand-trucks, graders, loaders, trucks and scrapers, to clear snow.
- Crushed aggregate will be produced to spread on the roads for improved traction.
- Storm-related visibility issues at the mine site will be addressed with the development of operating protocols to ensure safe and efficient traffic flow during periods of reduced visibility.
- Cable stands will be utilized, where necessary, to elevate pit equipment electrical cable from snow and ice.
- Buildings will be designed to meet building code requirements to withstand roof loading from snow and associated rain (based on the 1 in 50 year ground snow load).

Wind

High-velocity winds could create large waves in the tailings pond and damage buildings and power lines.

Mitigations include:

- Buildings will be designed per Part 4 of the Building Code.
- The TSF will be developed with significant tailings beaches (about 1000 m wide from the dam crest to pond), thereby keeping any waves a long distance from the embankments. Furthermore, under full flood storage conditions for the IDF event, the TSF filling schedule has been developed to maintain a minimum 1-m wave-run-up protection above the supernatant pond.

Drought

A significant reduction in the accumulated annual rain and snowfall would: reduce the runoff entering the tailings management structures and the open pit, thereby decreasing the dilution of mine discharge waters into the receiving environment. During droughts, there is also the potential for low-level effects to aquatic receptors due to changes in water quality from filter plant effluent discharge (for increased risk of forest fires, see the section below).

Mitigations include:

- The TSF operating pond is designed to have a minimum pond volume with an operating buffer under average conditions. Consecutive dry years may require diversion of excess water from the eastern part of the Fish Creek catchment to augment the TSF Pond volume.
- Water will not be released into the receiving environment from the mine site until the post closure period, currently estimated to begin at Year 44 of the mine life. Water quality monitoring anticipated to

be conducted throughout the life of the mine will provide opportunities to develop and implement appropriate treatment strategies prior to release if necessary.

FOREST FIRES

The primary effects of a fire in the mine site area would be a loss of infrastructure (process plant, mill, accommodations buildings) and operating delays. Depending on the size of the crossing and the severity of the fire, damage or loss of bridges along the access corridor caused by a fire could restrict road access to the mine site from half a day up to two weeks. Extensive dead timber due to the MPB could increase the risk and intensity of fire.

- Fire-fighting equipment will exist as part of the Health and Safety system for the mine. This equipment, as well as employee awareness training to assist the prevention of forest fires, will minimize the potential for forest fires to affect the Project.
- A safety plan will be developed that describes appropriate procedures and protocols to effectively deal with hazards including hazard evaluation, appropriate control procedures and protocols, personal protective equipment to be used, air and water monitoring protocols and specifications, confined space entry procedures, and detailed fire-fighting procedures.
- Personnel not involved in containing a fire from work areas or camps will be gathered at muster stations and evacuated.
- Water pumps and fire-fighting equipment will be strategically located around the mine site.
- Vegetation that could be fuel for fire will be removed from around mine infrastructure.
- Steel sub-structures will be incorporated into bridge designs, leaving only the wooden decks vulnerable to fire.
- Backup generators at the mine site will have enough power capacity to operate essential equipment around the sites in case of transmission line loss.
- A spare transmission line conductor will be stored on site to expedite repairs.

SEISMIC ACTIVITY (EARTHQUAKES)

The Project is located in a seismically stable region of Canada. Nonetheless all Project components could potentially be affected by a seismic event, and the appropriate codes such as Part 4 of the Building Code will be implemented.

Of all the structures the tailings embankment has the potential for being most affected and for having the greatest impact if it failed. The design and construction of TSF embankments will be done per Canadian Dam Association's "*Dam Safety Guidelines*" 2007. Embankment dams will be designed to safely withstand seismic ground motions from the maximum design earthquake, defined according to the Dam Classification and based on the criteria specified by the Canadian Dam Association's Dam Safety Guidelines. For the Main Embankment, the maximum design earthquake is defined as the 1 in 5000 year earthquake with a maximum ground acceleration of 0.42 g and design earthquake magnitude of 7.5.

2.7.8 Capacity of Renewable Resources

The issue of the Project's impacts on renewable resources was assessed in detail througout Section 2.7. The physical renewable resources assessed were the atmospheric environment and surface and ground water. For the biotic environment the assessed were water quality and aquatic ecology, fish and fish habitat, soils, vegetation, and wildlife. After consideration of the Project's design, the best management practices that would be employed, and the project-specific mitigations developed where needed, the determination for all renewable resources is that the project will not have significant effects. While the measure for significance is specific to each resource, generically significance is determined by a regulatory standard or a threshold based on community values or management objectives. None of the Project's residual effects exceeded these standards or thresholds and were therefore determined to be not significant. Section 2.7 contains assessment details supporting the conclusions of the project not having significant effects on the capacity of renewable resources.

In addition to the assessment of physical renewable resources and the biotic environment, Section 2.7 also assesses Project specific and cumulative effects on Resource Uses for the following: land use objectives; forestry; agriculture and ranching; fishing; hunting; public recreation; tourism; and trapping. No significant negative effects by the Project were determined. For some the effect was positive.

2.8 ENVIRONMENTAL MANAGEMENT

The following section outlines an Environmental Management System (EMS) for the New Prosperity Project.

An overview of the Environmental Management Plans (EMPs) is provided in Section 2.8.1. This series of written plans that will comprise the EMS will be designed to form the basis for more detailed procedures to be developed concurrent with project permitting and associated construction and commissioning phases.

The Decommissioning and Closure Plan is provided in Section 2.8.2.

Section 2.8.3 presents Monitoring and Follow-up Programs, and discusses adaptive management as a means of addressing unforeseen effects or for correcting exceedences.

The EMS is a structured system that Taseko will utilize to manage its regulatory and environmental commitments in a cost efficient manner. It is also a tool that will control New Prosperity Project's environmental effects as identified during the Environmental Assessment.

Environmental Policy

Taseko is committed to continual improvement in the protection of human health and stewardship of the natural environment.

In order to fulfill this commitment throughout all stages of development, construction, operation and closure of the New Prosperity Project, Taseko will:

1. prevent pollution, within the bounds of the operation
2. comply with relevant environmental legislation, regulations, and corporate requirements
3. integrate environmental policies, programs, and practices into all activities regarding the Project
4. ensure that all employees understand their environmental responsibilities and encourage dialogue on environmental issues
5. develop, maintain, and test emergency preparedness plans to ensure protection of the environment, workers and the public
6. work with Government and the public to develop effective and efficient measures to improve protection of the environment, based on sound science
7. establish and maintain an environmental committee to review environmental performance and ensure continued recognition of environmental issues as a high priority

Objectives and Targets

Table 2.8-1 outlines the priority objectives required to ensure New Prosperity meets the Environmental Policy. Measurable targets and performance indicators will be set for each environmental component with the approvals and permits.

Table 2.8-1 New Prosperity Project–Priority Objectives

Surface Water and Groundwater	Prevent offsite impacts on water quality due to mining activity
Fisheries (Loss of Fish and Fish Habitat)	Preserve Fish Lake and is fishery; implement a successful fish compensation plan
Air Emissions	Achieve or beat target air emissions objectives
Wildlife and habitat	Minimize land disturbance and practice progressive reclamation; implement a habitat compensation plan

Regulatory/Legal Requirements

Taseko will implement measures to ensure compliance and review reporting performance with relevant environmental legislation and industry standards. Environmental Management Plans will reference and comply with legislation and regulations that will apply to the Project. Applicable legislation and regulations at the time of writing include but are not limited to:

- *Canadian Environmental Protection Act*
- *Transportation of Dangerous Goods Act*
- *Species at Risk Act*
- *Fisheries Act*
- *Navigable Waters Protection Act*
- *Environmental Management Act*
- *Water Act*
- *Forest and Range Practices Act*
- *Weed Control Act*
- *Mines Act*
- *Wildlife Act*
- *Fisheries Act*
- *Heritage Conservation Act*

Environmental Management Team

Essential to the success of any EMS is the clear understanding of the roles, responsibilities, and level of authority that employees and contractors have when working at the mine site.

For the New Prosperity Project, it will be Taseko's responsibility to clearly define and communicate roles, responsibilities and authorities for implementing the project's EMS. This will achieve effective environmental management in line with the environmental policy and permit conditions specified by the regulatory authorities. Taseko will appoint a qualified person to ensure that EMS requirements are established, implemented and maintained, and that performance of the EMS is reported to management for review and action. EMS policies, programs and practices will be integrated into management plans and operational controls wherever practical.

All documentation associated with New Prosperity's EMS will clearly state who is responsible for ensuring the requirements defined are fulfilled. Taseko will be responsible for overall management of the mine and will therefore be responsible to establish employment agreements for employees and contractors, to communicate environmental requirements to them, and to conduct periodic reviews of performance against stated requirements.

The following individuals or positions will play key roles in environmental management for the New Prosperity Mine. Currently planned division of responsibilities is as follows, with details to be finalized in a Responsibility Procedure as the Project advances.

Vice President, Operations is responsible for ensuring that adequate resources are available to the EMS and that site personnel are fulfilling their responsibilities required to achieve environmental commitments.

New Prosperity General Manager is a Taseko employee reporting to the Vice President, Operations, and is responsible for environmental performance as one aspect of his/her overall responsibility for mine operations. The position is responsible for ensuring compliance with environmental requirements and performance of the New Prosperity Project during construction and operations. This position is directly responsible for ensuring that operations carried out by Taseko employees and contractors conform to the plans and standards established in the EMS and that they meet regulatory requirements. The General Manager will support and ensure the integration of EMS programs into project operations and is responsible for allocating adequate resources for EMS implementation. This position also reports actual or anticipated non-compliance and non-performance to Taseko corporate and to regulatory agencies in a timely manner.

Operational Department Heads, reporting to the General Manager, will be responsible for effective implementation of the EMS to achieve environmental permit compliance and uphold the commitments of the Environmental Policy. Issues of non-compliance will be reported to the New Prosperity General Manager.

An Environmental Superintendent, reporting to the General Manager will be responsible for monitoring the performance of the EMS and reporting any actual or anticipated non-compliance or non-performance to the respective Department Head. The Superintendent, like every employee at New Prosperity, has the authority and responsibility to stop a specific activity if there is an environmental issue. The Environmental Coordinator is directly responsible for ensuring that environmental monitoring is undertaken in compliance with regulatory requirements, and for meeting environmental regulatory reporting requirements, including: reporting under the Mine and Reclamation Permit, Waste Management Permit, and other permits, licenses and approvals. The Environmental Coordinator will work with operational staff to plan and implement progressive reclamation, and to monitor performance of mitigation and management systems. This person will also assess needs and develop plans for contingency measures, if monitoring and surveillance plans indicate this is required. This position will also be responsible for the delivery of environmental site orientation and environmental awareness training to all employees.

Environmental Coordinator and Technicians, reporting to the Environmental Superintendent, will be responsible for environmental field sampling and construction monitoring and for compiling this data into reportable formats

Periodically, there will be a need for consultants and students to provide additional environmental support services.

Direct responsibility and accountability for environmental performance and safety rests with all management and supervisory staff of all departments under the direction of the Department Head. Supervisors are responsible for ensuring that workers are properly instructed to work in an environmentally appropriate manner, and to meet standards associated with their specific jobs. They will be supported in the delivery and documentation of the environmental policy, operational procedures, training materials, inspections, task observations, and auditing by the Environmental Coordinator.

All permanent and contract employees have the responsibility to adhere to the procedures, guidelines, plans, and environmental objectives in their area of responsibility and for immediately reporting any environmental issue to the respective Department Head or to the Environmental Coordinator. All site personnel, whether Taseko employee or contract worker, will be held accountable to work in a safe and environmentally responsible manner. Further to this, all worksite personnel will be expected to work in accordance with all Taseko environmental and safety policies and management systems.

Training and Awareness

Work activities that could create an impact upon the environment will be identified so as to schedule appropriate personnel training. Mechanisms will be put in place to ensure employees, contractors and other agents associated with the Project are aware of any potential environmental impacts of their work activities, and their roles and responsibilities in conforming to the Project's EMS policies.

The Human Resources Department will conduct formal training on the Environmental Emergency Response and spill response plans at New Prosperity. All newly hired employees, contractors and consultants will be briefed on the plan and all employees are informed periodically on any changes and updates to the plan. These plans will be subjected to periodic testing to ensure that training and awareness of policies and procedures are at an acceptable level and to ensure that the procedures are adequate.

Internal and External Communications Policy

Effective EMS implementation requires good communication between various levels and functions within the company, and between the company and stakeholders. Procedures will be established to maintain suitable internal or external communications channels for situations such as accidents, incidents and emergencies, and for statements of environmental performance. In addition, a process will be developed for:

- communicating internally to employees
- receiving documenting and responding to communication from external interested parties
- communicating significant environmental aspects within the Company and externally

Documentation and Document Control

A combination of procedures and management techniques, such as environmental management plans and monitoring programs, will be used to assist New Prosperity in fulfilling its policy requirements and the conditions of regulatory bodies and other stakeholders. Document control procedures will be developed to ensure that documents are readily available and particularly that current versions of relevant documents are available for use by employees. Procedures will be in place to ensure documents can be easily located, periodically reviewed, updated and approved.

Emergency Preparedness

The EMS will assist personnel to identify the potential for uncontrolled situations and to prepare themselves in the advent of their occurrence. Information from the environmental impact assessment process (including specialist studies, stakeholder input, and permitting requirements) will be used to compile a list of significant issues and activities. These issues and activities may require some means of control, such as management plans, physical infrastructure, and monitoring programs. Procedures will be established for responding to actual and potential accidents, incidents and emergency situations with the aim of preventing and mitigating their effects. Emergency preparedness will be tested where practicable, and systems and procedures will be reviewed following each emergency incident.

Monitoring

Specific programs will be developed to monitor the key characteristics of the project's operations and activities that are considered as having potential for a significant effect on the environment. A list of environmental and socioeconomic aspects and associated impacts will also be used as a reference to identify the legal requirements that are applicable to the project. Ongoing compliance with legal requirements will be monitored and, where necessary, reported to relevant parties. Data from monitoring and measurement will be analyzed and compared with performance criteria or predictions, or to determine compliance. Non-compliance investigations will be performed as necessary to ascertain the causes and to provide guidance for the implementation of solutions.

Incidents and Non-conformance Reporting

The Environmental Management Plans will describe methods and responsibilities for how incidents and non-conformances against specified operating criteria are recorded and reported. Corrective and preventive action implementation procedures will be established to guide the mitigation of any resulting environmental effects. Investigations into cause and effect will be conducted as appropriate.

Environmental Audits

The EMS will define the frequency and scope of internal and external audits to verify the company's conformance with specified environmental management requirements and conditions established by regulatory bodies. Audits will also assess the effectiveness of the EMS and identify opportunities for improvement.

Management Review

New Prosperity's environmental committee and management team will carry out reviews of the EMS and its programs to ensure they continue to effectively meet the needs at the site. Quarterly reporting to Management is proposed during operations, with a formal annual Management Review.

Where appropriate, changes to EMS policy and systems may be approved by the General Manager, and the outcomes will be recorded and reported as necessary.

2.8.1 Environmental Management Plans

The EMPs form an integral part of the project, as they provide guidance on all environmental aspects during the construction, operations and decommissioning phases. They convert the proposed environmental assessment mitigation measures into actions that are intended to minimize and, where possible, eliminate environmental impacts associated with the project.

The EMP overviews provided in this section have been developed to provide a description of procedures and records that will be further developed in compliance with both regulatory requirements as well as New Prosperity's environmental policy. All plans are presented at the conceptual level as the project has not yet been given approval or obtained permits requiring detailed engineering plans.

The objectives of the EMPs may include but are not limited to the following:

- To identify environmental protection issues for each discipline (e.g. terrain and soils, wildlife) as they pertain to each phase of the Project
- To identify the environmental protection requirements for mitigating identified environmental risks
- To provide a tool for achieving those requirements in the field, and more generally, and
- To provide supporting information for environmental permit applications.

The EMPs will define the roles of Taseko, contractors, and subcontractors by:

- Serving as a reference document for Project personnel when planning and conducting specific environmental management activities and mitigation measures, and
- Establishing the scope of the procedures (to be prepared by Taseko personnel or contractors), including the contractors' specific environmental management responsibilities.

Finally, the EMPs will outline communication requirements by:

- Specifying a mechanism for communication of revisions to the procedures due to changes in site conditions, and
- Establishing a framework for environmental incident reporting.

Appropriate EMPs will be provided to contractors submitting tenders at each phase of the Project. It may be necessary to prepare separate procedures for individual components of the Project, due to activity- and site-specific differences.

Conceptual management plans are provided in the following section and cross-referencing to those listed in the order of the EIS guidelines is provided below:

Table 2.8.1-1 Conceptual Management Plans

EIS Guidelines	Plan in this EIS Document
Construction Management	a) Construction Management Plan
Access Management	b) Access Management Plan
Tailings Impoundment Operations Plan	c) Tailings Impoundment Operations Plan
Materials Handling (non-mined materials)	d) Materials Handling (non-mined materials) and Waste Management Plan
Emergency Response and Spill Contingency	e) Emergency Response Plan (for Spill Contingency see plan d)
Geotechnical Stability Monitoring	f) Geotechnical Stability Monitoring
Soil Salvage and Storage Plan	g) Soil Handling Plan
Surface Erosion Prevention and Sediment Control	h) Surface Erosion Control and Sediment Retention Plan
Air Quality Management Plan	i) Air and Noise Management Plan
Noise Management	i) Air and Noise Management Plan
Water quality/quantity management and monitoring	j) Water Management Plan
Solid Waste Management	d) Materials Handling (non-mined materials) and Waste Management Plan
ARD/ML management for mine waste	k) Mine Materials Handling and ARD/ML Management
Vegetation Management Plan, including invasive species	l) Vegetation and Wildlife Management Plan
Protection of migratory birds	See Section 2.7.2.8 and Appendices for Habitat Compensation Plan references
Bear-human and wolf-human conflict management	l) Vegetation and Wildlife Management Plan
Cultural and Heritage Protection	m) Cultural and Heritage Protection Plan
Reclamation and Closure	See Section 2.8.2, Reclamation and Decommissioning Plan
Follow-up and Monitoring	See Section 2.8.3, Monitoring and Follow-Up Programs
Surface water and groundwater quantity and quantity management and monitoring	j) Water Management Plan
Follow-up, compliance and effects monitoring of groundwater and surface water quality and quantity during closure and post-closure	j) Water Management Plan
Others	n) Occupational Health and Safety Plan

a. CONSTRUCTION MANAGEMENT PLAN

An environmental management plan specific to the construction of New Prosperity will include, at a minimum, procedures and policies with respect to site access, geotechnical stability, soils salvage, erosion control, vegetation, wildlife, cultural and heritage resources and emergency response. This plan will be prepared prior to the commencement of construction activities, and used to guide employees and contractors through initial development phases of the project. Roles and responsibilities of environmental supervisors for contractors will be the key to each component of this plan to emphasize the need for an on-site training, monitoring and communications.

Access

The access component for the construction period will be designed to safely meet the needs of mine employees contractors, local residents, and the general public. The plan will describe the policies and procedures that will control transportation and access to and from the New Prosperity mine site, and access restrictions for lands surrounding the property.

Geotechnical Stability

Geotechnical stability monitoring for the Construction Phase will focus on construction-related slope stability issues at Project excavation and building sites such as the access road, transmission line, and mine buildings.

Prevention of damage to soil and mass wasting events will be a focus of the geotechnical stability assessments and monitoring. Detailed on-site terrain stability will be assessed as needed to identify unstable areas, particularly slopes greater than 60%. Slopes surrounding the excavation and building sites will be surveyed prior to the start of work and as needed during construction. The survey data will be used to monitor the slope stability. Slope stability problems could necessitate some adjustments to the alignment of the access roads and transmission line, and the final positions of some structures, to ensure that Project components are constructed on stable terrain.

Groundwater and surface water monitoring data may be used to avoid geotechnical events, as high groundwater content and erosion from surface flows can weaken slopes. Strategies will be developed to minimize water-related geotechnical events include surface water diversion, selective work stoppage during heavy rain and snowmelt events (as needed), and protection of banks that could become undercut. It may be necessary to re-grade slopes or reduce the load on upper slopes to reduce the risk of mass wasting. Banks and slopes affected by construction will be stabilized, restored and re-vegetated as needed to increase their stability and minimize the rates of surface water runoff or ground-water infiltration.

Soil Salvage

A variety of best management practices will be employed to ensure that soils are handled and stored properly during all phases of the mine development project. Soil salvage protocols specific to the construction areas will be developed, including measures to control erosion and to minimize soil compaction. The plan will detail how stockpiles will be designed to prevent anaerobic conditions and where they will be located to protect them from further disturbance or contamination.

Non-Mined Materials Handling

Non-mined materials during the Construction Phase will include:

- Building materials
- Fuel and maintenance materials for mobile equipment
- Spoil/cut and fill/rock
- Timber
- Organic and mineral soils
- Construction debris
- Concrete produced on site at a concrete batch plant, and
- Pavement.

Procedures will be developed that outline how these materials will be produced, transported, used, stored, and disposed of in order to prevent or minimize their environmental effects during construction.

Emergency Response

The Emergency Response Plan for the Construction Phase will include detailed protocols on preparedness, prevention, response, and contingency plans to address:

- Health and safety requirements
- Information on hazardous product found on site
- Practice drill procedures
- Preventative measures (e.g. re-fuelling protocols)
- Initial notification procedures
- Personnel responsibilities and contact information
- Response protocols for initial response, control, containment, and clean-up, and
- Procedures for incident reporting and assessment.

In addition, the Emergency Response Plan will be developed for the potential construction-related accidents and malfunctions discussed later on in the EIS. All Project employees and contractors will receive training on appropriate emergency response procedures.

Air Quality and Noise Management

Land clearing and burning for construction is the primary sources of criteria air contaminants (CAC) emissions (mainly particulates) while mine equipment is the primary source of greenhouse gases (GHGs). Procedures will be developed to ensure contractors use the Best Available Technology Economical Available (BATEA) and Best Management Practices to minimize both of these emissions, such as contractors minimizing burning and prioritizing revegetation (for carbon sequestration) in temporarily disturbed areas.

Several components of the Project will produce noise that could disturb the acoustic environment. Policies may be developed to minimize the effects of noise and artificial light on nearby communities, such as contractors by restricting construction activities to daytime hours (07:00 to 21:00) wherever possible in areas identified as noise and light sensitive, and by regularly inspecting and maintaining construction equipment to ensure that high quality mufflers are installed.

Erosion and Sediment Control

The erosion and sediment control procedures specific for the Construction Phase which may include, but not be limited to, the following:

- Use of sediment and erosion control prevention techniques, material and equipment
- Control strategies for on-site water, and off-site water as it pertains to the construction area, for each mine feature including diversion ditch designs and sediment control ponds
- Sediment and erosion control procedures around fish-bearing waters during installation of any proposed clear-span bridges
- Delineation of potential erosion control areas of concern
- Restoration of erosion control areas of concern
- Contingency plans for stream loading and sediment control, and
- Monitoring and surveillance program.

All necessary sediment and erosion control mitigation measures will be in place and operational prior to construction.

Vegetation Management

Activity specific measures will be developed for contractors to minimize damage to vegetation at each of the Project components, but several general measures include:

- Minimize vegetation loss (including rare plants and ecosystems of conservation concern) through environmentally sensitive Project design
- Implement best management practices including the creation of buffer zones around wetland habitats, maintaining connectivity among wetlands within wetland complexes, and restricting employee and contractor access to wetlands outside of construction or work areas
- Where possible, minimize the extent of grubbing, stripping and the removal of shrubs and herbaceous species, and retain the humus layer and vegetation root mat
- Re-establish vegetation on disturbed areas as soon as reasonably possible
- Ensure water flow around work site is not interrupted
- Wherever possible, schedule any construction to occur in sensitive wetland and riparian areas to occur when potential impacts are minimized

- Remove any green felled or windthrown spruce from the site as required in consultation with MOFR, to avoid buildup of spruce bark beetle populations; leave any mountain pine beetle “green attack” trees from the site except under MOFR direction, and
- Encourage slope stability and minimize soil quality degradation through grass seeding and slope revegetation.

The invasive plant management plan (Appendix 5-5-K of the March 2009 EIS/Application) outlines procedures to be followed during all phases of mining, some of which are specific for contractors that will be arriving with equipment.

Wetland and riparian ecosystems will be monitored during construction of the mine access road and any access roads used to support construction or maintenance of the transmission line corridor.

Wildlife Management

Wildlife control measures and environmental protection procedures will be put in place to minimize risks to wildlife and humans during the construction phase. Controls and procedures to be developed prior to the initiation of work on the site may include:

- Education for drivers to minimize the risk of collisions with wildlife
- Work windows, when planning proposed work methods, activities, and schedule, in order to protect listed populations and/or individuals and their habitat
- Development of a problem wildlife prevention and response plan, and initiate Bear Aware and Safety training, and
- Controls for helicopter over-flights to minimize acoustic disturbance during the big horn sheep lambing period.

Specific to the construction of the transmission line, procedures developed for bird protection may include:

- Evaluation and selection of the most appropriate bird markers
- Incorporation of trees and shrubs into the route design where feasible, to provide natural obstacles for birds to navigate, directing their flight over lines
- Identification of high collision risk areas
- Confirmation that conductor/line spacing is large enough to greatly minimize or eliminate electrocution risk, and
- Evaluation and selection of perch deterrents (e.g., “bird spikes”) for the poles.

Cultural and Heritage Protection

The Cultural and Heritage Protection Plan for the Project will apply during the construction phase. The Plan will describe methods for the protection of heritage and archaeological sites through avoidance where possible, procedures for mitigation and recovery where avoidance is not feasible, and procedures for any newly discovered archaeological sites to ensure work is halted and sites are appropriately managed.

Occupational Health and Safety Plan

Occupational Health and Safety Plans will be provided to Taseko for approval by contractors responsible for construction, as required by Worksafe BC.

Transmission Corridor Management Plan

In order to address First Nations, landowner and public concerns regarding increased access, archaeological and cultural resources, and potential water and wildlife impacts, policies and procedures will be developed specific to transmission corridor construction, maintenance and decommissioning.

As part of the permitting and consultation, Taseko will work with Ministry of Forests, Lands and Natural Resource Operations, First Nations and Ministry of Environment to assist with the development of a public access plan while protecting wildlife and heritage values. In addition, Taseko will work with the landowners and the grazing tenure holders to develop schedules and policies that protect the natural grasslands and minimize disturbance to grazing systems during construction.

Sensitive Areas Preservation

Certain areas on-site and along the right-of-way may be designated environmentally sensitive. These areas include but are not limited to areas classified as:

- Erodible
- Ecological
- Scenic
- Historical and archaeological
- Cultural, and
- Fish and wildlife refuges.

Finalizing the centerline for the corridor will take into consideration all available information so as to avoid sensitive areas where possible. During construction, contracting crews will take all necessary actions to avoid adverse impacts to these sensitive areas and their adjacent buffer zones. These actions may include:

- Suspension of work or change of operations during periods of sensitive times during the construction period

As described in the Cultural and Heritage Protection Plan, if prehistoric or historic artifacts or features are encountered during clearing or construction operations, Taseko and its contractors will halt work and the operations will immediately cease for at least 30 m in each direction, and construction superintendent will be notified. The site will be left as found until a significance determination is made. Work may continue elsewhere beyond the 30 m perimeter if that work does not affect the potential site.

Water Crossings and Water Quality

Contractor construction activities will be performed by methods that will prevent entrance or accidental spillage of contaminants, debris, and other pollutants into streams, dry watercourses, lakes, and ponds. The clearing contractor will erect and use best management practices such as silt fences on steep slopes and next to any stream, wetland, or other waterbody. Additional best management practices may be required for areas of disturbance created by construction activities. Appropriate permits from the Ministry of Environment for works in and about streams, and from Ministry of Forests and Range will be obtained as required. In addition, there will be compliance with all the criteria and guidance contained in the Department of Fisheries and Oceans applicable Operational statements and the Ministry of Environment's "*A Users Guide to Working In and Around Water*". Each crossing will be planned and the appropriate approval or notification under the Water Act will be submitted before work begins. Every attempt will be made to schedule these stream-crossing changes during the least risk window. Any Habitat Alteration Disturbance or Destruction (HADD) will be submitted to Department of Fisheries for authorization.

Vegetation Management

The management of the power line right-of-way for vegetation control will closely follow the BC Hydro guidelines. The first activity on the right-of-way will be to clear the standing timber. The vegetation management objective will be to eliminate all tall-growing tree species from the corridor, and to remove any hazard or problem trees that are outside the corridor before construction gets underway. Tree removal will be undertaken to a maximum width of 80 m. Merchantable wood will be separated and piled in sorting areas to be transported. The remaining brush from the timber will be either windrowed and crushed at the sides of the right-of-way or burned at the appropriate time and under fire regulation permit. Where appropriate, brush piles may be utilized to limit future ATV access. To further limit access, low-growing species will be left intact.

Wildlife Management

Wildlife impacts from the power line right-of-way can be mitigated through controlling vegetation. Because the right-of-way has to be cleared of tall and fast growing vegetation, it is in a continual state of succession. In consultation with First Nations, Ministry of Forests and Range, and Ministry of Environment, Taseko will develop best management practices for the maintenance of the vegetation that will provide appropriate wildlife habitat while minimizing public access, and maintaining a safe and reliable transmission facility.

Archaeological and Cultural Heritage Resources Sites

Once the centerline for the transmission corridor is confirmed, archaeological investigations on areas proposed for disturbance will be conducted on the priority areas under the guidance of a professional archaeologist and appropriately permitted will be initiated.

b. ACCESS MANAGEMENT PLAN

The Transportation and Access Management Plan for the New Prosperity Mine will be developed to safety meet the needs of mine employees and contractors, local residents, and the general public. The plan will describe policies and procedures addressing all transportation and access issues within Taseko's control on and around the New Prosperity mine site, including:

- Access to and from the New Prosperity mine site
- Areas the property boundaries, and
- Adjacent Crown lands accessed from the property.

Procedures will also be included for road maintenance requirements and monitoring. Within the mine site, roads will be developed in accordance with the Health, Safety and Reclamation Code for Mines in British Columbia (2003) and become an integral component of the Mine Plan and the Health and Safety Plan for the New Prosperity Mine.

Access To and From Site

The mine site will be accessed by a gravel road from Highway 20 west of Williams Lake. The road will provide year round access for the delivery of supplies, products and personnel, and the transportation of concentrate from the mine site.

On Highway 20, the allowable axel load of all delivery trucks is restricted to 70% from mid-March to mid-May due to the spring thaw and high volume of precipitation. During this period the service schedule of the delivery and concentrate trucks will be changed to ensure the uninterrupted operation of the plant.

The existing road between Highway 20 and the plant site is approximately 91.4 km long and is designated as the Taseko Lake Road, the 4500 Forest Service Road (formerly Riverside Road) and New Prosperity Plant Access Road. The Taseko Lake Road, approximately 68.4 km long crosses two rivers and both bridges are full axle load rated. The following 19.4 km along the 4500 Road will be upgraded to a single lane with pull outs spaced at 2 km intervals. The last section, the approximately 2.8 km long New Prosperity Plant Access Road will be new road construction, single lane with pull outs.

Trucks hauling concentrate from the New Prosperity mine site will use Provincial Highway No. 97 from Williams Lake, traveling 54 km along the existing 2 lane, paved road to the Gibraltar Mine Concentrate Load-out Facility near Macalister.

Transportation policies to the mine site will apply to personnel, materials, and supplies. Transportation policies from the mine site will apply concentrates and wastes. The policies that will be developed apply to private roads associated with the project and include the expectation that employees, contractors and suppliers will comply with the policies on public transportation corridors and roadways. Each segment of the access corridor (Highways 97 and 20, the Taseko Lake and 4500 Road) may each require specific procedures that will be addressed in the plan.

In order to minimize traffic, workers will be bussed to and from the mine site from strategic locations such as Williams Lake. Workers will be staying at a camp facility during the days they are working.

All mine vehicles, including concentrate trucks and busses, will be restricted to traveling at posted speed limits or as appropriate for road conditions. Following designated speed limits will prevent excessive amounts of dust from passing vehicles.

Mine Site Access Restrictions

Access to the project site will be restricted to employees, contractors, regulators and guests. Access control protocols will be developed and implemented to ensure employee and contractor safety and to minimize social and environmental effects related to the project. Employees will be informed of these access control protocols at the time of hire.

Extensive security fencing is not considered necessary for the project site. The areas which will require fencing are:

- Plant site entrance gatehouse on the New Prosperity site access road
- Start of the road to the explosive magazine area extending 50 m on either side of the road, and
- Wildlife fence around lined process water pond and substation.
- The entrance gatehouse will be manned by security personnel 24 hours per day, 365 days per year.

Mine Site Traffic

Major haul roads for large equipment will be required from the open pit to the crusher, stockpiles, overburden spoil piles, waste dumps and the tailings management facility for construction and waste disposal. A number of smaller ancillary roads will be required to access miscellaneous infrastructure facilities such as site power distribution, overland conveyor access, headwater channel, on-site fish compensation facilities, and explosives magazines.

The Transportation and Access Plan will outline the procedures for assigning project transportation routes, speed limits and access limits. The reduction in nonessential use of the project roadways will minimize the disturbance to the environment by reducing noise, dust, animal–vehicle interactions, and spill probability. Policies may include:

- Restricted access of private vehicles to the project site, which will mitigate an increase in traffic on the internal roadway system
- Onsite transport will also be restricted to authorized drivers with vehicles equipped for onsite use, and
- Vehicle speed limits will be posted throughout the project.

The mine owned and leased equipment fleet will be kept in sound mechanical condition through regular scheduled maintenance by experienced mechanics. Engine and exhaust systems will be operated at manufacturer's specifications to minimize exhaust gases. All contractors will be required to maintain their vehicles per factory specifications.

Access from Mine Site to Adjacent Crown Lands

Employees staying onsite during their rotation will restrict their off hour activities to the New Prosperity mine site, access roads and pre-defined recreational areas that will be determined before construction begins.

Transmission Corridor

The transmission corridor passes through Crown forest land administered by the Ministry of Forests and Range which have other users or permit holders, including grazing tenures. The Ministry will set the criteria for occupancy and the procedures for maintenance. In addition, the corridor passes through private lots and agricultural land in the vicinity of the Fraser River.

There may be issues around the potential for increased access resulting in disturbance of cultural sites, wildlife and wildlife habitat. As part of the permitting and consultation, Taseko will work with Ministry of Forests and Range, First Nations and Ministry of Environment as the Ministries develop a public access plan to protect wildlife and heritage values. In addition, Taseko will work with the landowners and the grazing tenure holders to develop procedures that can be implemented during construction and maintenance of the corridor that help restrict ATV access.

Road Maintenance

For the private roads that Taseko is responsible for, road maintenance procedures will be developed. Regular maintenance is expected to include but not be limited to:

- Gravelling, grading and sub-grade repairs
- Dust treatment as required from time to time (water sprays)
- Removal of fallen trees, rocks and debris
- Maintenance of safety berms
- Winter snow removal and application of traction aggregate
- Maintenance of signage, and
- Ensuring ditches, culverts and settling ponds operate effectively.

The least amount of clearing or brushing of vegetation required to safely permit the road sight lines to be maintained will be done. Despite this objective, lines of sight along the access road will need to be maintained to ensure adequate forward vision for the posted speed limit.

Protection of Wildlife

The protection of wildlife will be an important consideration during road development and use. Proper road use procedures will be developed as part of Taseko's safety and environmental orientation programs with the objective of minimizing impacts on wildlife. Policies that will be considered include:

- No Taseko employee or contractor employee will be permitted to have firearms on site.
- No Taseko employee or contractor will be permitted to hunt or sport fish while on their rotation at the mine site.
- Project-related wildlife vehicle collisions or near misses will be recorded and reviewed regularly to identify problem areas. If necessary, appropriate measures will be implemented (e.g., warning signs) to avoid future problems.

Dust, Emissions and Noise Management

Dust will be of most concern on unpaved roads between the mine and Hanceville. If dust related to equipment, truck and bus traffic compromises private and/or public road safety, mitigative measures to control dust will include but not be limited to:

- The enforcement of speed limits
- Road watering, or using a dust suppressant, and
- Upgrading the road-surfacing materials by adding a gravel base.

Taseko will cooperate with the Ministry of Transport with respect to controlling dust and safety issues for the portion of the road that is a public highway.

Air emissions from vehicles will be mitigated by but not be limited to:

- Regular maintenance of all mobile equipment
- Not allowing vehicles to idle, except when necessary, and
- Imposing speed limits.

To manage noise, vehicles and equipment will be equipped with silencers and noise suppression systems where possible.

Implementation and Monitoring

To implement the Transportation and Access Management Plan, safety and security personnel will be appointed by Taseko before construction. The safety and security personnel will ensure contractors and employees are given proper orientation.

Taseko will liaise with logging companies on their activities and methods to prevent accidents. These may include monitoring of radio frequencies, travel restrictions, and turn-off checks.

All vehicles entering and leaving the site will be monitored by security staff posted at the security gate at the entrance to the mine site. Security will make sure that vehicles entering the mine site are equipped with required safety devices such as buggy whips. Security will also maintain current copies of transporter licenses, insurance, permits whenever possible.

The Transportation and Access Management Plan will be developed by Taseko and its contractors and maintained over the life of the New Prosperity Project. Taseko will work closely with the Ministry of Forests and Range and the Ministry of Transportation to develop the plan for compliance with the applicable regulations. The plan will address environmental conditions, measures, and mitigation processes defined in the Project's EA. New items identified through the Project's approval process and information collected during the Project's follow-up program will be addressed as well.

Closure

At mine closure, all roads within the mine site, including haul roads, will be reclaimed using the following methods:

- Road surfaces will be ripped or otherwise treated to decompact soils within the running surfaces

- Culverts will be removed, with creek crossings and cross-ditches established in accordance with the post-mine water management system
- On sidehills, sidecast material will be pulled back to the extent practicable to establish grades that complement the reclaimed landscape
- Prepared surfaces will be capped with salvaged soils from adjacent windrows, and
- Roads will be revegetated in accordance with concepts presented in Reclamation and Decommissioning Plan to meet reclamation goals of appropriate end land use objectives, erosion prevention and weed control.

If any road access is required within the mine project areas after closure, these roads will be left in semi-permanent deactivated condition. Semi-permanent deactivation will allow the road to remain in place and be useable, but also environmentally stable. Semi-permanent deactivation measures which will be carried out to include removal of culverts and replacement with cross-ditches; installation of ditch blocks at cross ditch locations; installation of waterbars across the road to direct road surface water off the road; removal or breaching of windrows along the road edge; outsloping/insloping of the road surface as appropriate; and revegetation of exposed soil surfaces for erosion and weed establishment control.

c. TAILINGS IMPOUNDMENT OPERATIONS PLAN

The following section provides a conceptual tailings operating and management plan for the proposed New Prosperity Project. The plan will be refined as design details develop at the permitting stage.

Dam Design and Raising Schedule

The tailings impoundment will be formed in a shallow valley, with containment provided by three embankments, the Main Embankment, the South Embankment and the West Embankment. The Main Embankment will form the starter impoundment, while the South and West embankments will commence construction several years afterwards. All three embankments will be raised in stages through the life of the project.

All three embankments will have a central core comprised of compacted glacial till material, which has a low hydraulic conductivity. The till core of each embankment will be keyed into the native till that blanket that covers most of the impoundment area and hence forms a natural “liner” that will serve to limit the rate of seepage loss from the impoundment.

The Main Embankment will be expanded in stages across the Fish Creek Valley, while the South Embankment will contain the impoundment near the southern-most portion of the Fish Creek catchment. The West Embankment will be constructed along the western ridge which separates the Fish Creek drainage basin from the Onion Lakes drainage basin. The embankments will be developed in stages throughout the life of the project using low permeability glacial till, overburden and non-PAG overburden and waste rock materials from stripping operations at the Open Pit. All three embankments will be raised using the centreline method of construction.

Embankment Development

The Main Embankment will be the starter embankment for the initial start-up period. Once the starter embankment is complete, it will be able to contain 2 years of tailings storage, plus the Inflow Design Flood (IDF), wave run-up, the supernatant pond and additional freeboard. In approximately Year 1, the first few metres of the South Embankment will be constructed, along with an on-going raise of the Main Embankment. In approximately Year 7, the West Embankment will commence construction. All three embankments will be raised annually or bi-annually until near the end of the mine operations..

Each embankment will have a central core zone, consisting of compacted glacial till core, supported by filter and transition zones, followed by bulk rock fill. All three embankments will be raised using the centreline method of construction, which will include all zones previously mentioned.

Beach Development

The discharge of tailings from the delivery pipelines into the TSF will be from a series of large diameter valved off-takes located along the Main, West and South Embankments. Tailings discharge will begin along the Main Embankment, and will be extended along the west side of the facility to reach the South embankment. Eventually, once the West Embankment begins construction in Year 7, the tailings line will be placed on that embankment as well. The purpose of beach development is to keep the supernatant pond away from the embankments and towards the east side of the TSF.

The coarse fraction of the tailings are expected to settle rapidly and will accumulate closer to the discharge points, forming a gentle beach with a slope of about 1%. Finer tailings particles will travel further and settle at a flatter slope adjacent to and beneath the supernatant pond. The beaches will be developed with the intent to maximize storage volume and to control the location of the supernatant pond. Selective tailings deposition will be used to maintain the supernatant pond away from the embankments, in order to reduce seepage and to ensure that reclaimed water is clear and accessible for reuse in the milling process.

Potentially Acid Generating Waste Storage Area Development

The PAG waste storage area will be developed within the impoundment along the east side of the valley and will be offset a minimum of 500 m from the Main Embankment, in order to allow development of tailings beaches. This zone of tailings beach will provide a low permeability transition zone between the coarse, permeable reactive waste rock and the tailings embankments, and will function as a seepage control measure

PAG waste will be hauled to the TSF for co-disposal with tailings and submergence by the tailings and supernatant pond. The PAG waste storage area has been designed in step with the mine production schedule. It will be developed at the same or similar rate of rise as the tailings but will be several meters higher to provide a dry, stable placement surface. The ongoing maximum elevation of the PAG waste rock and overburden may be maintained at an elevation above the natural flood level of the supernatant pond. At closure, the PAG waste rock and overburden will be submerged below tailings and pond water. Based on the present mining schedule, a minimum of three years of tailings deposition will occur after final placement of PAG materials. In the case of premature closure, a portion of the PAG waste materials will need to be excavated to an elevation below the natural flood elevation. They will therefore be maintained in a saturated state in the long term.

Seepage

Special design provisions to minimize seepage losses include the development of extensive tailings beaches (which isolate the Supernatant Pond from the embankments), toe drains to reduce seepage gradients, and contingency measures for groundwater recovery and recycle.

The principal objectives of the design for the TSF are to ensure protection of the regional groundwater and surface waters both during operations and in the long-term (post-closure), and to achieve effective reclamation at mine closure. The feasibility design of the TSF has taken into account the following requirements:

- The dam designs will include a core of compacted, low hydraulic conductivity glacial till to limit seepage through the dam where appropriate.
- The core zones for each dam will be tied into the native foundation till blanket; effectively cutting off seepage flows through the high hydraulic conductivity sands and gravels comprising the upper aquifer.
- The tailings discharged into the impoundment will, once the impoundment is well developed beyond the first few years of operation, serve to limit the rate of seepage through the foundation soils. This will be of particular benefit in any areas where the natural glacial till blanket is discontinuous and there is direct communication between the upper and lower aquifers.
- Diversion of clean surface runoff water to the north towards Fish Lake This will utilize a harvesting approach to collect as much clean water east and south of the TSF and direct it to the inlets of Fish Lake.
- The inclusion of monitoring features for all aspects of the facility to ensure performance goals are achieved and design criteria and assumptions are met.
- Limit seepage during operations, particularly in the early years prior to effective blanketing of the basin with tailings solids, from the tailings impoundment to the downstream receiving environments.

<u>Seepage Control Measures and Monitoring</u>

Seepage through the Main Embankment will be primarily intercepted through two seepage collection ponds, located immediately downstream of the embankment and located at topographic lows. Water from these seepage collection ponds will be pumped back to the TSF during operations, and towards the open pit in closure. When water quality issuitable, the seepage collection ponds will release to the inlets of Fish Lake. Groundwater monitoring may be installed downstream of the Main Embankment as part of the monitoring program and may be converted to recovery wells to also evaluate seepage rates in the foundation and to recover any foundation seepage.

The Open Pit will function as an ideal sub-surface collection point by intercepting any seepage that may otherwise migrate down gradient to lower Fish Creek. A surface collection pond adjacent to the open pit will receive water from pit dewatering activities, as well as any surface runoff from upstream stockpiles.

The South and West Embankments will be constructed with toe drains to collect seepage through the embankments. In addition, seepage collection ditches will be constructed along the toe of the West and South Embankments.

The Seepage Collection Ponds will be constructed with a compacted glacial till (low permeability) liner. All ponds will be designed to provide for two days of storage from seepage and surface runoff for the 1 in 10 year, 24-hour storm event (including a 1 m freeboard allowance). The pumpback system will be designed for year round operation and will comprise a submersible pump with one standby.

HDPE pipelines laid along the downstream face and across the crest of the embankments will convey water from the SCPs into the TSF.

Groundwater will be monitored in wells situated downstream of all three embankments and between the West Embankment and the Taseko River. If deemed necessary, as part of the mitigation measures to be listed in the EA document, groundwater recovery wells may be installed in the same locations, with water being pumped to the TSF.

On-going water quality monitoring will be used to assess the effectiveness of the seepage collection system. In the unlikely event that the seepage collection system is found to not effectively recover seepage, it will be necessary to install additional seepage control provisions. The efficiency of the primary seepage recovery system may be improved with additional interception ditching and pump back systems. Although current information and seepage analyses do not suggest that a secondary system will be required, its inclusion will be assessed further as the project progresses.

Seepage Water Quality

Pore water within tailings retains some dissolved and suspended solids. These products are mobilized by seepage passing through the tailings toward the embankments. As a result of this mobilization, the seepage water will tend to have slightly different chemistry than the water in the tailings pond.

The quality of this water has been predicted based on experience at other mines and from humidity cells. During operation, a percentage of this seepage is collected at seepage collection ponds and returned to the tailings pond. Some of the seepage may escape seepage collection reporting to the underlying aquifer. This volume is generally very low. As the open pit is developed deeper the ground water draw down cone will force ground water to drain to the pit.

Water Management and Sediment Control

The main components of the water management plan during the early stage of development include the following:

- A cofferdam will be constructed immediately upstream of the Main Embankment so as to assist keeping the foundation area dry.
- Two small earthfill dams will be constructed at the outlet of the lake, to prevent surface flows from leaving the lake area. Excess water will be pumped to the Fish Lake inlets and the TSF.
- A collection ditch will be constructed along the east slope of the Fish Creek Valley along the 4500 road during the pre-production period to collect and divert clean runoff toward the inlets to Fish Lake.

Surface sediment control ponds will be located at strategic spots downstream of each component (i.e. haul road, ore stockpile, etc…). At the open pit area, the pit water will require sediment control prior to discharge until the open pit dewatering system is established.

Once construction of the Stage Ia Main Embankment is complete, the TSF will be used to impound surface water flowing from the undiverted portion of the upper Fish Creek Valley. During operations the location of the supernatant pond will be situated away from the embankments and controlled by the development of the tailings beaches and the PAG waste storage area. The supernatant pond location will be controlled in order to reduce seepage losses at the embankments and to provide a clean, accessible source of water for the milling process.

Site Water Balance

As the supernatant pond is the main source of process water, water balances were completed in order to estimate the annual water surplus or deficit at the TSF. The TSF Water Balance is a model which describes the movement of water within the operational system throughout the life of mine. External influences on this model include precipitation and evaporation. These are the principle input parameters from which all other parameters are calculated.

Process water and fresh water that is required for the operation of the mill is primarily derived from the pit dewatering wells and the TSF supernatant pond.

An annual site water balance was based on average precipitation conditions for the year prior to start-up, and 19 years of operation, based on complete years of production.

In order to evaluate the design of the TSF and availability of sufficient water for continuous operations, annual site water balances were calculated for extreme precipitation conditions. The design of the TSF embankments is dependent on the probable maximum pond volumes for each year of operations, and continuous operations of the mine are influenced by the probable minimum pond volumes.

Under extreme dry conditions, the results of the analysis indicate that there may be a requirement to divert a portion of flows from the catchment east of the existing included in order to maintain the necessary pond volume to facilitate continuous, uninterrupted operations. Additionally, a large proportion of the fresh make-up water derived from the deep aquifer remains largely unused during each year of operations, and could be potentially utilised to supplement deficits in the TSF under these extreme conditions.

Tailings Discharge System

Tailings from the mill process will be delivered by gravity from the mill to the TSF for as long as possible. Thereafter, the required head for gravity discharge may be provided by pumping to a head tank above the east abutment of the Main Embankment, or by pumping directly to discharge. The initial requirement for pumping is deferred to Year 5 of operations, at which time tailings discharge from the West Embankment begins. At that stage, pumping will only be required when tailings are being discharged from the West Embankment. Discharge from the Main Embankment will be by gravity until Year 7 of operations.

Tailings Delivery to the Tailings Storage Facility

Two gravity pipelines will be laid from the mill to the east abutment at start-up. One pipeline will extend to the centre of the Main Embankment, and the second to the West abutment. Each pipeline will be sized to carry up to 50% of the design tailings production from the mill. Discharge into the TSF will be from valved off-takes along the two pipelines on the Main Embankment crest. A full diameter off-take in each line will allow for “emergency” discharge at the east abutment.

During the first year of operations, a third line will be laid from the mill to the east abutment. In Year 4, the third discharge pipeline will be extended across the Main Embankment A tailings pump station will be required to service this pipeline. Both of the gravity pipelines on the Main Embankment will remain in service. Discharge from the pipelines will not be continuous, but will be rotated between lines as appropriate for tailings distribution within the TSF and to ensure adequate beach development.

During later years of operations the tailings may be pumped to the point of discharge. Valving will allow for discharge to be directed to the appropriate discharge pipeline. The tailings discharge system will be flexible enough to take advantage of tailings discharge by gravity for as long as possible, thereby reducing the annual pumping costs associated with the system.

It will not be necessary to provide any emergency tailings line dump pond or tailings recovery system at the mill to handle pipeline drainage during emergency or planned shutdowns, as long as the Mill Tailings Head Box elevation remains sufficiently above the embankment crest elevation. This requirement must be re-evaluated during ongoing operations.

<u>Discharge into the Tailings Storage Facility</u>

Tailings will be discharged from the delivery pipelines into the TSF from large diameter valved off-takes located along the pipelines on the Main and West Embankments and the ridge along the west side of the facility. The off-takes will consist of rubber lined steel tees or elbows, with appropriate valving and HDPE discharge piping. In-line valves installed at intervals along the delivery pipelines will allow the tailings discharge locations to be relocated as appropriate for beach development.

Reclaim Water System

Water will be reclaimed from the tailings pond by a barge mounted pump station. The water will consist of supernatant from the settled tailings and runoff from precipitation and snowmelt within the catchment area. A dedicated pipeline will convey the reclaimed water to the process water pond, located adjacent to and upgradient from the mill.

<u>Reclaim Barge</u>

The floating reclaim pump station in the TSF will initially be confined in a deep narrow channel at a location remote from the point of tailings discharge. This will maximize the potential for the recovery of water of acceptable clarity. Relocation of the barge will be required to accommodate development of the PAG waste rock area and increases in the elevation of the tailings pond. The barge will be relocated during Years 2 and 6 and moved to its final location during Year 16.

The barge pumps will be controlled from the mill control room, based on the water level in the process water pond. The barge will be fitted with vertical turbine pumps, including standby pumping capacity and all necessary control, check, drainage and isolation valves. One pump will normally be operated at all times during winter to reduce the potential for freezing of the water in the reclaim pipeline.

Reclaim Pipelines

Reclaimed water will be pumped from the reclaim barge to the process water pond at the mill. The operational storage capacity of this pond will be approximately 110,000 m^3. The reclaim pipelines will be graded to minimize high or low sections and to allow for gravity drainage back into the TSF, or the process water pond.

The reclaim pipeline from the TSF will consist of sections of large diameter HDPE and steel pipe. Steel pipe would be used only for the initial high pressure sections of the pipeline, between the barge and the headwater channel, while HDPE pipe will be used for the remainder of the pipeline.

Instrumentation and Monitoring

Geotechnical instrumentation will be installed in the tailings embankment and foundation during construction and over the life of the project. The instrumentation will be monitored during the construction and operation of the TSF to assess embankment performance and to identify any conditions different to those assumed during design and analysis. Amendments to the on-going designs and/or remediation work can be implemented to respond to the changed conditions, should the need arise.

Geotechnical instrumentation, comprising piezometers and movement monuments will be installed at selected planes along the Main and West Embankments. Groundwater wells will be installed at suitable locations downstream of each embankment.

Instrumentation

Vibrating wire type piezometers will be installed in the embankment foundation, fill and tailings materials to measure pore water pressures during initial placement and operations. The piezometers will be distributed throughout the various foundation and fill zones to provide a spectrum of monitoring data. The piezometer leads will be appropriately routed from the fill to read-out panels for ease of monitoring.

Movement monuments will be installed on the embankment crest following the completion of selective embankment raises to monitor deflections along the slope and crest of the embankment. Periodic surveying of the monument locations will provide early warning of movements and possible acceleration of movement which often occurs prior to failure.

Groundwater monitoring/recovery wells will be installed at appropriate locations along the downstream toe. The wells will be used to recover samples for water quality monitoring.

Monitoring Program

The instrumentation monitoring should be done routinely both during construction and operations. Following initial installation of the geotechnical instrumentation, measurements should be taken and analyzed on a daily basis to monitor the response of the earthfill and foundation from earthfill loading.

The frequency of monitoring for the piezometers and inclinometers may be decreased to bi-monthly readings once the effects of initial construction have dissipated. Surface movement monuments should be surveyed twice per year during operations. Water quality monitoring of the seepage through the embankment and foundation shall be monitored monthly during operations.

Decommissioning and Closure

Upon mine closure, surface facilities will be removed in stages and full reclamation of the TSF will be initiated. General aspects of the closure plan include:

- Selective discharge of tailings around the facility during the final years of operations to establish a final tailings beach that will facilitate surface water management and reclamation.
- Dismantling and removal of the tailings and reclaim delivery systems and all pipelines, structures and equipment not required beyond mine closure.
- Construction of an outlet channel/spillway at the east abutment of the Main Embankment to enable discharge of surface water from the TSF to the open pit and ultimately to Lower Fish Creek. This full closure scenario will also work well in the event of premature closure of the mine.
- Removal of the seepage collection system at such time that suitable water quality for direct release is achieved.
- Removal and regrading of all access roads, ponds, ditches and borrow areas not required beyond mine closure.
- Long-term stabilization of all exposed erodible materials.

The possibility of creating a self-sustaining fishery in the closed facility is being explored jointly with the EA team.

<u>On-going Monitoring Requirements</u>

The seepage collection ponds and recycle pumps will be retained until monitoring results indicate that any seepage from the TSF is of suitable quality for direct release to downstream waters. The groundwater monitoring wells and all other geotechnical instrumentation will be retained for use as long term monitoring devices.

Post-closure requirements will also include an annual inspection of the TSF and an on-going evaluation of water quality, flow rates and instrumentation records to confirm design assumptions for closure.

d. MATERIALS HANDLING (NON-MINED MATERIALS) AND WASTE MANAGEMENT PLAN

The Materials Handling and Waste Management (MHWM) Plan will identify opportunities to reduce, reuse and recycle waste, prior to resorting to disposal. This will be done through the identification and management of the various waste streams. The plan will also ensure that all aspects of domestic and industrial waste management (collection, transportation, storage and disposal) are conducted in a responsible manner protective of the environment. This plan will be supported by various procedures related to the handling of hazardous and non-hazardous wastes, management of the various waste storage facilities, and the Spill Prevention and Response Plan.

<u>Materials Inventory</u>

An inventory of types and quantities of all chemicals used on site will be developed and updated regularly. Material Safety Data Sheets (MSDS) will be obtained and made available at point of use. The

MHWM Plan will describe specific handling, storage and disposal requirements so that the potential risks to employees' health and to the environment are controlled.

Typical hazardous materials that will be transported to and from and stored on site at New Prosperity, include the following.

- Transported to and stored at the site :
  - Petroleum products (diesel fuel, gasoline, lubricants, hydraulic fluids, oil and solvents)
  - Propane (during construction only)
  - Explosives (e.g., ammonium nitrate (AN))
  - Batteries
  - Mill reagents (flotation collectors such as xanthate, thionocarbamate, and thiophosphate, frothing agents such as methyl isobutyl carbinol (MIBC)and pine oil, flocculants, and quicklime), and
  - Antifreeze.
- Transported from and stored at the site:
  - Copper/gold concentrates
  - Waste batteries
  - Waste oil
  - Waste solvents, and
  - Empty petroleum and reagent drums, carboys, and pails.

There will be other materials stored on site in relatively small quantities. These include but not limited to supplies such as:

- Fluorescent mercury and sodium lights
- Laboratory reagents
- Scraps of treated lumber
- Bottled gases (acetylene and oxygen), and
- Solvents for shop supplies.

Specifications for materials storage and handling will be developed to protect workers and the environment. The MHWM Plan will outline the design requirements for a hazardous waste storage facility including secondary containment, elevated deck to detect leaks, appropriate signage and fencing. In general, hazardous liquids, such as solvents, mill reagents and lab chemicals, will be stored with secondary containment to comply with relevant legal requirements. Flammable substances will be securely stored in dedicated locations. Regulatory signs will be attached to the storage facilities or containment structures. Firefighting and other emergency response equipment will be available near all storage areas.

<u>Explosives</u>

Explosives will be used for blasting the rock in the open pit. The MHWM Plan will provide information on how explosives will be transported, stored, and used in a safe and environmentally sound way at New Prosperity. A contractor will be engaged to supply explosives, primarily ammonium nitrate-fuel oil mix (ANFO). All explosives manufacturing, storage and product delivery systems will be subject to existing federal and British Columbia regulations. The contractor will own and operate the explosives manufacturing plant and will deliver the explosives to the pit. The explosives supplier/on-site contractor will be licensed and permitted to operate in British Columbia.

Explosives will be used at safe distances from facilities or personnel. There will be two separately mounted container magazines with lightning protection for accessories such as detonators and container magazines with lightning protection for explosives. Each container pair will have its own perimeter fence and perimeter security lights. The distance between each container pair will be at least 60 m.

The ANFO plant will be at least 100 m from the container magazines. It will consist of an ammonium nitrate shed with all the necessary equipment including bulk handling and a diesel tank. The permanent explosives storage area pad will be constructed of sized fill and include a barrier surrounding the explosives storage area. The plant will also be surrounded by its own perimeter security fence with lights. All buildings will be surrounded by a second fence. Access to the magazines will be restricted to authorized personnel only. Blast notification procedures and other safety procedures and policies will be developed prior to construction.

Hydrocarbon Management

All hydrocarbons, including waste oils, will be provided secondary containment facilities that meet current industry standards. These installations will be regularly reviewed. The MHWM Plan will describe hydrocarbon handling, transport, reception, transfer, use and disposal procedures. The objective of these procedures is to manage the pollution risk and minimize spill potential. The MHWM Plan will also describe or refer to spill response procedures including containment, reporting, clean-up, and corrective action; these procedures will be described in the emergency preparedness and response documentation.

Waste Management

The MHWM Plan will identify ways of reducing waste, mainly through minimizing packaging and where applicable, returning packaging for reuse. The Plan will emphasize reuse, and will also highlight the recycling program which will see segregation at the source of the most typical recyclables including aluminum cans, paper and cardboard. Non-hazardous and hazardous waste will be segregated at source to reduce the potential for environmental effects. Disposal mechanisms for both non-hazardous and contaminated wastes will be developed for the MHWM Plan.

Waste Management Facilities

The various waste management facilities, which will include a hazardous waste storage area, landfill, landfarm, and a laydown area for used tires, scrap metal and wood, will be a part of the Plan.

Non-hazardous and Domestic Waste

The domestic waste management plan will consist of a series of guidelines that will minimize the potential impact on the environment. Domestic waste, including paper, plastics, glass, tins, scrap metal, food and other biodegradable materials will be collected in labelled, secure refuse bins. Domestic waste that cannot be recycled or re-used will deposited in the landfill and the MHWM Plan will include the design, construction and operation details according to relevant regulatory requirements. Landfill operating procedures will ensure that this waste stream is handled to not create a wildlife attractant.

The MHWM Plan will incorporate the treatment of domestic waste water / sewage, both during construction and operations. The majority of the information pertaining to the operation and optimal performance of the sewage treatment system will be provided in an operation and maintenance plan, a supporting document, supplied by the manufacturer. An important component of the management of sewage will be the training of operators who can be certified under the Environmental Operators Certification Program to operate the sewage treatment plant.

Sewage from the mill site and camp areas will be collected by a gravity sewer system. One sewage treatment plant (STP) will be used to service the mine during the construction phase and continue for operation. The STP will be located at the west end, low side, of the mill site, well away from the camp and other occupied areas.

During construction, the treated effluent discharge will be pumped to a tile field or lagoon. Prior to any construction, tile field design and location will have to be verified by field percolation tests. Once the mine is operational, the treated STP effluent will be discharged to the TSF. A buried pipeline will discharge the effluent into the gravity section of the tailings pipeline near the concentrator building. At that time, the chlorine contact chamber will be activated because the effluent will become part of the reclaim water from the TSF.

Sewage from the washroom facilities that are remote from the mill site gravity sewer system, will be directed to nearby sewage holding tanks. These tanks will be emptied at regular intervals and their contents treated at the mill site STP. Sludge from the STP will be removed to an off-site municipal facility approximately every two months.

Hazardous Waste

Hazardous wastes will include, but not be limited to, used waste oil, glycol, grease, hydraulic oil, used oil filters, oily rags and absorbent materials, solvents, batteries, mill reagents and lab chemicals. The majority of hazardous waste will be disposed of off-site, the exception being the reuse of some waste oil in the blasting process (ANFO). Throughout the operational period, many chemicals and reagents will be used for the daily mining and milling activities of the mine. During the final months of operations, the supply and demand of these chemicals and reagents will be monitored carefully, so that the smallest volume will remain when operations cease. Any residual products will be packaged appropriately and shipped back to the supplier. The transportation of hazardous wastes will follow the federal Transportation of Dangerous Goods Regulation requirements.

Hydrocarbon Management

Used oil and oil filters will be collected and recycled off site as part of the operational phase. Records of waste oil removal and recycling will be kept. During the closure phase, trucks and other equipment will be required for reclamation, and this procedure of collecting and recycling will continue until all closure activities have been completed. Should soil become inadvertently contaminated during the operational and closure phases, it will be treated on-site with appropriate products as necessary.

Contingency Plans

The MHWM Plan will identify situations for which contingency plans may be required.

Spill Prevention and Response

The objective of the Spill Prevention and Response Plan will be to promote the prevention of the accidental release of harmful substances into the receiving environment and, in the event of a spill, to provide adequate information to guide the response crew to safely, efficiently and effectively respond to and clean-up a spill.

The Spill Prevention and Response Plan will be designed to prevent spills through the development of procedures in the transfer, handling and storage of fuel and other hazardous products and wastes, plus awareness training in these procedures. Prevention will be further supported by regular environmental site inspections and written assessments.

In the event of a spill, the Spill Prevention and Response Plan will incorporate a spill response action plan that will detail how to manage a spill, depending on the product that was spilled, the quantity spilled and the location of the spill. The Plan will maintain a list of products that are used at, and transported to and from, the mine site. For each product a data sheet will be available in the Plan that documents the physical and chemical properties of the product, safety measures related to that product such as personal protective equipment, and methods for containing and removing the product if spilled, plus the storage, transfer and disposal of the spilled product.

The Spill Prevention and Response Plan will also provide details related to the structure of the spill response team, and the duties and responsibilities of each individual on that team, including the responsibilities of the person who discovered the spill. Contact lists for persons/agencies to notify in the event of a spill, from corporate, to government, to clean up contractors and suppliers, to neighbouring dwellings/communities, will also be a component of the Plan.

Other components of the Plan will include an inventory of the location of spill response kits and their contents, the policy on reporting spills, and a spill response form that will form the written documentation and recording of spills.

Lastly, the Plan will dictate that emergency response personnel receive spill response and cleanup training from a qualified instructor.

<u>Responsibility</u>

The Environmental Coordinator will be appointed the Spill Contingency Coordinator. If the Environmental Coordinator is unavailable, the Manager of Mining will be the designated and in his/her absence the Manager of Milling. The Environmental Coordinator must be notified of any reportable spills as soon as possible and must ensure that all of the proper authorities have been notified. The Environmental Coordinator will also act as the liaison between New Prosperity Mine and any outside agencies. A complete New Prosperity Mine contact list will be created and kept current.

Every employee at the New Prosperity Mine will be responsible for using environmentally safe operating practices to minimize environmental damage in the event of a spill

<u>Training</u>

All supervisors and employees will be trained in:

- The prevention of spills, the safe handling of all materials and an awareness of hazards associated with materials they work with.
- Emergency Response Team notification and emergency response procedures.
- The use of the WHMIS and the MSDS.

In addition to the above, all supervisors will be trained in:

- The use of the Spill Prevention and Response Plan. This includes a working knowledge of reference information (contact lists, hazardous material information sheets) in the event of a spill.
- The 5-step spill handling procedure—assessment, containment, cleanup, reporting and disposal.

<u>Accidents and Malfunctions</u>

As identified and discussed previously, procedures specific for potential accidents and malfunctions will be developed and incorporated into the Spill Prevention and Response Plan. At a minimum, spill response procedures will be developed for:

- Fuel spills on land
- Fuel spills in water
- Major leakage from tailings or pipelines, and
- Concentrate haul spill.

e. EMERGENCY RESPONSE

This section provides a conceptual framework for emergency response at the New Prosperity Mine. The plan outlined within this document provides a policy level overview that will be further expanded and refined as the application and permitting process progresses. Specific components will be developed prior to construction and incorporated into the Construction Management Plan. It will be continually updated into a full Emergency Response Plan (ERP) as mine development progresses.

In support of a policy for Emergency Response at New Prosperity, the following guidelines are identified:

1. Personnel safety is the primary concern.
2. Notification of an event to key New Prosperity Mine personnel and/or relevant third parties is mandatory.
3. Containment of the event is critical to limit injury and damages.
4. Reactive responsibilities will be assigned prior to the event occurring, wherever possible.
5. External communications will be channelled through the Mine General Manager of the New Prosperity Mine or his designate.
6. It is the responsibility of all employees to report any errors or omissions in the Plan to the Emergency Response Co-coordinator. Effective response is dependent upon all aspects of the Emergency Response Plan being current.

7. All employees are to be aware of the Emergency Response Plan and understand their responsibilities.

Purpose

The purpose of the ERP is to ensure that New Prosperity Mine personnel can react quickly and appropriately to emergencies which may affect employees or the operation of the New Prosperity Mine. This ERP will be designed to provide a set of procedures for emergency response to various incidents or occurrences. It will further provide a series of activities to allow for the restoration of critical business functions within an identified timeframe should the incident be of a serious nature or magnitude.

The ERP will address all levels of emergencies:

- Level 1—Individual Emergency
- Level 2—Crew Emergency
- Level 3—Departmental Emergency
- Level 4—Property wide Emergency

Components

The ERP will have two main components which identify activities and responsibilities in response to an incident: Emergency Response Team, and Recover Team Responses. The Emergency Response Team is intended to be a first response only and will essentially provide activities to ensure the safety of our employees, contact of required emergency services, and a return to normal operations following the incident. If the incident is of a serious nature and requires further escalation, then the second component, the Recover Team Responses, will be activated. This section identifies responsibilities, activities and references required to restore operational capabilities within the four main areas of the Company.

Considerations

The comprehensive Emergency Response Plan will identify a base set of activities to follow in response to general types of emergency. The considerations identified below will assist in the responses to our requirements:

1. Requirements for first aid are set out in the Occupational Health and Safety Guidelines, Occupational Health and Safety Regulation Issued by WorkSafeBC (the Workers' Compensation Board of BC).
2. A first aid station will be maintained and equipped with a rapid contact system for physicians in Williams Lake. An effective means of summoning the first aid attendant will be developed. There will be trained Industrial First Aid personnel on site, and a helipad that can be used for medical evacuations. A specific procedure will be developed for summoning either a road ambulance or Provincial Air Ambulance.
3. All operating shifts shall have and maintain an Emergency Response Team trained in Mine Rescue techniques as per the Mines Code (part 3.7) and be comprised of various employees representing all departments. A mine Emergency Response Plan will be developed and filed with the Chief Inspector for Mines. The Manager will ensure that there is a fully trained mine rescue team, with an appropriate

number people trained in mine rescue procedures. This team will form the core of the emergency response team, responsible for rescue and firefighting duties in the event of an emergency.

4. An onsite telephone Emergency number will be posted and highly visible throughout the site.
5. "Muster Locations" outside of each building where all employees can meet after a building will be identified and posted.
6. All employees shall be trained in how to activate the Emergency Response Team should an emergency occur.

Emergency Responses

The New Prosperity Project ERP will detail a series of responses and provide a list of activities to react to accidental incidents listed under the following headings:

Fire Emergency Response—The comprehensive Fire Emergency Response component will based on, but not limited to, the plan used at its Gibraltar Mine operation. Upon discovering a fire, every person working at the New Prosperity Project will be aware of, and capable of, carrying out initial containment measures. These would include an attempt to control the fire with the nearest extinguisher, raising the alarm, and seeking assistance. The emergency response team will be well trained in firefighting techniques, and will be available to respond to fire alarms. If there is a forest fire near the mine site, management will initiate close monitoring of the fire and seek advice from the Ministry of Forests and Range. Sources of water for forest fire fighting will be identified in the ERP.

Accident, Serious Injury or Death Emergency Response—When injuries require patient transfer to the Provincial Ambulance Service or air evacuation shall be arranged. The First Aid Attendant will instruct the Direct Supervisor to call for it. All treatment and transportation decisions are entirely the responsibility of the First Aid Attendant. Accident site security and investigation must be carried out as if there is a fatality; all operations in the area will be suspended, mine officials must be notified immediately, and the Mines Inspector and Occupational Health and Safety Committee must be notified within 16 hours.

Acts of God Emergency Response—The ERP will address responses to any incident which results in the release of contained water or, flooding from internal or external sources, any type of weather related situation such as snow storms, tornadoes, hurricanes, major electrical storms, etc. which affects the company's ability to conduct business, and any incident (i.e., berm or dump failure/seismic activity) which endangers people or damages property.

Essential Services Emergency Response—This response will be aimed at providing a list of activities to react to incidents caused by loss of primary services such as electrical power, and water.

Telephone Threat Emergency Response—A procedure is in place at the Gibraltar Mine for dealing with threats of violence, sabotage (bomb threat) that have been transmitted by telephone and will be incorporated into the New Prosperity ERP.

Spill Emergency Response—Procedures for responding to any incident which results in an environmental spill on or off the property are identified in the Spill Response section of the Materials Handling and Waste Management Plan above.

Accidents and Malfunctions—In addition, ERP procedures and policies will be developed for the potential construction-related accidents and malfunctions. Emergency response procedures will be developed for, at a minimum:

- Fuel spills on land
- Fuel spills in water
- Major leakage from tailings or pipelines
- Concentrate haul spills
- Block road culverts
- Excessive water in the TSFLoss of power to TSF seepage recovery, and
- Storm event exceeds the design criteria for the Fish Lake Flood Control Dams.

f. GEOTECHNICAL STABILITY MONTORING

A Geotechnical Stability Monitoring Plan for the New Prosperity Project will be developed during the detailed design phase that will provide monitoring procedures for the open pit, the waste rock disposal facilities and the tailings storage facility. The site conditions and monitoring objectives each of these facilities are different, and as a result the methods used for each geotechnical monitoring will be site specific. It is to be expected that these monitoring procedures may be modified during mine operations as operational experience is gained and site conditions change. This section provides an overview of the typical components that will be found in a geotechnical stability monitoring plan for each of the three components.

<u>The Open Pit</u>

The open pit will be excavated into the host soil and rock. The typical objective of an open pit geotechnical monitoring program is:

- To maintain a safe working environment
- The identification and monitoring of pit wall deformation
- The early identification of slope stability issues or concerns
- The monitoring of water level in the open pit walls
- The monitoring of the effectiveness of pit wall controls (i.e., pit wall dewatering, blasting procedures, and wall push back)

A pro-active approach to geotechnical monitoring for all pit design sectors during all stages of the pit development will be implemented. The monitoring and reporting will follow the Operations Monitoring and Surveillance (OMS) plan. This OMS plan will detail the operational procedures, the geotechnical monitoring program and actions to take in the event of an atypical occurrence. It will be implemented as a staged approach and will include geotechnical and tension crack mapping, surface displacement monitoring, the installation of subsurface displacement monitoring (i.e., Multiple Point Borehole Extensometers, slope movement prisms, and/or slope indicators) and the installation of piezometers to monitor pit depressurization and the water level in the pit walls. In addition the mine will ensure that suitable staffing resources are allocated to collect, process and interpret the geotechnical monitoring data, typically on a weekly basis but more frequently as required. The timely identification of accelerated movements from surface displacement monitoring and tension cracks is critical.

<u>Waste Rock Disposal Facilities</u>

The non-PAG/overburden waste rock stockpile for the New Prosperity Project is located north and east of the open pit and the tailings storage facility, as well as within the basin of the tailings storage facility. The waste rock disposal facilities will consist of large volumes of generally random rockfill material from the open pit and rock will be placed with minimal compaction.

The waste rock disposal facilities will be developed based on the OMS plan. For the placement of waste rock the geotechnical monitoring program will include the following components: visual observation to evaluate performance, records of placement rates, face advance rates, wireline extensometer to monitor disposal facility deformation, foundation piezometers to monitor pore water pressure and a regular waste rock disposal facility survey.

The mine will ensure that sufficient and competent personnel are available and responsible for ensuring that the waste rock disposal facilities monitoring is carried out regularly. Because of the large volumes of material being moved and the rapidly changing conditions under which the mine waste rock disposal facilities operate, the routine monitoring will likely occur as a daily activity with the pit supervisor preparing a shift report based on visual observation for routine operations. Additional documented walkovers of the waste rock disposal facilities will be required following extreme or unusual events. A weekly and quarterly report on waste rock disposal facilities operations and monitoring would typically be prepared for mine planning.

<u>Tailings Storage Facility</u>

The TSF will be equipped with a variety of geotechnical instrumentation installed in the tailings embankment and foundation during construction and over the life of the Project, as laid out in the OMS. The geotechnical instrumentation will be monitored during the construction and operation of the TSF to assess embankment performance and to identify any conditions different to those assumed during design and analysis. Amendments to the on-going designs and/or remediation work can be implemented to respond to the changed conditions, should the need arise.

The geotechnical instrumentation may include visual observation, vibrating wire piezometers, slope inclinometers and surface movement monuments. Additionally, standpipes, seepage monitoring ponds, seepage flow weirs and load cells may be used. The geotechnical instrumentation will generally be installed in planes along the tailings embankments and groundwater monitoring wells will be installed at suitable locations downstream of each embankment. The frequency of monitoring for the piezometers and inclinometers during construction and following first filling will be higher than for the typical operating condition. Monitoring frequency is typically reduced to bi-monthly readings once the effects of initial construction have dissipated. Surface movement monuments should be surveyed twice per year during operations. Water quality monitoring of the seepage through the embankment and foundation shall be conducted routinely during operations.

The OMS plan will detail the operational procedures, the geotechnical monitoring program and actions to take in the event of an atypical occurrence, with a flow chart of pre-prepared plans to execute in the event of an emergency situation. A review of the geotechnical instrumentation records would typically be undertaken at least annually by the design engineer and a periodic Dam Safety Review by a qualified and experienced independent engineer would be undertaken as set by the Canadian Dam Association Guidelines.

g. SOIL HANDLING PLAN

The soil salvage plan is based upon the data collected by Talisman in 1996 and 1997 (Talisman Land Resource Consultants Inc. 1997), and soil sampling and mapping completed by JWA in 2006 (see March 2009 EIS/Application Volume 5, Section 4.5 Scope of Assessment for Soils). Details of the reclamation suitability criteria for soil used to generate salvage volumes are outlined in Section 2.7.2.6, Terrain and Soils.

The primary limitation to soil suitability for reclamation in the Project area is coarse fragment content. Coarse fragment content greater than 50% by volume is common, with greater than 70% coarse fragment content occurring in colluvial and glaciofluvial soils. Most morainal soils have coarse fragment contents between 40 and 75%. Morainal soil texture is frequently sandy loam to loam with some soils possessing finer textured (silt loam to clay loam) lower soil horizons. Most morainal soils are rated “fair” for use in reclamation due to high coarse fragment content or fine texture. The colluvial and glaciofluvial soils have coarse sandy loam to loamy sand texture, as well as high coarse fragment contents, making them poorly suited or unsuitable for use in reclamation.

Reclamation suitability ratings for the undisturbed mineral soil of the root zone (mineral soil above the C horizon) on the mine site were determined using the methods outlined in *Soil Quality Criteria Relative to Disturbance and Reclamation* (AAFRD 1987) (see Table 2.8.1-2 and Table 2.8.1-3).

Table 2.8.1-2 Criteria for Evaluating the Suitability of Root Zone Material in the MDA

Rating/Property	Good (G)	Fair (F)	Poor (P)	Unsuitable (U)
Reaction (pH)[1]	5–6.5	4–5; 6.5–7.5	3.5–4; 7.5–9	<3.5 and >9
Salinity (EC)[2] (dS/m)	<2	2–4	4–8	>8
Sodicity (SAR)[2]	<4	4–8	8–12	>12[3]
Saturation (%)[2]	30–60	20–30; 60–80	15–20; 80–100	<15 and >100
Coarse Fragments[4] (% Vol)	<30[5]; <15[6]	30–50[5]; 15–30[6]	50–70[5]; 30–50[6]	>70[5]; >50[6]
Texture	L, SiCL, SCL, SL, FSL,	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rating/Property	Good (G)	Fair (F)	Poor (P)	Unsuitable (U)
Moist Consistency	very friable, friable	Loose, firm	very firm	extremely firm
CaC03 (%)	<2	2–20	20–70	>70

Notes:

[1] pH values presented are most appropriate for trees, primarily conifers. Where reclamation objective is for other end land uses, such as erosion control, and where other plant species may be more important, refer to Table 6 in *Soil Quality Criteria Relative to Disturbance and Reclamation* (AARD, 1987).

[2] Limits may vary depending on plant species to be used.

[3] Materials characterized by an SAR of 12 to 20 may be rated poor if texture is sandy loam or coarser and saturation percent is less than 100.

[4] 0.2 to 25 cm diameter fragments in the soil material.

[5] Matrix texture (modal) finer than sandy loam.

[6] Matrix texture (modal) sandy loam and coarser.

Table 2.8.1-3 Reclamation Suitability Ratings

Rating	Description
Good	None to slight limitations that can affect plant growth
Fair	Moderate to severe limitations; can be overcome by proper planning and good management
Fair to Poor	Contains soils with fair and poor ratings
Poor	Severe soil limitations that make use questionable; careful planning and very good management are required
Unsuitable	Chemical or physical soil properties are so severe that use in reclamation is not possible or economically feasible
Not Rated	Organic soils are not rated in this system

The overburden materials in the pit area were assessed for suitability for reclamation and were rated generally poor to unsuitable (Talisman Land Resource Consultants Inc., 1997). The primary limitation for the overburden material was high pH values (8.1 to 8.8), with additional limitations of fine textures (silt loam to heavy clay) in the glaciolacustrine material and coarse fragment content (up to 86%) in the glaciofluvial materials. At depths ranging from 25 to 39 m, the material also becomes sodic, and unsuitable for use in reclamation. Chemical analyses indicate that isolated overburden samples had arsenic, chromium, and nickel concentrations higher than the agricultural criteria recommended by the *Canadian Council of Ministers for the Environment* (CCME, 1999), and copper concentrations in overburden were frequently greater than the 63 mg/kg agricultural criterion (CCME, 1999). Thus, it is not proposed that significant volumes of overburden be used as a surface reclamation material. Refer to the Terrain and Soils assessment for mitigation to prevent detrimental admixing of soils.

Three types of soil salvage will occur during the project and the type selected is dependent on the infrastructure being developed:

- *Windrowed soils:* for linear features such as channels, roads, and retention ponds, soil will be excavated and placed in linear piles or berms along the features. The depths of soil replaced for reclamation will be dependent on the amount of soil that was available to salvage from the sites. All linear features will have soil windrowed unless they are at risk of dust deposition which may impact soil quality. For example, the conveyor line is a linear feature which will have soil removed from that location to avoid metal deposition on topsoil rather than leaving it in place in windrows. In addition, roads that run parallel to the conveyor belt will need soil stripped and stored in stockpiles that will be away from those operations. The Plant Site is another area that may have metal deposition; therefore the soils stripped from this location will also be stored in a stockpile. The soil material from these metal deposition areas will be stored in the Plant Site stockpile
- *Two-lift operation of soils:* In areas of buried services, a two-lift soil salvage operation will be used. For this salvage method the first lift would be for the soil and the second lift for the subsoil or overburden. When soil is placed back in a trench it is done in the reverse order thereby preventing admixing of lower quality material with soil that is used as a plant growth medium. No long-term soil storage is required as soils will be replaced once the infrastructure is in place.
- *Soil stripping and storage in stockpiles:* this is the removal of soil after vegetation has been cleared and transporting the soil by haul trucks to designated long-term storage sites. Sites proposed for this type of soil salvage include areas that will be covered by mine features such as the plant site, tailings

pond and beaches, tailings storage facility embankments, and waste dumps. The storage locations take into consideration the volumes required for reclamation of project development areas such as the tailings storage facility beaches and embankments, plant site and conveyor line, ore stockpile, and the non-PAG waste rock dumps. Salvage of sufficient soils for a replacement depth of 50 cm was selected to provide a sufficient rooting medium for plant growth. The soil cap will be replaced in one lift.

- Due to the limited availability of soils with low coarse fragment content suitable for reclamation in the project area, both mineral and organic soils will be salvaged and stored together in the stockpiles. Based on the volumes calculated for salvage and storing in stockpiles, the mixed soil material will consist of approximately 26% organic soils and 74% mineral soils by volume.

A soil handling plan was developed which takes into account the volumes of soil required for final reclamation of mine disturbance sites. The soil volumes were determined for the various salvage areas (refer to Figure 2.8.1-x). Table 2.8.1-x lists the Project mine disturbance areas and sites which will be reclaimed progressively during mine life and at closure. Approximately 1,380 ha will require a soil cover prior to revegetation.

Table 2.8.1-x details the volumes of soil required for final reclamation based on the area of each disturbance site and the proposed soil replacement depths. For soil volume estimation, waste rock storage and TSF embankment slope areas were increased by a liberal 30% in order to account for larger surface areas once these sites are resloped to 2H:1V grades. Approximately 6,322,000 m3 of soil material will be required for capping. Figure 2.8.1.2-7 shows the areas of soil salvage to meet the required volumes for reclamation; the figure also shows the locations of proposed soil stockpile sites within the MDA.

Based on the soil material volumes required for reclamation (Table 2.8.1-4), soil salvage volumes to be stockpiled were calculated. Soils classified as unsuitable due to poor quality or being located in steep, unstable terrain were not included in the soil salvage volume calculations. The remaining mineral soils rated as Fair and Fair to Poor and Organic soils were included in the salvage volume calculations. Table 2.8.3-9 provides a listing of estimated soil volumes which will be salvaged before and during mine development; the table also lists the stockpile locations where the salvaged soil materials will be stored. It is estimated that approximately 6,502,429 m3 will be salvaged consisting of both mineral and organic soils; the majority (74 %) will be mineral soils. The estimated salvage volume will have a surplus of approximately 180,199 m3 over what will be required for reclamation (refer to Table 2.8.1-5). In addition, the salvage volume estimate does not include potential soil material volumes present beneath the remaining unsalvaged portions of the TSF Beach, TSF Embankments and TSF Pond areas (Figure 2.8.1-1). These remaining unsalvaged portions will be contingency soil salvage areas to obtain additional material if more is required as the project advances. The decision on whether or not to salvage additional soils from these areas will be made well before the area is covered with tailings or ponded water.

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.8.1-1 …

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.8.1-2 …

A total of five stockpiles have been selected for soil storage (Table 2.8.1-6). Selecting the stockpile locations has taken into account: the volume of soil that must be stored within its dimensions, topography (gentle to flat slopes), avoidance of natural drainages, and travel required for stockpiling. In addition, the need to be at a sufficient distance from mine project activities to avoid dust contamination was also considered.

Upon completion of construction, a final mine site map will be prepared showing the exact locations and dimensions of stockpiles.

A detailed yearly soil handling plan will be developed with more specific information regarding soil salvage areas and yearly volumes at permitting.

Table 2.8.1-4 Areas Covered by Proposed Mine Features

Feature	Area (ha)
Access Trail	1.3
Conveyor	2.3
Ditch – Contact	8.3
Ditch Non-Contact	5.9
Explosives Storage	1.2
Fish Lake Dam	0.7
Fish Lake Pumphouse	0.3
Haul Road	26.9
Pipelines	12.3
Pit (pit walls and pit pond- permanent disturbances/features; no final reclamation)*	177.2
Plant	35.9
Pond – Contact	11.4
Pond - Non-Contact	5.2
Pond – Tailings	0.1
Site Road	45.3
Stockpile - Non-PAG	132.0
Stockpile – Ore	77.5
Stockpile – Soil	129.5
TSF Beach	763.9
TSF Embankment	123.0
TSF Pond (pond- permanent feature; no final reclamation)*	405.6
Total Disturbance Area	1,965.6
Minus Permanent Disturbed Areas/Water Areas*	582.8
Remaining Area for Reclamation	1,382.8

Table 2.8.1-5 Soil Volumes Required for Reclamation

Disturbance Site	Area (ha)	Soil Capping Depth (cm)	Soil Volume Required (m^3)	Soil Source/Stockpile
Windrowed Soil Sites[1] :				
Access Trail	1.3	76	9,896	Access trail windrows
Ditch – Contact	7.9	57	45,074	Ditch windrows
Ditch Non-Contact	5.7	54	31,248	Ditch windrows
Explosives Storage	1.2	87	10,328	Explosives storage windrow
Fish Lake Dam	0.5	108	5,113	Fish Lake Dam windrow
Fish Lake Pumphouse	0.1	45	268	Fish Lake Pumphouse windrow
Pipelines	12.3	52	63,688	Pipeline windrows
Pond – Contact	11.3	74	83,359	Pond windrows
Pond - Non-Contact	5.2	48	25,113	Pond windrows
Pond – Tailings	0.1	45	563	Pond windrows
Site Road	43.9	55	240,229	Site road windrows
Windrow Sub-totals:	*89.4*		*514,879*	
Stockpiled Soil Sites:				
Conveyor	2.3	50	11,316	Plant Site Stockpile
Haul Road	26.9	50	134,363	Plant Site Stockpile
Pit[2]	177.2	0	0	
Plant	35.9	50	179,655	Plant Site Stockpile
Stockpile - Non-PAG	132.0	50	660,000	Plant Site Stockpile
Stockpile – Ore	77.5	50	387,741	Plant Site Stockpile
Stockpile – Soil[3]	129.5	0	0	
TSF Beach	763.9	50	3,819,276	East Stockpile 1, East Stockpile 2
TSF Embankment	123.0	50	615,000	North Stockpile 1, North Stockpile 2
TSF Pond[4]	405.6	0	0	

Stockpile Sub-totals:	*1,873.7*		*5,807,351*	
Totals:	1,963.1		6,322,229	

Notes:

1. For Windrowed Soil Sites- volumes of soil salvaged are the volumes that are replaced at time of reclamation; therefore, replacement soil depths will depend on the areas to cover at time of reclamation. Depths in Table 2.8.3-4 are based on the site areas and the calculated soil salvage volumes of the sites in Table 2.8.3-5.
2. Pit walls and pond will remain as permanent disturbance features; no soil replacement.
3. Soils under soil stockpile sites will be left intact; therefore, no soil replacement required.
4. TSF Pond will remain as permanent disturbance feature; no soil replacement.

Table 2.8.1-6 Estimated Soil Salvage Volumes and Stockpile Locations

Salvage Sites	Map ID #	Salvage Area (ha)	Salvage Volumes (m^3)			Totals	Stockpile Site
			Organic (Stockpile)	Mineral (Stockpile)	Mixed/ Windrowed		
Windrowed Soil Sites:							
Access Trail	1	1.3			9,896	9,896	Access trail windrows
Ditch – Contact	3	7.9			45,074	45,074	Ditch windrows
Ditch Non-Contact	4	5.7			31,248	31,248	Ditch windrows
Explosives Storage	5	1.2			10,328	10,328	Explosives storage windrow
Fish Lake Dam	6	0.5			5,113	5,113	Fish Lake Dam windrow
Fish Lake Pumphouse	7	0.1			268	268	Fish Lake Pumphouse windrow
Pipelines	9	12.3			63,688	63,688	Pipeline windrows
Pond – Contact	12	11.3			83,359	83,359	Pond windrows
Pond - Non-Contact	13	5.2			25,113	25,113	Pond windrows
Pond – Tailings	14	0.1			563	563	Pond windrows
Site Road	15	43.9			240,229	240,229	Site road windrows
Windrowed Soils Sub-totals:		*89.4*			*514,879*	*514,879*	

Salvage Sites	Map ID #	Salvage Area (ha)	Salvage Volumes (m^3)			Totals	Stockpile Site
			Organic (Stockpile)	Mineral (Stockpile)	Mixed/ Windrowed		
Stockpiled Soil Salvage Sites:							
Conveyor	2	2.3	1,976	9,698		11,674	Plant Site Stockpile
Haul Road	8	26.8	13,029	118,540		131,569	Plant Site Stockpile
Pit	10	128.7	196,127	535,675		731,802	Plant Site Stockpile
Plant	11	35.9	87,316	138,087		225,403	Plant Site Stockpile
Stockpile - Non-PAG	16	113.7	81,126	444,769		525,895	Plant Site Stockpile
Stockpile – Ore	17	77.3	83,798	286,865		370,663	Plant Site Stockpile
Stockpile - Soil[1]	18	0.0				0	
TSF Beach[2]	19	532.9	927,815	2,134,407		3,062,222	East Stockpile 1, East Stockpile 2
TSF Embankment	20	93.2	140,302	374,256		514,558	North Stockpile 1, North Stockpile 2
TSF Pond[3]	21	84.4	29,517	384,247		413,764	East Stockpile 1, East Stockpile 2
Stockpiled Soil Sub-totals:		*1,095.3*	*1,561,006*	*4,426,544*		*5,987,550*	
Totals:		1,184.6	5,987,550		514,879	6,502,429	
Volumes Required for Final Reclamation:			5,807,351		514,879	6,322,229	

Notes:

1. Soil materials under soil stockpile locations will not be salvaged.
2. Total salvage area= 754 ha; only 532.9 ha required to meet soil volume requirements. Remaining area to remain as contingency if additional soil material required.
3. Total area= 406 ha; only 84.4 ha required to meet soil volume requirements. Remaining area to remain as contingency if additional soil material required until it becomes flooded.

Table 2.8.1-7 Soil Stockpile Characteristics and Volumes

Name	Area (ha)	Approximate Dimensions			Stockpile Volume Capacity (m^3)	Estimated Soil Salvage Volumes in Stockpiles (m^3)		
		Length (m)	Width (m)	Height (m)		Organics	Mineral	Total
Plant Site Stockpile	34	904	370	6	2,040,000	463,372	1,533,634	1,997,006
North Stockpile 1	6	452	133	2	120,000	28,060	74,851	102,912
North Stockpile 2	15	1028	145	3	450,000	112,241	299,405	411,646
East Stockpile 1	59	1028	575	5	2,950,000	785,012	2,065,297	2,850,309
East Stockpile 2	16	945	170	4	640,000	172,320	453,358	625,678
Totals:	130				6,200,000	1,561,006	4,426,544	5,987,550

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For the soil salvaging and stockpiling operations, Taseko will undertake a variety of best management practices to ensure that soils are handled and stored properly during all phases of the mine development project. Best management practices proposed to be carried out include:

Best Management Practices for Soil Stripping and Salvage

- Wet conditions will be avoided when possible during soil salvage operations.
- Excessive traffic will be avoided during the salvage process to minimize admixing, compaction and rutting.
- Traffic will be confined to established routes to avoid unnecessary compaction of soil in undisturbed areas.
- Erosion control measures provided in the Erosion Control and Sediment Retention Plan will be implemented.

Best Management Practices for Soil Stockpiles

- Soil will be stockpiled in suitable locations where it will not be moved or subject to further disturbance to minimize admixing and physical deterioration.
- Stockpiles will be located a sufficient distance away from operations to protect soils from contamination from risk of spills or metal deposition (i.e., dust from the mine).
- Protective ditches will be constructed around stockpiles to prevent any spill reaching stockpiles and prevent any erosion from stockpiles from escaping off site.
- Erosion will be managed by limiting the height and slope of stockpiles. Where possible, slopes will be less than 3:1 and heights will not exceed 10 m.
- Whenever possible, stockpiles will be oriented to reduce wind erosion and stockpiles will not be stored at heights of land to reduce wind exposure.
- Where required, erosion control measures will be implemented.
- Any woody vegetation slash that is not cleared from the site will be mulched or otherwise incorporated into soil stockpiles.
- Soil stockpile locations will be identified by signage to prevent removal of material from the site or contamination with other materials.
- Vegetation will be promptly established on stockpiles to reduce exposure of bare soil to wind and water and establishment of invasive plants.
- Invasive plant prevention will be followed as outlined in the Taseko Invasive Plant Management Strategy (March 2009 EIS/Application, Volume 5, Appendix 5-5-K)

Soil Replacement

Reclamation sites will be capped with soil materials stored in windrows or from designated stockpiles.

The soil replacement depths for the windrow sites are determined from the volume of material estimated to be salvaged from the sites and their areas. An average soil replacement depth of 50 cm will be placed on areas that will receive soils from stockpiles. This depth is based on average pre-development rooting depths.

The access trails, water management facilities/structures, pipelines, roads and explosives facilities will be reclaimed through replacement of windrowed soil.

The non-PAG waste rock dump (non PAG stockpile), ore stockpile, plant site, conveyor line, haul road and tailings embankments will be reclaimed through placement of 50 cm of salvaged and stockpiled soil in one lift. The replaced soil cap will consist of up to 26 % organic soils by volume mixed with mineral soils based on the amount of organic soils that are expected to be salvaged and mixed into stockpiles. Where required, soil may be scarified prior to seeding if the surface becomes compacted due to truck or equipment traffic.

Portions of the tailings beach requiring capping to enhance vegetation growth and reduce effects from wind erosion will be capped with stockpiled soil material to a depth of 50 cm, with the exception of a proposed a 100 m wide zone on the beach area measured from the high water mark. Soil replacement is not planned for this zone to prevent erosion of the soil capping material along the shoreline. Establishment of riparian and shoreline vegetation is expected to be successful without soil capping.

Best Management Practices for Replacement

- During the closure phase of the project, soil will be placed on the beach surface as soon as tailings deposition ends at mine closure to prevent dust formation.
- Soil will be transported from the stockpiles to the reclamation sites as soon as they become available.
- Soil replacement operations will not be carried out if the soil material is saturated to the point that it is in a near-liquid state which makes it difficult to handle by heavy equipment; or the ground conditions at the replacement sites are saturated to the point that heavy equipment cannot travel on it.
- Traffic will be managed during the replacement operation to minimize admixing, compaction and rutting.
- Low ground pressure equipment will be preferred for soil reapplication / spreading.
- Traffic on reclamation sites will be minimized, especially after soil replacement.
- Erosion will be monitored and controlled.

h. EROSION CONTROL AND SEDIMENT RETENTION PLAN

Taseko is committed to developing and implementing an erosion and sediment control plan (ESCP) consistent with industry best management practices (BMPs) to mitigate environmental effects attributed to sediment. Whereas detailed ESCPs are developed prior to construction to address construction specific mitigation techniques, a conceptual ESCP is a planning level tool addressing general Project erosion and sediment control requirements.

This conceptual plan deals with management of sediments arising from erosion of overburden fines in areas disturbed during construction and operation and includes design considerations for erosion and sediment control structures. The goal of this conceptual ESCP is to develop measures that will minimize erosion and intercept potential sediments as close to the source as possible. Measures presented in the following conceptual ESCP will act as a guideline for the detailed and site-specific ESCP that will be implemented at the time of construction to comply with regulatory requirements.

This ESCP covers six main management areas of the project where construction disturbance will be concentrated. These areas include:

- Access corridor
- Transmission line corridor
- Borrow areas
- Mine open pit/plant site/mill site/waste rock dump areas
- Mine TSF, and
- Ancillary facilities.

<u>Access Corridor</u>

Access for construction and operations will be provided by the following roads:

- Provincial Highway No. 20 (90 km of an existing double lane paved road) from Williams Lake to the Taseko Lake Road
- Taseko Lake Road (a.k.a. Whitewater Road) (68.4 km of existing gravel road)
- 4500 Road (a.k.a. Riverside Haul Road) (19.4 km of existing single lane gravel road) which will be upgraded with pullouts at 2 km intervals
- New Prosperity Mine Access Road (2.8 km of new single lane gravel road, which will be constructed 5 m wide and with pullouts), and
- Provincial Highway Route No. 97 (54 km of existing double lane paved road) from Williams Lake to the Gibraltar Concentrate Load-out Facility near Macalister.

The new Project site access road will be gravel, 2.8 km long, 5 m wide, one lane, with pullouts. Upgrades to the existing 4500 Road will also be completed. The existing 5 m wide road will be expanded to 8 m and the bed and surface will be upgraded with 450 mm of suitable material. A total of 10 pullouts, spaced 2 km apart will be constructed.

No road crossings over Taseko River or Fish Creek are anticipated. Site specific erosion and sediment control measures for watercourse crossings will be addressed in the detailed ESCP that will be completed once further details of the Project development become available.

New roads will be constructed according to the Forest Practices Code, Forest Road Engineering Guideline. Road construction within the project site will provide adequate drainage to minimize damage due to erosion. Small settling ponds with rock overflow weirs may be created if treatment is required to settle road runoff prior to discharge into watercourses. Gravel roads will be maintained by grading and adding gravel when necessary. Gravel road surfaces will be graded so that they are crowned at the center to promote drainage. A network of drainage ditches and culverts will be installed to convey storm water efficiently. Exposed soils such as road edges and ditches will be seeded with a grass mix that meets the requirement for Canada No. 1 Seed (minimum purity of 97%, and a minimum germination of

75%). Native species will be used wherever feasible. Paved roads will be kept free of mud and debris from mine traffic to the greatest extent possible.

Transmission Line Corridor

A 230 kV power transmission line 125 km long and 500 m wide, with switch stations at Dog Creek and the mine site, will be constructed to supply power from the BC Hydro Grid. The transmission line corridor has been designed to avoid lakes and wetlands and to follow the access corridor wherever possible. Clearing for the transmission line right-of-way will follow erosion and sediment control measures outlined in the Fisheries and Oceans Canada (DFO) Operational Statement for Overhead Line Construction (DFO 2007). The total cleared forest area required for installation of the transmission line is estimated as 585 ha. Transmission poles will be excavated in earth and overburden 2.1 to 3.6 m deep (90% of the poles) or in rock and slash (10% of the poles). Holes will be backfilled with gravel and native soil. Silt fencing will be used around sensitive watercourses and/or wetlands within the 80 metre transmission line corridor.

Borrow Areas

In order to manage erosion and sediment from borrow areas, the following measured will be implemented:

- Clearing in borrow areas will be limited to the greatest extent possible
- Banks will be sloped to provide positive drainage
- Runoff from borrow areas will be directed to ditches or other sediment treatment areas
- Large borrow sites will be contoured to direct runoff to a sediment trap at the downstream end
- Bare surfaces will be stabilized with temporary erosion control blankets in areas of high erosion risk (evidence of rill erosion) with permanent vegetation being established as soon as final grades are established

Further techniques to manage runoff from all borrow sites will be addressed in the site-specific ESCP.

Mine Open Pit/Plant Site/Mill Site/Waste Rock Dump Areas

All mine site runoff from the disturbed project areas including the open pit, mill site, waste dumps and tailings storage facility will be directed to a number of site sediment and erosion control ponds located throughout the site. Drainage ditches will be constructed to collect water from all the disturbed areas including the primary crusher, the overland conveyor, the mill site and the camp to direct surface runoff from these areas to the pond during operations. During the construction phase, the pond may not yet be available for site runoff collection, so temporary measures will be used, which will include silt fencing, and sediment basins and traps to limit sediment discharge from any disturbed areas to the environment.

Mine Tailings Storage Facility

Surface and seepage water will be controlled during construction of the Stage 1a Main Embankment. Initial sediment control ponds will be constructed to management sediment during the construction phase of the TSF. Two small earthfill dams will be constructed at the outlet of the lake to Fish Lake from draining into the open pit.

Ancillary Facilities

The main construction camp will be located adjacent to and south of the proposed mill site. The general areas of the campsite will be graded for positive drainage. All roads and parking areas within the camp will be raised with an average 150 mm thick layer of gravel to mitigate muddy conditions. Drainage ditches and culverts will be constructed and installed as required. Runoff collected from the construction camp area will be channelled towards the water collection pond, to the west of the camp. This drainage can be achieved readily, as the general area of the construction camp has a natural slope of approximately 1% towards the west. Temporary measures such as silt fencing, sediment basins and sediment traps may also be used to limit discharge from disturbed areas to the environment while the water collection pond is under construction.

Taseko will continue to identify areas of high risk for erosion and sedimentation throughout the life of the project (planning and design, construction, operation, decommissioning and reclamation). General mitigation for each stage of the project is described below. Detailed mitigation plans will be developed for these identified areas during the project permitting, and will be updated during construction and operations.

General Mitigation

Measures will be implemented to minimize downstream sediment concentrations. BMPs for surface erosion protection and sediment control include, but are not limited to:

- Maximize the diversion of clean water around areas of potential disturbance
- Establish buffer zones around disturbed areas for natural filtering of surface runoff
- Intercept sources of potential sediment-laden water as close to source of erosion as possible and re-direct runoff to stable areas
- Minimize disturbance and/or removal of vegetation
- Utilize bioengineering practices by establishing self-sustaining vegetation in erosion-prone areas once use of disturbed areas is no longer required
- Place vegetation matting on slopes susceptible to surface erosion
- Use appropriate sediment traps and barriers such as silt fences and rock check dams to minimize erosion and sheet flow in areas prone to erosion
- Use silt fencing extensively during the construction phase around the perimeter of the mine site, on access roads, on the transmission line corridor (in sensitive areas) and near sediment sources to prevent the transport of sediment-laden water to natural watercourses
- Use rock check dams or riprap to reduce water velocity and scour potential and to provide temporary sediment retention
- Use sediment catch basins

- Use water bars to divert sediment laden water out of ditches and into adjacent stable, vegetated areas
- Use ditch armouring depending on factors such as steepness, soil type and presence of immediate downstream watercourses
- Undertake operations in sensitive areas during periods of dry weather where possible
- Minimize traffic through sensitive areas and select equipment that will generate the least disturbance
- Minimize slopes and/or use mid-slope benching where possible
- Cover exposed slopes with side slopes greater than 1H:1V with polyethylene sheeting
- Install silt fencing in ditch line and at outlets of cross drain culverts
- Use non-woven geotextile to control erosion in ditches and around the perimeter of sediment ponds
- Line ditches with loose/fine substrates using clean gravel, and
- Install French drains to redirect subsurface flows where possible.

Pre-Construction and Construction Phase Mitigation

The pre-construction and construction phase will include disruption of existing habitat and terrain. Construction disturbance typically results in the release of fine sediments into any surface runoff flowing through the work area. As a result, all erosion and sediment control measures, including sediment ponds, must be implemented at the outset of construction. Erosion and sediment control measures will be inspected and maintained regularly.

Surface drainage patterns will be managed to minimize erosion and associated sedimentation. For ditches (at all project areas), measures such as armouring, geotextile, silt fencing, and sediment ponds will be utilized. Exposed soil in roadside slopes will be revegetated with an appropriate seed mix as soon as possible. Sediment ponds that are no longer required after construction will be reclaimed and revegetated.

Pre-construction and construction activities will be monitored routinely by a qualified Environmental Monitor for the duration of this phase of the Project. Qualifications and reporting requirements for the Environmental Monitor are addressed in Monitoring and Inspection.

Operations Phase

During operation of the mine, erosion and sediment control measures will include, but not necessarily be limited to:

- Routine erosion and sediment management (precipitation/snowmelt) along the access road, the transmission line corridor, and within the mine site
- Management of operations during major precipitation events

Procedures will be established for the collection and analysis of water quality samples to ensure that site runoff complies with permit requirements and regulatory requirements. Protocols will also be established for the monitoring and maintenance of erosion control measures. The Environmental Coordinator for the site will have the ability to shut work down if non-compliance issues are observed, or where it is anticipated that unforeseen circumstances are likely to cause environmental damage.

Mine Closure

At the time of mine closure, the basic components that will require erosion and sediment control include:

- Breaching of collection channel located to the east of the TSF along the 4500 road.
- Flooding of the tailings and waste rock impoundment facility
- Construction of the permanent spillway for the tailings dam
- Reclamation of overburden stockpiles
- Removal and regrading of all access roads, ponds, ditches and borrow areas not required beyond mine closure
- Long-term stabilization of all exposed erodible materials

All areas above the waterline with forest capability will be reclaimed to promote productive forest ecosystems. Reclamation techniques are detailed in the Conceptual Reclamation Plan.

Any roads within the project area required for access after closure will be semi-permanently deactivated. Semi-permanent deactivation measures include:

- Removal of culverts and replacement with cross ditches
- Installation of ditch blocks at cross ditch locations
- Installation of waterbars across roads to direct water away from the road
- Sloping the road surface, as appropriate
- Revegetation of exposed soils surfaces

Installed closure components must be sustainable in the long term and should involve a minimal amount of subsequent inspection and maintenance once constructed. Further information on reclamation and closure works is provided in Reclamation and Decommissioning Plan

Techniques and Best Management Practices

Erosion Control

Erosion refers to the dislodgement, removal and loss of topsoil, sand, silt or clay from its original location by water, wind, ice or gravity. During construction of a mine and ancillary facilities, soil erosion is caused by vegetation removal and the exposure of soils to water, and to a lesser extent, wind.

Conditions that influence surface runoff, including slope steepness, slope morphology, and material type and texture, are used to assess surface erosion potential. Types of water erosion on soils include raindrop splash, sheet erosion, rill and gully erosion, and stream and channel erosion.

Erosion control involves minimizing the extent and duration of land disturbance that exposes bare soil. Erosion control measures are typically more effective than sediment control, and will therefore take precedence. The following provides some additional detail on erosion control measures that may be appropriate.

Runoff Interception and Control

Diversion of surface water will minimize the volume of water running onto disturbed areas, thereby reducing the potential of erosion from these areas, and the level of sediment control and treatment that might otherwise be required.

A collection channel located along the 4500 road will harvest non-contact water and direct it to the inlet streams of Fish Lake.

Further interception or diversion channels will be constructed at various locations in order to capture and control stormwater runoff, and to direct it off site. Ditches prevent stormwater from entraining sediment from exposed areas and may partially filter out potential pollutants. Diversion ditches typically discharge directly to the downstream environment or to locations where no potential for adversely affecting the environment would occur.

Diversion ditches may be designed in accordance with the following criteria, subject to detailed construction plans and site constraints:

- Sized to accommodate 110% of peak or storm flows (a 25 year event based on the Rainfall Frequency Atlas of Canada). Sizing of ditches should allow vegetation planting for further erosion control.
- Corners and outfalls will be armoured with rip rap or boulders.
- Ditches should have sufficient grade and capacity to carry the expected runoff, and should be designed and spaced to drain the entire site effectively.

Appropriate channel lining will be specified depending on channel gradients and velocities. Some initial flushing, erosion and self-armouring are expected following construction. A number of permanent interception/diversion ditches will be constructed as part of the overall operations phase.

Diversion berms may be constructed on exposed slopes to intercept sheet flow, re-routing the water to more stable areas. If required, berms will be placed to ensure that water will not drain back onto the disturbed areas.

Sediment traps may be used where drainage ditches are required. Sediment traps are any structure constructed for the purpose of effectively removing suspended sediment from runoff. The construction of sediment traps typically involves the construction of a containment area or pools within a ditch to retain runoff for a long enough period of time that suspended materials can settle. Sediment traps and silt fences will be cleaned regularly to maintain maximum efficiency.

All ditches will be graded to direct runoff to the drainage ditches, or directly to the sediment ponds. Silt fences and gravel berms will be installed at intervals along the length of the ditches as required, in order to promote the settling out of sediment. All runoff will be directed to the sediment ponds for final settling prior to being discharged to a drainage ditch. During large storm events, if appropriate, surface storm water runoff can be directed into vegetated/undisturbed areas where water will flow away from the site. The Environmental Monitor should be onsite to confirm whether the discharging of storm water runoff to vegetated areas is suitable for the site and will not cause further erosion. If water is discharged to vegetated areas, the hose outlet will be modified (e.g., with a capped PVC pipe) to diffuse water and energy at the outfall. The environmental monitor on site should verify that runoff from large storm events is managed sufficiently so that scouring of vegetated surfaces does not occur. Diverting water onto vegetated undisturbed areas still may result in significant erosion depending on the nature of the land surface (i.e., gradient, and focusing of water and gully formation and flows may require further diffusion at the outfall.

Dewatering may be required on occasion throughout the life of the Project in order to maintain work areas. Dewatering may also proceed in areas where concrete work is being completed to ensure that the concrete work is completed under dry conditions. As per the contract documents, pumps used to maintain dewatered areas may discharge water towards or into Fish Creek provided that the water is clean and free of all deleterious substances.

Bed protection and stabilization, as well as energy dissipation measures, may be required where the diversion ditches discharge into Fish Creek.

To dissipate energy, water may be discharged over large rocks to reduce velocities. If pumps are used, a capped perforated PVC pipe may be attached to the pump outlet to diffuse water energy and prevent erosion at the outfall.

No water will be extracted from fish bearing waters unless the pump intake is equipped with a fish exclusion screen. The fish exclusion screen must prevent entrainment (drawing fish into the intake) and impingement (holding fish against the screen so it is unable to free itself) and comply with the Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO 1995).

Grubbing and Stripping

Grubbing and stripping pertains primarily to activities along the new section of main access road (2.4 km), the transmission line corridor, and the access roads to the transmission line corridor. Grubbing and stripping limits will be marked in the field using fencing or spray paint prior to the commencement of work to ensure that vegetation in adjoining areas is not disturbed.

The grubbing and stripping of soils is to be limited to areas absolutely necessary to satisfy the construction requirements of the Project. Where construction can be completed without grubbing and stripping, none shall occur. Grubbing will not proceed more than five days in advance of any subsequent activity without the installation of appropriate surface drainage control. Grubbing will be suspended during and immediately after intense rainstorms that have resulted in excessive runoff. Any stripped topsoil shall be stockpiled and covered for future use in restoration.

Stockpiling

Temporary stockpiles of excavated material or backfill may be kept on-site. Any piles of earth or erodible construction materials stockpiled on-site will be placed so that erosion into ditches or other open water cannot occur and in a location that stockpiles will not impede drainage. All stockpiles with side slopes greater than 1V:1H will be covered with tarpaulins or plastic sheeting for erosion control. A silt fence will be required around the toe of stockpiles to prevent sediment movement from the stockpile. All silt fencing will be dug in a minimum 200 mm into the ground. Runoff that originates from stockpiled materials will be collected and directed to the sediment pond or trap.

Slope Protection

Erosion protection measures will be used to reduce and eliminate the detachment or migration of slope soils at all times, especially during rain events, and will be used in conjunction with the runoff control measures described above. Where feasible, exposed slopes with slopes greater than 1V:1H will be covered by tarpaulins and/or polyethylene sheeting. Tarpaulins and plastic sheeting will be secured with stakes and staples, or rocks, and may be bordered by silt fences. Erosion control blankets may also be used on sensitive slopes. Where blankets are used they will be secured at the top of the slope by trenching the blanket into a shallow trench and by securing the blanket to the ground. The sides of each roll of blanketing will be overlapped by 5 to 15 cm, and the ends of each roll will be shingled with a 10 to 20 cm overlap.

Check Dams

Check dams can be used to both control water runoff velocities and allow for suspended sediment to settle out. Check dams can also filter coarse suspended solids from the water column. Effective check-dams are typically 600 mm in height, constructed of clean crushed rock (gravel), have silt fencing installed on top, and are installed every 50 to 75 m along the channel. Locations of check dams will be determined in the field by the Environmental Monitor and the contractor, but at a minimum should be installed in all surface runoff collection ditches. A combination of silt fences and check dams may be used to reduce water velocity in ditches leading to existing natural drainages.

Erosion Control Blanket

An erosion control blanket (rolled erosion control product) is a biodegradable soil covering used to protect exposed soils from erosion which may be installed during any phase of the project. The installation of an erosion control blanket is designed to protect disturbed and exposed soils and slopes 1V:1H and steeper, where the potential for erosion is high (silts and sand), and on slopes where vegetation may be slow to develop. The location of erosion control blankets will be determined in the field by the Environmental Monitor and the contractor.

French Drain

French drains may be used to redirect surface and ground water away from areas. Composed of a ditch filled with gravel, a French drain is primarily utilized to prevent ground and surface water from penetrating or damaging building foundations. If necessary, the onsite environmental monitor may recommend the field fit installation of a French drain to distribute water away from areas that may be sensitive to soil saturation or water pooling.

Contingency Planning & Work in Rain

Rainfall events can result in significant erosion due to the impact of the water on exposed soils and the runoff generated. In the event of heavy runoff, diversion berms and check dams will be used to slow flows and prevent erosion. Tarpaulins and plastic sheeting over exposed soils will also reduce erosion. Check dams may be constructed of clear crushed gravel, sand bags, or silt fences. Materials required to handle excess runoff following a storm event will be stored on site at all times. If a severe storm results in runoff exceeding the capacity of the sediment control provisions, additional measures will be undertaken to contain the runoff or work will be halted.

Sediment Control

Where water diversion and erosion control are not enough to prevent the erosion of disturbed soils, retention of sediment-laden water through the use of sediment ponds and other forms of sediment traps will be undertaken (sediment control). The following provides some additional detail on erosion control measures that may be appropriate.

Sediment Control Ponds

The following environmental practices will be implemented if sediment ponds are required:

- Sediment ponds will be located in the lowest practical point of the catchment area
- The location, number and size (volume capacity) of ponds will depend on the area (topography) and extent of construction activities
- The inlet and outlet of sediment ponds should distribute flows evenly across the width of the pond and baffles should be installed to reduce the potential for remobilization of settled sediment within the pond, and
- The pond outlet invert will consider input flow rates and pond capacity and will be established at an elevation (relative to the pond inlet) that allows for adequate retention time for the settling of suspended sediments, prior to final discharge.

Design parameters for sediment ponds are summarized from the Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al. 1992) and provided in Table 2.8.1-8.

Table 2.8.1-8 Design Parameters for Sediment Control Ponds

Parameter	Comment
Design Particle Size	0.02 mm
Design Pond Area	Design to the 5-year storm event (1:5) or a minimum of 1% of the total erodible area
Design Horizontal Velocity	Horizontal velocity will not cause suspension or erosion of deposited material
Design Hydraulic Retention Time	Minimum 40 minutes
Design Drawdown Time	48 hours with no incoming flows or loss of accumulated solids
Overflow Spill Capacity	Developed site 1:10 year storm event
Emergency Spillway Capacity	Developed site 1:100 year storm event

During the construction phase, appropriately sized sediment ponds will be constructed at strategic locations, to allow sufficient retention time for fine suspended particles to settle out of the water prior to being discharged to the downstream environment. If necessary (i.e., for problematic sediments such as glaciolacustrine clays), flocculants (settling aids) will be considered. Any flocculant used must be non-toxic to the receiving environment.

All sediment-laden water captured by runoff control interception ditching should be directed to a sediment pond. During operation of the mine, the tailings and waste rock impoundment will receive the majority of site runoff not collected by perimeter drainage. The tailings impoundment will therefore act as a sediment pond. Surface runoff directed into diversion ditches will be of similar quality to freshwater upstream of the project site, and will not need to be directed towards the sediment ponds.

The sediment pond will undergo annual maintenance and if sediment levels reach 75% of pond capacity. Removal of excess sediment will proceed during dry weather or in isolation of flows. Sediment removed during maintenance activities can be drained and if possible will be used for developing reclaimed features such as the Pit Lake, TSF beach or TSF Island.

All sediment control facilities will be closely monitored to ensure sediment discharge levels are maintained below both construction and operations phase permit levels. The maximum allowable discharge level for total suspended solids from the tailings facility during operations is set by the Canada Metal Mine Effluent Regulations at 15 mg/L (monthly average); however, no discharge from the tailings facility is planned until the post-closure phase.

Silt Fencing

Silt fences and related support structures provide an effective barrier for sediment-laden runoff from erodible slopes and surfaces, trapping the sediment close to the erosion source and preventing mobilization into runoff. While they are very effective on short relatively steep slopes, these devices must be properly installed and maintained to be effective.

Silt fences will be properly installed on the lower perimeter of slopes where the potential for erosion is high and/or it is desirable to contain waterborne movement of soils. Other areas where silt fences will be used include the bottom of cut or fill slopes, the base of material stockpiles and disturbed natural areas. Each silt fence will be embedded a minimum of 200 mm into the ground and reinforced with wire, stakes or gravel. Maintenance of silt fences will be required and installation of new fences will occur where needed.

Monitoring and Inspection

To effectively mitigate project-related erosion and sediment impacts, the ESCP must be properly implemented in the field. Quick and appropriate decisions in the field regarding critical issues such as placement of erosion controls, dewatering, spoil containment, and other construction related items are essential.

To ensure that the ESCP is properly implemented, at least one Environmental Monitor (EM) will be designated by Taseko during active construction. The EM should report directly to the Resident Engineer / Chief Inspector who has overall authority. The EM will have the authority to stop activities that violate the environmental conditions of permits and authorizations and to order corrective action.

Qualifications of the Environmental Monitor

Taseko will employ a qualified EM who is familiar with the field implementation of erosion and sediment control measures to monitor water quality as well as general instream and riparian construction activities. The EM may be required to monitor pH and turbidity at any discharge points or at runoff areas and will ensure that instream and riparian habitat protection measures are followed.

Environmental Monitor Responsibilities

At minimum, the EM will be responsible for:

- Providing guidance to ensure compliance with the ESCP
- Inspecting erosion and sediment control measures for proper installation and maintenance
- Identifying, documenting and recommending corrective measures to return activities to a state of compliance with the ESCP
- Advising the Resident Engineer / Chief Inspector of recommended corrective measures and of when conditions such as wet weather make it advisable to restrict construction activities that have the potential to generate sediment laden water
- Verifying the timing and spatial extent of clearing and construction
- Verifying the locations of buffer zones around sensitive areas such as watercourses and wetlands
- Prepare compliance monitoring reports to confirm works abide with the ESCP and relevant guidelines or conditions of regulatory approvals

Reporting Requirements

After each site visit, the EM will document the following:

- Silt fencing is in an appropriate location and functioning as intended
- Road surfaces affected by construction activities are clean and free of excessive fine sediment that may enter a watercourse
- All attempts are made to reduce the transport of fine materials from the worksite to natural watercourses
- Runoff from the active worksite is in compliance with the DFO Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al. 1992) at the time of sampling (i.e., suspended sediments less than 25 mg/L above background levels or less than 75 mg/L above background levels during rainfall conditions)

In addition, recommendations to improve sediment and erosion control will be provided to the Resident Engineer / Site Inspector.

h. AIR AND NOISE MANAGEMENT PLAN

The main objective of the Air Quality and Noise Management Plan will be to ensure that the levels of fugitive dust, emissions, noise and artificial light generated by the New Prosperity Project activities are managed to ensure the protection of humans, vegetation, fish, wildlife and other biota. Project policies for management of air quality and noise will be made known to all employees, contractors and subcontractors. The comprehensive Air Quality and Noise Management Plan will be developed to meet regulatory specifications.

Air Quality—Dust

Measures that may be used through construction and operations to reduce fugitive dust levels may include but not limited to the following:

- Revegetation or covering of exposed areas subject to wind erosion
- Use of large haul trucks for ore and waste transport to minimize the number of trips required between the source and destination
- Installation of dust extraction and ventilation filtration systems within the plant complex
- Installation of dust collection systems at the primary and secondary crushers
- Regular application of surface-binding chemicals or water on roads and exposed surfaces
- Vehicle speed regulations to minimize dust
- In order to evaluate the effect of dust suppression measures and systems the company will implement monitoring programs including dust monitoring stations in sensitive ecological or work environments

<u>Construction Phase</u>

During construction, fugitive dust will be generated from vehicles traveling on unpaved roads, construction of the access corridor (including blasting in quarry pits) and other construction activities, including clearing, earthworks, topsoil removal and stockpiling. Fugitive dust can be exacerbated by dry climatic conditions and winds. Dust control is an important aspect of the project environmental management system. The comprehensive Air Quality Management Plan will be developed to meet or exceed regulatory specifications during construction. Fugitive dust will be managed by:

- Applying water or surface-binding chemicals as a dust suppressant to unpaved roads and active earthworks areas during dry weather
- Imposing speed limits to limit the amount of fugitive dust generated by vehicles
- Alternatives to wood waste burning during site and power line clearing will be investigated

<u>Operations Phase</u>

The comprehensive Air Quality Management Plan will be developed to reduce fugitive dust levels and to meet or exceed regulatory specifications during the New Prosperity Mine operations.

Fugitive dust can be created by vehicle traffic on unpaved roads, ore transfer, truck loading and unloading, and blasting. To mitigate fugitive dust around the open pits, water will be sprayed on the haul roads, vehicle speeds will be enforced, and blasting practices optimized to reduce noise and dust.

Fugitive dust caused by wind erosion on the tailings will be limited by maintaining a water cover over the deposited materials. Fugitive dust caused by wind erosion on the waste rock piles will be mitigated by progressive reclamation.

The source of dust from the ore processing area will be the ore stockpile, primary and secondary crushers, conveyors and ore transfer points. Most of the dust created in these areas will be captured by dust collectors. Where buildings are open on two sides, the two open ends will be oriented at 90º to the prevailing wind direction to reduce fugitive dust. The other indoor ore processes are wet and hence dust will be negligible.

More-active measures of dust suppression will be implemented at the outdoor facilities associated with the plant. A dust suppression system will be used at the primary crusher, and water will be sprayed around the crusher, the ore stockpile pad and the process plant itself to minimize fugitive dust from ore handling and local traffic on unpaved roads.

Traffic on the unpaved access corridor may contribute to the generation of fugitive dust. Mitigative measures include the enforcement of speed limits of contractors and employees, no-idling policies, road watering/calcium sealing and upgrading the road-surfacing materials with coarse local aggregates.

The concentrate load-out facilities will be the Gibraltar facility on the CN Rail line 9 km north of McLeese Lake. Dust control measures are identified in the Concentrate Load-out Management Plan.

Other mitigative measures will be incorporated for the management of fugitive dust at the project (i.e., a vegetation cover) will be established on stripped surface areas as required.

<u>Closure Phase</u>

Activity will be significantly reduced during this phase. However, all precautions exercised in the construction and operations phases regarding equipment operations and hours of operation will still closely be observed in the closure phase as well.

Air Quality—Emissions

In all aspects and phases of the New Prosperity Project the Air Quality Management Plan will be developed to meet or exceed the regulatory requirements of the Canada and British Columbia Ambient Air Quality Objectives for air emissions. Taseko will incorporate the Best Available Technology Economically Achievable (BATEA) measures to reduce Criteria Air Contaminant (CAC) emissions.

<u>Construction Phase</u>

The main sources of air pollutants during the construction and commissioning phase will be diesel exhaust and waste incineration. During this phase, land clearing burning briefly produces the majority of CAC emissions (mainly particulate). Taseko personnel will restrict disturbances and manage all land clearing as much as possible to minimize burning.

During the construction phase, diesel emissions will be produced primarily by light and heavy duty vehicles, stationary construction equipment and haul trucks carrying loads to and from the camp.

Diesel emissions will include carbon monoxide/dioxide, nitrogen oxides, sulfur dioxide, particulate matter (PM) and residual unburned fuel vapours. Air emissions from vehicles will be mitigated and managed by:

- Minimizing diesel emissions through regular maintenance of all generators and mobile equipment
- Not allowing vehicles to idle, except when necessary
- Imposing speed limits, and
- Avoiding spills during the refuelling of vehicles and stationary power equipment to minimize the release of hydrocarbons to the atmosphere.
- Air emissions will also be produced by the incineration of inorganic and organic wastes. Emissions from waste incineration will be mitigated by:
- Implementing waste segregation and recycling programs to reduce the quantity of inorganic wastes incinerated, thereby decreasing CO_2 emissions, and
- Investigating alternatives to wood waste burning during site and power line clearing.

Operations Phase

The comprehensive Air Quality Management Plan will be developed to meet or exceed regulatory specifications during the New Prosperity mine operations phase. Air emissions will be controlled and monitored throughout the life of the project. The main pollutants will include greenhouse gases (mainly carbon dioxide, carbon monoxide and nitrous oxide), sulphur oxides (SOx), nitrogen oxides (NOx) and volatile organic compounds (VOCs). Activities that will produce gaseous air emissions during operations include mining (blasting, earthworks, excavation), ore processing, tailings and waste rock disposal/storage, and the transportation of personnel and materials to and from the mine site by means of the access road.

Mining activities that result in air emissions include blasting and the operation of diesel-powered mining equipment and haul trucks for transporting waste and ore. Emissions include SOx, NOx, CO and PM.

To reduce diesel emissions, equipment engines will not be left to idle except when necessary, speed limits will be imposed, the consumption of fuel, diesel or used oil will be monitored, and equipment and vehicles will be regularly maintained. Optimizing vehicle movements to minimize emission of GHG emissions will be a priority at the New Prosperity site. Taseko will explore the availability and potential use of biodiesel fuel in mine equipment.

Equipment use in the ore processing area will be limited to propane powered equipment utilizing state of the art scrubbing systems to allow for utilization within enclosed buildings. Such pieces of equipment will be propane powered Bobcats, fork lifts and mobile man lifts.

Traffic on the unpaved access corridor will contribute to air emissions through diesel exhaust. Mitigative measures include the enforcement of speed limits and no-idling policies.

To reduce diesel emissions, equipment engines will not be left to idle except when necessary, speed limits will be imposed, the consumption of fuel, diesel or used oil will be monitored, and equipment and vehicles will be regularly maintained.

Other mitigative measures will be incorporated for the management of air emissions: the waste incinerator will have a built-in emission control system, and the fuel storage tanks will be equipped with pressure valves to control fuel vapour air emissions.

Closure Phase

Activity will be significantly reduced during this phase. However, all precautions exercised in the construction and operations phases regarding equipment operations and hours of operation will still closely be observed in the closure phase as well.

Workplace Air Quality Control

The workplace is generally defined as an indoor setting where air quality control is required to provide an environment that protects the health and safety of workers. Indoor air quality control measures will be established during both the construction and operations phases of the project.

Workers in outdoor settings may also be exposed to air contaminants, but the effects of dilution and dispersal into the volume of the air mass reduce the need for protective measures. The main air contaminants that can affect the health and safety of workers are PM, CO and diesel exhaust.

The major project locations where workplace air quality will be of concern are the process plant and open pit mining areas.

The comprehensive Air Quality Management Plan will be developed to meet or exceed regulatory specifications for workplace air quality control during the New Prosperity Mine operations.

The workplace air quality guidelines for the New Prosperity Project will include provisions for:

- Conducting periodic monitoring of workplace air quality for air contaminants relevant to employee tasks and equipment operations
- Providing good ventilation systems
- Providing air pollution control equipment such as scrubbers
- Maintaining protective respiratory equipment and air quality monitoring equipment in good working order, and
- Ensuring that employees use protective respiratory equipment when the exposure levels for various contaminants, including welding fumes, solvents and other materials present in the workplace, exceed local or internationally accepted standards.

Noise

The comprehensive Noise Management Plan will be developed to meet or exceed regulatory specifications for noise levels during the New Prosperity Mine operations. Noise levels will be controlled to protect employees and to minimize disturbance to wildlife. Noise monitoring options and strategies will be developed and assessed in accordance with BC Reg. 382/2004 and CSA Standard Z107.56-94 Procedures for the Measurement of Occupational Noise Exposure. Noise dosimeters (which measure high level sounds) and sound-level meters (which monitor ambient noise) will be used for measuring noise exposure in the identified risk areas.

High noise zones, such as the crusher and the mill, will be identified and mapped. Zones of high noise levels will be clearly marked, and employees operating in high-noise zones will be required to wear hearing protection. Vehicles and equipment will be equipped with silencers and noise suppression systems that, where possible, meets occupational industrial acoustic standards (i.e., 85 dBA at 1 m).

Most of the noise generating equipment (e.g., crushers, air compressors, blowers, etc.) will be housed inside buildings with adequate insulation and metal cladding for noise suppression. Conveyors will be enclosed. The primary chorusing unit will be housed inside the crusher building. Typically, blasting activities will be restricted to daytime hours (i.e., 07:00 to 22:00).

To minimize the noise effects from construction, the following mitigation measures will be implemented:

- Where practical, construction activity will be restricted to day
- Time hours (i.e., 07:00 to 22:00 adjusted for seasonal variations of daylight)
- Noise mitigation measures that are installed on power generator and construction equipment (e.g., mufflers) will be kept in good working condition, and
- Construction equipment not in use will be turned off when practical.

During Project construction, operations and closure, the following mitigation measures will be implemented to minimize noise effects from Project-related road traffic:

- Vehicles will be routinely maintained and serviced to ensure optimal operation and mufflers are in good working condition
- Vehicle speed limits will be followed, and
- Project roads will be maintained to minimize vehicle noise associated with vibration.

Taseko is committed to managing noise issues and to promptly responding to any noise complaint. In the event of a noise complaint, a local noise survey will be conducted to determine the cause, and mitigative measures will be identified and where feasible, implemented. Wildlife reactions to blasting will be evaluated and, if significant effects are observed, mitigation measures will be explored and evaluated.

During the closure phase of the Project, mitigation measures are similar to those during construction, including:

- Schedule all decommissioning and reclamation related activities during daytime hours (07:00–22:00), wherever possible, and
- Perform regular inspection and maintenance of vehicles and equipment to ensure that they have high quality mufflers installed and worn parts replaced where practical turn off equipment when not in use.

Artificial Light

The potential for artificial light management issues will be discussed through the permitting and consultation. Mitigative measures can be identified for any artificial light issues and incorporated into the Air Quality and Noise Management Plan once the detailed design of the mine site is complete and the mill is constructed and operating.

i. MINE MATERIALS HANDLING AND ARD/ML MANAGEMENT

Mined waste materials at New Prosperity consist of overburden, waste rock and tailings. The disposal of these materials will carried out in accordance to their PAG and non-PAG properties. PAG materials will be disposed of within the TSF to be submerged below water and non-PAG materials will be used for construction of the tailings embankments or placed on the waste rock dump downstream of the main tailings dam. Characterization and segregation of PAG/non-PAG is described in the EIS. A summary of the materials mined and tonnages are illustrated in Table 2.8.1-9.

Table 2.8.1-9 Mined Materials and Tonnages

Material Classification	Kilotonnes	Kilotonnes
Cumulative low grade		87,000
Cumulative PAG waste and overburden		237,000
Cumulative non-PAG overburden		60,000
Cumulative non-PAG waste		102,000
Direct pit to mill feed		400,000
Construction borrow material overburden and rock	6,600	
Total	**6,600**	**886,000**

Analytical methods include routine procedures for on-site testing for waste management, off-site confirmatory analyses and non-routine procedures. The following procedures will form part of the routine analyses:

- Rinse pH (Price 1997)
- Sulphur as sulphide determined by Leco furnace on a rock initially leached with hydrochloric acid to remove sulphate (MEND 1991)
- Modified neutralization potential (MEND 1991)
- Net acid generation (NAG) test (MEND 1991)

Potential for ARD would generally be determined by the measurement of (NP-10)/AP. Paste and rinse pH are used to classify the immediate potential of rock and overburden to release metals. For rock samples, a paste pH criterion of 6 is used. If the paste pH is above this level, it is very likely that the rock contains no acidity at the time of testing and that immediate metal leaching will not be significant.

For oxidized overburden materials, rinse pH is used. For these materials, a classification criterion of seven has been used to separate materials based on copper leaching potential. Any oxidized overburden with rinse pH<7 or with (NP-10)/AP<3 will be disposed in the PAG waste rock storage facility.

Delineation and segregation of PAG and non-PAG waste rock types will be a central requirement for waste management at the New Prosperity Project. The potential for ARD would generally be determined by the measurement of (NP-10)/AP. Actual permit conditions will specify the operational criterion. This criterion will apply to the bulk of the waste rock and will be used to segregate rock for subaqueous disposal in the PAG waste rock storage facility and sub aerial disposal in the non-PAG waste rock storage facility.

The methods used to segregate waste types will essentially be the same as those used at open pits throughout the world for segregation of ore and waste. The New Prosperity Project will use state of the art vehicle information technology that has been proven for more than 20 years at different mine sites worldwide. This technology uses a combination of radio control systems, high precision GPS (Global Position Systems) with both linked to a central computer in the Mine Engineering office. Accurate and timely information transfer will permit mine operators to make confident decisions by monitoring, controlling and managing mining equipment in real-time.

While ore dilution is an accepted practice with open pit mining, mixing of PAG with non-PAG waste will be minimized. In blasts with both PAG and non-PAG material, conservative dig limits will be established to ensure that PAG material is not migrating into the non-PAG material. Monitoring at disposal locations will be used to ensure that wastes are appropriately dumped.

Table 2.8.1-2 provides an overall summary of four main disposal or management facilities and the types of material destined for each facility. All materials in this table are below ore grade.

In addition to the facilities indicated in Table 2.8.1-10, a temporary low grade ore storage facility will be developed during the initial pit development using material with lower gold and copper grades. The ore will be used as supplemental feed during operations with the balance processed at the end of pit development. In the event of a premature closure, a strategy for managing or processing the stockpile will be developed depending on the volume of ore present, economics at the time, and environmental risk.

Table 2.8.1-10 Summary of Waste Management Facilities, Source Materials and Criteria Used for Classification

Facility	Material	Criteria
Tailings storage facility	PAG waste rock	(NP-10)/AP <2
	Overburden	(NP-10)/AP<3 or rinse pH<7
	Tertiary basalt	Sulphide sulphur >0.1%
	Tailings	All
Main tailing embankment and non-PAG waste rock storage facility	Non-PAG waste rock	(NP-10)/AP >2
	Overburden (as required for embankment construction)	(NP-10)/AP>3 and rinse pH>7
West embankment	Overburden	(NP-10)/AP>3 or rinse pH>7
	Tertiary basalt	Sulphide sulphur <0.1%
Overburden stockpile	Overburden	(NP-10)/AP>3 and rinse pH>7

Overburden consists of transported unconsolidated surficial materials such as glacio-fluvial deposits and glacial till. Tertiary basalt is also included in this category due to its stratigraphic position and its geochemically unique characteristic in comparison to the deposit host rocks. Overburden may be used for construction purposes or stockpiled for future reclamation. A portion of the overburden (Unit FANL—limonitic conglomerate) is expected to be acid generating and will be managed as per PAG rock management procedures. Placement of acidic overburden in the TSF may affect the water quality of the impoundment during operations. This effect may be reduced by adding lime directly to the impoundment as part of the mill process or by adding lime to the overburden before disposal. If lime is to be added directly to overburden material, the required lime dosage will need to be determined by shake flask extractions or other testing to measure acidity.

Mined waste rock will be the major geological waste product. The waste rock will be segregated during mining based primarily on potential to produce ARD. Waste rock defined as PAG will be placed in the tailing impoundment to achieve permanent underwater disposal. Waste rock classified as non-PAG will be placed in the non-PAG storage facility or used in construction of the tailings embankments. The potential for ARD would generally be determined by the measurement of NP/AP. Waste rock with a NP/AP ratio greater than two will be placed on the main tailing embankment or on the non-PAG waste rock storage facility. Those materials with a NP/AP less than two will be placed within the TSF and eventually flooded to mitigate ARD.

A single tailings product will be discharged to the TSF and will form a shallow tailings beach containing relatively coarse tailings and a pond area containing process water and relatively finer grained tailings. Any seepage water that exits the TSF through the Main and West embankments during operations will be collected in the WCP. Additional outflow from the TSF will be via surface discharge through a spillway in the Main Embankment starting during the closure period.

Existing data show that tailings will be non-PAG, based on testing from tailings produced from ore samples collected across the deposit. Seepage chemistry is expected to be dominated by calcium and sulphate, with an increase in copper, manganese, and fluoride concentrations and low concentrations of other trace elements. Performance of tailings disposal will be assessed through monitoring of tailings solids, of seepage water down gradient of both the Main Embankment and the West Embankment, and of tailings pond supernatant. A periodic composite of the quarterly tailing sand samples will be submitted for mineralogical analysis using optical and XRD methods.

k. VEGETATION AND WILDLIFE MANAGEMENT PLAN

Vegetation communities will be affected within the proposed project footprint and transmission corridor. The Vegetation and Wildlife Management Plan will outline strategies and procedures for avoiding vegetation loss, minimizing disturbance, mitigating against invasive species and site rehabilitation through the life of the project and upon closure.

Activity specific measures will be developed for contractors and employees to minimize damage to vegetation at each of the Project components, but several general measures include:

- Minimize vegetation loss (including rare plants country foods, and ecosystems of conservation concern such as wetlands, riparian areas, grasslands and old growth forest) through environmentally sensitive Project design
- Implement best management practices including the creation of buffer zones around wetland habitats, maintaining connectivity among wetlands within wetland complexes, and ensuring obstacles are utilized where possible to limit public access to wetlands beyond the Projects maximum disturbance area
- Where possible, minimize the extent of grubbing, stripping and the removal of shrubs and herbaceous species, and retain the humus layer and vegetation root mat
- Wherever possible, schedule any construction to occur in sensitive wetland, riparian and grassland areas to occur when potential impacts are minimized
- Remove any green felled or wind thrown spruce from the site as required in consultation with Ministry of Forests and Range, to avoid buildup of spruce bark beetle populations; and not remove any mountain pine beetle “green attack” trees from the site

- Encourage slope stability and minimize soil quality degradation through grass seeding and slope revegetation; ensure water flow around work sites is not interrupted, and
- Re-establish vegetation on disturbed areas as soon as reasonably possible; progressive reclamation activities will be used, when feasible, to revegetate disturbed areas within the mine site to include natural species and country foods.

Specific to the transmission corridor, measures to be included in the Vegetation and Wildlife Management Plan will include minimizing disturbance by timing construction to when soils are frozen or dry, delivery of transmission poles to wetland and grassland areas by helicopter, and minimizing area of disturbance during pole installation. Within the grassland ecosystems above the Fraser River, measures for minimizing disturbance and protecting existing plant communities will be rigorous.

Specific to the access road, dust deposition on plant communities arising from traffic will be minimized by procedures for such as using dust suppressants when conditions warrant, and ensuring that loaded concentrate trucks are covered to prevent dust escaping during transit.

Invasive Plant Management

The invasive plant management plan (Appendix 5-5-K of the March 2009 EIS/Application) outlines procedures to be followed during all phases of mining, some of which are specific to contractors that will be arriving with equipment.

Principles set out in the invasive plant management program consist of a coordinated approach to:

- Prevention
- Proper identification and knowledge of species
- Inventories, mapping and monitoring
- Educated control decisions based on knowledge of potential damage, cost of control method and environmental impact of the weed and control decision
- Combining weed management methods, and
- Ongoing evaluation of the effectiveness of the strategies used.

This approach will be applied throughout all stages of construction, operation, and reclamation. Wetland, riparian and grassland ecosystems, in particular, will be monitored for new infestations during construction of the mine access road and transmission corridor, and any access roads used to support construction or maintenance of the transmission line corridor. Areas within the mine site will be monitored for weed infestations during operations, and for an extended period following closure until revegetation reaches a self-sustaining state.

Wildlife Management

Direct and indirect effects on wildlife can be expected as part of project development and operations. Wildlife impact mitigation strategies and procedures will be fully developed in Taseko's comprehensive Vegetation and Wildlife Management Plan. This plan will be made available to all project employees and contractors.

Wildlife control measures and environmental protection procedures will be put in place to minimize risks to wildlife and humans during the construction, operations and closure phases. Controls and procedures to be developed prior to the initiation of work on the site may include:

- Minimizing site clearing and prior to activities, inspect the area for any wildlife habitat features; avoid site clearing of moderate or higher quality denning habitat in mid-winter to reduce the risk of destroying or disturbing active dens
- Education for drivers to minimize the risk of collisions with wildlife, enforcing speed limits, and recording all Project-related wildlife-vehicle collisions or near misses
- Establish work windows when planning proposed activities in order to protect listed populations and/or individuals and their habitat
- Development of a problem wildlife prevention and response plan, and initiate Bear Aware and safety training
- Evaluate wildlife reactions to blasting and, if significant effects are observed, explore and evaluate mitigation measures
- Put in place controls for helicopter over-flights to minimize acoustic disturbance during the big horn sheep lambing period

Specific to the construction of the transmission line, site clearing will be limited to minimum width required and new access roads will be minimized wherever feasible. Procedures developed for bird protection may include:

- Evaluation and selection of the most appropriate bird markers
- Incorporation of trees and shrubs into the route design where feasible, to provide natural obstacles for birds to navigate, directing their flight over lines
- Identification of high collision risk areas
- Confirmation that conductor/line spacing is large enough to greatly minimize or eliminate electrocution risk, and
- Evaluation and selection of perch deterrents (e.g., “bird spikes”) for the poles.

Throughout the Project area, and particularly on the transmission corridor, temporary access roads will be deactivated in such a manner so as to deter ATV travel. Where fencing is required for cattle, wildlife-friendly fencing will be used in accordance with specifications recommended by the Ministry of Environment.

Mitigation measures to be implemented during construction and operational phases will include the creation of policies to limit human activities in and around the project operations and camp areas as well as no-hunting and no-recreation policies for employees while on their work rotation.

To decrease the attractions for bears and other scavengers, the Vegetation and Wildlife Management Plan will be integrated with the waste management and recycling program. Littering, feeding and harassing wildlife will be prohibited at all times on any Project site. By limiting and controlling garbage generation, fewer human–wildlife interactions will occur.

l. CULTURAL AND HERITAGE PROTECTION

Unique to the New Prosperity project, an extensive AIA has been developed for the mine site. The results of the AIA and the mitigation plan are presented in this EIS. To ensure avoidance, minimize disturbance and protect sites, an archaeological and heritage resources protection procedure will been developed for the New Prosperity Project including but not limited to the following

- Prior to work on site, site orientation will be provided to geologists, contractors, engineering field crew, and equipment operators in order that they are aware of all known archaeological and heritage resources.
- An Environmental Monitor will be designated to ensure work does not cause excessive or unneeded disturbance.
- All known sites near planned activities and will be flagged with a 20 meter boundary.
- Daily checks will be performed to ensure that work is not encroaching on the buffer zoned areas.
- Once activities have been completed in the areas of archaeological and heritage resource sites, flagging will be removed so as not to draw attention to the sites.

The proponent will invite interested aboriginal groups to participate in developing further procedures and policies, such as a traditional use monitoring plan, to support long term viability of the area for traditional use practices.

m. SURFACE AND GROUNDWATER MANAGEMENT PLAN

Water is a key component in the mine processing and in the Fish Compensation Plan. Water must be managed to ensure: compliance with operating permits, smooth and uninterrupted operation of the mine, control of effects to water quality and quantity in the Fish Creek watershed.

As such, Taseko is committed to developing a comprehensive water management plan that applies to all mining activities undertaken during all phases of the New Prosperity Project. This EMP will be developed prior to pre-construction and construction activities. The main objectives of the Water Management Plan will be to:

- Regulate the movement of water around the mine site to ensure long term environmental protection
- Define the environmental control structures to be put in place to manage volumes required for the Fish Compensation Plan and mine processing
- Implement proper procedures for the protection of water quality to ensure that any discharges meet and/or exceed the permitted water quality levels and guidelines

The following provides an overview of the components that will be included in the Water Management Plan under the categories of Water Volume Control, Erosion Prevention and Sediment Control, and Water Quality. Material contained in this section is closely related to material appearing elsewhere in the report.

Water Volume Control

Changes to Flow Pathways and Drainage Areas at Mine Site

The following section provides a brief summary on the changes to flow pathways and drainage areas within the project area.

Permanent changes will occur to Fish Creek from the construction of a tailings and waste rock impoundment. The total potential undiverted catchment area of the proposed tailings and waste rock impoundment and the open pit area is estimated to be 125 km^2; thus, it is imperative to implement water management in this area.

Diversions are necessary to minimize the amount of water entering the tailings and waste rock impoundment and the open pits. These diversions will consist of diversion structures and diversion channels that will reduce the total catchment area to 39.3 km^2 for operation Years 2 to 4 and to 35.7 km^2 for Years 5 to 20. Additional diversions will be built for the tailings dam construction period to further reduce the catchment reporting to the dam area.

The water management activities will include the following:

- Diverting a portion of the undisturbed runoff from the Fish Creek catchment area through a headwater channel and into the Wasp Lake fisheries compensation works
- Collecting and recycling seepage from the TSF, waste storage areas, ore stockpiles, and the open pit
- Controlling, collecting, and utilizing undiverted surface water runoff upstream from the open pit
- Eliminating uncontrolled release of water from the Project area
- Optimizing the volume of water stored in the tailings supernatant pond to meet operations and closure requirements
- Managing the system to facilitate decommissioning of the open pit dewatering and depressurization facilities immediately following completion of mining activities

At closure of the mine all the freshwater diversions will be breached allowing water to flow into the tailings and waste rock impoundment. Excess water in the tailings and waste rock impoundment will exit into the pit below the dam through a spillway on the right abutment.

Construction

The pre-construction and construction phases of mine development commence approximately 24 months prior to operations. These phases are characterized by extensive clearing, grubbing and stripping, development of access roads and haul roads, construction of the east side collection ditch, Fish Lake Flood Control Dams, Mine Facilities, and commencement of the TSF Starter Embankment. The east side collection ditch harvests water from the eastern-most catchment of the Fish Creek Valley and sends it to the inlets of Fish Creak.

Sediment control ponds will be developed downstream of each construction activity, in the TSF area, at the mine site, downstream of the non-PAG and overburden stockpile, etc… A fresh water collection pond will be established between the lake and the pit, and will act as a repository for the pit-dewatering, and for the project area catchment runoff as construction continues. This runoff will include the Open Pit Catchment, Embankment Seepage, non-PAG Waste Storage Area catchment runoff, and Plant Site runoff. Commencement of the TSF Main Embankment will result in surface water runoff from the undisturbed catchment (below the headwater diversion channel) being impounded behind the Main Embankment.

Operations

At the start of operations (Year 1), the TSF Pond will contain 6.9 Mm^3 of water collected from runoff, as well as 4.3 Mm^3 from the outflow of Fish Lake, for a total of about 11 Mm^3. The eastern collection channel will continue to divert undisturbed runoff from the eastern catchment of the TSF. Runoff from the undisturbed TSF catchment will continue to be collected in the TSF throughout operations. Seepage and surface runoff from all embankments (Main, West and South), directed through toe drains and collection ditches, will be pumped back into the TSF. Groundwater and surface runoff into the Open Pit, including water from the vertical depressurization wells, will be diverted to the surface Water Pond. Runoff from the non-PAG Waste Storage Area, Ore Stockpiles, and Plant Site will also be collected in the surface Water Collection Pond. All water from the Water Collection Pond will be recycled to the Plant Site process water pond, or pumped directly into the TSF Supernatant Pond. The TSF, Open Pit dewatering, runoff collection systems, and stockpile diversions will provide adequate Plant Process water from Year 2 until the end of Year 16.

Make-Up Water

There is a water balance for the mine site and no requirement for make-up water.

Potable Water

Potable water for the project will be obtained from multiple wells. As such, should one well fail the others would act as back up until necessary repairs are completed. If an event were to occur where potable water is transported to site a management plan will be developed for this.

During construction, production from wells will be confirmed against forecasted required volumes and contingency plans will be developed as required to address shortfalls.

Process and Reclaim Water

The process water requirements come from three sources: Pit dewatering, tailings supernatant pond reclaim and the water collection pond. The water system is a closed system and contained to the footprint of the mine site. A management plan will be developed to mitigate onsite spillage should a failure of the system occur.

Closure

Following year 16, the Open Pit dewatering system will be deactivated and the Pit will commence filling (Years 17–44). The Supernatant Pond, Seepage Collection, and Stockpile Runoff provide sufficient Plant process water for ongoing operations, without any requirement for external supplementary water.

The TSF Lake will continue to fill naturally for approximately one year after operations. Upon the commencement of the closure phase I (Year 21), a channel will be constructed to discharge water from the South Embankment seepage collection pond. Throughout closure, Fish Lake will continue to receive diverted water from the eastern and southern channels. The TSF Lake will discharge into the Pit Lake until such time as water quality is suitable for release to the inlets to Fish Lake.

At the commencement of post-closure (Year 45), the Embankment slopes and the TSF beach will be sufficiently re-vegetated for long-term stabilization of any exposed, potentially erodible materials. The following measures have been incorporated into the Project design to ensure that the TSF is stable and self-sustaining: engineered zoned embankments designed as per the Canadian Dam Association Guidelines; long beaches to keep the supernatant pond away from the embankment crests, thereby improving stability of the structures; a constructed spillway sufficient to prevent overtopping and eroding of the embankments, as well as maintaining the supernatant pond at the desired elevation; and the inclusion of vibrating wire piezometers within each embankment to allow for on-going monitoring of the structure's stability.

At post-closure, the Pit Lake will commence discharging into Lower Fish Creek. The eastern-catchment of the TSF will be decommissioned and the catchment will again flow along its baseline path.

Direct precipitation and runoff from the surrounding catchment that is not diverted by the diversion structures will be routed to the tailings impoundment.

Water Balance for Mine Site

A thorough understanding of water movement, including flow patterns, flow volumes and occurrence, throughout the project site is essential to water management planning.

As the supernatant pond is the main source of process water, water balances were completed in order to estimate the annual water surplus or deficit at the TSF. Annual site water balances were based on average precipitation conditions, for the year prior to start-up, the 20 years of operation, and post-closure.

Immediately prior to start-up, the Main Embankment of the TSF will store approximately 11 Mm^3 of water, derived from the storage of a freshet. Due to density of tailings during the initial years of operations, the available water in the supernatant pond gradually decreases as water received into the TSF is trapped in the pore spaces of the tailings, reaching a low of 4 Mm^3 during Year 6. Following Year 6, the dry density of the tailings reaches the assumed maximum, and the Pond begins to accumulate water, reaching a maximum volume during operations of approximately 22.6 Mm^3 during Year 16. Subsequent annual water deficits starting in Year 17 result from the cessation of inflow from the open pit dewatering facilities, as the open pit is permitted to commence filling. The pond volume at closure is approximately 18.7 Mm^3 and the annual post closure surplus in the TSF is estimated at approximately 6.6 Mm^3.

Under extreme dry conditions, the results of the analysis indicate that there may be a requirement to divert a portion of flows from the catchment east of the headwater channel in order to maintain the necessary pond volume to facilitate continuous, uninterrupted operations. Additionally, a large proportion of the fresh make-up water derived from the deep aquifer remains largely unused during each year of operations, and could be potentially utilized to supplement deficits in the TSF under these extreme conditions. The probabilistic water balance is highly conservative, and still indicates that there will be no requirement for a permanent make-up water supply, with any shortfalls being appropriately addressed with careful management of water throughout operations.

Access Corridor Water Management

The mine site will be accessed from the Forest Service 4500 road and is referred to as the New Prosperity Plant Access Road. Construction and maintenance of this road will follow the Forest Practices Code of BC and standard industry practices. Upgrades will be required to the 4500 road and will also be constructed and maintained as per the Forest Practices Code.

The Taseko Lake Road, Highway 20 and 97 are maintained by the Ministry of Highways and upgrades, if necessary, will follow the Ministry of Transportation guidelines.

Transmission Corridor Water Management

The 125 km long transmission corridor begins at the proposed switching station near Dog Creek and terminates at the mine site. The construction and maintenance of the access roads and the corridor will be consistent with the Forest Practice Code and standard industry practices to protect fish and fish habitat.

Contractor construction activities will be performed by methods that will prevent entrance or accidental spillage of contaminants, debris, and other pollutants into streams, dry watercourses, lakes, and ponds. The clearing contractor will erect and use best management practices such as silt fences on steep slopes and next to any stream, wetland, or other waterbody. Additional best management practices may be required for areas of disturbance created by construction activities. Appropriate permits from the Ministry of Environment for works in and about streams, and from Ministry of Forests and Range will be obtained as required. In addition, there will be compliance with all the criteria and guidance contained in the Department of Fisheries and Oceans applicable Operational statements and the Ministry of Environment's "*A Users Guide to Working In and Around Water*". Each crossing will be planned and the appropriate approval or notification under the *Water Act* will be submitted before work begins. Every attempt will be made to schedule these stream-crossing changes during the least risk window. Any HADD will be submitted to Department of Fisheries for authorization.

Diversion Structures

Diversions are necessary to manage the amount of water entering the tailings impoundment and minimize the water entering into the open pit. All of the water management structures are designed to reflect both regulatory requirements and engineering standards.

An eastern-side Channel will be constructed along the east slope of the Fish Creek Valley during the pre-production period to collect and divert clean runoff. The Headwater Channel will minimise the volume of runoff reporting to the Tailings Storage Facility from the undisturbed portion of the catchment area.

Monitoring and Surveillance

To ensure the channels are constructed to design specifications, monitoring will be scheduled at regular intervals throughout construction of the various channel components. The construction monitoring schedule will generally follow recommendations described in Standards and Best Practices for Instream Works (MWLAP 2004).

To determine the accuracy of environmental effects predictions and effectiveness of the proposed channels, a monitoring program will be developed and implemented. The program will adhere to methods established in the Guidelines for Instream and Off-Channel Routine Effectiveness Evaluations (FIA 2003) and focus on the biological effectiveness (e.g., seasonal use for rainbow trout spawning in the HCRP outlet/New Prosperity Lake inlet) and physical integrity of constructed channel components.

The follow-up program will include assessments of water quality (e.g., temperature, pH) and quantity, habitat structure and attribute integrity and functionality (e.g., substrates), riparian revegetation survival, and fish use by species- and life-stage (limited to the New Prosperity Lake inlet channel). The following schedule has been nominally identified:

- Seasonal assessments of water quality, biological (where relevant) and physical attributes of the constructed channels during the first year of operation (four assessments), and
- Annual assessment of the New Prosperity Lake inlet channel during the rainbow trout spawning and egg incubation period.

Remedial or adaptive measures will be applied immediately following any evaluation that determines a reduction in functionality or integrity of the compensation element based on a quantified trigger value.

Water Quality Control

The EMP will identify sources of wastewater and effluent, and specify the collection and storage of wastewater and effluent before treatment and disposal or release. The EMP will also specify what methods of treatment will be used to achieve acceptable discharge water quality standards; treated water will not be permitted to exit the site unless specified water quality criteria have been met. Means to contain effluent where release is not feasible will be described. Wells will be monitored regularly to determine possible effects of the project on groundwater quality. Results will be compared to specified water quality criteria.

Mitigations designed to protect water quality will also protect sediment quality and aquatic communities, including fish. The Plan will comply with the following documents and guidance:

- Fish-Stream Crossing Guidebook (MOF 2002)
- Riparian Management Area Guidebook (MOF 1995)
- Pacific Region Operational Statement Overhead Line Construction Version 2 (DFO 2006)
- Model Class Screening Report - Embedded Culverts Project in Fish-bearing Streams on Forestry Roads In British Columbia (DFO 2005), and
- Land Development Guidelines for the Protection of Aquatic Habitat (DFO and MOELP 1992).

The New Prosperity Project incorporates many design features that limit potential effects on the environment. Its compact design provides containment of all mine waters on site until approximately 24 years post-closure, at which time there will be two discharge points to surface water: the main discharge from the pit to Fish Creek and the smaller discharge of TSF seepage to Big Onion Lake and eventually the Taseko River.

Project design aspects and mitigation measures to reduce potential effects of discharge from the Pit Lake include:

- Diversion of clean water to lower Fish Creek and Wasp Lake until post-closure
- Operation of a compact closed system, that contains all mine waters on site until approximately 27 years post-closure, and directs any surface drainage, effluent
- Treatment plant, sediment or metal-laden water to the TSF during operations
- The planned configuration of the mine, with the pit being the most downstream element, which provides for a very reliable system of water management in that no surface water can leave the Project without passing through the open pit and is a very robust measure of controlling discharge to Lower Fish Creek
- Proper storage of PAG waste rock and tailings in deep portions of the TSF, overlain by non-PAG tailings; submerging PAG materials has been shown to be effective in TSF design elements, including: materials used to build and line the embankment, development of extensive tailings beaches to keep the supernatant water an appropriate distance from the embankment crest, seepage collection ditches and ponds, materials used to construct the West Embankment, use of the pit as a groundwater and surface water catchment for the Project area, and locating of all Project elements within a single watershed
- Controlling metal leaching (ARD/ML)
- Reclamation planning for the 25 to 30 year closure phase that avoids revegetation of features projected to be flooded as part of the pit, to prevent buildup of organic matter and concerns about methylation of mercury once the location is flooded
- The ability to control flows from the TSF into the pit post-closure to reduce loadings during the early spring low flow period on the Taseko River if monitoring indicates that increased levels of metals, hardness and sulphate at that time of year are predicted to pose a risk to aquatic life, and
- Use of the TSF and pit as depositional areas to reduce sediment and metals loadings to surface waters, with up to 27 years prior to discharge to lower Fish Creek.

Taseko recognizes there is uncertainty inherent in the mass balance model used to predict pit water quality, but is confident that both the opportunity and the technology are available to address any exceedances of water quality guidelines adequately. Natural attenuation processes in the pit (precipitation of metals to the sediment) that cannot be accounted for in the mass balance model, and are not easily modelled, will reduce metals levels below those predicted as reasonable worst case estimates. In addition, there are treatment options available that are feasible using current technology. The need for treatment will be assessed through monitoring programs during operations and closure to assess the actual geochemical performance of the Project (to calibrate the water quality prediction to site data) and during the 27 years required for the pit to fill. Data from these monitoring programs will remove a large amount of uncertainty contained in the current prediction about metal loads generated by the different waste sources.

Should monitoring indicate the need for water treatment, there are current technologies capable of achieving the necessary load reductions to meet existing provincial and federal guidelines and objectives.

Taseko will deal with uncertainty about predicted versus actual pit discharge concentrations by committing to meet generic or site-specific WQG that may be developed for the Project during the permitting stage. Additional mitigations, such as treatment of groundwater than contains porewater seeping through the western embankment and moving toward Big Onion Lake, would need to be assessed based on monitoring programs and implemented if actual groundwater quality is not as good as the conservative predictions made.

n. OCCUPATIONAL HEALTH AND SAFETY

The comprehensive New Prosperity Occupational Health and Safety Plan will be developed to uphold Taseko's commitment to a safe environment for employees, contractors and visitors. All aspects of the Taseko's New Prosperity Project will conform to the health and safety requirements detailed in the *Mines Act* and the Health, Safety and Reclamation Code for Mines in British Columbia (2003). Day to day workplace rules will be in accordance with the Parts 2 and 3 of the Code. The New Prosperity Project Safety Manager will take the lead in establishing an Occupational Health and Safety Committee. This plan also addresses requirements that are not legislated under the *Mines Act* and subject to the BC *Workers Compensation Act [RSBC 1996].*

The Occupational Health and Safety Plan will set out the framework under which health and safety on the mine site, to and from the mine site and at the concentrate load out facility will be managed. The roles and responsibilities of the company, manager, superintendents, supervisors, and workers are set out under this plan. The plan also covers contractors that are New Prosperity site, including the power line right-of-way. Contractors not on-site are excluded from this plan and are expected to adhere to the appropriate legislation of their jurisdiction.

The programs that will be outlined under the plan include provisions for the anticipation, recognition, evaluation and control of physical, chemical, radiological, biological, ergonomic and psycho-social factors that may exist at the project site and in other project related activities.

<u>Vision Statement</u>

Taseko is committed to establishing a healthy and safe working environment for all individuals at its New Prosperity Project. To achieve this, Taseko will develop and maintain an occupational health and safety plan designed to prevent injuries and disease for all personnel. All employees and contractors will be required to know and follow our stringent safety guidelines for safe work procedures.

<u>Strategic Objectives</u>

The following strategic objectives have been designed to reflect the commitments set out in the in Taseko's Health and Safety Policy:

- Identify workplace hazards
- Minimize the potential for occupational injuries, disease or loss of life
- Meet workers' expectations to be informed as to the potential environmental and psycho-social factors that may affect the health and well-being of workers and apply this knowledge in the prevention of accidents and occupational diseases
- Meet stakeholders' expectations to ensure the health and safety of all persons on-site, including meeting training needs

- Identify and make provisions to address the needs of all individuals with respect to health and safety; in such away their ability to do work is not compromised
- Share information related to the health and safety of workers so they can share and contribute to the achievement of goals
- Ensure that contractors activities legislated by the *Workers Compensation Act* are addressed with similar commitments to health and safety and legal obligations are met
- Meet the legal requirements of the BC *Mines Act* (1996), Regulation and the appropriate sections of the Health, Safety and Reclamation Code
- Limit financial losses resulting in injuries and disease

Strategies and Program Planning

To meet the strategic objectives outlined above, Taseko will incorporate the following in their Occupational Health and Safety Plan for New Prosperity:

- Safety policies that at least cover on-site work, camp accommodation, off-site work, transportation of personnel, and contractors
- A safety management program that focuses on the prevention and management of workplace accidents and injuries, including musculoskeletal disease (MSD); as required under the BC *Mines Act* (1996)
- An occupational health management program that focuses on the anticipation, evaluation and control of worker exposure to environmental factors and stressors that may be physical (other than accident and ergonomic hazards), chemical, radiological or biological, in order to prevent short- and long-term occupational diseases; this program will integrate a workplace monitoring program as required under the BC Health, Safety and Reclamation Code
- A worker well-being program that focuses on optimizing social conditions at work to minimize stress and enhance well-being in workers
- A program for on-site medical attention and care
- A return-to-work program to help returning injured workers to work as soon and as safely as possible
- A risk communication program that focuses on (a) the need to raise awareness of risks to human health and the roles and responsibility of managers, supervisors, workers, health and safety committees that are related to the identification, prevention and control of these risks; and (b) the need to integrate feedback from workers, and
- A training program in order to have competent workers, supervisors, managers and committees, with respect to worker health and safety.

Implementation

Taseko's Health and Safety Policy states: It is the policy of Taseko to provide and maintain safe and healthy working conditions, and to establish operating practices which safeguard employees and physical assets.

To achieve this goal Taseko dedicates itself to:

- Meeting or exceeding all industry standards and legislative requirements
- Developing and enforcing safe work rules and procedures
- Providing employees with the information and training necessary for them to work safely and effectively
- Acquiring and maintaining materials, equipment and facilities so as to promote good health and safety
- Encouraging employees at all levels to take a leadership role in accident prevention by reporting and/or correcting unsafe situations
- Providing a safe and healthy workplace for all of our employees, contractors and visitors
- Train and motivating all of our people to work in a safe and responsible manner
- Making health and safety a part of all business decisions
- Integrating the highest safety standards through exploration, design, construction, operations and closure
- Applying “best practice” to our health and safety activities
- Exceeding community expectations for health and safety
- Striving for continuous improvement in our health and safety program
- Holding all of our people accountable for health and safety

As per the *Mines Act*, the Mine Health and Safety Program will use the following to establish a safe and positive working environment for employees:

- Clear and demonstrated commitment from management
- Competent personnel in coordinator roles
- Health and safety policy
- General safety rules
- Codes of practice
- Safe work procedures
- A management system to identify the requirements of the program
- A list of hazardous materials and work situations
- Safe handling procedures
- Provision of antidotes for chemicals used
- Monthly crew safety meetings
- Procedures for accident and serious incident investigation
- Procedures for safety tour inspections, and

- A written preventative training program regarding musculoskeletal disorders.

Codes of practice will focus on project design. Safe work procedures will focus on employee roles and responsibilities. They will be written in a way that can be clearly understood and performed in a consistent manner. The scope will be reduced and expanded by the manager and/or the Occupational Health and Safety Committee, as is their duty under the *BC Mines Health, Safety and Reclamation Code*. This program will integrate a workplace monitoring program.

Codes of practice and safe work procedures will be developed and/or reviewed before each project phase (construction, operations and closure). These will be implemented and updated for the duration of the project, using a continual improvement process. To assure mine safety, Taseko will focus on general safety rules, safe work procedures and internal operational policies and training. Policies will be addressed and managed by department, as required by the BC *Health, Safety and Reclamation Code*. Specific roles and responsibilities, scope, objectives, tasks, timescales and budgets will be established for each phase, and adjusted accordingly. Objectives and performance standards will be established and reviewed annually. Where improvements are required, action plans will be developed to achieve stated goals.

Roles and Responsibilities

The Safety and Security Department will implement the programs outlined within the Occupational Health and Safety Plan. The Health and Safety Coordinator will have a thorough understanding of the company's operations and associated occupational health hazards. The coordinator will be familiar with appropriate methods to identify, evaluate, and control health and safety hazards. The Occupational Health and Safety Plan will outline the roles and responsibilities for the following:

- Commitments and responsibilities at the corporate level
- Mine Manager's responsibilities
- Superintendents' responsibilities
- Supervisors' responsibilities
- Workers' responsibilities, and
- Contractors' responsibilities.

Occupational Health and Safety Committee

At the beginning of development, an Occupational Health and Safety Committee will be formed and composed of two or more persons representative of management and an equal or greater number of worker representatives. Outcomes from health and safety management meetings will be communicated to employees, and contractors.

The Occupational Health and Safety Committee will have specific responsibilities with respect to this plan and include:

- Reviewing Mine Health and Safety Program and all other programs under the Occupational Health and Safety Plan for completeness and effectiveness on an ongoing basis and submit its findings to the Mine Manager
- Implementing monthly inspections of workplaces and comply with meeting and reporting requirements as set out in the BC *Mines Act*, and
- Participating in the investigation of reportable incidents.

Hazardous Materials

A formal system will be implemented to monitor and guide the purchase, handling, use, storage and transport of hazardous materials. The Safety and Security and Environment Department will assess all new substances when they are purchased by Taseko or used on site by contractors. A list of hazardous materials will be kept for each department. Hazardous materials to be used on site include:

- Petroleum products (e.g., diesel fuel, gasoline, lubricants, hydraulic fluids, oil and solvents)
- Explosives (e.g., ammonium nitrate [AN])
- Batteries, and
- Mill reagents (e.g., flotation collectors such as potassium amyl xanthate, frothing agents such as methyl isobutyl carbinol (MIBC), flocculants, and quicklime).

Other Procedures and Policies

Other procedures and policies include:

- Monthly crew safety meetings
- Procedures for accident and serious incident investigation
- Procedures for safety tour inspections
- Safe handling procedures (see Hazardous Materials Management Plan)
- Storage and provision of appropriate antidotes on-site
- Storage and maintenance of personal protective equipment, and
- Provision of information regarding services and support available to workers.

2.8.2 Decommissioning and Closure Plans

This section contains the conceptual reclamation and decommissioning plan for the New Prosperity Gold-Copper Project. The plan has been updated from the previously reviewed Prosperity Project to incorporate requirements of the New Prosperity Gold-Copper Mine Project Draft Environmental Impact Statement Guidelines (EIS Guidelines 2012), but remains consistent with the requirements of the *Health, Safety and Reclamation Code for Mines in BC.*

The following section outlines Taseko's plan for specific actions and activities that will be implemented to minimize the potential or long-term environmental degradation, and clearly defines Taseko's ongoing environmental monitoring for documenting reclamation success.

The reclamation and decommissioning plan focuses on the mine site as no changes to the access road and transmission line have occurred from the previously reviewed Prosperity Project. The main changes from Prosperity to New Prosperity that require revisions to the reclamation and decommissioning plan, including soils salvage and replacement planning, include:

- Revised size and location of TSF and embankments;
- Revised location and number of soil stockpiles;
- Revised location of non-PAG waste rock storage;
- Elimination of the Prosperity Lake, headwater retention pond, and related water works; and,
- Revised water management features at operations and closure.

The EIS Guidelines requests the following information for the components of the Project that have changed:

- Proposed end land use objectives for the various mine site components – Section 2.8.2.1;
- Productivity or capability objectives and the general means by which these objectives will be achieved – Section 2.8.2.2
- Plans for removal of structures and equipment and remediation of contaminated soils – Section 2.8.2.3;
- Plans for reclaiming roads and other linear disturbances – Section 2.8.2.4;
- Waste rock stockpile reclamation plans, including final configurations, proposed re-sloping, soil replacement, and re-vegetation methods – Section 2.8.2.5;
- Tailings impoundment reclamation plans, including final impoundment configuration and water levels, re-sloping, soil replacement and re-vegetation methods – Section 2.8.2.6;
- Open pit filling times and final configuration – Section 2.8.2.7 (see also Section 2.8.1- Water Management Plan);
- Site water management plans for all facilities and including re-establishment of post-mine watercourses – Section 2.8.2.8 (see also Section 2.8.1 – Water Management Plan);
- Concepts for monitoring and research programs that will assess reclamation success and for meeting overall closure objectives – Section 2.8.2.9;

- Conceptual monitoring programs for permanent structures to ensure long-term geotechnical stability – Section 2.8.2.10 (see also Section 2.8.1 – Geotechnical Stability Monitoring Plan).
- Site water management plans including conceptual long-term monitoring programs for surface and groundwater quality – Section 2.8.2.11 (see also Section 2.8.1 – Water Management Plan and Section 2.7.2.4 Water Quantity and Quality)
- Management plans for final closure as well as temporary closure and/or early permanent closure – Section 2.8.2.12.

2.8.2.1 End Land Use Objectives

Consistent with the *Health, Safety and Reclamation Code for Mines in BC*, the Conceptual Reclamation and Decommissioning Plan for New Prosperity has three main objectives:

1. Provide for stable landforms;
2. Prevent erosion and sedimentation to protect aquatic resources; and,
3. Re-establish a productive land use that is of value for wildlife, while providing opportunities for First Nations use for traditional purposes and other resource users for trapping, grazing and recreation, mitigating the residual effects of the mine.

Similar to pre-development conditions, where primarily forested ecosystems provided a range of values, the post-closure landscape will be capable of supporting a range of simultaneous end land uses. Use of land and resources of the area by the First Nation people is a critical component of the end land use objectives. Reclamation to provide habitat for furbearers will help to promote the re-establishment of trapping opportunities on the portions of the mine area disrupted during operations. Grazing of horses and cattle is a more contemporary use of the landscape, but has economic value to First Nations and other resources users; therefore, re-establishment of grazing opportunities is another secondary objective.

To achieve the wildlife and secondary end land use objectives, reclamation at the mine site will focus on the establishment of:

- Forest and shrub lands for wildlife, that may also be suitable for plant gathering;
- Fisheries habitat, that may also be suitable for fishing;
- Wetland and riparian habitat for waterfowl and mammals, that may also be suitable for hunting and trapping; and,
- Open forage areas for wildlife that may also be suitable for plant gathering and/or grazing.

2.8.2.2 Capability Objectives and General Means by which Objectives Will Be Achieved

The general concept applied to reclamation has not changed from the Prosperity Project; reclamation will be conducted with the goal of establishing post-mine capability on an average site-wide basis equivalent to the average capability of the land prior to mining, consistent with the *Health, Safety and Reclamation Code for Mines in BC*.

The reclamation approach is intended to foster a return to appropriate and functional ecosystems, supported by soil replacement strategies that will facilitate the establishment of self-sustaining vegetation communities.

Post closure capability is predicted using ecosystem mapping. Post-closure ecosystem mapping integrates post-closure soil characteristics (moisture and nutrient regimes) and forecasted landform topography (elevation, slope and aspect). The post closure ecosystems are only predicted for the mine site due to the changes in the landscape.

In general, the projected post-closure site series are similar to pre-development ecosystems as replaced soil materials and depths are very similar to pre-development conditions. The post-closure site topography encompasses a wider range of elevation, slope angles and aspects than the pre-development site. Pre-development slopes were typically flat to gentle, with moderate south-west facing aspects bounding the site to the north and east. Post-closure sites will consist of longer, steeper slopes with predominantly northwest, southwest and northeast aspects. The typical edaphic conditions are expected to be the same on the non-PAG waste rock stockpile, ore stockpile and plant site due to the replacement of the soil rooting zone and an organic-enriched horizon; however, the edaphic conditions on the TSF beach and embankments are expected to be drier due to the increase in elevation and depth to groundwater. Where clearing has been the only disturbance associated with development (e.g., on areas adjacent to roads or ditches), post-closure site series will be identical to those found in the same area prior to development.

There will be an overall increase in the amount of higher elevation area within the disturbance footprint due to the creation of the tailings storage facility and non-PAG waste stockpile features. The higher elevations of these features are predicted to result in an increase in the amount of area in the post-closure reclaimed landscape that will be located in the drier, colder Sub-boreal Pine Spruce biogeoclimatic zone, with a corresponding decrease in the area in the Montane Spruce zone

Pre-disturbance and post-closure ecosystem units are compared in Table 2.8.2.2-1.

Table 2.8.2.2-1 Pre- and Post-Closure Ecosystem Units for the New Prosperity Copper-Gold Project Mine Footprint

Biogeoclimatic Unit	Site Series	Map Code	Ecosystem Description	Baseline Area (ha)	Predicted Post-Closure Area (ha)	Change in Ecosystem Area (ha)	Change in Ecosystem (%)
MSxv	01	LG	Pl–Grouseberry–Feathermoss	1107.6	306.8	-800.8	-72
	03	LK	Pl–Kinnikinnick–Cladonia	24.2	54.6	30.4	126
	04	GK	Pl–Grouseberry–Kinnikinnick	20.1	0.0	-20.1	-100
	05	LT	Pl–Trapper's tea–Crowberry	1.8	0.0	-1.8	-100
	06	SC	Sxw–Crowberry–Knight's plume	95.1	0.0	-95.1	-100
	07	SG	Sxw–Crowberry–Glow moss	47.9	28.2	-19.7	-41
	08	SH	Sxw–Horsetail–Crowberry	51.7	0.0	-51.7	-100
	09	ST	Sxw–Labrador tea–Willow	2.9	0.0	-2.9	-100
	00	BE	Beach	0.0	52.8	52.8	100
	00	BF	Water sedge–Beaked sedge	117.1	27.5	-89.6	-77
	00	DD	Ditch	0.0	3.5	3.5	100
	00	DP	Pipelines	0.0	2.8	2.8	100
	00	DT	Dandelion–Timber oatgrass	1.2	0.0	-1.2	-100
	00	JK	Juniper–Kinnikinnick	0.2	0.0	-0.2	-100
	00	LA	Lake	6.2	0.0	-6.2	-100
	00	LF	Pl- Fescue - Stereocolon	0.0	805.5	805.5	100
	00	OW	Open Water	0.3	0.0	-0.3	-100
	00	PD	Pond - contact	0.0	5.6	5.6	100
	00	RE	Reservoir	0.0	405.6	405.6	100
	00	RZ	Road Surface	0.2	25.0	24.8	12400
	00	WM	Grey-leaved willow–Glow moss shrub carr	9.6	0.0	-9.6	-100
	00	WS	Willow–Scrub birch–Sedge fen	62.0	0.0	-62.0	-100
	00	YL	Yellow pond-lily	0.2	0.0	-0.2	-100
			Subtotal	**1548.2**	**1718.0**	**169.8**	**11**
SBPSxc	01	LK	Pl–Kinnikinnick–Feathermoss	249.4	2.3	-247.1	-99
	02	LC	Pl–Kinnikinnick–Cladonia	5.6	9.4	3.8	67
	03	SB	Sxw–Scrub birch–Fen moss	5.3	0.0	-5.3	-100
	04	SF	Sxw–Scrub birch–Feathermoss	29.1	0.0	-29.1	-100
	05	SH	Sxw–Horsetail–Glow moss	11.9	0.0	-11.9	-100
	00	BF	Water sedge–Beaked sedge fen	9.7	0.0	-9.7	-100

	00	DD	Ditch	0.0	1.0	1.0	100
	00	DP	Piplines	0.0	1.1	1.1	100
	00	DS	Drummond's willow–Sedge swamp	2.4	0.0	-2.4	-100
	00	ES	Exposed Soil	2.4	0.0	-2.4	-100
	00	JK	Juniper–Kinnikinnick	2.7	0.0	-2.7	-100
	00	OW	Open Water	0.3	0.0	-0.3	-100
	00	PD	Pond - contact	0.0	1.4	1.4	100
	00	PH	Pumphouse	0.0	0.3	0.3	-
	00	RE	Reservoir	0.0	143.6	143.6	-
	00	RO	Rock Outcrop	0.0	33.6	33.6	-
	00	RZ	Road Surface	2.4	8.4	6.0	249
	00	TA	Talus	1.1	0.0	-1.1	-100
	00	WM	Grey-leaved willow–Glow moss shrub carr	24.0	0.0	-24.0	-100
	00	WW	Willow–Scrub birch–Sedge fen	24.5	0.0	-24.5	-100
			Subtotal	**370.9**	**201.1**	**-169.8**	**-46**
			Total	**1919.1**	**1919.1**	**-**	**-**
Pl – Lodgepole pine (Pinus contorta) Sxw – Hybrid white spruce (Picea engelmannii x glauca)							

Note: 47.5 ha of the baseline footprint has already been disturbed by trails and road access, but has not been classified as disturbed in the TEM.

Wildlife Capability

Reclamation for wildlife will focus on habitat characteristics for key species that were assessed as Key Indicators for wildlife (see Section 2.7.2.8 – Impact Assessment for Wildlife). Where reclamation practices are of particular benefit to a key species, these are shown in brackets following the description of the practice; however, it should be understood that these measures are not limited in application to the key species. For example, movement corridors beneficial to ungulates and bears will also be used by wolves and coyotes.

Key wildlife species for this Project for which habitat capability is specifically targeted on the reclaimed landscape are great blue heron, Barrow’s goldeneye, mallard, short-eared owl, fisher, mule deer, moose, black bear and grizzly bear (Taseko Mines Ltd. 2009). Some species indicated as important by the Tsilhqot‘in in the *William* Case are key species for reclamation, while the habitat requirements of others are captured by reclamation of habitat for other key species. Reclamation of habitat for the SARA-listed species olive-sided flycatcher is captured in general reclamation for key species that share similar broad habitat requirements (i.e., mature forest), but specific reclamation practices (e.g. planting snags) are included as well.

Comparable to pre-mining conditions, predicted ecosystems will provide: moderately high to moderate capability for moose, moderately high to low capability for grizzly bears and mule deer; moderate to low capability for fisher; moderate capability for short-eared owl; moderate to nil capability for black bear & Barrows goldeneye.

Consideration of Species of Interest to First Nations based on the *William* Case

Twenty-four species were identified in the William Case as being of particular importance to the TNG. Five of these species (moose, mule deer, grizzly bear, black bear and fisher) were used to develop wildlife capability ratings for the post-closure footprint. The capability for 14 of the other species is considered to be inferable from the capability rating for the key reclamation species that are related, or have similar behaviour and habitat use patterns. These linkages between *William* Case species and key reclamation species are presented in Table 2.8.2.2-2.

Table 2.8.2.2-2 Linkages between Key Reclamation Species and William Case Species

Key Reclamation Species	William Case Species
Grizzly bear*	wolf, cougar, Canada lynx, bobcat, snowshoe hare, wolverine, American marten, American mink, weasels, mice and voles
Black bear*	red squirrel, northern flying squirrel, American marten, weasels, mice and voles
Mule deer*	wolf, cougar, Canada lynx, bobcat, snowshoe hare, feral horses, wolverine, American marten, weasels, mice and voles
Moose*	wolf, cougar, Canada lynx, bobcat, snowshoe hare, wolverine, American marten, American mink, weasels, mice and voles
Fisher*	red squirrel, northern flying squirrel, American marten, American mink, weasels, mice and voles
Short-eared owl	mice and voles, feral horses
Barrow's goldeneye	red squirrel, northern flying squirrel, American marten, American mink, weasels, mice and voles
*key reclamation species also listed as important First Nations species	

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.8.2.2-1 Pre-Development Wildlife Habitat Capability for the New Prosperity Copper-Gold Project Footprint

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.8.2.2-2 Post-Closure Wildlife Habitat Capability for the New Prosperity Copper-Gold Project Footprint

First Nations Use for Traditional Purposes

The reclamation of habitat for ungulates and large carnivores will provide moderate to high hunting opportunities on the post-closure mine features. Trapping opportunities for Lynx, Snowshoe Hare, mink, weasels, and squirrels will also likely be high based on the moderate to high post-closure capability for mule deer habitat. Trapping opportunities for beaver, muskrat and river otter will be lost from the wetland areas under the TSF, which will not be reclaimed to suitable wetland and marsh habitats for these species; however, trapping of these species can still occur in the Fish Lake watershed north of the TSF. There will also be no capability for fishing in the Pit Lake predicted at this time, but fishing capability will be maintained in Fish Lake and the TSF.

Traditional use (berry, medicine and other cultural use) plants that are listed in the final revegetation species list include: dwarf mountain blueberry, wild strawberry, black currant, black gooseberry, red elderberry, common paintbrush, black hawthorn, green alder, and water birch. Other species may be added to the revegetation mix based on successful survival trials in reclamation research. Taseko will be open to discussing with interested First Nations the reclamation species lists through all phases of mining.

Other Resource Uses

Grazing opportunities may be restored on reclaimed areas of the non-PAG waste rock storage areas and the TSF tailings beach, where open landscape can provide forage for summer use. Waterfowl viewing areas are expected to be obtained on the TSF with the sedge ecosystem ([BF] Water sedge – beaked sedge).

Fish Lake Island, an area identified as being of particular importance to First Nations, will be maintained through the New Prosperity mine. During all phases of mining, access to Fish Lake will be provided.

Recreational opportunities will be provided in the post-closure landscape by: improved safer access to Fish Lake and the reclaimed mine site area by the upgraded access road; and hunting opportunities on the former mine site due to the creation of wildlife habitats.

Post-mining recreational capability for boating, camping, and wildlife viewing are expected in the TSF area.

General Means by Which Objectives Will Be Met

General reclamation practices include:

- Salvage, storage and replacement of sufficient quality soil materials for reclamation to meet land capability objectives.
- Resloping the non-PAG waste rock stockpile and TSF embankments to 2H:1V prior to reclamation. Resloping will assist facilitate placement of soil, establishment of vegetation and ease of movement of humans, wildlife and livestock.
- Recontouring reclaimed linear disturbance features (i.e. pipelines, roads and drainage ditches) to re-establish natural drainage patterns
- Site preparation to alleviate compaction where required and facilitate drainage.

- Seeding areas as soon as possible after placement of soil with a seed mix suitable for erosion protection. Interim seeding mixes will also provide summer forage for bears, moose and mule deer.
- Planting deciduous and coniferous trees in variable densities and clumps to create habitat patches and forest openings that increase the suitability of the reclaimed landscape for a variety of species for feeding and shelter (ungulates, bears, short-eared owl).

Additional techniques to further improve site suitability for wildlife and promote wildlife use can be developed through the detailed reclamation planning process required for *Mines Act* permitting, but such techniques could include:

- Leaving natural forest intact within the mine site clearing boundary wherever possible to enable movement of wildlife (bears, ungulates) and plants across the mine site.
- Providing visual breaks on large mine features by creating topographic features such as low berms or rock piles and dense plantings of conifers and large deciduous shrubs (bears, ungulates).
- Adding large logs, rock piles, stumps, and other coarse woody debris to future forested areas to provide micro-habitats for small mammals and furbearers and perching habitat for raptors (short-eared owl, fisher).
- In areas requiring vegetation clearing only, (i.e., power lines) leaving tall stumps (stubs) and snags, where possible and safe to do so, for cavity nesting species and raptor perches.
- Planting artificial snags 5 m high on reclaimed areas along forest edges (olive-sided flycatcher)
- Installing nest box on poles in areas less than 500 m from Fish Lake and Wasp Lake to compensate for habitat lost by the construction of the TSF (Barrow's goldeneye).

Soil Salvage and Stockpiling

A soils handling plan is provided in Section 2.8.1 Environmental Management Plans. Soil salvage is based upon the data collected by Talisman in 1996 and 1997 (Talisman Land Resource Consultants Inc. 1997), and soil sampling and mapping completed by JWA in 2006 (see March 2009 EIS/Application Volume 5, Section 4.5 Scope of Assessment for Soils). Details of the reclamation suitability criteria for soil used to generate salvage volumes are outlined in Section 2.7.2.6, Terrain and Soils.

The soil handling plan takes into account the volumes of soil required for final reclamation of mine disturbance sites. Table 2.8.2.2-3 lists the Project mine disturbance areas and sites which will be reclaimed progressively during mine life and at closure. Approximately 1,380 ha will require a soil cover prior to revegetation.

Table 2.8.2.2-3 further details the volumes of soil required for final reclamation based on the area of each disturbance site and the proposed soil replacement depths. For soil volume estimation, waste rock storage and TSF embankment slope areas were increased by a liberal 30% in order to account for larger surface areas once these sites are resloped to 2H:1V grades. Approximately 6,322,000 m3 of soil material will be required for capping.

Table 2.8.2.2-3 Soil Volumes Required for Reclamation

Disturbance Site	**Area (ha)**	**Soil Capping Depth (cm)**	**Soil Volume Required (m^3)**	**Soil Source/Stockpile**
Windrowed Soil Sites[1] :				
Access Trail	1.3	76	9,896	Access trail windrows
Ditch – Contact	7.9	57	45,074	Ditch windrows
Ditch Non-Contact	5.7	54	31,248	Ditch windrows
Explosives Storage	1.2	87	10,328	Explosives storage windrow
Fish Lake Dam	0.5	108	5,113	Fish Lake Dam windrow
Fish Lake Pumphouse	0.1	45	268	Fish Lake Pumphouse windrow
Pipelines	12.3	52	63,688	Pipeline windrows
Pond – Contact	11.3	74	83,359	Pond windrows
Pond - Non-Contact	5.2	48	25,113	Pond windrows
Pond – Tailings	0.1	45	563	Pond windrows
Site Road	43.9	55	240,229	Site road windrows
Sub-totals:	**89.4**		**514,879**	
Stockpiled Soil Sites:				
Conveyor	2.3	50	11,316	Plant Site Stockpile
Haul Road	26.9	50	134,363	Plant Site Stockpile
Pit[2]	177.2	0	0	
Plant	35.9	50	179,655	Plant Site Stockpile
Stockpile - Non-PAG	132.0	50	660,000	Plant Site Stockpile
Stockpile – Ore	77.5	50	387,741	Plant Site Stockpile
Stockpile – Soil[3]	129.5	0	0	
TSF Beach	763.9	50	3,819,276	East Stockpile 1, East Stockpile 2
TSF Embankment	123.0	50	615,000	North Stockpile 1, North Stockpile 2
TSF Pond[4]	405.6	0	0	
Sub-totals:	**1,873.7**		**5,807,351**	
Totals:	**1,963.1**		**6,322,229**	

Notes:

For Windrowed Soil Sites- volumes of soil salvaged are the volumes that are replaced at time of reclamation; therefore, replacement soil depths will depend on the areas to cover at time of reclamation. Depths in Table 2.8.3-4 are based on the site areas and the calculated soil salvage volumes of the sites in Table 2.8.3-5.

Pit walls and pond will remain as permanent disturbance features; no soil replacement.

Soils under soil stockpile sites will be left intact; therefore, no soil replacement required.

TSF Pond will remain as permanent disturbance feature; no soil replacement.

Recontouring

The non-PAG waste rockpiles will be resloped as required to meet end land use goals, facilitate the placement of soil, and revegetate as part of the reclamation plan, as well as assist the long-term geotechnical stability of these waste piles.

Surfaces of waste rock and overburden compacted from equipment traffic will be scarified as necessary prior to soil capping.

Soil Replacement

Soils replacement strategies are presented in the soils handling plan in Section 2.8.1 Environmental Management Plans. Reclamation sites will be capped with soil materials stored in windrows or from designated stockpiles. The soil replacement depths for the windrow sites are determined from the volume of material estimated to be salvaged from the sites and their areas. An average soil replacement depth of 50 cm will be placed on areas that will receive soils from stockpiles. This depth is based on average pre-development rooting depths.

The access trails, water management facilities/structures, pipelines, roads and explosives facilities will be reclaimed through replacement of windrowed soil.

The non-PAG waste rock dump (non PAG stockpile), ore stockpile, plant site, conveyor line, haul road and tailings embankments will be reclaimed through placement of 50 cm of salvaged and stockpiled soil in one lift. The replaced soil cap will consist of up to 26 % organic soils by volume mixed with mineral soils based on the amount of organic soils that are expected to be salvaged and mixed into stockpiles. Where required, soil may be scarified prior to seeding if the surface becomes compacted due to truck or equipment traffic.

Portions of the tailings beach requiring capping to enhance vegetation growth and reduce effects from wind erosion will be capped with stockpiled soil material to a depth of 50 cm, with the exception of a proposed a 100 m wide zone on the beach area measured from the high water mark. Soil replacement is not planned for this zone to prevent erosion of the soil capping material along the shoreline. Establishment of riparian and shoreline vegetation is expected to be successful without soil capping.

Revegetation

Revegetation prescriptions proposed are based on plant species occurrences at baseline, post closure conditions, availability of species in greenhouses or as seed mix, historical effectiveness of species, as well as plant species of interest to First Nations in the *William* case.

Interim revegetation refers to the seeding of soil stockpiles, soil windrows, disturbances associated with the transmission corridor, diversions ditches and mine features, particularly sloping sites as they become temporarily or permanently inactive, for the purpose of invasive plant and erosion control. Interim revegetation involves seeding of a grass and legume ground cover consisting predominantly of native grass and legume species and some agronomic species.

Ground cover will successfully reduce water impacts, velocities, and runoff on the slopes. Candidate species for interim reclamation, invasive plant control and reclamation designed to control surface erosion on stockpile slopes are given in Table 2.8.2.2-4.

Table 2.8.2.2-4 Candidate Grass and Legume Species for Interim Reclamation

Common Name	Scientific Name	Grass/Legume/Forb
Native species:		
spreading needlegrass	*Achnatherum richardsonii*	Grass
hair bentgrass	*Agrostis scabra*	Grass
timber milk-vetch	*Astragalus miser*	Legume
Bluejoint	*Calamagrostis canadensis*	Grass
slimstem reed grass	*Calamagrostis stricta*	Grass
slender wheatgrass	*Elymus trachycaulus*	Grass
Fireweed	*Epilobioum angustifolium*	Forb
Rocky mountain fescue	*Festuca saximontana*	Grass
needle and thread grass	*Hesperostipa comata*	Grass
fowl bluegrass	*Poa palustris*	Grass
Kentucky bluegrass	*Poa pratensis*	Grass
Nevada bluegrass	*Poa secunda*	Grass
bluebunch wheatgrass	*Pseudoroegneria spicatum*	Grass
American vetch	*Vicia americana*	Legume
Agronomic species:		
cicer milkvetch	*Astragalus cicer*	Legume
annual ryegrass	*Lolium multiflorum*	Grass
birdsfoot trefoil	*Lotus corniculatus*	Legume
Sainfoin	*Onobrychis vicifolia*	Legume
annual / fall rye	*Secale cereal*	Grass

Notes:

1. Native species listed based on species surveyed in mine project area.
2. Use of listed native species will be dependent on availability of seed stock from commercial seed suppliers. If unavailable, suitable substitute species will be used.
3. Annual agronomic grass species included to provide a fast growing/establishing vegetation cover until native species become established.
4. Agronomic legume species included to provide faster establishing nitrogen fixing species; application rates will be kept low to prevent from becoming too widespread and out-competing native species.

The candidate species mix focuses on native species to address concerns of introducing agronomics for reclamation in specific areas of the Project, limiting the spread of introduced species, and where feasible, including species of importance to First Nations.

Due to the large amount of disturbed ground that is created in mining operations, development of a program to prevent invasive plant species from becoming a management problem on the mine site and associated disturbances is necessary. An invasive plant management plan, an overview of which is provided in Section 2.8.1, developed by the proponent will be implemented.

Final reclamation will involve both planting and seeding prescriptions. All areas with moderate forest capability will be reclaimed using treatments designed to promote return to productive forest ecosystems with wildlife values. Such treatments will include planting of coniferous and deciduous trees and understory shrub and forb species to provide stand diversity.

Table 2.8.2.2-5 provides a list of native tree, shrub and herb species which potentially could be used for final reclamation. Planted areas may be inter-seeded with nitrogen-fixing agronomic legumes to enhance site nutrient, control surface erosion and prevent invasive plant establishment on newly reclaimed sites.

Areas with low forest capability, but moderate to high capability for wildlife will be reclaimed using treatments to promote productive open landscapes with wildlife values. Such treatments will include combinations of seeding or transplanting of grasses, sedges and rushes; and planting of deciduous shrubs.

The initial reclamation objective on slope faces will be controlling surface erosion to prevent degradation of the soil cap as described above. Over time these reclaimed areas will provide a variety of changing habitats. As natural regeneration progresses they will provide a diversity of habitat through the natural colonization of deciduous tree and shrub species, and will eventually evolve into mature conifer forest ecosystems.

Trees and shrubs will be planted predominantly on the non-PAG waste stockpile plateaus and in variable densities and clumps (from open to dense forest), creating habitat patches and forest openings that increase the suitability of the reclaimed landscape for a variety of species for feeding and shelter.

As with the non-PAG waste stockpile, the initial focus of revegetation efforts on the tailings embankments and beach will be seeding with a grass/legume mix to prevent erosion of the soil cap. Deciduous shrub and tree species will be planted in island groupings.

Table 2.8.2.2-5 Candidate Species for Final Reclamation

Biogeoclimatic Subzone	Tree Component		Shrub and Herb Component	
	Common Name	Scientific Name	Common Name	Scientific Name
SBPSxc	lodgepole pine	*Pinus contorta*	green alder*	*Alnus tenuifolia*
	trembling aspen	*Populus tremuloides*	Saskatoon berry	*Amelanchier alnifolia*
			scrub birch	*Betula glandulosa*
			water birch*	*Betula occidentalis*
			buckbrush*	*Ceanothus sanguineus*
			black hawthorn*	*Crataegus douglasii*
			wolf-willow*	*Elaeagnus commutata*
			common juniper	*Juniperus communis*
			creeping juniper	*Juniperus horizontalis*
			black twinberry	*Lonicera involucrata*
			false box*	*Paxistima myrsinites*
			prickly rose	*Rosa acicularis*
			Barclay's willow	*Salix barclayi*
			grey leaved willow	*Salix glauca*
			Soopolallie	*Sheperdia canadensis*
			dwarf mountain blueberry*	*Vaccinium caespitosum*
			birch-leaved spirea	*Spirea betulifolia*
			Yarrow	*Achillea millefolium*
			Kinnikinnick	*Arctostaphylos uva-ursi*
			pasture sage	*Artemisia frigida*
			crow berry	*Empetrum nigrum*
			Fireweed	*Epilobium angustifolium*
			wild strawberry*	*Fragaria virginiana*
MSxv	hybrid white spruce	*Picea X*	green alder*	*Alnus tenuifolia*
	lodgepole pine	*Pinus contorta*	scrub birch	*Betula glandulosa*
	trembling aspen	*Populus tremuloides*	black hawthorn*	*Crataegus douglasii*

			common juniper	*Juniperus communis*
			false box*	*Paxistima myrsinites*
			black currant*	*Ribes hudsonianum*
			black gooseberry*	*Ribes lacustre*
			prickly rose	*Rosa acicularis*
			Willow	*Salix sp*
			Barclay's willow	*Salix barclayi*
			short fruited willow	*Salix brachycarpa*
			red elderberry*	*Sambucus racemosa*
			Soopolallie	*Sheperdia canadensis*
			dwarf mountain blueberry*	*Vaccinium caespitosum*
			Yarrow	*Achillea millefolium*
			Kinnikinnick	*Arctostaphylos uva-ursi*
			common paintbrush*	*Castellija miniata*
			Fireweed	*Epilobium angustifolium*
			wild strawberry*	*Fragaria virginiana*

Notes:
1. Native species listed based on species surveyed in mine project area.
2. Species marked with an asterisk have been identified as plant species of importance to Tsilhqot'in in the *William Case*.

The species will be tested in planting trials to determine their ability to establish on reclamation sites. The species mix will be further refined to include plants which are most likely to successfully establish on the reclamation sites to achieve the proposed end land uses.

2.8.2.3 Plans for Removal of Structures and Equipment and Remediation of Contaminated Soils

At the end of closure, several new landforms will have been created. These will include:

- The pit with Pit Lake, which will fill with water to the 1440 m elevation;
- The soil capped non-PAG waste stockpile; and,
- The TSF with submerged PAG materials, soil capped tailings beach, uncapped tailings beach (shoreline), and soil capped embankments.

Areas that will be returned to landforms similar to pre-mining and capped with stockpiled or windrowed soil are:

- Plant site

- Ore stockpile pad
- Soil stockpile footprints
- Conveyor Line
- Power lines (where soil has been removed to level grade)
- Interior roads and linear disturbances
- Fresh water and site water collection ditches and collection ponds around stockpiles and the plant site, and
- Explosives site.

Dependant on the timing of ability to discharge TSF lake water and seepage directly to the environment mine features that may remain unreclaimed for a period of time at closure could include:

- Seepage collection ditches and ponds below the tailings embankments
- Groundwater pumping wells below the main embankment
- Pipelines directing water from the main embankment seepage ponds and groundwater wells to the Pit Lake, and
- Roads and power lines for maintenance of any prolonged use water management features.

Other facilities requiring decommissioning include:

- The tailings and reclaim pipelines and reclaim barge.

For the final configuration of all mine features at post-closure, including unreclaimed mine features and mine site drainage, see Figure 2.8.2.3-1.

All structures and equipment not needed for permanent water management will be removed in the decommissioning and closure phase. The only features that will be retained are key diversion ditches, pipelines and groundwater pumping wells required to meet long-term water management objectives. Structures to be removed include all plant site facilities; the conveyor; maintenance/warehouse complexes; explosives manufacture and storage facilities including the manufacturing plant, storage tanks, silos and plant services; substations, power lines and poles.

Concrete building/structure foundations (i.e., slabs, footings and foundation walls) will be left in place if the concrete is steel-reinforced, or otherwise broken apart. Compacted areas will be ripped prior to soil capping and revegetation, and windrowed soil will be pushed back over the site to a minimum depth of 50 cm prior to revegetation.

Any soils identified as being contaminated with hydrocarbons or other hazardous materials will be managed in accordance with provincial and federal regulations.

FIGURE TO BE INCLUDED IN FINAL EIS SUBMISSION

Figure 2.8.2.3-1 Post-closure Mine Site Configuration

2.8.2.4 Mine Site Interior Roads and Other Linear Disturbances

Site haul roads will be constructed with non-PAG overburden and waste rock material. At mine closure, all haul roads will be reclaimed using the following methods:

- Road surfaces will be ripped or otherwise treated to decompact the running surface
- Culverts will be removed, with creek crossings and cross-ditches installed to re-establish natural drainage in accordance with the post-mine water management system
- Sidecast material along roads will be pulled back to the extent practicable re-establish grades that blend with the natural topography
- Prepared surfaces will be capped with salvaged soils from adjacent windrows, and
- Surfaces will be revegetated with species listed in Section 2.8.2.6 to meet end land use objectives prevent erosion, and prevent invasive plant establishment on bare soils.

Roads required for maintenance access for any required water management features will be left in semi-permanent deactivated condition. Semi-permanent deactivation will allow the road to remain in place and be useable, but also environmentally stable. Semi-permanent deactivation measures which will be carried out to include removal of culverts and replacement with cross-ditches; installation of ditch blocks at cross ditch locations; installation of waterbars across the road to direct road surface water off the road; removal or breaching of windrows along the road edge; outsloping/insloping of the road surface as appropriate; and revegetation of exposed soil surfaces for erosion and weed establishment control.

2.8.2.5 Non-PAG Waste Rock Pile

Non-PAG waste rock and overburden not used in the construction of the TSF or in road construction will be placed in the non-PAG waste stockpile to the northeast of the pit. Final configuration of the non-PAG waste stockpile is illustrated in Section 2.2.5. At mine closure, all areas of the non-PAG waste stockpile not previously revegetated through progressive reclamation during operations will be reclaimed using the following methods:

- The stockpile will be resloped to maximum slope angles of 2H:1V
- Plateau surfaces will be ripped or otherwise treated to decompact soils as required, and
- Surfaces will be capped with 50 cm of salvaged soils from stockpiles. Surfaces will be revegetated to meet end land use objectives prevent erosion, and prevent invasive plant establishment on bare soils.

The ore stockpile will be mined out entirely by closure, and footprint will be left at natural topography. A soil capping of 50 cm will be placed over the footprint, and the site will be revegetated in the manner of the non-PAG waste stockpile.

2.8.2.6 Tailings Storage Facility

Final configuration of the tailing storage facility is illustrated in Section 2.2.5. The embankments will be raised over the life of operations to contain the tailings, and will be constructed of compacted glacial till, non-PAG overburden and waste rock. PAG waste rock and overburden will be submerged within the TSF impoundment and covered completely with selectively discharged tailings during Years 17 to 20 of operations, when the low grade ore stockpile is being processed. The supernatant pond, called the TSF Lake at closure, and the tailings cover will prevent oxidation of non-PAG waste and ARD generation.

The following measures have been incorporated into the Project design to ensure that the TSF is stable and self-sustaining: engineered zoned embankments designed as per the Canadian Dam Association Guidelines; long beaches to keep the TSF Lake away from the embankment crests, thereby improving stability of the structures; a constructed spillway sufficient to prevent overtopping and eroding of the embankments, as well as maintaining the TSF Lake at the desired elevation; and, the inclusion of vibrating wire piezometers within each embankment to allow for on-going monitoring of the structure's stability.

At mine closure, the TSF will be reclaimed using the following methods:

- With the exception of the shoreline, the tailings beach surfaces will be capped with 50 cm of salvaged soils from stockpiles.
- Embankments will be resloped to 2H:1V and capped with 50 cm of soil.
- Surfaces will be revegetated to meet end land use objectives prevent erosion, and prevent invasive plant establishment on bare soils. Rocks and coarse woody debris will be placed in piles across the beach surface for line of sight breaks and habitat enhancement.

A strip of beach up to 100-m wide, measured from the high water mark of the TSF Lake, will not be capped with soil, but will be revegetated using native grasses and sedges. When water quality monitoring confirms the area is suitable for wildlife use, additional wetland species will be planted. Post-closure wildlife capability ratings likely underestimate the wildlife capability of this shoreline zone due to uncertainties regarding water quality and the timeframe for the area to become suitable habitat; however, if revegetated with emergent and wetland species, the zone would be expected to have high capability for small mammals, waterfowl, breeding habitat for amphibians.

2.8.2.7 Pit

At the end of Year 16, the open pit will be approximately 1200 to 1600 m in diameter, and 525 m deep. The pit will naturally begin filling with water once operations have ceased, beginning in Year 17. Water from the TSF will be released to the pit starting in Year 31 or sooner, if the TSF Lake elevations reach the spillway before the projected fill date. The pit will be allowed to fill with water over 27 years, to the 1440 m elevation, by approximately Year 45. At the end of Year 16, the open pit will be approximately 1200 to 1600 m in diameter, and 525 m deep. The pit will naturally begin filling with water once operations have ceased, beginning in Year 17. Water from the TSF will be released to the pit starting in Year 31 or sooner, if the TSF Lake elevations reach the spillway before the projected fill date. The pit will be allowed to fill with water over 27 years, to the 1440 m elevation, by approximately Year 45. The pit water quality will be monitored and released only if it will enable water in Fish Creek to meet either established water quality standards, or site-specific objectives. These water quality standards will be set out in the effluent permit. If water quality standards will not be met as a result of natural geochemical processes (e.g., precipitation of metals in ambient conditions), water treatment (either of specific sources, in the pit, or with a water treatment plant upstream of the Pit Lake spillway) may be required. The need for treatment will be identified through monitoring of water quality during the 27 years the pit is filling. Effluent water quality and environmental effects monitoring programs will be conducted in accordance with effluent permit requirements.

The nominal elevation of the pit rim will be 1470 m, leaving up to 30 m of rock and overburden pit wall exposed above the lake level. Approximately 31 ha of rock wall will be left, and will be exempt from reclamation (Section 10.7.14 of the Health, Safety and Reclamation Code). Approximately 10–15 ha of pit wall will be located in overburden, which will be sloped to 30 degrees and seeded with a non-invasive native and agronomic grass/legume mix. No soil capping will be conducted on the overburden walls.

2.8.2.8 Water Management Plans and Watercourse Re-establishment

Water management system reclamation at mine closure will focus on the deactivation of structures and subsequent stabilization and revegetation. A water management plan is presented in Section 2.8.1

The reclamation of water management structures will include:

- Removal of non-essential diversion ditches and pipelines
- Re-establishing drainages into original creek channels where possible, and
- Stabilization of permanent structures for erosion control.

Windrowed soil will be pushed back over deactivated structures following recontouring, and revegetated.

The contact and non-contact ditches and collection ponds around the non-PAG waste stockpile, ore stockpile, plant site and pit will be reclaimed at closure, and all drainage from the stockpile and plant site areas will be allowed to return to natural drainage patterns. The drainage from the non-PAG waste stockpile will flow to the Pit Lake, and the drainage from the ore stockpile location and plant site will flow to Fish Lake.

Fish Lake Recirculation System

A system of pipelines, dams, a pumphouse and diversion ditches will be used to prevent contact water from the mine from entering the Fish Lake watershed, and to maintain water volumes in the Upper Fish Creek tributaries for fish spawning habitat while the Lower Fish Creek spawning grounds are dammed off during operations. Groundwater pumping wells will also be installed below the Main Embankment to capture groundwater flowing out of the TSF and prevent it from reaching Fish Lake; this seepage will be pumped back into the TSF. The Fish Lake outflows will be managed by a pumping system located at the northern end of the lake, with water conveyed in a pipeline and released to the Upper Fish Creek tributary inlet channels of the lake, immediately downstream of the TSF Main Embankment. Two non-contact water ponds, one located east of the TSF adjacent to the reclaim barge and one south of the TSF adjacent to the soil stockpile, will also capture water in undisturbed catchments to be pumped to the Fish Lake recirculation pipeline to discharge clean water to the inlet channels of Fish Lake. Excess flows not needed for the inlet channels will be directed to the TSF. These features will be decommissioned in stages over the 29 years between Year 16 and Year 45 while the TSF Lake and Pit Lake fill to final elevations.

Once mining in the pit has stopped in Year 16, but processing of ore form the stockpile continues, any water not required to maintain Fish Lake inlet flows will be allowed to drain to the pit, but the rest of the recirculation system will remain in place as during operations.

Phase I of closure begins when processing of the ore stockpile is finished in Year 20. During phase I closure, water from the Fish Lake outflow continues to be pumped back to the inlets, and the non-contact water from catchments east and south of the TSF are also directed to the Fish Lake inlet channels, with flows in excess of what is required to maintain spawning habitat diverted to Wasp Lake. Drainage from the east catchment below the existing road will be allowed to drain to the TSF Lake.

Closure phase II begin when the TSF Lake reaches the spillway elevation in Year 31. During phase II of closure, all of the east catchment drainage will be allowed to flow into the TSF Lake. The catchment south of the TSF will be allowed to resume flow through natural channels to Wasp Lake. The dams on the outflow of Fish Lake are removed, and the outflow water is allowed to drain entirely to the pit. Overflow from the TSF Lake will be directed through diversion ditches or a pipeline to the Upper Fish Creek tributaries. Seepage collected from the TSF South Embankment will drain to Wasp Lake through natural channels, and seepage from the West Embankment will drain to Big Onion Lake through natural channels. Seepage from the Main Embankment and the groundwater pumping wells will cease to be pumped to the TSF, and will instead be diverted through a pipeline to the Pit Lake.

The post-closure phase begins around Year 45, when the Pit Lake reaches spillway elevation, and will begin to spill to the north down Lower Fish Creek. The seepage collection ditches and ponds for each TSF embankment will remain in place until such time as water quality permits direct discharge to Fish Lake. The groundwater pumping wells and Main Embankment pond pumping system will also remain in place to divert TSF water away from the Fish Lake tributaries, through the pipeline to the open pit for as long as water quality objectives require. All other water management features will be removed and natural drainages will be re-established.

Water management under temporary or early closure scenarios is described in the Water Management Plan (Section 2.8.1).

2.8.2.9 Reclamation Monitoring and Maintenance

Reclamation success will be monitored throughout mine life to ensure that reclamation is successful, and that end land use goals are being achieved. Post-closure reclamation monitoring for the mine site will continue until a self-sustaining vegetation cover that meets end land use objectives has been established and documented. The primary objectives of the environmental monitoring program after closure will remain consistent with those during operations. Parameters that will be assessed include:

- Successful establishment of ground cover for erosion control
- Forage production in open landscapes and meadow ecosystems
- Planted tree and shrub seedling survival and growth
- Natural establishment of vegetation and evidence of increasing diversity of native species
- Wildlife use of reclaimed areas (through site personnel observation records, scat counts, nest box surveys or other wildlife surveys), and
- Trace element uptake in vegetation.

On sites where ground cover or survival of planted stock is too low to provide erosion control or wildlife habitat value, re-seeding and infill planting will be completed. Investigation of soil properties, browse pressure and other factors will be undertaken if revegetation success remains low, so that limitations to reclamation success can be identified and removed or mitigated.

Monitoring and control of invasive plants on the reclaimed site will be conducted according to the invasive plant management plan in Section 2.8.1.

Monitoring programs for ground and surfaced water quality and seepage volumes are discussed in Section 2.8.1 – Water Management Plan. Long-term monitoring of the geotechnical stability of the TSF is described in Section 2.8.1 – Geotechnical Stability. Monitoring plans for aquatic and terrestrial ecosystems outside of reclaimed areas are discussed in Section 2.7 for each ecosystem component. More information on the monitoring program, including data collection and evaluation methods and thresholds that trigger mitigation, will be established in consultation with the MEM and will be provided at the time of permitting.

Soils and vegetation on the New Prosperity project area have naturally elevated metal concentrations in comparison to published standards from non-mineralized areas (see Section 2.6.1.6 – Impact Assessment, Soils); therefore, similar elevated metal concentrations are expected to be found in soils used for reclamation. Vegetation will be sampled from all reclaimed sites to determine if trace element concentrations on reclaimed sites vary from the baseline values in similar vegetation. Monitoring will focus on species and plant parts consumed by cattle, horses or wildlife, or that were specified as country foods of interest to First Nations. If it is shown that plants accumulate trace elements to levels where humans, wildlife or livestock may be affected, suitable mitigation measures will be developed. Such measures may include the placement of additional suitable soil material over the site to prevent metal uptake from the metal-enriched substrate.

Reclamation research will initially focus on survival trials to determine which native plant species will have the best survival on the site. Additional research may be conducted as site-specific issues for reclamation arise.

Research focusing on water quality, wildlife habitat quality or safety for human use of Fish Lake and associated tributaries is described in the follow-up and monitoring requirements described in the Impact Assessment (Section 2.8.3) for each valued ecosystem component.

2.8.2.10 Geotechnical Stability

Design of permanent mine-related landforms such as the open pit, tailings storage facility, and non-PAG waste stockpiles have been undertaken to ensure long-term stability after mine closure. The tailings storage facility has been designed to be fully compliant with the Canadian Dam Association Safety Guidelines, and the non-PAG waste stockpile has been designed in accordance with the Interim Guidelines of the BC Mine Waste Rock Pile Research Committee per section 10.6 of the Health, Safety and Reclamation Code for Mines in British Columbia (refer to the Mine Plan, Section 2.2.4).

Geotechnical stability monitoring is described in Section 2.8.1, Environmental Management Plans.

2.8.2.11 Long-Term Monitoring for Surface and Groundwater Quality

Surface and Groundwater Quality monitoring is described in Section 2.7.2.4 Water Quality and Quantity.

2.8.2.12 Management Plans for Final Closure and Temporary and/or Early Closure

In the event of a short-term closure of less than one year, the following actions will be taken to maintain the site:

- Site environmental monitoring and management programs continue as per regular operations without interruption.
- A "care and maintenance" team is retained from the site operations and maintenance personnel which will maintain the site security program, maintain the equipment in an operationally ready state as well as monitor and maintain all site environmental systems.
- Pumping of tailings seepage water and runoff collected from the waste rock dumps and low grade ore stockpile will continue as per regular operations.
- Mining equipment will be relocated to a marshalling site for storage.
- Reagent inventories retained in their original packaging will be assessed to determine which, if any, will be adversely impacted by the expected storage term.
- Any reagents which will degrade during the shutdown period will be returned to the vendor, sold or disposed of in an approved facility. Any reagents which will remain active for the resumption of operations will be stored in a secure manner.
- Any reagent inventory which has entered the concentrator process and is stored bulk in tankage after cessation of operations will be removed and disposed of in an approved manner.
- Solvent, oil and fuel inventories at the site will be assessed to determine quantities to be retained and consumed during the site care and maintenance activities. The balance will be returned to the vendor or sold.
- Any waste oil and/or grease inventory will be disposed of in an approved facility.
- Inventory of blasting supplies will be assessed and any supplies which will expire during the shutdown period will be returned to the vendor or disposed of in an approved manner. All retained inventory will continue to be held in a secure facility.
- Nuclear sources will be removed from the concentrator density gauges and stored in a secure facility on site as per Canadian Nuclear Safety Commission regulations.
- All of the coarse ore stockpile will be processed through the mill prior to cessation of operations.
- Any other stockpiled ore will remain in stockpiled and available as mill feed.
- Drainage from the stockpile will be controlled and treated.
- Mill facilities and equipment (including concentrate sheds as well as concentrate and ore handling systems) will be washed down after operations cease. All concentrate will be shipped to market and any excess mineral from the cleanup will be impounded in the tailing facility.
- The tailings facility will continue to be maintained with required freeboard limits.
- If a tailings lift is underway at the time of closure and is required to maintain freeboard levels through the closure period then construction of the tailings lift will be completed.

- Dust from the tailings facility will be mitigated during dry periods by either wetting the tailings beach with supernatant water from the TSF or implementing alternative methods effective for dust control.

In the event that the short-term closure extends beyond one year with no imminent foreseeable change, the following items in addition to those listed above will be scheduled for action as appropriate for the length of closure anticipated:

- Remaining reagents at site will be returned to suppliers, sold or disposed of in an approved facility.
- Remaining blasting supplies at site will be returned to the vendor or disposed of in an approved manner.
- Fuel and lubricating oil storage at site will be minimized with sufficient supplies maintained at site to support only the going care and maintenance activities.

In the event of a permanent premature closure, the decommissioning and reclamation plan in this section will be implemented with the following modifications:

- If required, PAG waste rock material in the TSF will be excavated and re-distributed to ensure PAG is submerged, and
- All stockpiled ore will be processed prior to closure.

2.8.3 Monitoring and Follow-up Programs

Framework for Compliance and Follow-up Monitoring Programs

Compliance monitoring programs are appropriate to verify that Taseko has implemented the required mitigation measures and fulfilled the provisions of the environmental assessment with respect to public consultation, requirements for additional studies or work to be completed. A follow-up and effects monitoring program is appropriate to verify the accuracy of environmental assessment conclusions and to determine the effectiveness of measures implemented to mitigate adverse environmental effects of the Project as well as to confirm the nature and extent of beneficial effects predicted to occur. The EIS Guidelines require Taseko to provide a framework upon which compliance as well as follow-up and effects monitoring will be conducted and evaluated throughout the life of the Project, should the Project proceed. The framework is to include:

- A description of the methods to be used, reporting frequency, duration, methods and format;
- A description of roles and responsibilities for the program and it’s review process by both peers and the public;
- A tabular summary of the main components of the program including:
  - Identification of the environmental variable to be monitored and the indicators to be used
  - Discussion on which of the program objectives the activity is fulfilling
  - Description of the sampling or survey methodology, frequency and duration of monitoring that will be employed, and
  - Roles to be played by Taseko, regulatory agencies, Aboriginal groups and others including consideration of the possible involvement of independent researchers, sources of funding and information management and reporting.

Both compliance and follow-up and effects monitoring programs are required if there is a project and if that project is constructed, operated and closed. At the EA stage of project development and review, while it may be feasible to outline a framework of what such programs might look like if the Project proceeds, it is not possible in a meaningful way to define or identify specific environmental variables to be monitored, indicators to be used, sampling methodology, frequency or duration or specify the roles and responsibilities of regulators, Aboriginal groups and other elements of such programs. This level of detail and specificity quite properly as a matter of practice is determined at permitting. Compliance and effects monitoring programs will be required as part of permits and licenses issued by various governmental agencies, including BC Ministry of Energy and Mines, BC Ministry of Forests, Lands and Natural Resource Operations, BC Ministry of Environment, Environment Canada, Transport Canada and the Department of Fisheries and Oceans. It is understood that additional development of the details included in these monitoring plans and programs will be developed and included as necessary as the Project schedule progresses, such that construction follow up and monitoring programs are established and functioning prior to the commencement of construction, and similarly for operations and closure.

Taseko is committed to monitoring the effects of the New Prosperity Project and to follow-up with the results of these programs. If any unforeseen adverse effects arise during the life of the Project, measures will be taken to correct these effects and prevent them from occurring in the future. All monitoring undertaken will be done in accordance with terms and conditions of permits and authorizations issued and the results will, among other things, serve to ensure that the Environmental Management System (EMS) is functioning effectively. As part of an adaptive management process, the EMS will be updated and associated training programs enhanced to improve the level of environmental protection based on the results of these programs.

Table 2.8.3-1 describes the framework of compliance and follow-up and monitoring program to the extent possible at this stage of project development and review. The table identifies the main project components and describes either the mitigation measure or EA provision discussed throughout the EIS where the need for a monitoring programs or provision was identified. It also describes the objective and temporal aspects of each program and identifies to the extent possible both the methods to be employed and the roles and responsibilities for implementation and reporting for each program. Specific details concerning sampling or monitoring methodology, frequency, duration, and information management and reporting aspects for each mitigation measure or EA provision listed on the Table are not provided as they can only be determined appropriately at the permitting and detailed design phase of project development.

Adaptive Management

The concept of adaptive management was originally developed by C.S. Holling (1978) and is seen as a method whereby information from environmental studies could be used to better understand how the environment is affected by change. This, in turn, provides the basis for developing and implementing management practices based upon knowledge and ongoing experimentation even with uncertainty (Halbert, 1993).

Adaptive management is more than trial and error and learning by doing because it reflects a strategy for addressing management under uncertainty (Downs and Kondolf, 2002; Thom, 2000); Walters (1986) indicates adaptive management project designs are underpinned by mathematical models to highlight uncertainties and statistical analyses allowing decisions to be made on the basis of the best information available and to be further refined as more information is collected through monitoring and measurement. According to Thom (2000) and others, adaptive management can be a powerful tool for assessing and improving the performance of systems if it is established in the planning phase and implemented during the monitoring and management phases (Walters and Holling, 1990). The key point is that monitoring and management are inseparable components to effective adaptive management. Monitoring is the fundamental tool in adaptive management that will provide the project managers and evaluators with the information they need to implement change and strive for continuous improvement.

The New Prosperity Mine Project proposes to develop and implement an adaptive management plan (AMP) consistent with the principals discussed above. Adaptive management is not new to the mining industry and the following two notable mining operations have incorporated adaptive management into their planning and operations:

- DeBeers, Snap Lake Diamond Project (2004); Northwest Territories
- Alexco, Bellekeno Project (2009); Yukon Territories

In both these cases, adaptive management is seen as a management tool for guiding responses to unforeseen events or for managing uncertainty. In the case of the DeBeers project, adaptive management has been linked to its environmental management system (EMS) and is expected to facilitate the implementation of corrective actions and to continuously improve the mine's performance.

Adaptive management is in widespread use across a range of resource sectors and countries (Stanky et al., 2005). This reflects its potential as an effective strategy for situations where there is uncertainty with respect to the predicted effects of a project on the environment (water quality, aquatic and terrestrial habitat, hydrology, hydrogeology, structural integrity, water management etc.). Implementing an effective adaptive management plan is a way to manage this uncertainty and not be crippled by it.

The AMP envisioned for fish and fish habitat, compensation plans as well as water quality and lake productivity predictions will include specific monitoring provisions. Part of these monitoring provisions will include the following, as reflected by Thom (2000):

- Measuring the condition of the system with selected indicators (numbers, size and health of fish populations, water quality in Fish Lake and tributaries, etc.)
- Identification of goals and setting performance criteria and standards (target numbers of fish in compensation habitat, water quality at or below predetermined thresholds, etc.
- Development of monitoring plans with adequate detection power (temporal and spatial coverage) to identify both deficiencies and shortcomings along with root causes.
- Evaluating root causes and the extent of deficiencies to make a decision on what actions to take: do nothing, implement corrective actions, or change the goal.

It is probable a number of AMPs will be developed for evaluating project effects on the receiving environment. In principle, the plans will be specific to the environment receptor/resource that could be affected by the project. For example, water quality predictions have been made for Fish Lake and its tributaries and these modelled predictions have, in turn, been compared with Federal and Provincial guidelines as a metric to identify potential effects. Exceedances to the guidelines for some metals and sulphate are anticipated when the TSF is allowed to discharge to the inlets to Fish Lake., as the project proceeds, monitoring programs will be in place to gauge the accuracy of the predictions and the process by which to determine if any action is required. Because of uncertainty, it is not possible to predict exactly the timing or concentration of these parameters and monitoring is the tool available to confirm predictions. For the example of water quality in Fish Lake tributaries, should monitoring show or suggest levels are increasing the AMP will include an “alert” level which could reflect a particular parameter is within X% of the guideline level. The alert level could be tied to increased monitoring and an “action level” would be declared if the level were to approach X_i% of the guideline. The action level would initiate corrective actions which might include treatment and/or pumping captured seepage into the TSF. This scenario is presented in a conceptual context only but it is intended to illustrate how an AMP would be implemented to address uncertainty and manage project effects to design or acceptable levels.

The concept of alert and action levels could be applied to but not necessarily limited to all of the following:

- Predicted water quality in Fish Lake and tributaries
- Success of habitat compensation programs
- Survival, growth and health of fish in Fish Lake
- Fish Lake trophic status and capability of the lake to support and sustain the monoculture population of Rainbow Trout, and
- Other project components not just those related to environmental receptors.

Adaptive management is expected to be a valuable tool for monitoring project effects and for making adjustments in order to continuously improve and ensure the project functions as predicted. AMPs have been identified in concept only and their development will proceed with the permitting phase of the project. Monitoring programs developed will be part of adaptive management

Table 2.8.3-1 Summary of Follow-Up and Monitoring

	Project Element	Discipline/VEC	Phase	Mitigation Measure/Provision of EA	Objective	Program Details/Responsibility
1	Mine	Surface Water Hydrology and Hydrogeology	Construction, Operations, Closure	• Collect additional hydrogeologic data in the adjacent Big Onion and Little Onion Lake systems, Wasp Lake and Taseko River . Location of shallow pit perimeter wells. • Improve transport simulations used to evaluate concentration and transport times for seepage migration to Big Onion Lake beyond their current scoping level. • Install a groundwater well network along the length of the west tailings embankment and sample on a quarterly basis for deviation from baseline conditions; establish a minimum of one year prior to commencement of active mining activities • Install an adequate number of contingency seepage collection and pump back wells during the construction period	Confirming mitigation Verifying predicted effects Verifying predicted effects Confirming mitigation	Program details to be determined at permitting. Taseko and regulatory agencies responsible.
2	Mine	Water Quality	Construction, Operations, Closure	• Continue water quality studies in lower Fish Creek, Wasp Lake, Beece Creek, TSF and pit lake to confirm water characteristics at various stages of the Project. • If water quality parameters are greater than predicted, identify additional measures (e.g., liming of Pit Lake, water treatment plant) and implement to adequately treat water outflows to protect aquatic life.	Verifying predicted effects Confirming mitigation	Program details to be determined at permitting. Taseko and regulatory agencies responsible.
3	Mine	Water Quality	Construction, Operations	• ML/ARD Prediction and Prevention Plan	Confirming mitigation	Program details to be determined at permitting. Taseko and regulatory agencies responsible.
4	Mine	MMER	Construction, Operations, Closure	• Monitor Fish Creek and Taseko River post-closure in accordance with the required MMER Environmental Effects Monitoring program. • Design and implement MMER effluent and water monitoring programs and Environmental Effects Monitoring of the aquatic organisms (fish health, benthic invertebrates, fish tissue, supporting environmental factors), or any similar legislation monitoring once there are discharges from the site	Verifying predicted effects	Program details to be determined upon issuance of Schedule 2 Authorization. Taseko and regulatory agencies responsible.
5	Mine Access Road	Mine Site Soil	Construction, Operations, Closure	• Have the environmental supervisor ensure suitable soil quality for reclamation. • Identify additional areas of soil salvage if the quality of soil does not meet the requirements of the reclamation plan. • Check soil stockpiles regularly and after storm events or rapid snow melt to ensure vegetation cover is maintained and additional erosion control measures are effective. • Evaluate the effectiveness of soil mitigation for compaction, rutting, and drainage prior to revegetation efforts. • Once vegetation is established, visual inspections of vegetation vigour and cover density will provide an indication of soil fertility. If soil fertility has been diminished from baseline conditions, foliar analysis will to determine the fertilizer amendments that may be required. • For new road construction, it is assumed that soils with reclamation value will be stripped and windrowed unless it is deemed to be in proximity of metal deposition, where metal exceedences are anticipated. If in an area where metal exceedences are anticipated soil will be stockpiled an appropriate distance from Project activities associated with metal deposition. • At post-closure, check the shoreline along the TSF and Pit lakes for evidence of erosion on an as needed basis to protect the soil resource.	Confirming mitigation	Program details to be determined at permitting Taseko and regulatory agencies responsible
6	Transmission Line	Transmission Line Soil	Construction, Operations, Closure	• Have an environmental supervisor with knowledge of soil assigned to the site during construction and decommissioning activities of the Project. • During construction and at decommissioning, conduct visual inspections to ensure no detrimental physical changes such as admixing, compaction and rutting and erosion occur on the site.	Confirming mitigation	Program details to be determined at permitting Taseko and regulatory agencies responsible
7	Access Road and Transportation	Wildlife-Vehicle Collisions	Construction, Operations, Closure	• Record all project-related wildlife-vehicle collisions or near misses.	Confirming mitigation	Program details to be determined at permitting Taseko and regulatory agencies responsible
8	General	Wildlife - Grizzly Bear	Construction,	• Implement a “Grizzly Bear Mortality Investigation Program” be implemented under	Verifying predicted effects	Program details to be determined at

			Operations, Closure	the direction of the BC Ministry of Environment. • Implement a Grizzly Bear education and awareness program and contribute to the Province's Grizzly Bear population monitoring program		permitting Taseko and regulatory agencies responsible
9	Mine	Physical and Cultural Heritage Resources	Construction, Operations	• Develop and Implement a Cultural and Heritage Protection Plan	Confirming Mitigation	Program details to be determined at permitting Taseko and regulatory agencies responsible
10	Mine Access Road and Transportation	Atmospheric Environment	Construction, Operations, Closure	• Develop and implement an air quality and dust control management plan (AQEMMP), as per EAO direction • Prepare and submit a burn plan for vegetative debris consistent with the Open Burning Smoke Control Regulation (BC Reg. 145/93) prior to initiation of the construction and commissioning phase	Confirming Mitigation	Program details to be determined at permitting Taseko and regulatory agencies responsible
11	Mine	Socio-Economic, Human Health and Ecological Risk	Construction, Operations, Closure	• Undertake a monitoring program for metal concentrations in soils, local surface water and vegetation throughout the Project. • If through monitoring, concentrations of metals in water and/or fish were elevated over background concentrations, undertake a risk assessment to ascertain if the levels were of a sufficient concentration to pose a potential risk.	Verifying predicted effects Confirming mitigation	Program details to be determined at permitting Taseko and regulatory agencies responsible
NOTES: (Phase = C–Construction, O–Operations, CL–Closure; Discipline = At–Atmosphere, Hy–Surface Water Hydrology, WQ–Water Quality, F–Fisheries, V–Vegetation, W–Wildlife, RU–Resource Users, Ac–Acoustic, TS–Terrain and Soils, EI–Economic, SI–Social, CH–Community and Health)						

2.9 TABLE OF COMMITMENTS

The EIS Guidelines states that Taseko shall summarize key commitments in implementing mitigations, contingency plans, monitoring, taking corrective actions, reclaiming the site and providing offsets for unavoidable Project effects. The summary shall include commitments that are applicable to the Project such as:

- Taseko's commitments as outlined in the BC Environmental Assessment Certificate, which Taseko commits to implementing as part of this EIS and the federal EA process, except where otherwise noted in this EIS
- Commitments made as part of the 2009/2010 review
- Any proposed changes to existing commitments in the BC Environmental Assessment Certificate
- Any new commitments proposed by Taseko relevant to the changes made to project components and activities
- A summary of all significant management commitments
- Any applicable standards, legislation and/or policies
- A discussion of any special management practices or design feature commitments, and
- A table summarizing the timing and responsibility for each of the actions for which a commitment has been made.

The summary of key commitments is found in Table 2.9-1 below. In building the Table, all documents included in Schedule A to the BC Environmental Assessment Certificate, including commitments identified and reported in the Issue Tracking Tables prepared for each VEC were reviewed and commitments included in the Table. The Table includes all commitments contained within the Table of Commitments attached as Schedule B to the BC Environmental Assessment Certificate. All proposed changes to previous commitments, resulting from the new mine development plan as well as a summary of timing and responsibility for each commitment are indicated in the Table. New commitments relevant to changes made to project components and activities are included as appropriate.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
1	Schedule A to EA Certificate Public Comment Period Summary Report – Issue Tracking Table – Archaeology – ID#2	Taseko will commit to implementing and completing the mitigation program outlined in this comment subject to the following: 1. Implementation and completion of such a program will be phased at Taseko's discretion, dependent upon mine development plan. 2. No work will be done unless/until Taseko receives the appropriate authorizations and permits and proceeds to develop the project. 3. The excavation work identified in item (1) of the mitigation program will be completed at each of the 16 sites requiring further investigation before that site is disturbed, 4. No work will be done by Taseko if	The proposed New Prosperity Project footprint (MDA) avoids 86% of the identified protected archaeological sites and therefore they will not be lost or disturbed. Of the twelve sites that still remain within the MDA, five are located in the area of the pit and can't be avoided and the remainder lie within the buffer zone and will not be directly impacted or disturbed.	The previous Project would have resulted in the loss or severe disturbance of all 79 protected archaeological sites identified during the AIA. To adequately compensate for the loss of these sites to mine development the provincial Archaeological Branch specified a detailed mitigation program to be implemented at 16 of the protected sites. With the New Prosperity mine site layout, disturbance or destruction of all sixteen sites requiring further investigation is being avoided. In keeping with item (4) no work will be done at those sites. As Fish Lake is no longer being drained a lake survey will not be	Taseko will complete the required AIA of the new site access road area prior to construction and in accordance with Archaeology Branch direction.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		the site is not going to be disturbed by Taseko. 5. With respect to item (2) lake survey, Taseko will undertake a judgmental inspection of the lake bottom in areas where it is reasonable and safe to do so looking for readily visible artifacts and features; 6. With respect to the cairn-like feature at site EiRv-7, Taseko will need further clarification as to just what further assessment is required before agreeing to undertake this work. 7. Taseko will complete the required assessment of the new site access road as per the above conditions		done. Taseko will complete the required assessment of the new site access road as outlined in the commitment. Details of any required mitigation program will be specified by the Archaeology Branch at permitting.	

Table 2.9-1 New Prosperity Table of Commitments

Item #	Reference	2009/2010 Commitment	Changes	Rationale	Timing/Responsibility
		8. Taseko will undertake work necessary to first confirm the nature of the suspected burial feature and, if it is a burial feature, then exhume and relocate the feature associated with site EiRv-3. 9. Taseko will work with both the Branch and the appropriate First Nation in an effort to determine respectful handling procedures and an appropriate manner of disposition.			
2	Schedule A Public Comment Period Summary Report – Issue Tracking Table – Air Quality – ID#5	EIS Volume 3, Section 9.4.9 (Pg 9-98) and Volume 4 Section 2.4.3 (Pg 2-61) indicate that, "...follow-up actions for Criteria Air Contaminants (CACs) include: • develop and maintain an annual inventory of GHGs for both internal management and potential external reporting needs..."	No change.	Taseko recognizes the importance of maintaining an annual inventory for CACs and GHGs to ensure that project emissions remain below those used in the modeling and, thereby assure that the predicted ambient concentrations and	Details of the AQEMMP will be developed by Taseko and the appropriate provincial ministry at permitting.

Table 2.9-1 New Prosperity Table of Commitments

Item #	Reference	2009/2010 Commitment	Changes	Rationale	Timing/Responsibility
				overall conclusions of the EIS remain valid. As detailed at Item #8 below, Taseko will work with MOE to develop an Air Quality and Emissions Monitoring and Management Plan (AQEMMP) as outlined in the MOE submission (dated May 25, 2009 from Graham Veale to EAO).	
3	Schedule A Public Comment Period Summary Report -Issue Tracking Table -Hydrology/Hydrogeology -ID#3	Secondary seepage control measures (e.g. groundwater interception wells) will be implemented as needed to mitigate the migration of contaminated groundwater into Big Onion Lake. The goal of these secondary mitigation measures (if necessary) will be to prevent migration of contaminated groundwater into Big Onion Lake and/or the Taseko River. Further hydrogeological and hydrologic data collection	Changes to the potential location of secondary seepage control measures may be required in response to the new TSF location.	Taseko remains committed to implementing technically and economically achievable mitigation measures to prevent migration of contaminated groundwater into surrounding lakes and rivers. Further hydrogeological and hydrologic data collection will be conducted to permit design and location	Taseko will implement appropriate mitigation measures as and when required. Details to be specified at permitting.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		will be conducted in the permitting phase to permit design and location of secondary seepage control measures (e.g. groundwater interception wells) should monitoring indicate that they be needed. (See also Item #7 below)		of secondary seepage control measures (e.g. groundwater interception wells) should monitoring indicate that they be needed.	
4	Schedule A Public Comment Period Summary Report -Issue Tracking Table -Human Health & Ecological Risk Assessment -ID#4	EIS Volume 6, Table 6-9 indicates that post-closure concentrations of arsenic and antimony are predicted to exceed the Guidelines for Canadian Drinking Water Quality at mixing points B and C which are located downstream of the Pit Lake discharge in Lower Fish Creek. Taseko has committed to conduct monitoring during operations and post-closure to confirm predictions and where predictions are not correct, corrective action will be taken. This could include treatment if necessary.	Post-closure water quality predictions have changed with the New Prosperity mine development plan	Taseko remains committed to conduct monitoring during operations and post-closure to confirm predictions and where predictions are not correct, corrective action will be taken.	Details of monitoring to be determined at permitting.
5	Schedule A Public Comment Period Summary	The EIS includes a commitment by Taseko to develop an Operations,	Size and location of the TSF has changed with the	Taseko remains committed to the development of an	Details and content of the plan to be determined at

Table 2.9-1 New Prosperity Table of Commitments

Item #	Reference	2009/2010 Commitment	Changes	Rationale	Timing/Responsibility
	Report -Issue Tracking Table -Engineering -ID#13	Maintenance and Surveillance plan for TSF. This will follow from detailed engineering of the TSF and will be a condition of provincial permitting. The details of post-closure monitoring will also be stipulated by provincial ministries as part of the permitting process.	New Prosperity mine development plan.	Operations, Maintenance and Surveillance Plan for the TSF.	permitting
6	Schedule A Public Comment Period Summary Report -Issue Tracking Table -Aboriginal Interest and Cultural Heritage -ID#41	As identified in the Transportation and Access Management Plan overview in the EIS, Taseko has committed to implementing a policy for workers while on shift. Employees staying onsite during their rotation will restrict their off hour activities to the mine site, access roads and pre-defined recreational areas that will be determined before construction begins. The Transportation and Access Management Plan overview identifies there may be issues around the potential for increased access resulting in disturbance of cultural sites, wildlife and wildlife habitat. Taseko has committed to	No change.	Taseko remains committed to the development of these policies and plans.	Details and content of the policies and plans to be determined at permitting.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		working with Ministry of Forests and Range, First Nations and Ministry of Environment through the permitting and consultation processes to develop a public access plan to protect wildlife and heritage values. In addition, Taseko will work with the First Nations, landowners and the grazing tenure holders to develop procedures that can be implemented during construction and maintenance of the transmission corridor that help restrict access.			
7	Schedule A Taseko Follow-Up from June 25th 2009 WQ Hydrology and Hydrogeology Meeting – Williams Lake	Collection of baseline data for the Onion Lake Basin and mitigation options. 1. The hydrology related data collection programs contemplated to date in the west ridge are summarized as follows: 2. Pumping test in the west ridge 3. Surface water and groundwater hydrologic data in	Size and location of the TSF has changed with the New Prosperity mine development plan.	The concerns raised during the previous EA review concerning the potential for tailings seepage through the west embankment and ridge likely remain with the revised design. Taseko remains committed to the development and implementation of an appropriate data collection program.	Details, content and timing of the data collection program to be determined at permitting

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		the Big Onion Lake catchment 4. Baseline chemical characterization of groundwater and surface water in Big Onion Lake system			
8	Schedule A Information Request 2.2 – Temporary Closure Scenario	In the event of a short-term closure of less than one year, the following actions will betaken to maintain the site: 1. Site environmental monitoring and management programs continue as per regular operations without interruption. 2. A "care and maintenance" team is retained from the site operations and maintenance personnel which will maintain the site security program, maintain the equipment in an operationally ready state as well as monitor and maintain all site environmental	No change.	The need to detail a short-term closure plan was raised during the EA review of the proposed Prosperity Project. Taseko remains committed to the implementation of this plan for New Prosperity.	Taseko will implement this plan as and when required.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		systems. 3. Pumping of tailings seepage water and runoff collected from dumps and stockpiles will continue as per regular operations. 4. Mining equipment will be relocated to a marshaling site for storage. 5. Reagent inventories retained in their original packaging will be assessed to determine which, if any, will be adversely impacted by the expected storage term. Any reagents which will degrade during the shutdown period will be returned to the vendor, sold or disposed of in an approved facility. Any reagents which will remain active for the resumption of operations will be stored in a secure			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		manner. 6. Any reagent inventory which has entered the concentrator process and is stored bulk in tankage after cessation of operations will be removed and disposed of in an approved manner. 7. Solvent, oil and fuel inventories at the site will be assessed to determine quantities to be retained and consumed during the site care and maintenance activities. The balance will be returned to the vendor or sold. 8. Any waste oil and/or grease inventory will be disposed of in an approved facility. 9. Inventory of blasting supplies			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	Reference	2009/2010 Commitment	Changes	Rationale	Timing/Responsibility
		will be assessed and any supplies which will expire during the shutdown period will be returned to the vendor or disposed of in an approved manner. All retained inventory will continue to be held in a secure facility. 10. Nuclear sources will be removed from the concentrator density gauges and stored in a secure facility on site as per Canadian Nuclear Safety Commission regulations. 11. Any low grade stockpiled ore will remain in stockpile and available as mill feed. Drainage from the stockpile will be controlled and treated. 12. All of the high grade ore from the			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	Reference	2009/2010 Commitment	Changes	Rationale	Timing/Responsibility
		coarse ore stockpile will be processed through the mill prior to cessation of operations. 13. Mill facilities and equipment (including concentrate sheds as well as concentrate and ore handling systems) will be washed down after operations cease. All concentrate will be shipped to market and any excess mineral from the cleanup will be impounded in the tailing facility. 14. The tailings facility will continue to be maintained with required freeboard limits. If a tailings lift is underway at the time of closure and is required to maintain freeboard levels through the closure period then			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		construction of the tailings lift will be completed. 15. Dust from the tailings facility will be mitigated during dry periods by either wetting the tailings beach with supernatant water from the TSF or implementing alternative methods effective for dust control. 16. In the event that the short-term closure extends beyond one year with no imminent foreseeable change, the following items in addition to those listed above will be scheduled for action as appropriate for the length of closure anticipated: 17. Remaining reagents at site will be returned to suppliers, sold or			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	Reference	2009/2010 Commitment	Changes	Rationale	Timing/Responsibility
		disposed of in an approved facility. 18. Remaining blasting supplies at site will be returned to the vendor or disposed of in an approved manner. 19. Fuel and lubricating oil storage at site will be minimized with sufficient supplies maintained at site to support only the going care and maintenance activities. 20. Mobile and stationary equipment will be appropriately prepared and placed into long term storage. 21. Freeboard at the TSF will be actively monitored and maintained at safe levels. This will be done via either tailings dam construction or via storage of excess tailings supernatant			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		in the open pit or a combination thereof. 22. Exposed PAG waste in the TSF will be assessed and an action plan developed appropriate for the length of closure anticipated. 23. Existing mitigation measures for dust control may be enhanced by seeding accessible areas of tailings beach.			
9	Schedule A Information Request 4.1- Long Term Treatment of Pit Lake Water Quality	Although water treatment is a potential contingency in the far future of the project, and is not a predicted requirement, Taseko has indicated that water treatment will be implemented if necessary to ensure mine discharge meets appropriate water quality criteria.	Post-closure water quality predictions have changed with the New Prosperity mine development plan	Taseko remains committed to conduct monitoring during operations and post-closure to confirm predictions and where predictions are not correct, corrective action including water treatment will be taken as required.	Details of monitoring to be determined at permitting.
10	Schedule A Information Request 6.2 –	**Mitigation Strategies General**	No change	There are no changes to the location and	Taseko will implement these strategies as appropriate during

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
	Transmission Line Corridor Mitigation Strategies	1. Terrain hazards best avoided when possible by routing or by spanning the hazard with appropriate pole placement 2. Avoid non-pine forests of any age wherever possible 3. Prevent cattle disturbance in wetland or riparian areas that may become more accessible with the new ROW (e.g. erecting fences) 4. Wildlife habitat features (e.g., mineral licks, dens, nest trees) that are identified will be evaluated for potential mitigation measures (e.g. avoidance) *5.* Prior to ROW clearing, nest searches are to be conducted for bald eagle and osprey and other species as per the *Wildlife*		construction of the proposed transmission line. Taseko remains committed to the implementation of the transmission line corridor mitigation strategies.	construction.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		Act 6. Any identified wildlife habitat features (e.g., badger dens [active or non-active], mineral licks, seeps, etc.) will be avoided wherever possible 7. Retain actual or potential wildlife trees (i.e., dead or dying trees and snags, and living or dead deciduous trees) wherever possible 8. Prior to and during ROW clearing, any potential nest trees that are identified will be evaluated for potential mitigation measures (e.g., avoidance) 9. If clearing cannot be avoided during the breeding window, nest searches are required in the ROW 10. Any active nests			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	Reference	2009/2010 Commitment	Changes	Rationale	Timing/Responsibility
		found should be buffered (i.e., flagged off), and clearing avoided for the remainder of the breeding window 11. Post wildlife tree signs on any wildlife trees/snags they have purposely been retained along the ROW **Wetlands** 1. Time construction activities in or adjacent to wetlands to coincide with seasonally dry or frozen ground conditions 2. Protect vegetation within 30 m of wetlands, clearing only where required to ensure sufficient clearance for transmission lines 3. Clearly flag the boundaries of any wetlands and wetland 30-m			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		buffers that are in proximity to construction activities 4. Use low-load tracked machinery when working in and around wetlands 5. Minimize excavation area for pole placement foundation 6. Minimize footprint of side-cast material 7. Deliver poles to wetlands area by the least intrusive means available 8. Refer to *Interim Guidelines for Wetland Protection and Conservation in British Columbia* (Chapter 9 – Road and Utility Corridors, Section 9.4.2 ‘Construction’) for further guidance **Riparian** 1. Time construction activities in or			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		adjacent to riparian areas to coincide with seasonally dry or frozen ground conditions 2. Protect vegetation within 30 m of watercourses, clearing only where required to ensure sufficient clearance for transmission lines 3. Clearly flag the boundaries of any riparian 30-m buffers that are in proximity to construction activities 4. Conform to specifications set out in the BCMOFR cutting permit when working in and around forested riparian areas 5. Refer to *Forest Practices Code Riparian Areas Management Guidebook* for further guidance **Fisher Natal Denning**			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		1. Avoid clearing during the denning period (March to May) **Lewis's Woodpecker Nesting** 2. Avoid clearing during the breeding window (mid-April to early August) **Flammulated Owl Nesting** 3. Avoid clearing during the breeding window (late April to mid-August) **Sheep Escape Terrain** 1. During helicopter use, adhere to specific setbacks (i.e., no fly zones) for sensitive areas such as winter escape terrain and lambing areas 2. Avoid pole placement during sensitive periods, such as lambing (late April to mid-June) **Grasslands** 1. Tree removal will be specifically			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		avoided as trees are of limited availability in these habitats and may be important as perches for birds such as raptors 2. Protect vegetation, clearing only where required to ensure sufficient clearance for transmission lines 3. Avoid or minimize construction activities on > 15% south-facing slopes 4. Minimize excavation area for pole placement foundation 5. Minimize footprint of side-cast material 6. Minimize vehicle traffic in the grasslands—maximize use of existing tracks/roads; clearly identify routes to be taken by all construction traffic to and from the work site			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		7. Refer to *Best Management Practices for Recreational Activities on Grasslands in the Thompson and Okanagan Basins* (Section 3.2 ‘Motorized Recreation’) for further guidance on vehicle use. **Rare Plants and Ecosystems** 1. Conduct a pre-construction survey of RoW for occurrence of rare plants 2. Mitigation measures to be developed as required, in consultation with BCMOE 3. Conduct a pre-construction survey of RoW for occurrence of rare ecosystems 4. Mitigation measures to be developed as			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		required, in consultation with BCMOE 5. Nuttall's Alkaligrass–Foxtail Barley wetland – buffer by 50 m where this type of wetland occurs in proximity to construction activities **Old Forest** 1. Conform to specifications set out in the BCMOFR cutting permit **Flooding** 1. Line should span floodway, towers in the floodway fringe areas **Gully/Surface Erosion** 1. If upslope from agricultural land, must have sediment catchment in place 2. In non-agricultural land, trim vegetation rather than clear to reduce surface erosion 3. Line should span			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		gullies with support towers set back from edge of gully **Slump/Slide/Surface Erosion and Rock Slide** 1. Avoid slope loading on initiation zone of slope 2. Vegetation cover and root mass to be maintained above and below slump and slide areas			
11	Schedule A Fish and Fish Habitat Compensation Plan Performance Measures	The Ministry of Environment developed a benchmark statement identifying ministry policy respecting the fish and fish habitat for Fish and Little Fish Lake. The benchmark statement identifies four objectives the fish and fish habitat compensation plan should meet in regards to Fish Lake and Little Fish Lake, and associated stream habitat: 1. Maintenance of the genetic line exhibited in the trout population of	The Fish Habitat Compensation Plan has changed to reflect a reduction in the harmful alteration, disruption and destruction of fish habitat associated with New Prosperity.	Although plan elements and details may change in response to the new mine plan, Taseko remains committed to working with the Ministry and the Department of Fisheries and Oceans to develop and implement an appropriate and successful habitat compensation plan.	It remains Taseko' s responsibility to develop and implement acceptable and successful habitat compensation plans.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		the Fish Lake System. 2. To develop lake and stream environments of equivalent productive capacity for trout as provided by the Fish Lake system now. 3. A healthy, self-sustaining trout population. 4. A trout fishery for First Nations and the public of at least similar character to what is supported by Fish Lake under current conditions Taseko in consultation with the Ministry will develop performance measures and clearly define Taseko Mines Ltd. obligations and responsibilities associated with implementation of plan elements.			
12	Schedule B - Governance 1.0 Policies	1.1 Develop and implement corporate policies	No change	With New Prosperity Taseko remains committed to the	If not already developed and in place Taseko will develop

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		(Policies) that will be made available on the Taseko website for reference during all phases of the Project. Current policies in place or under development comprise the Prosperity Sustainability framework and include: a) Environment Policy (in place); b) Health and Safety Policy (in place); c) Code of Ethics and Trading Restrictions (in place); d) First Nations Long-term strategy for consultation and engagement (in place); e) Emergency Preparedness		development and implementation of the policies.	and implement all remaining corporate policies prior to commencement of operations.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		(under development); and, f) Responsible Resource Development (on-going development) Taseko's goal is to develop the mineral resource while making certain that the construction, operations and closure of Prosperity are handled in a sustainable manner, including the primary responsibility of contributing towards the maintenance of healthy lands, communities, resources and ecosystems for present and future generations. Moreover, Taseko			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		is committed to ensuring the entire Project makes a net positive contribution to sustainability of lands, communities, resources and ecosystems over the long term.			
13		1.2 Implement Prosperity's Sustainability Framework through the life of the Project.	No change	With New Prosperity Taseko remains committed to the implementation of the Sustainability Framework through the life of the Project.	Taseko will implement the policy through the life of the Project.
14		1.3 Ensure that responsible site management, employees and contractors are familiar with these Policies, and their actions at all times comply with them and relevant acts, regulations, permits, licenses, authorizations and approvals.	No change	With New Prosperity Taseko remains committed to the implementation of these actions throughout the life of the Project.	Taseko will implement these actions through the life of the Project.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
15	Schedule B - Governance 2.0 Consultation/First Nations	2..1 Maintain early, open, and full communication with First Nations on Taseko projects and programs in their asserted traditional territories.	No change	With New Prosperity Taseko remains committed to making best efforts to maintain early, open and full communication with First Nations.	Taseko – ongoing.
16		2.2 Recognize and take into consideration the value and significance First Nations place on traditional, cultural and heritage knowledge and interest.	No change	With New Prosperity Taseko will continue to recognize and take into consideration the value and significance First Nations place on traditional, cultural and heritage knowledge and interest.	Taseko – ongoing.
17		2.3 Promote the development of mutually beneficial partnerships with our First Nation neighbours.	No change	With New Prosperity Taseko will continue to promote the development of mutually beneficial partnerships with our First Nation neighbours.	Taseko - ongoing
18		2.4 Work with First Nation Governments to	No change	With New Prosperity Taseko will continue to encourage the	Taseko - ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		encourage the formation and development of locally owned businesses.		formation and development of locally owned businesses.	
19		2.5 Provide opportunities for employment.	No change	With New Prosperity Taseko will continue to provide opportunities for employment.	Taseko - ongoing
20		2.6 Provide opportunities for training and career advancement for employees.	No change	With New Prosperity Taseko will continue to provide opportunities for training and career advancement for employees.	Taseko - ongoing
21		2.7 Continual improvement in the protection of human health and responsible stewardship of the natural environment.	No change	With New Prosperity Taseko will continue efforts to improve the protection of human health and responsible stewardship of the natural environment.	Taseko - ongoing
22		2.8 Prior to or during the construction of the transmission line, should information become available from First Nations identifying habitat, vegetation, or features of	No change	With New Prosperity there are no changes to the location and construction of the proposed transmission line. Taseko remains	Taseko – prior to construction of the Transmission Line

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		importance not previously considered in the constraints analysis undertaken to select the centre-line, Taseko will make reasonable efforts to avoid or mitigate impacts to these features.		committed to the implementation of this commitment.	
23	Schedule B - Governance 3.0 Consultation/Communities	3.1 Maintain early, open, and full communication with local communities.	No change	With New Prosperity Taseko will continue efforts to maintain early, open and full communications with local communities.	Taseko – ongoing.
24		3.2 Promote the development of mutually beneficial partnerships with local communities.	No change	With New Prosperity Taseko will continue efforts to promote the development of mutually beneficial partnerships with local communities.	Taseko – ongoing
25		3.3 Work with local communities to encourage the formation and development of locally owned businesses.	No change	With New Prosperity Taseko will continue efforts to work with local communities to encourage the formation and development of locally owned businesses.	Taseko – ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
26		3.4 Provide opportunities for employment.	No change	With New Prosperity Taseko will continue to provide opportunities for employment.	Taseko – ongoing
27		3.5 Provide opportunities for training and career advancement for employees.	No change	With New Prosperity Taseko will continue to provide opportunities for training and career advancement for employees for employment.	Taseko – ongoing
28		1.6 Continual improvement in the protection of human health and responsible stewardship of the natural environment	No change	With New Prosperity Taseko will continue efforts to improve in the protection of human health and responsible stewardship of the natural environment	Taseko – ongoing
29	Schedule B - Governance 4.0 Sustainability Management Plan	4.1 Develop and implement an Environmental Management System (EMS) the Project to encompass continual improvement in sustainability and the protection of human health and stewardship of the	EMS Plan elements will change to reflect the new mine plan.	With New Prosperity Taseko will develop and implement an Environmental Management System (EMS) for the Project to encompass continual improvement in sustainability and the protection of	Taseko will develop an EMS at permitting and implement the EMS throughout the life of the Project.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		natural environment.		human health and stewardship of the natural environment.	
30		4.2 Establish measureable sustainability goals and targets through the EMS which would include commitments agreed to with First Nations, local communities and regulatory agency representatives.	No change	With New Prosperity Taseko will establish measureable sustainability goals and targets through the EMS..	Taseko - ongoing
31	Schedule B - Governance 5.0 Contractors/External Forces	5.1 Require that Prosperity's contractors or consultants comply with Taseko Policies related to sustainability, environment, health and safety, training, local employment, and procurement.	No change	With New Prosperity Taseko will continue to require that all contractors or consultants comply with Taseko Policies.	Taseko - ongoing
32	Schedule B – Environmental Stewardship 6.0 Environmental Management System	6.1 Establish an EMS which will include Environmental Management Plans (EMPs) as an integral part of the Project and provide guidance on all	The EMS and associated EMPs will change to reflect the new mine plan.	With New Prosperity Taseko will develop and implement an Environmental Management System (EMS) for the Project.	Taseko will develop an EMS at permitting and implement the EMS throughout the life of the Project.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		environmental aspects during all phases of the Project. These EMPs convert the environmental assessment mitigation measures and best management practices (BMPs) as identified throughout the Application, as well as future permit or panel commitments, into actions that are intended to minimize or eliminate negative environmental effects associated with the Project. The EMPs presented in Volume 3 of the Application will be further developed and finalized prior to construction, where relevant, and prior to operations in all cases. Standard Operating Procedures (SOPs)			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		will be used to implement the EMPs.			
33		6.2 Maintain a proactive working relationship with appropriate Regulatory authorities in the development of EMPs.	No change	For New Prosperity Taseko will continue to maintain a proactive working relationship with appropriate Regulatory authorities in the development of EMPs.	Taseko - ongoing
34		6.3 Qualified Environmental and Engineering staff must be on site during all phases of mine development (i.e. construction, operation, closure and post-closure) and: a) Will ensure that all Prosperity employees, contractors and their employees are fully aware of environmental requirements. b) Will monitor	No change	For New Prosperity Qualified Environmental and Engineering staff will be on site during all phases of mine development.	Taseko - ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		compliance with EMPs and specific operating procedures. c) Will report any incidents of non-compliance in accordance with the compliance reporting required by the EA Certificate and as required by regulation.			
35	Schedule B – Environmental Stewardship 7.0 ARD/ML	7.1 Implement the Mine Materials Handling Plan described in the Application, Volume 3, Section number 9.2.3.	Mine Materials Handling Plan has changed to reflect the new mine plan.	Taseko will implement the Mine Materials Handling Plan detailed in Section 28.1	Taseko will implement plan throughout operations.
36		7.2 Ensure that potentially acid generating waste rock (PAG), overburden, tertiary basalt and tailings with criteria described in Table 9.3 of the Application is segregated and deposited in	The location of the disposal facility will change with the new mine plan.	For New Prosperity, segregation and deposition of PAG material procedures will not change.	Taseko – ongoing during operations.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		subaqueous disposal in the PAG waste rock disposal facility (tailings impoundment).			
37		7.3 Submerge PAG waste rock before onset of ARD/ML.	No change	For New Prosperity, segregation and deposition of PAG material procedures will not change	Taseko – ongoing during operations
38	Schedule B – Environmental Stewardship 8.0 Water Management	8.1 Finalize and implement the construction water management plan as described in Volume 3, Section number 9.2.1 of the Application to ensure, at a minimum, that procedures and policies are followed with respect to site access, geotechnical stability, soils salvage, erosion control, vegetation, wildlife, cultural and heritage resources, and emergency response. a) Develop and	The construction water management plan and ESCP have changed to reflect the new mine plan.	The water management and ESCP plans developed for New Prosperity as detailed in Section 2.8.1 of this EIS will be finalized and implemented in accordance with this commitment.	Taseko – at permitting and ongoing thereafter.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		implement an erosion and sediment control plan (ESCP) consistent with industry BMPs to mitigate environmental effects attributed to sediment as detailed in Volume 3, 9.2.11 of the Application. i) Designate at least one Qualified Environmental staff person on-site during active construction to ensure the ESCP is properly implemented. The qualified staff person will report to the senior engineer			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		on-site. b) Ensure all necessary sediment and erosion control mitigation measures will be in place and operational prior to construction.			
39		8.2 Operate a closed system that contains all mine waters on the Project site until approximately 27 years after the cessation of pit operations when the pit is flooded. Direct any surface drainage, sewage treatment plant, sediment or metal-laden water to the tailings storage facility (TSF) during operations.	No change?	New Prosperity will operate and maintain a closed system throughout the life of mine.	Taseko - ongoing
40		8.3 Implement the Tailings Impoundment Operation EMP elements as described in Volume 3, Section	Tailings Impoundment Operation EMP elements will change to reflect the new mine plan.	The New Prosperity Tailings Impoundment Operation EMP as detailed in Section 2.8.1 of this EIS incorporates these	Taseko –at permitting and ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	Reference	2009/2010 Commitment	Changes	Rationale	Timing/Responsibility
		9.2.4 of the Application. This plan will include but is not limited to: a) Ensuring seepage reduction provisions are in place to minimize seepage losses from the TSF; b) Installing surveillance instrumentation in the tailings embankment and foundation during construction and over the life of the Project and monitoring on a consistent basis; c) In the event of premature mine closure, the PAG waste would be excavated to a level below the natural flood elevation of the TSF or otherwise submerged; and, d) In the event of a temporary closure, the actions outlined in the July 31, 2009		mitigation measures.	

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		Temporary Closure Reclamation and Decommissioning Plan (IR 2.2) would be implemented.			
41		8.4 Develop and implement the Tailings Dam Operation, Maintenance and Surveillance (OMS) Plan and ensure an annual Dam Safety Review is conducted as required by the Mines Act HSRC, and Dam Safety Reviews are conducted as set out by the Canadian Dam Association (CDA) Guidelines.	Details of the OMS have changed to reflect the new mine plan.	The New Prosperity OMS Plan and Dam Safety Reviews as detailed in Section 2.8.1 of this EIS will be implemented. They will be in full compliance with Mines Act requirements and CDA Guidelines.	Taseko – at permitting and ongoing
42		8.5 Continue to identify areas of high risk for erosion and sedimentation throughout the life of the Project (planning and design, construction, operation, decommissioning and reclamation)	General mitigation measures will not change but component-specific changes may be appropriate to reflect the new mine plan.	Taseko will implement mitigation measures to identify areas of high risk for erosion and sedimentation for New Prosperity.	Taseko - ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		and implement general mitigation measures detailed in Volume 3, Section 9.2.11.1 of the Application.			
43		8.6 Develop and implement a hydrologic and hydrogeological data collection and monitoring program appropriate to: a) Meet compliance monitoring requirements; and, b) Increase confidence in interpreted hydrogeological conditions assumed for the Project area. In particular with respect to the west embankment, development and implementation of this program will be consistent with the mitigation measures and technical	The new mine plan will likely require adjustments to the mitigation measures and technical considerations associated with data collection.	For New Prosperity, Taseko remains committed to address the need, if any, to collect additional hydrologic and hydrogeological data.	Taseko – at permitting and ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	Reference	2009/2010 Commitment	Changes	Rationale	Timing/Responsibility
		considerations outlined in Taseko's July 9, 2009 memorandum to the BC Ministry of Environment (MOE) on the subject. Taseko commits to collecting the additional information to further assess seepage issues and that this information will be available and incorporated into the detailed designs for seepage control and interception measures. Timing of the provision of this additional information will be determined at the Mines Act permitting stage but will be prior to the detailed design stage.			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
44		8.7 Meet generic and any site-specific Water Quality Guidelines (WQG) in Fish Creek that may be developed during permitting through treatment, if required, as detailed in Volume 5, Section 2 of the Application. The water quality objectives for Taseko River stipulate no change from upstream to downstream of mine operations.	Post-closure water quality predictions have changed with the New Prosperity mine development plan	For New Prosperity, Taseko remains committed to meet generic and any site-specific Water Quality Guidelines (WGQ) if required.	Details will be developed through permitting.
45	Schedule B – Environmental Stewardship 9.0 Fish Compensation	9.1 Develop and implement a Fish and Fish Habitat Compensation Plan that supports provincial fisheries management objectives and the application of federal policy respecting the protection of fish and fish habitat. The Fish and Fish Habitat Compensation Plan	The Fish Habitat Compensation Plan has changed to reflect a reduction in the harmful alteration, disruption and destruction of fish habitat associated with New Prosperity.	Although plan elements and details may change in response to the new mine plan, Taseko remains committed to working with the Ministry and the Department of Fisheries and Oceans to develop and implement an appropriate and successful habitat compensation plan.	It remains Taseko’ s responsibility to develop and implement acceptable and successful habitat compensation plans

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		will be designed and implemented to achieve the following objectives: b) Development and maintenance of lake and stream environments of similar or better productive capacity for trout as provided by the Fish Lake system; c) A healthy, self-sustaining trout population; and, d) A trout fishery for First Nations and the public of at least similar character to what is supported by Fish Lake under current conditions. The performance measures outlined in Taseko's December 4, 2009 memorandum will be used to assess			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		whether the Fish and Fish Habitat Compensation Plan meets each of the objectives. These measures will need to be effective for the period of time defined in the December 4th memorandum.			
46		9.2 Develop and implement a monitoring program to verify the proper implementation of all performance measures and a follow-up program to determine the accuracy of conclusions and the efficacy of the required measures as described in Volume 3, Section 8.4 of the Application. This program is to be developed and implemented in consultation with	Details of the Fish Habitat Compensation Plan have changed.	For New Prosperity Taseko remains committed to the development, implementation and monitoring of a fish habitat compensation plan.	It remains Taseko' s responsibility to develop and implement acceptable and successful habitat compensation plans

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		MOE and DFO.			
47		9.3 Use an adaptive management process to incorporate contingency planning, management objectives, ongoing monitoring, and commitment for achieving benchmark goals within specified timelines with regard to fish and fish habitat compensation plans.	Details of the Fish Habitat Compensation Plan have changed.	For New Prosperity Taseko remains committed to the development, implementation and monitoring of a fish habitat compensation plan.	It remains Taseko' s responsibility to develop and implement acceptable and successful habitat compensation plans
48	Schedule B – Environmental Stewardship 10.0 Wildlife	10.1 Implement the mitigation measures for wildlife for all aspects of the Project as described in Volume 5, Section 6.4.1 and Table 6-67 (Mine), 6-68 (Transmission Line), and 6-69 (Access road) of the Application.	No change	For New Prosperity Taseko remains committed to the implementation of the mitigation measures.	Taseko - ongoing
49		10.2 Implement additional wildlife	No change.	For New Prosperity	Taseko - ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		protection measures to apply to Project personnel travelling to and from the Project on workdays. These provisions will include but are not limited to: a) Firearms are prohibited at all times except when specifically authorized (e.g., wildlife monitor); b) No littering; c) No feeding or harassment of wildlife; d) No hunting and fishing on the Project site; and, e) Project-related traffic is restricted to designated access roads and trails (including all-terrain vehicles and snowmobiles).		Taseko remains committed to the implementation of these additional wildlife protection measures.	
50		10.3 Commit to the strict and	No change.	For New Prosperity Taseko remains	Taseko – ongoing.

Table 2.9-1 New Prosperity Table of Commitments

Item #	Reference	2009/2010 Commitment	Changes	Rationale	Timing/Responsibility
		rigorous implementation of mitigation measures, in concert with MOE and with other agencies as appropriate, to eliminate or severely minimize the risk of direct mortality to grizzly bear (from all sources, see also Sections 6.1.2.1 and 6.3.4.8 of the Application).Taseko will work with the BC Ministry of Transportation and Infrastructure (MOT) to control mine related traffic speed along the section of Taseko Lake Road that is within known grizzly bear range.		committed to the implementation of these and additional mitigation measures to protect grizzly bear as detailed in Section 2.7.2.8 of this EIS.	
51		10.4 Record all Project-related wildlife-vehicle collisions or near misses as described in Volume 5 in Section	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko – ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		6.4.3.1 of the Application. Wildlife vehicle collisions will be reviewed regularly by Qualified Environmental staff person who will take appropriate action. If a problem area is identified appropriate actions will be taken (e.g., warning signs, sitespecific speed limits). In addition, Taseko Mines Ltd. will report any wildlife mortalities resulting from Project vehicles to the MOE regional office and MOT.			
52		10.5 Implement the Vegetation and Wildlife Management Plan (Volume 3, Section 9 of the Application) and mitigation measures (Volume 5, Section 6.4.1 of the Application) and Materials Handling and Waste	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko – ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		Management Plan for dealing with potential human-bear conflicts.			
53		10.6 Implementation of wildlife protection provisions as detailed in the Transportation and Access Management Plan Volume 3, Section 9.2.2 of the Application.	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Details and content of the policies and plans to be determined at permitting.
54		10.7 Design and construct a transmission line consistent with BCTC's standard practices to mitigate potential transmission line electrocution/collision impacts to migratory birds.	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko to incorporate in design and implement during construction
55	Schedule B – Environmental Stewardship 11.0 Habitat Compensation	11.1 Develop and implement a plan for achieving compensation for adverse impacts to wetland habitat, the productive capacity of the lake, recreation values,	A plan for achieving compensation for adverse impacts will change to reflect the new mine plan	For New Prosperity Taseko remains committed to these principles and will apply them in the development and implementation of a plan for achieving	Taseko in consultation with MOE, CWS and First Nations. Timing of implementation to be determined as detailed in the Reference Document referred to in item #56 below.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		wildlife, wildlife habitat and the critical habitat of species at risk. Development and implementation of the plan will be guided by the following principles: a) A suite of mitigation measures designed to eliminate or minimize Project effects have been outlined in the Application. The effectiveness of these mitigation measures will be taken into account when assessing the need and justification for specific compensation measures. b) Compensation measures will be considered and		compensation for adverse impacts.	

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		implemented on a case-by-case basis based on the appropriateness of each proposed compensation measure in each case. c) There will be no need for compensation if there is a technically defensible confirmation that there is no adverse impact. The process by which a determination of impact is reached will be transparent, readily understood, and undertaken in consultation with MOE, CWS, and First Nations.			
56		11.2 Taseko will work with MOE officials in a timely	No change	Taseko has prepared a Draft Reference	Taseko in consultation with MOE, CWS and First Nations.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		manner to develop a "Reference Document" in which roles and responsibilities, timing and strategies for implementation of the plan outlined in 11.1 will be detailed.		Document and will work with MOE officials to finalize it in a timely manner.	
57	Schedule B – Environmental Stewardship 12.0 Vegetation, Wetland and Riparian Habitats	12.1 Implement BMP and methods for constructing and upgrading the access road(s) and transmission line, and related stream crossings (Volume 3, Section 9.2.1 in the Application).	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko – ongoing
58		12.2 Implement mitigation measures to minimize mine related environmental effects on wetland ecosystems. These mitigation measures will be primarily directed at protecting and conserving wetlands in close proximity to the	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko – ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		mine footprint to minimize potential for incremental disturbance. The principles of these mitigation measures will be to: Avoid vegetation loss, minimize disturbance, mitigate against invasive species, and maintain natural drainage patterns (Volume 5, Section 5.3.2 of the Application).			
59		12.3 Implement all appropriate mitigation measures for wetland ecosystems on the transmission line including but not limited to: a) Timing construction to avoid activity until ground is frozen; b) Transmission pole delivery to wetland areas completed by	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko – ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		helicopter drop; and, c) Minimize the area of excavation for pole foundations and area of footprint of the side cast material.			
60		12.4 Monitor construction of the access road and transmission line to ensure that wetland ecosystems are avoided wherever possible and environmental effects to wetland ecosystems are minimized through application of prescribed mitigation measures. Taseko must follow DFO Pacific Region's Maintenance of Riparian Vegetation in existing Rights of Way Operational Statement and principles and practice in British	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko – ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		Columbia Hydro's Approved Works Practices or Managing Riparian Vegetation when maintaining the transmission line right-of –way.			
61		12.5 Replant only native species in disturbed areas associated with the transmission corridor that fall within the grassland zones.	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko – ongoing
62		12.6 Implement the invasive plant management plan as proposed in Volume 5, Appendix 5-5-K: and as discussed in Volume 3 section 9.2.12 of the Application. This will include a weed management strategy for maintenance of the transmission line developed in consultation with regulatory agencies, land	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko – ongoing

Table 2.9-1 New Prosperity Table of Commitments

Item #	Reference	2009/2010 Commitment	Changes	Rationale	Timing/Responsibility
		owners, and First Nations.			
63		12.7 Execute mitigation measures for the reduction or elimination of construction related sediment releases into fish-bearing and non-fish-bearing habitats as detailed in EMP (Volume 3, Section 9 of the Application). These measures will follow the Standards and Best Practices for In-stream Works (MWLAP 2004) and DFO Operational Statements.	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko – ongoing
64	Schedule B – Environmental Stewardship 13.0 Reclamation and Closure	13.1 Implement Reclamation, Temporary Closure and Decommissioning Plans as described in Volume 3, Section 9.3 of the Application and Taseko's July 31, 2009 memo Temporary Closure Reclamation and	Reclamation, closure plans and decommissioning plans have changed to reflect the new mine plan.	For New Prosperity Taseko will implement reclamation, temporary closure and decommissioning plans as described in Section 2.8.2 of this EIS.	Taseko – as detailed at permitting.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		Decommissioning Plan (IR 2.2).			
65		13.2 Implement the soil salvage plan described in Volume 3, Section 9.3.3.1 of the Application.	Soil salvage plan has changed to reflect the new mine plan.	For New Prosperity Taseko will implement the soil salvage plan as described in Section 2.8.2 of this EIS.	Taseko – as detailed at permitting.
66		13.3 Implement reclamation practices that are consistent with the BC Mines Act and its Health, Safety and Reclamation Code. The conceptual reclamation practices and decommissioning plan described in the Application provides a basis for detailed reclamation planning and bonding discussions that will be held with the BC Ministry of Energy, Mines and Petroleum Resources (MEMPR) at a later date as part of the	Conceptual reclamation practices and plan have changed to reflect the new mine plan.	For New Prosperity Taseko will implement the reclamation and decommissioning plans as described in Section 2.8.2 of this EIS.	Taseko – as detailed at permitting.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		permitting application.			
67		13.4 Further develop reclamation and decommissioning plans, including progressive reclamation, in consultation with regulatory agencies, First Nations and local communities. At the end of mine operations, complete implementation of the approved closure plan.	No change	For New Prosperity Taseko remains committed to the development and implementation of these plans.	Taseko – as detailed at permitting.
68		13.5 Mitigate residual effects of mining with respect to recreation values, wildlife, wildlife habitat, at-risk plant communities and the habitat of species at risk through reclamation approaches as described in the decommissioning plan.	Decommissioning plan has changed to reflect the new mine plan.	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko – as detailed at permitting.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	Reference	2009/2010 Commitment	Changes	Rationale	Timing/Responsibility
69		13.6 Remove the transmission line and reclaim the transmission line corridor when no longer required.	No change	For New Prosperity Taseko remains committed to the implementation of this mitigation measure	Taseko – Post closure as appropriate.
70	Schedule B – Environmental Stewardship 14.0 Protection of Ecological Values	14.1 Employ BMP throughout all Project phases and activities. In particular, prior to construction commencing, undertake all appropriate measures to ensure that sensitive habitat features and wildlife values are identified and all appropriate mitigative measures are implemented to avoid adverse effects.	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko - ongoing
71		14.2 Identification and implementation of additional measures adequate to protect aquatic life as detailed in Volume 1, Table 20-1 of the Application.	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko - ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
72		14.3 Develop policies and procedures, conduct public consultation, and conduct access planning for the transmission line ROW.	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko – as detailed at permitting
73		14.4 Identify and quantify Project effects on wildlife and vegetation at a local level on a scale that would enable the identification of appropriate mitigation/compensation measures.	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko - ongoing
74	Schedule B – Environmental Stewardship 15.0 Mitigation specific to transmission line construction	15.1 Review transmission line final design details and proposed construction scheduling with MOE-ESD (Environmental Stewardship Division) before commencement of construction.	No change	For New Prosperity Taseko remains committed to this consultation	Taseko – at permitting
75		15.2 During construction, work with MOE-ESD and	No change	For New Prosperity Taseko remains	Taseko – at permitting and during construction

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		with other regulatory bodies as appropriate to implement all appropriate mitigation strategies as detailed in Taseko's "Transmission Line Corridor Mitigation Strategies"(IR 6.2). This will include surveying the final transmission line corridor to identify and mitigate impacts to wildlife features, rare plants, and other features of importance.		committed to the implementation of these mitigation measures	
76	Schedule B – Environmental Stewardship 16.0 Monitoring	16.1 Implement the follow-up and monitoring plan described in Volume 3, Section 9 in the Application (which includes a program for environmental effects monitoring and follow-up through construction, operation, closure,	Follow-up and monitoring plan has changed to reflect the new mine plan.	For New Prosperity Taseko remains committed to the implementation of the follow-up and monitoring plan as detailed in Section 2.8.3 of this EIS. Details of compliance monitoring programs will be developed during permitting.	Taseko – ongoing. Compliance monitoring details will be developed at permitting.

Table 2.9-1 New Prosperity Table of Commitments

Item #	Reference	2009/2010 Commitment	Changes	Rationale	Timing/Responsibility
		and post-closure to verify the accuracy of the environmental assessment) and determine the effectiveness of mitigation measures. a) Develop and implement compliance monitoring programs to meet applicable provincial and federal permits, licenses and approvals and meet any reporting requirements of these permits, licenses and approvals.			
77		16.2 Conduct the Follow-up and Monitoring programs summarized in Table 16-1, Volume 1 of the Application in the nine specific	Follow-up and monitoring plan has changed to reflect the new mine plan.	For New Prosperity Taseko remains committed to the implementation of the follow-up and monitoring plan as detailed in Section	Taseko – ongoing.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		disciplines listed through all mining phases.		2.8.3 of this EIS.	
78		16.3 Assess the suitability of reclaimed sites for wildlife use through trace element monitoring in vegetation.	No change	For New Prosperity Taseko remains committed to the implementation of this mitigation measures	Taseko - ongoing
79		16.4 Assess routine monitoring results for the various waste streams during operations to develop specific effluent treatments if needed. Investigate if monitoring results indicate effluent quality of specific waste streams is likely to contribute to exceedances post-closure.	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko – no change
80		16.5 Continue ongoing discussions with MOE-ESD and undertake additional hydrology and hydrogeology baseline sampling.	No change	For New Prosperity Taseko remains committed to discuss the need, if any, for additional baseline sampling	Taseko – at permitting

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
81	Schedule B – Environmental Stewardship 17.0 Air Emissions	17.1 Incorporate into Project design, Best Available Technology that is Economically Achievable (BATEA) measures to reduce Criteria Air Contaminants (CAC) and Greenhouse Gas (GHG) emissions wherever possible.	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko - ongoing
82		17.2 Utilize effective dust suppression methods and CAC and GHG mitigation measures, including but not limited to: a) Install covered conveyor belt ore transport systems and housing of the rail load-out facilities to minimize fugitive particulate emissions; b) Install a water suppression system at the discharge point of the coarse	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko - ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		ore stockpile to reduce dust emissions; c) Install dust control measures at the primary crusher truck dump to control dust emissions; d) Cover trucks used to transport concentrate to prevent loss of this material and to ensure there is no tracking of any residual concentrate on route to the concentrate load-out facility; e) Ensure posted speed limits are followed by all mine equipment and vehicles; f) Ensure application of surface-binding			

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		chemicals or water on site roads and exposed surfaces as required to control dust; g) For vehicles, off-road construction, and mining equipment, best practices will include ensuring equipment is properly tuned and maintained, and vehicle idling times reduced to a minimum; h) Optimize vehicle movements to minimize emission of GHGs; and, i) Minimize disturbances and manage all land clearing to minimize burning.			
83		17.3 Develop and implement an Air Quality and Dust	No change	For New Prosperity Taseko remains committed to the	Taseko – at permitting

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		Control Management Plan as described in Volume 3, Section 9.2.9.		development and implementation of this Plan.	
84		17.4 Taseko will work with MOE to develop an Air Quality and Emissions Monitoring and Management Plan (AQEMMP) as outlined in the MOE submission (dated May 25, 2009 from Graham Veale to EAO). The AQEMMP will be implemented as soon as practicable after a decision to proceed with the Project has been made and will continue through the life of the Project. The AQEMMP will ensure that facility emissions are tracked and contaminants of potential concern are monitored; that	No change	For New Prosperity Taseko remains committed to the development and implementation of this Plan.	Taseko – at permitting

Table 2.9-1 New Prosperity Table of Commitments

Item #	Reference	2009/2010 Commitment	Changes	Rationale	Timing/Responsibility
		all applicable federal and provincial ambient air quality, criteria, standards, objectives, and guidelines are met; and provide an umbrella document to house all related monitoring programs and management plans, including contingency plans with identified actions and triggers for implementation.			
85		17.5 Ongoing monitoring of dust resulting from the tailings beach to verify the predicted levels and to ensure that any impacts are minimized. Design of monitoring program will allow for input from regulatory agencies.	No change	For New Prosperity Taseko remains committed to the monitoring of dust resulting from the tailings beach	Taseko – ongoing during operations
86		17.6 Limit fugitive dust caused by wind erosion on the tailings by	No change	For New Prosperity Taseko remains committed to	Taseko – ongoing during operations

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		maintaining a water cover over the deposited materials as stipulated in the Operational Deposition Plan. Fugitive dust caused by wind erosion on the waste rock piles will be mitigated by progressive reclamation.		maintaining a water cover over the deposited materials as stipulated in the Operational Depositional Plan.	
87		17.7 Prepare and execute a burn plan for vegetative debris consistent with the Open Burning Smoke Control Regulation (BC Reg. 145/93) prior to initiation of the construction and commissioning phase.	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko – during construction and operation
88		17.8 Develop and maintain an annual inventory of GHGs and CACs for both internal management and potential external reporting needs.	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko - ongoing
89		17.9 PM2.5 Ambient Air Quality	No change	For New Prosperity	Taseko – at permitting

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		Objectives (AAQO's) will be included in the Prosperity Ambient Air Monitoring Program.		PM2.5 AAQOs will be included in the monitoring program.	
90	Schedule B – Environmental Stewardship 18.0 Adaptive Management	18.1 Incorporate adaptive management processes for this Project including contingency planning, management objectives, ongoing monitoring, and the proponent's commitment for achieving benchmark goals within specified timelines.	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko - ongoing
91		18.2 Implement corrective measures should unforeseen adverse effects arise during the life of the Project. Measures will be taken to correct these effects and prevent them from occurring in the future. The EMS is then	No change	For New Prosperity Taseko remains committed to the implementation of these mitigation measures	Taseko - ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		updated and associated training programs enhanced to improve the level of environmental protection based on the results of these programs.			
92	Schedule B – Economic Contributions 19.0 Direct Employment	19.1 Implement hiring practices consistent with good business decisions and underlying principles of delivering maximum economic value and social benefit—locally, regionally and provincially.	No change	With New Prosperity Taseko will continue efforts to implement such hiring practices.	Taseko - ongoing
93		19.2 Give local candidates preference where all things being equal, two candidates seek employment at Prosperity, and there is only one position available. A local employment candidate shall be defined as someone who lives in the Cariboo-	No change	With New Prosperity Taseko will continue efforts to implement such hiring practices.	Taseko - ongoing

Table 2.9-1 New Prosperity Table of Commitments

Item #	Reference	2009/2010 Commitment	Changes	Rationale	Timing/Responsibility
		Chilcotin region.			
94		19.3 Expand efforts to hire local First Nations candidates by ensuring employment opportunities are communicated. Undertake to inform local communities of the employment positions and opportunities available at Prosperity before expanding the search for potential employees beyond the Cariboo-Chilcotin region.	No change	With New Prosperity Taseko will continue to give local candidates preference in accordance with corporate hiring policies.	Taseko - ongoing
95		19.4 Establish policies to help potential candidates gain required standards and qualifications to ensure local people have the opportunity to be eligible for hiring and career advancement (see Training below).	No change	With New Prosperity Taseko will continue efforts to develop and implement such policies.	Taseko - ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
96		19.5 Encourage Taseko suppliers, contractors, and consultants to give local candidates preference.	No change	With New Prosperity Taseko will continue to encourage suppliers to give local candidates preference.	Taseko - ongoing
97	Schedule B – Economic Contributions 20.0 Training	20.1 Promote “Mining: Your Future”, Taseko’s education and training initiative, to give individuals the opportunity for gainful employment in the mining industry.	No change	With New Prosperity Taseko will continue education and training initiatives.	Taseko - ongoing
98	Schedule B – Economic Contributions 21.0 Business Opportunities	21.1 Develop policies on procurement of goods and services to build and operate the mine based on good business decisions and guided by a desire to deliver maximum economic value and social benefit—locally, regionally and provincially.	No change	With New Prosperity Taseko will continue to develop and implement such procurement policies.	Taseko - ongoing
99		21.2 Cultivate an entrepreneurial spirit to develop	No change	With New Prosperity Taseko will continue to cultivate an	Taseko – ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		lasting relationships with suppliers based on cost competitiveness, continuous innovation, service and productivity improvement, employee health and safety, and environment protection.		entrepreneurial spirit and relationship with suppliers.	
100		21.3 Encourage First Nations to form and develop locally owned businesses that provide supplies or services to Prosperity.	No change	With New Prosperity Taseko will continue to encourage First Nations to form and develop locally owned businesses.	Taseko - ongoing
101		21.4 Ensure contractors share Taseko's commitment to investing in local community success through their respective purchasing, hiring, contracting, and logistical support practices.	No change	With New Prosperity Taseko will continue to encourage contractor's to share their commitment to investment in local community success.	Taseko - ongoing
102	Schedule B – Social Development 22.0 Health and Safety	22.1 Implement a comprehensive health and safety	No change	With New Prosperity Taseko will develop	Taseko – at permitting and ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		program based on the current Taseko Policy that includes safety leadership by mine management, risk and harm reduction, safety management systems, safe work behavior programs, and continual improvement.		a comprehensive health and safety program.	
103		22.2 Establish at the commencement of development, an Occupational Health and Safety Committee.	No change	With New Prosperity Taseko will establish an Occupational Health and Safety Committee.	Taseko – at permitting and ongoing
104		22.3 Meet the obligations set out in the BC Mines Act (1996, updated to 2007) Regulation and appropriate sections of the Health, Safety and Reclamation Code, including the provision of support to contractors and contractors' managers to comply with the Act when on-site.	No change	With New Prosperity Taseko will meet the obligations of the BC Mines Act.	Taseko – at permitting and ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
105		22.4 Develop and implement a Transportation and Access Management Plan for the Project as described in Volume 3, Section 9.2.2 of the Application, to safely meet the needs of mine employees and contractors, local residents, and the general public. This plan will include but will not be limited to: a) Appointing safety and security personnel before construction; b) Providing transportation for workers to and from the mine site from strategic locations throughout all phases of mine life; and, c) Developing and	No change	With New Prosperity Taseko will develop and implement the Transportation and Access Management Plan as described in Section 2.8.1 of this EIS.	Taseko – at permitting and ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		implementing access control protocols to ensure employee and contractor safety and to minimize social and environmental effects such as wildlife mortality related to the Project.			
106		22.5 Taseko will implement a plan to monitor and ensure open pit stability to protect worker safety.	No change	With New Prosperity Taseko will implement a plan in accordance with the BC Mines Act.	Taseko – at permitting
107	Schedule B – Social Development 23.0 Emergency Response	23.1 Continue to implement a risk management approach for the design, construction, operation and closure of the Project. a) Implement procedures and measures to address accidents, malfunctions and	A revised Accidents and Malfunctions Plan has been developed to accommodate the new mine plan.	With New Prosperity Taseko remains committed to implement a risk management approach and Accidents and Malfunctions Plan as detailed in Section 2.7.6 of this EIS.	Taseko – at permitting and ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		unplanned events. Table 17-1 in Volume 1 of the Application summarizes these measures and Volume 9 of the Application provides detailed procedures.			
108		23.2 Develop a full Mine Emergency Response Plan specific to the Project for any material risks identified before operations start.	No change	With New Prosperity Taseko will develop and implement a Mine Emergency Response Plan.	Taseko – at permitting and ongoing
109		23.3 Follow procedures for the handling, storage and disposal of hazardous chemicals used from construction through closure as dictated by the Material Handling and Waste Management Plan. a) Manage all hazardous materials according	No change	With New Prosperity Taseko will develop and implement a Material Handling and Waste Management Plan as detailed at Section 2.8.1 of this EIS.	Taseko – at permitting and ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		to their Material Safety Data Sheet (MSDS) and provide training for employees handling these chemicals in the Workplace Hazardous Materials Information System.			
110		23.4 Institute measures to ensure that fuel and lubricants do not escape to surrounding areas by: a) Equipping fuel systems with emergency fire safety valves and anti-siphon solenoid valves at tanks; b) Installing concrete grade slabs sloped to direct any spillage back into the containment; c) Any precipitation	No change	With New Prosperity Taseko will develop and implement these mitigation measures as detailed at Section 2.8.1 of this EIS.	Taseko – at permitting and ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		or drips which fall within the containment will pass through an oil/water separator before discharge to the environment; d) Implementing the Spill Prevention and Response Plan to promote the prevention of the accidental release of harmful substances into the receiving environment; and, e) In the event of a spill, providing adequate information to guide the response crew to safely, efficiently and effectively respond to and clean-up a spill.			
111	Schedule B – Social Development 24.0 Cultural Heritage Resources	24.1 Provide Project plans and drawings to identify	The new mine plan avoids many of the sensitive	For New Prosperity, Taseko will work with the Archaeology	Taseko – at permitting and ongoing

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		areas of archaeological and cultural sensitivity that require protection and/or monitoring.	sites.	Branch and First Nations to ensure that sensitive sites requiring protection or mitigation are appropriately identified.	
112		24.2 Implement archaeological resource management measures throughout the Project area to avoid or mitigate adverse effects on identified resources and culturally sensitive areas as outlined in the Ministry of Tourism, Culture and the Arts' letter of 22 May 2009. The mitigation program, details of which will be specified in subsequent permit applications, will include but will not be limited to: a) Systematic excavation of 16 of	The new mine plan avoids 86% of the identified resources and culturally sensitive sites.	For New Prosperity Taseko will work with the Archaeology Branch to finalize details of any required mitigation plan.	Taseko in consultation with the Archaeology Branch prior to permitting.

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		the 79 archaeological sites identified within the mine footprint of which 6 are to be subject to intensive investigation; b) A survey of the lake basin after draining and the gathering and analysis of palaeo-environmental data from the lake basin; and, c) Lithic sourcing.			
113		24.3 Completion of the Archaeological Impact Assessment for the transmission line and a management plan prepared to the satisfaction of the Archaeology Branch prior to commencement of construction.	No change	For New Prosperity the Transmission Line AIA will be completed before completion of engineering.	Taseko – at permitting
114		24.4 Completion of the Archaeological Impact Assessment of the proposed 2.8 kilometres of new	The new mine plan avoids disturbing the features at site EiRv-7.	For New Prosperity the AIA of the new mine access road will be completed before	Taseko – prior to construction and in accordance with direction provided by the Archaeology

Table 2.9-1 New Prosperity Table of Commitments					
Item #	**Reference**	**2009/2010 Commitment**	**Changes**	**Rationale**	**Timing/Responsibility**
		road and to further assess the cairn-like feature at site EiRv-7.		commencement of construction.	Branch at permitting.

2.10 SUMMARY OF RECOMMENDATIONS

The EIS Guidelines require a summary of the prior panel's recommendations provided in the 2010 prior panel report for the previous project proposal. The Guidelines require that the EIS explain how the Proponent will incorporate those recommendations relating to the management of environmental effects as a result of the change to components and activities associated with the new MDP. In addition, the Proponent is required to identify if the implementation of certain recommendations will conflict with the Project.

Taseko has adopted the following approach to address the requirements of the Guidelines:

1. Summarize the prior panel's recommendation provided in the 2010 prior panel report for the previously assessed project.
2. Briefly describe the aspect of the previous design that was the basis of the recommendation.
3. Briefly describe any change in the design (where applicable) that might affect the need for the recommendation.
4. Explain whether and to what extent applicable recommendations relating to the management of environmental effects associated with the new design are to be incorporated.
5. Explain why any recommendations have not been incorporated (as appropriate).
6. Identify if the implementation of certain recommendations will conflict with the Project.

Recommendation 1

Taseko and appropriate parties re-examine the choice of the transmission line corridor to determine whether one transmission line would be an appropriate alternative to serve both the Project and the Tsilhqot'in National Government's proposed biomass fired, thermal electric power plant, should that project proceed prior to construction of the transmission line.

It is not clear to Taseko how the panel's recommendation related to mitigation of a significant adverse environmental effect under the CEAA nor was it identified as an accommodation measure relevant to asserted or established aboriginal rights or title.

The March 2009 EIS/Application included an alternatives assessment of transmission line alternatives that was acceptable to both the federal and provincial governments. Both governments concluded that there were no significant adverse effects associated with the transmission line as proposed.

There has been no change in the transmission line with respect to design or refinement of the centreline relative to the previously proposed project.

During the panel hearings testimony from the Tsilhqot'in National Government suggested a particular interest in developing a biomass fired, thermal electric power plant near Hanceville that might provide reconsideration of one of the transmission line alternatives.

On May 31, 2010 BC Hydro issued "The Bioenergy Phase 2 Call Request for Proposals." The purpose of the call was for BC Hydro to seek to acquire three products; hourly firm energy, non-firm energy and Environmental Attributes. The energy to be acquired constitutes Clean or Renewable Biomass. The Call is consistent with government energy policy and legislation, namely the 2007 BC Energy Plan, the 2008 BC Bioenergy Strategy and the Clean Energy Act.

The Tsilhqot'in Power Corporation, a joint venture between Run of River Power Inc. and the Tsilhqot'in National Government, responded to the call with a project proposal called the Tsilhqot'in Power Project, to be built at Hanceville.

On January 20, 2011, eight projects were selected from five preferred proponents representing approximately 1,600 GWh per year of electricity. The Tsilhqot'in Power Project was not one of those selected. On January 26, 2011 Run of River Power Inc. (TSX-V: ROR) (“ROR Power” or “the Company”) announced its Tsilhqot'in Power projects were no longer under consideration in BC Hydro’s Bioenergy Phase 2 Call. On April 13, 2011, Run of River Power Inc. subsequently announced that due to the considerable uncertainty of a future Bioenergy Call and award of an Energy Purchase Agreement by BC Hydro, the Company had decided to write down the carrying value of its investment in its biomass projects of approximately $5.0 million to a nominal value.

The Bioenergy Phase 2 Call process concluded in August 2011 when BC Hydro announced the selection of four projects for Electricity Purchase Agreement (EPA) awards, two projects proposed by West Fraser Mills Ltd. and two projects proposed by Western BioEnergy Inc.

As it is unlikely that the Tsilhqot'in Power Project would proceed prior to construction of the transmission line, no re-examination of the choice of transmission corridor is contemplated at this time and no further consideration of this recommendation is warranted.

Recommendation 2

Taseko monitor water levels in Beece Creek and implement appropriate corrective action in order to minimize flooding at Taseko Lake Lodge.

The previous project design directed overflow from the proposed Prosperity Lake to Beece Creek during operations resulting in increased annual Beece Creek flow volumes of 3.8% during operations which was considered minor in light of the large size of the Beece Creek watershed.

The revised design for New Prosperity eliminates the proposed Prosperity Lake and the water reporting to Beece Creek is reduced relative to the previously assessed project.

As a result of the design changes in the Project there is a reduced risk of flooding at Taseko Lakes Lodge as a result of the Project relative to the previously assessed project.

Taseko will monitor water flows and quality consistent with the monitoring program referenced in Section 2.8.3 and as per the Table of Commitments developed during the review of the Project assessed previously. (refer to Section 2.9, Commitment 8.6) to confirm predictions and ensure that the risk of flooding at Taseko lakes Lodge as a result of the Project is negligible. Monitoring results will be reported to MOE as per discharge permit requirements, which will be discussed with MOE during permitting.

The implementation of this recommendation in the manner and to the extent described above will not conflict with the Project.

Recommendation 3

A long-term follow-up and monitoring program be designed and implemented to verify the predicted seepage rates and concentration of contaminants from the tailings storage facility toward Big Onion Lake and the effectiveness of the proposed primary mitigation measures. Should the results show that the movement and concentration of contaminants is higher than

predicted, additional mitigation measures should be put in place, such as the addition of more interception wells.

The prior panel concluded that seepage from the tailings storage facility would not result in a significant adverse effect on water quality in Big Onion Lake, noting that Taseko would have sufficient time to undertake its commitments to gather further hydrogeological information to be incorporated in the final design of a seepage collection system, if necessary, for the west ridge. Further the prior panel recognized that interception wells are considered to be an appropriate practice to intercept seepage.

The revised design and change in location of the TSF for New Prosperity is predicted to result in a shorter length of ridge through which seepage into the Big Onion Lake system may occur. A reduced area of seepage affected groundwater flow should translate into a smaller seepage rate from the TSF into this catchment.

Despite the reduced risk of impacting water reporting in the direction of Big Onion Lake, Taseko will implement a long term follow-up and monitoring program to verify the predicted seepage rates and concentration of contaminants from the tailings storage facility as referenced in Section 2.8.3.

This recommendation is consistent with the Table of Commitments developed during the review of the Project assessed previously. (Refer to Section 2.9, Commitments 8.6 and 16.1) and therefore additional measures will be taken at the beginning of project development to reduce any remaining uncertainty concerning seepage issues through the west embankment and ridge. Details of the measures and monitoring will be discussed and with the BC MoE during permitting based on predicted seepage rates and contaminant concentrations related to the new project design. Should seepage occur, mitigation measures will be proposed and discussed with MoE.

This activity is standard responsible environmental practise and will not conflict with the Project.

Recommendation 4

Further detailed terrain hazard and soils mapping should be done by Taseko in areas of the transmission line right-of-way that have been identified as having potentially hazardous terrain and sensitive soils to assist in finalizing the centreline.

Although the prior panel concluded the Project would not result in a significant adverse effect on terrain and soils, they noted that there would be some slopes along the transmission line that would warrant further consideration to assist in further minimizing effects on terrain and soils.

There has been no change in the transmission line’s 500 m wide corridor relative to the previously assessed project.

Terrain hazards are an integral consideration in the final alignment of the right-of-way within the corridor and areas of steep slopes, erodible soils and sensitive soils are avoided where possible. Should areas of hazardous terrain and sensitive soils remain within the right-of-way after final alignment, an assessment by a qualified professional will be done by Taseko in these areas prior to construction.

This recommendation is consistent with the Table of Commitments developed during the review of the Project assessed previously. (Refer to Section 2.9, Commitment 15.2). Commitment 15.2 specifically details avoidance of terrain hazards as a mitigation strategy to be followed when finalizing the alignment of the centre line.

The presentation of a final alignment of the transmission right-of-way, construction details and management plans are a requirement of the review and consultation process for a License of Occupation with the BC Forests, Lands and Natural Resources Operations.

Refer to Environmental management plan for Construction phase, specifically geotechnical stability as outlined in Section 2.8.1.

The implementation of this recommendation is standard engineering practise and will not conflict with the Project.

Recommendation 5

Taseko complete an additional assessment of areas of slope instability on the access road at Tête Angela Creek crossing.

Although the prior panel concluded the Project would not result in a significant adverse effect on terrain and soils, they noted that further assessment of slope instability on the access road at the Tête Angela (Vedan) creek crossing was warranted.

There has been no change in the transportation access relative to the previously assessed project.

Taseko has not proposed building any new access road or crossing in the vicinity of Tête Angela Creek. Assessment of areas of slope instability on any creek crossings will be done by Taseko as part of upgrading the 4500 Road access and permitted through the BC Ministry of Forests, Lands and Natural Resources, or done in coordination with the BC Ministry of Transportation and Infrastructure as part of any upgrading of the Taseko Lake Road.

The implementation of this recommendation is standard engineering practise and will not conflict with the Project.

Recommendation 6

Areas identified as unstable undergo a detailed on-site terrain stability assessment by a qualified professional so that appropriate planning and mitigation measures can be undertaken prior to the commencement of construction activities.

Although the prior panel concluded the Project would not result in a significant adverse effect on terrain and soils, this recommendation was made to assist in further minimizing effects on terrain and soils.

There has been no change in the transmission line 500 m wide corridor with respect to the previously assessed project. On the mine site, there have been changes made with respect to the location of ore and waste stockpiles and the TSF.

Areas of potentially unstable terrain and which cannot be avoided during construction will undergo a detailed on-site terrain stability assessment by a qualified professional as identified in the Geotechnical Stability Management Plan in Section 2.8.1. This will be undertaken through the Mines Act permitting process with the BC Ministry of Energy and Mines.

This is consistent with the Table of Commitments developed during the review of the Project assessed previously. (Refer to Section 2.9, Commitment 8.5)

The implementation of this recommendation is standard engineering practise and will not conflict with the Project.

Recommendation 7

Taseko construct the transmission corridor right-of-way in such a manner as to avoid long straight-line sight distances to reduce the negative effect of the right-of-way on predator-prey relationships.

Although the prior panel concluded the Project would not result in a significant adverse effect on wildlife, this recommendation was made to assist in further minimizing effects.

The recommendation would appear to be the result of concerns raised by Esketemc (Alkali Lake Band) during the community hearing sessions regarding the straight line right-of-way created by the transmission line and the potential for this right-of-way to upset the predator/prey relationship.

There has been no change in the transmission line 500 m wide corridor relative to the previously proposed project.

Long line-of-sight runs will be added to the criteria of considerations in the final design and alignment of the right-of-way in addition to other commitments, such as, utilizing existing disturbed and cleared landscapes where possible, and avoiding hazardous terrain, areas of high biophysical values, and sites of cultural or heritage resources.

This recommendation is consistent with the Table of Commitments developed during the review of the Project assessed previously (refer to Section 2.9, Commitment s15.1 and 15.2)

Commitments 15.1 and 15.2 speak to the intent to review design details and proposed construction schedule with provincial Ministry of Environment and other regulatory bodies as appropriate to implement all mitigation strategies relative to the transmission line. The presentation of a final alignment of the transmission right-of-way, construction details and management plans are a requirement of the review and consultation process for a License of Occupation with the BC Forests, Lands and Natural Resources Operations.

The implementation of this recommendation in the manner and to the extent described above will not conflict with the Project.

Recommendation 8

Taseko begin discussions immediately with the British Columbia Ministry of Environment and the affected First Nations to develop a wildlife habitat compensation plan for mule deer.

The prior panel concluded that the Project previously assessed would have no significant effect on mule deer and their habitat. Specifically, the effect of the transmission line corridor on mule deer would not be significant. As well, although the loss of mule deer and moose winter habitat at the mine site would be relatively large, the mine site was not considered to be a regionally important mule deer or moose winter habitat and the Panel was of the opinion that, given the location of the proposed mine site, mule deer would likely still disperse around the mine site to continue their migration.

There has been no change in the transmission line's 500 m wide corridor relative to the previously proposed project. The transmission corridor crosses ungulate winter range (UWR) in the vicinity of the

Fraser River. Special mitigation measures and compensation for forest clearing through this area is already required through a Government Acts Regulation (GAR) order and application to the BC Ministry of Forests, Lands and Natural Resources Operations.

The predicted effects of the revised design for New Prosperity on wildlife habitat at the mine site in general are reduced as a result of the reduction in direct impact footprint.

Despite the reduced impact Taseko has developed a draft Habitat Compensation Framework (Appendix 2.7.1.3–A) for discussion with BC Ministry of Environment and Ministry of Forests, Lands and Natural Resource Operations should a decision be made to approve the issuance of authorizations, permits or approvals that would be required to enable this Project to proceed.

This is consistent with the Table of Commitments developed during the review of the Project assessed previously (refer to Section 2.9, Commitment 11.1).

This commitment applies to the entire project area including the mine site, transmission line and access road areas. Mule deer will be considered in the plan and any compensation implemented will be in accordance with the framework currently under development. As the details of the Habitat Compensation Framework develop and the need for specific compensation to offset identified adverse effects is confirmed the compensation will be implemented.

The implementation of this recommendation in the manner and to the extent described above is above and beyond that required by statute and regulation but will not conflict with the Project.

Recommendation 9

Taseko involve the affected First Nations in the development and implementation of the mitigation measures to address the concerns regarding access along the transmission line right-of-way.

The prior panel recognized that the entire region supports numerous logging roads that already provide access to the land in different areas and that the transmission line right-of-way could allow for increased accessibility to the land and to areas not previously readily accessible.

There has been no change in the transmission line 500 m corridor with respect to the previously proposed project.

The recommendation is consistent with the Table of Commitments developed during the review of the Project assessed previously (refer to Section 2.9, Commitments 2.1, 2.2, 2.3).

Commitments 2.1, 2.2 and 2.3 speak generally to Taseko's commitment to early, open and full communication with First Nations.

Taseko has begun the investigation into potential use of existing disturbed and cleared land in the final alignment of the transmission line right-of-way in order to avoid construction of any new access roads. As an aspect of its Transportation and Access Environmental Management Plan (refer to Section 2.8.1), Taseko has previously committed to working with First Nations, landowners, the public and appropriate regulatory agencies in the development of an access management plan for the transmission line.

The presentation of a final alignment of the transmission right-of-way, construction details and management plans are a requirement of the review and consultation process for a License of Occupation with the BC Forests, Lands and Natural Resources Operations.

The implementation of this recommendation in the manner and to the extent described above will not conflict with the Project.

Recommendation 10

Taseko develop and implement a wildlife habitat compensation plan that provides for the creation of additional wetland/riparian habitat beyond that proposed by Taseko at the mine site, in collaboration with Environment Canada, the British Columbia Ministry of Environment, affected First Nations and appropriate environmental organizations such as Ducks Unlimited.

The prior panel concluded that provided a wildlife habitat compensation plan is developed and implemented, the Project would not result in a significant adverse effect on migratory birds and their habitat.

The design of the Project previously assessed included the draining of Fish Lake and the subsequent use of the footprint of the lake for waste rock storage and an ore stockpile.

The revised design for New Prosperity relocates the waste rock storage and ore stockpile, retaining Fish Lake, and relocates the TSF upstream in the Fish Lake drainage. As a result there is a reduction in direct footprint on migratory bird habitat at the mine site.

Despite the reduced impact, Taseko has developed a draft Habitat Compensation Framework (Appendix 2.7.1.3–A) for discussion with the BC Ministry of Environment and Ministry of Forests, Lands and Natural Resource Operations should a decision be made to approve the issuance of authorizations, permits or approvals that would be required to enable this Project to proceed.

This is consistent with the Table of Commitments developed during the review of the Project assessed previously (refer to Section 2.9, Commitment 11.1)

This commitment applies to the entire project area including the mine site, transmission line and access road areas. As the details of the Habitat Compensation Framework develop and the need for specific compensation to offset identified adverse effects is confirmed the compensation will be implemented.

The implementation of this recommendation in the manner and to the extent described above is above and beyond that required by statute and regulation but will not conflict with the Project.

Recommendation 11

Local First Nations, the Province and Taseko develop an agreement outlining mitigation measures to avoid or minimize damage to archaeological finds, as well as how found artifacts would be preserved. The agreement should incorporate traditional values of First Nations and be completed prior to the start of construction. In particular, the Panel recommended that as a component of such an agreement Taseko consider the development and implementation of a chance find procedure in collaboration with First Nations and the Province to address all artifacts found during construction of mine site infrastructure and the transmission line right-of-way, including a process of communication with First Nations to address chance finds and employ a trained archaeological monitor to evaluate effects during construction activity.

On the mine site area, an extensive field assessment conducted in 2006 identified 79 pre-1846 archeological sites

The design of the Project previously assessed included the draining of Fish Lake and the subsequent use of the footprint of the lake for waste rock storage and an ore stockpile. The majority of archaeology sites were located around the shore of the lake.

The revised design for New Prosperity relocates the waste rock storage and ore stockpile, retaining Fish Lake, and relocates the TSF upstream in the Fish Lake drainage.

As a result of the design changes in the Project only 12 sites are within the maximum disturbance boundary, compared to 79 in the previous project design.

This archaeologically related recommendation is consistent the Table of Commitments developed during the review of the Project assessed previously (refer to Section 2.9, Commitments 24.1 and 24.2)

Commitment 24.1 and 24.2 clearly outline steps Taseko must take to outline mitigation measures. This is an area of provincial policy and their guidance will be followed.

Taseko will undertake further efforts during detailed design to avoid those sites remaining at risk in the mine site area. Additional archaeological impact assessment work will be conducted in the areas previously unsurveyed in the new location of the waste rock stockpile.

The Tsilhqot'in National Government has been a participant in all past archaeological investigations on the mine site. Invitations will continue to be extended to First Nations to participate in the field assessments, as well as to develop mitigation measures for any identified sites proposed for disturbance and handling of artifacts.

A qualified professional has developed a Chance Find Procedure for Taseko and the opportunity for review of the Archaeology Management Plan for Exploration with the Chance Find Procedure was extended to First Nations. This procedure has been recently utilized during 2012 exploration on the New Prosperity site which included participation by a First Nations nominated professional archaeologist.

Commitment 24.3 refers to the completion of the Archaeological Impact Assessment for the transmission line and a management plan prepared to the satisfaction of the Archaeology Branch prior to commencement of construction.

There has been no change in the transmission line 500 m wide corridor relative to the previously proposed project. Past assessments identified only 2 archaeology sites within 250 m of the corridor.

To enable finalization of the right-of-way alignment within the corridor, Taseko is completing an archaeological impact assessment in order to identify and, where possible, avoid any additional archaeology sites. First Nations have been invited to participate in this assessment.

As outlined in Section 2.5.1.1, Engagement and Consultation, Taseko will continue to extend invitations to First Nations to participate in planning through all phases of mining and will remain receptive to discussing additional mitigation measures. In the absence of participation from others, Taseko will develop archaeology management plans to the best of their knowledge of aboriginal values, and provide the plans to the province during transmission line and mine site permitting for consultation enabling First Nations the opportunity for review and comment.

The implementation of this recommendation in the manner and to the extent described above will not conflict with the Project.

Recommendation 12

Taseko consider relocating the transmission line outside the Esketemc Community Forest, or consider options mutually agreeable to all parties involved to minimize or compensate for the effects on the Community Forest.

The transmission line would run through the Esketemc Community Forest, an area that was reported to be important to the Esketemc and in the prior panel's view, efforts should be made to avoid this area given its importance to the Esketemc.

There has been no change in the transmission line 500 m wide corridor with respect to the previously proposed project.

Taseko continues to consider final alignment options that avoids or minimizes interference with the harvestable timber, sensitive biophysical and cultural features Esketemc holds for the Community Forest. If interference is not avoidable, provincial Ministry policy contains provisions to compensate the licensee of any unavoidable interference.

Taseko has met with the Alkali Resources Ltd. on this topic to propose a preferred alignment to minimize impacts on the Community Forest by routing the alignment through existing disturbance and cleared areas. Options for routing the line to the south of the Community Forests were also discussed but an additional challenge associated with invasive weeds with this option arise from enabling ATV and pick-up access off the grasslands on the southern border into the Community Forest. Taseko will continue to extend invitations to Alkali Resources Ltd. to finalize the route of the alignment, and to present the options formally to Esketemc Chief and Council.

The implementation of this recommendation in the manner and to the extent described above will not conflict with the Project.

Recommendation 13

Taseko meet with the affected tourism business owners to discuss compensation for lost business as a form of mitigation.

While the prior panel's view was that tourism would not be adversely affected in the region as a whole it heard that Taseko Lake Outfitters relied on the exclusive wilderness setting in which the Taseko Lake Lodge is situated for their business. Further, the prior panel heard that Taseko Lake Outfitters utilized the meadows in the Nabas region to graze their horses.

It is not clear to Taseko whether the prior panel’s finding on this point is in keeping with CEAAs policy on determining what significant effects are or whether any such effects are the basis of this recommendation.

Taseko is of the opinion that the existence of a mine and its limited footprint with respect to the region available for Taseko Lakes Lodge to conduct its business, coupled with the potential new business opportunities presented by a mine would not have the effect concluded by the prior panel.

However, Taseko is willing to meet with the affected tourism business owners to discuss any direct effects or opportunities that may occur as a result of the Project.

The implementation of this recommendation in the manner and to the extent described above will not conflict with the Project.

Recommendation 14

Taseko monitor ground level concentrations of particulate matter at the Taseko Lake Lodge.

The prior panel concluded that emissions of particulate matter from the previously reviewed project would not result in significant adverse effect. While this recommendation was made by the prior panel, there is no finding of significance by the prior panel with respect to particulate matter at the Taseko Lakes Lodge.

The changed project activities and physical works for New Prosperity do not result in substantial changes to criteria air contaminant emissions in any of the Project phases.

This recommendation is consistent with the Table of Commitments developed during the review of the Project assessed previously (refer to Section 2.9, Commitments 17.3 and 17.4)

Commitments 17.3 and 17.4 outline the obligation to develop and implement an Emissions and Monitoring Plan (AQEMMP) as directed by MOE. The installation and operation of a monitoring station in the vicinity of the Taseko Lake Lodge will be discussed with the BC Ministry of Environment during the review of the BC Mines Act Permit prior to construction, and monitoring locations will be considered as a component of the AQEMMP. Establishment of monitoring locations and reporting of monitoring results are formalized through the Air Discharge Permit issued by the BC Ministry of Environment.

The implementation of this recommendation in the manner and to the extent described above will not conflict with the Project.

Recommendation 15

Transport Canada hold further discussion with Taseko, First Nations and recreational users to determine whether interim access to other lakes would be desirable and if so, appropriate measures be developed to minimize the environmental effects of creating increased access to navigation and related fishing opportunities elsewhere.

The prior panel noted that should the previously reviewed project proceed, Transport Canada would require mitigation for the loss of navigation in Fish Lake, (Little Fish Lake) and portions of Fish Creek and that this would need to take into consideration matters related to navigation, including the fishing experience and the spiritual and cultural uses of Fish Lake, Little Fish Lake and portions of Fish Creek that would be lost. The prior panel was of the view that while the recreational fishing experience could not be replaced, it could be mitigated by the provision of increased access to other lakes as an interim measure and the ultimate development of the proposed Prosperity Lake. However, the prior panel also recognized that this would create additional pressure on other lakes that are also used by First Nations.

The design of the Project previously assessed included the draining of Fish Lake and the subsequent use of the footprint of the lake for waste rock storage and an ore stockpile. This design resulted in the loss of Fish Lake, Little Fish Lake and portions of Fish Creek but proposed the development of Prosperity Lake as compensation.

The revised design for New Prosperity relocates the waste rock storage and ore stockpile, retaining Fish Lake, and relocates the TSF upstream in the Fish Lake drainage. The revised design for New Prosperity retains Fish Lake, establishing a new public access to the Lake, and an appropriately revised fish compensation plan.

The recommendation put forward by the panel is directed at access developed to other lakes as part of potential compensation for the losses associated with the Project previously assessed. The recommendation is not applicable to the revised design and no further consideration of this recommendation is warranted.

Recommendation 16

Taseko provide access to the proposed Prosperity Lake within the same season that the lake becomes available as a compensation fishery – in approximately Year 7 of the operation phase.

One of the components of the Project previously assessed was the development of the proposed Prosperity Lake as compensation for the loss of Fish Lake. With the design of New Prosperity, Fish Lake is retained and there is no justification to develop Prosperity Lake. As a result, no further consideration of this recommendation is warranted.

Recommendation 17

Taseko establish access to the proposed Prosperity Lake to allow for boat launching, camping and fishing to replicate as much as possible the water bodies it would replace.

One of the components of the Project previously assessed was the development of the proposed Prosperity Lake as compensation for the loss of Fish Lake. With the design of New Prosperity, Fish Lake is retained, including a new public access and there is no justification to develop Prosperity Lake. As a result, no further consideration of this recommendation is warranted.

Recommendation 18

Taseko monitor arsenic and mercury in fish tissue as a precautionary matter to verify predictions and the results of the monitoring be provided to appropriate federal and provincial authorities.

Although the prior panel concluded that the previously assessed project would not result in a significant adverse effect on fish health in the Taseko River, they noted that there is a fear on the part of First Nations that the mine would contaminate the Taseko River and that the fish would no longer be fit for consumption.

Although the location of the waste storage, ore stockpile, and TSF have changed relative to the Project previously assessed, all components remain upstream of the open pit and the prediction of quality of water discharging from the open pit post closure remains similar as that of the Project previously assessed.

With the retention of Fish Lake as a viable fishery under the New Prosperity design it is also anticipated that a Fish Lake monitoring program will be required as well.

A fish tissue monitoring program that addresses concerns with respect to both Fish Lake and the Taseko River will be developed and implemented as directed by the BC Ministry of Environment and by Fisheries and Oceans, Canada during the permitting and authorization processes, respectively.

The implementation of this recommendation in the manner and to the extent described above will not conflict with the Project.

Recommendation 19

Taseko collaborate with the Secwepemc when determining the final alignment of the transmission line centreline in order to minimize disturbance resulting from the Project to areas of importance to the Esketemc (Alkali Lake Band) and Stswecem'c/Xgat'tem (Canoe Creek Band).

The prior panel noted that the Secwepemc people indicated they used the area of the proposed transmission line corridor for traditional purposes and that the transmission line may affect their ability to continue their current use practices due to increased access, loss of cultural connectivity with the land, and direct impacts to wildlife. The prior panel also noted that the area of the proposed transmission line crossing over the Fraser River has been identified as an area that is rich in archaeological and burial sites.

There has been no change in the transmission line 500 m wide corridor with respect to the Project previously assessed.

The recommendation is consistent with the Table of Commitments developed during the review of the Project assessed previously (refer to Section 2.9, Commitments 2.1, 2.2, 2.3)

Commitments 2.1, 2.2 and 2.3 speak generally to Taseko's commitment to early, open and full communication with First Nations.

Taseko has begun to implement their engagement strategy for access management planning and has initiated efforts to work with First Nations on this topic. Invitations have been extended to both the Esketemc (Alkali Lake Band) and Stswecem'c/Xgat'tem (Canoe Creek Band) to participate in 2010 field studies on wildlife, rare plants, and archaeology along the transmission line corridor. Invitations will continue to be extended in hopes of encouraging participation in planning the final alignment of the right-of-way and minimizing impacts on values of importance to Aboriginal people. Results of the studies will be submitted by Taseko to the BC Ministry of Forests, Lands and Natural Resource Operations during the review and consultation process for the License of Occupation for the transmission line.

The implementation of this recommendation in the manner and to the extent described above will not conflict with the Project.

Recommendation 20

Taseko commit to monitoring of transplanted *Schistidium heterophyllum* populations and the implementation of appropriate adaptive management measures to ensure its survival.

The prior panel heard that the moss, *Schistidium heterophyllum*, was considered to be at the limit of its range, as it was represented by only a few specimens; for these reasons, it was considered to be endangered in the region. The prior panel noted that Taseko has proposed to move the boulders hosting the moss and considerers this to be an acceptable mitigation measure to protect this species.

Schistidium heterophyllum, as in 2009 is not listed by the *Species at Risk Act* (SARA), and has since been downlisted from red listed to blue listed.

This recommendation is consistent with the Table of Commitments developed during the review of the Project assessed previously (refer to Section 2.9, Commitment 10.5).

Commitment 10.5 specifically refers to the Vegetation and Wildlife Management Plan mitigation measures outlined in Volume 5, Section 6.4.1. Follow-up monitoring for *Schistidium heterophyllum* is included amongst the mitigation measures.

The implementation of this recommendation in the manner and to the extent described above will not conflict with the Project.

Recommendation 21

Taseko investigate pit wall stability prior to closure to minimize any post-closure stability problems.

The prior panel noted that if a pit wall failure were to occur after closure, and certainly once the open pit was filled with water, a large volume of water would be released into Fish Creek and hence the Taseko River. Also, in the event of a pit wall failure once the open pit was filled, the stability of the Pit Lake would be disrupted and water from the bottom of the open pit, which would be higher in contaminants, could be brought to the surface and released into Fish Creek and the Taseko River. While these would appear to be unlikely events, the prior panel commented that consideration be given to future emergency response planning when the open pit would start to fill with water after closure of the mine.

The design of the Project previously assessed included the draining of Fish Lake and the subsequent use of the footprint of the lake for waste rock storage and an ore stockpile

The revised design for New Prosperity relocates the waste rock storage and ore stockpile and retains Fish Lake but there is no change in the pit design. Open pit stability will be continually monitored during operations and long-term stability will be assessed prior to closure. The pit design is reviewed by provincial Ministry of Energy Mines and Petroleum Resources (MEMPR). The Mines Act Permit will also detail specific requirements to investigate and address any potential post-closure stability issues.

The implementation of this recommendation in the manner and to the extent described above will not conflict with the Project.

Recommendation 22

Taseko develop a revised emergency response plan before mine closure to address a possible embankment failure.

With respect to a possible embankment failure, the prior panel noted that for the operating life of the mine as proposed in the Project previously assessed, in the event of a failure, water from the tailings storage facility would flow into the open pit. Also, the geotechnical instrumentation that would be installed in the embankments should alert Taseko if any changes occur from design predictions and allow corrective action to be taken.

The location of the TSF has changed relative to the Project previously assessed but remains in the same watershed and upstream of the open pit. The design leaves Fish Lake intact between the main embankment and the open pit. The design also incorporates a low permeability core for the full height of the embankment as compared to the previous design which utilized a low permeability core for the early stages only. Despite the design changes the geotechnical monitoring approach remains the same.

This recommendation is consistent with the Table of Commitments developed during the review of the Project assessed previously (refer to Section 2.9, Commitment 23.1)

Commitment 23.1 refers to the implementation of a risk management approach for the design, construction, operation and closure of the Project.

The operational emergency response plan is revised continually and will be revised at closure. This is a requirement of the Mines Act Permit and the Health, Safety and Reclamation Code for Mines in British Columbia.

The implementation of this recommendation in the manner and to the extent described above will not conflict with the Project.

Recommendation 23

The federal and provincial governments establish an independent monitoring committee as soon as possible to assist in building trust between Taseko and First Nations and to demonstrate that Taseko is implementing its commitments as intended throughout the mine life; the committee would consist of appropriate government agencies and/or independent experts, First Nations affected by the Project and local non-First Nation members, and would be funded by Taseko.

The prior panel noted that should the previously assessed project proceed, it would be important to attempt to build trust with First Nations and to operate in a fully transparent manner with them. Involving First Nations in the environmental management plans would be a means to assist in this regard. In the prior panel's view, this could be accomplished through the establishment of an independent monitoring committee with costs to be borne by Taseko. The committee would involve appropriate government agencies and or independent experts, First Nation and local non-First Nations members. The committee would have the responsibility to independently review and monitor the previously assessed project effects and the implementation of mitigation measures.

This recommendation is directed at the federal and provincial governments and should the Project proceed Taseko is committed to working with the appropriate regulatory agencies with respect to monitoring project effects and the implementation of mitigation measures as part of the permitting process.

The implementation of this recommendation in the manner and to the extent described above will not conflict with the Project.

Recommendation 24

The responsibilities of the independent monitoring committee should include the following:

- Reviewing and monitoring surface water quality and arsenic and mercury levels in fish tissue
- Reviewing the hydrogeological data collected as per commitment 8.6
- Reviewing and monitoring the data collected from the long-term follow-up and monitoring program to verify the predicted seepage rates and concentration of contaminants from the tailings storage facility toward Big Onion Lake and the effectiveness of the proposed primary mitigation measures
- Reviewing and monitoring data collected on the implementation of the fish and fish habitat compensation plan
- Reviewing the effectiveness of measures to control invasive plant species along the transmission line
- Reviewing the information collected on any Project-related grizzly bear-vehicle collisions or near misses
- Participating in the development of and reviewing the implementation of the access management plan for the transmission line

- Participating in the development of and reviewing the implementation of the wildlife habitat compensation plan, and
- Other matters that may arise during the construction, operation, and closure of the mine, as a result of monitoring and adaptive management measures.
- The prior panel noted that should the previously assessed project proceed, it would be important to attempt to build trust with First Nations and to operate in a fully transparent manner with them. Involving First Nations in the environmental management plans would be a means to assist in this regard. In the prior panel's view, this could be accomplished through the establishment of an independent monitoring committee with costs to be borne by Taseko. The committee would involve appropriate government agencies and or independent experts, First Nation and local non-First Nations members. The committee would have the responsibility to independently review and monitor the Project effects and the implementation of mitigation measures.

Taseko is committed to working with the appropriate regulatory agencies with respect to the mandate of independent monitoring committees that may result from the permitting process.

2.11 ASSESSMENT SUMMARY AND CONCLUSION

Will be provided in Final EIS Submission.