Mount Milligan Environmental Assessment Certificate Amendment Application

Application for Amendment #3 to EAC #M09-01 for the Mount Milligan Copper-Gold Project

Prepared for:
Thompson Creek Metals Company

Prepared by:
Stantec Consulting Ltd.

December 5, 2017

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Abbreviations

EAC Application	Environmental Assessment Certificate Amendment Application
AAIR	Amendment Application Information Requirements
EAC	Environmental Assessment Certificate
EAO	Environmental Assessment Office
EMPR	Ministry of Energy, Mines and Petroleum Resources
HDPE	high-density polyethylene
km	kilometre
L/s	litres per second
m	metre
m^3	cubic metres
m^3/s	cubic metres per second
MMPO	Major Mines Permitting Office
MOE	Ministry of Environment
Project	Mount Milligan Gold-Copper Project
TCMC	Thompson Creek Metals Company Inc.
TSF	tailings storage facility
VC	valued components

1 INTRODUCTION

Thompson Creek Metals Company Inc. (TCMC), a wholly-owned subsidiary of Centerra Gold, is applying for an amendment to its Environmental Assessment Certificate (EAC #M09-01) issued on March 16, 2009. The Certificate was granted for the construction and operation of the Mount Milligan Copper-Gold Project (the Project), located approximately 155 kilometres (km) north of Prince George.

The following two amendments have been previously issued by the BC Environmental Assessment Office (EAO) for the Project:

Amendment 1 – This amendment, issued on March 1, 2013, allowed for the relocation of the ore concentrate rail load-out facility from Fort St James to Mackenzie, and authorized the construction and operation of a camp near the mine site to accommodate workers during Project operations. The Amendment Assessment Report (EAO 2013a) concluded that, in consideration of proposed mitigation measures, no significant adverse effects were predicted, and that the potential for adverse effects on Aboriginal rights, including title, or treaty rights ("Aboriginal interests") were avoided, mitigated, or otherwise accommodated to an appropriate level.

Amendment 2 – This amendment, issued on March 3, 2017, changed ownership of the EAC to TCMC from Terrane Metals Corp. The Amendment Assessment Report (EAO 2017a) concluded there were no issues or adverse effects arising from the proposed changes.

This EAC Amendment application (the Application) is seeking an emergency short-term approval for the use of Esker Lakes and Philip Lake 1 as water sources for the Project from January 2018 to October 2019 (i.e., Phase 1 amendment application). Water levels in the Tailings Storage Facility (TSF) are currently at a level that the mine's water needs will not be achievable and a mine shut down is anticipated in early 2018 if additional water sources are not identified. This approval will allow the mine to obtain short term (approximately two years) water needs, and thus continue to operate, while it assesses long-term solutions. For Phase 1 to address this emergency, an assessment has been completed that is based on conservative assumptions of water needs and potential water sources that can be used to withdraw water at rates that follow proposed Risk Management Level 1 measures according to the provincial Environmental Risk Management Framework. During the two-year period that TCMC is requesting for this amendment, options will be explored for the development of secure long-term water sources (i.e., Phase 2 amendment application). Instream flow data will be collected to assess risk levels and capacity of potential water sources that are proposed as long-term use. Measures to monitor the effectiveness of proposed mitigation measures will be implemented and where mitigation measures are determined to be insufficient, proposed mitigation measures will be revised.

Figure 2-1 illustrates the proposed Project layout, including the location of water bodies being considered for short-term water withdrawal.

No other amendments are being applied for at this time. Within the next two years TCMC intends to apply for another amendment for Phase 2 of the Project to address long-term water needs.

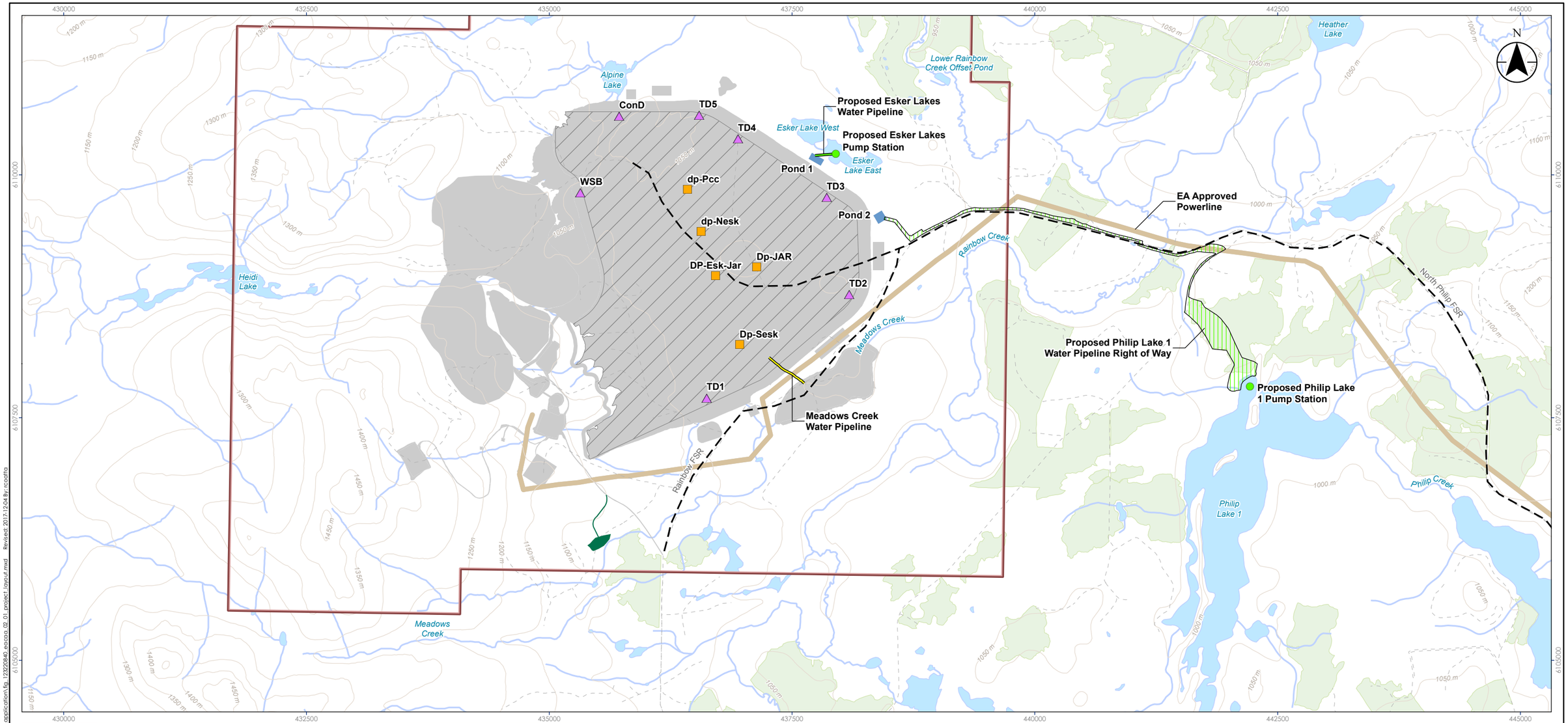
2 DESCRIPTION OF PROPOSED PROJECT CHANGES

2.1 CURRENT WATER SOURCES

The Project requires approximately 10,000,000 cubic meters (m^3) of water to produce gold-copper concentrate from mined ore. TCMC's water management plan includes storing precipitation and run-off that flows into the King Richard Watershed and then into the TSF, recycling TSF water for use in the mill to reduce demands on adjacent watersheds. The TSF is currently the primary source of make-up water and as such, TSF levels are critical to mill operations.

Meadows Creek Water Supply Pond (MCWSP) was proposed in the original environmental assessment, but was not built because of potential adverse environmental effects, the cost to construct and operate the pond and Indigenous concerns. Concerns included potential adverse effects to the headwaters of Meadows Creek that are utilized by fish, and the need to construct a 16.5 m dam and pond with an approximate footprint of 4,000 m^2.

In early 2017, as part of a pump test, approximately 650,000 m^3 of water was pumped from Meadows Creek during the freshet period. This amount of available water has been temporarily factored into water resources for the Project, but an operational water budget shortfall still exists. A description of the water balance is provided in Appendix A - Operational Water Management System Water Deficit Investigations.



- Gravel Road
- Forest Tenure Road
- Topographic Contour
- Watercourse
- Waterbody
- Forest Tenure Cut Block Opening
- Mining Lease (631503)
- Drill Pad Location for Water Recovery Well
- Tower Drain Location
- Water Pipeline
- Tailings Storage Facility
- Retention Pond
- EA Amendment 1 Camp and Access Road
- EA Approved Powerline
- EA Approved Project Footprint
- Proposed Water Pump Station
- Proposed Water Pipeline
- Proposed Water Pipeline Right of Way

0 0.5 1 1.5 km

1:40,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Data Source: DataBC, Government of British Columbia; Natural Resources Canada; Thompson Creek Metals Company Inc. TCMC
3. This document is provided by Centerra Gold (CG) for use by the intended recipient only. This information is confidential and proprietary to CG and is not to be provided to any other recipient without the written consent of CG.

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MOUNT MILLIGAN
centerra GOLD

Project Location
NTS Grid: 093O04
BCGS Grid: 93O.011

Project Number 123220840
Prepared by RCOATTA 20171106
Discipline Review by GWAGNER 20171201
GIS Review by NPUREWAL 20171201

Client/Project
Thompson Creek Metals Company Inc.
Mount Milligan Mine
Environmental Assessment Certificate Amendment Application

Figure No. **2-1**
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Title
Project Layout

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2.2 ANTICIPATED WATER SHORTAGE AND PROPOSED MAKEUP WATER SUPPLY PLAN

In late 2016, a bathymetric survey of TSF water levels showed that water levels were critically low. The current and anticipated water shortage is estimated to be 1,800,000 m^3 in 2018 and in 2019. This shortage is currently being investigated from the site's operational water balance model via strengths, weaknesses, opportunities, and threats (SWOT) analysis (Appendix A), and may be due to several factors, including:

- Consecutive years of dry conditions limiting replenishment of make-up water storage
- Inaccurate water balance model predictions (overestimated runoff to TSF)
- Calibrations of the model in recent years based on annual average flows rather than actual flows
- Decision not to construct the Meadows Creek Water Supply Pond due to operational, Indigenous and environmental considerations; and
- Water infiltration into silt lenses within TSF overburden resulting in the inability to access this water

To manage low water levels in the TSF, operating the mill at a reduced production rate was considered, but determined not to be economically feasible. Without additional sources of water, the Project is expected to run out of water between February and March 2018, resulting in shutdown of the mill. Mill shutdown will cause adverse impacts including temporary layoffs of approximately 450 workers, loss of regional income, and loss of company revenues. Spring freshet will provide replenished water supplies; however, there will be a period of approximately six weeks from the time the mine runs out of water to the start of freshet, depending on weather conditions.

To achieve an annual makeup water supply of 1,800,000 m^3 in 2018 and 2019, TCMC is proposing to withdraw water from Philip Lake 1, Esker Lakes, Meadows Creek, and to recover internal water from the TSF through tower drains and water recovery wells (Figure 2-1). The Philip Lake 1, Esker Lakes and Meadows Creek water withdrawals will be short-term; proposed to be functional for up to two years starting in early 2018. Water withdrawal from Meadows Creek was assessed and proposed in the EAC Application (Amec 2008) and approved in the EAC and is, therefore, not assessed in this Application. The two TSF water sources (i.e., towers and wells) will recover water contained in and under mine tailings currently stored in the TSF.As such, withdrawal of these water sources does not require amendments to the current EAC or additional regulatory authorizations. The TSF water sources are discussed further in the water investigation report Appendix A.

This Application is seeking approval for the use of the Esker and Philip 1 lakes as temporary water sources for varying amounts of water and time periods between January 2018 and October 2019. Pumping from Esker Lakes and Philip Lake during winter is planned only during 2018. Open water pumping from Philip Lake is proposed continue late into 2018 to avoid future need for

winter pumping. Table 2-1 provides a summary of the proposed water supply plan for each water source.

Table 2-1 Summary of Proposed Water Supply Plan

Water Source	Timing	Year		Approximate Withdrawal Rate[1]	Estimated Total Withdrawal Volume
Philip Lake 1	January 1–March 31	2018		35 L/s	260,000 m^3
Philip Lake 1	April 1–July 31 and October 1-October 31	2018	2019	58 L/s (operational max. 60 L/s)	788,000 m^3
Philip Lake 1	August 1-September 30	2018	2019	42 L/s	222,000 m^3
Esker Lakes	January 1–March 31	2018		25 L/s	200,000 m^3
Overall Potential Water Withdrawals	**January–October**	**2018**		**n/a**	**1,470,000 m^3** Not including Meadows Creek or TSF sources
	April–October		**2019**	**n/a**	**1,010,000 m^3** Not including Meadows Creek or TSF sources
Internal Water Sources (not included in Application)					
Meadows Creek[2]	April 1–June 1	2018	2019	Up to 163 L/s	Potential up to 800,000 m^3, total based on 2017 withdrawal plus added volume due to efficiencies
TSF Tower Drains[2]	Monthly	2018	2019	Flow rate variable	Potential volume to be determined
TSF Water Recovery Wells[2]	Monthly	2018	2019	Flow rate variable	Potential volume to be determined

NOTES:

[1] Withdrawal rate for Esker Lake and Philip Lake 1 are based on Risk Factor 1 of BC Water Tool 15% maximum allowable withdrawal percentage of monthly flow rate (FLNRO 2017).

[2] Meadows Creek, TSF drains, and TSF wells are not assessed in this Application as these are water sources approved under the EAC or not requiring environmental regulatory authorization. These water sources are included to illustrate internal water recovery efforts.

2.3 AMENDMENT ACTIVITIES AND SCHEDULE

To withdraw water from Philip Lake 1 and Esker Lakes, two new water pipelines are proposed. The first is a 100 m long water pipeline (6" high-density polyethylene (HDPE) pipe) proposed for installation from Pond 1 to Esker Lakes, crossing a riparian area and upland low shrub/forb vegetation. There would be no ground disturbance, and no clearing or grubbing would be required. Approximately 200,000 m^3 of water would be withdrawn at 25 liters per second (L/s) from January 1 to March 31 in 2018. Water withdrawal would then cease and the water pipeline would be dismantled.

The second is an approximately 5.4 km long water pipeline (18" HDPE pipe) proposed for installation from Pond 2 to Phillip Lake 1. The water pipeline would be buried within the right-of-way of existing forestry access roads (2 m depth along roads, 3-3.5 m at road crossings), and through a vegetated area comprised of riparian and upland vegetation immediately adjacent to Philip Lake 1. A 30 m x 200 m (0.6 hectare [ha]) vegetation clearing would be required from the edge of the cutover to Philip Lake 1 to allow construction of the pump station and intake placement into the water. The pipeline will cross Rainbow Creek adjacent to the existing bridge (km 33 on Rainbow Road), where the exposed section will be insulated to prevent freezing. To cross the creek, the 18-inch HDPE will be placed upon a manufactured truss adjacent to, but separate from, the existing bridge crossing. To prevent sediment and erosion that could impact water quality, construction will occur during snow-covered frozen periods and there will be no vegetation clearing within 15 metres of the wetted width of Rainbow Creek. . The pipeline will have a purge valve installed near its low point at Rainbow Creek to drain into the adjacent upland forest in the event of an emergency shut down to prevent freezing. Approximately 260,000 m^3 of water would be withdrawn at up to 35 L/s from January 1 to March 31, 2018. In 2018 and 2019, approximately 1,010,000 m^3 of water would be withdrawn at up to 60 L/s from April 1 to October 31.

A 10 m x 10 m floating barge pump station will be required at the terminus end of each water pipeline. The barges will be in parts of the lakes where water depth is greater than 2 m. The maximum pump capacity at Esker Lakes is anticipated to be 200 L/s, with a sustained flow rate at 100 L/s during the planned pump test and 25 L/s from January to March 2018. The maximum pump capacity at Philip Lake is anticipated to be 100 L/s, with sustained flow rates at 35 L/s up to 60 L/s (the operational maximum of the pipeline). A diesel generator will power the pumps, rated at 57 kW and 63 kVA under 80% load. The generator will be housed to produce a constant noise level of 68 dBA. Fuel consumption under 80% load will be approximately 13.08 L/hr, producing 3.45 x 10^{-2} metric tonnes/hr in carbon dioxide emissions.

The amendment activities for construction, operations and decommissioning phases of the Project are described in Table 2-2 along with the proposed timing of the activities.

Table 2-2 Description of Project Activities, Physical Works, and Schedule

Project Activities and Physical Works	Description
Construction – December 2017 (or Immediately Upon Regulatory Approval)	
Water pipeline and pump station	• Bury water pipeline to Philip Lake along existing linear features within current mine lease area using large excavator and/or small crane along the ground surface. Soil disturbance will include a 1.5 m wide trench, 2 m deep along the alignment, and 3-3.5 m deep at road crossings. Soils and small vegetation will be compacted by equipment, with few if any trees removed along the right-of-way. • Bury water pipelines along existing linear features outside of current mine lease area and one newly cleared area near Philip Lake 1 using large excavator and/or small cranes along the ground surface. Soil disturbance will include a 1.5 m wide trench, 2 m deep along the alignment, and 3-3.5 m deep at road crossings. Soils and small vegetation will be compacted by equipment, with few if any trees removed along the right-of-way except for the clearing near Philip Lake 1. • Clear a 30 m wide by 200 m long (0.6 ha) vegetated corridor near the terminus of the water pipeline route for Phillip Lake 1 (at end of cutblock down to lake edge). No vegetation clearing is required for any other infrastructure. • The water pipelines will be designed to have continuous flow and will not require heating during the winter. The Philip Lake pipeline will be insulated at the Rainbow Creek crossing. • The crossing of Rainbow Creek occurs at approximately 33km on the Rainbow FSR. The 18-inch HDPE will be placed upon a manufactured truss adjacent to but separate from the existing bridge crossing. To prevent sediment and erosion that could impact water quality, construction will occur during snow-covered frozen periods and there will be no vegetation clearing within 15 metres of the wetted width of Rainbow Creek. . A drain at the low point near the Rainbow Creek bridge will be used to drain approximately 500 m of the water pipeline into nearby upland forest if required. • Fabricate two floating pump barges offsite, and assemble them at site. Build two generator pads from local materials. Confirm that secondary containment is in place for any fueling and maintenance activities that have the potential to result in a hydrocarbon spill. • Float water pipelines on the lakes to reach the barge • Store general and recyclable waste in on-site facility • Operate vehicles along access roads (e.g., Rainbow Road FSR, Community Connector, and smaller deactivated side FSR to access cutblock) and the project tenure area for all aspects of construction activities, including transportation of workers, construction material, equipment and waste. These roads are mainly for mine traffic (i.e., crew buses, concentrate trucks, delivery vehicles, etc.); however, the roads are also used by the public.

Table 2-2 Description of Project Activities, Physical Works, and Schedule

Project Activities and Physical Works	Description
Operations – January to October 2018	
Water extraction	• Pump water supply continuously from: o Philip Lake 1 between January 1 and March 31, 2018 at up to 35 L/s, and between April 1 and October 1, 2018 and 2019 at 60 L/s o Esker Lakes between January 1and March 31, 2018 at 25 L/s • Temporarily store pumped water in Pond 1 and Pond 2 prior to pumping to TSF using existing electric pumps • Operate diesel generator as power supplies for pumps • Operate vehicles along access roads and in the project tenure area for monitoring, maintenance of the water pipelines and pump station including fueling activities.
Decommissioning – Fall 2019	
Decommissioning and Reclamation	• Cease water withdrawal on April 1, 2018 for Esker Lakes and October 1, 2019 for Philip Lake 1 • Dismantle infrastructure for: o Esker Lakes - end of 2018 o Phillip Lake 1 – end of 2019 unless Philip Lake 1 is identified as a viable long-term source of water and its use is approved through a future amendment to the EAC. • Dispose dismantled facility components at on-site facilities • Operate vehicles along access roads and in the project tenure area • Manage cleared areas consistent with Project commitments for progressive reclamation outlined in section 3.9 of the EAC Application

2.4 INTERNAL WATER RETRIEVAL EFFORTS

To reduce demands on external water sources, TCMC has established a water recovery plan within the TSF to maximize the available water for mill operation. TCMC is currently in the process of pumping water from five of seven decant basin underdrain towers (BUT) within the TSF. The two BUT's not being utilized are non-functional due to lack of water in those areas. The BUT's are designed to improve dam stability and while they were not intended as a water source, TCMC estimates the drains could supply up to 750,000 m^3 prior to the 2018 freshet. These drains can be used to provide water for a short duration, but will not provide enough water to support mill processing through to spring freshet.

As previously noted, TCMC suspects water may be trapped directly underneath the TSF. The landscape underneath the TSF has undergone several periods of glaciation, leaving behind strata and inter-layered sands and gravel. TCMC believes water may have percolated into these gravel lenses prior to the placement of tailings on the basin of the TSF. The placement of tailings on the basin of the TSF would eventually plug or "blind" off these gravel lenses to prevent

additional water from seeping into them. Groundwater monitoring by TCMC shows no trace of further seepage outside of the TSF system. As part of the investigation, five water recovery wells have been drilled into the gravel lenses to extract potential make-up water for the TSF. TCMC will pump as much water as possible from these wells and plans to utilize these waters as the priority for mill processing, minimizing the potential for use of water from Esker and Philip Lake 1. Initial flow rates from the wells have been variable, with a range of nil to 30 L/s. Preliminary pump tests show positive results and as much as 68 L/s combined may be able to be utilized. A hydrogeological investigation program has recently commenced; one component of this program is to assess the potential of this water source. This internal water from the TSF further mitigates the volumes required from outside resources, however the security of the volumes of water in these internal resources is as yet unknown. For this reason, external resources are still required at least as a contingency. In the original approved EA Certificate, there has always been a need to supply the mine with additional make-up water from an external outside resource.

As part of the evaluation for suitable water sources, TCMC also considered Heidi Lake and Rainbow Creek. During pre-Application consultation activities, Nak'azdli Whut'en advised against water withdrawals from Rainbow Creek due to potential adverse aquatic and terrestrial ecological effects. They also expressed concerns with taking water from Heidi Lake due to its small volume and potential impacts to the rainbow trout inhabiting the lake. As a result of this feedback, TCMC is no longer pursuing Rainbow Creek or Heidi Lake as potential water sources.

3 AMENDMENT PROCESS

A draft Amendment Application Information Requirements (dAAIR) was prepared and submitted to Nak'azdli Whut'en, McLeod Lake Indian Band and Takla Lake First Nations on October 11, 2017 for their preliminary review and comment. A revised version of the dAAIR was submitted to the EAO, Major Mines Permitting Office (MMPO), and the same Indigenous groups on November 1, 2017. The dAAIR was provided to Working Group members on November 9, 2017 for review and comment, and TCMC has responded to all comments received. Based on feedback from the Working Group, TCMC updated the document, and the final Amendment Application Information Requirements (AAIR) was then issued by the EAO on December 4, 2017. Based on feedback received to date and a review of the EAO document "Seeking an Amendment to an Environmental Assessment Certificate" (EAO, 2016) the proposed changes to the Project are considered to be consistent with a 'typical' class of amendment.

Upon submission to the EAO, this Application will be reviewed against the AAIR. If the Application is considered by the EAO to meet the requirements of the AAIR, it is expected that the Application will be provided to Working Group members and MMPO's Mine Review Committee for review and comment. At the EAO's discretion, the amendment process may include Working Group meetings or calls. TCMC will be required to track and provide adequate

responses to issues and concerns raised by Working Group members and the Mine Review Committee regarding the Application.

The EAO will then prepare an assessment report that will include revised or new conditions as necessary. The report will be reviewed by Working Group members (including First Nations), the Mine Review Committee, and TCMC. Upon completion of the review of the assessment report, documents will be finalized and referred to the EAO's Executive Director for a decision whether to issue the amendment.

4 ASSESSMENT METHODS

The assessment methods for the Application follows a staged process. The first stage identifies the potential for interactions between changes in this amendment and environmental, economic, social, heritage and health pillars. Where interactions are characterized as no interaction or negligible, a rationale is provided. Table 4-1 identifies valued components (VCs) and provides the rational for their inclusion or exclusion in the Application.

Table 4-1 Interactions with Proposed Project Changes

Valued Components	Section of EAC Application	Interaction with Proposed Change	Carried Forward in Assessment	Rationale
Environment Pillar				
Terrain, Soils and Geology	5.2	Yes	Yes	The water pipeline will be buried within right-of-ways and cut-blocks resulting in ground disturbance from trenching and cover of the pipeline, and placement of pump infrastructure will require the clearing of an area near Philip Lake 1. As a result, there is potential for the proposed work to interact with terrain, soils, and geology.
Climate and Air Quality	5.3	No/negligible	No	The additional diesel generators, pump stations, and emissions from the construction of the 5.4 km pipeline were assessed qualitatively but not carried forward in the assessment for the following reasons: • The potential effects on air quality associated with construction of the 5.4 km pipeline are similar to those associated with the operation of the Project, albeit very much smaller in magnitude and duration. As such the potential residual and cumulative effects from construction of the pipeline are unchanged from the original assessment and are predicted to be not significant. • The potential effects on air quality associated with operation of the 10 m x 10 m floating barge pump stations and diesel generators rated at 57 kW and 63 kVA under 80% load are similar to those associated with the operation of the Project, albeit very much smaller in magnitude and duration. Emissions of particulate matter and gaseous criterial air contaminants (primarily NO_X and SO_2) are small given each generator consumes approximately 13 l of diesel fuel per hour. Emissions of GHG are similarly small, estimated at 34.5 kg/hour. As such the potential residual and cumulative effects of operation of the diesel generator are unchanged from the original assessment and are predicted to be not significant.
Noise	5.4	No/negligible	No	Potential effects on the acoustic environment related to the additional diesel generators and pump stations, and emissions from the construction of the 5.4 km pipeline were assessed qualitatively but not carried forward in the assessment for the following reasons: • The potential effects on the acoustic environment associated with construction of the 5.4 km pipeline are similar to those associated with the operation of the Project, albeit very much smaller in magnitude and duration. As such the potential residual and cumulative effects from construction are unchanged from the original assessment and are predicted to be not significant. • The potential effects on the acoustic environment associated with operation of the 10 m x 10 m floating barge pump stations and diesel generators rated at 57 kW and 63 kVA under 80% load are similar to those associated with the operation of the Project, albeit very much smaller in magnitude and duration. The generator will produce a constant noise level of 68 dBA which will not have a significantly adverse effect on the acoustic environment in the remote setting. As such the potential residual and cumulative effects of operation of the diesel generator are unchanged from the original assessment and are predicted to be not significant.
Water Resources	5.5	Yes	Yes	Extraction of make-up water has the potential to affect water resources and will require an approval for the short-term use of water.
Fisheries and Aquatic Resources	5.6	Yes	Yes	Extraction of make-up water and installation of water pipeline infrastructure has the potential to affect fish and fish habitat. A federal authorization under Section 35(2) of the *Fisheries Act* may be required.
Vegetation and Plant Communities	5.7	Yes	Yes	Extraction of make-up water and installation of water pipeline infrastructure has the potential to affect vegetation and plant communities.
Wildlife and Wildlife Habitat	5.8	Yes	Yes	Extraction of make-up water and installation of water pipeline infrastructure has the potential to affect wildlife and wildlife habitat.
Heritage Pillar				
Archaeology and Heritage Resources	5.9	Yes	Yes	Water pipeline will be buried, with ground disturbance associated with trenching and cover within road right-of-ways, cut-blocks, and a cleared area near Philip Lake 1 where pump infrastructure will be placed. A portion of the proposed route near Philip Lake 1 has not been subject to in-field archaeological assessment and has unconfirmed potential for archaeological resources. As a result, there is a potential for interaction with archaeology and heritage resources.

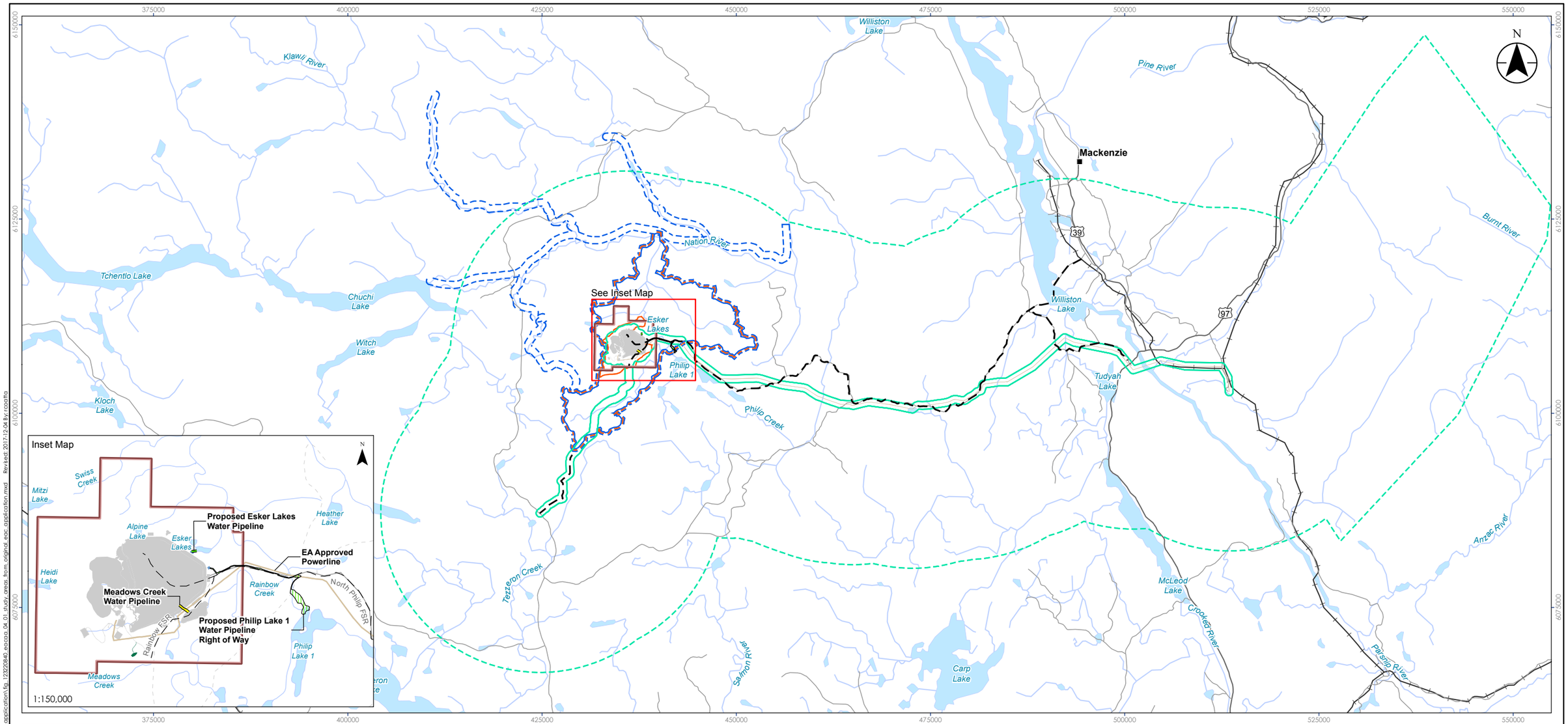
Table 4-1 Interactions with Proposed Project Changes

Valued Components	Section of EAC Application	Interaction with Proposed Change	Carried Forward in Assessment	Rationale
Social and Economic Pillar				
Social and Economic	5.10	No/negligible	No	Expenditures and workforces required to construct and operate the water pipeline infrastructure is negligible in comparison to overall Project expenditures and workforce requirements assessed in the original EA. Addition of these proposed amendment works components is anticipated to have a negligible interaction with social and economic conditions.
Non-traditional Land Use	5.11	No/negligible	No	The Esker Lakes infrastructure falls within the Project's existing license to cut (L50834) and mining lease (631503); no other active Crown tenures fall within this area (Appendix B). Negligible interactions are associated with the construction of these Project components and non-traditional land use. The Philip Lake water pipeline falls outside the Project's license to cut and mining lease. Clearing of lands outside the Project's license to cut will be minimal and will remove negligible volumes of timber from the regional timber supply area. Siting of the water pipeline parallel to existing cleared land associated with the Project's electric power line (license; Crown lands file 7408866), existing resource roads, and within existing cutblocks (retired status) will reduce overall land clearing associated with the Project. The water pipeline also intersects a notion of interest (NOI) for a gas and oil pipeline (interest holder – Ministry of Natural Gas Development; Crown Lands File 6408710) and a right-of-way (ROW; interim license) for the Prince Rupert Gas Transmission Project (Crown Lands file 9708458). Project use of overlapping lands within the NOI and ROW outside of its existing license to cut and mining lease could be incompatible with other tenured land uses. To this, engagement with affected interest holders is anticipated to reduce the magnitude of potential interactions to negligible levels. Changes in access to lands used for guiding (certificate 701117), trapping (ID TR0728T004), and non-tenured recreation (e.g., consumptive and non-consumptive recreation) are anticipated to have a negligible interaction with non-tenured land use as the Esker Lakes infrastructure fall within the Projects existing mining lease (this area is already designated for mining-related activities), while the Philips Lake infrastructure will be primarily located near, or parallel to, existing disturbances (e.g., the Project's electric power line, forestry roads, and cutblocks [retired status]) reducing the clearing of land and introduction of linear disturbances.
Visual and Aesthetic Resources	5.12	No/negligible	No	The water pipelines and pump infrastructure will be located primarily within the Project's existing license to cut or mining lease and parallel to existing disturbed linear features. The clearing of land (0.6 ha) and installation of the pump station outside the current mine lease at Philip Lake will have negligible interactions on visual and aesthetic resources due to the limited use of the area, and the nearest park, tourism use area or forest recreation site being located approximately 10 km east of the Project site. Based on the assessment of visual and aesthetic resources in the original EA and associated mitigation measures, it is anticipated that the potential interactions with the proposed amendment works will be negligible.
Navigable Waters	5.15	No/negligible	No	The water pipeline and pump infrastructure has no or negligible potential to interact with navigation of the waterways.
Health Pillar				
Environmental Health	5.13	No/negligible	No	Operation of this capacity of water intake infrastructure was assessed as part of the original EA. It is anticipated that the proposed changes would not result in chemical emissions not already assessed in the original EA. As such, no or negligible interactions are anticipated with environmental health.
Human Health	5.14	No/negligible	No	Operation of this capacity of water intake infrastructure was assessed as part of the original EA. It is anticipated that the proposed changes would not result in chemical emissions not already assessed in the original EA. As such, no or negligible interactions are anticipated with human health.

Based on the rationale presented in Table 4-1, the following VCs are carried forward for further assessment:

- Terrain, Soils and Geology
- Water Resources
- Fisheries and Aquatic Resources
- Vegetation and Plant Communities
- Wildlife Resources
- Archaeology and Heritage Resources

The spatial boundaries from the original EAC Application for these VCs are presented on Figure 4-1.



Inset Map

- City, Town, Village, or District Municipality
- Highway
- Road
- Gravel Road
- Railway
- Watercourse
- Waterbody
- Mining Lease (631503)
- Water Pipeline
- EA Approved Powerline
- EA Approved Project Components
- Proposed Water Pipeline
- Proposed Water Pipeline Right of Way

Original EAC Application Local Study Areas:
- Vegetation/Wildlife
- Water Resources
- Fisheries and Aquatics

Original EAC Application Regional Study Areas:
- Vegetation/Wildlife
- Water Resources
- Fisheries and Aquatics

0 5 10 15 20 km

1:500,000 (At original document size of 11x17)

MOUNT MILLIGAN
centerra GOLD

Stantec

Project Location
NTS Grid: 093O04
BCGS Grid: 93O.011

Project Number 123220840
Prepared by RCOATTA 20171117
Discipline Review by JMUNDY 20171124
GIS Review by NPUREWAL 20171201

Client/Project
Thompson Creek Metals Company Inc.
Mount Milligan Mine
Environmental Assessment Certificate Amendment Application

Figure No. **4-1**

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Title
Study Areas from Original EAC Application

Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Data Source: DataBC, Government of British Columbia; Natural Resources Canada; Thompson Creek Metals Company Inc. TCMC
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The second stage of assessment involves evaluating interactions for their potential to affect the conclusions presented in the EAO's Assessment Report (2009), and Amendment Assessment Reports (2013, 2017) with respect to the characterizations of residual effects and determinations of significance (Section 5) for these VCs.

Potential interactions are characterized as follows:

- Interactions that do not have potential to affect residual effects characterizations or significance determinations, in consideration of existing Project commitments.
- Interactions requiring further assessment to evaluate potential changes to the characterization of residual effects and/or significance determination. This may result in the development of new mitigation measures or conditions on the EAC.

A rationale is provided for the determination that an interaction does not require a change to previous assessment conclusions. For any such interactions, no changes to the spatial boundaries from the original EAC Application are required.

For interactions with the potential to change previous assessment conclusions, the Application presents an effects assessment that includes the following steps:

- **Mechanisms**: describe how the proposed changes to the Project could result in interactions with environmental, economic, social, heritage, or health effects not included in the original EA.
- **Mitigation**: describe mitigation measures to reduce or eliminate potential adverse effects.
- **Characterization of residual effects**: describe if and how the changes to the Project alter the characterization of residual effects set out in the original EA in terms of the metrics presented in section 3.1.5.3 of the EA (e.g., magnitude, spatial extent, duration, etc.). This may require updates to the local and/or regional study area for the value component to encompass potential changes to the extent of effects.
- **Significance determination**: provide a determination of whether there are required changes to the significance determinations for the Project, as presented in the EAO's Assessment Report (2008) and Amendment Assessment Reports (2013, 2017).

A cumulative effects assessment will be conducted if the proposed changes adversely alter the characterization of residual effects from the EA (e.g., an effect changes from being low magnitude to moderate magnitude or from being reversible to being permanent).

The assessment methods noted above are consistent with the EAO's *Guideline for the Selection of Valued Components and Assessment of Potential Effects* (EAO 2013b).

5 ASSESSMENT OF POTENTIAL EFFECTS

5.1 TERRAIN, SOILS AND GEOLOGY

The assessment of interactions with terrain, soils and geology related to the changes in this amendment is consistent with the approach in Section 5.4 of the EAC Application. The potential changes are located within the terrain, soils and geology regional study area reflected in Section 4.2 and 5.2 of the EAC Application, and within the terrain, soils and geology local study area except for the eastern section of the water pipeline to Philip Lake 1, which is located outside the terrain, soils and geology local study area but within the regional study area.

Section 5.2.3 of the EAC Application identifies valued ecosystem components that were evaluated for Terrain, Soils and Geology. Many of these valued ecosystem components are not affected by activities associated with the construction and operation of the water pipeline and construction and operation of the associated pumphouse as there is no disturbance of the bedrock geology, no alteration of the landform surface, no permanent loss of soil cover, and limited ground disturbance. These valued ecosystem components include:

- Physiography and topography
- Surficial geology
- Soil Cover
- Geochemistry e.g., ML/ARD
- Natural hazards
- Terrain stability

The valued ecosystem component identified in Section 5.2.2 of the EAC Application that has the potential to be affected by activities associated with construction of the water pipeline, specifically burying the pipe, is:

- Soil quality

The EAC Application did identify potential effects on the environment when surficial geology, bedrock, or soils are disturbed or used for any phase of the project. It is not anticipated that the burying of a water pipeline will result in effects to surficial geology or bedrock, and will be limited to:

- Erosion in relation to altered drainage in all parts of the proposed development

The Assessment Report (EAO 2009) determined that, considering the application of mitigation measures and reclamation activities at Project closure, residual effects to terrain, soils and geology are not significant.

The potential interactions with terrain, soils and geology associated with the changes in this amendment are characterized in Table 5-1.

Table 5-1 Potential Project Interactions with Terrain, Soils and Geology

Project Activities and Physical Works	Terrain, Soils and Geology Interaction
Construction	
Water pipeline and pump station	Interaction has no potential to alter the residual effects characterizations or significance determinations made in the Assessment Reports and is not carried forward in the assessment. As the pipeline corridors follow existing linear disturbances for the majority of their alignments, this activity will require very limited ground disturbance (approximately 0.6 ha) to facilitate construction access to Philip Lake 1, and no new soil disturbance for access to Esker Lakes. Sediment and erosion control measures will be implemented in areas where soils are disturbed for construction (per Section 6.3.7.4 of the 2008 EAC Application). In consideration of existing Project commitments, the additional ground disturbance to the Project is of a very small magnitude.
Operations	
Water extraction	Interaction has negligible potential to alter the residual effects characterizations or the determination of no significant effect made in the Assessment Report and is not carried forward in the assessment. As outlined in Assessment of Potential Effects to Water Resources (Section 5.1), proposed water extraction is predicted to result in no change to water depth at Esker Lakes (as extracted water will be replaced by groundwater) and a small (approximately 2 cm) decrease in water depth at Philip Lake 1 from January to October 2018 and from April to October 2019, with extracted water replaced primarily by surface water. This change is considered within the natural variability for Philip Lake 1 water levels. As such, hydrologic conditions in wetland soils (change in soil quality from changes in soil moisture) is not expected to change as a result of the amendment activity.
Decommissioning	
Decommissioning and Reclamation	After water pipeline and pump station infrastructure is removed, salvaged soils will be replaced and revegetated as outlined in the Section 3.9 of the EAC Application.

Adherence to existing mitigation measures described in the Assessment Reports and the Table of Proponent Commitments of EAC #M09-01 are expected to result in no changes to the characterization of residual adverse effects or alter the determination of no significant effect for terrain, soils and geology.

5.2 WATER RESOURCES

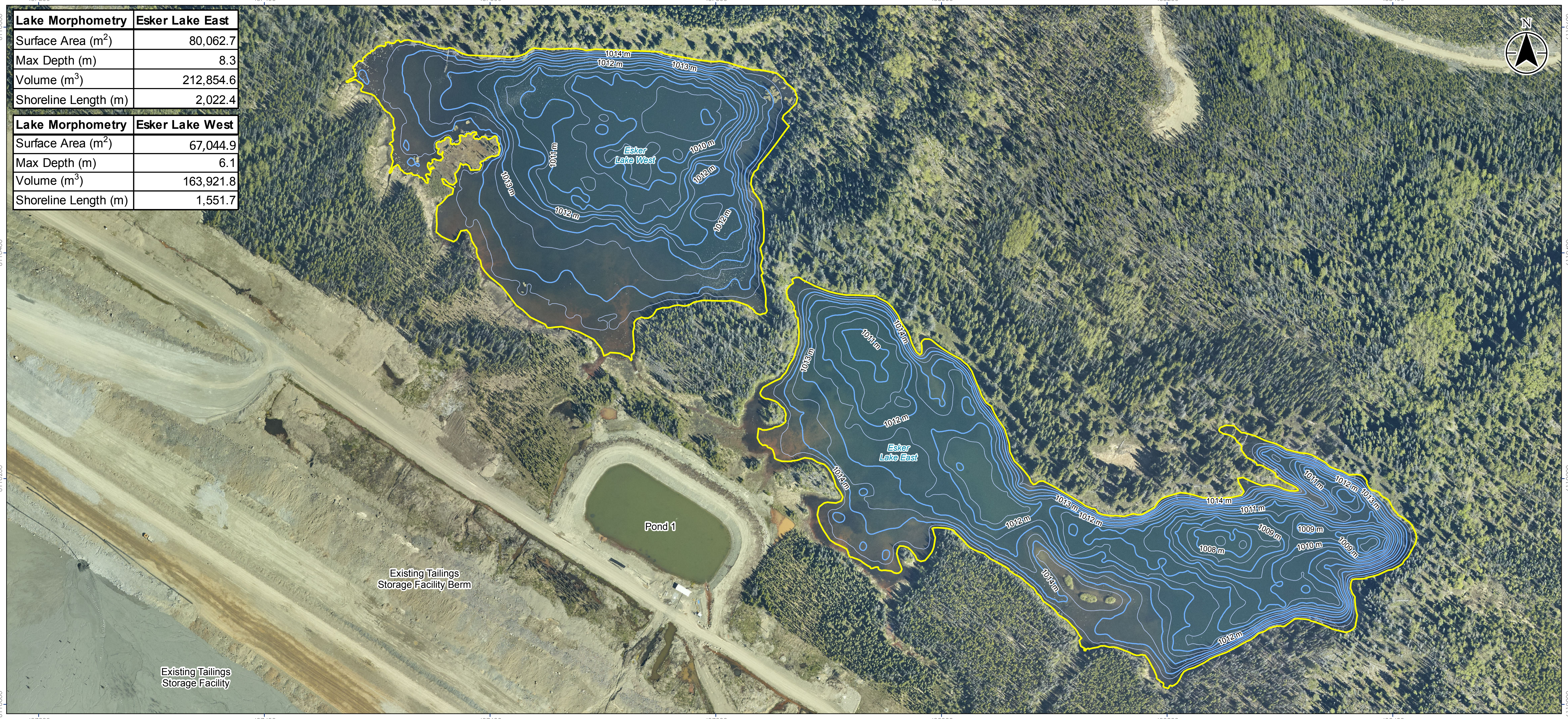
The assessment of project interactions with Water Resources is consistent with the scope in Section 5.5 of the EAC Application except for the proposed water withdrawals from Esker Lakes and Philip Lake 1, and their associated infrastructure (see Figure 2-1).

Water withdrawals from Esker Lakes were considered as a potential contingency water supply during consecutive dry-water years for the original assessment. However, the potential effect of contingency water withdrawals from Esker Lakes on water resources in Rainbow Creek was not assessed; Esker Lakes do not have surface inflows or outflows but are part of the regional groundwater system that has a potential to contribute baseflows to Rainbow Creek. Esker Lakes consists of two small lakes, Esker Lake West and Esker Lake East. Recent bathymetry was conducted of both lakes and the bathymetric contour maps are provided in Figure 5-1. Esker Lake West contains 163, 922 m^3 of water and has a maximum depth of 6.1 m. Surface area of the lake is 67, 045 m^2 and a shoreline length of 1,552 m. Esker Lake East contains 212, 855 m^3 of water and has a maximum depth of 8.3 m. Surface area of the lake is 80, 063 m^2 and a shoreline length of 2,022 m.

Water withdrawal from Philip Lake 1 was not included as part of the Project Description submitted with the original EAC Application. Therefore, effects to Water Resources in Philip Lake 1 were not assessed. As Philip Creek drains Philip Lake 1, it will also be assessed in this application. Recent bathymetry was conducted of Philip Lake 1 and the bathymetric contour maps are provided in Figure 5-2. Philip Lake 1 contains 5,339,760 m^3 of water and has a maximum depth of 10.1 m. Surface area of the lake is 2,015,447 m^2 and it has a shoreline length of 17,415 m.

Water withdrawal from Meadows Creek was assessed in the EAC Application and approved in the EAC. Therefore, water withdrawal from Meadows Creek is not assessed in this amendment to the Application. Changes to the potential interactions with water resources associated with the changes in this amendment are outlined in Table 5-2.

The assessment of potential effects to water resources related to water withdrawals from Esker Lakes and Philip Lake 1 has been conducted using the best available information at the time of this writing. This process has necessarily required the use of modelled groundwater and hydrologic data, and results of recent channel surveys and discharge measurements. As a result, these data introduce a degree of uncertainty into the assessment. TCMC will manage this uncertainty by actively monitoring groundwater levels and water levels in Esker Lakes, stream flows in Lower Rainbow Pond; and lake levels in Philip Lake 1 and streamflow and habitat in Philip Creek throughout 2018 and 2019. This monitoring program will provide data that TCMC will actively use to manage pumping rates, durations, and timing such that the identified effect thresholds will not be exceeded. Additional details are provided in the Operational Adaptive Management Plan (Appendix E).



Lake Morphometry	Esker Lake East
Surface Area (m^2)	80,062.7
Max Depth (m)	8.3
Volume (m^3)	212,854.6
Shoreline Length (m)	2,022.4

Lake Morphometry	Esker Lake West
Surface Area (m^2)	67,044.9
Max Depth (m)	6.1
Volume (m^3)	163,921.8
Shoreline Length (m)	1,551.7

Esker Lakes Outline (1014.9 m Elevation)

Esker Lakes Bathymetry Countour (1 m Interval)

Esker Lakes Bathymetry Countour (0.5 m Interval)

0 50 100 150 m

1:3,500 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 10N
2. Data Source: DataBC, Government of British Columbia; Natural Resources Canada; Thompson Creek Metals Company Inc. TCMC; Bathymetry source data provided by DWB Consulting Services Ltd.
3. This document is provided by Centerra Gold (CG) for use by the intended recipient only. This information is confidential and proprietary to CG and is not to be provided to any other recipient without the written consent of CG.

Project Location
NTS Grid: 093O04
BCGS Grid: 93O.011

Project Number 123220840
Prepared by RCOATTA 20171130
Discipline Review by DLUZI 20171201
GIS Review by NPUREWAL 20171201

Client/Project
Thompson Creek Metals Company Inc.
Mount Milligan Mine
Environmental Assessment Certificate Amendment Application

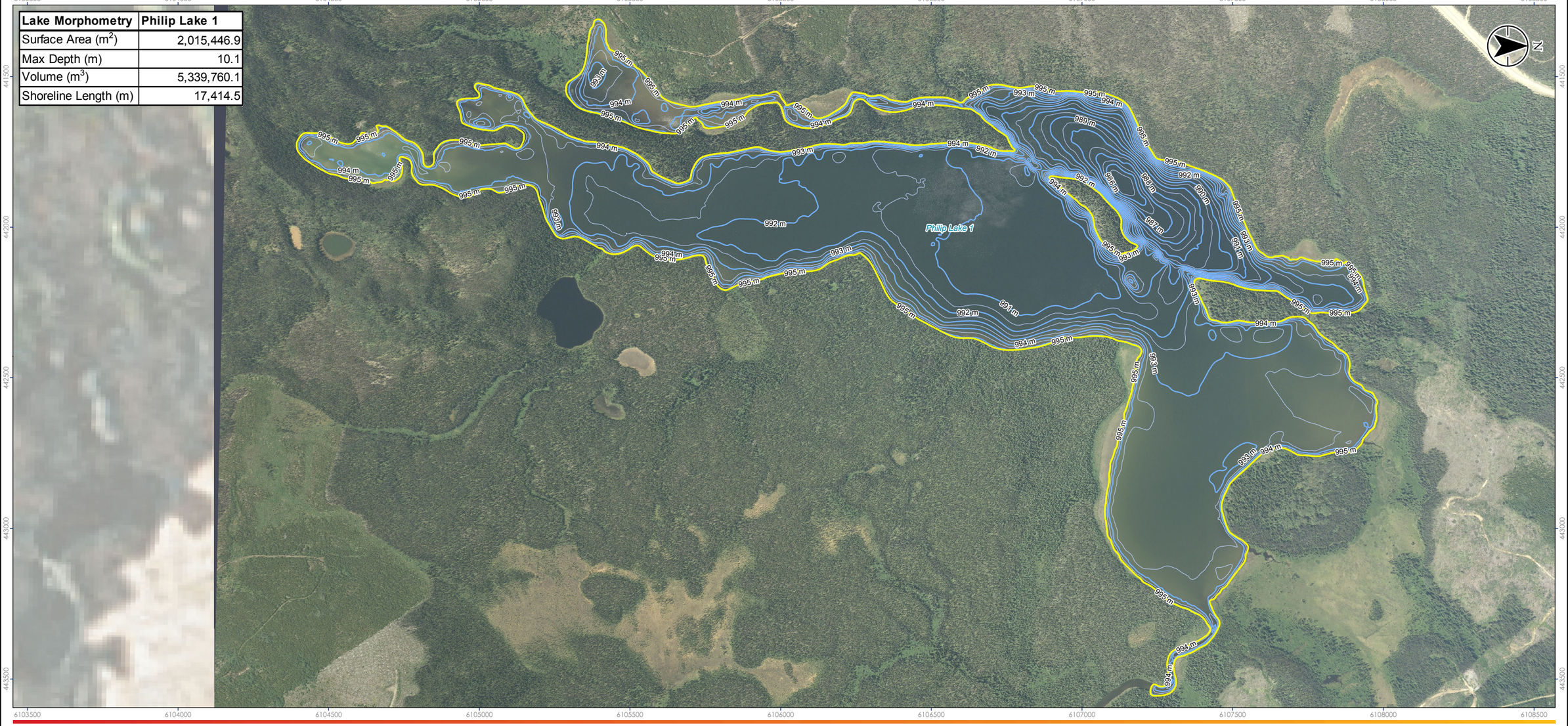
Figure No. **5-1**

Page No. 1 of 1

Title

Bathymetry and Morphometry of Esker Lakes

Lake Morphometry	Philip Lake 1
Surface Area (m^2)	2,015,446.9
Max Depth (m)	10.1
Volume (m^3)	5,339,760.1
Shoreline Length (m)	17,414.5



- Philip Lake 1 Outline (995.1 m Elevation)
- Philip Lake 1 Bathymetry Countour (1 m Interval)
- Philip Lake 1 Bathymetry Countour (0.5 m Interval)

0 100 200 300 400 500 m

1:13,000 (At original document size of 11x17)

Notes
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Stantec

MOUNTMILLIGAN
centerraGOLD

Project Location
NTS Grid: 093O04
BCGS Grid: 93O.011

Project Number 123220840
Prepared by RCOATTA 20171130
Discipline Review by DLUZI 20171201
GIS Review by NPUREWAL 20171201

Client/Project
Thompson Creek Metals Company Inc.
Mount Milligan Mine
Environmental Assessment Certificate Amendment Application

Figure No. **5-2**
Page No. 1 of 1

Title
Bathymetry and Morphometry of Philip Lake 1

\\cd1183403\Workgroup\1223\projects\123220840\figures\reports\eao_certificate_amendment_application\fig_123220840_eaoaa_05_02_hydrology_philip_lake_1_bathymetry_and_morphometry.mxd Revised: 2017-12-04 By: rcoatta

Table 5-2 Potential Project Interactions with Water Resources

Project Activities and Physical Works		Potential Interaction
Construction		
Water pipeline and pump station	Construction of a 100 m long water pipeline from Pond 1 to Esker Lakes	No interaction for groundwater and surface water quantity and quality because no water will be removed during pipeline construction. Construction of the pipeline at Eskers Lake will not involve ground disturbance or clearing of vegetation. The concrete pad for the generator will be placed outside of the riparian zone and therefore there will be no erosion and/or release of total suspended solids due to heavy machinery into surface water.
	Construction of a 5.4 km long water pipeline from Pond 2 to Philip Lake 1	No interaction for groundwater and surface water quantity or groundwater quality because no water will be removed and no discharges that could affect groundwater quality. Interaction for surface water quality requires further assessment because the water pipeline requires clearing of riparian vegetation along the banks of Philip Lake 1 and crossing of Rainbow Creek, which may cause erosion and sediment loading, increasing total suspended solid concentrations in surface water.
Operations		
Water extraction	Pumping up to 200,000 m^3 of water from Esker Lake West and Esker Lake East between January 1 and March 31 in 2018 at continuous rates of 11 L/s and 14 L/s, respectively	No interaction for surface water quantity and quality and groundwater quality because there will be no drawdown of surface water and no discharges that could affect water quality. Interaction for groundwater quantity requires further assessment because Esker Lakes are groundwater-fed and drain downslope, via groundwater, to Rainbow Creek. Groundwater withdrawals from Esker Lakes may affect summer and winter inflows to the Lower Rainbow Pond which was constructed downslope from Esker Lakes.

Project Activities and Physical Works		Potential Interaction
Water extraction (cont'd)	Pumping water from Philip Lake 1 between January 1 and October 31 in 2018 and between April 1 and October 31 in 2019 at a maximum withdrawal rate of 60 L/s during spring and fall freshets and up to 15% of mean monthly outflow during summer and winter low flow periods	No interaction for groundwater quantity because there will be no drawdown of groundwater. No interaction for groundwater or surface water quality because there will be no discharges that could affect water quality. Interaction for surface water quantity requires further assessment because proposed water withdrawals in winter of 2018 may affect water levels in Philip Lake 1 and flows in Philip Creek downstream of Philip Lake 1.
Decommissioning		
Decommissioning and Reclamation	Removal of the water pipeline between Pond 1 and Esker Lakes	No interaction for groundwater and surface water quantity and quality because no water will be removed and no additional ground disturbance or vegetation clearing will be required at Esker Lakes during decommissioning of the water pipeline.
	Removal of the barge, pump house, and water pipeline from Philip Lake 1	No interaction for groundwater quantity and quality or surface water quantity because no water will be removed and no discharges that could affect groundwater quality. Interaction for surface water quality requires further assessment because decommissioning of the water pipeline requires the use of heavy machinery that may cause erosion and sediment loading, increasing concentrations of total suspended solids in surface water.

5.2.1 Construction Phase

5.2.1.1 Surface Water Quality in Philip Lake 1

Construction of the water infrastructure between Philip Lake 1 and Pond 2 near the TSF will require clearing of riparian vegetation within a 30-m wide, 200-m long section located on the northern bank of the western basin of Philip Lake 1. The pipeline will cross over Rainbow Creek adjacent to an existing clear-span bridge. Clearing a large area of riparian vegetation (i.e., 30 m x 200 m) may increase bank erosion near Philip Lake, which could result in increased TSS entering Philip Lake 1, potentially affecting surface water quality. See Section 5.3.1 for potential effects of increased TSS of fish and aquatic resources during the construction phase.

The following mitigations measures will be implemented to minimize potential adverse effects of increased TSS on surface water quality in:

- Limit vegetation clearing to a 30-m wide strip within the riparian area of the lake by flagging the boundaries of the area and communicating these boundaries to heavy equipment operators prior to construction.
- An environmental monitor will be on-site during construction to confirm that riparian vegetation is not cleared beyond the flagged area
- Leave any tree stumps in the ground that do not interfere with construction or operation of the pipe or pump house
- Where possible, clear riparian vegetation during the winter when the ground is frozen
- Prohibit heavy machinery from working within 5 m of the top of bank of the lake

These erosion and sedimentation mitigation measures implemented at Philip Lake 1 are expected to be effective for limiting the amount of bank erosion and increased TSS that may occur at the water pipeline location therefore no residual adverse effects to surface water quality are anticipated to occur due to construction of the water pipeline and pump house at Philip Lake 1.

The pipeline crossing of Rainbow Creek is not expected to result in residual effects to surface water quality because the pipeline will cross the creek along its own structure adjacent to the existing clear-span bridge at the North Philip Forest Service Road crossing. No instream work will be required and only a small area of riparian vegetation will be removed at the top of each bank of Rainbow Creek, approximately 15 m from the creek edge. Therefore there is no potential for adverse effects to surface water quality of Rainbow Creek from increased TSS concentrations.

5.2.2 Operations Phase

5.2.2.1 Water Withdrawals from Esker Lakes

5.2.2.1.1 Groundwater Quantity

Pumping water from Esker Lake has the potential to reduce groundwater entering the "Lower Rainbow Pond", which was built as part of the Fish Habitat Compensation Plan offset measures (Section 5.3.2.1). The pond was built downslope of Esker Lakes and receives groundwater inflows entering the Rainbow Creek floodplain from the upslope aquifers, which includes Esker Lakes.

Water withdrawal rates from Esker Lakes would be limited to approximately 11 L/s and 14 L/s in West Esker Lake and East Esker Lake, respectively, between January 1 and March 31 in 2018. At these rates and over this duration, a total of approximately 200,000 m^3 of water would be pumped from Esker Lakes to the TSF. Previous groundwater modelling suggested that Esker Lakes could potentially supply water at a rate of 52 L/s with minimal impact to the environment. TCMC is proposing to withdraw a total of 25 L/s, which is 50% of the value presented in the EAC application.

An assessment of the potential effect of winter water withdrawals from Esker Lakes on groundwater inflows to the Lower Rainbow Pond was conducted using Edelman's solution (ILRI 1994) for estimating seepage into an open ditch within an unconfined aquifer. Inputs to this model included geologic and hydrogeologic baselines and the Site Wide Surface Water Balance prepared for the original EA Certificate Application (Water Management Consultants 2008). Assumptions used for the Edelman solution are described in Appendix D.

Based on this assessment, aquifer drawdown was predicted to extend to a maximum of 475 m from Esker Lakes. This is less than the distance between Esker Lakes and Rainbow Creek (1,100 m) and between Esker Lakes and the Lower Rainbow Pond (900 m). As a result, water withdrawals from Esker Lakes were not anticipated to have any effect on flows in Rainbow Creek or Lower Rainbow Pond (Stantec 2017). This is considered a conservative assessment because it was assumed that there would be no groundwater or surface water recharge of Esker Lakes during the water withdrawal period (i.e., the hydraulic gradient was maximized for evaluation of potential effects).

No residual adverse effects to groundwater quantity in Rainbow Creek or in the Lower Rainbow Pond are expected to occur due to the proposed winter water withdrawals from Esker Lakes because the aquifer drawdown does not extend to Rainbow Creek or the pond. Additional mitigation measures associated with the Esker Lakes withdrawals are discussed in Section 5.3.2.1. An Operational Adaptive Management Plan that outlines the strategies to mitigate uncertainties is provided in Appendix E. This plan will include pump tests in Esker Lakes in December to determine flow rates in the groundwater and recovery times in the wells. The results of these tests

will be used to determine final withdrawal rates as part of the operational adaptive management plan (Appendix E).

5.2.2.2 Water Withdrawals from Philip Lake 1

5.2.2.2.1 Surface Water Quality and Quantity

Although hydrometric stations have recently been installed at Philip Lake 1 and Philip Creek, the observed data is not of a sufficient length yet to be used for full assessment purposes. Baseline average monthly flow values for Philip Creek are shown in Table 5-3. The method used to determine the baseline flow for Philip Creek is provided in Appendix C.

Approximately 1,270,000 m^3 of water will be pumped from Philip Lake 1 to the TSF between January 1 and October 31 in 2018: (~260,000 m^3 between January 1 and March 31 and ~1,010,000 m^3 between April 1 and October 31). This is will be accomplished by pumping water at variable rates during operations, with an estimated rate of 58 L/s during the spring (May and June) freshet and fall (October) rainy period and at a rate that amounts to no greater than 15% of mean monthly discharge in January, February, March, April, July, August, and September at the Philip Lake 1 outlet (Table 5-3).

Pumping during the winter of 2018 is only being undertaken because of the current water deficit. No water will be withdrawn from Philip Lake 1 in the winter of 2019. Instead, pumping would begin on April 1 and would continue until October 31. Monthly pumping rates would be the same during these months as in 2018: maximum of 60 L/s during spring and fall no greater than 15% of mean monthly discharge at the Philip Lake 1 outlet in April, July, August and September (Table 5-3).

Table 5-3 Baseline Flows in Philip Creek and Proposed Withdrawal Rates from Philip Lake 1

Month	Baseline (m^3/s)	2018			2019		
		Proposed Withdrawal Rate (m^3/s)	Proposed Rate as Percentage of Baseline Flows (%)	New Outflow (m^3/s)	Proposed Withdrawal Rate (m^3/s)	Proposed Rate as Percentage of Baseline Flows (%)	New Outflow (m^3/s)
Jan	0.234	0.035	15	0.199	0.000	0	0.234
Feb	0.222	0.033	15	0.189	0.000	0	0.222
Mar	0.211	0.032	15	0.179	0.000	0	0.211
Apr	0.386	0.058	15	0.328	0.058	15	0.328
May	3.394	0.060	2	3.334	0.060	2	3.334
Jun	1.791	0.060	3	1.731	0.060	3	1.731
Jul	0.410	0.060	15	0.350	0.060	15	0.350
Aug	0.234	0.035	15	0.199	0.035	15	0.199
Sep	0.328	0.049	15	0.279	0.049	15	0.279
Oct	0.445	0.060	13	0.385	0.060	13	0.385
Nov	0.293	0.000	0	0.293	0.000	0	0.293
Dec	0.246	0.000	0	0.246	0.000	0	0.246

To assess the potential effect of the proposed withdrawal rates on Philip Lake 1 the decrease in outflow rate by way of Philip Creek was assessed. At the outlet of Philip Lake 1, Philip Creek has a width of 22 m and depth at thalweg of 1 m. The approximate channel slope at the head of Philip Creek, downstream from the lake is 0.0001 m/m and the Mannings roughness coefficient was estimated from field observations to be 0.04. Using the Mannings equation, the outlet channel flow area was estimated under mean monthly flow conditions. The Mannings equation was used to estimate the reduction in channel flow area (and depth) relative to a reduction in lake outflow based on the varying rates presented in Table 5-3. The corresponding reduction in flow depths are presented in Table 5-4, the maximum flow depth reduction is 0.022 m (2.2 cm) and translates to an estimated equivalent water level reduction of 2.2 cm in Philip Lake 1.

Table 5-4 Estimated Changes to Philip Lake 1 Water Depths

Month	2018 Depth Changes (cm)	2019 Depth Changes (cm)
Jan	1.65	0.00
Feb	1.50	0.00
Mar	1.50	0.00
Apr	2.20	2.20
May	0.80	0.80
Jun	1.10	1.10
Jul	2.20	2.20
Aug	1.65	1.65
Sep	1.99	1.99
Oct	2.16	2.16
Nov	0.00	0.00
Dec	0.00	0.00

Water withdrawals from Philip Lake 1 also have the potential to reduce flows in Philip Creek downstream of the lake. Five instream flow monitoring cross sections were established in Philip Creek in late October 2017. A one-dimensional hydraulic model (HEC-RAS) was developed and calibrated for Philip Creek using the channel geometry, depth and water velocity data collected at transects. Details of this model are provided in Appendix C.

Model results for the baseline conditions are presented in Table 5-5. As no withdrawals are proposed to occur in November and December in 2018 or 2019, results from those months are not provided. Table 5-5 shows the average monthly results for velocity, flow area and channel width for all five cross sections during baseline conditions. Differences between the baseline

model results and those calculated for 2018 and 2019 are provided in Table 5-6 and Table 5-7. The values presented in theses tables represent average monthly differences, using the modelled results from all five cross sections, between the baseline flow and project flows following the withdrawals. As can be seen by comparing the tables the modelled differences between baseline conditions and those during the proposed withdrawals are anticipated to be minimal relative to baseline values. Additional model results are discussed and presented in the Fish and Aquatic Resources section (Section 5.3).

Further mitigation measures to minimize potential effects to lake levels in Philip Lake and flows in Philip Creek are provided in the Operational Adaptive Management Plan in Appendix E.

Table 5-5 Modelled Baseline Results for Average Velocity, Flow Area and Channel Width in Philip Creek

Month	Velocity (m/s)	Flow Area (m^2)	Width (m)
January	0.26	1.25	7.8
February	0.25	1.22	7.8
March	0.25	1.19	7.6
April	0.30	1.64	9.4
May	0.62	5.69	13.8
June	0.50	3.85	13
July	0.31	1.69	9.5
August	0.26	1.25	7.8
September	0.29	1.51	8.5
October	0.32	1.77	7.9

Table 5-6 2018 Modelled Changes to Average Water Surface Elevation, Velocity, Flow Area and Channel Width in Philip Creek following Water Withdrawal

Month	Water Surface Elevation (m)	Velocity (m/s)	Flow Area (m^2)	Width (m)
January	0.011	0.017	0.093	0.330
February	0.012	0.008	0.095	0.484
March	0.012	0.007	0.095	0.496
April	0.014	0.018	0.135	0.340
May	0.004	0.004	0.063	0.027
June	0.006	0.006	0.077	0.060
July	0.013	0.018	0.131	0.248
August	0.011	0.017	0.093	0.329
September	0.013	0.016	0.127	0.745
October	0.013	0.014	0.128	0.288

Table 5-7 2019 Modelled Changes to Average Water Surface Elevation, Velocity, Flow Area and Channel Width in Philip Creek following Water Withdrawal

Month	Water Surface Elevation (m)	Velocity (m/s)	Flow Area (m^2)	Width (m)
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	0.014	0.018	0.135	0.340
May	0.004	0.004	0.063	0.027
July	0.013	0.018	0.131	0.248
August	0.011	0.017	0.093	0.329
September	0.013	0.016	0.127	0.745
October	0.013	0.014	0.128	0.288

Potential residual adverse effects from reduced surface water quantity in Philip Lake 1 and flow in Philip Creek are discussed in Section 5.3.2.2.

5.2.3 Decommissioning Phase

5.2.3.1 Surface Water Quality

The following erosion and sedimentation mitigation measures will be implemented during decommissioning of the water pipeline to limit the amount of bank erosion and sedimentation due to use of heavy equipment that may occur on the banks of Philp Lake 1 and Rainbow Creek:

- No additional riparian vegetation removal will be required
- TCMC will prohibit heavy machinery from working within 5 m of the top of bank at Philip Lake 1 and 15 m at Rainbow Creek
- Decommissioning will occur in winter when ground is frozen
- The barge at Philip Lake 1 will be lifted from the water by the crane and not dragged up the bank

The erosion and sedimentation mitigation measures implemented at Philip Lake 1 are expected to be effective for limiting the amount of bank erosion and increased TSS that may occur at the water pipeline location therefore no residual adverse effects to surface water quality are expected to occur during decommissioning of the water pipeline and pump house at Philip Lake 1.

No residual adverse effects on surface water quality are predicted in Rainbow Creek during decommissioning because the water pipeline will be removed from its location adjacent to the existing Rainbow FSR bridge without using heavy machinery on the slopes of the stream banks. Silt curtains will be placed along the top of the stream banks to prevent any sand or gravel from entering Rainbow Creek.

5.3 FISH AND AQUATIC RESOURCES

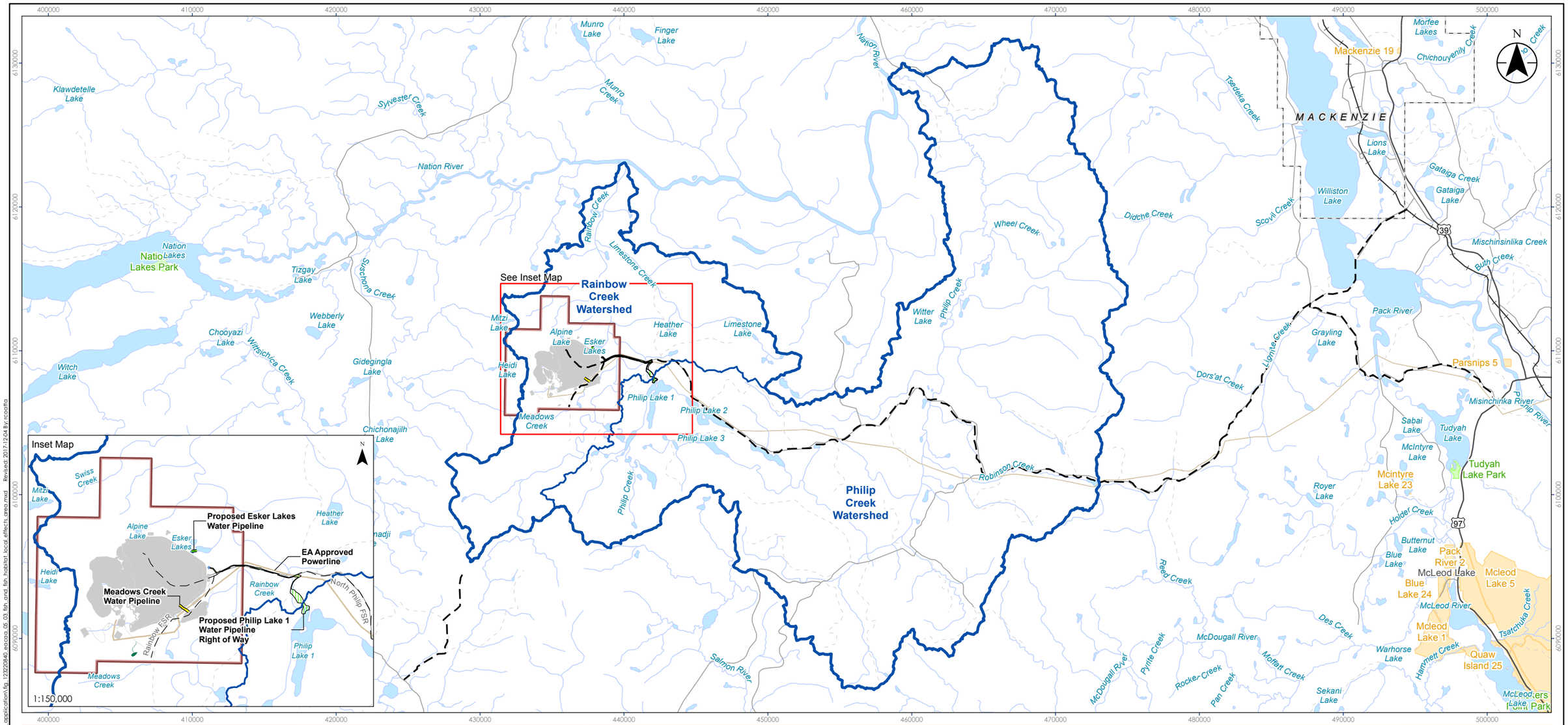
The assessment of project interactions with Fish and Aquatic Resources is consistent with the scope in Section 5.6 of the original EAC Application, except for the proposed water withdrawals from Esker Lakes and Philip Lake 1 and their associated infrastructure.

Water withdrawals from Esker Lakes were considered as a potential contingency water supply during consecutive dry-water years in the original assessment. However, the potential effect of contingency water withdrawals from Esker Lakes on fish and fish habitat in Rainbow Creek was not assessed; Esker Lakes are non-fish-bearing but contribute baseflows downslope to Rainbow Creek. Additionally, the potential effect of water withdrawals from Esker Lakes on fish and fish habitat in the Lower Rainbow Pond was not considered in the original EAC Application. This was because the Lower Rainbow Pond was not included in the conceptual Fish Habitat Mitigation

and Compensation Plan submitted as part of the original EAC Application. This pond was included in the final Tailings Impoundment Area Fish Habitat Mitigation and Compensation Plan (Terrane Metals 2012) submitted to Fisheries and Oceans Canada (DFO) in 2012. This pond was built in 2014 and relies on groundwater from the upslope aquifer, including Esker Lakes, for summer and winter inflows. For these reasons, potential water withdrawals from Esker Lakes are included in this EA amendment application (Table 5-8).

Water withdrawal from Philip Lake 1 was not included in the Project Description submitted with the original EAC Application. Therefore, potential effects to fish and fish habitat in Philip Lake 1 and Philip Creek, which Philip Lake 1 flows into, were not assessed and are included in this EA amendment application (Table 5-8). The Fish and Aquatic Resources local assessment area now includes the Rainbow Creek and Philip Creek watersheds (Figure 5-3).

This assessment of potential effects to fish and fish habitat from water withdrawals from Esker Lakes and Philip Lake 1 has been conducted using the best available information at the time of this writing. This process has necessarily required the use of modeled groundwater and hydrologic data, results of fish community surveys conducted in 2007, and a reconnaissance level habitat assessment of Philip Lake 1 and Philip Creek conducted in October 2017. Therefore, due to the lack of recent fish and fish habitat and long-term flow data, a degree of uncertainty is introduced into the assessment. TCMC will manage this uncertainty by actively monitoring groundwater levels, stream flows and water levels in Esker Lakes, the Lower Rainbow Pond, Philip Lake 1 and Philip Creek throughout 2018 and 2019. Data from this monitoring program will provide real-time data that TCMC will actively use to manage pumping rates, durations, and timing such that the identified effect thresholds will not be exceeded. Details of this Operational Adaptive Management Plan are provided in Appendix E.



Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Data Source: DataBC, Government of British Columbia; Natural Resources Canada; Thompson Creek Metals Company Inc. TCMC
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Project Location
NTS Grid: 093O04
BCGS Grid: 93O.011

Project Number 123220840
Prepared by RCOATTA 20171109
Discipline Review by BHORNE 20171130
GIS Review by NPUREWAL 20171201

Client/Project
Thompson Creek Metals Company Inc.
Mount Milligan Mine
Environmental Assessment Certificate Amendment Application

Figure No. **5-3**
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Title
Fish and Fish Habitat Local Effects Area

Table 5-8 Potential Project Interactions with Fish and Aquatic Resources

Project Activities and Physical Works		Fish and Aquatic Resource Interaction
Construction		
Water pipeline and pump station	Construction of a 100 m long water pipeline from Pond 1 to Esker Lakes	No potential interaction because Esker Lakes are non-fish-bearing
	Construction of a 5.4 km long water pipeline from Pond 2 to Philip Lake 1	Interaction requires further assessment because the water pipeline requires clearing of riparian vegetation along the banks of Philip Lake 1 and one crossing of Rainbow Creek
Operations		
Water extraction	Pumping up to 200,000 m^3 of water from Esker Lake West and Esker Lake East between January 1 and March 31 in 2018 at continuous rates of 11 Liters/second and 14 Liters/second, respectively	Interaction requires further assessment because Esker Lakes are groundwater-fed, drain downslope via groundwater, and provide baseflows to Rainbow Creek and the Lower Rainbow Pond
	Pumping water from Philip Lake 1 between January 1 and October 31 in 2018 and between April 1 and October 31 in 2019 at a maximum withdrawal rate of 60 Litres/second during spring and fall freshets and up to 15% of mean monthly outflow during summer and winter low flow periods	Interaction requires further assessment because the proposed water withdrawals in winter of 2018 may affect: • water levels in Philips Lake 1 and, therefore, survival of lake whitefish (*Coregonus clupeaformis*) eggs in the Lake • winter flows in Philip Creek downstream of Philip Lake 1 and, therefore, instream survival of mountain whitefish (*Prosopium williamsoni*) eggs and overwintering habitat quality for rainbow trout (*Oncorhynchus mykiss*) Additionally, water withdrawals in spring and summer of 2018 and 2019 may affect the spawning success and rearing conditions for rainbow trout in Philip Creek
Decommissioning		
Decommissioning and Reclamation	Removal of the water pipeline between Pond 1 and Esker Lakes	No potential interaction because Esker Lakes are non-fish-bearing
	Removal of the barge, pump house, and water pipeline from Philip Lake 1	Interaction requires further assessment because heavy machinery will be required to work in the riparian area of Philip Lake 1

5.3.1 Construction Phase

Construction of the water pipeline between Philip Lake 1 and Pond 2 near the TSF will require two activities with the potential to negatively affect fish and fish habitat: clearing of riparian vegetation on the bank of Philip Lake 1; and installation of a pipeline crossing over Rainbow Creek. The potential effects and mitigations for each of these activities is described below.

Clearing of riparian vegetation will occur in a 30 m wide section along the northern shore of the western basin of Philip Lake 1. Clearing is required to construct the pipeline and the pump station and to provide access for a crane to place an intake pipe barge in Philip Lake 1. Clearing of riparian vegetation has the potential to increase bank erosion at this location and, therefore, increase the amount of sediment entering Philip Lake 1.

Increased sediment load has the potential to increase total suspended sediment (TSS) concentrations in the water column and increase the amount of sediment settling into interstitial spaces between gravel or cobble substrates that may be present in the nearshore area of the lake at this location. Increased sedimentation in gravel substrates can reduce gas exchange in incubating eggs resulting in delayed hatching or decreased egg survival. Depending on the volume, particle sizes, and duration of sediment entering the lake, increased TSS concentrations can affect fish directly by causing abrasion of gill membranes, impairing gill respiration rates, and inhibiting their ability to find prey or to avoid predators. It may also indirectly affect fish by altering the abundance of plankton and benthic invertebrate communities that form the basis for the aquatic food web upon which fish depend.

To minimize the potential effects of riparian vegetation clearing on fish and fish habitat in Philip Lake 1, TCMC will:

- Limit vegetation clearing to a 30-m wide strip within the riparian area of the lake by flagging the boundaries of the area and communicating these limits of clearing to heavy equipment operators prior to construction.
- Provide an onsite environmental monitor during construction to confirm that riparian vegetation is not cleared beyond the flagged area
- Leave tree stumps in the ground that do not interfere with construction or operation of the pipe or pump house
- When possible, clear riparian vegetation during winter when the ground is frozen
- Prohibit heavy machinery from working within 5 m of the top of bank of the lake

These mitigation measures are expected to be highly effective for limiting potential bank erosion and sedimentation resulting from clearing of riparian areas of Phillip Lake 1 at the water pipeline location.

No residual effect to fish and fish habitat in Philip Lake 1 is expected to occur due to construction of the water pipeline and pump house. This is because the effectiveness of the proposed mitigation measures is expected to be high, the total width of the riparian clearing at the lake

shore will be <0.2% of the total shoreline length of Philip Lake 1 (17,415 m), and habitat in Philip Lake 1 at the water pipeline location is not suitable for lake whitefish spawning. Lake whitefish spawn over hard substrates, such as gravel, cobbles and boulders, at depths between 0.5 and 30 m (McPhail 2007; Begout Anras et al. 1999). In contrast, substrates in the nearshore area of Philip Lake 1 at the water pipeline location are comprised of silt and fine organics. Therefore, the number of lake whitefish eggs present in the nearshore area at the water pipeline location is predicted to be low to none.

The pipeline crossing of Rainbow Creek is not expected to result in residual effects to fish or fish habitat. This is because the pipeline will be placed on a truss located immediately adjacent to the existing clear-span bridge at the North Philip Forest Service Road crossing. Construction of the pipeline crossing will not require any in-stream work or any clearing of riparian vegetation within 15 m of the creek. Potential effects from elevated suspended solids and sedimentation on fish in Rainbow Creek will be further minimized because construction of the pipeline will occur in winter when the ground and banks are frozen.

5.3.2 Operations Phase

5.3.2.1 Water Withdrawals from Esker Lakes

Esker Lakes are non-fish-bearing and have no surface connection to any fish-bearing watercourse or water body (Figure 5-1). For this reason, there are no potential effects to fish or fish habitat in Esker Lakes due to pumping of water from Esker Lakes to the TMF during operations.

However, pumping of water from Esker Lakes has the potential to negatively affect fish and fish habitat through a reduction of groundwater inflows to Rainbow Creek and the Lower Rainbow Pond. This pond was built by TCMC to compensate for habitat losses caused by construction and operation of the mine. It was designed to provide summer rearing and overwintering habitat for rainbow trout. The pond was built downslope of Esker Lakes specifically because of groundwater inflows entering the Rainbow Creek floodplain from the upslope aquifer (Figure 5-4). This aquifer includes Esker Lakes. Therefore, pumping water from Esker Lakes may reduce the amount of groundwater entering the offset pond and, therefore, reduce the suitability of the pond for overwintering trout. This could occur if the reduction in groundwater inflows to the pond are sufficient to decrease the maximum pond depth below 0.5 m or increase the pond's retention time such that winter dissolved oxygen concentrations decrease to levels stressful or lethal for rainbow trout (i.e., <6 mg/L and <3 mg/L, respectively; Raleigh et al. 1984; Weithman and Haas 1984).

Based on the groundwater assessment provided in Appendix D and summarized in Section 5.2.2.1.1, no adverse residual effect to fish and fish habitat in Rainbow Creek or in the Lower Rainbow Pond is expected to occur due to the proposed winter water withdrawals from Esker Lakes in 2018.

Topographic Contour (5 m interval)

Forest Tenure Road

0 50 100 150 200 250 m

1:8,000 (At original document size of 11x17)

MOUNT MILLIGAN

centerra GOLD

Stantec

Project Location
NTS Grid: 093O04
BCGS Grid: 93O.011

Project Number 123220840
Prepared by RCOATTA 20171109
Discipline Review by BHORNE 20171130
GIS Review by NPUREWAL 20171201

Client/Project
Thompson Creek Metals Company Inc.
Mount Milligan Mine
Environmental Assessment Certificate Amendment Application

Figure No. **5-4**

Page No. 1 of 1

Title

Location of Lower Rainbow Creek Offset Pond in Relation to Eskers Lake

Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Data Source: DataBC, Government of British Columbia; Natural Resources Canada; Thompson Creek Metals Company Inc. TCMC
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TCMC will implement an Operational Adaptive Management Plan (Appendix E) that provides continuous data of lake levels in Esker Lakes, groundwater levels down gradient from Esker Lakes, and inflows to Lower Rainbow Pond. Data from this monitoring plan will be used to determine if water withdrawals are having a larger effect on the aquifer then anticipated and if they are reducing inflows to the pond. Should inflow volumes to the Lower Rainbow Pond decrease below 90% of baseflows currently entering the pond in winter, TCMC will commit to decreasing pumping rates and lengthening the duration of pumping, temporarily stopping pumping to allow the aquifer to recharge, or permanently stop pumping from Esker Lakes during the winter of 2018.

5.3.2.2 Water Withdrawals from Philip Lake 1

Philip Lake 1 is known to support populations of lake whitefish, mountain whitefish, rainbow trout, burbot (*Lota lota*), white sucker (*Catostomus commersoni*), northern pikeminnow *(Ptycheilus oregonensis*) and redside shiner (*Richardsonius balteatus*) (Ecofor 2007a; Appendix F). Lake whitefish and mountain whitefish are fall spawners, the former spawning primarily along rocky shorelines in lakes and the latter spawning primary over gravel/cobble riffles in streams. Burbot are winter spawners and will spawn over sand or gravel in lakes or over sand, gravel, or silt in low-velocity areas of streams and rivers (McPhail, 2007). Rainbow trout and white sucker are spring spawners. Both species typically spawn over gravel riffles in streams.

Based on the fish community in Philip Lake 1 and their known life histories and habitat preferences, pumping water from Philip Lake 1 over the winter, spring, and summer of 2018 and over the spring and summer of 2019 has the potential to negatively affect fish and fish habitat by:

- Reducing lake levels during winter when lake whitefish eggs may be present in the nearshore area of the lake
- Increasing fish morality by impinging fish on screens or entraining fish in the pumps
- Reducing flows in Philip Creek downstream of Philip Lake 1 during the winter when mountain whitefish eggs may be present in the gravels and rainbow trout may be overwintering in the pools
- Reducing flows in Philip Creek downstream of Philip Lake 1 in spring when rainbow trout are spawning
- Reducing flows in Philip Creek downstream of Philip Lake 1 in summer when rainbow trout are rearing and foraging.

These potential effects, their mitigation measures, and the likely residual effects are described below.

5.3.2.2.1 Reduced Winter Water Levels in Phillip Lake 1

Lake whitefish spawn over hard substrates, such as gravel, cobbles, and boulders, at depths between 0.3 and 30 m (Machniak 1975) between October and November (McPhail 2007). In a northwestern Ontario lake, their preferred spawning habitat was hard substrates on slopes ranging between 10% and 30% and at depths between 0.5 m and 3.5 m (Begout Anras et al. 1999). This type of habitat is present in Philip Lake 1 along the western shoreline of the main basin and around the perimeter of the island separating the main basin from the western basin of the lake (Appendix G – Philip Lake littoral habitat map). Here, clean gravel/cobble substrates extend to depths between 1 and 6 m (EDI, 2017; Appendix G) with the transition between clean gravel/cobbles and silt typically occurring at 4 m. The northern basin and southern tip of the lake could not be surveyed in October because of ice. However, it is unlikely that habitat suitable for lake whitefish spawning exists in these areas because they are <2 m deep and located adjacent to similarly shallow areas where substrates are comprised entirely of silt and fine organics.

Pumping water from Philip Lake 1 during the winter of 2018 has the potential to lower lake levels and, therefore, kill any lake whitefish eggs that may have been spawned along rocky western shoreline of the lake in fall 2017, either by dewatering or increased ice scour. Water level draw-down during the winter egg incubation period can reduce egg survival and egg densities, with associated decreases in population size (Gaboury and Patalas 1984; Cohen and Radomski 1993; DeGraaf 1993; Frisk et al. 1988).

The number of eggs killed by lake draw-down in winter depends on the magnitude of the draw-down compared to natural winter lake level variations, the depth range at which suitable spawning habitat exists in the lake, and the maximum winter ice thickness. The potential effect on the whitefish population in the lake then is dependent on the proportion of eggs potentially affected by the drawdown relative to the number of eggs spawned at depths deeper than would be affected by the draw-down. If most lake whitefish spawning habitat exists at depths that would be subject to dewatering or subjected to additional ice scour because of the winter draw-down, the effect on annual lake whitefish recruitment and, therefore, on the whitefish population would be high. Conversely, if most lake whitefish spawning habitat exists at depths greater than would be dewatered or subject to additional ice scour because of the winter draw-down, the effect on annual recruitment and, therefore, the lake whitefish population would be low.

Based on the pumping rates proposed during the winter of 2018 (Table 5-3), water levels in Philip Lake 1 are predicted to drop by approximately2 cm by the end of March (Figure 5-5 and Figure 5-6). Ice depths on lakes near the Mount Milligan Mine typically range between 70 and 90 cm depending on the duration and severity of the winter (S. Righi, TCMC, pers. comm.). This means that, under natural conditions, any lake whitefish eggs laid in <70 cm of water will be killed by ice in all years while any lake whitefish eggs laid between 70 cm and 90 cm of water would also be killed by ice in colder winters. Therefore, the predicted change in water level in Philip Lake 1 during the winter of 2018 will only result in the death of lake whitefish eggs laid within the

additional 2 cm of shoreline area that would be subject to winter draw-down due to pumping: between the 70 cm and 72 cm depth contours if the winter is relatively mild, between 90 cm and 92 cm if the winter is relatively cold or somewhere in between if the winter is "average".

Lake whitefish eggs in Philip Lake 1 will potentially be killed by the lake draw-down predicted to occur in the winter of 2018. This is because suitable spawning habitat for lake whitefish exists in Philip Lake 1 at the depth range susceptible to dewatering and ice scour caused by winter water withdrawal (i.e., 70 cm to 92 cm). However, the loss of eggs is not predicted to have a measurable effect on the lake whitefish population in Philip Lake 1. This is because the number of eggs killed by dewatering or additional ice scour will likely represent a very small proportion of the lake whitefish eggs laid in the lake in 2018.

Using the depth range and shoreline slopes at which suitable substrates for lake whitefish spawning were found along the western shoreline and the island separating the western basin from the main basin of the lake during the October survey, the area of suitable lake whitefish spawning habitat that would be dewatered or scoured by ice due to water withdrawals (302 m^2 in a mild winter and 340 m^2 in a cold winter) represents <2% of the total lake whitefish spawning habitat available in Philip Lake 1 in a mild winter (21,558 m^2) and a cold winter (18,378 m^2). This is supported by results from an experimental lake draw-down in northwestern Ontario which showed that a 2 to 3 m winter draw-down resulted in the desiccation of 56% and 70% of lake whitefish spawning sites in two consecutive years (Begout Anras et al. 1999). This is a winter draw-down at least three orders of magnitude greater than that predicted to occur in Philip Lake 1 during the winter of 2018. While this potential adverse effect to individual eggs is unavoidable, it is unlikely to result in a significant adverse effect to the lake whitefish population in Philip Lake 1.

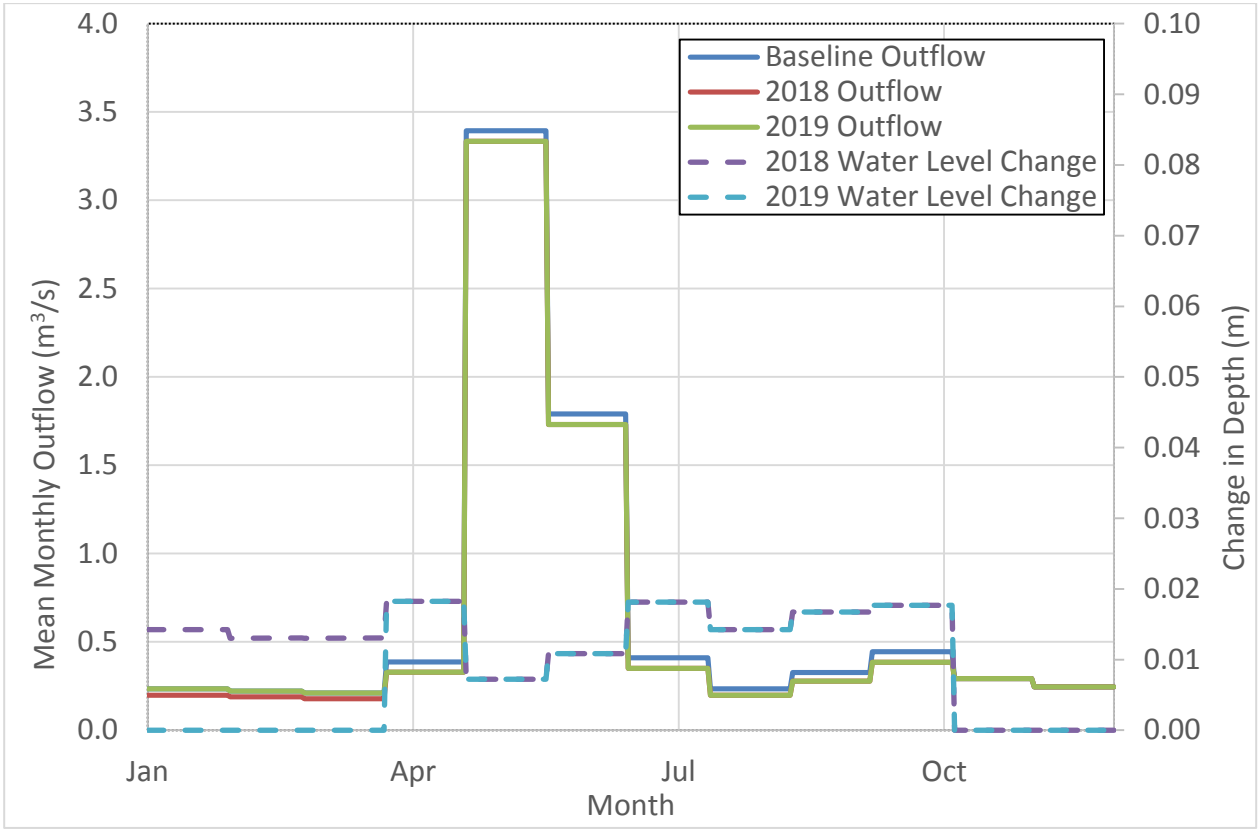


Figure 5-5 Predicted change in Philip Lake 1 outflow and water level in 2018 and 2019

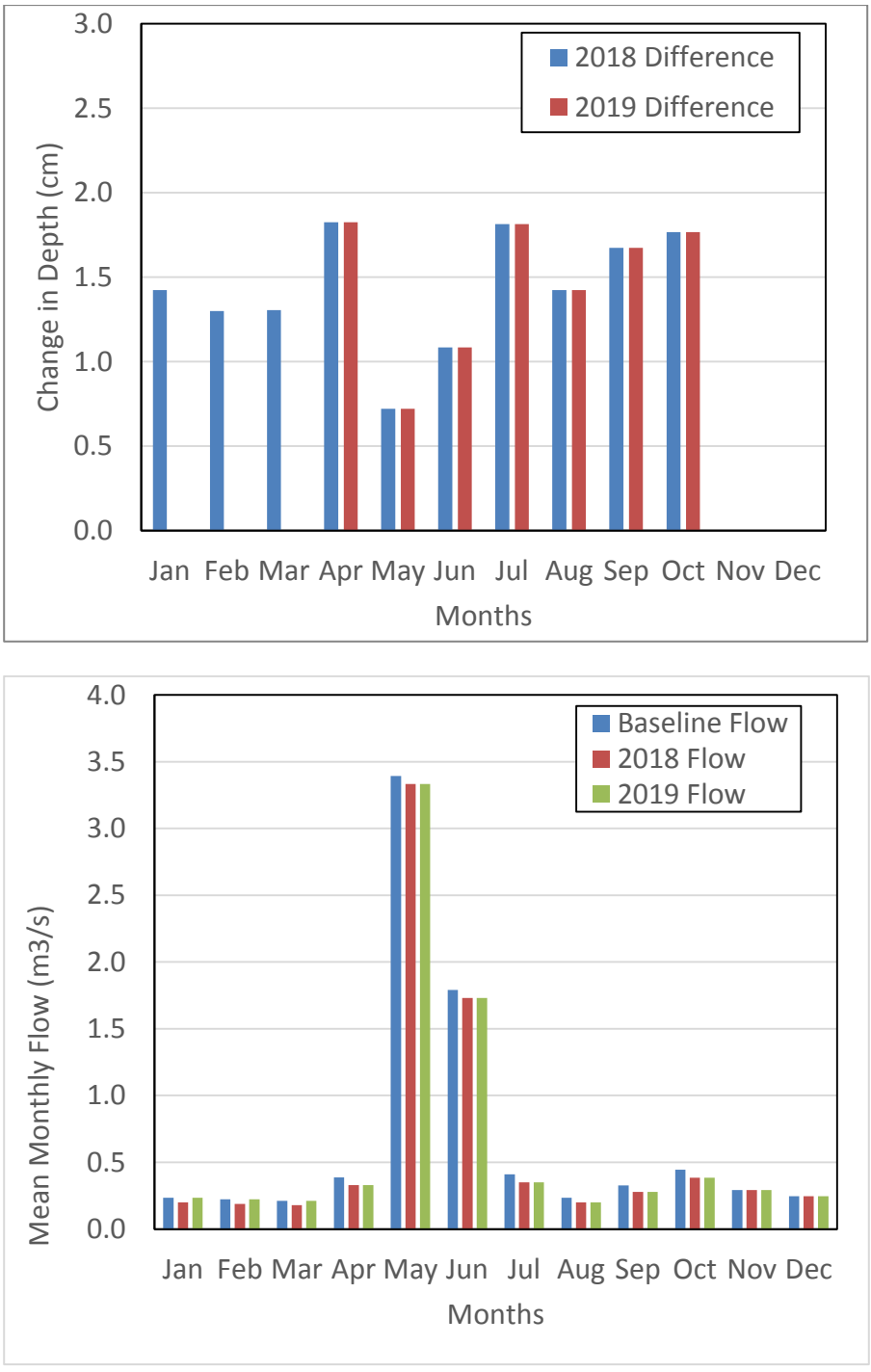


Figure 5-6 Predicted change in average depth in Philip Lake 1 (top) and average flow in Philip Creek (bottom), by month, in 2018 and 2019 compared to baseline

5.3.2.2.2 Impingement and Entrainment of Fish at Philip Lake 1 Water Intake

Screens will be installed on the end of the intake pipe placed in Philip Lake 1. These screens will be designed to meet DFO's "Freshwater Intake End-of-Pipe Fish Screen Guidelines" (DFO 1995) to minimize the number of fish mortalities caused by impingement on the screen or entrainment into the pumps. Screen and mesh size will be selected based on the total open screen area needed to maintain approach velocities < 0.038 m/s at the screen/water interface, the maximum approach velocity required to preclude impingement of juvenile (> 25 mm fork length), anguilliform swimming fish (e.g., burbot) on the screen (DFO 1995).

In addition to screens, impingement and entrainment of fish in Philip Lake 1 will be minimized by:

- Placing the intake pipe at least 30 cm above the bottom of the lake to avoid entrainment of sediment and benthic species
- Placing the intake pipe at least 15 m off-shore and in water at least 4 m in depth to avoid nearshore areas where concentrations of juvenile fish (i.e., smaller, poorer swimming fish than adults) may be higher than in off-shore areas. The northern end of the western basin of Philip Lake 1 has a maximum depth of 4 m (Figure 5-2)
- Including a manifold with screens to provide a more even distribution of water velocities across the screen surface
- Cleaning screens regularly by removing them from the water and pressure washing, manual scrubbing, or by back-washing with air or water from the pumps

Design and installation of fish screens on the end of the intake pipe is expected to be highly effective for minimizing impingement and entrainment of fish in Philip Lake 1. Fish mortalities resulting from impingement and entrainment are predicted to be low and the residual effect to fish populations in Philip Lake 1 is expected to be negligible.

5.3.2.2.3 Reduced Winter Flows in Philip Creek

Water withdrawals from Philip Lake 1 in the winter of 2018 have the potential to reduce flows in Philip Creek downstream of the lake. These flow reductions may result in stranding of mountain whitefish eggs because these eggs will have already been laid in the creek prior to flow reductions and, therefore, will be susceptible to any decreases in depth and wetted width that may occur because of water withdrawals from the lake. This is particularly true for any eggs laid in the shallowest areas of the creek such as near the stream margins or in riffles.

Mountain whitefish spawn in streams over clean gravel and cobble substrates in at least 0.15 cm of water with water velocities at least 0.15 m/sec but prefer to spawn at depths between 0.75 and 1.0 m and at water velocities between 0.5 and 1.0 m/sec (Beecher et al. 2016). Preferred spawning habitat for mountain whitefish does not exist in Philip Creek because the riffles and glides are too shallow and too slow during the mountain whitefish spawning period (October/November). However, useable spawning habitat for mountain whitefish does exist in Philip Creek in fall, primarily in glides downstream of the rock weir located approximately 1 km

downstream from the Philip Lake 1 outlet (Appendix H); riffles in Philip Creek are generally too shallow (<0.25 m maximum depth; <0.1 m average thalweg depth) in fall for mountain whitefish spawning. In comparison, average thalweg depths and water velocities in the glides in October are 0.3 m and 0.19 m/sec, respectively, with <20% fines within the cobble/gravel substrates.

Winter water withdrawals in 2018 may also affect any rainbow trout overwintering in Philip Creek. Adult rainbow trout typically move into primary pools (i.e., deep pools that span the entire channel width) with cobble/boulder substrates and woody debris in winter (Lewis 1969; Muhlfeld et al. 2001a; Meyer and Gregory 2000). Juvenile rainbow trout also move into pools with cover from woody debris and rubble (Swales et al. 1986; Bustard and Narver 1975). Preferred water depths and water velocities of adult and juvenile rainbow trout in winter are 0.15 m to 0.76 m and <0.15 m/sec (Beecher et al. 2016).

Primary pools do not exist in Philip Creek between Philip Lake 1 and Philip Lake 2. Instead, most (89%) of the habitat in Philip Creek is comprised of glides with mean depths >20 cm and cobble/gravel substrates (Appendix H). Secondary scour pools are present within the glides but they are rare and generally small with water depths <0.5 m (Appendix H). Woody debris is also relatively rare in Philip Creek. Therefore, Philip Creek, while likely not heavily used by adult rainbow trout, may provide suitable overwintering habitat for juvenile rainbow trout, particularly the two long glides that have mean depths >0.5 m. These two glides comprise 80% of the total habitat in Philip Creek.

To minimize the potential stranding of mountain whitefish eggs and the change in overwintering habitat quality for rainbow trout in Philip Creek, TCMC will limit water withdrawal rates to a maximum of 15% of mean monthly flow during the winter of 2018. This maximum withdrawal rate corresponds to a "Risk Management Level 1" for Philip Creek based on the BC Ministry of Forests, Lands, and Natural Resource Operations' (FLRNO) Environmental Risk Management Framework described in its Environmental Flow Needs Policy (BC FLNRO 2016). A stream, or specific flow period, deemed to be at Risk Management Level 1 from withdrawals means there is sufficient natural water availability for the proposed withdrawal period and that cumulative water withdrawals are below the specified threshold described in the Environmental Risk Management Framework (BC FLRNO 2016). Philip Creek and the proposed water withdrawal rates fall into the Risk Management Level 1 category because:

- Philip Creek is fish-bearing but is unlikely to support any endangered or threatened fish species listed by the federal *Species at Risk Act* (SARA) or by the BC *Wildlife Act* or support any red or blue-listed fish species in BC as listed by the BC Conservation Data Centre
- Philip Creek has not been designated as a "sensitive stream" under the BC *Water Sustainability Act* or BC *Water Sustainability Regulation*
- Mean monthly discharge in Philip Creek in January, February, and March has been modeled to be >20% of mean annual discharge (Table 5-9) which designates Philip Creek as a "low sensitivity" stream during these months for water withdrawals

- The total cumulative water withdrawal volume from Philip Creek in January, February, and March 2018 will be a maximum of 15% of mean monthly flow; there are no other water withdrawal proposals or water users on Philip Lake 1 or Philp Creek.

Table 5-9 Monthly flow sensitivity of Philip Creek in winter

Month	Modelled average monthly discharge (m^3/sec)	% of mean annual discharge[1]	Flow sensitivity category[2]
January	0.234	34%	Low
February	0.222	33%	Low
March	0.211	31%	Low

NOTES:

1 mean annual discharge in Philip Creek was estimated to be 0.683 m^3/sec

2 Flow sensitivity based on Environmental Risk Management Framework (BC FLRNO 2016) where flows ≥20% of mean annual discharge (MAD) is categorized as low sensitivity

Based on the low sensitivity of Philip Creek to winter water withdrawals and the maximum cumulative withdrawal volume of ≤15% of mean monthly flow during January, February, March, and April 2018, potential residual effects to the mountain whitefish eggs in Philip Creek due to dewatering or ice scour and to rainbow trout overwintering in Philip Creek are expected to be low. This assessment is supported by:

- For the purposes of hydrology modeling, changes in Philip Creek discharge were conservatively estimated by assuming the monthly volume of water withdrawn from Philip Lake 1 will result in an equivalent reduction in monthly discharge in Philip Creek. This is conservative because the storage volume of the lake will buffer some of the predicted change in outflow discharge. While it is not possible to predict the actual percent reduction in Philip Creek discharge until an outlet rating curve is developed, the percent reduction will not exceed 15% of mean monthly discharge.

- Baseflows in January, February, and March are predicted to decrease from 34%, 33%, and 31%, respectively, to 29%, 28%, and 26%, respectively, of mean annual discharge (0.683 m^3/sec) due to winter water withdrawals (Table 5-10). As a result, the change in quality of rainbow trout overwintering habitat in Philip Creek is expected to be small. Ideal trout streams have baseflows that represent ≥50% of mean annual discharge while baseflows between 25% and 50% are considered "fair" and baseflows <25% are considered "poor" (Raleigh et al. 1984). Therefore, winter baseflows in Philip Creek will remain within the "fair" range during the winter of 2018 with pumping

- Mountain whitefish will select areas in Philip Creek where the combination of water depth and water velocities most closely matches their preferred spawning habitat. In Philip Creek, this combination of hydraulic habitat exists most frequently in fall in the thalweg of glides. Therefore, it is likely that most mountain whitefish eggs will be laid in the deepest

part of Philip Creek, the area of the stream least likely to be dewatered by falling water levels or scoured by ice in winter (compared to riffle habitat or the stream margins). Although it is impossible to predict water depths and water velocities in the glides under the ice, this is also the area where water velocities are most likely to increase or remain constant over the winter as frazil and anchor ice along the shoreline concentrates flow into the middle of the channel.

Potential effects to mountain whitefish and rainbow trout in the winter of 2019 do not exist because winter water withdrawals from Philip Lake 1 will not be required. Instead, water withdrawals will start in April at the beginning of the spring freshet.

Table 5-10 Baseline and predicted winter flows in 2018 in Philip Creek

Month	Baseline Conditions		With Project	
	Modelled average monthly discharge (m^3/sec)	% of mean annual discharge[1]	Predicted average monthly discharge (m^3/sec)	% of mean annual discharge[1]
January	0.234	34%	0.199	29%
February	0.222	33%	0.189	28%
March	0.211	31%	0.179	26%

NOTES:

[1] mean annual discharge in Philip Creek was estimated to be 0.683 m^3/sec

5.3.2.2.4 Reduced Spring Flows in Philip Creek

Rainbow trout are spring spawners, preferring to spawn in gravel riffles or pool tail-outs with depths between 0.25 and 0.35 m (Beecher et al. 2016) and water velocities between 0.3 and 0.7 m/sec (Raleigh et al. 1984). Although rainbow trout will spawn in areas with deeper water and lower water velocities, habitat with water depths <0.10 m, water velocities <0.10 m/sec or >1.0 m/sec, or with more than25% fines in the gravel substrates is unsuitable for rainbow trout spawning (Raleigh et al. 1984).

A one-dimensional hydraulic model (HEC-RAS) was developed for the longest of the three riffles in Philip Creek using the channel geometry, depth and water velocity, and substrate data collected at transects in October 2017. There are no pools in Philip Creek so transects could not be established in any pool tail-outs.

Based on this model, under natural baseline conditions, the cross-sectional riffle area estimated to fall within the preferred depth and water velocity range for rainbow trout spawning in May and June is 43% and 23%, respectively (Table 5-11); May and June are the two months within which rainbow trout spawning typically occurs near the Mount Milligan Project (Terrane Metals 2007). Approximately 57% and 70% of the cross-sectional riffle area was estimated to fall within the depth and water velocity ranges considered useable for rainbow trout spawning in May and

June, respectively. The percentage of preferred spawning habitat was predicted to drop only 3% in May and <1% in June of 2018 and 2019 due to water withdrawals from Philip Lake 1 (Table 5-11) while the percentage of useable spawning habitat was predicted to increase by 3% in May and decrease by 7% in June. These small changes in the availability of preferred and useable rainbow trout spawning habitat are attributable to the small volume of water (0.06 m^3/sec) that would be extracted from Philip Creek compared to the estimated discharge in the creek during May (3.394 m^3/sec) and June (1.791 m^3/sec). This proposed water withdrawal volume represents only 2% and 3% of the estimated average monthly flow in these months (Table 5-7).

Table 5-11 Predicted hydraulic habitat in riffles in Philip Creek in May and June, 2018 and 2019

Month	Percent riffle area within preferred depth and water velocity ranges[1]		Percent riffle area within useable depth and water velocity ranges[2]	
	Baseline	With Water Withdrawals	Baseline	With Water Withdrawals
May	43%	40%	57%	60%
June	23%	23%	70%	63%

NOTES:

1 preferred depth (0.25 m to 0.35 m) and water velocity (0.3 m/sec to 0.7 m/sec) for rainbow trout spawning based habitat suitability index = 1.0 (Raleigh et al. 1984; Beecher et al. 2016)

2 useable depth (> 0.1 m) and water velocity (0.1 m/sec to 1.0 m/sec) for rainbow trout spawning based on habitat suitability index ≥0.2 (Raleigh et al. 1984; Beecher et al. 2016)

No significant residual adverse effect to rainbow trout spawning habitat is expected to occur in the spring of 2018 or 2019 based on this assessment. Confidence in this assessment is increased because of the conservative assumption that water withdrawn from Philip Lake 1 will result in an equivalent decrease in discharge in Philip Creek. In actuality, the storage capacity of the lake is likely to partially buffer the change in outflow discharge. While it is not possible to predict the actual percent reduction in Philip Creek discharge until an outlet rating curve is developed, the percent reduction in creek discharge will not exceed 3% of mean monthly discharge in May and June of 2018 and 2019.

5.3.2.2.5 Reduced Summer Flows in Philip Creek

In summer, juvenile and adult rainbow trout prefer to occupy deep pools with abundant cover provided by water depth, undercut banks, large and small woody debris, or overhanging vegetation (Raleigh et al. 1984; Muhlfeld et al. 2001b; Harvey et al. 2005). Preferred summer depth and water velocity ranges are between 0.85 m and 1.0 m and 0.22 m/sec and 0.38 m/sec (Beecher et al. 2016). Because they are territorial in summer, adult trout will occupy and defend sites that provide the best combination of refuge from high water velocities, cover from predators, and access to drifting invertebrate prey. These sites are typically at the front of deep

pools directly below riffles. Smaller juveniles are forced into less desirable locations or will migrate to find less densely populated locations if no suitable territories are available.

As mentioned above, there are no primary pools in Philip Creek between Philip Lake 1 and Philip Lake 2. As a result, summer rearing habitat for juvenile and adult rainbow trout in Philip Creek is restricted to glides, habitat that is less than ideal but more suitable for juvenile rainbow trout than for adult rainbow trout. Therefore, juvenile rainbow trout are the life stage most likely to be affected by flow reductions that occur in Philip Creek in summer, particularly in August, the lowest flow month in summer.

To mitigate potential effects to fish in Philip Creek in summer, TCMC will restrict water withdrawal rates to 15% of the predicted mean monthly flow in July, August, and September. Similar to winter withdrawals, the 15% cumulative water withdrawal corresponds to a "Risk Management Level 1" for Philip Creek based on the BC Ministry of Forests, Lands, and Natural Resource Operations' (FLRNO) Environmental Risk Management Framework (BC FLNRO 2016); Philip Creek is a "low sensitivity" stream in August because the predicted mean August discharge (0.234 m^3/sec) is 34% of mean annual discharge which is greater than the 20% threshold between "moderate" and "low" sensitivity categories set in the framework. This suggests that there is sufficient natural water available in summer for the proposed withdrawals and that risks to habitat, fish, and aquatic resources from the cumulative water withdrawals are low.

To support this contention, a one-dimensional hydraulic model (HEC-RAS) was developed for glide habitat in Philip Creek to predict the potential change in water depths and water velocities in glides in Philip Creek in August, the month with the lowest flows in summer. Data for this model was collected from transects established in Philip Creek in October 2017.

Based on this model, there is no preferred summer rearing habitat for juvenile rainbow trout in Philip Creek in August, even under natural conditions; the existing habitat is too shallow and too slow in August to fall within the preferred depth and water velocity range of juvenile rainbow trout. However, 35% of the cross-sectional glide area was estimated to fall within the useable water depth and water velocity range for juvenile rainbow trout in August under baseline conditions (Table 5-12). This is predicted to decrease to 30% of the cross-sectional glide area in August of 2018 and 2019 when pumping would occur.

Table 5-12 Predicted hydraulic habitat in glides in Philip Creek in August, 2018 and 2019

Month	Percent glide area within preferred depth and water velocity ranges[1]		Percent glide area within useable depth and water velocity ranges[2]	
	Baseline	With Water Withdrawals	Baseline	With Water Withdrawals
August	0%	0%	35%	30%

NOTES:

1 preferred depth (0.84 m to 1.2 m) and water velocity (0.22 m/sec to 0.38 m/sec) for rainbow trout summer rearing and foraging based habitat suitability index ≥ 0.8 (Beecher et al. 2016)

2 useable depth (>0.25 m) and water velocity (<1.0 m/sec) for juvenile rainbow trout summer rearing based on habitat suitability index ≥0.2 (Beecher et al. 2016)

Based on this assessment, no significant residual effect to juvenile rainbow trout are expected to occur in Philip Creek in the summer of 2018 or 2019. This is because the HEC-RAS model results suggest that the 15% cumulative water withdrawal rate imposed by TCMC in summer will result in only a small reduction in useable rearing habitat for juvenile rainbow trout and that the Risk Management Level 1 assigned to Philip Creek and the proposed water withdrawal rates is reasonable. Confidence in this assessment is increased because:

- It was conservatively assumed that water withdrawn from Philip Lake 1 will result in an equivalent decrease in discharge in Philip Creek. In reality, the storage capacity of the lake will partially buffer flow reductions in the creek
- Baseflows in August are predicted to decrease from 34% of mean annual discharge (0.683 m^3/sec) to 29% of mean annual discharge due to summer water withdrawals (Table 5-13). This change in summer baseflow is insufficient to drop Philip Creek from "fair" (i.e., baseflows between 25% and 50% of mean annual discharge) to "poor" (i.e., baseflows <25% of mean annual discharge) as categorized by Raleigh et al. (1984).
- The predicted average August discharge in Philip Creek in 2018 and 2019 with water withdrawals (29% of mean annual discharge) is just under the 30% of mean annual discharge threshold identified by DFO for streams having a "heightened risk of impacts to fisheries" (DFO 2013).

Table 5-13 Baseline and predicted summer flows in 2018 and 2019 in Philip Creek

Month	Baseline Conditions		With Project	
	Modelled average monthly discharge (m^3/sec)	% of mean annual discharge[1]	Predicted average monthly discharge (m^3/sec)	% of mean annual discharge[1]
August	0.234	34%	0.199	29%

NOTES:

1 mean annual discharge in Philip Creek was estimated to be 0.683 m^3/sec

5.3.3 Decommissioning Phase

The barge, pump house, and water pipeline will not be removed from Philip Lake 1 until closure of the Mt Milligan Project. This is because TCMC intends to withdraw water from Philip Lake 1 annually until the cessation of mining. Regardless of timing, decommissioning of water withdrawal infrastructure at Philip Lake 1 has the potential to adversely affect fish and aquatic resources because these activities require the use of heavy machinery near water. This machinery has the potential to increase bank erosion and sedimentation in Philip Lake 1 and Rainbow Creek to the detriment of fish, fish eggs, and benthic invertebrates. These potential effects are the same as those identified during construction of the barge, pump house, and water pipeline above.

No significant adverse residual effects to fish and aquatic resources in Philip Lake 1 are expected to occur during decommissioning of the barge, pump house, or water pipeline. This is because:

- No in-water work will be required
- No additional riparian vegetation removal will be required
- TCMC will prohibit heavy machinery from working within 5 m of the top of bank
- Decommissioning will occur in winter when ground is frozen
- The floating pump will be lifted from the water by the crane and not dragged up the bank

These mitigation measures are expected to be highly effective for limiting the amount of bank erosion and sedimentation occurring in Philip Lake 1 during decommissioning.

No significant adverse residual effects to fish and aquatic resources in Rainbow Creek are expected to occur during removal of the water pipeline at the Rainbow Creek crossing. This is because removal of the pipelilne will not require any in-stream work, no riparian vegetation will need to be removed, and no heavy machinery will be required to work within 15 m of the stream.

5.4 VEGETATION AND PLANT COMMUNITIES

The assessment of interactions with vegetation and plant communities related to the changes in this amendment is consistent with the approach in Section 5.7 of the EAC Application. The potential changes are all located within the vegetation regional study area reflected in sections 4.7 and 5.7 of the EAC Application, and within the vegetation local study area except for the final 1.5 km eastern section of the water pipeline to Philip Lake 1, which is located outside the vegetation local study area but within the regional study area (Figure 4-1).

Section 5.7 of the EAC Application characterized and evaluated the significance of the following potential effects to vegetation resources:

- **Plants used traditionally by Indigenous groups** – loss of individuals of 41 plant species in the Project footprint that are distributed widely through the local study area
- **Biodiversity and plant community structure and composition** – loss or alteration of 1,820 ha of terrestrial and aquatic habitats within the Project footprint
- **Rare plant species** – no anticipated effects on rare plant species as none were identified during rare plant surveys conducted for the Project.
- **Plant communities at risk** – loss or alteration of 188 ha of five blue listed communities within the Project footprint

The Assessment Report (EAO 2009) determined that, considering the application of mitigation measures and reclamation activities at Project closure, residual effects to vegetation and plant communities are not significant.

The potential interactions with vegetation and plant communities associated with the changes in this amendment are characterized in Table 5-14.

Table 5-14 Potential Project Interactions with Vegetation and Plant Communities

Project Activities and Physical Works	Vegetation and Plant Communities Interaction
Construction	
Water pipeline and pump station	Interaction has no potential to alter the residual effects characterizations or significance determinations made in the Assessment Reports and is not carried forward in the assessment. As the pipeline corridors follow existing linear disturbances for the majority of their alignments, this activity will require very limited (approximately 0.6 ha) vegetation clearing to facilitate construction access to Philip Lake 1, and no vegetation clearing for access to Esker Lakes. Limited vegetation clearing will be required at the Rainbow Creek bridge crossing to facilitate installation of the manufactured truss abutments, a minimum of 15 m outside of the wetted width of the creek. Sediment and erosion control measures will be implemented in areas where soils are disturbed for construction (per Section 6.3.7.4 of the 2008 EAC Application). Ecosystem mapping identified no plant communities at risk in the area adjacent to Philip Lake 1 that will be cleared during construction. No rare plant species were identified during rare plant surveys conducted in the vegetation regional study area (Amec 2008) or through review of data from the BC Conservation Data Centre (2017) and the Project has committed to a salvage and relocation program for any incidental rare plants identified during construction activities, per the Landscape, Soils, and Vegetation Management Plan. The effects determination from the Assessment Report was based on the loss or alteration of 1,820 ha of terrestrial and aquatic habitat and concluded no significant effect. In consideration of existing Project commitments, the changes to the Project are of a sufficiently small magnitude that they have no potential to alter the previous residual effects characterizations or significance determinations.

Operations	
Water extraction	Interaction has negligible potential to alter the residual effects characterizations or the determination of no significant effect made in the Assessment Report and is not carried forward in the assessment. As outlined in assessment of potential effects to Water Resources (Section 5.1), proposed water extraction is predicted to result in no change to water depth at Esker Lakes (as extracted water will be replaced by groundwater) and a small (approximately 2 cm) decrease in water depth at Philip Lake 1 from January to October 2018 and from April to October 2019, with extracted water replaced primarily by surface water. This is considered within the natural variability for Philip Lake 1 water levels. As such, hydrologic conditions in adjacent terrestrial and aquatic vegetation communities, including wetlands, will not be changed as a result of this Project activity.
Decommissioning	
Decommissioning and Reclamation	Interaction has no potential to alter the residual effects characterizations or the determination of no significant effect made in the Assessment Reports and is not carried forward in the assessment. After water pipeline and pump station infrastructure is removed, shrubby vegetation that was cleared for construction access will be allowed to naturally revegetate. In areas where soils were disturbed, revegetation will be completed as outlined in the Section 3.9 of the EAC Application (2008), including opportunities for progressive reclamation, consistent with the existing EAC condition.

Adherence to existing mitigation measures described in the Assessment Reports and the Table of Proponent Commitments of EAC #M09-01 are expected to result in no changes to the characterization of residual adverse effects or alter the determination of no significant effect for vegetation and plant communities.

5.5 WILDLIFE AND WILDLIFE HABITAT

Section 5.4 of the EAC Application considered potential Project effects on habitat loss or alteration, disruption of movement, displacement, attractants, and mortality to wildlife (EAO 2009). The assessment of changes in this amendment, and their interactions with wildlife and wildlife habitat, are consistent with the scope of the EAC Application. The potential changes are located within the previously defined wildlife local study area, except for the southernmost portion of the water pipeline to Philip Lake 1 (approximately 1.4 km; Figure 2-1). The Assessment Reports state that, following the implementation of mitigation measures through adherence to the Table of Proponent Commitments of EAC #M09-01, including reclamation activities at Project closure, residual effects on wildlife and wildlife habitat would not be significant (EAO 2009, 2013b, 2016).

In consideration of changes in this amendment, including the timelines and geographical area in which these changes occur, and the mitigation measures that will be implemented, potential residual effects will be of sufficiently small magnitude that they will not alter the previous residual effects characterizations or the determination of no significant effect described in the Assessment Report and Amendment Assessment Reports. Changes to the potential interactions described in the Assessment Report and Amendment Assessment Reports associated with the changes in this amendment are outlined in Table 5-15.

Table 5-15 Potential Project Interactions with Wildlife and Wildlife Habitat

Project Activities and Physical Works	Wildlife and Wildlife Habitat Interaction
Construction	
Water pipeline and pump station	Interaction has negligible potential to alter residual effects characterizations or the determination of no significant effect made in the Assessment Report and Amendment Assessment Reports and is not carried forward in the assessment. Most of the pipeline required to support additional water extraction will follow existing linear disturbances. A 100-m length of 6" HDPE pipeline will be an above-ground installation along existing linear features from Pond 1 to Esker Lakes crossing a riparian area and upland low shrub; no ground disturbance or clearing will be required. A 5.4 km length of 18" HDPE pipeline will extend from Pond 2 to Philip Lake 1 and will be buried within an existing forest access road right-of-way and riparian or upland vegetation adjacent to Philip Lake 1. A 30 m x 200 m (or 0.6 ha) parcel of forested areas and riparian vegetation adjacent to Philip Lake 1 will be required to allow for construction of the pump station, and will occupy <0.1% of the total perimeter of Philip Lake 1. Limited vegetation clearing will be required at the Rainbow Creek bridge crossing to facilitate installation of the manufactured truss abutments, a minimum of 15 m outside of the wetted width of the creek. Pipelines will either be above-ground 6" HDPE (Esker Lake) or buried (Philip Lake 1) and are not expected to disrupt wildlife movement. As pipeline construction is scheduled between December 2017 and January 2018 (Section 2.3), clearing is not expected to affect breeding birds or amphibians. The significance determinations from the Assessment Report and Assessment Amendment Reports were based on the loss or alteration of 1,820 ha of terrestrial and aquatic habitat of the Project footprint, all of which is located within the local study area, apart from the southernmost pipeline section to Philip Lake 1. Project mitigations and management plans previously developed for wildlife and wildlife habitat will be implemented to avoid or reduce residual effects from changes in this amendment. Based on this rationale, the changes in this amendment are of a sufficiently small magnitude that they have negligible potential to alter the previous residual effects characterizations or the determination of no significant effect for wildlife and their habitats.

Table 5-15 Potential Project Interactions with Wildlife and Wildlife Habitat

Project Activities and Physical Works	Wildlife and Wildlife Habitat Interaction
Operations	
Water extraction	Interaction has negligible potential to alter residual effects characterizations or significance determinations made in the Assessment Report and Amendment Assessment Reports and is not carried forward in the assessment. A description of water extraction methods, timing, and volume as part of the changes in this amendment are provided in Section 5.1 (Water Resources). Proposed water extraction methods, timing, and volume from Esker Lakes and Philip Lake 1 are expected to result in negligible changes to water depth. A small (approximately 2.2 cm) decrease in water depth is predicted at Philip Lake 1 between January and October 2018 and between April and October 2019. Spring freshet and groundwater recharges are expected to replace water extractions on a continual basis throughout the open water extraction period. Accordingly, water extraction recharge at Esker Lakes and Philip Lake 1 will be within the range of natural seasonal and annual variability for each location. Given that there are no predicted changes in lake depths, the potential for loss of aquatic habitat availability or alteration of its function (e.g., wildlife forage or breeding habitat) is considered negligible. If freshet or groundwater recharges replace water withdrawals on a continual basis, the potential for shoreline exposure and mortality (through desiccation) of overwintering, breeding, or developing (i.e., tadpoles) aquatic wildlife is also considered negligible.
Decommissioning	
Decommissioning and reclamation	Interaction has negligible potential to alter residual effects characterizations or significance determinations made in the Assessment Reports and is not carried forward in the assessment. After water pipeline and pump infrastructure is removed, vegetation that was cleared for construction access will regenerate and provide habitat value for wildlife.

Adherence to mitigation measures described in the Assessment Report, the Amendment Assessment Reports, and the Table of Proponent Commitments of EAC #M09-01 is expected to result in no change to the residual effects characterizations for wildlife and wildlife habitat.

TCMC's existing Wildlife Management Plan (TCMC 2016) outlines restricted work periods and recommended nest setbacks for birds potentially occurring within the local study area, referencing the *Region 7 Omineca – Reduced Risk Timing Windows for Fish and Wildlife* (BC MOE 2004). Vegetation clearing for changes in this amendment will adhere to restricted work periods outlined in the Wildlife Management Plan. If vegetation clearing is scheduled to occur within the restricted work period, a pre-clearing nest survey should be completed by qualified personnel, supervised by a Qualified Environmental Professional to confirm there are no active nests within or immediately adjacent to the proposed clearing footprint.

As described in Section 2.3, water extraction is scheduled to occur at Philip Lake 1 between January and March 2018 and April through October 2019. In the unlikely event that decreased water depths are recorded at this location and coincide with the breeding and development period for western toad (*Anaxyrus boreas*; approximately early May through early September), water extraction may result in residual effects beyond those previously described in the EAC Application. Section 5.1 (Water Resources) and Section 5.3 (Fish and Aquatic Resources) describe additional mitigation and monitoring measures to prevent changes in water levels at each extraction location and alterations to riparian habitat function throughout the withdrawal period. However, if decreased water depths are still observed during this period, then additional monitoring and salvage considerations may be required consistent with best industry practice (i.e., BC MFLNRO 2014).

5.6 ARCHAEOLOGY AND HERITAGE RESOURCES

Section 4.9 of the EAC Application considered potential Project effects on archaeology and heritage resources (EAO 2009). That assessment was based on completed baseline studies (archaeological overview and archaeological impact assessments (AIA)) undertaken to identify and inventory archaeological and heritage resource sites within the (then) proposed project footprint. The changes in this amendment include ground-altering development outside of areas addressed by the prior baseline studies. As a result, the assessment of the changes in this amendment and their interactions with archaeology and heritage resources, are not consistent with the scope of the EAC Application.

The majority of the revised development footprint is within or immediately adjacent to areas previously subject to AIA (Ecofor 2007b). Portions of the revised footprint for the water pipelines to Philip Lake 1 and the Esker Lakes (Figure 2-1) are outside of the area addressed by previous AIA work.

No previously recorded archaeological sites or other *Heritage Conservation Act* (HCA) protected heritage resources are within the proposed footprint for the water pipelines and pump station. For those portions of the expanded footprint not included in the previous AIA work, there is potential for Project activities to affect unrecorded archaeological sites and other HCA-protected heritage resources.

The changes to the potential interactions associated with the changes in this amendment are outlined in Table 5-16.

Table 5-16 Potential Project Interactions with Archaeology and Heritage Resources

Project Activities and Physical Works	Archaeology and Heritage Resources Interaction
Construction	
Water pipeline and pump station	Interaction requires further assessment, as portions of the proposed development footprint that have been previously assessed as having moderate to high potential for archaeological resources through a desktop study have not been subject to field assessment (EOA 2009). Field assessment conducted under a permit issued by the Archaeology Branch and developed through engagement with relevant First Nations will be required for Project activities that may result in surface or subsurface ground disturbance or removal of trees. Potential impacts to archaeological sites, if identified, will be managed consistent with the provincial HCA and the Project-specific Archaeology and Cultural Heritage Resources Management Plan (EAO 2009).
Operations	
Water extraction	Water extraction will not result in ground or vegetation disturbance and has negligible potential to affect heritage resources. It is not carried forward in the assessment.
Decommissioning	
Decommissioning and Reclamation	If decommissioning and reclamation activities overlap an HCA-protected heritage resource, alterations to the resource will be managed in accordance with HCA regulations and the Project-specific Archaeology and Cultural Heritage Resources Management Plan (EAO 2009). If no HCA-protected heritage resources are overlapped, decommissioning and reclamation will not be carried forward in the assessment.

Archaeological sites or other HCA-protected heritage resources may be identified with the Project footprint during assessment. Any sites and corresponding interactions that may be uncovered will be assessed as part of the provincially regulated heritage review process overseen by the Archaeology Branch. Potential effects on identified sites resulting from the Project will be mitigated in accordance with the Archaeology and Cultural Heritage Resources Management Plan, comments from First Nations, and applicable heritage legislation. Effects on individual archaeological or heritage sites resulting from the Project will be reduced through engineering options, avoidance, or the application of mitigation procedures following the Cultural Heritage Resources Management Plan and as required under provincial legislation. With the implementation of these measures, adverse residual effects for archaeology and heritage resources are anticipated to be not significant.

5.7 SUMMARY OF POTENTIAL EFFECTS FROM THE CHANGES IN THIS AMENDMENT

Table 5-17 Summary of Potential Effects from the Changes in this Amendment

Valued Component	Change to Mitigation Measures in the Assessment Reports	Change to Characterization of Residual Effects in the Assessment Reports	Change to Determination of Significance in the Assessment Reports
Terrain, Soils and Geology	No change	No change	No change
Water Resources	See 5.2	No change	No change
Fish and Aquatic Resources	See 5.3	No change	No change
Vegetation and Plant Communities	No change	No change	No change
Wildlife and Wildlife Habitat	No change	No change	No change
Archaeology and Heritage Resources	Additional archaeological assessment will be required for the revised construction footprint.	No change	No change

6 CONSULTATION

6.1 INDIGENOUS CONSULTATION

The following section summarizes Indigenous consultation activities undertaken by TCMC with Nak'azdli Whut'en, McLeod Lake Indian Band, and Takla Lake First Nation regarding the proposed Project changes outlined in this Application. A summary table of Indigenous information requests related to this Application, and TCMC's response to the information requests is included in Appendix I.

McLeod Lake Indian Band, Nak'azdli Whut'en, and Takla Lake First Nation were each sent a copy of the dAAIR (Oct. 12, 2017), revised dAAIR (Nov. 1, 2017), dART (Nov. 1, 2017), and the section 31 application (versions 1 and 2) (Nov. 9, 2017) for their review and comment. In addition, TCMCreviewed the proposed changes to the Project at the October 27, 2017 meeting of the Mount Milligan Community Sustainability Committee (CSC) to obtain feedback from McLeod Lake Indian Band and Nak'azdli Whut'en. The Mount Milligan CSC is a collaboration of

community-based organizations, local governments, First Nations and TCMC that was created to facilitate communication and information sharing between TCMC and regional residents.

Consultation with McLeod Lake Indian Band occurred between September 11, 2017 and November 16, 2017. The consultation included meetings with representatives of McLeod Lake Indian Band including Chief Harley Chingee. Topics discussed included:

- Water withdrawal from Philip Lake 1
- Working in winter months
- Dam core width
- Gravel lens details
- The proposed pipeline route
- Economic impacts of the Project on the community

TCMC made the following commitments to McLeod Lake Indian Band:

- Perform a cumulative effects assessment on potential effects associated with water withdrawal from Philip Lake 1
- Arrange a site visit (planned for December 7, 2017)
- Continue updating McLeod Lake Indian Band on Project developments

Consultation with Nak'azdli Whut'en occurred between September 14, 2017 and November 16, 2017. The consultation included meetings with various representatives of Nak'azdli Whut'en including Chief Alec McKinnon, and the *Keyoh* holder for the Project area. Topics of discussion included:

- Plans for Project Phase 1 and 2
- Income benefit agreements
- Permitting process
- Rainbow Creek water withdrawal
- Meadows Creek Supply Pond concerns
- Philip Lake 1 water source
- A monitoring station on Nation River
- The Heidi Creek option

In addition, TCMC has made the following commitments to Nak'azdli Whut'en:

- Arrange an open house (planned for December 11, 2017)
- Discuss reasonable compensation with the *Keyoh* holder for the affected area
- Continue updating Nak'azdli Whut'en and the *Keyoh* holder on Project developments

Consultation with Takla Lake First Nation occurred between November 3, 2017 and November 16, 2017. Topics of discussion included the Project Description, working in winter months, dam core width, and details regarding the gravel lens. TCMC is planning a site visit for Takla Lake First Nation on December 7, 2017.

West Moberly First Nations and Halfway River First Nation are invited to participate in the Mount Milligan CSC. While West Moberly First Nations representatives continue to receive email communication regarding the Committee, neither Nation has elected to participate in meetings.

West Moberly First Nations were invited to attend the October 27, 2017 Mount Milligan CSC meeting where a presentation was made on the proposed changes to the Project (the invitation was sent via email on September 26, 2017, and on October 20, 2017). In addition, West Moberly First Nations was sent the Mount Milligan Phase 1 and 2 permitting background document via email on October 27, 2017.

No comments have been received by TCMC from West Moberly First Nations or Halfway River First Nation on proposed changes to the Project. TCMC understands that the EAO is planning to engage in "notification" level consultation with West Moberly First Nations and Halfway River First Nation prior to making a decision on this Application. TCMC has not been privy to any results of this Crown-led consultation.

Table 6-1 provides a summary of the key issues and concerns raised by First Nations relative to proposed amendment to the EAC, TCMC's response to those issues and concerns, and the status of their resolution.

Table 6-1 Summary of Feedback from First Nations

Date	Topic of Interest/Concern Raised	TCMC Response	Interest/Concern Status
McLeod Lake Indian Band			
Sept. 11, 2017	Concerns about potential cumulative effects from water withdrawal from Philip Lake 1. The Band expressed some support for the Philip Lake 1 water withdrawal option.	TCMC will perform a cumulative effects assessment on water withdrawal from Philip Lake 1, including installing hydrology stations in the first three lakes in the system.	In progress
Sept. 11, 2017	Water withdrawal from Phillips Lake. Band members working within the TCMC Environmental Team to think about the option of pulling water from Philip Lake.	TCMC informed Council that they believe it is the best option.	Resolved
Nov. 3, 2017	Requested copy of pipeline route.	Pipeline route provided by TCMC.	Resolved
Nov. 16, 2017	Technical details and challenges, some examples: working in winter months, width of dam core, diagram of gravel lenses. Requested a copy of the section 31 variance letter and to visit site.	TCMC to follow up with technical details, and provide a copy of the variance letter. Technical Site Visit planned for Dec 7, 2017.	In progress
Nov. 16, 2017	TCMC received copy of letter of support sent to EAO from McLeod Lake Indian Band Administrator, Bob Inkpen. Outlined understanding of water short-term requirements and plans to obtain this water from Esker lake and Philip Lake 1. Expressed concerns regarding the economic impact that a shutdown would have on the community. Offered support for Phase 1 application.	TCMC will continue to update regarding Project developments.	Resolved
Nak'azdli Whu'en			
Sept. 14, 2017	First meeting to discuss plans for Phase 1 project. Asked for copy of project description.	Set up a meeting for Oct. 13, 2017, send copy of Project description.	Resolved
Oct. 4, 2017	Discussed impact benefit agreement(s) and upcoming permitting amendments. No concerns over the permitting process. Asked to see a copy of the dAAIR before it was submitted to MMPO/EAO.	TCMC provided a copy of the dAAIR on Oct. 12, 2017.	Resolved
Oct. 13, 2017	Prefers that no water is taken from Rainbow Creek or its watershed. Does not support the Meadows Creek Supply Pond. Conditionally supports using Philip Lake 1 as a short and long-term water source, given further monitoring. Suggested a monitoring station on Nation River.	TCMC is no longer considering Rainbow Creek as a water source option. TCMC is looking for long-term water solutions other than the Meadows Creek Supply Pond. Further baseline work and consultation has been completed. Monitoring station on Nation River not necessary since flow volumes will be below a detectable level.	Resolved
Oct. 26, 2017	Presented Phase 1 water needs. Requested to give full presentation at next Chief and Council meeting. Request made for TCMC to do an open house meeting in the community to inform members of Phase 1 and Phase 2 expansion plans.	TCMC presented to Council, Oct. 31, 2017. Open house meeting date set for Dec. 11, 2017.	Resolved
Oct. 13, 2017	Stated that the Rainbow Creek watershed, and its water flow must be protected. Strongly advised against water withdrawals from Rainbow Creek due to potential aquatic and terrestrial ecological impacts. Concerns with the Heidi Lake option, including concerns about increased access that might result from the construction of a new water pipeline.	Due to concerns raised, and the apparent limited amount of water available, TCMC did not pursue Rainbow Creek or Heidi Lake as potential new water sources for the Project.	Resolved

Date	Topic of Interest/Concern Raised	TCMC Response	Interest/Concern Status
Oct. 13, 2017	Supports the concept of water withdrawal from a deep groundwater source within the Rainbow Creek Watershed if the withdrawal does not result in changes to the water flow within Rainbow Creek Watershed. More data is required to ascertain if this is a viable option.	A consultant, Waterline Resources Inc., has been contacted to prepare a proposal for a deep groundwater investigation relative to the Rainbow Creek Watershed. Nak'azdli Whut'en has been invited to provide further feedback on the potential use of the Rainbow Creek Watershed.	In progress
Nov. 17, 2017	Stated opposition to the construction of the Meadows Creek Dam.	TCMC has decided not to construct the Meadows Creek Water Supply Pond due to concerns raised by Nak'azdli Whut'en, potential environmental impacts, and costs of pursuing this option.	Resolved
Oct. 31, 2017	Presented on Phase 1 Water Needs at Council Meeting. Would like to see consultation with area Keyoh holder. Conditionally supports the withdrawal of water from Phillip Lakes for short-term water needs. However, there still is a need for review/input from the *Keyoh* holder.	TCMC is retaining Philip Lake 1 as a water source for the Application as well as a potential future Phase 2 EAC amendment application. TCMC informed Council of their meeting Nov. 2, 2017 with Keyoh holder.	Resolved
Nov. 2, 2017	TCMC presented Phase 1 water needs to Keyoh holder. Keyoh holder requested visit to Philips Lake with TCMC.	TCMC made arrangements for visit, Nov. 1, 2017.	Resolved
Nov. 11, 2017	Visit potential water withdrawal site on Philip Lake 1. Expectation of reasonable accommodation and compensation for impacts to Keyoh. Request to be given regular updates on project.	TCMC committed to discussing reasonable compensation. TCMC agreed to update Keyoh holder on Phase 1 and Phase 2 permitting.	In Progress
Nov. 12, 2017	TCMC received copy of a Letter of Support for Philip Lake Water Withdrawal sent by the Keyoh holder to Chief. Keyoh holder acknowledged water needs of the mine, he has agreed to offer support for the project with the understanding that TCMC will keep him informed about developments to the project (including further baseline study results).	Receipt of this letter was required before the Chief would send TCMC a letter of support from Nak'azdli Whut'en. No further concerns were raised and TCMC expects Nak'azdli Whut'en letter of support to follow. TCMC will keep the Keyoh holder appraised of new developments with the project.	N/A
Nov. 16, 2017	TCMC received copy of letter of support sent to EAO from Chief Alec McKinnon of Nak'azdli Whut'en. Chief Alec McKinnon outlined his understanding of TCMC's water needs and plans to collect water from Esker Lake and Philip Lake 1 for short-term needs. Chief McKinnon expressed his concerns about the economic impact a shutdown would have on his community and offered support for TCMC's Phase 1 application while further baseline data collection is ongoing.	TCMC will continue to keep Nak'azdli Whut'en updated on project developments including results from baseline studies.	Resolved
Takla Lake First Nation			
Nov. 3, 2017	Request for original mine Project Description (2006).	Provided by TCMC.	Resolved
Nov. 16, 2017	Provided Project background information. Technical details and challenges, some examples: working in winter months, width of dam core, diagram of gravel lenses. Requested a copy of the s.31 variance letter and to visit site.	TCMC to follow up with technical details, and provide a copy of the variance letter. Site Visit scheduled for Dec 7, 2017	In progress

6.2 INDIGENOUS CONSIDERATIONS

6.2.1 Nak'azdli Whut'en, McLeod Lake Indian Band, West Moberly First Nations and Halfway River First Nation Aboriginal Interests

6.2.1.1 Introduction

This section assesses how proposed Project changes may affect the ability of members of Nak'azdli Whut'en, McLeod Lake Indian Band, West Moberly First Nations and Halfway River First Nation to exercise their Aboriginal Interests. Section 6.2.2 assesses how proposed Project changes may affect the ability of Takla Lake First Nation to exercise their Aboriginal Interests.

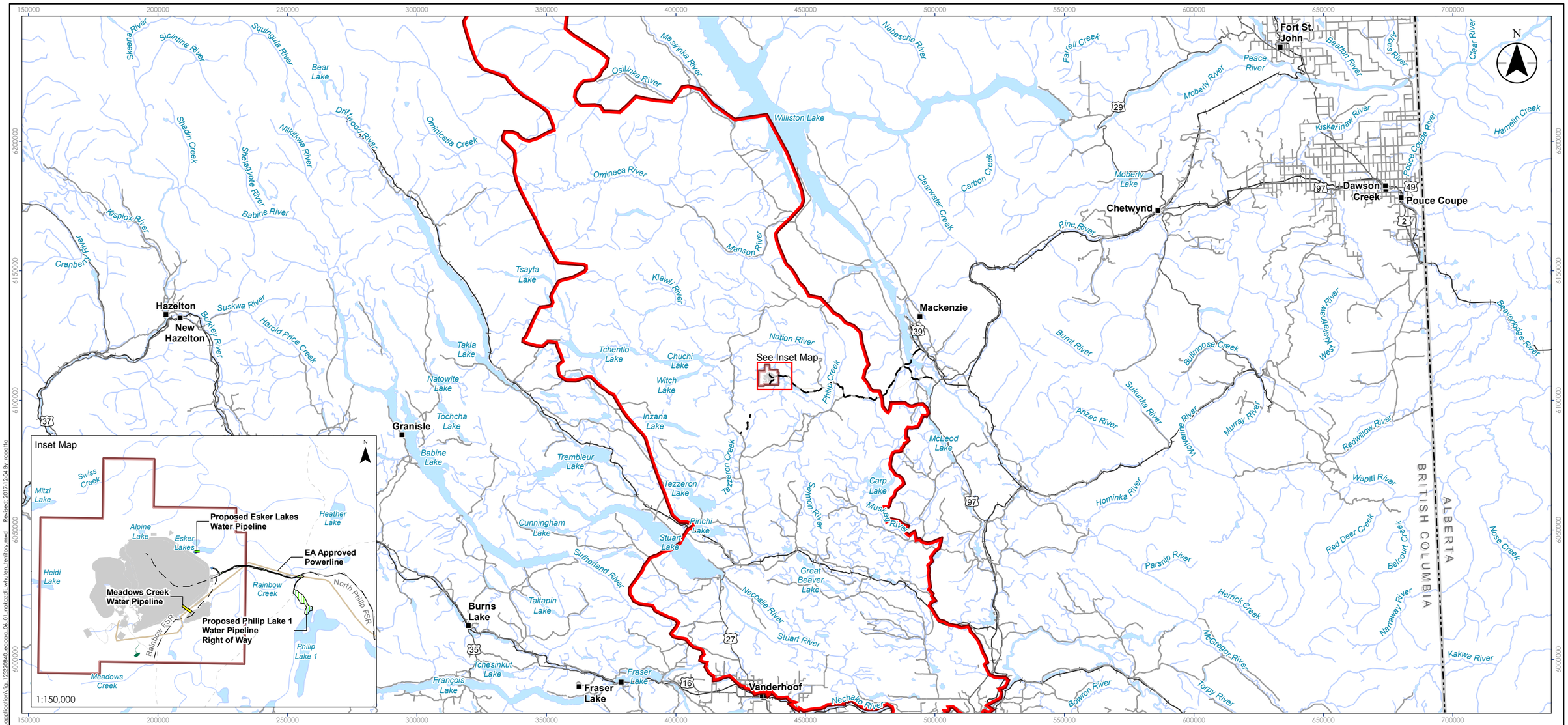
This section provides the following:

- A description of potential adverse effects of the proposed amendment on Aboriginal Interests
- A summary of mitigation measures to avoid or reduce potential adverse effects on Aboriginal Interests
- A characterization of residual adverse effects on Aboriginal Interests after mitigation
- A summary of outstanding Aboriginal Interests issues identified by First Nations

The assessment methodology is consistent with the scope set out in Section 2.0 ("First Nations Considerations") of the EAC Application.

6.2.1.2 Description of Potential Adverse Effects on Aboriginal Interests

The following figures show the boundaries of the traditional territories for Nak'azdli Whut'en, McLeod Lake Indian Band, West Moberly First Nations, Halfway River First Nation.



City, Town, Village, or District Municipality
Highway
Road
Gravel Road
Railway
Provincial Boundary
Watercourse
Waterbody
Mineral Tenure (631503)

Water Pipeline
EA Approved Powerline
EA Approved Project Footprint

Proposed Water Pipeline
Proposed Water Pipeline Right of Way

Nak'azdli Whut'en Territory Boundary

0 10 20 30 40 50 km
1:1,500,000 (At original document size of 11x17)

Notes
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Project Location
NTS Grid: 093O04
BCGS Grid: 93O.011

Project Number 123220840
Prepared by RCOATTA 20171130
Discipline by SBLACK 20171130
GIS Review by NPUREWAL 20171201

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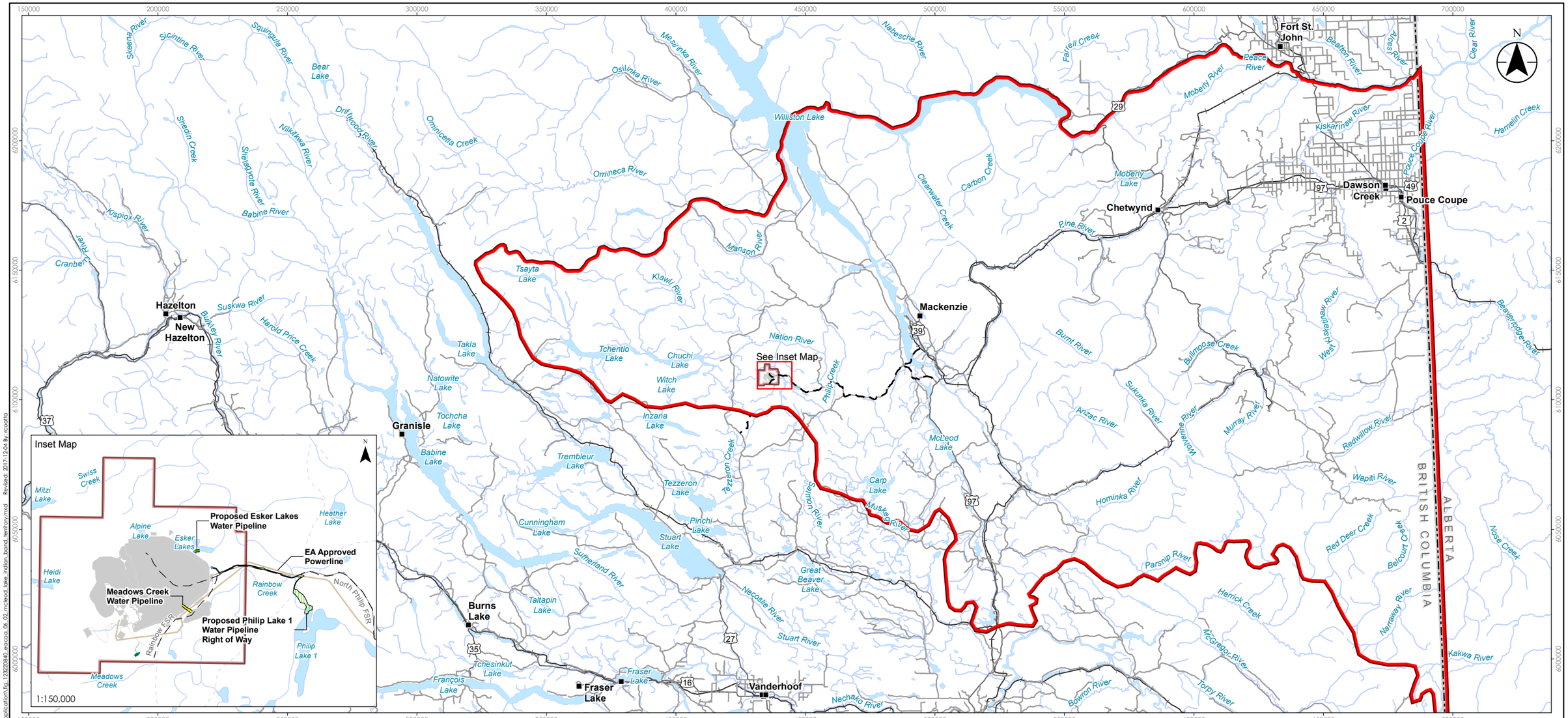
Mount Milligan Mine
Environmental Assessment Certificate Amendment Application

Figure No. **6-1**
Page No. 1 of 1

Title
Nak'azdli Whut'en Territory

\\cdl183f03\Workgroup\123X_projects\123220840\figures\reports\ea_certificate_amendment_application\fig_123220840_eccea_06_01_nakazdl_whuten_territory.mxd Revised: 2017-12-04 By: rcoattta



City, Town, Village, or District Municipality
Highway
Road
Gravel Road
Railway
Provincial Boundary
Watercourse
Waterbody
Mineral Tenure (631503)

Water Pipeline
EA Approved Powerline
EA Approved Project Footprint

Proposed Water Pipeline
Proposed Water Pipeline Right of Way

McLeod Lake Indian Band Territory Boundary

0 10 20 30 40 50 km
1:1,500,000 (At original document size of 11x17)

Notes
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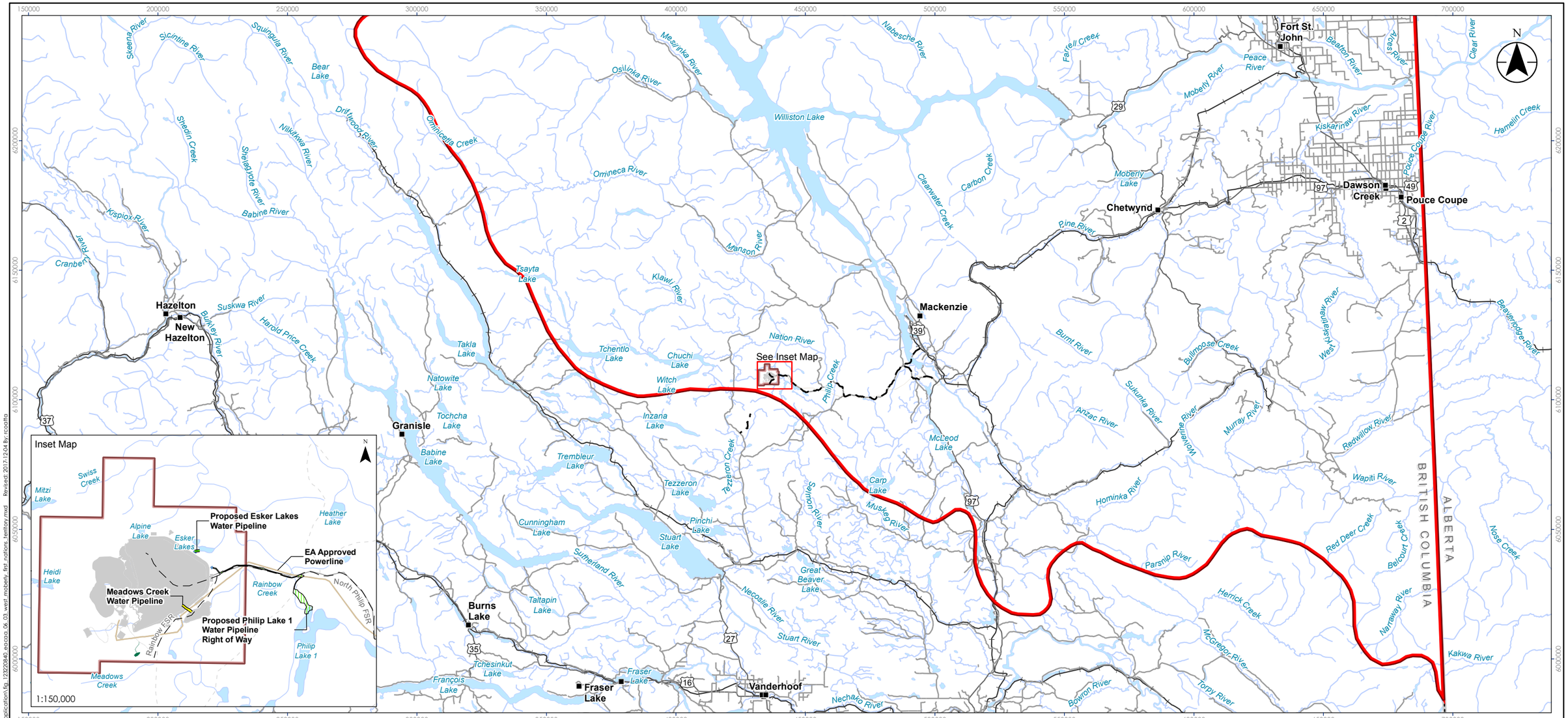
Figure No. **6-2**
Page No. 1 of 1

Title
McLeod Lake Indian Band Territory



- City, Town, Village, or District Municipality
- Highway
- Road
- Gravel Road
- Railway
- Provincial Boundary
- Watercourse
- Waterbody
- Mineral Tenure (631503)
- Water Pipeline
- EA Approved Powerline
- EA Approved Project Footprint
- Proposed Water Pipeline
- Proposed Water Pipeline Right of Way
- West Moberly First Nations Territory Boundary

0 10 20 30 40 50 km

1:1,500,000 (At original document size of 11x17)

Notes

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Figure No. **6-3**

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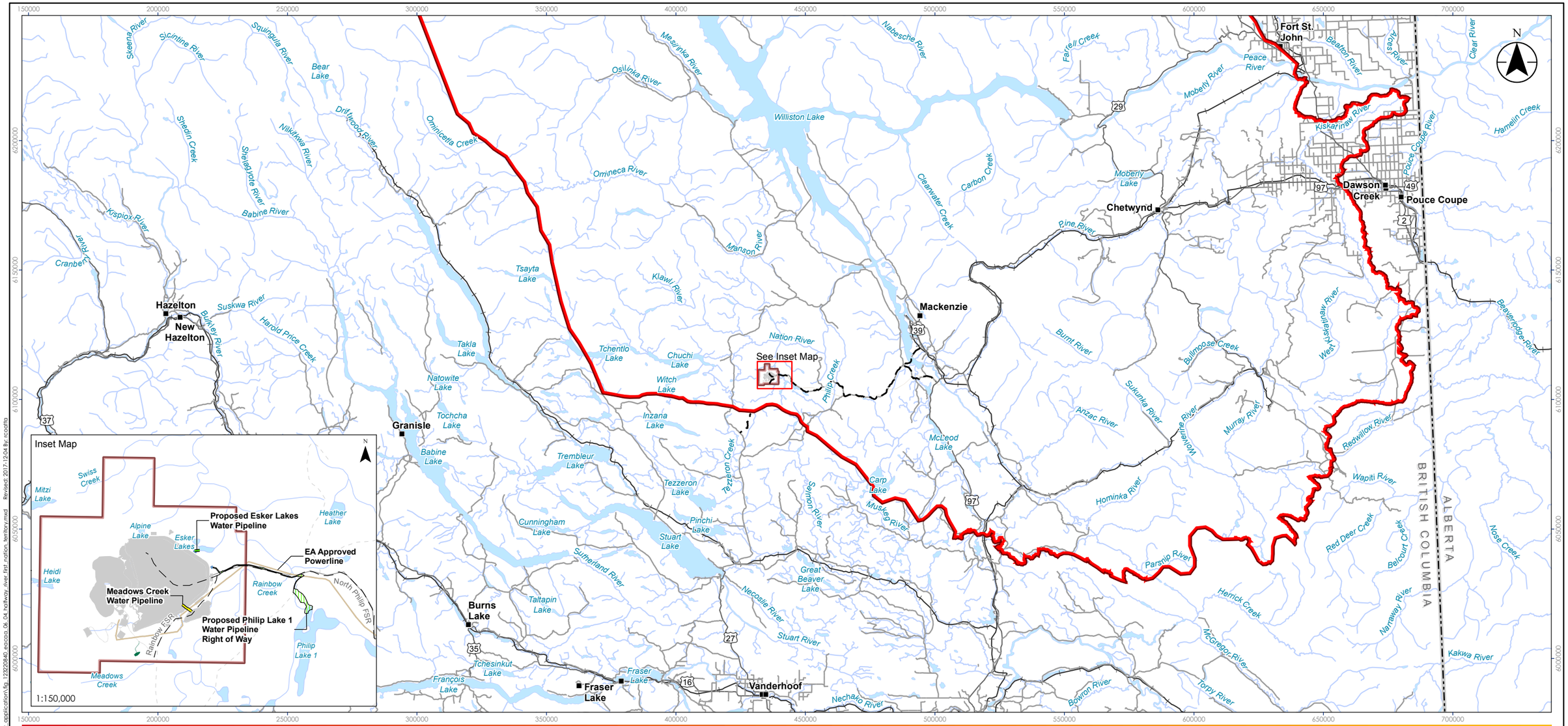
Title

West Moberly First Nations Territory



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Project Location
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Project Number 123220840
Prepared by RCOATTA 20171130
Discipline by SBLACK 20171130
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Mount Milligan Mine
Environmental Assessment Certificate Amendment Application

Figure No. **6-4**
Page No. 1 of 1

Title
Halfway River First Nation Territory

\\vcdi183403\Workgroup\123220840\project\123220840\figures\reports\ea_certificate_amendment_application\fig_123220840_eacaa_06_04_halfway_river_first_nation_territory.mxd Revised: 2017-12-04 By: rcoatta

The original assessment in the EAC Application concluded that there would be no significant adverse effects on either the biophysical environment, or on the cultural heritage resources that Indigenous people rely on when exercising their Aboriginal Interests. The original assessment relied on the conclusions for the following relevant VCs also assessed in the EAC Application:

- Fish and Aquatic Resources
- Vegetation and Plant Communities
- Wildlife and Wildlife Habitat
- Archaeology and Heritage Resources
- Visual and Aesthetic Resources
- Noise

The following analysis considers the effects of proposed changes to the Project on the VCs listed above, and examines how these effects could, in turn, affect how First Nations members exercise their Aboriginal Interests. Table 6-2 lists the referenced VCs, whether those VCs are carried forward in the assessment, and the rationale for why they are or are not carried forward for further assessment in the Application.

Table 6-2 Referenced Valued Components – Interactions with Proposed Project Changes

Valued Components	Section of EAC Application (2008)	Interaction with Proposed Change	Carried Forward in Assessment	Rationale
Fisheries and Aquatic Resources	5.6	Yes	Yes	Extraction of make-up water and installation of water pipeline infrastructure has the potential to affect fish and fish habitat.
Vegetation and Plant Communities	5.7	Yes	Yes	Extraction of make-up water and installation of water pipeline infrastructure has the potential to affect vegetation and plant communities.
Wildlife and Wildlife Habitat	5.8	Yes	Yes	Extraction of make-up water and installation of water pipeline infrastructure has the potential to affect wildlife and wildlife habitat.
Archaeology and Heritage Resources	5.9	Yes	Yes	Water pipeline will be buried, with ground disturbance associated with trenching and cover within road rights-of-way, cut-blocks, and a cleared area near Philip Lake 1 where pump infrastructure will be constructed. A portion of the proposed route near the north lobe of Philip Lake 1 has not been subject to in-field archaeological assessment and has unconfirmed potential for archaeological resources. As a result, there is a potential for interaction with archaeology and heritage resources.
Visual and Aesthetic Resources	5.12	No/negligible	No	The water pipelines fall within the Project's existing license to cut or the mining lease, or they will be located mainly parallel to existing linear features. Negligible interactions are anticipated between this infrastructure and visual and aesthetic resources. Based on the assessment of visual and aesthetic resources in the original EAC Application, and those mitigation measures, it is anticipated that the potential interactions related to proposed changes to the Project will be negligible.
Noise	5.4	No/negligible	No	Noise from pump stations was assessed as part of the original EAC Application. The pump station at Esker Lake will be similar in size and proximity to the original Meadows Creek station, functioning for the first three months of 2018. An additional pump station will be located as Philip Lake 1 with a diesel generator for a short duration (<2 years)

Given the interactions identified in Table 6-2, potential interactions with Aboriginal Interests associated with the proposed changes to the Project are outlined in Table 6-3.

Table 6-3 Proposed Project Changes – Potential Interactions with Aboriginal Interests

Project Activities and Physical Works	Aboriginal Interests Interaction
Water pipeline and pump station construction	Interaction requires assessment as proposed changes to the Project have the potential to interact with Aboriginal Interests through: • Potential changes in water quality in Esker Lakes and Philip Lake 1 resulting from erosion and sedimentation due to installation of pumps and water pipelines • Potential effects on rainbow trout (*Oncorhynchus mykiss*) and mountain whitefish (*Prosopium williamsoni*) resulting from a change in flows in Philip Creek • Clearing of traditional-use vegetation and plant communities. • Potential interaction with archaeology and heritage resources resulting from ground disturbance associated with trenching and cover within road rights-of-way, cut-blocks, and a cleared area near Philip Lake 1, where pump infrastructure will be placed
Water extraction	Interaction requires assessment as proposed changes to the Project have potential to interact with Aboriginal Interests through: • Potential effects to hydrogeology (groundwater) from withdrawal of make-up water at Esker Lakes, and potential effects to hydrology (surface flow) at Philip Lake 1 • Potential changes in water quality in Philip Lake 1 resulting from erosion and sedimentation due to operation of pumps and water pipelines • Potential interactions with harvested wildlife and their habitat through the extraction and transport of make-up water from the proposed water sources • Potential effects to rainbow trout resulting from changes in flows in Philip Creek • Potential effects to lake whitefish (*Coregonus clupeaformis*) and rainbow trout due to potential changes in lake levels in Philip Lake 1 • Potential effects on traditional-use vegetation and plant communities resulting from potential changes in water levels from water extraction
Decommissioning	Interaction has negligible potential to alter residual effects characterizations or significance determinations made in the Assessment Reports and is not carried forward in the assessment.

6.2.1.3 Summary of Mitigation Measures to Avoid or Reduce Potential Adverse Effects on Aboriginal Interests

Mitigation measures to avoid or reduce potential adverse effects on Aboriginal Interests are those listed in Section 5.3 for the Fish and Aquatic Resources VC, Section 5.4 for the Vegetation and Plant Communities VC, Section 5.5 for the Wildlife and Wildlife Habitat VC, and Section 5.6 for the Archaeology and Heritage Resources VC.

6.2.1.4 Characterization of Residual Adverse Effects on Nak'azdli Whut'en, McLeod Lake Indian Band, West Moberly First Nations and Halfway River First Nation Aboriginal Interests

Table 6-4 summarizes whether proposed Project changes result in changes to the original characterization of residual effects on referenced VCs as set out in the EAC Application.

Table 6-4 Conclusions for Relevant Valued Components

EAC Application Section	Valued Component	Change to Mitigation Measures in the EAC Application	Change to Characterization of Residual Effects in the EAC Application	Change to Determination of Significance in the EAC Application
5.6	Fish and Aquatic Resources	See Section 5.3	No change	No change
5.7	Vegetation and Plant Communities	No change	No change	No change
5.8	Wildlife	No change	No change	No change
5.9	Archaeology and Heritage Resources	Additional archaeological assessment will be required for the revised construction footprint.	No change	No change
5.12	Visual and Aesthetic Resources	No change	No change	No change
5.4	Noise	No change	No change	No change

Based on the assessment findings for relevant VCs set out in Section 5 of the Application, and considering the result of feedback received from First Nations on this Application, proposed changes to the Project would not alter the characterization of residual effects on Aboriginal traditional use as originally described in the EAC Application. As there is no anticipated change to the characterization of residual effects set out in the EAC Application, assessment of cumulative effects associated with the proposed Project changes is not required.

Furthermore, for the reasons noted above, no changes to the EAO's characterization of Project effects on Aboriginal Interests [as presented in the EAO's Assessment Report (2008) and Amendment Assessment Reports (2013, 2017)] are required. The EAO's original characterization of residual effects on the Aboriginal Interests of Nak'azdli Whut'en, McLeod Lake Indian Band, West Moberly First Nations, Halfway River First Nation members remain applicable. The risk of adverse effects on lands and resources needed to exercise Aboriginal Interests has been avoided or mitigated to be not significant due to the limited footprint of the Project, the mitigation measures that will be implemented to reduce the risk of direct and indirect impacts to fish and aquatic resources, wildlife and their habitat, the requirements for reclamation, and the finite timeframe of Project activities. A summary of these conclusions is shown in Table 6-5.

Table 6-5 Summary of Conclusions

EAC Application Section	Valued Component	Change to Mitigation Measures in the EAC Application	Change to Characterization of Residual Effects in the EAC Application	Change to Determination of Significance in the EAC Application	Change to EAO's Characterization of Residual Effects on Aboriginal Interests
2.4.1.2	McLeod Lake Indian Band Traditional Land Use Impact Assessment	No	No	No	No
2.4.2.2	Nak'azdli Whut'en Traditional Land Use Impact Assessment	No	No	No	No
2.4.3.2	West Moberly First Nations Traditional Land Use Assessment	No	No	No	No
2.4.3.2	Halfway River First Nation Traditional Land Use Assessment	No	No	No	No

6.2.1.5 Summary of Outstanding Aboriginal Interests Issues Identified by Nak'azdli Whut'en, McLeod Lake Indian Band, West Moberly First Nations and Halfway River First Nation

There have been no outstanding Aboriginal Interests identified by Nak'azdli Whut'en, McLeod Lake Indian Band, West Moberly First Nations or Halfway River First Nation during the development of this Application.

6.2.2 Takla First Nation Aboriginal Interests

6.2.2.1 Introduction

Takla Lake First Nation did not participate in the original environmental assessment for the Project. However, since the EAC was issued in 2009, Takla Lake First Nation has asserted that its traditional territory boundaries include the area affected by the Project changes. As a result, this section presents an assessment of the effects of the changes in this amendment on how Takla Lake First Nation members exercise their Aboriginal Interests. This section includes the following:

- A description of relevant baseline information
- A description of potential adverse effects of the proposed amendment on Takla Lake First Nation Aboriginal Interests
- A summary of mitigation measures to avoid or reduce potential adverse effects on Takla Lake First Nation Aboriginal Interests
- A characterization of residual adverse effects on Takla Lake First Nation Aboriginal Interests after mitigation
- A summary of outstanding Aboriginal Interests issues identified by Takla Lake First Nation

The assessment methodology is consistent with the scope set out in Section 2.0 ("First Nations Considerations") of the EAC Application. It follows the methods used for the assessment of effects as originally set out in the EAC Application, and is informed by publicly-available information on Takla Lake First Nation traditional use and any relevant information provided to TCMC by Takla Lake First Nation during consultation on proposed changes to the Project. This section provides the following:

6.2.2.2 Baseline Information

6.2.2.2.1 Takla Lake First Nation History, Culture, Language and Affiliations

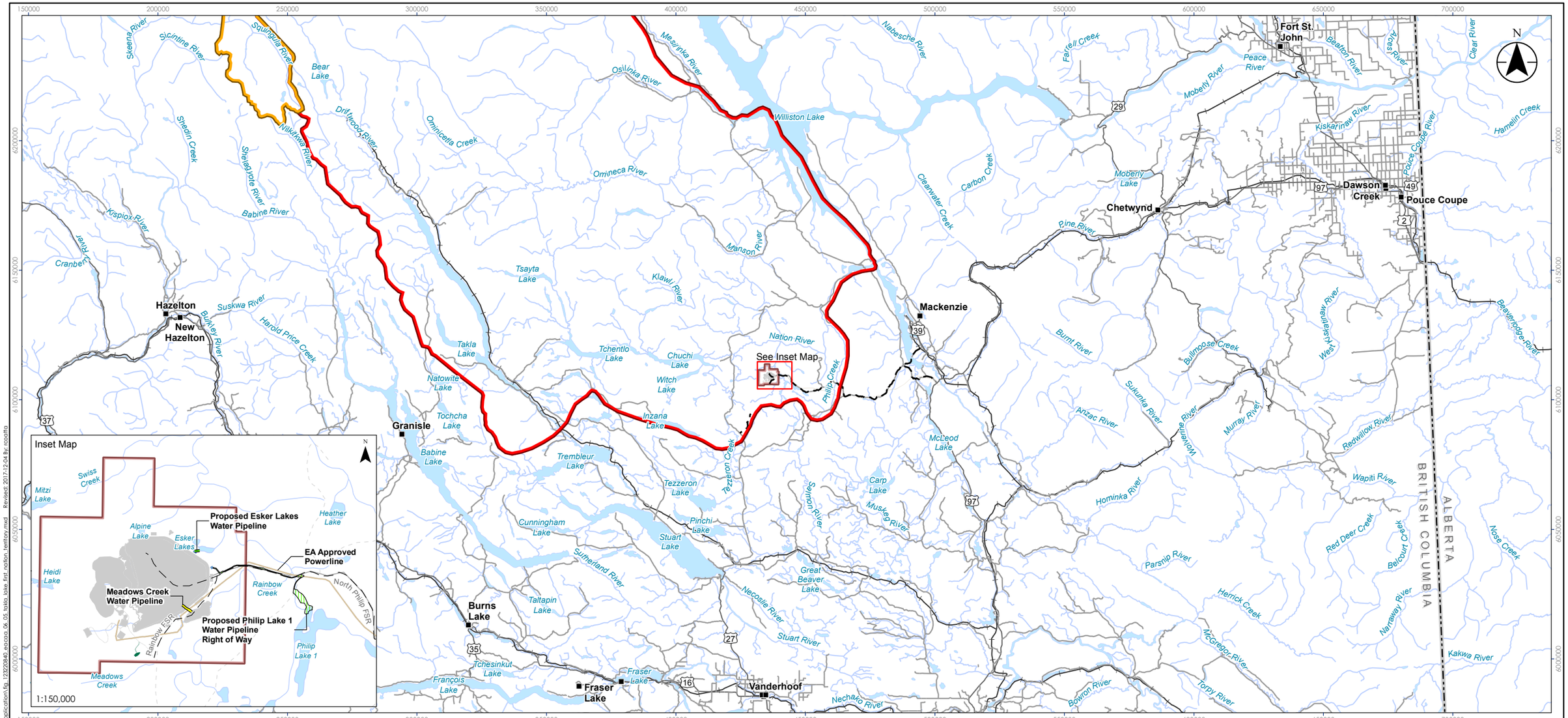
Takla Lake First Nation describes its members as the modern descendants of Carrier and Sekani (*Sasuchan* and *Yutuwichan*) groups (EAO 2014). Traditional languages spoken by Takla Lake First Nation members include the Carrier *(dakelh)* language and *tsek'ene* (ERM and Aurico Metals Inc. 2016). Takla Lake First Nation traditional governance includes a clan system that identifies who may use and has stewardship responsibilities for particular areas of Takla Lake First Nation territory (called a *k'eyakh* or *keyah*). Responsibility for a *keyah* is passed down from one

generation to the next within an extended family (EAO 2014; Crossroads Cultural Resource Management 2015).

Takla Lake First Nation resulted from the 1959 amalgamation of the Takla Band and Fort Connelly Band (ERM and Aurico Metals Inc. 2016). Takla Lake First Nation is currently a member of the Carrier Sekani Tribal Council (CSTC). CSTC also includes Burns Lake Band, Nak'azdli Band, Nadleh Whut'en, Saik'uz First Nation, Stellat'en First Nation, Tl'azt'en Nation, and Wet'suwet'en First Nation (Crossroads Cultural Resource Management 2015).

Takla Lake First Nation Traditional Territory

Figure 6-5 shows the current boundaries of asserted Takla Lake First Nation traditional territory relative to the Mount Milligan mine location.



Notes
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Project Location
NTS Grid: 093O04
BCGS Grid: 93O.011

Project Number 123220840
Prepared by RCOATTA 20171130
Discipline by SBLACK 20171130
GIS Review by NPUREWAL 20171201

Client/Project
Thompson Creek Metals Company Inc.
Mount Milligan Mine
Environmental Assessment Certificate Amendment Application

Figure No. **6-5**
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Title
Takla Lake First Nation Territory

\\vcdi183403\Workgroup\123220840\projects\123220840\figures\reports\ea_certificate_amendment_application\fig_123220840_eacaa_06_05_takla_lake_first_nation_territory.mxd Revised: 2017-12-04 By: rcoatta

6.2.2.2.2 Takla Lake First Nation Aboriginal Interests

Takla Lake First Nation describes itself as "a sovereign Nation" that "has never signed a treaty, been defeated or relinquished its Aboriginal Title and Rights". Takla Lake First Nation states that they hold Aboriginal title, rights, and interests throughout their traditional territory, including governance, cultural, spiritual and harvesting rights (Takla Lake First Nation n/d; EAO 2017b).

The Province of British Columbia has broadly recognized the existence of Carrier Sekani Aboriginal title and rights in Carrier Sekani traditional territory (Province of British Columbia et al. 2015).

6.2.2.2.3 Takla Lake First Nation Traditional Use Activities and Species

Takla Lake First Nation members hunt, fish, trap, and harvest berries, plants and trees, and gather other traditional use materials (e.g., stone and earthen materials) within their traditional territory. Preferred traditional use resources include, but are not limited to, those shown in Table 6-6.

Table 6-6 Takla Lake First Nation Harvested Species

Fish	Wildlife and Birds		Plants and Trees	
Dolly Varden (Bull Trout)	Caribou	Ruffed Grouse	Blueberries	Tamarack
Rainbow Trout	Moose	Beaver	Saskatoon Berries	Western Chokecherry
Sturgeon	Mountain Goat	Otter	Kinnikinnick	Yarrow
Salmon	Stone's Sheep	Mink	Wild Rose (and rosehips)	Thimbleberries
Omineca River Rocky Mountain Whitefish	Deer	Rabbit	Lingonberries	Fiddleheads
Arctic Grayling	Grizzly Bears	Porcupine	High-bush Cranberries and Cranberry buds	Cattails
Nechako White Sturgeon	Black bear	Squirrels	Soapberries	Bracken Fern
Ling (Burbot)	Cougar	Marten	Strawberries	Venus' Slipper
Golden Suckers	Lynx	Fisher	Raspberries	Spring Beauty
Char (Lake Trout)	Wolverine	Weasel	Huckleberries	Wild Onion
Trout	Hoary Marmots	Muskrat	Crowberries	Sweet Alpine Vetch
Kokanee	Bald Eagle	Fox	Devil's club	Canada Mint
	Ptarmigan	Coyote	Jackpine/ Lodgepole Pine (pitch)	Red Willow
	Spruce Grouse	Wolf	Rock Juniper	Mountain Alder
	Blue Grouse		Mushrooms	Lichens
	Ducks		Labrador tea	Black Twinberry
	Gulls		Balsam bark	Trembling Aspen
	Common Loon		Black Currant	Sage
	Canada Goose			Fireweed
	Crane			Horsetail
	Trumpeter Swan			

SOURCES:

ERM and Aurico Metals Inc. 2016; CSTC 2006; PRGT 2014; Littlefield et al. 2007; EAO 2014.

6.2.2.2.4 Takla Lake First Nation Traditional Use Locations

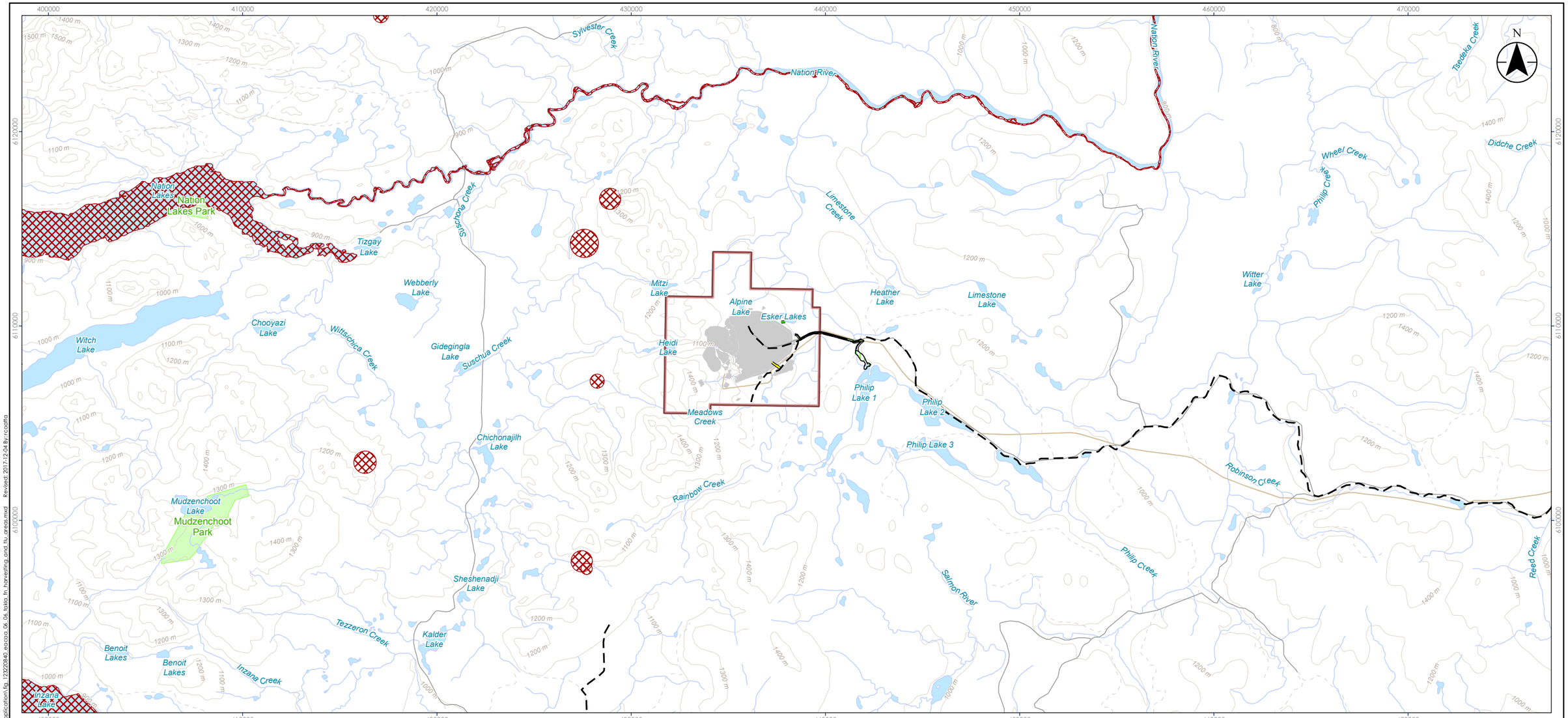
Information on traditional use locations was obtained through a review of publicly-available project reports that discuss Takla Lake First Nation traditional use. While considerable information on traditional use by Takla Lake First Nation members is available for certain parts of Takla Lake First Nation territory (e.g., Thutade Lake and Trembleur Lake), information on use in the Mount Milligan area is limited. This lack of information may not reflect the importance of the Mount Milligan area for Takla Lake First Nation members.

Figure 6-6 summarizes traditional use information that is available in the public domain. Identified traditional use areas located near the mine site are identified in red. Three of the identified areas are located within 10 km of the project site. Other areas identified in red include:

- **Nation Lakes**: Used for hunting grizzly bear and birds, and for fishing. The closest of the Nation Lakes is Chuchi Lake (located approximately 20 km from the project site).
- **Nation River**: Used for hunting and fishing, with associated camping sites and traditional trails. Passes within approximately 12 km of the project site.

Other identified traditional use areas in the Mount Milligan area include the following:

- **Inzana Lake:** Located approximately 30 km from the project site, Takla Lake First Nation has reported that its members hunt and fish there, and that cultural use areas and traditional trails are also in the area.
- **Sasklo Dome**: Located approximately 32 km from the project site, Takla Lake First Nation has reported traditional trails and cultural use areas in that area. (PRGT 2014; CSTC 2006; Sharp 2014; Takla Lake First Nation and CPAWS 2016



- Road
- Gravel Road
- Resource Road
- Topographic Contour
- Watercourse
- Waterbody
- Park, Ecological Reserve, or Protected Area
- Mining Lease (631503)
- Water Pipeline
- EA Approved Powerline
- EA Approved Project Footprint
- Proposed Water Pipeline
- Proposed Water Pipeline Right of Way
- Takla Lake First Nation Traditional Use Areas

0 2 4 6 8 10 km

1:200,000 (At original document size of 11x17)

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Project Location
NTS Grid: 093O04
BCGS Grid: 93O.011

Project Number 123220840
Prepared by RCOATTA 20171124
Discipline Review by SBLACK 20171130
GIS Review by NPUREWAL 20171201

Client/Project
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Mount Milligan Mine
Environmental Assessment Certificate Amendment Application

Figure No. **6-6**

Page No. 1 of 1

Title

Takla Lake First Nation Harvesting and Traditional Use Areas in Mt. Milligan Project Area

6.2.2.3 Description of Potential Adverse Effects on the Exercise of Takla Lake First Nation Aboriginal Interests

The locations affected by the changes in this amendment are within an area that may be used by Takla Lake First Nation members when exercising their Aboriginal Interests. Potential effects on biophysical resources harvested by Takla Lake First Nation members, effects on visual and aesthetic resources and noise, as well as the potential effects on cultural heritage resources (such as cabins) Takla Lake First Nation members use when exercising their Aboriginal Interests, are key issues to be addressed when assessing potential adverse effects.

The assessment of the Project effects on other First Nations' Aboriginal Interests in the EAC Application was based on conclusions for the following relevant VCs:

- Fish and Aquatic Resources
- Vegetation and Plant Communities
- Wildlife
- Archaeology and Heritage Resources
- Visual and Aesthetic Resources
- Noise

The following analysis follows that approach and considers the effects of changes in this amendment on those same VCs, and how those changes to the biophysical environment and cultural heritage may also affect how Takla Lake First Nation members exercise their Aboriginal Interests.

Potential interactions with Takla Lake First Nation Aboriginal Interests associated with the changes in this amendment are summarized in Table 6-7.

Table 6-7 Potential Project Interactions with Takla Lake First Nation Aboriginal Interests

Project Activities and Physical Works	Takla Lake First Nation Aboriginal Interests Interaction
Water pipeline and pump station construction	Interaction requires further assessment as the changes in this amendment have potential to interact with Takla Lake First Nation's Aboriginal Interests through: • Potential changes in water quality in Esker Lakes and Philip Lake 1 resulting from erosion and sedimentation due to installation of pumps and water pipelines • Potential effects on rainbow trout (*Oncorhynchus mykiss*) and mountain whitefish (*Prosopium williamsoni*) resulting from a change in flows in Philip Creek • Clearing of traditional use vegetation and plant communities. • Potential interaction with archaeology and heritage resources resulting from ground disturbance associated with trenching and cover within road right-of-ways, cut-blocks, and a cleared area near Philip Lake 1 where pump infrastructure will be placed.
Water extraction	Interaction requires further assessment as the changes in this amendment have potential to interact with Takla Lake First Nation's Aboriginal Interests through: • Potential effects to hydrogeology (groundwater) from withdrawal of make-up water at Esker Lakes, and potential effects to hydrology (surface flow) at Philip Lake 1; • Potential changes in water quality in Philip Lake 1 resulting from erosion and sedimentation due to operation of pumps and water pipelines; • Potential interactions with harvested wildlife and their habitat through the extraction and transport of make-up water from the potential water sources; • Potential effects to rainbow trout resulting from changes in flows in Philip Creek; • Potential effects to lake whitefish (*Coregonus clupeaformis*) and rainbow trout due to potential changes in lake levels in Philip Lake 1; • Potential effects on traditional use vegetation and plant communities resulting from potential changes in water levels from water extraction.
Decommissioning	Interaction has no potential to affect residual effects characterizations or significance determinations made in the Assessment Reports and is not carried forward in the assessment. No changes to Takla Lake First Nation Aboriginal Interests.

6.2.2.4 Summary of Mitigation Measures to Avoid or Reduce Potential Adverse Effects on Takla Lake First Nation Aboriginal Interests

Mitigation measures to avoid or reduce potential adverse effects on Aboriginal Interests are those listed in Section 5.3 for the Fish and Aquatic Resources VC, Section 5.4 for the Vegetation and Plant Communities VC, Section 5.5 for the Wildlife and Wildlife Habitat VC, and Section 5.6 for the Archaeology and Heritage Resources VC.

6.2.2.5 Characterization of Residual Adverse Effects on Takla Lake First Nation Aboriginal Interests

Given the general similarity of reported traditional use by Takla Lake First Nation in the immediately affected and surrounding areas to that reported for those Indigenous groups originally considered in the EAC Application, it follows that residual effects of the Project (with the addition of proposed Project changes) on Takla Lake First Nation Aboriginal Interests would be very similar to those assessed for other Indigenous groups in the EAC Application, the EAO's Assessment Report and Amendment Assessment Reports.

Based on the assessment findings for relevant VCs set out in Section 5 of the Application, and considering the result of feedback received from Indigenous groups on this Application, changes in the amendment would not alter the characterization of residual effects on traditional use by members of other Indigenous groups as originally set out in the EAC Application. Furthermore, no changes to the significance determinations, as presented in the EAO's Assessment Report (2008) and Amendment Assessment Reports (2013, 2017)] with respect to Aboriginal Interests are required. As there is no change in the characterization of residual effects set out in the EAC Application or the EAO's Assessment Report, changes to the cumulative effects assessment are not required.

Consistent with the EAO's findings regarding the effects of the Project on the Aboriginal Interests of Treaty 8 First Nations and Nak'azdli Whut'en, TCMC is of the view that the risk of adverse effects to lands and resources needed to exercise Takla Lake First Nation Aboriginal Interests has been avoided, adequately mitigated, or otherwise accommodated such that it is not significant. This is due to the relatively small footprint of the changes in this amendment, the mitigation measures that will be implemented to reduce the risk of direct and indirect impacts to fish and aquatic resources, wildlife and their habitat, the requirements for reclamation, and the finite timeframe of Project activities.

6.2.2.6 Outstanding Aboriginal Interests Issues Identified by Takla Lake First Nation.

There have been no outstanding Aboriginal Interests identified by Takla Lake First Nation during the development of this Application.

6.2.3 Other Indigenous Project Considerations

6.2.3.1 Indigenous Archaeology and Cultural Heritage Resources Assessment

The original assessment of Project effects on Indigenous archaeology and cultural heritage resources relied on conclusions for the Archaeology and Heritage Resources VCs assessed in the EAC Application. The following analysis follows that approach, and considers the effects of changes in this amendment on the same VCs, and how those changes to the biophysical environment and cultural heritage may, in turn, affect Indigenous Archaeology and Cultural Heritage Resources. The changes to the potential interactions associated with the changes in this amendment are outlined in Table 6-8.

Table 6-8 Potential Project Interactions with Indigenous Archaeology and Cultural Heritage Resources

Project Activities and Physical Works	Indigenous Archaeology and Cultural Heritage Resources Interaction
Construction	
Water pipeline and pump station	Interaction requires further assessment, as portions of the proposed development footprint have been previously assessed as having moderate to high potential for archaeological resources at the desktop level and have not been subject to field assessment (EOA 2009). Further assessment conducted under a permit issued by the Archaeology Branch and developed through engagement with relevant First Nations will be required. Potential impacts to archaeological sites, if identified, must be managed consistent with the provincial *Heritage Conservation Act* and the Project-specific Archaeology and Cultural Heritage Resources Management Plan (EAO 2009).
Operations	
Water extraction	Water extraction will not result in ground or vegetation disturbance and has negligible potential to affect heritage resources. It is not carried forward in the assessment.
Decommissioning	
Decommissioning and Reclamation	Decommissioning and reclamation will not result in additional ground or vegetation disturbance and has negligible potential to affect heritage resources so long as activities are confined to the construction footprint as defined in the SOI (2008). It is not carried forward in the assessment.

The proposed changes to the Project will not result in interactions with archaeology and cultural heritage resources in a manner that is different from those identified in the EAC Application. Relevant mitigation measures are described in Section 2.5.1.3 of the EAC Application.

Based on the lack of additional interactions, changes in this amendment do not alter the characterization of residual effects on Indigenous archaeology and cultural heritage resources as originally set out in Section 2.5.1.4 the EAC Application. No changes to the significance determination for the Project, as presented in the EAO's Assessment Report (2008) and Amendment Assessment Reports (2013, 2017)] are required. In addition, as there is no change in the characterization of residual effects set out in the EAC Application, changes to the cumulative effects assessment are not required. The characterization of residual effects on each First Nation's archaeology and cultural heritage resources remains as described in Section 2.5.1.4 of the EAC Application.

6.2.3.2 Indigenous Socio-Economic Assessment

The assessment of how changes in this amendment may interact with Indigenous socio-economic conditions is consistent with the scope in Section 2.5.2 of the EAC Application. The assessment of Project effects on socio-economics in the EAC Application used eight valued socio-economic components (VSECs) that capture a broad range of issues raised by First Nations. The eight VSECs are as follows:

- Employment and income
- Population
- Housing
- Services
- Infrastructure
- Family and community well-being
- Transportation

The following analysis is consistent with the approach set out in the EAC Application. The assessment considers the effects of changes in this amendment on those same eight VSECs, and how those changes may, in turn, affect Indigenous socio-economics.

The changes to the potential interactions associated with the changes in this amendment are outlined in Table 6-9.

Table 6-9 Potential Project Interactions with Indigenous Socio-Economic Conditions

Project Activities and Physical Works	Indigenous Socio-Economic Conditions Interaction
Water pipeline and pump station construction	Expenditures and workforces required to construct and operate the water pipeline infrastructure is negligible in comparison to overall Project expenditures and workforce requirements assessed in the original EA. Addition of the changes outlined in this amendment is anticipated to have a negligible interaction with Indigenous social and economic conditions.
Water extraction	No or negligible additional interaction. Addition of the changes in this amendment is anticipated to have a negligible interaction with Indigenous social and economic conditions.
Decommissioning	No or negligible additional interaction. Addition of the changes in this amendment is anticipated to have a negligible interaction with Indigenous social and economic conditions.

The proposed changes to the Project will not result in additional interactions with Indigenous socio-economic conditions in a manner that is different from those originally identified in the EAC Application. Relevant mitigation measures are described in Section 2.5.2.3 of the EAC Application. No new mitigation measures are required.

Based on the lack of additional interactions, changes in this amendment do not alter the characterization of residual effects on Indigenous socio-economic conditions as originally set out in Section 2.5.2.4 the EAC Application. No changes to the significance determination for the Project, as presented in the EAO's Assessment Report (2008) and Amendment Assessment Reports (2013, 2017)] are required. In addition, as there is no change in the characterization of residual effects set out in the EAC Application, no changes to the cumulative effects assessment are required as well. The characterization of residual effects on each First Nation's socio-economic conditions remains as described in Section 2.5.2.4 of the EAC Application.

6.2.3.3 Indigenous Health Assessment

The assessment of how changes in this amendment may interact with Indigenous health is consistent with the scope in Section 2.5.3 of the EAC Application. The original assessment of Project effects on Indigenous health examined the effects of the Project on the following determinants of health:

- Traffic on rural roads
- Country (traditional) foods and drinking water quality
- Local air quality and environmental noise
- Workers' control over work circumstances
- Income and income distribution

The following analysis follows that approach, and considers the effects of the changes in this amendment on the same "health factors", and how those changes may, in turn, affect Indigenous health.

The changes to the potential interactions associated with the changes in this amendment are outlined in Table 6-10.

Table 6-10 Potential Project Interactions with Indigenous Health

Project Activities and Physical Works	Indigenous Health Factors
Water pipeline and pump station construction	No or negligible additional interactions with the quality of country foods, drinking-water quality, or local air quality. Operation of this capacity of water intake infrastructure was assessed as part of the original EA. It is anticipated that the proposed changes would not result in chemical emissions not already assessed in the original EA. Noise from pump stations was assessed as part of the original EA. The proposed pump station at Philip Lake 1 would be the same size and noise level as those assessed in the original EA, including noise mitigation measures. Expenditures and workforces required to construct and operate the water pipeline infrastructure is negligible in comparison to overall Project expenditures and workforce requirements assessed in the original EA. Addition of the changes in this amendment is anticipated to have a negligible interaction with related health factors (i.e., traffic, workers' control over work circumstances, income and income distribution).
Water extraction	No or negligible additional interaction. Addition of the changes in this amendment is anticipated to have a negligible interaction with Indigenous health factors
Decommissioning	No or negligible additional interaction. Addition of the changes in this amendment is anticipated to have a negligible interaction with Indigenous health factors

In summary, proposed changes to the Project will not result in interactions with Indigenous health factors in a manner that is different from what was discussed in the EAC Application. Relevant mitigation measures are described in Section 2.5.3 of the EAC Application. No new mitigation measures are required. Based on the lack of additional interactions, Project changes do not alter the characterization of residual effects on Indigenous health factors as originally set out in Section 2.5.3.4 and Section 2.5.3.5 the EAC Application. The characterization of residual effects on each First Nation's health remains as described in Section 2.5.3 of the EAC Application. In addition, as there is no change in the characterization of residual effects set out in the EAC Application, changes to any related cumulative effects assessment are not required. Furthermore, no changes to the significance determination for the Project, as presented in the EAO's Assessment Report (2008) and Amendment Assessment Reports (2013, 2017)] are required.

6.3 PUBLIC CONSULTATION

TCMS's public consultation in support of the proposed changes to the Project has involved various events, as summarized in Table 6-11. A memo describing the changes in this amendment and work being undertaken in support of the permit amendment was developed and is attached in Appendix J. The memo (dated October 10, 2017) was circulated amongst key public stakeholders throughout October and November 2017. A detailed list of all information requests pertaining to the Project and TCMC responses is included in Appendix K.

Table 6-11 Summary of Public Consultation

Date	Consultation Event	Stakeholders	Interest/Concern Raised	TCMC Response	Interest/Concern Status
2017/09/18	Meeting with District of Vanderhoof Mayor & Council to discuss Mount Milligan water needs (Phase 1&2)	Chief Administration Officer; Mayor; and Councilors	Implications of a shutdown on local communities. Mayor expressed the support of the District to ensure the mine continues to operate.	TCMC will keep District updated as Project progresses	Ongoing
2017/10/04	Community Meeting in Fort St. James	General public	No concerns were raised; TCMC presented on current site water needs. (Phase 1&2)	None required	N/A
2017/10/24	Community Meeting in Mackenzie	General public	No concerns were raised; MTM presented on current site water needs. (Phase 1&2)	None required	N/A
2017/10/27	Phase 1 & 2 Water Needs Presentation to the Mount Milligan Community Sustainability Committee (CSC)	College of New Caledonia (Fort St. James), Project Planner; District of Fort St. James, Councillor; Member at Large, Fort St. James; District of Mackenzie, Director of Corporate Services; College of New Caledonia (Mackenzie), Regional Principal; McLeod Lake Indian Band, Employment & Training Liaison; Nak'azdli Whut'en, Natural Resources Manager; Nak'azdli Whut'en MTM Employment Liaison; District of Vanderhoof, Deputy Dir. Community Development; District of Vanderhoof, Councillor; Member at Large, Vanderhoof; City of Prince George, Councillor	Attendees had concerns about repercussions of a shutdown of the mine on local communities and asked what they could do to support the mine. Several technical questions were answered during the presentation, and were recorded in the meeting minutes sent to CSC members and posted to the Centerra Gold website.	Presentation and Phase 1 Summary Document sent to all CSC members. TCMC will keep CSC updated as Project progresses	Ongoing
2017/11/06	Phase 1 Update Email to the District of Mackenzie	Director of Corporate Services; Mayor	Phase 1 permitting and section 31 application	Status update provided on Phase 1 permitting, including section 31 application submission	Resolved
2017/11/06	Phase 1 Update Email to Mayor of District of Vanderhoof	Mayor	Phase 1 permitting and section 31 application	N/A	N/A
2017/11/06	Phase 1 Update Email to the District of Fort St. James	Councillor; Mayor; Chief Administration Officer	Phase 1 permitting and section 31 application	N/A	N/A
2017/11/06	Phase 1 Update Email to Vanderhoof members of the CSC	Vanderhoof Member-at-Large; Councillor from Vanderhoof	Phase 1 permitting and section 31 application	N/A	N/A
2017/11/06	Phase 1 Update Email to Fort St. James members of the CSC	Fort St. James Member-at-Large; Project Planner, College of New Caledonia (Fort St. James)	Phase 1 permitting and section 31 application	N/A	N/A
2017/11/06	Phase 1 Update Email to the City of Prince George	Mayor; Councillor	Phase 1 permitting and section 31 application	N/A	N/A
2017/11/07	Phase 1 Update Email to Mackenzie Member of the CSC	Regional Principal, College of New Caledonia (McKenzie)	Phase 1 permitting and section 31 application	N/A	N/A
2017/11/08	Copy of Section 31 Application sent to the District of Vanderhoof	Mayor	section 31 variance application	Copy of Mount Milligan's section 31 variance application sent by email	N/A

Consultation

Date	Consultation Event	Stakeholders	Interest/Concern Raised	TCMC Response	Interest/Concern Status
2017/11/08	Copy of section 31 Application sent to the District of Mackenzie	Mayor; Director of Corporate Services	section 31 variance application	Copy of Mount Milligan's section 31 variance application sent by email	N/A
2017/11/08	Copy of section 31 Application sent to the District of Fort St. James	Mayor; Chief Administrative Officer; Councillor	section 31 variance application	Copy of Mount Milligan's section 31 variance application sent by email	N/A
2017/11/08	Letter of Support sent to EAO from the District of Mackenzie	District of Mackenzie	Support for MTM Phase 1 permit amendment	None required	Resolved
2017/11/10	Letter of Support sent to EAO from the District of Vanderhoof	District of Vanderhoof	Support for MTM Phase 1 permit amendment	None required	Resolved
2017/11/17	Letter of Support sent to EAO from the District of Fort St. James	District of Fort St. James	Support for MTM Phase 1 permit amendment	None required	Resolved

6.4 REGULATORY CONSULTATION

TCMC began consultation with several regulatory agencies beginning in the early fall of 2017. A Project Description was provided to EAO on November 1, 2017 for their review and comment. EAO determined that an EAC amendment would be required for the proposed changes to the Project. On September 7, 2017 EAO and MMPO held a regulatory meeting with TCMC, Ministry of Environment (MOE), and Ministry of Energy, Mines and Petroleum Resources (EMPR) to introduce the changes in this amendment and discuss information requirements for regulatory authorizations, Indigenous group engagement and the regulatory process.

On October 18, November 10, November 17 and November 28, 2017 technical meetings were held with the Working Group and Mine Review Committee, including Indigenous groups. These meetings discussed project updates, project description questions from Indigenous groups, the water balance, dAAIR comments and the Application review schedule.

Consultation directly with the EAO involved a meeting on September 27, 2017 and a November 15, 2017. These meetings discussed the scope of the dAAIR relative to the original EA and the scope of the Indigenous Consultation section of the dAAir.

Four meetings were held with FLNRO between September 19 and November 1, 2017. These meetings discussed project changes, Esker Lakes pump test and groundwater investigation, Philip's Lake 1 as a water source, water management, potential pipe test impacts on Alpine Lake, and variable flows pumping ability.

One meeting was held with the DFO on November 11, 2017 to discuss project changes, impacts to fish and anticipated authorization.

Table 6-12 is a summary of the regulatory meetings undertaken by TCMC with government bodies regarding the dAAIR and this Application.

Table 6-12 Summary of Regulatory Consultation Events

Date	Stakeholders Present	Topic and Interest/Concern Raised	TCMC Response	Interest/Concern Status
Working Group and Mine Review Committee Meetings, Including Indigenous Groups				
2017/09/07	EAO, MMPO, MOE, EMPR	• Information requirements for project changes • Indigenous group engagement • Regulatory Process, Timelines and Communications	• Clarification of project changes • Prepare draft Application Information Requirements (dAAIR) and Information Requirements Table • Continue engagement with McLeod Lake Indian Band and West Moberly First Nations • Begin engagement with Nak'azdli Whut'en	Addressed
2017/10/18	EAO, MMPO, FLNRO, ENV, EMPR, Nak'azdli Whut'en, McLeod Lake Indian Band, Takla Lake First Nation	• Rationale for requiring additional water • Assessment of water quality and quantity impacts • Baseline information • Cumulative effects • Heidi Lake access	• Answer Indigenous groups' questions during the meeting	Addressed. Further discussions with Nak'azdli Whut'en to explore Heidi Lake access have been completed
2017/11/10	EAO, MMPO. MOE, ENV. EMPR, Nak'azdli Whut'en, McLeod Lake Indian Band, Takla Lake First Nation	• MMPO seeking clarification on land tenure • Dr. Freed requested further information on water balance and how MTM came to a water shortage • Dr. Freed asked if the application would fulfill mill production water needs and sustain tailings levels to keep PAG rock submerged.	Mine boundaries sent to EMPR Provide further background info to Dr. Freed Questions addressed on the call	TCMC sourcing tenure information. Dr. Freed to receive additional information prior to Nov. 17 Technical Meeting
Single Agency Meetings and Correspondence				
2017/09/27	EAO	TCMC sought clarification on the scope of the dAAIR relative to the original EA	• TCMC to proposed assessment methods in consideration of the conclusions in the EAC Application • Draft the AAIR and submit to EAO for review	Addressed
2017/11/15	EAO	TCMC sought clarification on the scope of the Indigenous Considerations section of the dAAIR and provided rationale for the proposed approach	EAO requested TCMC to consider undertaking an assessment more consistent with the EAO dAIR guidelines rather than the methods in the EAC Application. EAO to discuss further with Indigenous groups and follow-up with TCMC.	EAO to provide further guidance
2017/09/19	FLNRO	• Project changes and rationale • Esker Lakes pump test and groundwater investigation	• Submit application for pump test	Addressed
2017/10/20	FLNRO	• Use of BC Water Tool data for Phase 1 Philips Lake	• Provide anticipated water volumes needed • Submit Water License application	Volumes Addressed. Permit application ongoing - to be submitted in December 2017.
2017/10/27	FLNRO	• Water management • Indigenous group stance on Philips Lake as water source • Specifications on Philips Lake pipeline	Provide further information after pump test, once pipeline is designed	Ongoing
2017/11/14	FLNRO	• Potential pipe test impacts on Alpine Lake • Effects of Philips pumping on outflows • Variable flows pumping ability	Questions answered on call	Resolved
2017/11/01	DFO	• Project changes and rationale • Impacts to fish • Anticipated authorization	Provide request for review to referrals mailbox and DFO contact	Ongoing. Request to be submitted in December 2017.

7 SUMMARY OF REQUESTED AMENDMENTS

Based on the results of the assessment set out in this Application, TCMC is requesting the EAC #M09-01 be amended to include the temporary water withdrawal in 2018 from Philip Lake 1 and Esker Lakes as described in Table 7-1.

Table 7-1 Proposed Temporary Water Withdrawal

Water Source	Timing	Year	Total Withdrawal Volume
Philip Lake 1	January 1–March 31	2018	260,000 m^3
Philip Lake 1	April 1–October 1	2018, 2019	2,020,000 m^3
Esker Lakes	January 1–March 31	2018	200,000 m^3

TCMC also requests the following amendments to Schedule B Table of Proponent Commitments of EAC #M09-01:

- **Monitoring** – Add references to monitoring as described in Section 5.7 of this Application

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APPENDIX A
OPERATIONAL WATER MANAGEMENT SYSTEM WATER DEFICIT INVESTIGATIONS

Operational Water Management System

Water Deficit Investigations

Nov 27, 2017

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1. Introduction

Mount Milligan's operational water management system is designed as a closed system to minimize the use of external fresh surface water or ground water sources through maximizing recycle of process water. Process water is stored on site within the Tailings Storage Facility (TSF). Mount Milligan is authorized to make up additional water requirements from the Meadows Creek watershed by pumping from an off-channel pump station. Water supply and make-up sources currently authorized for the project are as follows:

- Precipitation runoff
- Recycling of water from the TSF supernatant pond
- Pit dewatering
- Freshwater from Meadows Creek
- Freshwater in small quantities from groundwater wells (potable supply, mill pump gland lubrication and reagent mixing)

In October 2016 Mount Milligan commissioned New Fields Consulting to conduct a bathymetric survey of the ponds in the TSF. The survey showed a measured water volume of 1.3 M m^3 in the TSF, analysis of the unmeasured portions of the pond allowed Mount Milligan staff to infer a further 0.8 ~ 1.1 M m^3 of water in areas that were inaccessible to the survey crew. At that time there was an additional 0.4 M m^3 stored in the open pit, for a total volume of water stored in the TSF in the range of 2.5 - 2.8 M m^3. At the lower bound of the estimate, 2.5 M m^3, the water stored on site in October 2016 was approximately half of the designed minimum pond volume. The volume of water in the TSF predicted for October 2016 by the Environmental Assessment site Water Balance Model (Clearwater Consultants Ltd. 2009) was 8.0 M m3. The site's Operational Water Balance model predicted the volume of water in the TSF to be approximately 7.6 Mm3. Mount Milligan is currently undertaking an investigation into the discrepancy between modelled and actual water volumes in the TSF. Until the results of the investigation are known, Mount Milligan have taken multiple steps towards rectifying this situation. Section 2 will provide some background of the water balance at Mount Milligan. The potential causes of the shortfall between the Operational Water Balance and the bathymetric survey will be reviewed in Section 3. A summary of water intake/usage since start of operation and the discrepancy between water models and site conditions will be discussed in sections 4 and 5. Section 6 will review the steps taken to rectify the current situation. Section 7 will outline plans to further increase the water in the TSF that have not yet been implemented. Section 8 will review the SWOT analysis performed and the path forward improving the Operational Water Balance model. A brief conclusion will be outlined in Section9.

2. Background

An overall site wide water balance assessment was carried out by Clearwater Consultants Limited (CCL) during the Updated Feasibility Study (Knight Piésold Document VA101-141/4-1, 2008). The water balance assessment evaluated the preproduction, operations, closure, and post-closure periods including sensitivity analyses for wetter and drier than average precipitation, as well as higher seepage rate scenarios. The water balance assessment indicated the following:

- The Mount Milligan site would be operating in a water deficit and would require an external permanent make up water supply source (Meadows Creek Water Supply Pond).
- The tailings pond water volume varies seasonally over a range of about 4.5 M m^3.
- Maximum water levels are typically at the end of snowmelt (end of May) with minimum levels reached in late winter (February through March).
- No release of surface water will be necessary during the mine operational period.
- Water storage using the Tailings Pond and Meadows Creek appear to be sufficient to provide operational water through a design dry event with a 10 year return period.
- The tailings impoundment should be designed to contain a maximum range of 12 M m^3 to 15 M m^3 of water over and above the volume of deposited tailing solids plus freeboard.
- Projected changes to annual precipitation and evaporation as a result of climate change are not expected to significantly change the overall water balance.

All initial studies of the Mount Milligan site found that the mine would be operating in a water deficit and would require a permanent make up water supply. The Feasibility Design of the TSF included an off stream fresh water storage in Meadows Creek. The intention of the storage was to fill with water during high flows and allow pumping to the TSF, as required, to maintain a minimum pond volume (Knight Piésold, Feasibility Design Report VA101-141-4-1).

In October of 2016, the Operation Water Balance was predicting a TSF supernatant pond volume of approximately 8 M m^3, 5.2 M m^3 more than measured and inferred. Knight Piésold were commissioned to examine the Thompson Creek Metals Company (TCMC) water balance and provide feedback, the results of the analysis were issued in January 2017 (VA17-00080). The analysis concluded that the discrepancy between the water balance and the TSF pond was due primarily to drier than average conditions since start up, that were not incorporated into the model.

3. Potential Causes of Water Deficit

3.1 Consecutive Years of Dry Conditions

As noted above, KP have concluded that the primary reason for the discrepancy between the Water Balance and the actual TSF pond is the drier than expected conditions on site since mill start up. Table 1 below, shows the flows observed at Meadows Creek Hydrometric Station 23

as a percentage of the flows presented in the Hydrometeorology Report (2008). The flows presented in the original report have been adjusted to reflect the reduction in drainage area in Meadows Creek as a result of construction of the mine. The watershed area was 22 km², and is now 11.3 km².

Table 3.1- Observed Flows at Hydrometric Station 23 on Meadows Creek Versus Forecasted Flows

Yr / Mth	April	May	June	July	Aug	Sep	Oct	Annual Average
2013		68%	41%	34%	39%	25%	32%	**40%**
2014		36%	33%	25%	14%	18%		**25%**
2015			28%	42%	44%	32%	16%	**32%**
2016	226%	30%	37%	160%	136%	86%	36%	**81%**
2017	37%	47%	38%	32%	24%	17%	28%	**32%**

As can be seen in Table 3.1, the annual average flows on site are less than half of the expected values, with a notable exception in 2016. The April flows in 2016 represent an early freshet followed by a much dryer than expected May. This indicates that 2016 was about average, but with an early wetter freshet and very dry autumn. It is highly unlikely that Mount Milligan is experiencing a sustained drought of this magnitude, a more plausible explanation is that the expected flows presented in the Hydrometeorological Report are higher than the true mean.

3.2 Unpredicted Percolations

Another potential source of the discrepancy between the water balance model and the actual pond is outlined in the TSF Geotechnical Report (KP VA101-00141/02-5 Rev 0 April 1, 2008). The TSF basin has undergone multiple periods of glaciation and as a result the overburden consists of strata of inter-layered sands and gravels, and dense silty glacial till. The observations from the report indicate that there is a layer of dense silty till at depths varying between 2 and 20 m, on top of this dense, low permeability material is a weathered sand and gravel material. Based on the observed densities of materials on site it is possible that up to 2 ~ 3 M m^3 of water percolated into the sands and gravels after mill operations started and before the basin was sealed with tailings. A hydrological drilling program is currently underway to investigate this.

3.3 Bathymetric Uncertainty

Bathymetric surveys at the TSF facility have only recently been conducted, data gaps as a result of accessibility and safety concerns have been issues. Once the water deficit became

apparent, TCMC has undertaken two bathymetric surveys to measure the amount of water stored in the TSF. The accessible area in the east cell is approximately 20% of the total pond surface area. The east cell survey data was extrapolated using straight line geometry to an assumed pond surface.

4. Water Balance Model Unpredictability

The CCL and KP water models both indicated that Mount Milligan would be in water surplus for the first 6 years of operations; however, the bathymetric survey conducted in October 2016 shows that this is not the case. One possible cause is that water is seeping out of the facility: the Mount Milligan environmental department continues to monitor the ground water at all monitoring points around the site and there is no evidence that this is the case. The more likely reason for the sudden drop in water is that the past two freshets (May 2015 and 2016) were smaller than expected. Figure 1 below shows the snow pillow for the Hendrick Lake Snow Pillow Gauge (1A14P). This gauge is located 220 km south east of the site and shows that the snow pack, and subsequent freshets in 2015 and 2016 were the smallest on record. Figure 2 shows the snow pillow for the Pine Pass Snow Pillow Gauge (4A02P). This gauge is located 80 km east-northeast of the site and shows that the snowpack and subsequent freshets in 2015 and 2016 were among the smallest on record. Mount Milligan measures snow depth on site, unfortunately there is not enough data to correlate the site measurements to either of the regional stations. Approximating the reduction in snow pack at the two regional stations and then reducing the 2015 freshet flows by 30% and the 2016 freshet by 40% allows the model to more accurately track the observed pond volume. While it is illustrative to examine the effects of reduced freshet flows in the model it cannot be concluded that this is what happened; however, the evidence does lead to this conclusion over other possibilities.

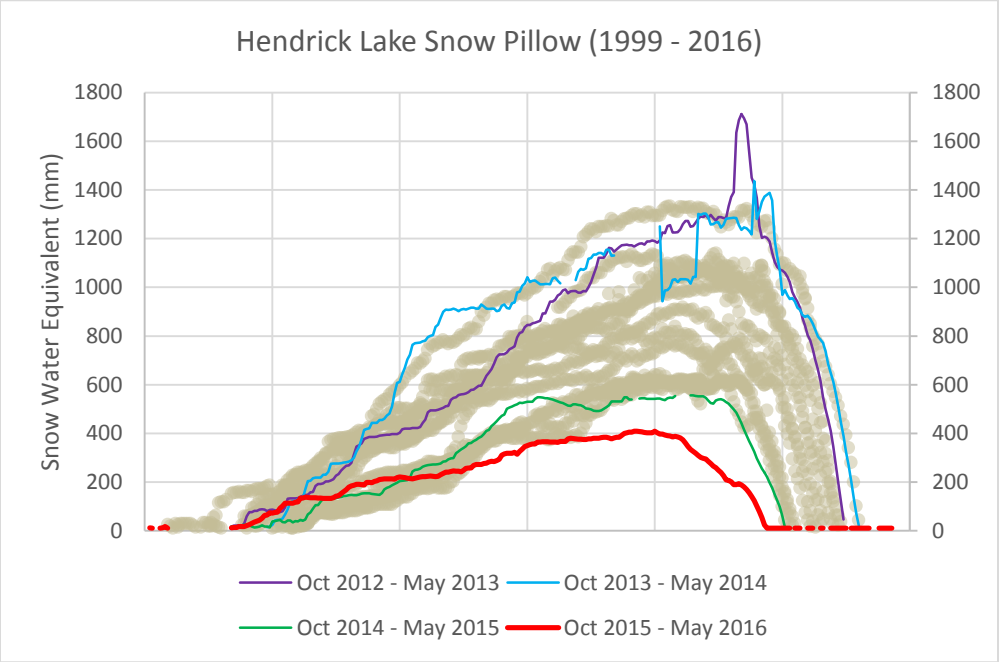


Figure 1: Hendrick Lake Snow Pillow

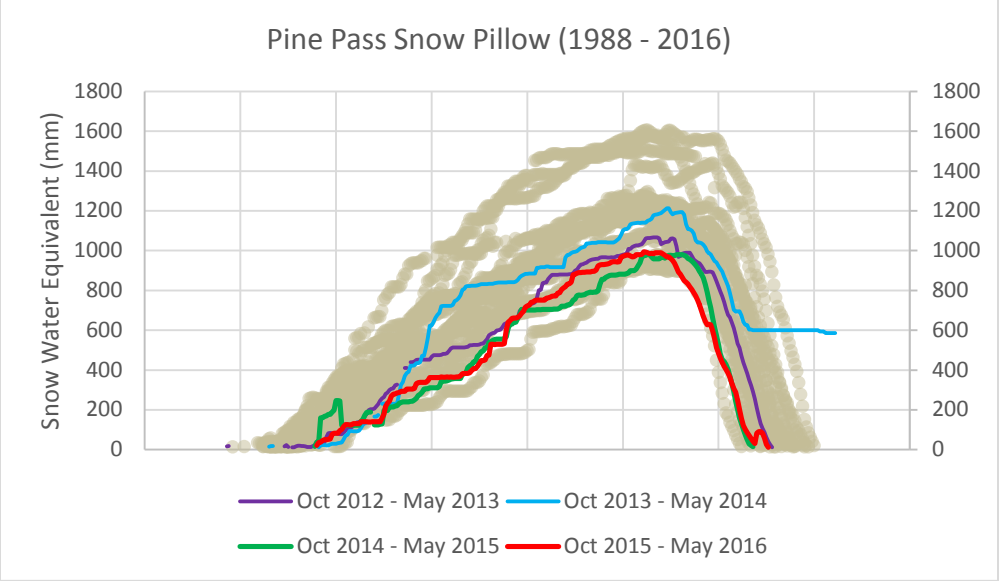


Figure 2: Pine Pass Snow Pillow

Source: BCMOE River Forecast Centre (http://bcrfc.env.gov.bc.ca/data/asp/index.htm)

5. Water Intake/usage Since Start of Operations

At mill start-up, September 2013, there were three freshets of 2011, 2012 and 2013 captured and stored in the TSF. Water was collected from a number of sources including runoff from King Richard Creek, Meadows Creek and from the disturbed catchment areas of the mine and permanent camp. The water balance estimated approximately 13.5 M m³ water storage at mill start up. The volume of water in the TSF continued to increase in late 2013 during the "run in" period for the mill but has steadily decreased (disregarding seasonal variation) since mid-2014. During this period water loses to tailings voids and evaporation have exceeded the water inflows from catchment runoff. The comparison to water intake/usage predicted during design phases in 2008-2009 and the actual site conditions has been presented in Table 5.1 below.

It should be noted that this table and Figure 3 have been generated based on partially available observed flows at Hydrometric Station 23 on Meadows Creek. The winter months runoff (November through April) for both FCST and OBS scenarios were unchanged from baseline average monthly (used in EA). This is Only to demonstrate how much measured values have deviated from baseline values. Otherwise, it is believed that the annual actual deviation is more than what presented in this section.

Table 5.1- Summary of Water Balance Since 2011 – Volumes in M m³

Water Balance		2011		2012		2013		2014		2015		2016		2017	
		FCST	OBS	FCST	OBS	FCST	OBS	FCST	OBS	FCST	OBS	FCST	OBS	FCST	OBS
Inflows	Runoff	4.3	4.6	6.6	5.6	6.6	4.2	7.0	3.7	7.0	5.2	7.4	7.6	7.4	4.6
	Other Sources	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.4	0.4	0.4	0.4	0.4	4.1	4.0
	Total	4.3	4.6	6.6	5.6	6.8	4.4	7.4	4.1	7.4	5.7	7.7	8.0	11.5	8.6
Outflows	Voids Evap. Seepage	0.4	0.4	0.7	0.7	1.8	1.8	7.0	7.0	7.0	7.0	8.9	8.9	8.5	9.2
Change in Storage (M m³)		3.9	4.2	6.0	4.9	5.0	2.6	0.5	-2.9	0.4	-1.3	-1.2	-0.9	3.0	-0.6
Deviation (M m³)		0.3		-1.0		-2.4		-3.3		-1.8		0.2		-3.6	

*FCST: Forecasted; OBS: Observed

As can be seen in comparison of Table 5.1 and Figure 3, the monthly average streamflow used for runoff calculation lead to an overestimation of available water volume. It is evident that the consecutive years of dry condition is the main reason that lead to this unpredicted water deficit.

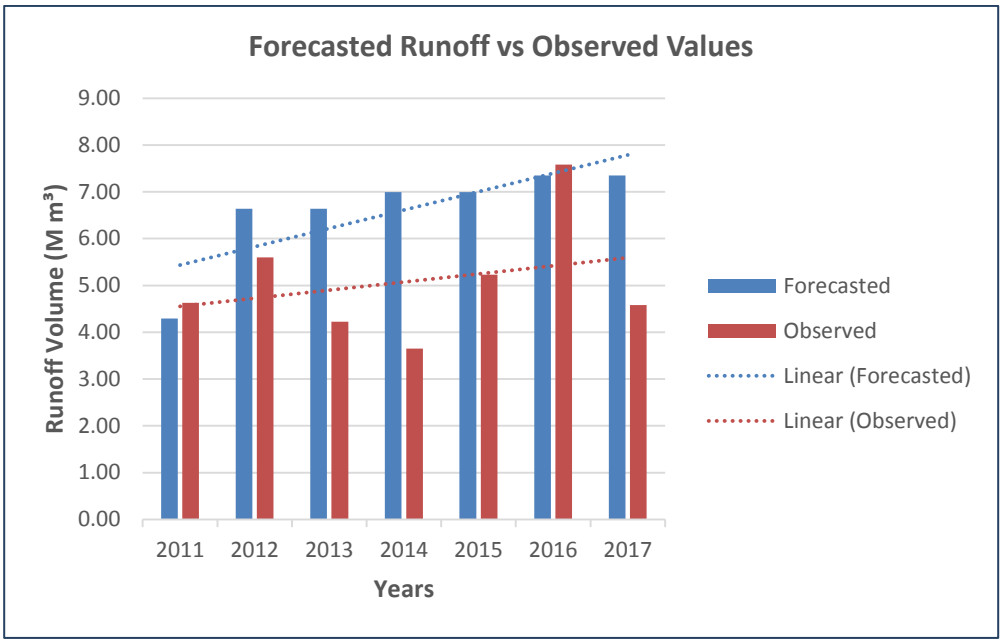


Figure 3: **Forecasted Runoffs versus Observed Values**

6. Steps Taken to Date to Remedy the Water Deficit

6.1 TSF Basin Underdrain Towers

Five Basin Underdrain Towers (BUT) were installed at the topographical lows along the main dam embankment during construction. Each BUT consists of a 2' diameter well screen placed on a concrete slab excavated into the natural ground surface upstream of the Cut-off Trench. The BUTs were initially intended to be used to lower the phreatic surface within the main embankment dam (?). The pumps for the BUTs were purchased during construction and were not intended to be online until Year 5 of operations. In January of 2017 the pumps were installed in BUT #1, #3, #4 and #5. A pump was not installed in BUT #2 as the TSF pond was in contact with the dam embankment at that location. The BUTs have consistently produced total flows of approximately 76.6 L/s. The total volume of water pumped from the BUTs between January and October 2017 is approximately 2.0 M m^3 of water. This water has been critical to maintaining operations prior to the 2017 freshet and continues to offset approximately 25%-30% of the daily water losses.

6.2 Meadows Creek Pump Station

Meadows Creek Water Supply Pond was partially constructed in the winter of 2012 (less the 16.5m high dam) and was anticipated to be used to supplement the TSF pond throughout the life of the mine from year 6 of operation onward. Due to low water volumes in the TSF at the beginning of 2017 the Meadows Creek Water Supply Station (MCWSS) was established in March 2017 to supplement water to the TSF during freshet. An electric pump that was purchased during construction was installed along with two rental diesel pumps in March and April 2017. A temporary steel plate with a bypass orifice was installed in the culvert downstream of the MCWSS to create a ponded area at the base of the station. Pumping at the station began at the end of April and continued through to the beginning of June. There was sufficient flow at the MCWSS to allow capture of 615,000 m^3 of water, which represents only 35% of the volume that was permitted 1.8 M m^3 according to Conditional Licence No. C125689.

6.3 TSF Wells

In addition to the existing BUTs, TCMC has built well pads on the interior of the TSF and has engaged a local water well drilling firm to drill seven wells into a lower strata of sands and gravels. This material was exposed on the east wall of the King Richard Creek valley. These wells will be used to further dewater the tailings deposited in the TSF. As part of the TSF internal well drill program TCMC has engaged Waterline Resources to provide supervision, well development and pump testing. Pump testing has been completed on five wells with a result of total useable flow rate of result of 68.8 L/s, however, it is unknown how long this source will be sustained. While on site Waterline Resources will outline the benefits and costs associated with drilling wells outside of the TSF to potentially supply additional water.

7. Plans to Further Increase the TSF Pond Volume

7.1 BUTs Pump Modification

TCMC will continue to pump out of the BUTs around the perimeter of the TSF. Additionally the current high-head pump in BUT #3 will be swapped with a medium-head pump that will have a higher flow, effectively doubling the flow realized from BUT #3. The tailings beach has been developed around the entire facility and BUT #2 has been brought on line in mid-October. All five BUTs are currently being utilized.

7.2 Meadows Creek Water Supply Station

TCMC will continue utilizing the MCWSS during the freshet of 2018. It is expected that an average or greater snow pack on the Meadows Creek catchment will result in sufficient flows at the MCWSS for the capture of the allowable 1.8 M m^3.

7.3 Esker Lakes Water Supply

TCMC has engaged Stantec Consulting to provide permitting support for applications to withdraw emergency water supply from Esker Lakes. Calculated by a bathymetric survey conducted on the two lakes in September 2017 approximately 380,000 m^3 of water is stored in Esker Lake, with a reported recharge of up to 50 L/s according to EA Volume 4 Section 4.5. According to water modeling and pump tests developed for Esker Lakes, a withdrawal rate of 25 L/s during January, February, and March of 2018 has been proposed in the permit applications.

7.4 Philip Lake #1 Water Supply

The Philip Lake Water Supply Station is proposed for construction during the winter of 2018/2019 to draw water from Philip Lake #1 as both a short-term and long-term water supply source. TCMC has engaged Stantec to provide permitting support for application to install the permanent pump station on Philip Lake #1. The short-term program, as an emergency water supply from Philip Lake #1, would provide an estimated 1.3 M m^3 (January through October 2018) and an estimated 1.0 M m^3 (April through October 2019) of water to the TSF over the next two years. Construction of this pipeline from MtM's Northeast Seepage Collection and Recycling Pond #2 (NESCRP2), adjacent to the TSF, to the Rainbow Creek bridge (approximately 3.0 km within MtM's current mine lease boundary and/or road right-of-way (ROW) is proposed to begin on December 4, 2017. Upon receipt of the permit(s), the last segment of pipe (approximately 2.5 km) and the pump station at the lake will be constructed. Operation of the short-term water supply program is scheduled to start on January 10, 2018, pending permit approvals.

7.5 Monitoring Plans

TCMC has started installing totalizing flow meters on all water sources that will flow into the TSF. This program is ongoing and will continue through 2018. Accurate inflow data will ensure that the values used in forecasting pond volume are better calibrated to site conditions and will allow for a more reliable forecast of long-term pond volumes.

8. Operational Water Balance, SWOT Analysis

A water balance model was developed by Knight Piésold (KP) and presented to Mount Milligan in August 2013 . The KP water balance relied on inputs from earlier data collection and was updated, where possible, to include inputs measured on site. TCMC has used this water balance for the past three years and has made some minor refinements to improve the functionality of the model.

Due to the discrepancies found between the water balance modeled and the site conditions at the TSF ponds, TCMC has undertaken an analysis by focusing on strengths, weaknesses, opportunities, and threats (SWOT) associated with the Operational Water Balance. The intention of this analysis is to verify the necessary improvements that may be required to ensure our Operational Water Balance is a defendable and reliable model that will accurately forecast life-of-mine (LOM) water needs. A summary of the SWOT analysis and an evaluation of the objectives are provided in Appendix A.

As a result of this analysis, the following actions will be implemented into the current Operational Water Balance to ensure its accuracy and reliability, and to streamline and improve water usage:

- The catchment area will be divided into smaller areas, with each area having a unique set of parameters such as coefficient of impermeability, precipitation adjustment factor, etc. The outputs from each of the sub-areas will be used to define a network flow model for the entire catchment.
- Arial survey of TSF catchment areas will be completed to update the TSF catchment areas.
- Annual snowpack survey will be completed to estimate magnitude of upcoming freshet.
- Hydrometeorological inputs will be updated based on additional years of collected data.
- Method of calculation and scaling factors for disturbed unit runoff will be verified.
- Slurry inflow and reclaimed water will be accounted for in the calculation.
- Known flows, rates and the volume of water that is being pumped using a truck will be clearly included into the operational model.
- The dry density and specific gravity for the leaner and Rougher tailings and the waste rock will be tested on a regular basis to validate that the water losses in void spaces are within the design ratio. The split between Cleaner and Rougher tailings will be replaced with actuals as well for the submerged waste rock.
- Recoverable and unrecoverable seepage will be studied further. Once completed the results will be implemented into the model.
- Possibility of percolation of water into sand and gravel layers will be further investigated. Once completed the results will be implemented into the model.

- Flow meters will be installed on all water sources entering into TSF. The monthly average stream flow values in the Operational Water Balance will be replaced with observed values as the data become available.
- All internal and external inputs (other than surface runoffs and direct precipitation), including BUTs, TSF wells, MCWSS, Esker Lakes and Philip Lake #1, will be added to the Operational Water Balance based on the observed values when they are implemented.
- The Operational Water Balance will be redeveloped using GoldSim simulation software as an industry standard. This will eliminate manipulation of inputs and will enable to evaluate sensitive analysis such as changes to throughput and climate.
- Periodic bathymetric surveys will be conducted to ensure the reliability of the Operational Water Balance.

9. Conclusions

The primary reason for the water deficit is the drier than expected conditions on site. The surficial sands and gravels that cover the TSF basin may have adsorbed up to 2-3 M m^3 of water as the TSF filled. Contributing factors to the problem going undetected include lack of data collection and not updating the water balance model with observed inputs.

TCMC is taking steps to avoid the runout of TSF water and to ensure the mill remains operational through the low-flow season of 2018 (January to March) Steps include optimizing the existing Basin Underdrain Towers by installing pumps and pumping from the BUTs and developing wells within the footprint of the TSF to pull trapped water from the sand and gravel lense(s).

TCMC is proposing both short-and long-terms programs to further increase the TSF water volume; these programs include utilizing external sources such as Esker Lakes and Philp Lake #1,as well as pumping from MCWSS during freshet.

TCMC has undertaken a SWOT analysis by focusing on strengths, weaknesses, opportunities and threats associated with the existing Operational Water Balance. This analysis will help verify the necessary improvements to TCMC's Operational Water Balance, ensuring that it is a defendable and reliable water balance model that will accurately forecast LOM water needs.

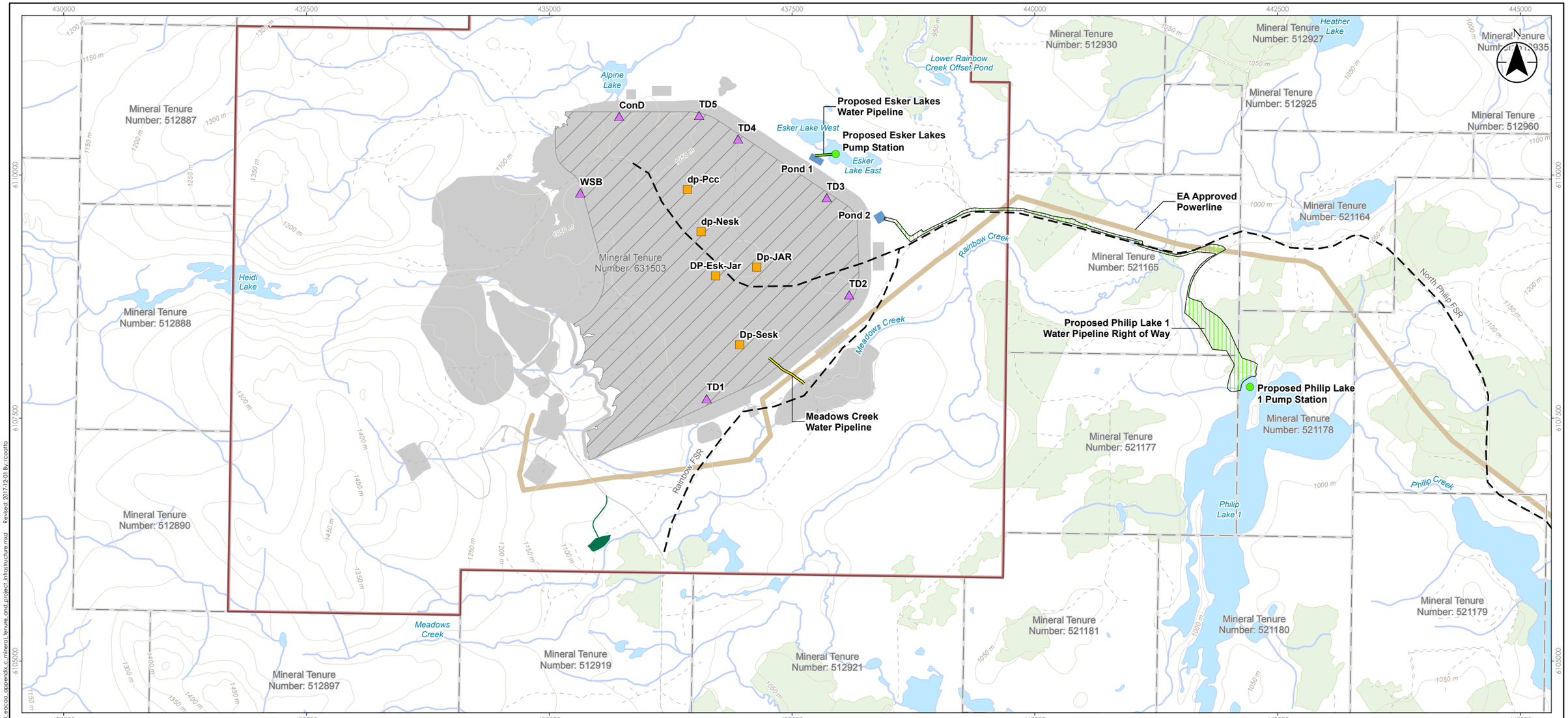
10. References

1. Knight Piésold, Feasibility Design of the Tailing Storage Facility and Water Supply Pond, Ref. No.

VA101-141/2-7.

2. Knight Piésold, Hydrometeorology Repot, Ref No. VA101-141-2-4.
3. Knight Piésold, Independent Water Balance Review, Ref. No. VA17-00080.
4. Knight Piésold ,TSF Geotechnical Report, Ref. No. VA101-00141/02-5.
5. Mount Milligan, Water Balance Review, Technical Memorandum, October, 2017.
6. Mount Milligan, Operational Water Management SWOT Analysis, November, 2017.

APPENDIX B
MINERAL TENURE AND PROJECT INFRASTRUCTURE MAP



- Gravel Road
- Forest Tenure Road
- Topographic Contour
- Watercourse
- Waterbody
- Forest Tenure Cut Block Opening
- Mining Lease (631503)
- Mineral Tenure
- Drill Pad Location for Water Recovery Well
- Tower Drain Location
- Water Pipeline
- Tailings Storage Facility
- Retention Pond
- EA Amendment 1 Camp and Access Road
- EA Approved Powerline
- EA Approved Project Footprint
- Proposed Water Pump Station
- Proposed Water Pipeline
- Proposed Water Pipeline Right of Way

0 0.5 1 1.5 km

1:40,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 10N
2. Data Source: DataBC, Government of British Columbia; Natural Resources Canada; Thompson Creek Metals Company Inc. TCMC
3. This document is provided by Centerra Gold (CG) for use by the intended recipient only. This information is confidential and proprietary to CG and is not to be provided to any other recipient without the written consent of CG.

Stantec

MOUNT MILLIGAN
centerra GOLD

Project Location
NTS Grid: 093O04
BCGS Grid: 93O.011

Project Number 123220840
Prepared by RCOATTA 20171106
Discipline Review PENDING
GIS Review PENDING

Client/Project
Thompson Creek Metals Company Inc.
Mount Milligan Mine
Environmental Assessment Certificate Amendment Application

Figure No.
Appendix B

Page No.
1 of 1

Title
Project Layout

APPENDIX C
HYDROLOGIC AND HYDRAULIC MODELLING REPORT

Hydrologic and Hydraulic Modelling Report

Prepared for:
Mount Milligan Centerra Gold Inc.
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Prepared by:
Stantec Consulting Ltd.
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Burnaby, BC V5H 0C6

December 5, 2017

Revision	Description	Authors		Quality Check		Independent Review	
1	Text	Matthew Friend, Mariah Arnold	Dec 5, 2017	David Luzi	Dec 5, 2017	Sandra Webster	Dec 5, 2017

Stantec

MOUNTMILLIGAN

centerragold

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Executive Summary

This report provides additional details regarding the selection of mean monthly flows for Philip Lake 1 and Philip Creek for the Mount Milligan Copper Gold Project (the Project) amendment to its Environmental Assessment (EAC #M09-01). Regional data complemented with site data are believed to be adequate to describe the hydrology for the purposes of this amendment, a short-term water license for the use of Esker Lakes and Philip Lake 1 as water sources for the Project from January 2018 to October 2019. Results of this report will be validated through ongoing data collection at the site, operational water monitoring, as well as the additional hydrometric stations installed specifically for the purposes of this Project. This ongoing data collection and monitoring will also be used to support and inform management decisions regarding pumping rate determinations.

Average monthly flows were calculated to determine baseline flows at the outlet of Philip Lake 1. These flows and the Project flows, baseline flows minus monthly withdrawals, for 2018 and 2019 were used in hydraulic models to determine the potential changes in lake levels in Philip Lake 1 and in Philip Creek downstream of Philip Lake 1.

Abbreviations

the Application	Environmental Assessment Certificate Amendment Application
BC	British Columbia
EAC	Environmental Assessment Certificate
EDI	Environmental Dynamics Inc.
FLNRO	Ministry of Forests, Lands, and Natural Resource Operations
km	kilometres
km^2	square kilometres
L/s	litres per second
$L/s/km^2$	litres per second per square kilometre
m	metres
m^3	cubic metres
$m^3/s/km^2$	cubic metres per second per square kilometre
mm	millimetres
m/s	metres per second
OWT	Omineca Water Tool
the Project	Mount Milligan Copper-Gold Project
TCMC	Thompson Creek Metals Company Inc.
TSF	Tailings Storage Facility
WSC	Water Survey of Canada
XS	cross section

1 INTRODUCTION

Thompson Creek Metals Company Inc. (TCMC), a wholly-owned subsidiary of Centerra Gold, is applying for an amendment to its Environmental Assessment Certificate (EAC #M09-01) issued on March 16, 2009. The Certificate was granted for the construction and operation of the Mount Milligan Copper-Gold Project (the Project), located approximately 155 kilometres (km) north of Prince George.

This report is written to support an EAC Amendment application (the Application) which is seeking an emergency short-term approval for the use of Esker Lakes and Philip Lake 1 as water sources for the Project from January 2018 to October 2019. In late 2016, a survey of water volumes stored within the Tailings Storage Facility (TSF) found that the water volumes were critically low. The current and anticipated annual water shortage in the TSF is estimated to be 1,800,000 m^3 in 2018 and 2019.

Without additional sources of water, the Project is expected to run out of water between February and March 2018, resulting in shutdown of the mill. Mill shutdown will result in several adverse effects including temporary layoffs of up to 450 workers, loss of regional income, and loss of company revenues. Spring freshet will bring new water supplies; however, there will be a period of approximately six weeks from the time the mine runs out of water to the start of freshet.

To achieve a makeup water supply of 1,800,000 m^3 in 2018 and 2019, TCMC is proposing a short-term withdrawal of water from Philip Lake 1 and Esker Lakes. An assessment of potential effects on water levels within Esker Lakes was done based on results of groundwater modelling presented in the original EAC application (AMEC 2008). The modelling results in the EAC suggest that Esker Lakes could potential provide a supply of water at a rate of 50 L/s with minimal effect to the environment. There are no surface inflows or outflows from Esker Lakes. An additional groundwater investigation program was initiated in late November 2017 to reduce uncertainty in the amount of groundwater available from Esker Lakes as well as uncertainty in the potential effects to down gradient waterbodies. The results of this investigation will be known prior to initiation of the withdrawal program and the data will be used to determine final withdrawal rates.

Philip Lake 1 was not assessed or modelled in the original EAC application. Monitoring stations have been installed in Philip Lake 1 and in Philip Creek, the stream draining Philip Lake 1. As the hydrometric stations have only been active for a short period of time, the available data is not of sufficient length to generate average monthly flows for baseline conditions. The purpose of this report is to provide supplemental information to support the current EAC amendment application for short-term water use. Specifically, this report will present:

1. The methods and results for generating mean monthly stream flows to represent baseline conditions in Philips Creek

2. The methods and results of the hydraulic analysis used to estimate the potential drawdown of Philip Lake 1 due to proposed water withdrawals
3. The methods and results of the hydraulic analysis used to determine the differences between baseline and project flows in Philip Creek to assess environmental flow needs.

2 SITE CHARACTERISTICS

The Mount Milligan mine (elevation of approximately 1,000 m) lies within the southern end of the Swannell Range of the Omineca Mountains, which are located within the Nechako Plateau (Holland 1976). Surficial sediments in the area consist of Quaternary and Holocene deposits.

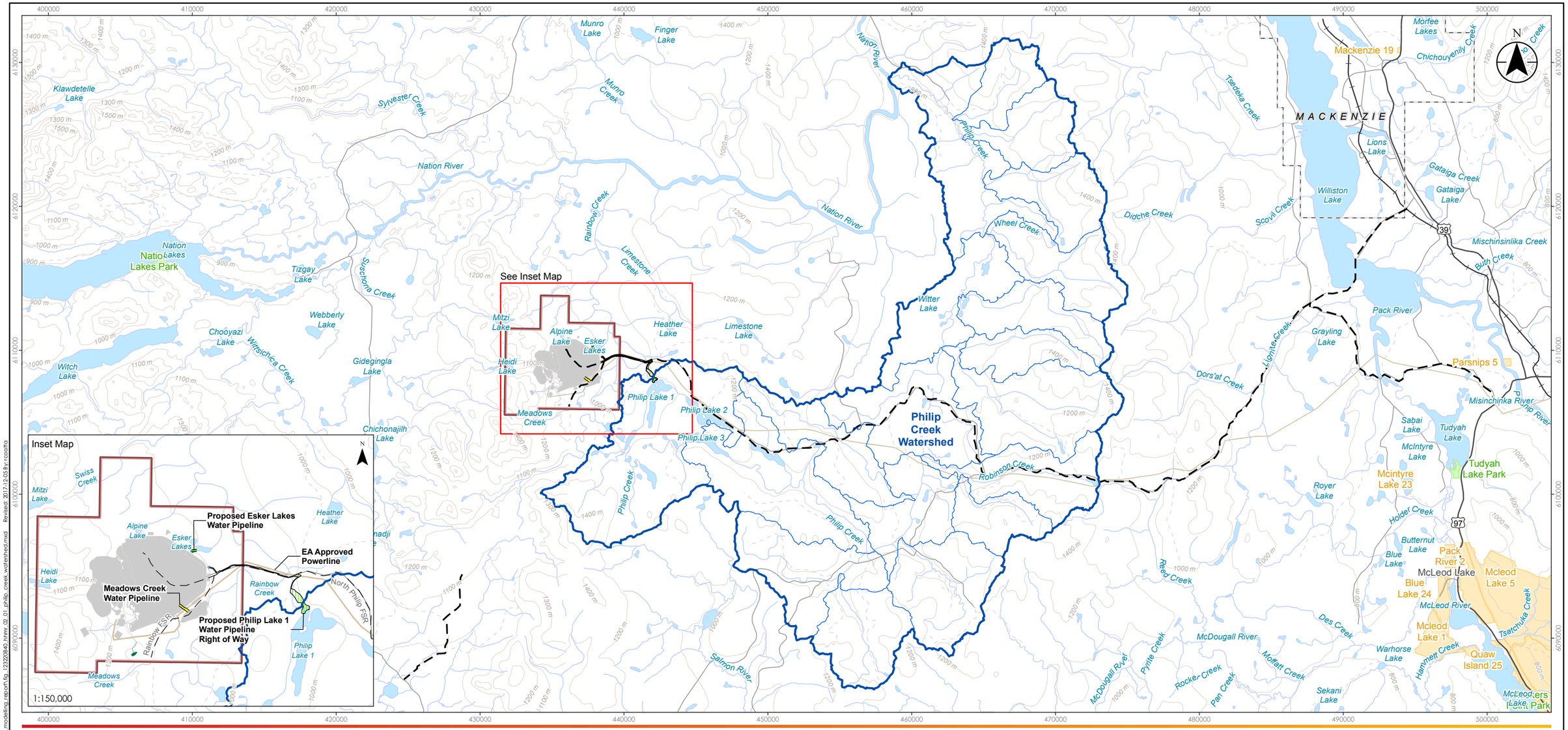
The two proposed water sources for the Project are Esker Lakes and Philip Lake 1 (Figure 2-1). Esker Lakes are located within the Rainbow Creek watershed. Rainbow Creek is a tributary of the Nation River. The Rainbow Creek watershed drains an area of 231.9 km^2 and ranges in elevation from 886 m to 1,488 m. The Esker Lakes are comprised of two lakes, Esker Lake East and Esker Lake West. Bathymetric surveys of the Esker Lakes allowed the calculation of morphometric characteristics, including lake surface area, maximum depth, volume, and shoreline length (Figure 2-2). Based on these measurements the associated lake volume of Esker Lake East was estimated to be 212,855 m^3 and the volume of Esker Lake West was estimated to be 163,922 m^3.

Philip Lake 1 falls within the Philip Creek watershed. The hydrologic regime of the upper Philip Creek watershed is dominated by lakes (Figure 2-1). The overall Philip Creek watershed is approximately 763 km^2, with 1.2 km^2 (1.5%) as lakes. Philip Creek generally drains from south-west to north-east and eventually discharges into the Nation River. The upper Philip Creek watershed is comprised of three big lakes, Philip Lake 1, Philip Lake 2, and Philip Lake 3. Table 2-1 summarizes the surface area, volume and watershed area at lake outlet for each lake. This report focuses on modelling the results of the proposed project withdrawals on Philip Lake 1 and Philip Creek, upstream of Philip Lake 2.

Table 2-1 Lakes of Upper Philip Creek

Lake	Watershed Area at Lake Outlet (km^2)	Surface Area (m^2)	Volume (m^3)
Philip Lake 1	60.9	2,015,446.9	5,339,760.1
Philip Lake 2	79.0	1,790,501.1	11,815,871.1
Philip Lake 3	98.9	1,222,469.6	4,690,842.3

A bathymetric survey of Philip Lake 1 determined that the volume of water in the lake was approximately 5,339,760 m^3 (Figure 2-3). Minor first and second order tributaries contribute flow to Philip Lake 1. There are no known reserves or restrictions on the Philip Creek system upstream of Philip Lake 2.



- Highway
- Road
- Gravel Road
- Resource Road
- Railway
- Topographic Contour (100 m Interval)
- Municipal Boundary
- Watercourse
- Waterbody
- First Nations Reserve
- Park, Ecological Reserve, or Protected Area
- Water Pipeline
- EA Approved Powerline
- EA Approved Project Footprint
- Mining Lease (631503)
- Proposed Water Pipeline
- Proposed Water Pipeline Right of Way
- Philip Creek Watershed
- Philip Creek 3rd Order Assessment Watershed

0 2 4 6 8 10 km

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Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Data Source: DataBC, Government of British Columbia; Natural Resources Canada; Thompson Creek Metals Company Inc. TCMC
3. This document is provided by Centerra Gold (CG) for use by the intended recipient only. This information is confidential and proprietary to CG and is not to be provided to any other recipient without the written consent of CG.

Stantec

MOUNT MILLIGAN
centerra GOLD

Project Location
NTS Grid: 093O04
BCGS Grid: 93O.011

Project Number 123220840
Prepared by RCOATTA 20171106
Discipline Review by DLUZI 20171204

Client/Project
Thompson Creek Metals Company Inc.
Mount Milligan
Hydrologic and Hydraulic Modelling Report

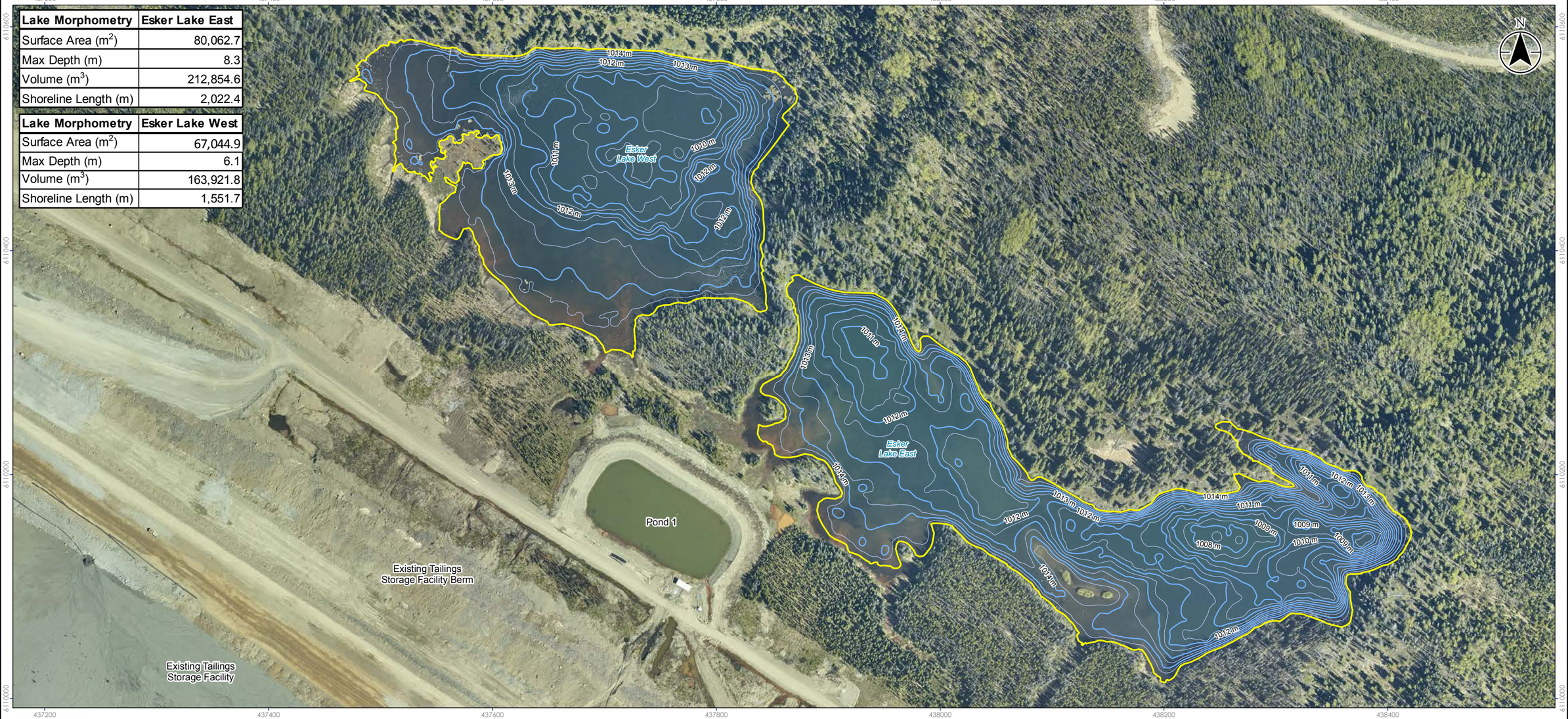
Figure No. **2-1**
Page No. 1 of 1

Title
Philip Creek Watershed

\\cd1183-f03\Workgroup\123\project\123220840\figures\report\hydrologic_and_hydraulic_modelling_report\fig_123220840_hmr_02_01_philip_creek_watershed.mxd Revised: 2017-12-05 By: rcoatta

Lake Morphometry	Esker Lake East
Surface Area (m^2)	80,062.7
Max Depth (m)	8.3
Volume (m^3)	212,854.6
Shoreline Length (m)	2,022.4

Lake Morphometry	Esker Lake West
Surface Area (m^2)	67,044.9
Max Depth (m)	6.1
Volume (m^3)	163,921.8
Shoreline Length (m)	1,551.7



- Esker Lakes Outline (1014.9 m Elevation)
- Esker Lakes Bathymetry Countour (1 m Interval)
- Esker Lakes Bathymetry Countour (0.5 m Interval)

0 50 100 150 m

1:3,500 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Data Source: DataBC, Government of British Columbia; Natural Resources Canada; Thompson Creek Metals Company Inc. TCMC; Bathymetry source data provided by DWB Consulting Services Ltd.
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Project Location
NTS Grid: 093O04
BCGS Grid: 93O.011

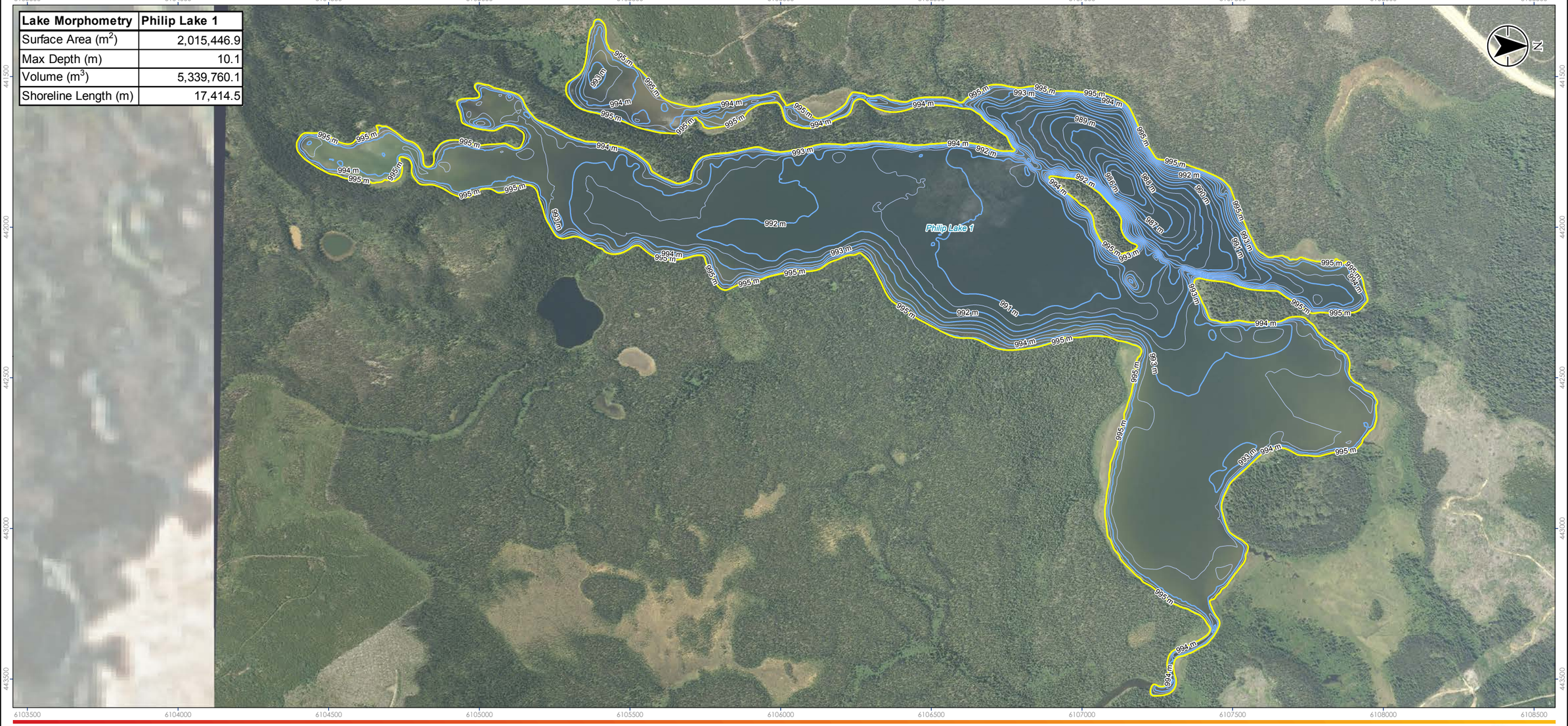
Project Number 123220840
Prepared by RCOATTA 20171130
Discipline Review by DLUZI 20171201
GIS Review by NPUREWAL 20171201

Client/Project
Thompson Creek Metals Company Inc.
Mount Milligan Mine
Hydrologic and Hydraulic Modelling Report

Figure No. **2-2**
Page No. 1 of 1

Title
Bathymetry and Morphometry of Esker Lakes

Lake Morphometry	Philip Lake 1
Surface Area (m^2)	2,015,446.9
Max Depth (m)	10.1
Volume (m^3)	5,339,760.1
Shoreline Length (m)	17,414.5



- Philip Lake 1 Outline (995.1 m Elevation)
- Philip Lake 1 Bathymetry Countour (1 m Interval)
- Philip Lake 1 Bathymetry Countour (0.5 m Interval)

0 100 200 300 400 500 m

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Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Data Source: DataBC, Government of British Columbia; Natural Resources Canada; Thompson Creek Metals Company Inc. TCMC; Bathymetry source data provided by Bazett Land Surveying Inc.
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Project Location
NTS Grid: 093O04
BCGS Grid: 93O.011

Project Number 123220840
Prepared by RCOATTA 20171130
Discipline Review by DLUZI 20171201
GIS Review by NPUREWAL 20171201

Client/Project
Thompson Creek Metals Company Inc.
Mount Milligan Mine
Hydrologic and Hydraulic Modelling Report

Figure No. **2-3**
Page No. 1 of 1

Title
Bathymetry and Morphometry of Philip Lake 1

3 SITE HYDROLOGY

3.1 CLIMATE

TCMC manages an on-site meteorology station that has been in operation for 11 years. It was installed in 2007. Temperature has been recorded during this 11-year period of record. Historical average monthly temperatures and the most recent complete year of average monthly temperature data (2016) are shown in **Error! Reference source not found.** and Figure 3-1.

Table 3-1 Mount Milligan Historical and 2016 Average Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Historical Average Temperature (°C)	-9.1	-7.3	-3.9	1.3	7.3	11.2	14.0	13.4	8.8	1.9	-5.2	-10.3
2016 Average Temperature (°C)	-6.4	-1.3	-0.3	5.0	8.6	11.9	13.9	14.7	8.0	-0.5	-1.1	-12.6

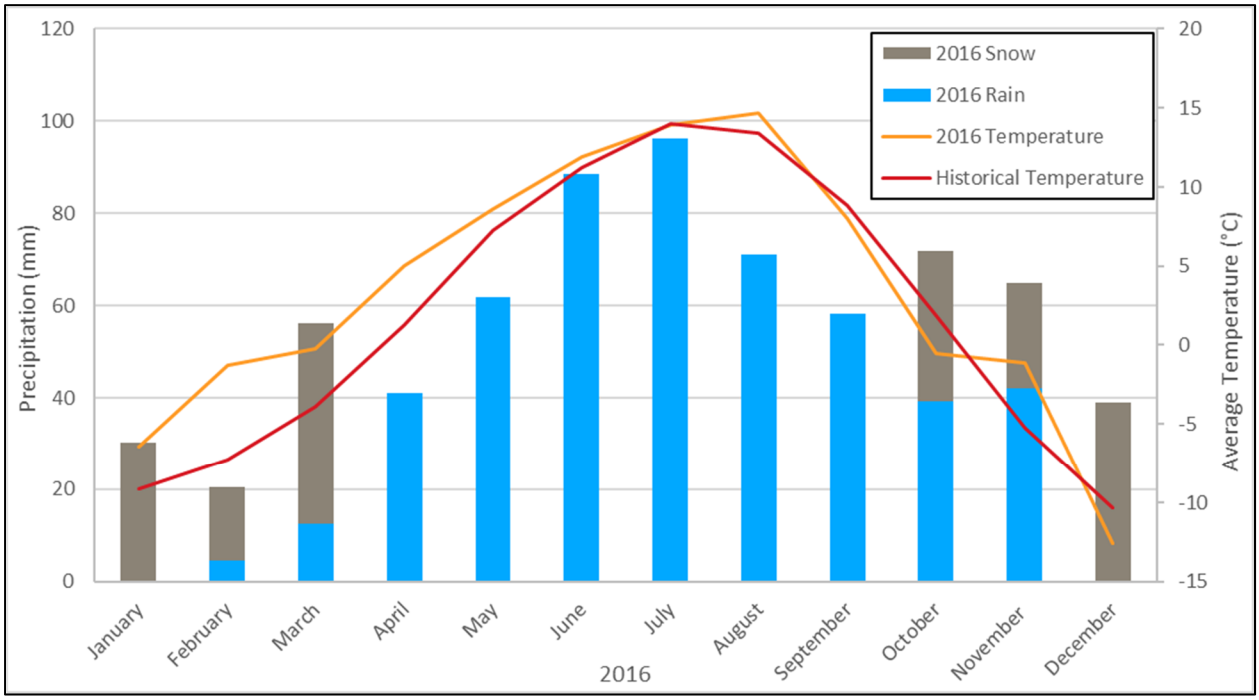


Figure 3-1 Mount Milligan Historical Average Temperature and Precipitation and 2016 Average Monthly Temperature and Total Monthly Precipitation

Problems with the on-site rain gauge prevented the calculation of average annual and monthly precipitation values for most of the historic precipitation data, but 2016 data was deemed reliable (see Table 3-2). Annual precipitation in 2016 was 699.5 mm, which is close to the annual average precipitation of 770.0 mm (approximately 91% of the predicted value calculated by Knight Piésold (KP) in the 2008 Hydrometeorology report (KP 2008). Precipitation was unevenly distributed throughout 2016, with approximately 74% falling as rain and 26% falling as snow. The EAC application assumed that the amount of rainfall and snowfall was evenly divided (KP 2008).

Table 3-2 Mount Milligan 2016 Precipitation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Rain (mm)	0.0	4.5	12.4	41.0	61.7	88.5	96.3	71.0	58.3	39.3	42.2	0.0	515.2
% Precip as rain	0%	1%	2%	6%	9%	13%	14%	10%	8%	6%	6%	0%	74%
Snow (mm)	30.3	15.9	43.9	0.0	0.0	0.0	0.0	0.0	0.0	32.5	22.6	39.0	184.3
% Precip as snow	4%	2%	6%	0%	0%	0%	0%	0%	0%	5%	3%	6%	26%
Total Precip (mm)	30.3	20.4	56.3	41.0	61.7	88.5	96.3	71.0	58.3	71.8	64.8	39.0	699.5
% Precip	4%	3%	8%	6%	9%	13%	14%	10%	8%	10%	9%	6%	100%

Analysis of regional snow pillow data indicates low snow packs in recent years. No active snow pillow stations are located within the same hydrologic zone (Nechako Plateau) as Mount Milligan. The snow weather station located at Aiken Lake (station 4A30P) was selected for analysis due to its proximity to the mine site, similar elevation (61 m difference), and similar terrain and climate. The 4A30P station is managed by BC Hydro and is located approximately 160 km north-west of Mount Milligan, within the Omineca Region's Northern Rocky Mountains hydrologic zone. Snow pack data in the form of snow water equivalents from the past five water years (with each water year beginning in October 1 and ending on September 30) indicate that these years fall within the average to low portion of the historical range (Figure 3-2). The two most recent completed years, 2015 and 2016, fall within the low portion of the historical range.

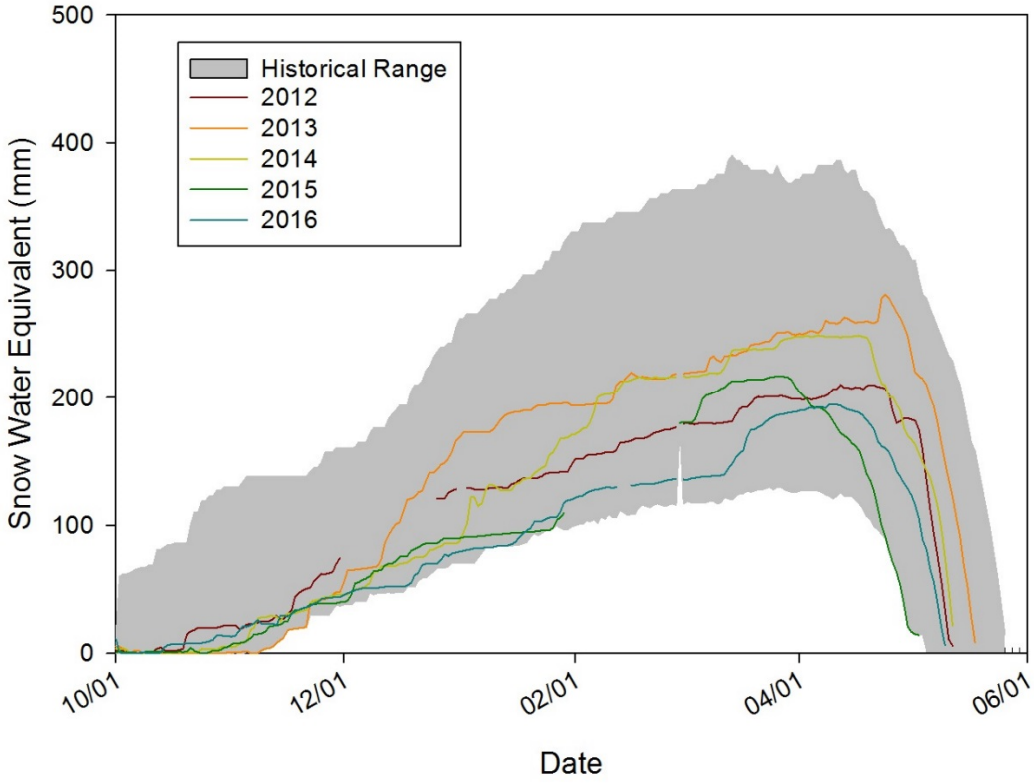


Figure 3-2 Aiken Lake Snow Weather Station (4A30P) Snow Pillow

Historical average wind speed data are presented in Table 3-3 along with the most recent complete year of data (2016). Both historical and 2016 wind speeds were typically highest during the summer and lowest in the winter.

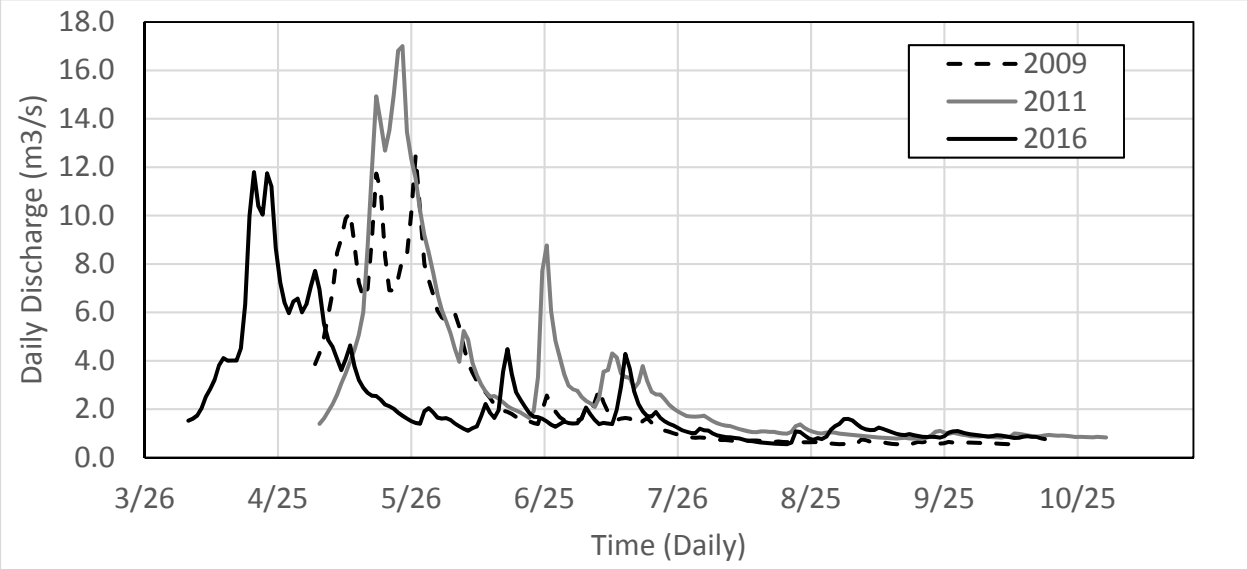
Table 3-3 Mount Milligan Historical and 2016 Average Wind Speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Historical Average Wind Speed (m/s)	1.72	1.81	2.08	2.28	2.30	2.31	2.26	2.09	2.12	2.03	1.90	1.64
2016 Average Wind Speed (m/s)	0.92	1.66	2.01	1.98	2.83	2.25	2.17	2.41	2.12	1.78	1.73	2.02

3.2 HYDROLOGY

Hydrology in the project area is dominated by snow melt driven flows in the spring and rains in the fall. A representative hydrograph from the site hydrometric station at Rainbow Creek downstream of STN 6 stream mouth (STN 26) is provided in Figure 3-3. This hydrometric station monitors a watershed area of 124 km^2. The three years provided show the annual variability in stream flows at the site as well as the distribution during the year.

The project area falls within the Nechako Plateau Hydrologic Zone 8 of British Columbia, following Obedkoff (2003). Ahmed (2015) updated the earlier Obedkoff (2000) report for the Omenica. Twenty-four hydrometric stations were used in the analysis for this hydrologic zone, with drainage areas ranging from 9.8 km^2 to 14, 235 km^2, with an average of 3,710 km^2. Average annual unit runoff values for the stations ranged from 4.2 L/s/km^2 to 28.6 L/s/km^2 with an average of 11.7 L/s/km^2. With few exceptions, stations with higher values of unit runoff tended to be in watershed with higher median elevations (typically over 1,100 m).



SOURCE: Ahmed 2015

Figure 3-3 Example of Annual Hydrographs from Rainbow Creek (Station 26)

4 FLOW ESTIMATION

As discussed previously, hydrometric stations were installed in August 2017 and October 2017 in Philip Lake 1 and in Philip Creek at the outlet of Philip Lake. The data record is, therefore, not long enough to generate monthly flow averages to represent baseline conditions. Instead, historic, regional, and local data sources were used to generate baseline average monthly flow values. Data sources included:

1. Mount Milligan Environmental Assessment (2008)
2. Hydrometric Data – Rainbow Creek STN 23 (Mount Milligan)
3. British Columbia (BC) Omineca Water Tool (OWT) (BC FLNRO 2017)
4. Water Survey of Canada (WSC) (WSC 2017)

The approach taken to generate average monthly flows representing baseline conditions for Philip Creek was as follows:

1. Select a monthly flow distribution to apply to Phillip Creek downstream of Philip Lake 1.
2. Select a unit runoff to apply to the watershed draining to Phillip Creek downstream of Philip Lake 1.
3. Calculate baseline monthly flows in Phillip Creek downstream of Philip Lake 1 using the results of step 1 and 2.

4.1 MONTHLY FLOW DISTRIBUTION

Selection of a monthly flow distribution to represent Philip Creek was based on a review of three monthly distributions from locations that had similar characteristics and were in similar topographic areas as Philip Creek (Table 4-1and Figure 4-1). These three, monthly distributions are from Rainbow Creek, the BC OWT data extracted for Philip Creek at the outlet for Philip Lake 1, and a WCS station in Pack River. Rainbow Creek was the monthly flow distribution used in the original EAC application. Upper Rainbow Creek is located in a similar topographic position as Philip Creek and would likely experience a similar climatic forcing. The monthly flow distribution generated by the BC OWT is similar to the average distribution of all stations within the Nechako Plateau Hydrologic Zone (Ahmed 2015), therefore it is likely the BC OWT uses the Nechako Plateau dataset to generate its results. The WSC station at Pack River, which is located at the Outlet of McLeod Lake (station 07EE010), was selected because of its proximity to the Project (approximately 60 km away) and a shared Hydrologic Zone (Nechako Plateau), and more importantly, the station is located at the outlet of a lake which makes it similar to the Philip Creek site.

The BC OWT dataset was removed as an option because it showed a muted freshet (Figure 4-1). The monthly flow distribution for Rainbow Creek and Pack River matched closely making them both viable options, however, to maintain continuity with hydrologic parameters already accepted in the original EAC application the Rainbow Creek distribution was selected.

Table 4-1 Monthly Flow Distribution

Source	Monthly Flow Distribution											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainbow Creek	3%	3%	3%	5%	41%	22%	5%	3%	4%	5%	4%	3%
BC OWT	2%	2%	1%	9%	22%	26%	12%	6%	5%	6%	5%	3%
Pack River at Outlet of McLeod Lake	4%	4%	4%	15%	36%	14%	5%	3%	2%	4%	6%	4%

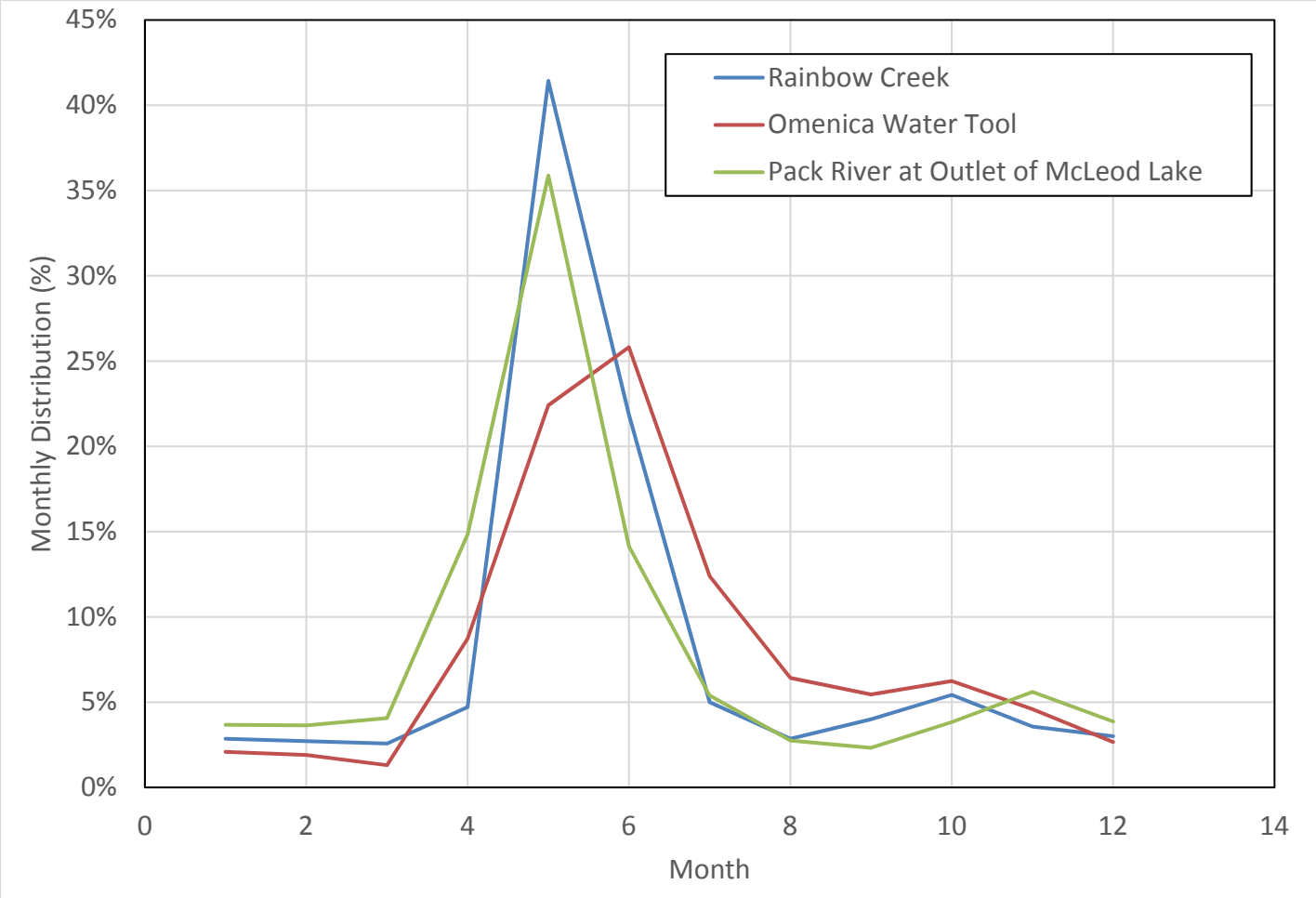


Figure 4-1 Monthly Flow Distribution

4.2 UNIT RUNOFF

Unit runoff is the total quantity of water that is discharged (runs off) from a drainage basin in a year. Unit runoff is determined by dividing the total annual discharge observed at a station by the drainage area upstream of that station. Unit runoff is typically presented as litres per second per square kilometre (L/s/km^2) or cubic metres per second per square kilometre (m^3/s/km^2). Runoff represents the difference between annual precipitation (i.e., rain and snow) and evaporation. Runoff is valuable for obtaining gross estimates of the water available in a basin.

Monthly, annual average, and total annual values for unit runoff for the Upper Rainbow Creek (STN 23) are provided in Table 4-2. The average annual unit runoff value in the Environmental Assessment for Upper Rainbow Creek was estimated to be 14.3 L/s/km^2. Unit runoff estimated from the BC OWT dataset and Pack River were 11.2 L/s/km^2 and 11.8 L/s/km^2, respectively. As previously mentioned, the range in average annual unit runoff for the Nechako Plateau was between 4.2 L/s/km^2 and 28.6 L/s/km^2.

Monthly, annual average, and total annual values for unit runoff values at Philip Creek were calculated from the Upper Rainbow Creek station. Stream flow monitoring was not completed during the winter season due to safety concerns, therefore none of the years of available monitoring data represent a complete annual hydrograph. The two years with the longest continuous stream flow data at Upper Rainbow Creek—2013 and 2016—were selected for unit runoff estimations.

For months where stream flow data were available, data were averaged to produce mean monthly flow values. The resultant mean monthly flow values were then converted to unit runoff. The monthly flow distribution selected in Section 4.1.1 (Rainbow Creek) was used to determine what percentage of the annual distribution was observed. To account for unit runoff during months where no data were available at the Upper Rainbow Creek station, typically during the winter, the percentage of the annual flow observed was used to estimate what the annual flow could have been, if monitoring occurred during the winter. Once the estimated annual value was known, flows for months where no data were available were determined by apportioning percentages from the estimated annual runoff according to the monthly distribution. For example, streamflow values recorded from April to October 2013 were converted to mean monthly runoff and summed. The sum of runoff values over this period, according to the monthly flow distribution, accounted for approximately 82% of the annual streamflow. The observed monthly values were summed (102 L/s/km^2) and then divided by 82% to produce an estimated total annual runoff of 120 L/s/km^2. From this new estimated annual runoff value, the remaining months where no observed data were available were determined by multiplying the annual value by the percentage of the monthly distribution apportioned to that specific month. The same process was repeated for 2016. The completed results are presented in Table 4-2. Bolded values in the Table 4-2 represent values estimated from the mean monthly flows.

Table 4-2 Unit Runoff

Month	Upper Rainbow Creek - EA	OWT Output - Philips Creek	Pack River	Rainbow Creek 2013	Rainbow Creek 2016
	Unit Runoff ($L/s/km^2$)	Unit Runoff ($L/s/km^2$)	Unit Runoff ($L/s/km^2$)	Unit Runoff ($L/s/km^2$)	Unit Runoff ($L/s/km^2$)
Jan	7.00	2.81	5.21	**3.44**	**4.36**
Feb	7.00	2.56	5.17	**3.27**	**4.14**
Mar	7.00	1.76	5.77	**3.09**	7.12
Apr	8.00	11.74	21.04	8.27	37.50
May	55.00	30.15	50.93	68.05	31.73
Jun	42.00	34.73	20.08	11.33	19.04
Jul	10.00	16.67	7.66	4.98	16.35
Aug	9.00	8.64	3.91	3.02	5.00
Sep	6.00	7.34	3.30	1.99	9.04
Oct	8.00	8.39	5.43	4.96	**8.29**
Nov	6.00	6.17	7.95	**4.30**	**5.45**
Dec	7.00	3.58	5.49	**3.61**	**4.58**
Average	14.33	11.21	11.83	10.03	12.72
Sum	172.00	134.53	141.94	120.32	152.59

NOTE:
Bolded values represent values estimated as described in the text above

Annual unit runoff at Rainbow Creek in both 2013 and 2016 was substantially lower than the unit runoff at Upper Rainbow Creek estimated in the original EAC application (14.3 $L/s/km^2$). The Upper Rainbow Creek unit runoff estimation provided in the original EAC application was also higher that the estimated OWT and Pack River unit runoff values. The total annual unit runoff value selected for the original EAC appeared to be elevated when compared to the average observed in the Hydrologic Zone (11.7 $L/s/km^2$). The discrepancy between the values presented in the original EAC application and post-EAC unit runoff values may be caused by an overestimation of the runoff at the site during the EAC process or that the observed runoff post-EA was substantially lower than values observed during the EAC data collection period. In selecting the total annual unit runoff value to apply to the Philip Creek watershed, a conservative approach was taken. A wide range of runoff values are presented in Table 4-2. The BC OWT result (134.53 $L/s/km^2$) was selected to represent the baseline total unit runoff value for the outlet at Philip Lake 1 and will be used in the current EAC amendment and for hydraulic modelling presented below. The BC OWT result represented the second lowest estimated unit runoff value and was approximately half-way between the two years of observed Rainbow Creek values in 2013 and 2016.

4.3 BASELINE MONTHLY FLOW ESTIMATION FOR PHILIP CREEK

Baseline monthly flow values for Philip Creek were calculated using the monthly flow distribution determined in Section 4.1 using the Rainbow Creek dataset and the unit runoff determined in Section 4.2 using the BC OWT output. The annual unit runoff value selected in Section 4.2 was distributed monthly using the monthly percentages selected in Section 4.1. The monthly unit runoff values were then multiplied by the drainage area upstream of the Philip Lake 1 outlet (60.9 km^2) to produce monthly stream flows. Table 4-3 presents the modelled average monthly flow estimates representing baseline conditions for Philip Creek downstream of Philip Lake 1 that were used for the assessment of potential project effects in the EAC amendment.

Table 4-3 Baseline Flows for Philip Creek (m^3/s)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Philip Creek (m^3/s)	0.23	0.22	0.21	0.39	3.39	1.79	0.41	0.23	0.33	0.44	0.29	0.25

5 HYDRAULIC MODELLING

5.1 WITHDRAWAL RATES

Proposed project withdrawal rates from Philip Lake 1 were selected to meet emergency operational requirements for the Project as well as to maintain environmental flow requirements. Withdrawal rates were selected to maintain the cumulative withdrawal at Risk Management Level 1 rates (15%) using the BC Ministry of Forests, Lands, and Natural Resource Operations' (BC FLNRO) Environmental Risk Management Framework (BC FLNRO 2016). For operational purposes, the 15% withdrawal rate will determine the rates of water withdrawal. For the purposes of the EAC amendment, baseline monthly flows were generated to assess potential effects of water withdrawal on stream flows. However, the actual volume withdrawn will vary based on observed flows, but will not exceed 15% of measured flows or 60 L/s (operational capacity) whichever is the more conservative threshold at the time.

Monthly average flows for baseline conditions, proposed withdrawal rates for 2018 and 2019, as well as project flows for 2018 and 2019 are presented in Table 5-1. The values presented in the table were used for the hydraulic analysis discussed in Section 5.3.

Table 5-1 Proposed Withdrawal Rates for 2018 and 2019

	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
Baseline	m^3/s	0.234	0.222	0.211	0.386	3.394	1.791	0.410	0.234	0.328	0.445	0.293	0.246	0.683
2018 Withdrawal Rates	m^3/s	0.035	0.033	0.032	0.058	0.060	0.060	0.060	0.035	0.049	0.060	0.000	0.000	-
2018 Flow	m^3/s	0.199	0.189	0.179	0.328	3.334	1.731	0.350	0.199	0.279	0.385	0.293	0.246	0.643
Change from Baseline	%	15%	15%	15%	15%	2%	3%	15%	15%	15%	13%	0%	0%	6%
2019 Withdrawal Rates	m^3/s	0.000	0.000	0.000	0.058	0.060	0.060	0.060	0.035	0.049	0.060	0.000	0.000	
2019 Flow	m^3/s	0.234	0.222	0.211	0.328	3.334	1.731	0.350	0.199	0.279	0.385	0.293	0.246	0.651
Change from Baseline	%	0%	0%	0%	15%	2%	3%	15%	15%	15%	13%	0%	0%	5%

5.2 LAKE LEVEL ASSESSMENT

A conservative approach was taken to assess the potential effects of the withdrawal on water elevations in Philip Lake 1. The following steps were followed to complete a lake level assessment for Philip Lake 1:

1. Create an outlet cross section (XS) for Philip Lake 1. The outlet XS used was a composite of measured XSs and measured widths at outlet of Philip Lake 1
2. Develop a stage-discharge relationship using the Mannings equation and calibrate the hydraulic model based on observed flow and depth.
3. Assume water withdrawal occurs at outlet XS and no volume is removed from the lake; this assumption would overestimate the potential lake drawdown effects because it does not account for inflows.

Figure 5-1 represent the composite cross section for the outlet of Philip Lake 1. The cross section was used to develop a stage-discharge relationship.

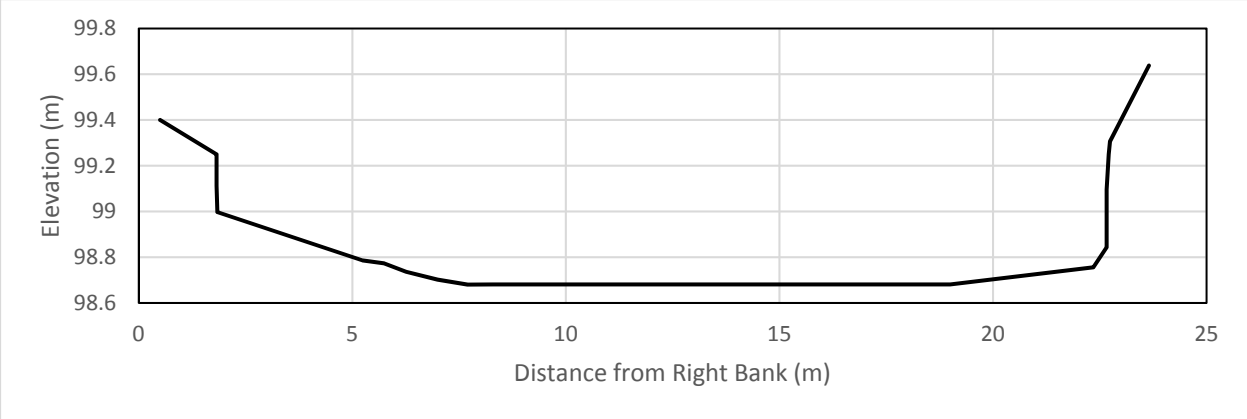


Figure 5-1 Composite Cross Section for Philip Lake 1 Outlet

A spreadsheet tool that employed the Mannings equation was used to determine the hydraulic parameters of the cross section presented in Figure 5-1. The spreadsheet tool solved for several variables, including flow area, wetted perimeter, hydraulic radius, top width, and hydraulic depth. The discharge values associated with baseline and project flows for 2018 and 2019 were then input into the spreadsheet and differences in the parameters were calculated. Two of the variables solved for can be extrapolated to assess potential reductions in lake levels, water surface elevation and hydraulic depth. Change in water surface elevation at the outlet best represent changes in lake levels.

The results of monthly changes in water surface elevation is provided in **Error! Reference source not found.**. A maximum 2.20 cm reduction in Philip Lake 1 water levels in April and July were modeled in both 2018 and 2019. This expected change in water level is small, within the

expected range of natural variability, and is not expected to adversely affect either the aquatic or riparian ecosystem of the lake.

Table 5-2 Estimated Depth (cm) reductions from Baseline levels in Philip Lake 1 for 2018 and 2019

Month	2018	2019
Jan	1.65	0.00
Feb	1.50	0.00
Mar	1.50	0.00
Apr	2.20	2.20
May	0.80	0.80
Jun	1.10	1.10
Jul	2.20	2.20
Aug	1.65	1.65
Sep	1.99	1.99
Oct	2.16	2.16
Nov	0.00	0.00
Dec	0.00	0.00

5.3 HEC RAS ASSESSMENT

To assess the effects of water withdrawal on Philip Creek, a hydraulic analysis was completed using the 1-D hydraulic modelling software HEC-RAS developed by the U.S. Army Corp of Engineers. Model geometry data were collected on October 27, 2017 by Environmental Dynamics Inc. (EDI) personnel. Five cross sections along a 45 m section of the Philip Creek were surveyed, with the cross sectional profile, edge of water elevation, and discharge measured at each transect location. Four of the five measured discharges were averaged to establish an average discharge of 0.324 m^3/s for the creek and for modelling purposes. The fifth discharge value was discarded as it fell outside the range of expected variability.

In constructing model geometry for Philip Creek, a Mannings n coefficient of 0.10 was selected for the banks, while a coefficient of 0.04 was initially selected for the channel (Chow 1959). Reach boundary conditions for the model were set to normal depths of 0.4% for both upstream and downstream, and a steady state flow analysis was selected with a mixed flow regime computational method. The calibration flow collected on October 27, 2017 (0.324 m^3/s) was run through the model, with the Mannings n coefficient for the channel adjusted until water elevations at each transect matched those observed during the EDI field survey. Once the model was calibrated, it was used to evaluate the differences between baseline flows and project flows for 2018 and 2019. The project flow scenarios are presented in Table 5-1

Key results from the HEC-RAS model are presented in Table 5-3 and show the average differences in water surface elevations, hydraulic depths, average channel velocity, flow areas and channel widths during January to October in 2018 and April to October in 2019. The cross sections presented are transects with 5 being the most upstream cross section. The modelled differences between baseline conditions and those during the proposed withdrawals indicate that potential impacts anticipated to be minimal relative to baseline values. The Fish and Fish Habitat section of the EAC amendment application uses the results of this model to assess the potential impacts on fish and fish habitat.

Table 5-3 HEC-RAS Philip Creek Model Results – Differences Between Baseline and Project Conditions

Cross Section Number	2018					2019				
	Water Surface Elevation (m)	Hydraulic Depth (m)	Velocity (m/s)	Flow Area (m^2)	Channel Width (m)	Water Surface Elevation (m)	Hydraulic Depth (m)	Velocity (m/s)	Flow Area (m^2)	Channel Width (m)
5	0.012	0.005	0.010	0.112	0.561	0.011	0.003	0.009	0.120	0.664
4	0.009	0.003	0.017	0.063	0.434	0.008	0.005	0.022	0.065	0.257
3	0.012	0.008	0.010	0.127	0.179	0.012	0.009	0.010	0.129	0.120
2	0.011	0.005	0.014	0.100	0.272	0.011	0.007	0.014	0.103	0.205
1	0.011	0.008	0.011	0.117	0.228	0.010	0.008	0.011	0.123	0.211

6 CONCLUSIONS

This report presents the methods used for generating the mean monthly stream flows to represent baseline conditions in Philips Creek, located downstream from Philip Lake 1. Mean monthly stream flow values were calculated using the monthly distribution provided in the original EAC application and the annual unit runoff value generated from the BC OWT.

The Mannings equation was used to develop a stage-discharge relationship for the outlet of Philip Lake 1. This relationship was used to estimate the change in water depth in the cross section resulting from the flow withdrawal. This resultant change in depth was extrapolated to determine potential drawdown in Philip Lake 1. A maximum drawdown of 2.2 cm was estimated to occur due to the proposed water withdrawals at Philip Lake 1.

Lastly, a HEC-RAS model was constructed to investigate the potential effects of water withdrawals from Philip Lake 1 on water levels Philip Creek. The hydraulic analysis indicated minimal differences between baseline and project flows on cross sections established in Philip Creek. The model results will be used in the EAC amendment application to determine the effects of these differences to fish and fish habitat.

7 CLOSURE

We trust that the information included in this memo meets your requirements. Please do not hesitate to contact the undersigned with any questions.

Regards,

STANTEC CONSULTING LTD.

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APPENDIX D
WATER ANALYSIS - EDELMAN SOLUTION (MICHELE FRASER MEMO)

Stantec

Memo

To:	David Luzi Burnaby BC Office	From:	Michelle Fraser Waterloo ON Office
File:	123220840/31	Date:	November 29, 2017

Reference: Dewatering Assessment
Mt. Milligan Mine Site

Centerra Gold (Centerra) operates the Mt. Milligan Mine (Site), located approximately 70 km west of MacKenzie, British Columbia. A 12 week water supply shortage is forecasted for the process plant. In order to keep the process plant operational, make up water is required during the 12 week period, prior to spring freshet when the water supply reservoir could be restored. Centerra is proposing to supply the reservoir with water pumped from nearby Esker Lake East and Esker Lake West. The following memo assesses the potential effect of pumping Esker Lake East and Esker Lake West on groundwater levels.

1.0 SITE SETTING

The following section provides background details related to the Site setting.

1.1 LAND USE, PHYSIOGRAPHY, AND TOPOGRAPHY

The Site is located within a remote lowland that is 30 km wide and about 1,100 m above mean sea level (AMSL). Land use in the area is forest with portions of forests harvested for timber.

1.2 SURFACE WATER FEATURES

Esker Lake East and Esker Lake West are located adjacent to the Mt. Milligan Mine eastern tailings management facility (TMF) embankment, with both lakes approximately 100 m east of the TMF, and less than 20 m from TMF collection pond. The Esker Lakes are predominantly supplied by groundwater with minimal input from direct precipitation. Esker Lake East is approximately 570 m long, 175 m wide, and 7 m deep and Esker Lake West is approximately 300 m long, 210 m wide, and 5 m deep.

Rainbow Creek is located approximately 900 m east of Esker Lake East.

1.3 GEOLOGY AND HYDROGEOLOGY

The geology and hydrogeology in the area of the Site is summarized by Water Management Consultants (WMC) as part of the Hydrogeology and Site Wide Surface Water Balance Report completed for the Mt. Milligan Mine (WMC 2008)[1]. Overburden is 5 m to 60 m thick and generally comprises three units described from youngest to oldest as:

- Surficial sands and gravels ranging from a few centimeters to 7 m thick. Knight Piésold conducted test pitting of the TMF embankment centerline and characterized the surficial sands

[1] Water Management Consultants (MWC), 2008. Mt. Milligan Hydrogeology and Site Wide Surface Water Balance Report. Prepared for Knight Piésold Ltd. June 2008.

and gravels as generally 5 m thick (MWC 2008). The hydraulic conductivity of the surficial sand and gravel was interpreted as $1x10^{-4}$ m/s (WMC 2008).

- Dense basal or morainal till consisting of dense silty sand or sand and gravel underlies the surficial sand and gravel. The hydraulic conductivity of the till unit was interpreted as $9.3x10^{-8}$ m/s (WMC 2008).
- A fluvial sand and gravel unit located within the till and at a relatively consistent elevation of 1,000 to 1,020 m AMSL (15 m to 35 m below ground surface).

Bedrock in the area is of the Quesnel Belt, which consists of Triassic volcanics, tertiary sediments, and tertiary volcanics. Stocks of intermediate to felsic intrusive igneous rock intruded the volcanic rocks and host significant porphyry copper and gold mineralization.

Groundwater flow within the vicinity of Esker Lakes is east, toward Rainbow Creek (MWC 2008).

2.0 SURFACE WATER DEWATERING

Centerra proposes to pump water from Esker Lake East and Esker Lake West to the Mt. Milligan Mine water supply reservoir for a period of up to 12 weeks to provide make up water for the process plant until spring freshet can restore the water supply reservoir. The following section describes the proposed dewatering rates and predicted extent of drawdown.

2.1 AVERAGE AND MAXIMUM PUMPING RATES

Centerra proposes to pump Esker Lake East at 14.4 L/s and Esker Lake West at 11.3 L/s for a period of 12 weeks. It is assumed that pumping will be continuous, occurring 24 hours a day and 7 days a week.

2.2 PREDICTED DRAWDOWN WITHIN LAKES

Table 1 presents the proposed volume of water pumped from Esker Lake East and Esker Lake West over 12 weeks. MWC (2008) completed water balance modelling of the catchment in which Esker Lake East and Esker Lake West are located. MWC (2008) estimated a groundwater discharge rate of 52.5 L/s from the Esker Lake East and Esker Lake West catchment, which represents a 12 week volume of about 381,024 m^3. The combined volume to be pumped from Esker Lake East and Esker Lake West is 186,665 m^3, which represents about 49% of the 12 week groundwater discharge from the Esker lakes catchment. Therefore, no significant drawdown within Esker Lake East and Esker Lake West, which are predominantly groundwater fed, is anticipated.

However, to be conservative, the equivalent depth of surface water pumped from Esker Lake East and Esker Lake West was conservatively estimated by assuming no groundwater or surface water recharge during the pumping period. Table 1 presents the volume of Esker Lake East and Esker Lake West compared to the volume pumped over 12 weeks. The pumped volumes represent about 1.0 m and 1.3 m of water from Esker Lake East and Esker Lake West, respectively, assuming no groundwater or surface water recharge during the pumping period.

Table 1 Volume of Lake Compared to Pumped Volume

Lake	Lake Volume (m^3)	Total Volume Pumped over 12 Weeks (m^3)	Equivalent Depth of Surface Water* (m)
Esker Lake East	698,000	104,509	1.0
Esker Lake West	315,000	82,156	1.3

Notes:
*: assumes no surface water recharge and no constant head boundaries for duration of pumping.

2.3 PREDICTED EXTENT OF DRAWDOWN

It is expected that during surface water pumping, Esker Lake East and Esker Lake West will receive recharge from the surrounding groundwater drainage catchment area. The majority of recharge will likely occur from the adjacent TMF located approximately 100 m to the west and groundwater drawdown will not extend beyond that distance. Some groundwater recharge will also be occurring from the east. The potential extent of drawdown to the east was estimated using the Edelman (1947)[2] solution for seepage into a ditch within an unconfined aquifer. Assumptions for the calculations included:

- Esker Lake East and Esker Lake West were modelled as open ditches with lengths of 570 m and 300 m, respectively.
- The surficial sand and gravel aquifer was assumed to be 7 m thick.
- A hydraulic conductivity of 10^{-4} m/s was assumed for the surficial sand and gravel (MWC 2008).
- A porosity of 0.3 of the surficial sand and gravel based on literature values (Fetter 1994)[3].
- For calculation purposes, a total drawdown in Esker Lake East and Esker Lake West of 1.0 m and 1.3 m, respectively (Section 2.2) was assumed as a conservative measure to create a maximum hydraulic gradient for evaluation of potential impacts. Actual surface water drawdown will be less.
- The duration of pumping was 12 weeks (84 days).
- There is no surface water runoff, snow melt, or precipitation recharge to Esker Lake East or Esker Lake West for the duration of pumping.

Based on these assumptions, the predicted extent of drawdown as a result of pumping Esker Lake East and Esker Lake West was 475 m.

[2] International Institute for Land Reclamation and Improvement (ILRI), 1994. Drainage Principles and Applications. Publication 16, 2nd edition.
[3] Fetter, C.W., 1994. Applied Hydrogeology, Third Edition. Prentice-Hall, New Jersey.

Reference: Dewatering Assessment
Mt. Milligan Mine Site

2.0 IMPACT ASSESSMENT

The following section focuses on potential impacts that the temporary pumping may have on other groundwater users in the area, on local surface water features, or the surrounding environment.

3.1 GROUNDWATER INTERFERENCE

There are no known groundwater well users within 1 km radius of Esker Lake East and Esker Lake West. Therefore, it is not interpreted that well users will be impacted as a result of the temporary pumping activities.

3.2 SURFACE WATER INTERFERENCE

Rainbow Creek is located approximately 900 m east of Esker Lake East and is an important part of the offsetting program and is known fish habitat. The extent of drawdown was conservatively predicted to extend up to 475 m from Esker Lakes East and Esker Lake West, which is less than the distance to Rainbow Creek. Therefore, no unacceptable effect of pumping Esker Lake East and Esker Lake West on Rainbow Creek is anticipated.

3.0 CONCLUSIONS

Based on modelling conducted by MWC (2008), it is anticipated that minimal to no measurable drawdown will be observed at Esker Lake East and Esker Lake West as a result of pumping at rates of 14.4 L/s and 11.3 L/s, respectively for a period of 12 weeks. However, to be conservative, an estimate of the extent of drawdown was predicted assuming no surface water recharge to Esker Lake East and Esker Lake West throughout the 12 week pumping period. Based on this conservative assumption, the radial extent of drawdown was estimated at 475 m from Esker Lake East and Esker Lake West. There are no known sensitive surface water features or well users located within 475 m of Esker Lake East and Esker Lake West and therefore, no significant impact to nearby surface water features or well users are anticipated.

We trust this meets your current needs. Should you have any questions or concerns, please don't hesitate to contact the undersigned.

STANTEC CONSULTING LTD.

Michelle Fraser, M.Sc., P.Geo.
Hydrogeologist
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Attachment: Attachment A – Dewatering Estimates

ATTACHEMENT A
DEWATERING ESTIMATES

Seepage within Ditch within Unconfined Aquifer

Esker Lake East

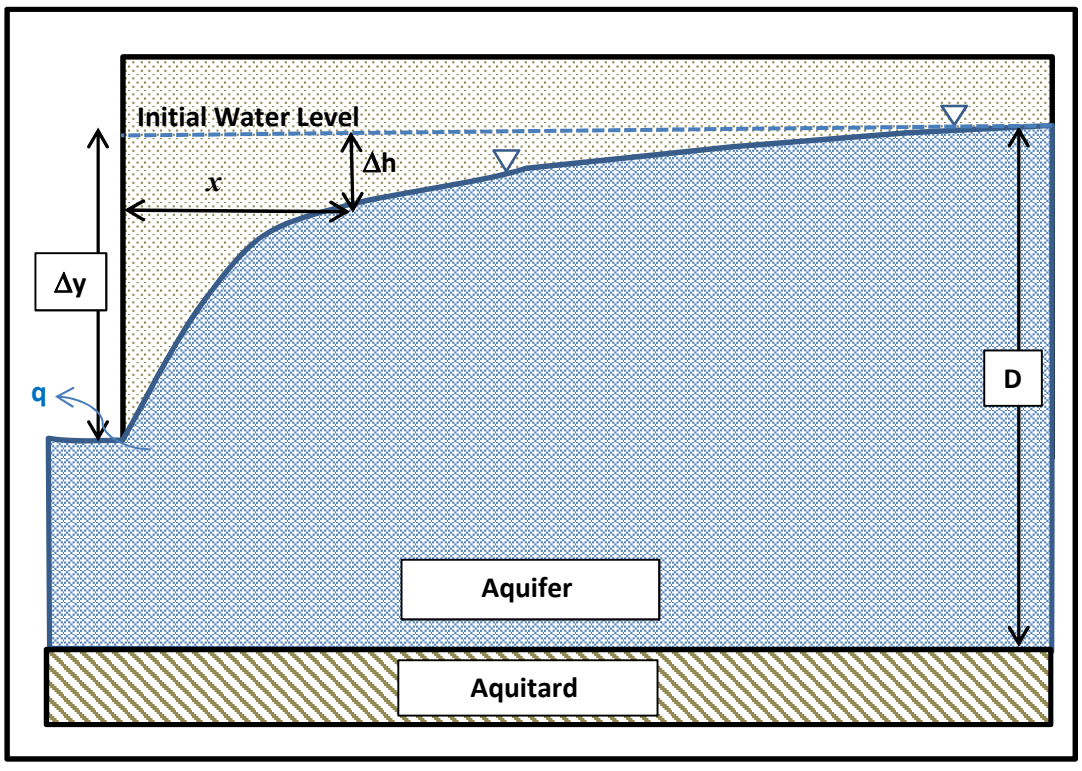
$$\frac{\partial h}{\partial t} = \frac{KD}{\eta}\frac{\partial^2 h}{\partial x^2}$$

Based on solution by Edelman (1947)

$$u = \frac{x}{2\sqrt{\frac{KDt}{\eta}}}$$

$$\Delta h = -\Delta y\, f_o(u), when\ \Delta y > 0$$

$$q_o = \frac{KD(\Delta y)}{\sqrt{\pi}} * \left(\frac{KDt}{\eta}\right)^{-0.5}$$



Where:

K = Hydraulic Conductivity (m/s)
D = Thickness of Initial Aquifer (m)
η = porosity
x = distance from edge of excavation (m)
t = time (s)
Δh = change in water level (m)
Δy = change in water level within ditch (m)
q_o = seepage rate per unit length of ditch (m^2/s)
Q = Seepage volume (L/day)

Calculations are for flow along one site of ditch and assume instantaneous change in head within the ditch, Dh << D, horizontal flow and infinite aquifer.

Calculations

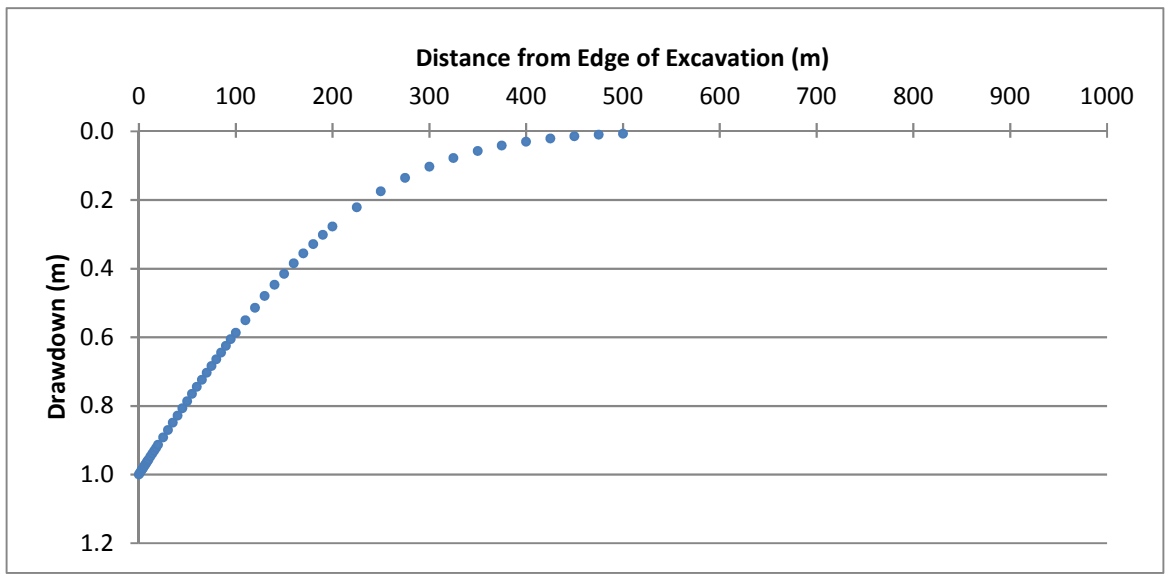
K =	1.00E-04	m/s	Initial water level =	200	m AMSL
D =	7	m	Maximum Drawdown =	199	m AMSL
η =	0.3		Δy =	1	m
			Length of Ditch =	570	m

Groundwater Seepage

Time (t)	Seepage Rate (q_o)	Seepage Volume (Q)
(days)	(m^2/sec)	L/day
1	2.8E-05	1,369,829
42	4.3E-06	211,369
84	3.0E-06	149,461

Steady State Extent of Drawdown

Calculated after 84 days of excavation



Equations obtained from International Institute for Land Reclamation and Improvement (ILRI), 1994. Drainage Principles and Applications. Publication 16, 2nd Edition.

Seepage within Ditch within Unconfined Aquifer

Esker Lake West

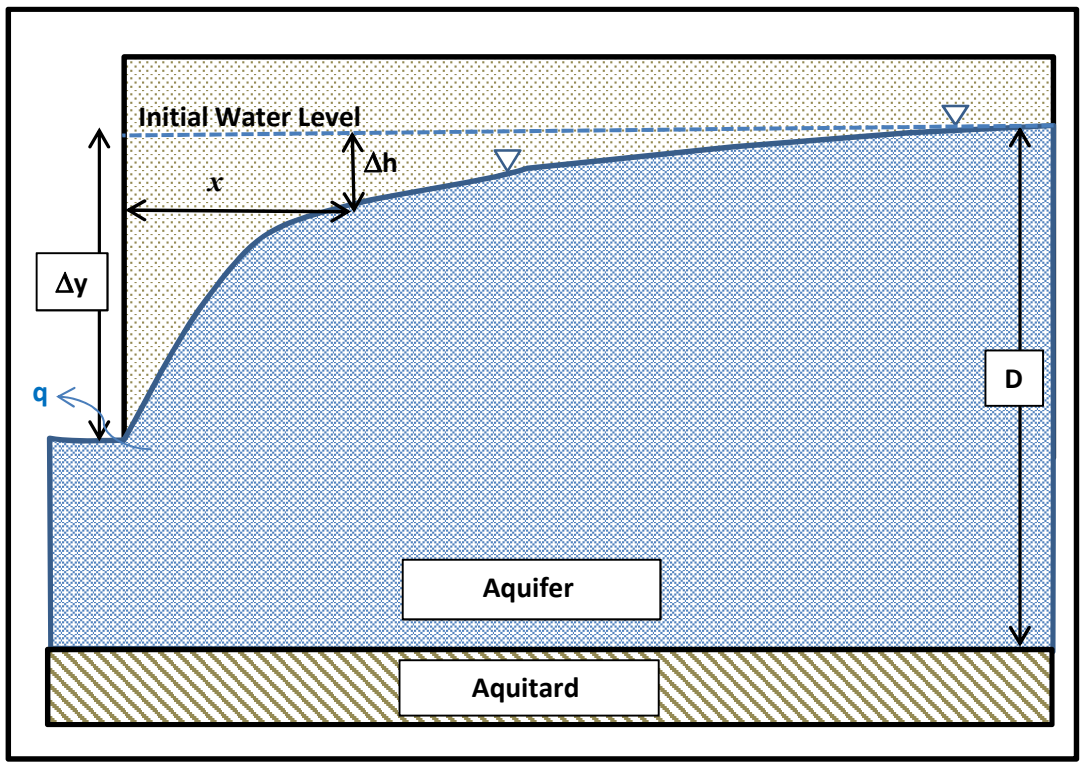
$$\frac{\partial h}{\partial t} = \frac{KD}{\eta}\frac{\partial^2 h}{\partial x^2}$$

Based on solution by Edelman (1947)

$$u = \frac{x}{2\sqrt{\frac{KDt}{\eta}}}$$

$$\Delta h = -\Delta y\, f_o(u), when\ \Delta y > 0$$

$$q_o = \frac{KD(\Delta y)}{\sqrt{\pi}} * \left(\frac{KDt}{\eta}\right)^{-0.5}$$



Where:

K = Hydraulic Conductivity (m/s)
D = Thickness of Initial Aquifer (m)
η = porosity
x = distance from edge of excavation (m)
t = time (s)
Δh = change in water level (m)
Δy = change in water level within ditch (m)
q_o = seepage rate per unit length of ditch (m^2/s)
Q = Seepage volume (L/day)

Calculations are for flow along one site of ditch and assume instantaneous change in head within the ditch, Dh << D, horizontal flow and infinite aquifer.

Calculations

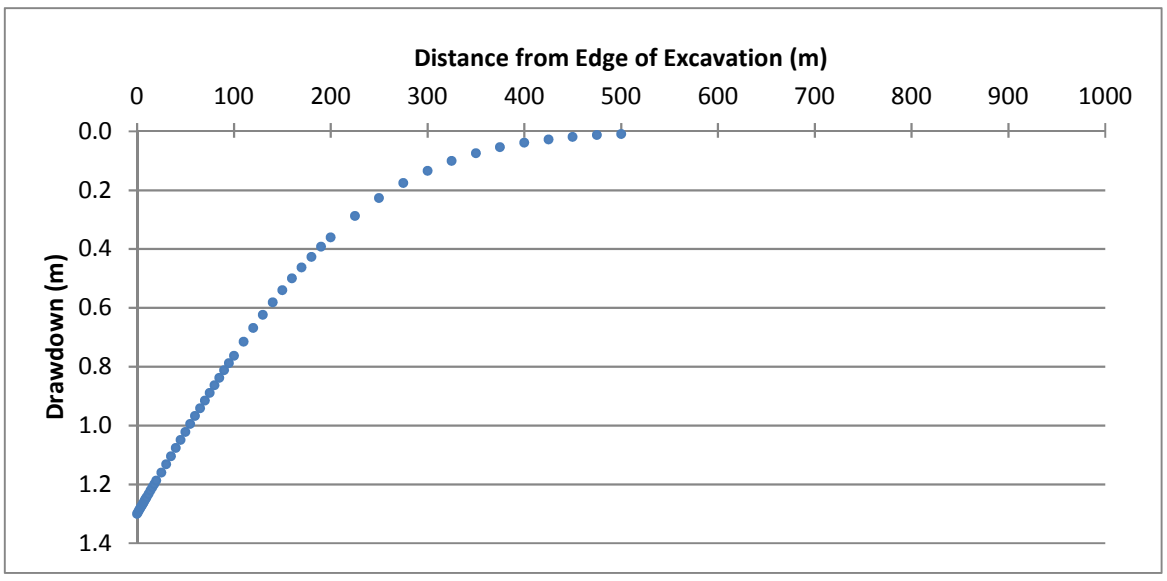
K =	1.00E-04	m/s	Initial water level =	200	m AMSL
D =	7	m	Maximum Drawdown =	198.7	m AMSL
η =	0.3		Δy =	1.3	m
			Length of Ditch =	300	m

Groundwater Seepage

Time (t)	Seepage Rate (q_o)	Seepage Volume (Q)
(days)	(m^2/sec)	L/day
1	3.6E-05	937,252
42	5.6E-06	144,621
84	3.9E-06	102,263

Steady State Extent of Drawdown

Calculated after 84 days of excavation



Equations obtained from International Institute for Land Reclamation and Improvement (ILRI), 1994. Drainage Principles and Applications. Publication 16, 2nd Edition.

APPENDIX E
OPERATIONAL ADAPTIVE MANAGEMENT PLAN

Operational Adaptive Monitoring Plan

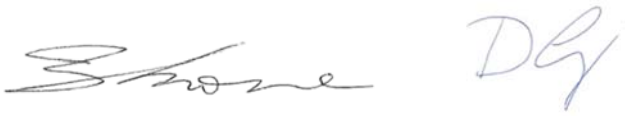
Prepared for:
Mount Milligan Centerra Gold Inc.
177 Victoria Street, Suite 100
Prince George, BC, V2L 5R8

Prepared by:
Stantec Consulting Ltd.
500 – 4730 Kingsway
Burnaby BC V5H 0C6

December 5, 2017

Sign-off Sheet

This document entitled Operational Adaptive Monitoring Plan was prepared by Stantec Consulting Ltd. ("Stantec") for the account of Thompson Creek Metals Company (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by  _____

(signature)

Bradley Horne and David Luzi

Reviewed by  _____

(signature)

Sandra Webster

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Abbreviations

BC FLNRO	British Columbia Ministry of Forests, Lands, and Natural Resource Operations
EA	Environmental Assessment
EAC	Environmental Assessment Certificate
EFN	Environmental Flow Needs
Km	Kilometre
TCMC	Thompson Creek Metals Company Inc.
TSF	Tailings storage facility

1.0 INTRODUCTION

Thompson Creek Metals Company Inc. (TCMC), a wholly-owned subsidiary of Centerra Gold, is applying for an amendment to its Environmental Assessment Certificate (EAC #M09-01) issued on March 16, 2009. The Certificate was granted for the construction and operation of the Mount Milligan Copper-Gold Project (the Project), located approximately 155 kilometres (km) northwest of Prince George.

In late 2016, a survey of water volumes stored within the Tailings Storage Facility (TSF) found that the water volumes were critically low. The current and anticipated annual water shortage in the TSF is estimated to be 1,800,000 m^3 in 2018 and 2019. Without additional sources of water, the Project is expected to run out of water between February and March 2018, resulting in shutdown of the mill. Mill shutdown will result in several adverse effects including temporary layoffs of up to 450 workers, loss of regional income, and loss of company revenues. Spring freshet will bring new water supplies, however, a period of no water lasting approximately six weeks will occur prior to freshet.

To address short-term water needs TCMC is submitting an EAC Amendment application for the use of Esker Lake and Philip Lake 1 as water sources for the Project from January 2018 to October 2019. The use Esker Lakes as a source of water on a contingency basis was inferred as an integral part of the original issuance of EAC #M09-01 during consecutive dry years. Collecting water from Esker Lakes is aligned with the M09-01 Schedule B Commitment, under Protection of Ecological Values, in that TCMC will continue to meet the commitment that they will "Implement the water and waste management plans in the Application as a means of ensuring protection of the fisheries resources in Rainbow Creek and Nation River and of wildlife".

Baseline studies identified Esker Lakes as being non-fish bearing, with only groundwater inflow and outflow. However, no hydrogeological studies were performed to determine if water withdrawal from Esker Lakes would have potential groundwater effects on Rainbow Creek or the Lower Rainbow Pond, located approximately 1 km east and downslope of Esker Lakes. Monitoring stations to measure water levels and stream discharges have recently been installed in Esker Lake East and in Esker Lake West, as well as in the groundwater collection ditch that flows into the Lower Rainbow Pond. The Lower Rainbow Pond is an overwintering pond built in the Rainbow Creek floodplain as part of the offset plan for the Schedule 2 amendment of the Metal Mine Effluent Regulation.

Water withdrawal from Philip Lake 1 was not included as part of the Project Description submitted with the original EAC Application. Monitoring stations have recently been installed in Philip Lake 1 and in Philip Creek, the stream draining Philip Lake 1, to measure water levels and stream discharge.

This Operational Adaptive Monitoring Plan provides the following information to guide water withdrawals from Esker Lakes and Philip Lake 1:

- Water level and stream flow monitoring programs to be implemented at Esker Lakes, Rainbow Pond, Philip Lake 1, and Philip Creek during water withdrawal
- Frequency of water level sampling events
- Programs to be completed prior to water withdrawal
- Operational thresholds for adjustments in water withdrawal rates based on results of the monitoring programs

Locations of the proposed water sources, water pipeline and associated infrastructure, and hydrometric monitoring stations are provided in Figure 1.

1.1 ESKER LAKES

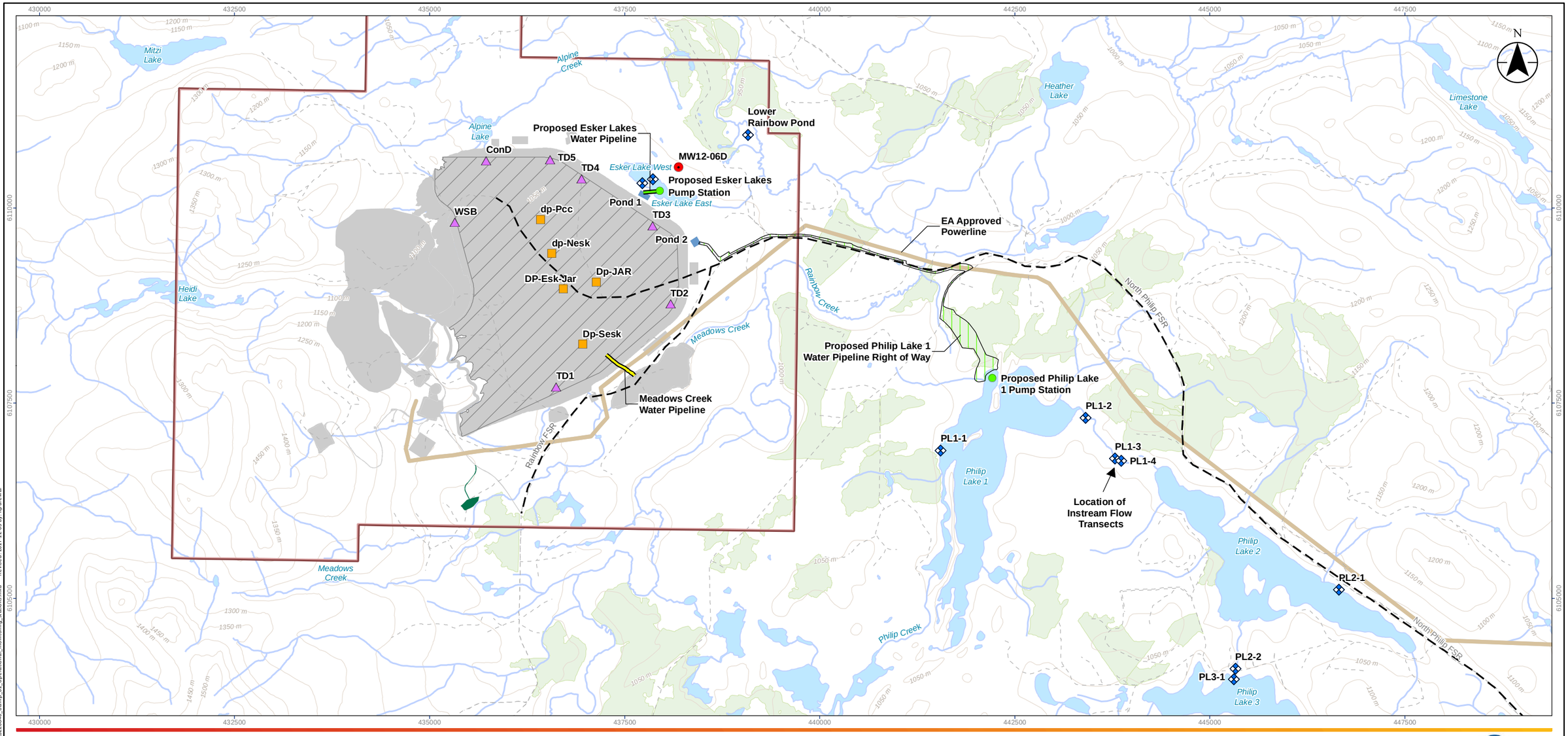
TCMC proposes a total extraction volume of approximately 200,000 m^3 of water in 2018 from Esker Lakes. Extraction rates will be constant during the three-month extraction period, running from January 1, 2018 to March 31, 2018. Water will be pumped at a maximum rate of 25 L/s, with 14 L/s coming from Esker Lake East and 11 L/s coming from Esker Lake West. The difference in withdrawal rates is due to the different size and shape of the two basins. Construction of the 6 inch HDPE pipeline and pump arrangement is proposed to begin by mid-December, 2017, if the EAC amendment is approved. Following completion of water extraction on March 31, 2018, the pipeline will be removed.

1.1.1 Monitoring Program

Pressure transducers are currently installed at the following locations to continuously record fluctuations in water levels (Figure 1):

- Esker Lake East and Esker Lake West
- Groundwater well between Esker Lakes and Rainbow Creek (i.e., downgradient of Esker Lakes); labelled as MW12-06D in Figure 1
- The groundwater collection channel that provides inflow to the Lower Rainbow Pond, a V-notch weir has also been installed at this location to accurately measure discharge going into the pond.

Additional monitoring stations may be added in and around Esker Lakes based on results of on-going hydrogeological monitoring programs. An update of all monitoring locations will be provided prior to the start of operations.



- Gravel Road
- Forest Tenure Road
- Topographic Contour
- Watercourse
- Waterbody
- Forest Tenure Cut Block Opening
- Mining Lease (631503)
- Drill Pad Location for Water Recovery Well
- Tower Drain Location
- Water Pipeline
- Tailings Storage Facility
- Retention Pond
- EA Amendment 1 Existing Camp and Access Road
- EA Approved Powerline
- EA Approved Project Footprint
- Proposed Water Pump Location
- Proposed Water Pipeline
- Proposed Water Pipeline Right of Way
- Hydrometric Station
- Groundwater Monitoring Well

Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Data Source: DataBC, Government of British Columbia; Natural Resources Canada; Thompson Creek Metals Company Inc. TCMC
3. This document is provided by Centerra Gold (CG) for use by the intended recipient only. This information is confidential and proprietary to CG and is not to be provided to any other recipient without the written consent of CG.

0 0.5 1 1.5 2 km
1:50,000 (At original document size of 11x17)

Stantec

MOUNT MILLIGAN
centerra GOLD

Project Location
NTS Grid: 093O04
BCGS Grid: 93O.011

Project Number 123220840
Prepared by RCOATTA 20171204
Discipline Review by DLUZI 20171204
GIS Review by NPUREWAL 20171205

Client/Project
Thompson Creek Metals Company Inc.
Mount Milligan Mine
Operational Adaptive Management Plan

Figure No. 1
Page No. 1 of 1

Title
Operational Monitoring Stations

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1.1.2 Monitoring Frequency

Water level data will be collected continuously from the pressure transducers installed in the two Esker Lakes, in the groundwater wells, and in the groundwater collection channel. Data from these pressure transducers will be downloaded weekly to determine if water withdrawals are affecting lake or aquifer levels, or groundwater inflows to the Lower Rainbow Pond. These data will be compared to the operational thresholds defined in Section 1.1.4 to determine if and what management action is required.

1.1.3 Programs to be Completed Prior to Operations

To reduce uncertainty regarding the Esker Lakes water supply, TCMC will conduct a pumping test in Esker Lakes in December 2017 prior to water withdrawals. Water levels, discharge rates, and field water quality parameters will be monitored throughout the pump test. The purpose of this pump test is to assess the hydraulic response in the lakes and surrounding aquifer and to quantify the groundwater recharge rate. Additional details of the pumping test are provided in the Phase 1 Hydrogeology and Groundwater Supply Assessment, Mount Milligan Mine memo (Waterline 2017) provided in Appendix A.

1.1.4 Operational Thresholds

Esker Lakes are non-fish-bearing, therefore, any reduction in water levelswill not affect fish or fish habitat in Esker Lakes. However, Esker Lakes are part of the aquifer that provides groundwater to Rainbow Creek and the Lower Rainbow Pond. The Lower Rainbow Pond provides summer rearing and overwintering habitat for rainbow trout. Therefore, a reduction in groundwater inflows to Rainbow Creek or the Lower Rainbow Pond could have adverse effects on rainbow trout overwintering in the pond.

To protect rainbow trout in the Lower Rainbow Pond, water withdrawal rates from Esker Lakes will be reduced if the discharge in the collection ditch to the pond decreases by more than 10% of the average discharge measured the previous week or if dissolved oxygen concentrations recorded weekly in the pond during the water withdrawal period decrease by more than 10% of the monthly trend recorded during the previous two winters. These operational thresholds have been set using professional judgement but is considered to be conservative. Additional details about the operational thresholds and adjustments to the water withdrawal rates will be developed based on the results of the pump test to be completed in December 2017.

1.2 PHILIP LAKE 1 AND PHILIP CREEK

TCMC proposes a total extraction volume of approximately 2,278,000 m^3 of water from Philip Lake 1 over the entire two (2) year extraction period, with 1,270,000 m^3 extracted in 2018, and 1,010,000 m^3 extracted in 2019. Water will be pumped at a maximum rate of 60 L/s. Extraction rates will vary throughout the year, based on both water requirement timing and maintenance of Environmental Flow Needs (EFN) set by application of the British Columbia Ministry of Forests, Lands, and Natural Resource Operations' (BC FLNRO) Environmental Risk Management Framework (BC FLNRO 2016).

Construction is proposed to begin within the mineral lease boundary in December, 2017.This will include construction of the pipeline within the Rainbow Creek watershed. Construction of the pipeline, installation of the floating pump, and installation of the diesel generator at Philip Lake 1 will begin once approvals are received as Philip Lake 1 is beyond TCMC's mineral boundary. System commissioning and the start of water extraction is anticipated to begin in January, 2018.

1.2.1 Monitoring Program

Pressure transducers are currently installed at the following locations to continuously record fluctuations in water levels or stream discharge (Figure 1):

- Philip Lake 1
- The outlet of Philip Lake 1 in Philip Creek
- Philip Creek approximately 1 km downstream of Philip Lake 1
- Philip Lake 2
- Philip Creek near the inlet to Philip Lake 3
- Philip Lake 3

Transects were established in riffles and glides in Philip Creek in October 2017 (Figure 1). The purpose of these transects is to develop hydraulic habitat relationships that correlate hydraulic variables important to fish for spawning, rearing, and overwintering (e.g., water depth, water velocity, wetted perimeter) to stream discharge. An initial data set was collected in October 2017, but additional data will be collected from these transects during open water in 2018 to develop and calibrate these relationships over a wider range of flows.

Once developed, these relationships will be used to predict hydraulic conditions in these riffles and glides under different stream discharges and to refine water withdrawal rates if it is found that the 15% threshold during low flow periods (see Section 1.2.4) or the 60 L/sec maximum pumping rate during high flow periods will have an adverse effect on fish.

1.2.2 Monitoring Frequency

Data from the pressure transducers will be downloaded weekly during the winter of 2018 and during the summers of 2018 and 2019, and monthly during the spring and fall freshets of 2018 and 2019. The higher frequency of transducer downloads during the winter and summer low flow periods reflects the greater sensitivity of the lake and stream to water withdrawals during these months.

Data from the transducers will be compared to the operational thresholds defined in Section 1.2.4 to determine if and what management action is required. In addition, a weekly discharge measurement will be collected from Philip Creek during the winter months to inform withdrawal rates for the upcoming week. Discharge measurements from Philip Creek will be collected monthly during high flow periods during the open water season (typically May, June and October) and weekly during low flow open water periods (typically during July, August and September). Sampling frequency can be reduced during open water season, for both high and low flow periods, once a stage-discharge relationship is established. A stage-discharge relationship will be developed in accordance with RISC (2009) standards.

Data will be collected from the transects established in Philip Creek at a minimum of four times during the 2018 open water season. Visits to these transects will include at least three visits when discharges are <40% of mean annual discharge as recommended by Lewis et al. (2004).

1.2.3 Programs to be Completed Prior to Operations

Discharge in Philip Creek will be measured twice during the week prior to commencement of water withdrawals from Philip Lake 1, with at least one of the measurements occurring within two days of the start of pumping. This initial discharge measurement will be multiplied by 15% to calculate the pumping rate for the following week, 15% being the cumulative water withdrawal rate for a Risk Management Level 1 classification in Philip Creek following the BC Environmental Risk Management Framework (BC FLNRO 2016). Discharge in Philip Creek will be measured weekly during winter low flows (i.e., ice-covered periods, typically in January, February, March, and April) and summer low flows (July, August, and September) to determine the pumping rate for the following week needed to maintain the 15% cumulative withdrawal rate. Discharge in Philip Creek will be measured biweekly during the spring and fall freshets to enable development and calibration of the outlet rating curve at the Philip Lake 1 outlet. The frequency of this can be reduced once a stage-discharge relationship is developed for the creek (see Section 1.2.2.

1.2.4 Operational Thresholds

To protect fish in Philip Creek, weekly calculations will be conducted during the winter of 2018 to determine the withdrawal rates needed to maintain the 15% withdrawal threshold at the Philip Lake 1 outlet. This will be done by adding the measured weekly discharge in Philip Creek to the volume rate of water currently withdrawn from the lake. This will provide an estimate of the total Philip Creek discharge that would normally occur without pumping. This number will then be

multiplied by 15% to set the new water withdrawal rates for the coming week. Equation 1, illustrates this procedure.

$$W_{t+1} = (Q_t + W_t) \times 0.15 \quad (1)$$

Where W_{t+1} is the withdrawal rate for the coming week, Q_t is the discharge measured the day before withdrawal rates are to be adjusted, W_t is the withdrawal rate in place when discharge was measured, and 0.15 is to establish the 15 % withdrawal rate.

This operational threshold is based on the BC FLNRO (2016) Environmental Risk Management Framework described in its Environmental Flow Needs Policy (BC FLNRO 2016). A stream or specific flow period is characterized as a Risk Management Level 1 when there is sufficient natural water availability for a proposed withdrawal period and when cumulative water withdrawals are below the specified thresholds (5 to 15% of the natural or naturalized flow). Philip Creek falls into the Risk Management Level 1 category because:

- Philip Creek is fish-bearing but is unlikely to support any endangered or threatened fish species listed by the federal *Species at Risk Act* (SARA) or by the BC *Wildlife Act* or support any red or blue-listed fish species in BC as listed by the BC Conservation Data Centre
- Philip Creek has not been designated as a "sensitive stream" under the BC *Water Sustainability Act* or BC *Water Sustainability Regulation*
- Mean monthly discharge in Philip Creek in January, February, and March have been modeled to be >20% of mean annual discharge, which designates Philip Creek as a "low sensitivity" stream during these months for water withdrawals
- The total cumulative water withdrawal volume from Philip Creek in January, February, and March 2018 will be a maximum of 15% of mean monthly flow; there are no other water withdrawal proposals or water users on Philip Lake 1 or Philp Creek.

Once ice cover has melted, flows in Philip Creek will be maintained at ≥85% of the weekly discharge calculated using the same method described above.

2.0 REFERENCES

BC FLNRO (British Columbia Ministry Forests, Lands, and Natural Resource Operations). 2016. Environmental Flow Needs Policy. Available from: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/water-rights/efn_policy_mar-2016_signed.pdf

Lewis, A., T. Hatfield, B. Chilibeck, and C. Roberts. 2004. Assessment methods for aquatic habitat and instream flow characteristics in support of applications to dam, divert, or extract water from streams in British Columbia. A report prepared for the BC Ministry of Water, Land, and Air Protection and the BC Ministry of Sustainable Resource Development. 59 p. + appendices.

Resources Information Standards Committee, Ministry of Environment (RISC). 2009 Manual of British Columbia Hydrometric Standards. BC Ministry of Environment, Science and Information Branch.

Waterline. 2017. Phase 1 Hydrogeology and Groundwater Supply Assessment, Mount Milligan Mine. Prepared for Thompson Creek Metals Company. 8 pp.

Appendix A PHASE 1 HYDROGEOLOGY AND GROUNDWATER SUPPLY ASSESSMENT, MOUNT MILLIGAN MINE (WATERLINE 2017)

Appendix A Phase 1 Hydrogeology and Groundwater Supply Assessment, Mount Milligan MIne (Waterline 2017)
December 5, 2017

2430 Jingle Pot Road
Nanaimo, British Columbia
Canada V9R 6W2
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Toll Free: 1.844.585.0800
www.waterlineresources.com

November 30, 2017
2932-17-002

Thompson Creek Metals Company
Mount Milligan Mine
177 Victoria Street, Suite 100
Prince George, British Columbia
V2L 5R8

Attention: Tim Caldwell, RPF – Environmental Superintendent

Dear Mr. Caldwell,

RE: Phase 1 Hydrogeology and Groundwater Supply Assessment, Mount Milligan Mine

1.0 INTRODUCTION

Thompson Creek Metals Company (TCM) requires an additional source of water to support mill processing operations at the Mount Milligan Mine. Historically, the mine has relied on surface water to fill the reservoir but due to several consecutive dry years, the mine is forecasting that their supply will run dry approximately six weeks prior to the spring freshet. The potential water shortage would result in the likely shutdown of the mill so it is critical that a makeup water supply is identified and brought into production quickly. Waterline understands that the immediately need for water is an emergency situation but that a long-term secure supply is also needed.

The required water supply volume is estimated to be 1.8 to 2.0 million cubic meters (MM^3) which translates to approximately 0.061m^3/s (967 US gpm) of continuous withdrawal. Several short-term alternatives are being considered as follows:

1) Water obtained through a combination of water withdrawal from Eskers Lake and Meadow Creek;
2) Tailings pore water recovery using existing Tower drains and newly installed production wells within the tailings facility;
3) Water obtained from a deep regional aquifer; and
4) Water obtained from Philip Lakes. Philip Lake was presented as the long term source of water, but also could supply the short term requirement for water.

Waterline is currently working on the hydrogeology component of the Eskers Lake water supply Option (Option 1), the tailings pore water recovery program (Option 2), and a regional deep aquifer assessment program (Option 3). Stantec is working on options 1 and 4 and the Amendment Application for Environmental Assessment (EA). It is also understood that water data collected during the Phase 1 program will be on-going and will help inform the planned Phase 2 program to secure a permanent, long-term water supply. The following sections describes hydrogeology

programs currently underway to help meet the short-term “emergency” water supply requirements for the Mine.

2.0 ESKERS LAKE PROGRAM

Eskers Lake consists of two non-fish-bearing bodies of water, separated by a shallow, narrow naturally occurring causeway. A bathymetric survey of the two lakes completed in September 2017 indicated the Lakes contained a total of 380,000 m^3 of water.

Considerable work was completed to assess the Eskers Lake geology and hydrology as part of the original Environmental Assessment completed in 2009. Subsequent geotechnical, geophysical and hydrogeology studies were completed for Terrane Metals Corp as part of the construction and commissioning of the Tailings Storage Facility (TSF). The data collected indicates that the Eskers Lakes are predominantly groundwater fed.

Groundwater modelling and impact assessments completed as part of the EA suggests that the Eskers Lakes could potentially provide water supply at a rate of 50L/s with minimal impact to the environment. TCM is proposing a more conservative approach to support short-term (emergency) water needs which will allow for data collection and confirmation of recharge rates to the Lakes. At this time, TCM is proposing to only extract at a rate of 25 L/s (50% of the EA value) in order to ensure the maintenance of water levels in the Lakes and Rainbow Pond located down slope which is also believed to be predominantly groundwater fed.

The continuity of the Esker deposits and its ability to transmit groundwater to the Eskers Lakes will greatly influence the recharge capacity of the lakes. In order to reduce the potential uncertainty with Eskers Lake supply, TCM is also proposing a pumping test in advance of water diversion for emergency use. The following pump test proposal has been submitted and approved by the Ministry of Forest Lands and Natural Resource Operations (MFLNRO) and is currently scheduled to start in early December 2017. The equipment layout is shown on Figure 1.

1. The pump test will utilize an electric suction pump housed in a platform located along the berm of Northeast Seepage Pond #1. The intake suction line will be extended into the Eskers Lake B (East Lake) and equipped with a screened intake. A discharge line will report directly to NESP#1.
2. The discharge will be monitored by an in-line flow meter which will record both instantaneous and total flow during the test.
3. The pump will be powered by a 75 kilowatt diesel generator located near the crest of NESP#1, which will be fueled from a contained 500 gallon fuel tank. The diesel generator will be housed within a secondary containment structure to prevent fuel spillage.
4. The test is designed to pump at a rate of 100 litres/second for 5 days. A total volume of 43,200 m^3 will be pumped into NESP #1 during the test. The water will then be pumped directly into the TSF via existing pumping infrastructure.

Surface water and groundwater monitoring will be completed during the test. Waterline is proposing to use existing monitoring wells that surround the lakes to monitor the groundwater response (Figure 2). Data loggers are currently installed in the following locations:

- Eskers A and B lakes and Alpine Lake (Figure 2).
- Shallow and deep groundwater monitoring wells, including: MW12-01D, MW12-02D, MW12-03D, MW12-05R, MW12-06D, KP06-6D, KP07-19, MW13-06, and KP07-18D all shown on Figure 2. Additional wells may be monitored manually and loggers may be moved or adjusted during the test depending on the observed hydraulic response.
- Lower Rainbow Pond located approximately 1,100 meters northeast of the Eskers Lake where groundwater seepage is being collected. The logger at this location will be calibrated to measure pond level and related to volumetric flow at the outlet weir.

Water levels, discharge rates, and field water quality parameters will be monitored throughout the test. The intent of groundwater and surface water monitoring is to assess the hydraulic response in the lakes and surrounding aquifer and groundwater recharge rates.

Based on the current areal extent of the Eskers Lake B, Waterline estimates that the lake level could drop by as much as 0.5m over 5 days of pumping at rate of 100 Litres/sec (8640 m^3/day, or 1585 US gpm). This assumes no groundwater recharge into the lake during the test. Although this is not expected, the test will be closely monitored by Waterline and modified accordingly to meet the observed field conditions and terminated if excessive drawdown is observed. The intent of the Eskers Lake test is to induce hydraulic stress on the lake and aquifer system and to assess the recharge capacity and determine a safe rate of water extraction.

Once the pumping test has been completed, Waterline will continue to monitor the water level recovery response in the lakes and monitoring wells. The loggers will be downloaded and the data assessed at the end of the recovery phase. The data loggers will remain in place and will be used to monitor long-term water level fluctuations before and during water extraction operation to meet the short-term water supply requirements. The data collected during the short-term emergency period will be used to further verify Eskers Lakes recharge characteristics, and to support a long-term license application under the Water Sustainability Act.

3.0 TAILINGS PORE WATER RECOVERY PROGRAM

Tailings pore water recovery is currently underway using the Tower Drains (TD labelled points on Figures 2 and 3). Based on water balance estimates, TCM estimates process water losses of approximately 15 L/s to tailings pore water and the unconsolidated deposits beneath the TSF. As a result, TCM has proposed the drilling of additional engineered water supply wells inside the TSF to enhance the collection of tailings pore water and help meet the water supply shortfall.

Waterline and Cariboo Water Wells Ltd. were retained in to complete a test well drilling program between October 26 and November 24th 2017. An Atlas Copco TH60 air rotary drilling rig was used to advance and drill through fill materials and into unconsolidated sand and gravel materials

within the TSF area. A Waterline hydrogeologist was on site during the program to collect sediment samples, log the geology, measure water quality field parameter, collect water samples, and design the test wells. In total, eight boreholes were drilled and six test wells were completed. The test wells are shown on Figure 3 and include TDW17-2, 3b, 4, 5, 6 and 7.

Test wells were designed with wire-wrapped wells screen and fully developed to a near sediment-free condition. Temporary pumps were installed by Ingram Well and Pumps Ltd. to initiate well testing and assess well capacity. Step-drawdown and short-term (24 hour) constant rate tests were completed in five of the six wells (TDW17-2, 3b, 4, 6 and 7). The testing program was completed on November 27, 2017. Test data is currently being processed by Waterline to estimate the capacity of each well and the well field during simultaneous pumping. The intent of these wells is to capture tailings water losses to supplement the short-term and long-term water needs for the Milligan project. On-going flow and water level monitoring will be required to assess performance and well to well interference.

4.0 REGIONAL GROUNDWATER ASSESSMENT PROGRAM

A regional groundwater assessment study is currently underway to identify potential deep water supply aquifers within close proximity to the Mount Milligan Mine. The Phase 1 study involves a desk-top assessment of existing hydrogeological information which will be used to identify the most promising aquifer targets for development of a deep aquifer supply. Although the current Phase 1 program is accelerated; exploration drilling, aquifer testing, and regulatory approval will take time and is not expected to meet TCM's short-term emergency water needs.

5.0 ADAPTIVE MANAGEMENT

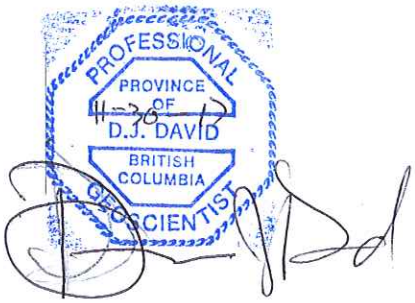
Well-established groundwater and surface water monitoring networks currently exists at the Milligan site. Regular monitoring is being conducted and data is evaluated to assess environmental impacts from current operations. As discussed, the current Phase 1 program is required to meet TCM's short-term emergency supply needs. The programs were designed to collect the needed groundwater data to assess the long-term feasibility and potential impact of various groundwater supply options being investigated. The information collected as part of the Phase 1 will be used to update existing adaptive management plans and strategies to ensure on-going protection of groundwater resources at the Mount Milligan site.

6.0 CLOSURE

Waterline is pleased to provide the enclosed describing the Phase 1 Hydrogeology and Groundwater Supply Assessment program. We trust that the information provided herein is sufficient for your current needs. Should you require more information or have any questions or concerns, please do not hesitate to contact the undersigned.

Respectfully submitted,

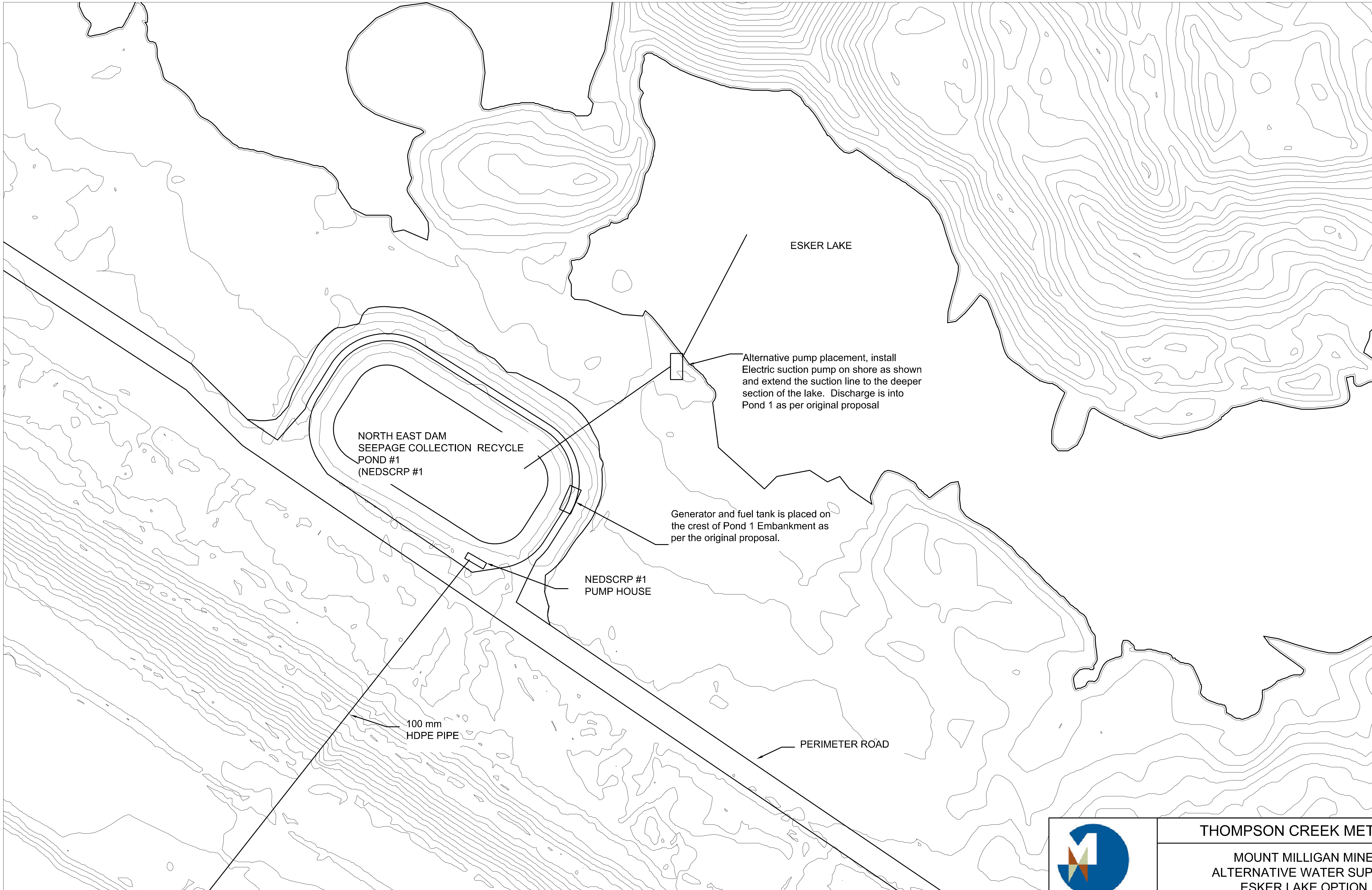
Waterline Resources Inc.



Darren David, M.Sc., P.Geo.
Principal Hydrogeologist

Dalton Pajak, B.Sc., P.Geo.
Hydrogeologist

FIGURES



THOMPSON CREEK METALS

MOUNT MILLIGAN MINE
ALTERNATIVE WATER SUPPLY
ESKER LAKE OPTION
PUMP TEST ALTERNATIVE ARRANGEMENT

MOUNT MILLIGAN

DRAWING NO. DWG - 001

REVISION A

DRG. NO.	DESCRIPTION
REFERENCE DRAWINGS	

REV	DATE	DESCRIPTION	DESIGN	DRAWN	CHK'D	APP'D
REVISIONS						

REV	DATE	DESCRIPTION	DESIGN	DRAWN	CHK'D	APP'D
A	04DEC'16	ISSUED FOR DISCUSSION	MACS	MACS		
REVISIONS						

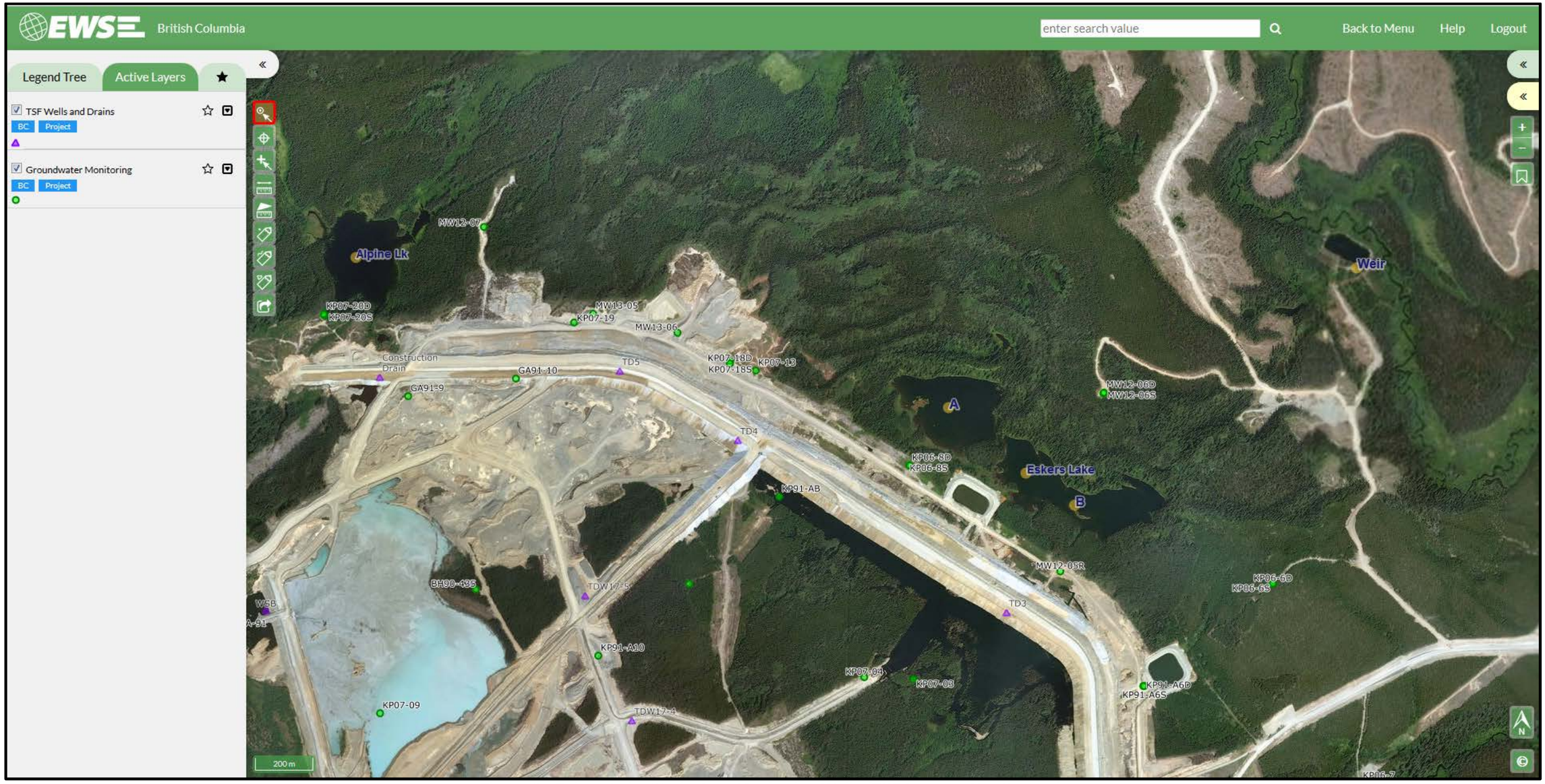


Figure 2: Eskers Lake Study Area Monitoring Wells (TSF Imagery Not Current)

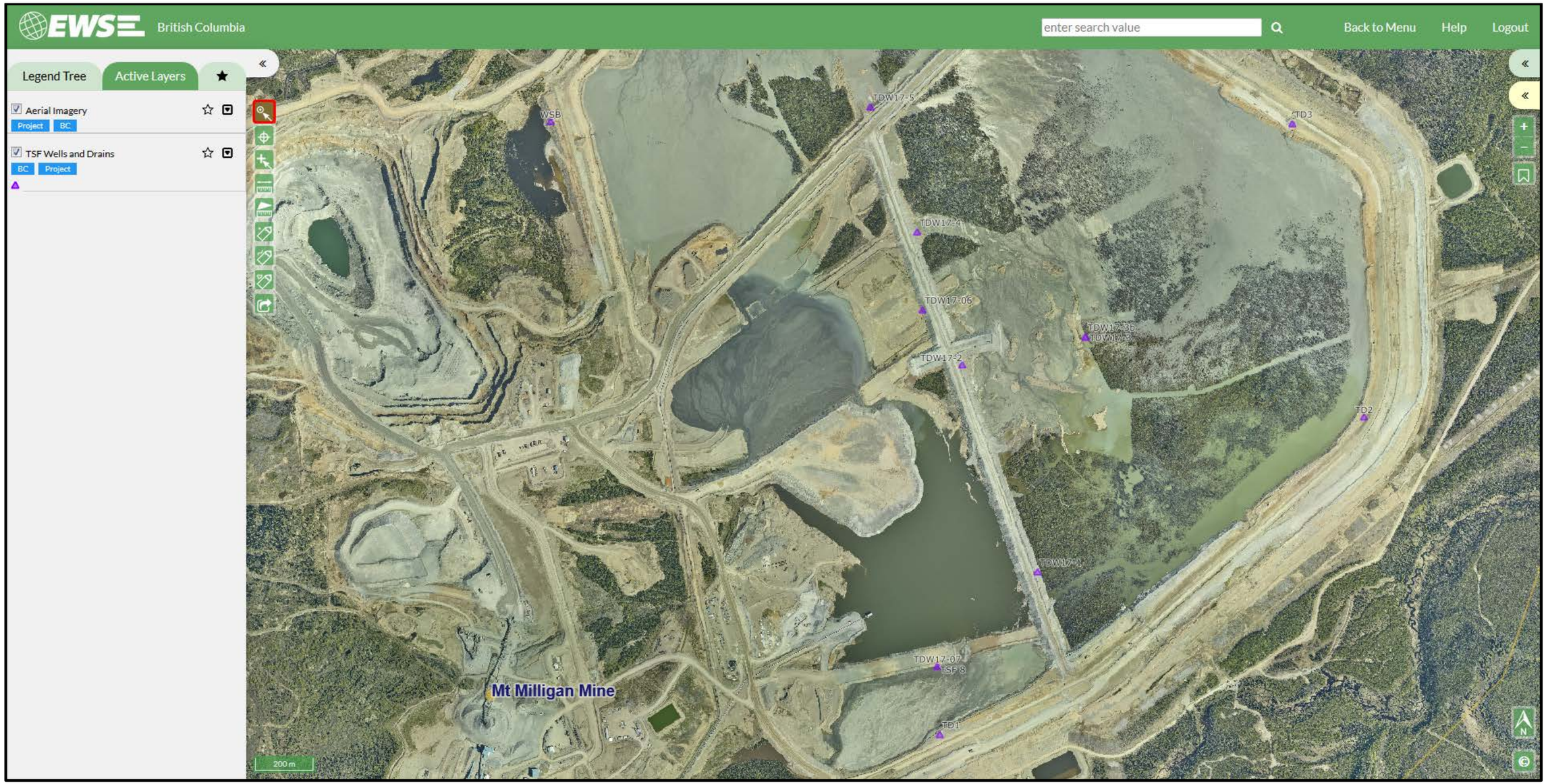


Figure 3: Newly Installed TSF Wells (November 2017)

APPENDIX F
MT MILLIGAN COPPER-GOLD PROJECT – 2007 LAKE HABITAT SURVEYS REPORT

Heidi Lake

Heidi Lake Annotated Ortho Map

Projection: NAD83, UTM Zone 10
Date: October 18, 2007

- Photo Number/Direction
- Gill Net
- Temperature Profile Location
- Minnow Trap Location
- Ekman Sediment Grab Location
- E-Line 1
- E-Line 2
- E-Line 3
- E-Line 4
- E-Line 5

PLANT TYPES

- Sedge
- Nuphar
- Chara

MT-1 MT-2 MT-3 MT-4 MT-5 MT-6 MT-7 MT-8 MT-9 MT-10 MT-11 MT-12 MT-13 MT-14 MT-15 MT-16

ESG-1 ESG-2 ESG-3

POC POT

N

50 0 50 100 150
Meters
Scale: 1:5,000

ECOFOR natural and cultural resource consultants

TERRANE METALS CORP.

Heidi Lake Detailed Survey Map

Projection: NAD83, UTM Zone 10
Date: October 18, 2007

- Photo Number/Direction
- Gill Net
- Temperature Profile Location
- Minnow Trap Location
- Ekman Sediment Grab Location
- E-Line 1
- E-Line 2
- E-Line 3
- E-Line 4
- E-Line 5

PLANT TYPES

- Sedge
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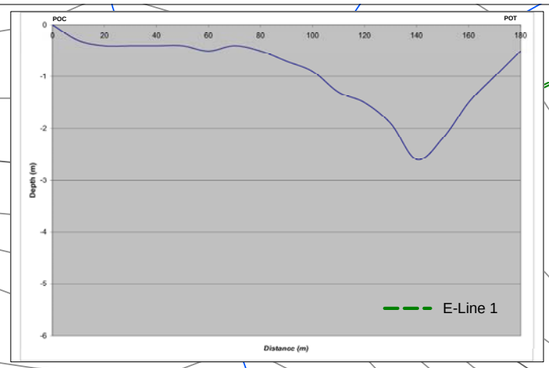

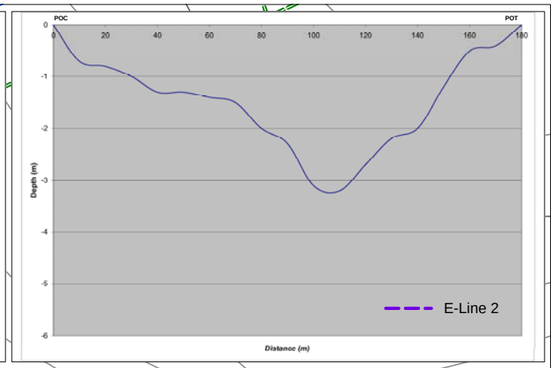

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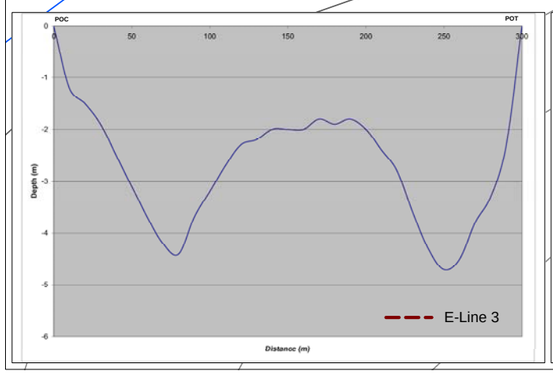

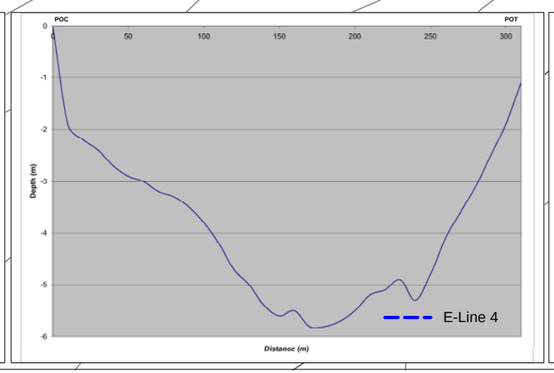

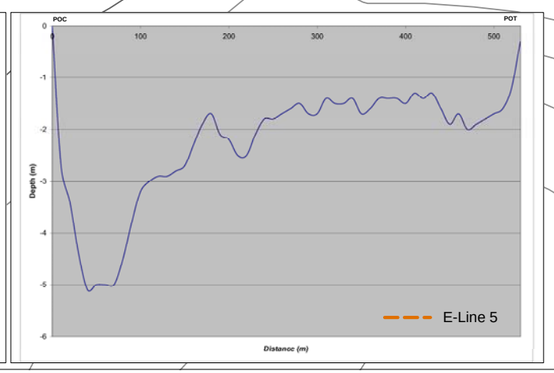

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TERRANE METALS CORP.

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Meters
Scale: 1:5,000

ECOFOR
natural and cultural resource consultants

Heidi Lake

Photo #: 1

Date: August 28, 2007

Comments: View of the southern shore containing a fringe of dead alder in the southwestern most portion of the main lake.

Photo #: 2

Date: August 28, 2007

Comments: Southeastern view of the southwestern bay of the main lake showing the island (to the left) and a sedge fringe.

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Heidi Lake

Photo #: 3

Date: August 28, 2007

Comments: A western view of a shallow bay located at the most northwestern portion of the main lake.

Photo #: 4

Date: August 28, 2007

Comments: An eastern view of the shallow bay located at the most northwestern portion of the main lake.

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natural and cultural resource consultants

Heidi Lake

Photo #: 5

Date: August 28, 2007

Comments: A view of the northwestern basin's shoreline composed of a sedge/dead alder fringe.

Photo #: 6

Date: August 28, 2007

Comments: An eastern view through the narrows with the island in the background.

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natural and cultural resource consultants

Heidi Lake

Photo #: 7

Date: August 28, 2007

Comments: An eastern view of the narrows of the southern shoreline.

Photo #: 8

Date: August 28, 2007

Comments: A western view of the most southwestern point of the main lake.

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Heidi Lake

Photo #: 9

Date: August 28, 2007

Comments: Eastern view of the southern shoreline of the main lake.

Photo #: 10

Date: August 28, 2007

Comments: Eastern view of the entire eastern portion of the main lake.

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Heidi Lake

Photo #: 11

Date: August 28, 2007

Comments: A narrow channel leading to the small portion of the lake. Shoreline composed almost exclusively of dead alder with lots of woody debris.

Photo #: 12

Date: August 28, 2007

Comments: A gravel bar extending across the channel showing the dead alder fringe and woody debris.

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Heidi Lake

Photo #: 13

Date: August 28, 2007

Comments: View of the culverts connecting the main lake to the small lake.

Photo #: 14

Date: August 28, 2007

Comments: Southwestern view of the most eastern basin of the small lake.

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Heidi Lake

Photo #: 15

Date: August 28, 2007

Comments: Northwestern view of the westernmost point in the small lake.

Photo #: 16

Date: August 28, 2007

Comments: The typical shoreline (consisting of sedge) encountered in the small lake.

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Heidi Lake

Photo #: 17

Date: August 28, 2007

Comments: The outlet of Heidi Lake located in the most western basin of the small lake.

Photo #: 18

Date: August 28, 2007

Comments: The outlet of Heidi Lake located in the most western basin of the small lake.

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Heidi Lake

Date: September 6, 2007

Comments: Rainbow trout caught while angling

Date: September 6, 2007

Comments: Rainbow trout caught while angling

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Heidi Lake

Date: September 6, 2007

Comments: Rainbow trout caught while angling

Date: September 6, 2007

Comments: Rainbow trout caught while angling

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Heidi Lake

Date: September 6, 2007

Comments: Rainbow trout caught using a gill net

Date: September 6, 2007

Comments: Lake chub caught in a minnow trap

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Heidi Lake stream outlet

Date: September 6, 2007

Comments: Young of the year rainbow trout caught at the lake outlet electrofishing

Date: September 6, 2007

Comments: Young of the year rainbow trout caught at the lake outlet electrofishing

Philips Lake

Philip Lake Annotated Ortho Map

Projection: NAD83, UTM Zone 10
Date: October 18, 2007

- Photo Number /Direction
- Minnor Trap Location
- Gill Net
- Ekman Sediment Grab Location
- Water Profile Location
- Sedge
- E-Line 1
- E-Line 2
- E-Line 3
- E-Line 4
- E-Line 5
- E-Line 6

POT
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MT-3
MT-6
POT
POC
ESG-3
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10
ESG-4
POT
5
POC
POC
6
14
MT-7
ESG-2
MT-2
POC
4
POT
MT-8
MT-1
7
MT-10
11
ESG-1
POT
POT
POC
MT-9
2
12
8
13
15
POC

ECOFOR natural and cultural resource consultants

N

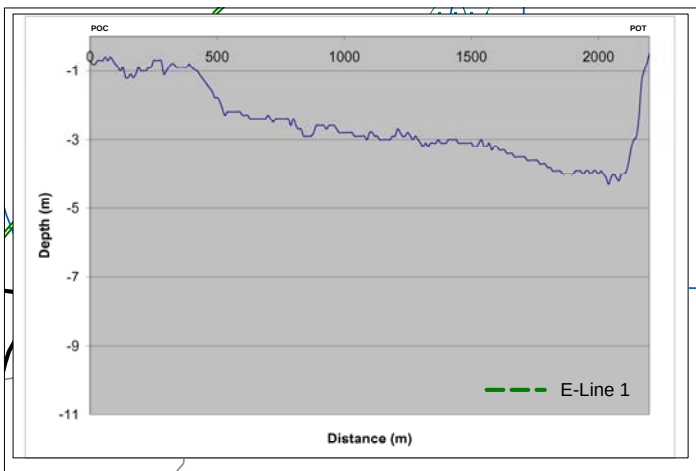
100 0 100 200 300
Meters
Scale: 1:10,000

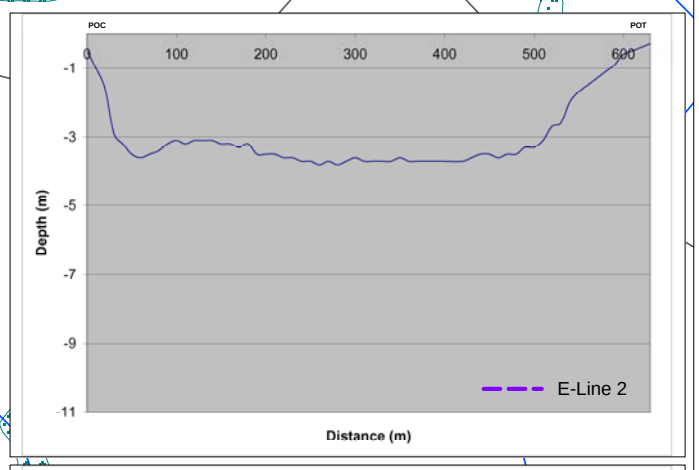
TERRANE METALS CORP.

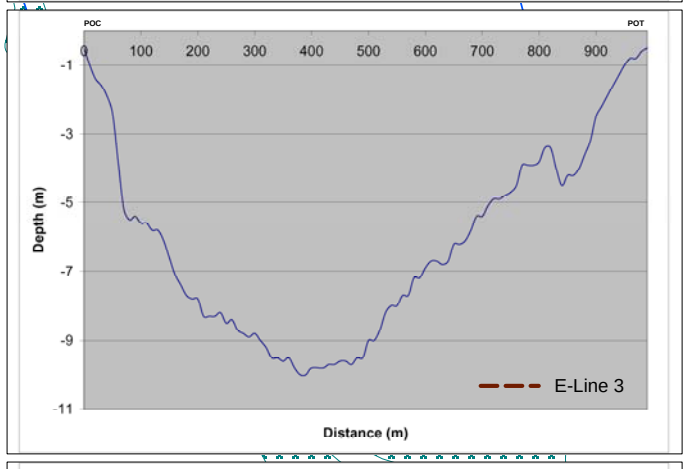
Philip Lake Detailed Survey Map

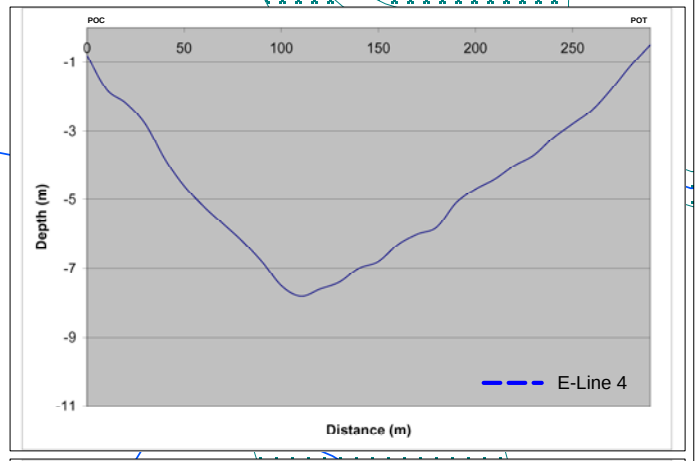
Projection: NAD83, UTM Zone 10
Date: October 18, 2007

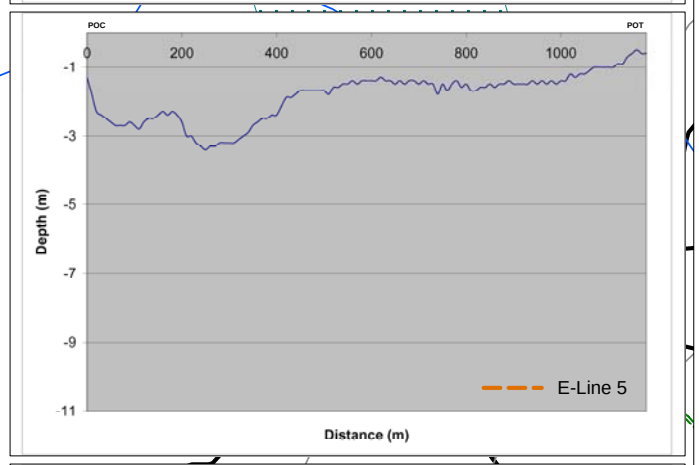
- Photo Number /Direction
- Minnor Trap Location
- Gill Net
- Ekman Sediment Grab Location
- Water Profile Location
- Sedge
- E-Line 1
- E-Line 4
- E-Line 2
- E-Line 5
- E-Line 3
- E-Line 6

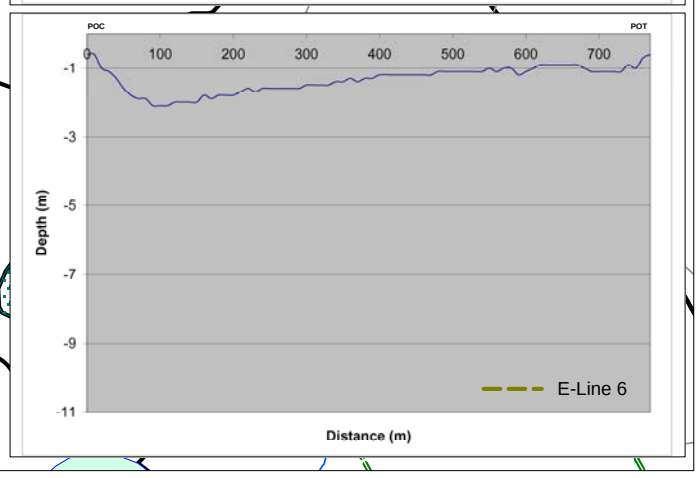












POT
POC
ESG-1
ESG-2
ESG-3
ESG-4
MT-1
MT-2
MT-3
MT-4
MT-5
MT-6
MT-7
MT-8
MT-9
MT-10

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TERRANE METALS CORP.

N

100 0 100 200 300
Meters
Scale: 1:10,000

ECOFOR
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Philips Lake

Photo#: 1

Date: October 20, 2007

Comments: A view of the meadow located on the southern shore of the most northeastern basin.

Photo#: 2

Date: October 20, 2007

Comments: A channel on the western side that joins into the main lake. Shoreline consisted primarily of sedge and other grasses.

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Philips Lake

Photo#: 3

Date: October 20, 2007

Comments: Typical shoreline consisting of alder and grasses with submerged woody debris.

Photo#: 4

Date: October 20, 2007

Comments: Eastern shoreline composed of an alder and grass fringe.

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Philips Lake

Photo#: 5

Date: October 20, 2007

Comments: A view of the northwestern basin shoreline.

Photo#: 6

Date: October 20, 2007

Comments: An eastern view of the meadow located on the southern side of the northeastern basin.

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natural and cultural resource consultants

Philips Lake

Photo#: 7

Date: October 20, 2007

Comments: A northern view of the narrows located in the southern basin of the main lake.

Photo#: 8

Date: October 20, 2007

Comments: A view of the western shoreline. The peninsula was composed primarily of alder with patches of grass.

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Philips Lake

Photo#: 9

Date: October 20, 2007

Comments: A pocket of meadow located in the most northern point of the northwestern basin.

Photo#: 10

Date: October 20, 2007

Comments: A grass meadow point located on the northeastern side of the main lake.

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natural and cultural resource consultants

Philips Lake

Photo#: 11

Date: October 20, 2007

Comments: A view of the eastern shoreline of the main lake.

Photo#: 12

Date: October 20, 2007

Comments: A southern view of the main lake from the island located in the northern part of the lake.

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Philips Lake

Photo#: 13

Date: October 20, 2007

Comments: A view of the southeastern portion of the main lake.

Photo#: 14

Date: October 20, 2007

Comments: A northern view of the northwestern basin. Eastern edge of small island on left of photo.

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Philips Lake

Photo#: 15

Date: October 20, 2007

Comments: A northern view of the entire main lake from the southern portion.

Photo#: 16

Date: October 20, 2007

Comments: A view of the northern meadow located in the most northern part of the northeastern basin.

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Philips Lake fish

Date: October 22, 2007

Comments: Redside shiner caught in a minnow trap

Date: October 22, 2007

Comments: Redside shiner caught in a minnow trap

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Philips Lake fish

Date: October 22, 2007

Comments: Juvenile burbot caught in a minnow trap

Date: October 22, 2007

Comments: Juvenile burbot caught in a minnow trap

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Philips Lake fish

Date: October 22, 2007

Comments: Juvenile northern pikeminnow caught in a minnow trap

Date: October 22, 2007

Comments: Unidentified minnow species caught in a minnow trap

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Philips Lake fish

Date: October 20, 2007

Comments: Adult mountain whitefish caught in a gillnet

Date: October 20, 2007

Comments: Adult mountain whitefish caught in a gillnet

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Philips Lake fish

Date: October 20, 2007

Comments: Adult rainbow trout caught in a gillnet

Date: October 20, 2007

Comments: Adult rainbow trout caught in a gillnet

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Philips Lake fish

Date: October 20, 2007

Comments: Adult lake whitefish caught in a gillnet

Date: October 20, 2007

Comments: Adult lake whitefish caught in a gillnet

ECOFOR
natural and cultural resource consultants

Philips Lake fish

Date: October 20, 2007

Comments: Adult lake whitefish caught in a gillnet

Date: October 20, 2007

Comments: Adult white sucker caught in a gillnet

Esker Lakes

Esker Lakes Annotated Ortho Map

Projection: NAD83, UTM Zone 10
Date: October 18, 2007

- Photo Number/Direction
- Gill Net
- Water Profile Location
- Minnow Trap Location
- Ekman Sediment Grab Location
- E-Line 1
- E-Line 2

PLANT TYPES

- Sedge
- Nuphar
- Equisetum
- Potamogeton
- Chara

MT-1
MT-2
MT-3
MT-4
MT-5
MT-6
MT-7
MT-8
MT-E1
MT-E2
MT-E3
MT-E4
MT-E5
MT-E6
MT-E7
MT-E8
ESG-1
ESG-2
ESG-3
ESG-4
ESG-5
ESG-6
POC
POT

N

35 0 35 70 105
Meters
Scale: 1:3,500

ECOFOR
natural and cultural resource consultants

TERRANE METALS CORP.

Esker Lakes Detailed Survey Map

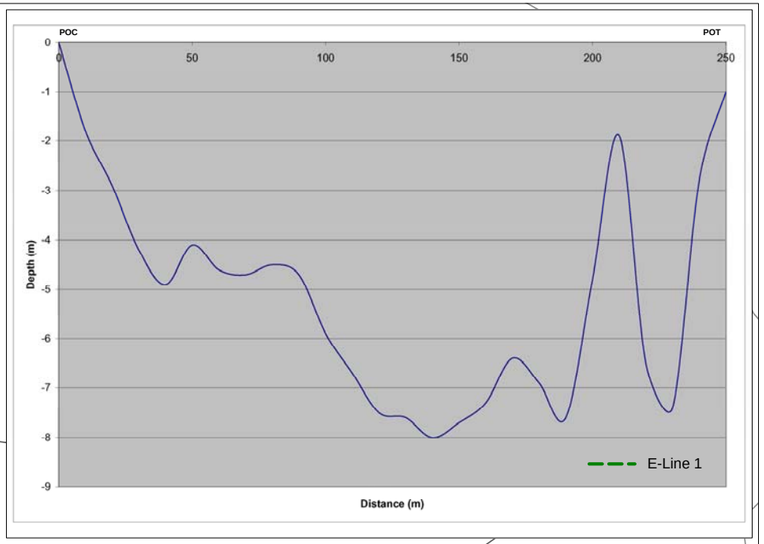
Projection: NAD83, UTM Zone 10
Date: October 18, 2007

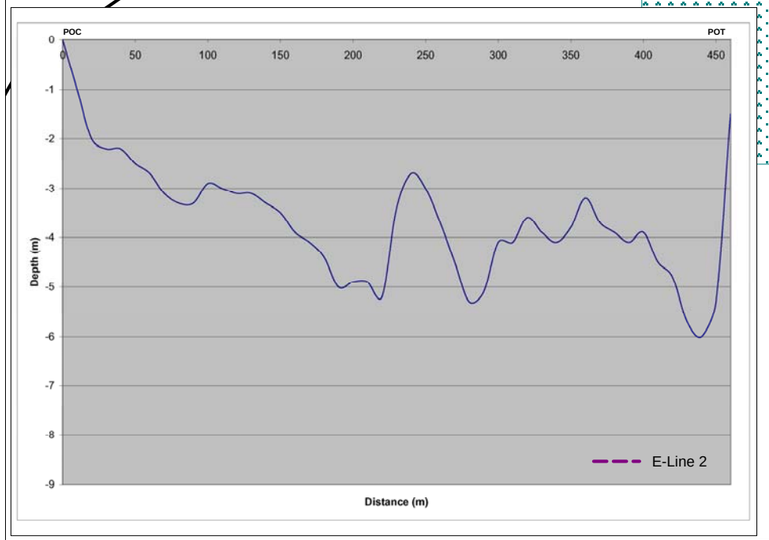
- Photo Number/Direction
- Gill Net
- Water Profile Location
- Minnow Trap Location
- Ekman Sediment Grab Location
- E-Line 1
- E-Line 2

PLANT TYPES

- Sedge
- Nuphar
- Equisetum
- Potamogeton
- Chara

MT-1
MT-2
MT-3
MT-4
MT-5
MT-6
MT-7
MT-8
MT-E1
MT-E2
MT-E3
MT-E4
MT-E5
MT-E6
MT-E7
MT-E8
ESG-1
ESG-2
ESG-3
ESG-4
ESG-5
ESG-6
POC
POT





N
35 0 35 70 105
Meters
Scale: 1:3,500

ECOFOR natural and cultural resource consultants

TERRANE METALS CORP.

ECOFOR
natural and cultural resource consultants

Esker Lakes

Photo #: 1

Date: September 9, 2007

Comments: View of the shallow southwestern basin. Sedge was the dominant vegetation found along the shoreline.

Photo #: 2

Date: September 9, 2007

Comments: View of the western shoreline. Sedge dotted the shoreline while aquatic grasses were typically found around a 10-25 m fringe from shore.

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Esker Lakes

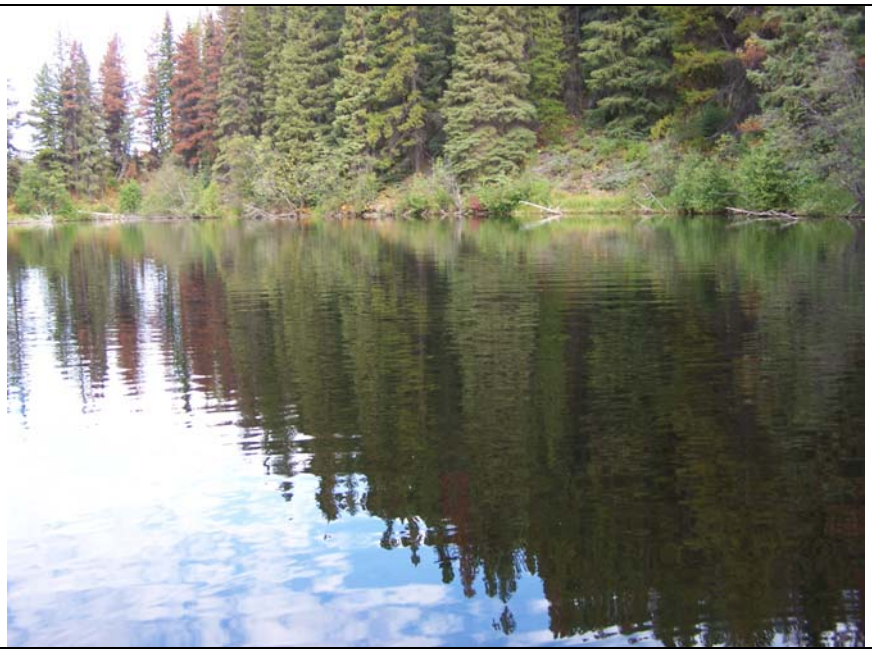

Photo #: 3

Date: September 9, 2007

Comments: View of the northwestern shore. Overhanging alder and woody debris made up a significant portion of the shoreline.

Photo #: 4

Date: September 9, 2007

Comments: Spruce and the occasional pine was found along the northern shoreline in proximity to the lake.

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Esker Lakes

Photo #: 5

Date: September 9, 2007

Comments: A typical pocket found in eskers. A mixture of alder, spruce, pine, grass and juniper coexist.

Photo #: 6

Date: September 9, 2007

Comments: An easterly view of the northern shore. Alder and spruce found along the shoreline.

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Esker Lakes

Photo #: 7

Date: September 9, 2007

Comments: A view of the eastern bay primarily composed of alder. Lots of woody debris was found along the shoreline.

Photo #: 8

Date: September 9, 2007

Comments: View of the southern shore in the eastern bay comprised of an alder fringe with pine.

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Esker Lakes

Photo #: 9

Date: September 9, 2007

Comments: A view from western shore to the eastern shoreline.

Photo #: 10

Date: September 9, 2007

Comments: A view of the northern shore.

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natural and cultural resource consultants

Esker Lakes

Photo #: 11

Date: September 9, 2007

Comments: A grassy island that was located in the southern portion of the lake

Photo #: 12

Date: September 9, 2007

Comments: A northwestern view of the southern shoreline. Grass and lily pads were the dominant vegetation.

ECOFOR
natural and cultural resource consultants

Esker Lakes

Photo #: 13

Date: September 9, 2007

Comments: An eastern view of the inlet into the main Esker Lakes.

Photo #: 14

Date: September 9, 2007

Comments: A western view of the inlet channel into the main Esker Lakes.

APPENDIX G
EDI HABITAT REPORT

Memorandum

To:	Tim Caldwell, Stephanie Righi
From:	Eric O'Bryan, EDI Environmental Dynamics Inc.
Date:	November 15, 2017
Project No:	17P0364
Re:	Philips Lake 1 Shoreline Survey

SCOPE AND OBJECTIVE

This memo outlines a summary of the Philips Lake 1 foreshore assessment completed in support of an Environmental Assessment Certificate Amendment and Water Licence Amendment. The assessment focused on littoral zone mapping including substrates, slope gradients and riparian cover. Incidental wildlife observations were also recorded.

The primary objective was to document and map littoral zone habitat features that would support lake whitefish spawning including the extent of gravel and cobble shoals, associated with lower gradient littoral zone slopes.

An outcome of the assessment is the preparation of a map that identifies the location and extent of the different shore types.

Fish sampling and shoreline utilization was not part of this scope of work.

METHODS

Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Lake Survey Form Field Guide (2008) and Standard Methods for Completion of Foreshore Inventory and Mapping Projects Schleppe and Mason (2009) were used to document shoreline habitat. The assessment mapped littoral zone substrate, littoral slope gradient as percent and associated cover. Riparian vegetation, and in situ water quality including dissolved oxygen and temperature profile was also collected.

An inflatable zodiac boat was used to survey along the shoreline. Transects were delineated based on shore substrate primarily, but littoral slope and cover also considered. The riparian zone was assessed visually and slopes were determined using the categories outline in Schleppe and Mason (2009).

Substrate within the littoral zone was assessed visually, and secchi depths were taken at the transition zone between the littoral and benthic zone. Depths were taken at the edge of the littoral zone and a range finder accurate to 0.1 meter was used to measure distance to high-water mark for littoral zone slope calculation.

Data was recorded on a large site sketch of the lake. *In situ* water quality and dissolved oxygen and temperature profiles were collected using a YSI multimeter calibrated the night before.

RESULTS

The shoreline survey of Phillips Lake 1 was completed on 29 October 2017. Cold weather resulted in ice development in shallow and shaded lake areas which prevented data collection on a portion of the lake. Figure 1 depicts the established transects, littoral substrates and outlines areas that could not be assessed. Relevant photographs are presented at the end of the memo.

Water Quality

Water quality was collected near the deepest point on the lake on the west side of the island (Table 1 and 2). The surface water temperature was 2.3ºC, with a dissolved oxygen concentration of 12.03 mg/L. Dissolved oxygen and temperature profile indicates that the lake had experienced fall turnover. Water quality was collected both descending and ascending (Table 2).

Table 1. Phillips Lake 1 *in situ* water quality October 29, 2017.

Temperature (ºC):	2.3
DO (mg/L):	12.03
SPC (µS/cm):	102.3
pH:	7.9
Turbidity (NTU):	0.54
Secchi Depth (m):	3.8

Table 2. Dissolved oxygen and temperature profiles for Phillips Lake 1, October 29, 2017.

Depth (m)	Temperature (ºC)	DO (mg/L)	Depth (m)	Temperature (ºC)	DO (mg/L)
0	2.3	11.93	9.5	3.8	5.82
0.5	2.5	11.65	8.5	3.9	5.57
1.5	3.2	11.37	7.5	3.4	10.60
2.5	3.3	11.42	6.5	3.4	11.52
3.5	3.3	11.05	5.5	3.4	11.34
4.5	3.3	11.44	4.5	3.3	11.50
5.5	3.4	10.70	3.5	3.3	11.44
6.5	3.4	11.05	2.5	3.2	11.66
7.5	3.6	7.36	1.5	3.3	11.55
8.5	3.7	6.69	0.5	2.9	11.68
9.5	3.8	6.14	0	2.2	11.97

*DO profile collected near the deepest lake depth as documented on bathymetry mapping provided by MTM.

Riparian Zone

Riparian zone and upland vegetation primarily consisted of a mature coniferous forest composed of white spruce (*Picea glauca*), black spruce (*Picea mariana*), lodgepole pine (*Pinus contorta*) with alder (*alnus sp.*), willows (*salix sp.*) and grasses common at and below the high-water mark (Table 3). Slopes were variable with shallow gradients observed near the north end outlet and east side of the lake whereas moderate and moderately steep gradients were documented near the south end and west side.

Table 3. Phillips Lake 1 Riparian Habitat Characteristics.

Transect	Riparian Slope*	Riparian Vegetation	Bank Stability	Cover
1	Moderate	Coniferous	Stable	Occasional LWD
2	Moderate	Coniferous	Stable	Occasional LWD
3	Moderately Steep	Coniferous	Stable	Overhanging vegetation
4	Moderately Steep	Coniferous	Stable	Sparse overhanging vegetation
5	Moderate	Wetland	Stable	Sparse hydrophilic vegetation
6	Moderately Steep	Coniferous	Stable	None
7	Shallow	Wetland	Stable	Hydrophilic vegetation
8	Shallow	Wetland	Stable	Hydrophilic vegetation
9	Moderate	Coniferous	Stable	Trace LWD
10	Moderate	Coniferous	Stable	Trace LWD, overhanging vegetation
11	Moderately Steep	Coniferous	Stable	Overhanging vegetation
12	Moderately Steep	Coniferous	Stable	Trace LWD
13	Moderately Steep	Coniferous	Stable	Trace overhanging vegetation
14	Moderately Steep	Coniferous	Stable	Trace overhanging vegetation
15	Moderately Steep	Coniferous	Stable	Trace overhanging vegetation

* <5% shallow, 5-20% moderate, 20-60 moderately steep

Littoral Zone

Philips Lake 1 has a shoreline perimeter of approximately 17 km. Approximately 7 km of shoreline could not be assessed due to ice cover. This included the bay near the lake outlet, bay at the south end and narrow lake finger along the west side including the primary lake inlet.

The shoreline remains primarily undisturbed from development although forest harvesting has occurred close to the lakeshore on the west side. Cutting boundaries have left only a small buffer near the inlet stream and western lake finger.

Three primary shore types were delineated including gravel/cobble, silt and wetland (Table 4). These shore types are consistent with those used by Schleppe and Mason (2009).

Silt shore type was the most abundant, followed by wetland shore and then gravel/cobble (Table 4). Shoreline not assessed due to ice cover is likely dominated by silt based on review of bathymetry data and shallow slopes noted in the field; however, further assessment during more favorable ice-free conditions is required to confirm.

Table 4. Philips Lake 1 littoral zone substrate and slope characteristics.

Transect	Substrate %					Degree of Embeddedness	Littoral Zone Slope (%)	Comments
	Silt/Clay	Sand	Gravel	Cobble	Boulder			
1	100	-	-	-	-	-	4.9	Silt substrate with occasional leaf litter along bank.
2	97	-	3	-	-	-	5.8	Occasional embedded gravels
3	55	-	5	40	-	M	8.0	Fine and coarse gravels present.
4	100	-	-	-	-	-	15.5	Moderately steep slopes, no gravel
5	100	-	-	-	-	-	6.7	Shallow bay with silt substrate
6	100	-	-	-	-	-	1.7	Silt substrate
7	100	-	-	-	-	-	0.7	Shallow bay with silt substrate. Wetland habitat
8	100	-	-	-	-	-	2.9	Shallow bay with silt substrate, Partial wetland habitat
9	99	-	-	1	-	H	8.2	Occasional sparse submergent vegetation, very sparse, would not provide suitable cover
10	99	-	-	1	-	H	8.7	Uniform shoreline, no gravels
11	100	-	-	-	-	-	0.63	Shallow bay with silt substrate. Water depth at lake narrowing 0.15 m (UTM 441820E, 6104821N)
12	5	5	80	10	-	L	13.9	Water depth at shoreline 0.2 m
13	-	10	65	25	-	M	47.8	Water depth at shoreline 0.2 m
14	-	20	35	45	-	M	54.5	Water depth at shoreline 0.5 m
15	5	10	50	35	-	L	24.6	Gravels present along shore of entire island.

Gravel/Cobble Littoral

Of the 10 km shoreline that could be assessed, 2.25 km consisted of gravel/cobble substrate with low to moderate embedment, primarily located on the western shore of the main lake body including the island (Figure 1, Transects 12-15). Gravel/cobble substrate in Transects 12-14 extended two to nine meters before transitioning to silt with water depths ranging 0.5 to 3 meters. Transect 15 on the west side of the island had gravels extending up to 25 m from shore and water depths ranging from 0.5 to 4 meters.

Littoral zone slope gradients of approximately 14% to 55% were documented. Riparian and upland slopes were moderately steep ranging from 20% to 60% and variable cover was present including overhanging vegetation (primarily *salix sp.*) and large woody debris. Transect 15 had minimal cover.

Gravel/cobble shoreline associated with Transects 12-15 may provide more suitable habitat for lake whitefish spawning compared to the silt and wetland shore types.

Silt

Approximately 7.85 km of shoreline was composed of a shallow or moderately sloping littoral zone with silt substrate (Table 3). Silt layers close to shore measured up to 0.50 m deep. Occasional submerged vegetation was noted, typically within the wetland shorelines. Dense areas of submerged or emergent vegetation that would provide cover and refuge for fish were not observed.

Wetlands

Wetland shore type made up approximately three kilometers of shoreline and were associated with shallow littoral zone slopes, shallow upland slopes, shallow lake depths, silt substrate, organics and submerged or emergent vegetation. A portion of the wetland shore type along the lake inlet channel and western finger could not be assessed.

Tributaries

Six tributary streams are mapped; however, only one located on the southeastern shore was accessible or visible. It had a channel width of 0.80 m and with silt substrates. The outlet stream located along the northeastern shore had a channel width of 40 m, depth greater than two meters and silt substrates.

References

Bryan, J.E., A. Kato. 1975. Spawning of lake whitefish, *Coregonus clupeafonnis*, and round whitefish, *Prosopium cyiindracoum* , in Aishihik Lake and East Aishihik River, Yukon Territory. J. Fish. Res. Board Can.32: 283-288.

M. L. Bégout Anras , P. M. Cooley , R. A. Bodaly , L. Anras & R. J. P. Fudge (1999) Movement and Habitat Use by Lake Whitefish during Spawning in a Boreal Lake: Integrating Acoustic Telemetry and Geographic Information Systems, Transactions of the American Fisheries Society, 128:5, 939-952.

Ministry of Environment. 2008. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standar ds and Procedures, version 2.0, RIC (2001); Errata (April 2007).

Schleppe, J. and B. Mason. 2009. Standard Methods for Completion of Foreshore Inventory and Mapping Projects. Prepared by: Ecoscape Environmental Consultants Ltd. and The Community Mapping N etwork.

Photos:

Photo 1. TS 2, south view

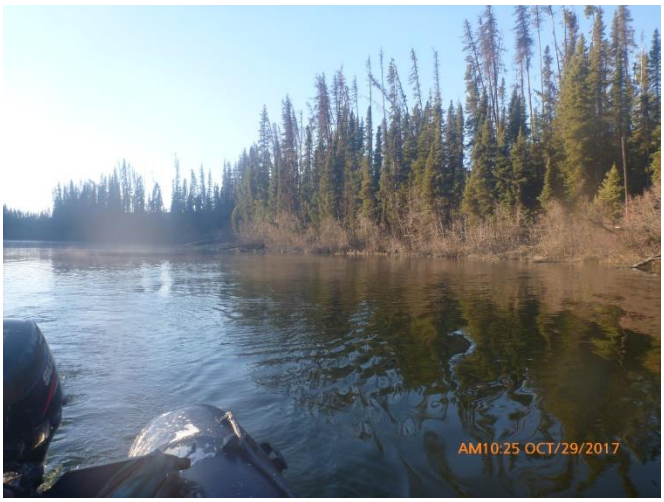


Photo 2. TS 1, south view

Photo 3. TS 3, south view

Photo 4. TS 3 substrate

Photo 5. TS 4, south view

Photo 6. TS 5, northwest view

Photo 7. TS 5, northeast view

Photo 8. TS 8, west view

Photo 9. TS 8, north view.

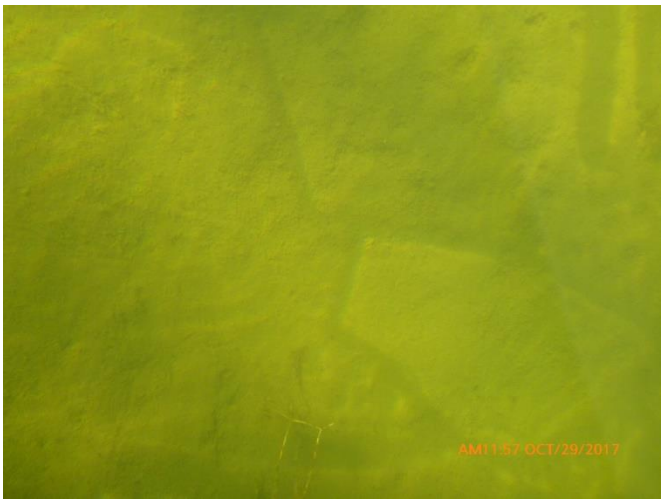


Photo 10. TS 8 substrate

Photo 11. TS 7, east view.

Photo 12. TS 9 east view.

Photo 13. 10 Swans observed southwest shore.

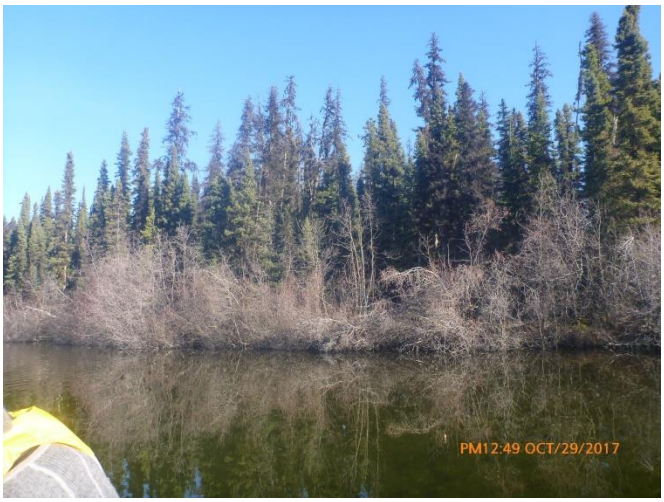


Photo 14. TS 10, northeast view

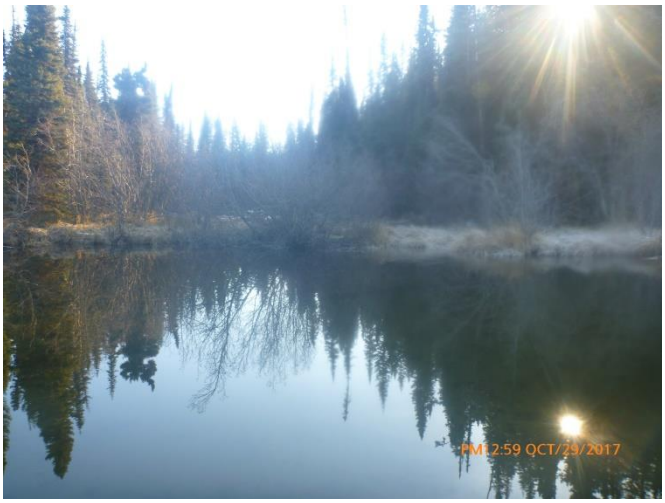


Photo 15. TS 10, tributary on southeast shore.

Photo 16. TS 11, south view.

Photo 17. TS 11, southeast view.

Photo 18. TS 11, north view of west shore.

Photo 19. TS 12, northwest view.

Photo 20. TS 12, typical substrate with leaf litter.

Photo 21. TS 13, southwest view.

Photo 22. TS 14, northwest view.

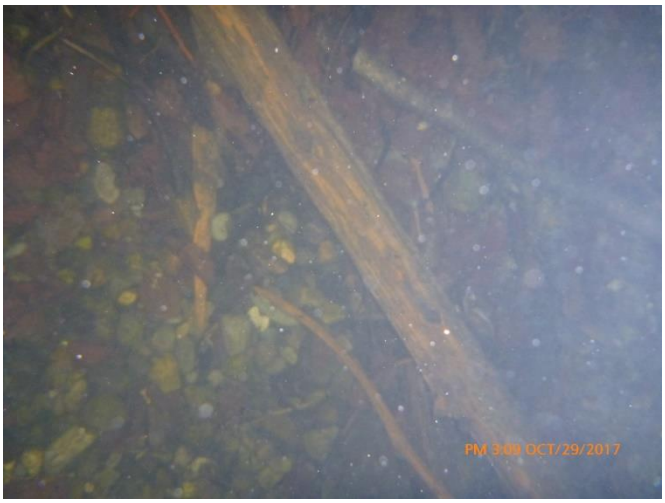
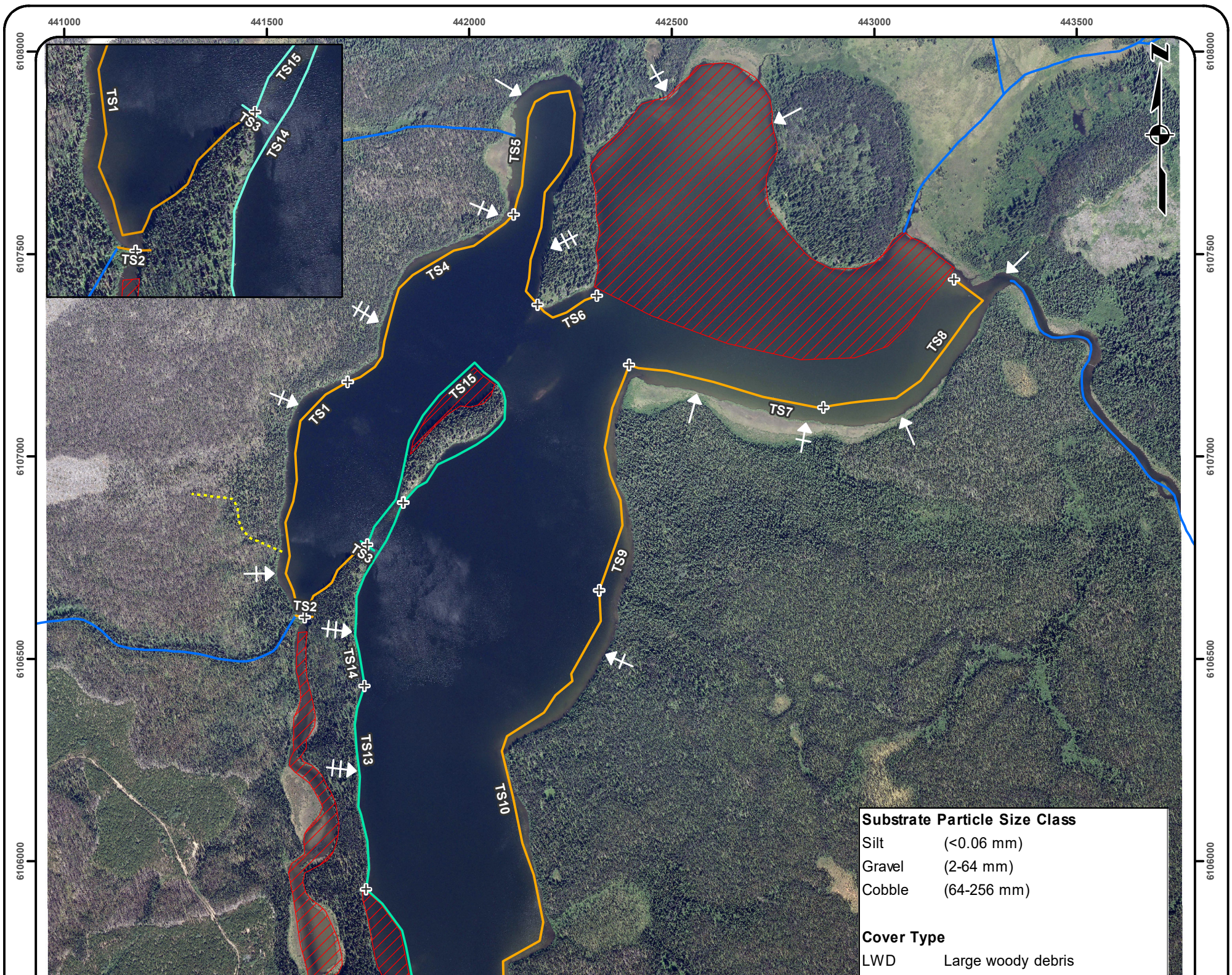


Photo 23. TS 14, typical substrate

Photo 24. TS 15, northwest side of island.



Substrate Particle Size Class

Silt	(<0.06 mm)
Gravel	(2-64 mm)
Cobble	(64-256 mm)

Cover Type

LWD	Large woody debris
OV	Overhanging vegetation
SEV	Sparse emergent vegetation
SUB	Submergent vegetation

Shoreline Slope

- shallow slope (<5%)
- moderate slope (5-20%)
- moderately steep slope (20-60%)

Transect	Substrate	Littoral Slope (m)	Cover Type
TS1	Silt	4.9	SEV
TS2	Silt	5.8	SEV
TS3	Gravel/Cobble	8.0	SEV
TS4	Silt	15.5	SUB
TS5	Silt	6.7	SEV
TS6	Silt	1.7	SEV
TS7	Silt	0.7	SEV
TS8	Silt	2.9	SEV
TS9	Silt	8.2	OV LWD
TS10	Silt	8.7	OV LWD
TS11	Silt	0.6	SEV
TS12	Gravel/Cobble	13.9	OV LWD
TS13	Gravel/Cobble	47.8	OV
TS14	Gravel/Cobble	54.5	OV
TS15	Gravel/Cobble	24.6	SEV

LEGEND

- \+ Transect POC or POT
- Trail

Substrate Type

- Gravel/Cobble
- Silt
- Watercourse
- Not Assessed (ice cover)

0 200 400 800

Meters

Original Map Size 11x17in

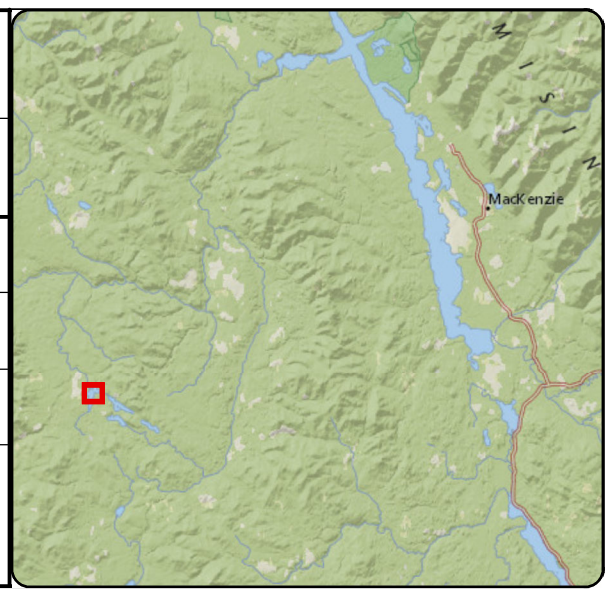
Scale: 1:11,500

Thompson Creek Metals

Figure 1. Philip Lake #1 Shoreline Map

Drawn: V. Smith	Datum/Projection: NAD 1983 UTM Zone 10N
Checked: E. O'Bryan	EDI Project No.: 17P0364
Date: 11/9/2017	Data Sources: Refer to References Section

EDI



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APPENDIX H
EDI MEMO ON PHILIP CREEK HABITAT SURVEY

Memorandum

To:	Tim Caldwell, Stephanie Righi (Centerra Gold)
Cc:	Glenn Wagner (Stantec)
From:	Eric O'Bryan (EDI Environmental Dynamics Inc.)
Date:	December 4, 2017
Project No:	17P0364
Re:	Philips Creek Fish Habitat Assessments

Scope/Objective

In support of a EA Certificate and Water Licence Amendment applications baseline fish habitat and instream flow assessments were completed in Philips Creek between Philips Lake 1 and Philips Lake 2.

The primary objective of the assessment was to document fish habitat within the channel that would support salmonid overwintering, rearing and spawning habitat and document sensitive habitat features that may be impacted by changes to the flow regime from proposed works. EDI was responsible for data collection and quality control. Data analysis is being completed by others.

Methods

Fish Habitat Assessment Procedures

The assessment followed Level 1 field methods outlined in *Fish Habitat Assessment Procedures* (Johnston and Slaney 1996) and *Reconnaissance Fish and Fish Habitat Inventory Standards and Procedures* (RISC 2001). A quantitative description of fish habitat conditions was collected, and habitat units were delineated using naturally-occurring morphological features as strata. This information, along with qualitative observations was used to determine an overall fish habitat rating.

Mean water depth of each habitat unit was collected by averaging three to five depths taken at representative locations within the units. Bankfull widths were collected using either an eslon tape or a range finder depending on stream width and access. An average of three to five measurements was used to determine mean wetted width within each habitat unit. Bank heights were collected at a representative location within each habitat unit. Bed material, instream cover, bank stability and riparian cover were visually estimated using the categories outlined in Johnston and Slaney (1996).

In situ water quality was collected using a calibrated YSI multimeter probe and Oakton T-100 turbidimeter. Parameters collected included dissolved oxygen, specific conductivity, pH and turbidity. Gradients were collected using a clinometer.

A spawning survey within the riffle sections was conducted prior to IFN survey work. This consisted of walking the channel and visually looking for signs of active spawning (mountain and lake whitefish) and documenting gravel patches suitable for rainbow trout.

Instream Flow Transects

Instream flow need (IFN) transects were completed using methods outlined in Lewis et al. (2004), and Reconnaissance (1:20000) Fish and Fish Habitat Inventory (2001). Philips Creek was stratified into mesohabitats and whole-stream transects were established within riffle mesohabitats only. Depth, velocity, substrate and cover measurements were collected at 25 verticals along multiple points for each transect. Three benchmarks were established above the highwater mark and one instream staff gauge (rebar) was installed at each transect. A Solnist level logger was installed in each riffle (2 total) and set to record data at 15-minute intervals.

The transects were set up to collect information a minimum of four times during the open water year (between 0% to 40% of mean annual discharge).

Results

Fish Habitat Assessment

The FHAP assessment was completed on October 28, 2017. Philips Creek was delineated into eight habitat units composed of riffles and glides. The channel was primarily composed of deep glide habitat with silt substrate and an average gradient of 1.2%; three small riffles were documented with shallow depths and gradients 1 to 2%. An anthropogenic rock weir was noted spanning the entire channel. Beaver dam activity was noted as well. Neither feature would sever as a barrier to fish migration. Physical habitat data as recorded on the FHAP form can be found in Table 1. Habitat units 1- 8 are depicted on Figure 1.

Riffle/shallow glide habitat units (HU 1-4) were present from Philips Lake 2 inlet to approximately 150 meters upstream. Mean water depth in the glides was 0.3 m with mean channel width of 10.7 m. A side channel approximately 13.1 m long by 6.0 m wide with suitably sized gravels was located along the left bank providing habitat complexity. Large woody debris and overhanging vegetation were present throughout this reach providing suitable cover for rearing.

A second riffle feature extending 89 meters (HU 6) was located immediately downstream of the weir (444 meters upstream of Philips Lake 2). The riffle had a mean water depth of 0.28 m with a residual pool depth of 0.18 m. Substrates were composed of low embedded gravels and cobbles with the occasional boulder. Large woody debris, instream vegetation and pools provided cover.

The rock weir was approximately 17.2 m wide and 0.20 m high and consisted of large cobbles stacked across the channel. Water depth immediately upstream was 0.43 m, while water depth downstream of the weir was 0.26 m.

Instream Flow Assessment

Eight Instream flow transects were established within Philips Creek between Philips Lake 1 and 2 at two separate riffle features (Figure 1). A Solinst level logger was installed at each riffle site in a location deep enough to ensure water coverage through the winter low flow period.

Five transects were established in HU 6 immediately downstream of the weir. Three transects were established in HU 2.

To date, two subsequent visits have been completed (November 11 and 24, 2017) in low flow conditions. Level logger data was downloaded each time and water levels were surveyed at the staff gauge.

Data analysis and hydraulic curve development is being completed by others. Instream flow transect data is available upon request.

References

Resource Inventory Standards Committee (RISC). 2001. Reconnaissance (1:20,000) fish and fish habitat inventory standards and procedures - version 2.0. Available: http://srmwww.gov.bc.ca/risc/pubs/aquatic/recon/index.htm

Resource Inventory Standards Committee (RISC). 2009. Manual of standard operating procedures for hydrometric surveys in B.C. Available: http://srmwww.gov.bc.ca/risc/pubs/aquatic/hydro/index.htm

Lewis, A., T. Hatfield, B. Chilibeck and C. Roberts. 2004. Assessment methods for aquatic habitat and instream flow characteristics in support of applications to dam, divert, or extract water from streams in British Columbia. Report prepared for Ministry of Water, Land & Air Protection and Ministry of Sustainable Resource Management. Available: http://wlapwww.gov.bc.ca/wld/documents/bmp/assessment_methods_instreamflow_in_bc.pdf

Johnston, N.T., and P.A. Slaney. 1996. Fish Habitat Assessment Procedures. Watershed Restoration Technical Circular No. 8. B.C. Ministry of Environment, Lands and Parks and Ministry of Forests, Victoria, BC.

McPhail, J.D., 2007. The Freshwater Fishes of British Columbia.

Table 1. FHAP fish habitat assessment field data.

Station ID: Philips Creek Survey Distance (m):1598	Survey Date (d/m/y): 28/10/17 Survey Crew: AM/RB	Coordinates U/S: 443297; 6107419 Coordinates D/S: 444335; 6106667
Temperature ©: 2.8 Channel Velocity (m/s): Variable (see transects sheets) Current flow conditions: Moderate Discharge Estimate (m/s): n/a	NTU: 1.64 DO (mg/L): 11.12 SPC (uS/cm): 117.2 pH: 6.47	Comments: Partial ice cover on stream Weather: Sunny, air temp 10℃

Habitat Unit	Habitat Type	Distance from start (m)	Length (m)	Slope (%)	Depth (m)		Width (m)		Bed Material					Pool Info Depth (m)			Fish Passage Barriers	
					Mean	Bankfull	Mean	Bankfull	Fines %	Gravel %	Cobble %	Boulder %	Bedrock %	Type	Max	Crest	Type	T/P
1	G	0	47	1	0.30	0.41	10.7	10.7	19	25	55	1		S	0.54	0.43	N	
2	R	47	59	1	0.24	0.32	8.4	8.4	9	25	65	1		S	0.26	0.24	N	
3	G	106	28	1	0.32	0.44	10.8	10.8	9	55	35	1		-	0.36	0.32	N	
4	R	134	20	1.5	0.23	0.35	20	20	14	65	20	1		S	0.31	0.20	N	
5	G	154	290	1	0.71	0.9	17.2	17.2	95		4	1		Unknown	-	-	N	
6	R	444	89	2	0.28	0.32	16.9	17.3	5	40	50	5		-	0.44	0.26	N	
7	G	533	77	1	0.34	0.43	14.9	16.1	7	70	20	3		-	0.46	-	Weir	
8	G	610	988	1	0.57	0.63	17.2	17.2	90	5	5			Weir	0.57	-	BD	T

Habitat Unit	Banks of channel				Instream cover							Photos #	Comments	Riparian Cover		
	Left Bank Height (m)	Right Bank Height (m)	Left bank Stability	Right bank Stability	Pool %	Boulder %	Instream Vegetation %	Overhang vegetation %	Undercut bank %	LWD %	SWD %	(Role#)		Canopy %	LB %	RB %
1	0.73	0.41	Stable	Stable				5	1	10		759, 760	Inlet of lake 2	0-20		
2	0.32	0.49	Stable	Stable				5	1	10		761, 762	Shallow riffle, no true pools present	0-20		
3	0.44	0.49	Stable	Stable			5	1		15		763-765	Good spawning gravels throughout unit	0-20		
4	0.30	0.39	Stable	Stable			1			5		766-769	Side channel (13.1 m by 6.0 m) with suitable spawning gravels	0-20		
5	0.77	1.03	Stable	Stable			2			5		770-773	Depth prevented wading, measurements taken at start of Habitat Unit	0-20		
6	0.29	0.33	Stable	Stable	15		5			12		see IFA transect photos	Gravels present throughout boulders	0-20		
7	0.38	0.76	Stable	Stable		20	2			3		774-777	10-20 LW noted, pockets of suitable spawning gravels present	0-20		
8	0.63	0.43	Stable	Stable	10					2		778, 779	Algae present on substrate, too deep to wade to lake 1 outlet. Channel ice approx. 50 m upstream of weir.	0-20		

Comments: Could not wade in large glides due to deep water, silty bottom and ice cover, Measurements in these areas were taken at the beginning of the habitat unit.

Good salmonid spawning and rearing habitat throughout riffle sections and shallower glides. Deeper glides would provide excellent over wintering habitat.

Habitat Ratings:

Spawning: Good - an abundance of suitably sized gravel present within riffle and glide habitat units
Rearing: Good - A complexity of habitat features offering cover for rearing juvenile and adult fish throughout survey area
Adult Feeding: Good - Water depth and cover to support adult fish while in stream. Substrate type to support a variety of benthic invertebrates for food source.
Over-wintering: Good - Numerous deep pool and glide sections to support overwinter use.
Migration: Good - Man made weir and small beaver dams are not considered barriers to fish passage. Adequate water depth and flow throughout survey area.

Weir measurements:

Length:17.2m
Height : ~0.20 m
Water depth upstream: 0.43 m
Water depth downstream: 0.26 m
Weir does not impede fish passage.

Overall Rating

Spawning: Good **Rearing: Good** **Adult Feeding: Good** **Over-wintering: Good** **Migration: Good**

Photo 1. HU1 upstream view

Photo 2. HU 3 substrate

Photo 3. HU 3 downstream view

Photo 4. HU 2 downstream view

Photo 5. HU 4 side channel

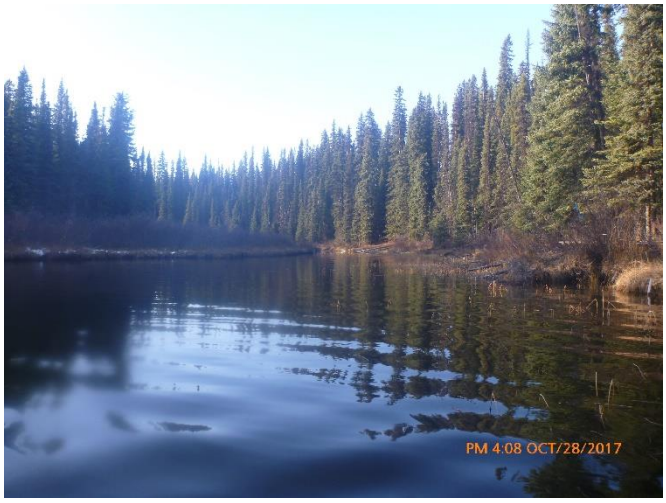


Photo 6. HU 5 downstream view

Photo 7. HU 6 upstream view

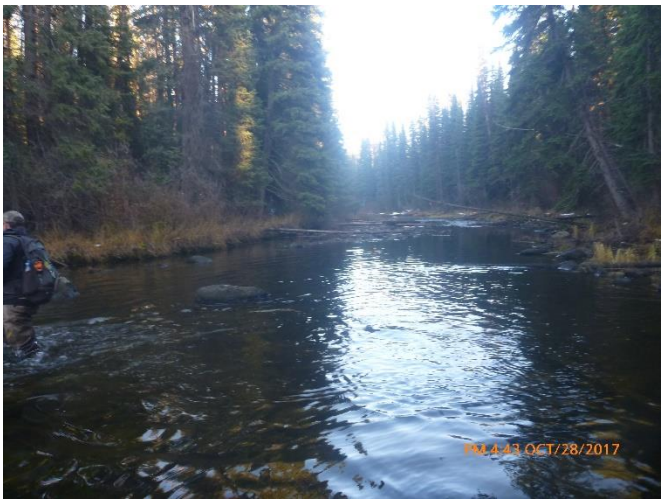


Photo 8. HU 7 downstream view

Photo 9. HU 8 upstream view

Photo 10. Weir right bank downstream view

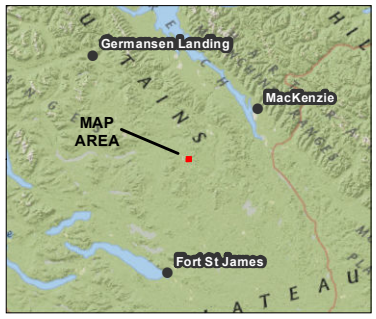
Photo 11. Weir downstream view

Photo 12. Weir right bank upstream view

Figure 1. Phillips Creek Fish Habitat Map

Legend

- Hydrology Stations
- IFN Transects
- Habitat Unit Boundaries



Map scale 1:6,500 (printed at 8.5x11)
Map Projection: NAD 1983 UTM Zone 10N

Data Sources
Imagery layer- Google Earth Pro

Drawn:	Checked:	Drawing:	Date:
D. Powe	E. O'Bryan	#1	12/4/2017

EDI

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APPENDIX I
INDIGENOUS INFORMATION REQUESTS AND RESPONSES

Mt. Milligan Project - Issues Tracking Table First Nations Comments Only										
Last Updated	5-Dec-17		**Updated By:**	S.Righi						
Project Description - EA Amendment Self Determination and Permitting Requirements										
ID	**Comment/ Issue Date**	**Comment Stage**	**Comment Author**	**Comment Organization**	**Subject**	**Document**	**Issue Description or Comment**	**Response**	**Timing**	**Reference**	**Status ""In Progress" indicates comment will be addressed through the appropriate Application"**
EAO-PA-006	11-Oct-17	Pre-application	D.Grace	EAO	General	EA Amendment	In follow up to the Province's meeting with Takla Lake First Nation, Nak'azdli Whut'en and McLeod Lake Indian Band on September 28th regarding TCMC's proposed amendment to the Mount Milligan project, EAO and MMPO developed a list of draft questions that were raised at the meeting (see rows 42-50 below).	Tim Caldwell provided written responses to each of the questions provided by David Grace (see rows 42 to 50 below). Tim also provided these answers during an EAO-organized meeting with regulators and First Nations (Nak'azdli Whut'en, McLeod Lake Indian Band, Takla Lake First Nation) in Vancouver, BC on Oct 18, 2017.		In Progress	
EAO-PA-015	11-Oct-17	Pre-application	D.Grace	EAO	Cumulative Effects	EA Amendment	**Cumulative Effects:** 9) Nak'azdli has a strong interest in exploring issues related to access to Heidi Lake. Further discussions are required between TCMC, Nak'azdli and EAO to explore solutions for ensuring EA compliance and meeting the interests of Nak'azdli.	9) Agreed – we are looking to find a mutually agreeable solution that allows us to comply with our legislated requirements and maintain our positive relationship with Nak'azdli.		In Progress	
EAO-PA-028	10-Nov-17	Pre-application	D.Grace	EAO	Cumulative Effects	dAAIR	Pg 9 – Takla Lake has expressed concern over cumulative effects methods used in the original EA. For this reason, it would be worth considering the inclusion of a cumulative effects analysis, even if the characterization of residual effects does not change from the original EA.	All methods used for the cumulative effects assessment in the original EA followed the guidelines set out by the CEA Agency in "Addressing Cumulative Environmental Effects under the Canadian Environmental Assessment Act" (CEA Agency 1999), and were concluded to be not significant. The conclusions are not anticipated to change as a result of the Amendment. TCMC will engage First Nations on cumulative effects assessments on water withdrawal from Philip Lakes, including installing hydrology stations in the first three lakes in the system. Additional cumulative effects assessment will be conducted as outlined in page 9 of the dAAIR.		In progress	
EAO-PA-030	10-Nov-17	Pre-application	D.Grace	EAO	First Nations Consultation	dAAIR	Section 6.2 – any feedback from Takla Lake initial meetings should be included in this table as well.	Takla Lake First Nation has been added to Table 2 (Section 6.3) of the dAAIR, which provides a summary of preliminary feedback received from Aboriginal Groups on the dAAIR.		In progress	
MMPO-PA-010	23-Oct-17 (initial data request) 27-Oct-17 (info request in table form)	Pre-application	T.Goodsell	MMPO	Water Mgmt	EA Amendment	The Province has prepared the attached Draft Water Source Options Summary for your review and comment. The table has been prepared per request by Nak'azdli, Takla Lake, McLeod Lake at our October 18th meeting for a summary of the short and long term water source options being contemplated by Thompson Creek Metals Company (TCMC). • The table is intended to summarize our current understanding of the options brought forward by TCMC to help narrow down the best options based on regulatory requirements, baseline information available and known concerns including those raised to date by Takla, McLeod Lake and Nak'azdli. • The Province has not identified a preferred option and in recognition of our collaboration, we hope the attached table can serve as a tool to collaboratively discuss and determine the preferred short and long term water source options. • The attached has been drafted based on information received to date. MMPO and EAO understand that we may not have up to date descriptions and therefore the table is missing some key information (e.g. available and proposed withdrawal water quantities, baseline information collected to date, and confirmation of option descriptions). Please complete the following: 1) Review / revise the front matter that precedes the table as required 2) Review / revise the option descriptions so that each accurately describes the conceptual proposal contemplated 3) Provide seasonal water capacity and withdrawal volumes as well as rate of withdrawal (currently blank) 4) Provide additional information such as comments for each option (e.g. TCMC no longer advancing option due to XYZ, option A to be used in conjunction with option B, etc.) 5) Provide comment on whether there is any additional information that can be included to assist our collective efforts in selecting the best option(s)	See summary and populated table: "20171101_Mount Milligan Water Source Options Summary_DRAFT Rev 2.docx". Document provided by TCMC to MMPO for review on Nov 1. Document provided by MMPO to First Nations groups, EAO and FLNRO on Nov 1 for review.		Closed	
Nak'azdli-PA-001	11-Nov-17	Pre-application	A.Halleran	Technical Advisor - Takla Lake First Nation & McLeod Lake Indian Band	Water Mgmt	EA Amendment	Nak'azdli prefers that no water is taken from Rainbow Creek or its watershed. Nak'azdli does not support the construction of the Meadows Creek Water Supply Pond.	TCMC is no longer considering Rainbow Creek as a water source option. TCMC is looking for long-term water solutions other than Meadows Creek Supply Pond.		Closed	
Nakazdli-PA-002	17-Nov-17	Pre-application	A.Halleran	Technical Advisor - Nak'azdli Whut'en	Water Mgmt	Water License	In the low flow months in the winter, I suspect that the lake level is low. So when you withdraw water, would you affect shoreline that would not normally be impacted by low water levels? Has it been modeled? The Keyoh holder is ok with lake levels decrease of up to 5cm but nothing more than that.	Waterline – there is always natural fluctuation in lakes, and we do not think this would fall outside of normal fluctuation. The assumption we've taken is a conservative approach, and we have done a water balance for the lake. The largest drop in water levels, if that occurs, would be at the outlet of the lake (the lowest point). We can vary the amount that is taken throughout the year. We want to make sure we are maintaining the flow. TCMC – In the long term we do not plan on taking water during low flow periods from this lake.		Closed	
Nakazdli-PA-003	28-Nov-17	Pre-application	A.Halleran	Technical Advisor - Nak'azdli Whut'en	Water Mgmt	EA Amendment	Where does the 15% baseline flow come from that you are referring to and do you have data that you have collected yourselves?	Stantec: 15% baseline flow is based on Risk Level 1 of the BC WaterTool, result from TCMC's original EA and measured flows from Meadow's Creek. We do not have enough data on Philip Lake at this time; therefore, modelling is done with surrogate numbers for now.		In progress	
Nakazdli-PA-004	29-Nov-17	Pre-application	R.Sam	Nak'azdli	indigenous interests	EA Amendment	They do not have any additional comments on the dAAIR. Wanted to emphasize that Nak'azdli and the Keyoh holder would like to continue to work with TCMC regarding the Meadows Creek withdrawals, but they have no additional information requirements.	Noted		Closed	
Takla/MLIB-PA-001	10-Nov-17	Pre-application	R.Freed	Source Environmental	Water Mgmt	EA Amendment	What is the evidence from TCMC to show the need for water? How much water are you seeking to obtain?	Evidence includes 2016 bathymetric survey and updated water balance in comparison to original water balance. TCMC is seeking to obtain 1.8Mm³ between January and April 2018.		In Progress	
Takla/MLIB-PA-002	10-Nov-17	Pre-application	R.Freed	Source Environmental	Water Mgmt	EA Amendment	Does this application seek enough water for mill production and to keep tailings submerged? Is there PAG rock in the TSF? Will it remain fully submerged?	The application for Phase 1 is for the amount of water that the mill would require to keep running from when MtM is expected to run out of water (beginning to end of February 2018) to beginning of freshet (mid to end of April 2018). PAG rock is stored within a separate cell of the TSF. Water to submerge tailings and PAG rock is not a requirement during this phase.		Closed	

Mt. Milligan Project - Issues Tracking Table First Nations Comments Only											
Last Updated	5-Dec-17		**Updated By:**	S.Righi							
Project Description - EA Amendment Self Determination and Permitting Requirements											
ID	**Comment/ Issue Date**	**Comment Stage**	**Comment Author**	**Comment Organization**	**Subject**	**Document**	**Issue Description or Comment**	**Response**	**Timing**	**Reference**	**Status ""In Progress" indicates comment will be addressed through the appropriate Application"**
Takla/MLIB-PA-003	27-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Water Mgmt	Mines Act Permit Amendment	Assessment of Impacts on the Regional Watershed 1) Greater baseline information on impacted water bodies: The dIR include a requirement to provide a report detailing how the current water deficient occurred, which is intended to provide a clear understanding of the events that led to the unpredicted water deficit. A second report should also be required that describes the baseline state of the water bodies that will be impacted by the proposed water withdrawal. This report must include the following information that is required to adequately assess the impacts of the increased water withdrawal on the local and regional watershed: Surface water bodies: o Baseline information (including seasonal flows and volumes) on each of the potentially implicated waterbodies (Eskers Lakes, Philips Lakes system (5 lakes and connecting streams), Meadows Creek, and Rainbow Creek); o Environmental flow needs (volume and timing of water flow required for the proper functioning of the aquatic ecosystem of the waterbody) for Eskers Lakes, Philips Lakes, Meadows Creek, and Rainbow Creek, including identification of environmental risk management levels for each of these waterbodies taking into account the drought conditions observed over the past few years and how climate change may be affecting streamflow hydrographs; and o Upstream / downstream connectivity effects of the increased water withdrawal. Groundwater: o Baseline information on the local and regional groundwater aquifer (in light of groundwater connection of Eskers Lakes and possibly other waterbodies); o Baseline information on the gravel aquifer under the Tailings Storage Facility (including potential rates of withdrawal, volume, porosity, depth, and lateral extent), along with a thorough description of the method for drilling for the water supply in this gravel aquifer (the "Aquifer Source"); and o Management decision framework that prioritizes water usage from the Aquifer Source over other water sources.	Report detailing how the deficit occurred and SWOT (Strengths, weaknesses, opportunities, threats) analysis were complete and will be included in the MAPA application. Regarding a secord report on the baseline state of water bodies impacted by the proposed water withdrawal, much of this information will be/is included in the EA application and will be found there. Rainbow Creek is no longer being contemplated as an option and will not require further assessment. Esker Lakes does not have flows and can not be assessed for Environmental Flow Needs. Environmental risk levels can be assessed but will take longer than the Phase 1 timing will allow. This will be evaluated more fully in Phase 2. Groundwater: Baseline on local and regional groundwater aquifer information will be more fully assessed for Esker Lakes and their connectivites will be assessed as part of the pump test and will be more fully assessed in Phase 2. The gravel aquifer under the TSF has been largely assessed and will be included as a separate appendix report in the application. It is important to note that the gravel aquifer under the TSF is not part of the application process.		In Progress	
Takla/MLIB-PA-004	27-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Water Mgmt	Mines Act Permit Amendment	**Assessment of Impacts on the Regional Watershed** **2) Defined plans and water withdrawal thresholds** **The dIR should be amended to ensure that the Application includes the following updates to applicable management plans, including the Construction and Environmental Management Plans, Erosion and Sediment Control Plan, Wildlife Management Plan, and such other Management Plans that require updating:** **a) monitoring requirements to continuously assess the impacts of water withdrawal on local and regional watersheds; and** **b) adaptive management processes and contingency measures (including limiting withdrawals) should water withdrawal operations exceed specified withdrawal thresholds (discussed below).** **Criteria or thresholds must be established for water withdrawal impacts for lake and stream changes in flow and/or volumes. Such thresholds must:** **a) be determined with Indigenous groups, including Takla and MLIB;** **b) be separately defined for all potentially impacted water bodies;** **c) consider the sensitivity of base-flow reductions in winter settings; and** **d) be supported by clear rationales.**	Monitoring and adaptive management components will be part of the EA application. Thresholds are currently being contemplated in the Phase 1 component and will be included in the in the EA application. Given the the timing of the comments provided (Nov 27) and the timing for the application submission (Dec 5), there is very limited timing in Phase 1 to discuss and agree on thresholds for each water body with all parties. MTM proposes to have further discussions as part of the Phase 2 component. Base flow reductions are being considerd and will be addressed as part of the EA application. More clarification is needed on the "clear rationales".		In progress	
Takla/MLIB-PA-005	27-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Water Mgmt	Mines Act Permit Amendment	**Assessment of Impacts on the Regional Watershed** **3) Protection of water quality** **Specific commitments to ensure that no contaminants or deleterious substances are discharged into the environment as a result of the activities outlined in the Application are required. Accordingly, the dIR should be amended to include a section on measures that will be implemented to ensure no contaminants or deleterious substances are released into the environment as a result of the activities proposed in the Application.**	Measures to ensure no contaminants/deleterious substances released into environment due to activities (include further verbage in CEMP/WSECMP) and will be a component of the EA application. Hydrocarbon- or other contaminant-based spills will be managemend under TCMC's Construction Environmental Management Plan and Spill Contingency Plan. Sediment and erosion control will be managed under TCMC's Water, Seepage and Erosion Control Management Plan.		In progress	
Takla/MLIB-PA-006	27-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Indigenous Title and Rights	Mines Act Permit Amendment	Assessment of Impacts on Indigenous Title and Rights The dIR does not include any requirement for an independent assessment of the impacts of the proposed activities on Indigenous title and rights (including Indigenous and treaty rights). Significant amendments to the dIR are required in that regard, as described below. Moreover, the Carrier Sekani First Nations have a new framework for cumulative effects assessment that should be incorporated in the requisite evaluation of the cumulative effects of the proposed activities and corresponding impacts to Indigenous title and rights, including treaty rights.	Carrier-Sekani Tribal Council cumulative effects assessment framework will be considered as part of the Phase 2.		In progress	
Takla/MLIB-PA-007	27-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Indigenous Title and Rights	Mines Act Permit Amendment	Assessment of Impacts on Indigenous Title and Rights a) Mapping of Project effects and impacts at a traditional territorial-level To help assess the impacts of the short-term water extraction on Takla Lake and McLeod Lake's Indigenous title and rights, figures showing the location of the proposed activities must include the boundaries of the potentially impacted First Nations' traditional territories, including Takla and MLIB's traditional territories. Figures must also be provided that show the location of vegetation corridors that may be cleared as a result of this work. This may require a series of figures to ensure the effects and impacts of the mine can be visually considered.	Indigenous traditional territory maps will be included as part of the EA application and where necessary as part of MAPA. This will include all Indigenous groups that may potentially be impacted.		In progress	
Takla/MLIB-PA-008	27-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Indigenous Title and Rights	Mines Act Permit Amendment	Assessment of Impacts on Indigenous Title and Rights b) Impacts on Indigenous title and rights associated with assessed values Takla Lake and McLeod Lake's Indigenous title and rights may be directly or indirectly impacted by effects on various values referred to in the dIR. Accordingly, the dIR must be amended to ensure that Takla and MLIB's ability to meaningfully exercise their Indigenous title and rights as a result of effects to those values is properly assessed.	Impacts on Indigenous title and rights will be further assessed as part of the Phase 2 assessment, as discussed on November 28 Technical Meeting.		In progress	
Takla/MLIB-PA-009	27-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Indigenous Title and Rights	Mines Act Permit Amendment & EA Amendment	Assessment of Impacts on Indigenous Title and Rights c) General Indigenous considerations Finally, the dIR must clearly provide that the Application will meaningfully and adequately assess impacts of the proposed activities on Takla Lake and McLeod Lake's Indigenous rights, and seek to identify measures to avoid such impacts, and, if unavoidable, to mitigate them in a manner that is acceptable to Takla and MLIB.	As the timing of Phase 1 application and approval does not allow for the meaningful engagement and discussions required to adequately address this component, this process will be started early in 2018 as part of the First Nations engagement in preparation for Phase 2.		In progress	
Takla/MLIB-PA-010	17-Nov-17	Pre-application	R. Freed	Source Environmental	Technical Meeting	EA Amendment	1) Map provided needs to be clearer and updated. 2) Geology of the area including gravel aquifer under the TSF needs to be described 3) Threshold/criteria for water levels and flows in the different water bodies needs to be included in the applications	1) A map will be provided to MRC. This will include updated information and clear pipeline corridors and crossings. 2)Gravel aquifer will be described as part of EA application appendices. 3)Scenarios for adaptive management are being incorporated into the EA application.		In progress	
Takla/MLIB-PA-011	17-Nov-17	Pre-application	Takla/MLIB	Source Environmental	Water Mgmt	EA Amendment	Would Philip Lake be the sole source of water in the long-term?	Yes. Although we are also looking at groundwater sources as a potential long term source.		Closed	

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Takla/MLIB-PA-012	17-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Water Mgmt	EA Amendment	Climate change considerations? What if there are more or harsher dry conditions?	That is why we are also considering groundwater sources from deep aquifers. We are collecting additional baseline data in order to detect changes potentially due to climate change and make adaptive changes, however, we can't accurately predict these changes at this time.		Closed	
Takla/MLIB-PA-013	17-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Water Mgmt	EA Amendment	What is the duration of proposed withdrawal? Are you proposing to withdraw water from Eskers from Jan – March 2018 and from Philips from Jan – Sept 2018?	Yes; however, we are considering applying for withdrawal from Philip Lake 1 from Jan – Sept for 2018 and 2019 as the short term use approval can be granted for up to 24 months. The 2019 component is only contingent on not receiving approval on Phase 2 permitting.		Closed	
Takla/MLIB-PA-014	28-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Water Mgmt	EA Amendment	Why are you using Risk Level 1? Does this represent the amount of water you need rather than the lake sensitivity?	Yes, Risk Level 1 means the least risk to the water body (most conservative). We don't have enough baseline data to use high risk rating at this time.		Closed	
Takla/MLIB-PA-015	28-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Water Mgmt	EA Amendment	Concerned about proposed water withdrawal volume from Philip Lake.	Stantec: We took the conservative approach for modelling our withdrawal rates. Used current information we have collected from Philip Lake 1 outlet (cross-sectional flows to create rating curve) for the model. Modelling our withdraw rates to focus on the most sensitive feature, the outlet.		Closed	
Takla/MLIB-PA-016	28-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Water Mgmt	EA Amendment	Want to see adaptive management strategies in application.	MMPO: Beneficial to include description of adaptive management in the appication. EAO: As well as including how information will be included in Phase 2 application.		In progress	
Takla/MLIB-PA-017	28-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Project Description	EA Amendment	Want to see timelines very clearly laid out in application regarding ongoing monitoring and adaptive management plans.	This will be included in the EA application.		In progress	
Takla/MLIB-PA-018	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Project Description	EA Amendment	Want company's intentions to address First Nations' Title and Rights incorporated into formal document.	Agreed. Considerations on impacts to Indigenous title and rights will be formally addressed as part of the Phase 2 application.		Open	
Takla/MLIB-PA-019	28-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Project Description	EA Amendment	Is Esker Lakes fed by groundwater movement from TSF?	These systems are not connected. TCMC conducts both GW/SW testing in this region and no effects are shown.		In progress	
Takla/MLIB-PA-020	28-Nov-17	Pre-application	L.Krebs	Takla Lake First Nation	Water Mgmt	Water License	What does the review look like following this 24-month short-term use approval? If agreed to expedite this process should you run both Phase 1 and Phase 2 at the same time?	The 24-month short-term use approval is temporary only. Running Phase 1 and Phase 2 at the same time overlaps and would not be an efficient process.		In progress	
Takla/MLIB-PA-021	28-Nov-17	Pre-application	L.Krebs	Takla Lake First Nation	Water Mgmt	Water License	Will year one of Phase 1 provide enough baseline data to move forward with Phase 2?	Stantec: Figures for 2018 and 2019 are very conservative, reducing potential withdrawal rate from Philip Lake significantly. 2018 baseline data could be used to update withdrawal rates for 2019. As a short term use we want to remain conservative. Calibrated rates from baseline information would inform the Phase 2 pumping rates.		In progress	
Takla/MLIB-PA-022	28-Nov-17	Pre-application	R.Freed	Source Environmental	Water Mgmt	EA Amendment	Why do you still need Meadows Creek Water Supply Station?	We will not be able to collect enough water from Philips Lake #1 in 2018 and 2019 to meet orerational requirements so we need to continue using MCWSS for now.		Closed	
Takla/MLIB-PA-023	28-Nov-17	Pre-application	R.Freed	Source Environmental	Water Mgmt	EA Amendment	How would you deal with the scenario where there is a very long flow through Philip Creek? Would like to see slide showing thresholds and how they work for various scenarios (ex. 15% mean monthly flow in low flow year). Would like to see graphs depicting our actual data. If you do not have enough data at this time would like to see estimates of data.	Stantec: Below 30% mean annual discharge (MAD) you cannot pump water as this is the critical flow. We are currently modelling for this using averaged flows based on best known information we currently have available to us. We will continue to collect data and update the model as we go (adaptive management strategy). We do not currently have enough Philip Lake data at this time to graph but data collected from Meadows Creek can be used as surrogate for now.		Closed	
Takla/MLIB-PA-024	28-Nov-17	Pre-application	R.Freed	Source Environmental	Water Mgmt	Water License	The short-term use approval lasts for two years?	FLNRO: Short-term use approvals can be valid for up to 24 months. A conditional document will accompany the approval that can be updated as baseline data is collected and analyzed (after one year of pumping and baseline monitoring). Phase 2 will be covered by the next EA amendment but during permitting for Phase 2 TCMC may need further water sourcing through this short-term use approval. TCMC: Having a 24-month short-term use approval allows us to collect more baseline data through Phase 2 permitting process and consultation.		In progress	
Takla/MLIB-PA-025	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	First Nations Consultation	dAAIR	Incredulously, the dAAIR does not purport to assess the impacts of the water withdrawals on Indigenous title and rights.	In response to these comments, section 6.2 of the dAAIR has been revised and now reads as follows: "The proposed Project changes have the potential to interact with Aboriginal Interests. The amendment Application will set out whether the proposed Project changes require revisions to the original assessment conclusions found in Section 2.0 "First Nations Considerations" of the EAC Application and the corresponding conclusions presented in the EAO's Assessment Report (2009) and the Amendment Assessment Reports (2013, 2017) regarding the assessment of Project effects on Aboriginal Interests. This analysis will be informed by relevant information provided to TCMC by First Nations involved in the original EA arising from consultation activities on the proposed Project changes. Takla Lake First Nation did not participate in the original EA of the Project. However, since the EAC was issued in 2009, the Nation has asserted traditional territory which now includes the Project area. As a result, the Application will present an assessment of the effects which are expected to occur as a result of the proposed Project changes on Takla Lake First Nation's Aboriginal Interests. This analysis will be informed by the methodology used to undertake the assessment of Aboriginal Interests set out in the EAC Application, by publicly-available information on Takla Lake First Nation Aboriginal Interests, and by any relevant information provided to TCMC by Takla First Nation arising from consultation activities on the proposed Project changes. The amendment Application will include the following: • A figure showing the boundaries of First Nation traditional territories relative to the proposed water sources and cleared vegetation corridors; • A description of potential adverse effects of the proposed amendment on Aboriginal Interests; • A description or summary of mitigation measures to avoid or reduce potential adverse effects of the proposed amendment on Aboriginal Interests; • A characterization of the residual adverse effects of the proposed amendment on Aboriginal Interests after mitigation; and • A summary of outstanding Aboriginal Interests issues identified by First Nations."		In progress	
Takla/MLIB-PA-026	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Project Description	dAAIR	1. Assessment of Impacts on the Regional Watershed (a) Mapping of waterbodies and mine infrastructure The dAAIR should be amended to specify that maps showing the locations of mine infrastructure and existing waterbodies be included in the Application, for clarity and ease of review.	The dAAIR has been amended to clarify that a description of proposed short-term water extraction needs including an updated figure showing the location of the proposed water sources and infrastructure relative to the approved Project will be included in the Application.		In progress	

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Takla/MLIB-PA-027	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Assessment Methods	dAAIR	1. Assessment of Impacts on the Regional Watershed (b) Greater baseline information on impacted water bodies Section 2 of the dAAIR outlines the information that Centerra intends to include in the Application to describe the proposed mine changes, including the following operational activities: "Water withdrawal locations, volumes, rates, timing, and durations from identified water sources into the water seepage return ponds (Pond 1 and Pond 2)". The dAAIR should be amended to ensure that more information is included in the Application to adequately assess the impacts of the increased water withdrawal on the local and regional watershed. Specifically, the dAAIR should be amended to ensure that the following information is described in the Application: (i) Surface water bodies: o Baseline information (including seasonal flows and volumes) on each of the potentially implicated waterbodies (Eskers Lakes, Philips Lakes system (5 lakes and connecting streams), Meadows Creek, and Rainbow Creek)	Baseline information will be provided for the water bodies and watercourses that are anticipated to be affected by the proposed water withdrawals from Esker Lakes and Philip Lake. Available or modeled baseline information is intended to support only the short-term water withdrawals from these two sources. More detailed baseline information is currently being collected and will continue to be collected in 2018; this information will be presented in support of the proposed long-term water withdrawal application. Baseline information for Meadows and Rainbow creeks will not be included in the Application because the amendment does not propose to withdraw more water from Meadows Creek than was originally assessed in 2008.		In progress	
Takla/MLIB-PA-028	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Assessment Methods	dAAIR	1. Assessment of Impacts on the Regional Watershed (b) Greater baseline information on impacted water bodies Section 2 of the dAAIR outlines the information that Centerra intends to include in the Application to describe the proposed mine changes, including the following operational activities: "Water withdrawal locations, volumes, rates, timing, and durations from identified water sources into the water seepage return ponds (Pond 1 and Pond 2)". The dAAIR should be amended to ensure that more information is included in the Application to adequately assess the impacts of the increased water withdrawal on the local and regional watershed. Specifically, the dAAIR should be amended to ensure that the following information is described in the Application: (ii) Surface water bodies: Environmental flow needs (volume and timing of water flow required for the proper functioning of the aquatic ecosystem of the waterbody) for Eskers Lakes, Philips Lakes, Meadows Creek, and Rainbow Creek, including identification of environmental risk management levels for each of these waterbodies taking into account the drought conditions observed over the past few years and how climate change may be affecting streamflow hydrographs; and	Environmental flow needs in Philip Creek have been considered during the selection of the proposed withdrawal rates from Philip Lake and will be included in the assessment. Esker Lakes are non-fish-bearing and do not have surface connection to fish-bearing water bodies or watercourses. However, these lakes are part of a larger groundwater system that provides water to Rainbow Creek and the Lower Rainbow Creek Offset Pond. The potential effect of short-term (3 months) water withdrawal from Esker Lakes on inflows to Rainbow Creek and the Lower Rainbow Creek Offset Pond will be assessed. Assessment of environmental flows in Meadows Creek and Rainbow Creek will not be included in the assessment. Proposed water withdrawals from Meadows Creek will not exceed those already assessed in the original EA application.I24		In progress	
Takla/MLIB-PA-029	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Assessment Methods	dAAIR	1. Assessment of Impacts on the Regional Watershed (b) Greater baseline information on impacted water bodies Section 2 of the dAAIR outlines the information that Centerra intends to include in the Application to describe the proposed mine changes, including the following operational activities: "Water withdrawal locations, volumes, rates, timing, and durations from identified water sources into the water seepage return ponds (Pond 1 and Pond 2)". The dAAIR should be amended to ensure that more information is included in the Application to adequately assess the impacts of the increased water withdrawal on the local and regional watershed. Specifically, the dAAIR should be amended to ensure that the following information is described in the Application: (iii) Surface water bodies: o Upstream / downstream connectivity effects of the increased water withdrawal.	The application will include an assessment of the potential downstream effects on Philip Creek from water withdrawals from Philip Lake. Water withdrawals from Philip Lake are not anticipated to have an effect on any upstream lake or stream. However, the potential effect of lake draw-down on the connectivity to upstream tributaries will be addressed. The application will also include an assessment of the potential reduction of groundwater inflows to Rainbow Creek and the Lower Rainbow Creek Offset Pond. Esker Lakes are groundwater-fed and, therefore, the proposed water withdrawals will not affect upstream connectivity to any fish-bearing stream or lake.		In progress	
Takla/MLIB-PA-030	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Assessment Methods	dAAIR	1. Assessment of Impacts on the Regional Watershed (b) Greater baseline information on impacted water bodies Section 2 of the dAAIR outlines the information that Centerra intends to include in the Application to describe the proposed mine changes, including the following operational activities: "Water withdrawal locations, volumes, rates, timing, and durations from identified water sources into the water seepage return ponds (Pond 1 and Pond 2)". The dAAIR should be amended to ensure that more information is included in the Application to adequately assess the impacts of the increased water withdrawal on the local and regional watershed. Specifically, the dAAIR should be amended to ensure that the following information is described in the Application: (iv) Groundwater: Baseline information on the local and regional groundwater aquifer (in light of groundwater connection of Eskers Lakes and possibly other waterbodies); Baseline information on the gravel aquifer under the Tailings Storage Facility (including potential rates of withdrawal, volume, porosity, depth, and lateral extent), along with a thorough description of the option for drilling for the water supply in this gravel aquifer.	Baseline and modelled information from the original EA application regarding groundwater flow paths, recharge rates, and aquifer boundaries will be presented in the application as necessary to understand the potential effects of winter water withdrawals from Esker Lakes on Rainbow Creek. Centerra has collected additional groundwater information since 2008 and is currently conducting a detailed groundwater investigation around Esker Lakes. Data from the current groundwater program will not be ready for this application. However, the preliminary results of this data will be considered prior to implementation of the Esker Lakes withdrawal program.		In progress	
Takla/MLIB-PA-031	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Effects Assessment	dAAIR	1. Assessment of Impacts on the Regional Watershed (c) Defined plans and water withdrawal thresholds (i) The dAAIR should be amended to provide: Monitoring plans to continuously assess the impacts of water withdrawal on local and regional watersheds; and adaptive management plans and contingency plans (including limiting withdrawals) should water withdrawal operations exceed specified withdrawal thresholds (discussed below)	The Application will include an adaptive monitoring plan that identifies the current hydrology, groundwater, and water quality monitoring networks as well as the new stations that TCMC has recently established in the Philip Creek Watershed and near Esker Lakes. This monitoring plan will discuss the frequency and duration of sampling, methods used, and the data analysis that is and will be conducted on the collected data. The Adaptive Monitoring Plan will identify thresholds and outline how TCMC will respond to any threshold exceedances. This plan will identify any contingencies or actions that would be triggered by any threshold exceedances.		in progress	
Takla/MLIB-PA-032	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Assessment Methods	dAAIR	1. Assessment of Impacts on the Regional Watershed (c) Defined plans and water withdrawl thresholds (ii) It is critical that criteria or thresholds be established for water withdrawal impacts for lake and stream changes in flow and/or volumes. Such thresholds must: -be determined with Indigenous groups, including Takla and MLIB; -be defined for all potentially impacted water bodies; consider the sensitivity of base-flow reductions in winter settings; and -be supported by clear rationales	TCMC agrees that thresholds must be established to protect the aquatic environment in the Philip Lake system and in Rainbow Creek, downstream of Esker Lakes. These thresholds will be identified in an Adaptive Monitoring Plan and will focus on protecting the aquatic environment during low-flow periods. Thresholds will initially be set using available or modeled data. However, these thresholds will be revisited as new data from the monitoring program becomes available. As such, TCMC looks forward to working with the Takla Lake First Nation and McLeod Lake Indian Band to develop and refine these thresholds during the assessment of the long-term (Phase 2) water withdrawals required to keep the Project operating.		In progress	
Takla/MLIB-PA-033	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Cumulative Effects	dAAIR	1. Assessment of Impacts on the Regional Watershed (c) Defined plans and water withdrawl thresholds (iii) We also stress that the Carrier Sekani First Nations have a new framework for cumulative effects assessment that should be incorporated in the requisite evaluation of the cumulative effects of the proposed activities.	A cumulative effects assessment will be conducted if the proposed changes are anticipated to adversely alter the characterization of residual effects from the original EA (e.g., an effect changes from being low magnitude to moderate magnitude or from being reversible to being permanent). The assessment methods noted above are consistent with the EAO's Guideline for the Selection of Valued Components and Assessment of Potential Effects (2013).		In progress	

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Takla/MLIB-PA-034	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Effects Assessment	dAAIR	1. Assessment of Impacts on the Regional Watershed (d) Protection of water quality Specific commitments to ensure that no contaminants are discharged into the environment as a result of the activities outlined in the Application are required. Accordingly, the dAAIR should be amended to include a section on measures that will be implemented to ensure no contaminants are released into the environment as a result of the activities carried out to withdraw water from the new water sources.	Existing environmental management plans (including the spill response plan, erosion and sediment control plan, and the hazardous materials handling plan) and operational procedures currently implemented at Mount Milligan will be implemented during all phases of the proposed water withdrawals from Philip Lake and Esker Lakes included in the EA amendment. These plans will be revised as necessary and will be made available in the Application.		In progress	
Takla/MLIB-PA-035	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	First Nations Consultation	dAAIR	2. Assessment of Impacts on Indigenous Title and Rights (a) Map depiction of new activities in relation to Takla and MLIB's traditional territories As mentioned above, section 2 of the dAAIR outlines the information that Centerra intends to include in the Application to describe the proposed changes to mining operations. This includes a description of the proposed short-term water extraction needs with an updated figure showing the location of the proposed water sources relative to the approved mine. To help assess the impacts of the short-term water extraction on Takla and MLIB's Indigenous title and rights, this figure must include the boundaries of the potentially impacted First Nations' traditional territories, including Takla and MLIB's traditional territories. The figure must also show the location of vegetation corridors that may be cleared as a result of this work. This may require a series of figures to ensure the effects and impacts of the mine can be visually considered.	The dAAIR has been revised based on this feedback. A figure showing the boundaries of First Nation traditional territories relative to the proposed water sources and cleared vegetation corridor will be included in the Amendment Application.		In progress	
Takla/MLIB-PA-036	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	First Nations Consultation	dAAIR	2. Assessment of Impacts on Indigenous Title and Rights (b) Impacts on Indigenous title and rights associated with valued components Takla and MLIB's Indigenous title and rights may be directly or indirectly impacted by environmental effects on various valued components recognized in Table 1 of the dAAIR, including: · Water Resources – extraction of make-up water has the potential to affect water resources located within Takla and MLIB's traditional territories, which Takla and MLIB rely on in exercising their Indigenous rights; · Fisheries and aquatic resources – extraction of make-up water and installation of water pipeline infrastructure has the potential to affect fish and fish habitat located within Takla and MLIB's traditional territories, which Takla and MLIB rely on in exercising their Aboriginal rights; · Vegetation and plant communities – extraction of make-up water and installation of water pipeline infrastructure has the potential to affect vegetation and plant communities located within Takla and MLIB's traditional territories, which Takla and MLIB rely on in exercising their Indigenous rights; and · Wildlife and wildlife habitat – extraction of make-up water and installation of water pipeline infrastructure has the potential to affect wildlife and wildlife habitat located within Takla and MLIB's traditional territories, which Takla and MLIB rely on in exercising their Indigenous rights. Accordingly, the dAAIR must be amended to ensure that Takla and MLIB's ability to meaningfully exercise their Indigenous title and rights as a result of environmental effects to those valued components is properly assessed.	TMCM recognizes that the proposed Project changes have the potential to interact with established or asserted Aboriginal rights or treaty rights ("Aboriginal Interests"). The amendment Application will set out whether the proposed Project changes require revisions to the original assessment conclusions found in Section 2.0 "First Nations Considerations" of the EAC Application and the corresponding conclusions presented in the EAO's Assessment Report (2009) and the Amendment Assessment Reports (2013, 2017) regarding the assessment of Aboriginal Interests. In addition, the amendment Application will present an assessment of the effects that are expected to occur as a result of the proposed Project changes on Takla Lake First Nation's Aboriginal Interests. This analysis will be informed by the methodology used to undertake the assessment of Aboriginal Interests set out in the EAC Application. The original assessment of Project effects on Aboriginal traditional use and Aboriginal Interests in the EAC Application relied on the conclusions for the following relevant VCs also assessed in the EAC Application: • Fish and Aquatic Resources • Vegetation and Plant Communities • Wildlife and Wildlife Habitat • Archaeology and Heritage Resources • Visual and Aesthetic Resources • Noise The analysis in the amendment Application will consider the effects of proposed Project changes on the VCs listed above, and examines how these effects could, in turn, affect Aboriginal Interests, including traditional use.		In progress	
Takla/MLIB-PA-037	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	First Nations Consultation	dAAIR	2. Assessment of Impacts on Indigenous Title and Rights (c) Fisheries of importance to Aboriginal rights The dAAIR identifies rainbow trout and lake whitefish as the indicator species to assess the potential effects of the water withdrawals on fish and aquatic resources. As discussed above [Takla/MLIB-AP-014], however, Takla and MLIB's Indigenous title and rights may be directly or indirectly impacted by environmental effects on the fisheries and aquatic resources valued component. It is therefore critical that Takla and MLIB determine the appropriate indicator species to use to assess effects on this valued component, as well as impacts on Takla and MLIB's Indigenous title and rights. The dAAIR must be amended accordingly.	TCMC recognizes that the proposed Project changes have the potential to interact with Aboriginal Interests through potential effects to fish that may be important to Takla and MLIB community members. Rainbow trout and lake whitefish were selected as potential indicator species because they represent a spring and fall spawning species that, respectively, use streams and lakes for spawning. The assessment will also include potential effects to mountain whitefish because they are fall spawners that use streams for spawning and, therefore, their eggs are susceptible to stranding during winter. The intent of selecting these indicator species was to assess the effectiveness of mitigation measures to eliminate or reduce potential adverse effects to spring and fall spawning species with the assumption that these mitigations measures would also protect other spring and fall spawning species in Philip Lake and Philip Creek when implemented. Other fish species known to inhabit Philip Lake include burbot, white sucker, and redside shiner. No bull trout have been found in Philip Lake or in Philip Creek near the proposed water withdrawal site. Bull trout are only known to inhabit Philip Creek near its confluence with the Nation River. A survey will be conducted in 2018 to confirm the absence of bull trout from the lake.		In progress	
Takla/MLIB-PA-038	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	First Nations Consultation	dAAIR	2. Assessment of Impacts on Indigenous Title and Rights (d) General Aboriginal considerations Finally, section 6.2 of the dAAIR outlines Indigenous considerations that Centerra intends to address in the Application. This section focuses on traditional use, and makes no reference to Indigenous title and rights, and potential impacts to them. As the mine is located within Takla and MLIB's traditional territories, and the proposed increase water withdrawal has the potential to significantly impact Takla and MLIB's Indigenous title and rights, section 6 must be revised to ensure the Application meaningfully and adequately assesses such impacts, and seeks to identify measures to avoid such impacts, and, if unavoidable, to mitigate them in a manner that is acceptable to Takla and MLIB.	In response to this comment, section 6.2 of the dAAIR has been revised to read as follows: "The proposed Project changes have the potential to interact with Aboriginal Interests. The amendment Application will set out whether the proposed Project changes require revisions to the original assessment conclusions found in Section 2.0 "First Nations Considerations" of the EAC Application and the corresponding conclusions presented in the EAO's Assessment Report (2009) and the Amendment Assessment Reports (2013, 2017) regarding the assessment of Project effects on Aboriginal Interests. This analysis will be informed by any relevant information provided to TCMC by First Nations involved in the original EA arising from consultation activities on the proposed Project changes. Takla Lake First Nation did not participate in the original EA of the Project. However, since the EAC was issued in 2009, the Nation has asserted traditional territory which now includes the Project area. As a result, the Application will present an assessment of the effects which are expected to occur as a result of the proposed Project changes on Takla Lake First Nation's Aboriginal Interests. This analysis will be informed by the methodology used to undertake the assessment of Aboriginal Interests set out in the EAC Application, by publicly-available information on Takla Lake First Nation Aboriginal Interests, and by any relevant information provided to TCMC by Takla First Nation arising from consultation activities on the proposed Project changes. The amendment Application will include the following: • a figure showing the boundaries of First Nation traditional territories relative to the proposed water sources and cleared vegetation corridors; • a description of potential adverse effects of the proposed amendment on Aboriginal Interests; • a description or summary of mitigation measures to avoid or reduce potential adverse effects of the proposed amendment on Aboriginal Interests; • a characterization of the residual adverse effects of the proposed amendment on Aboriginal Interests after mitigation; and • a summary of outstanding Aboriginal Interests issues identified by First Nations."		In progress	
Takla/MLIB-PA-039	28-Nov-17	Pre-application	R.Freed	Source Environmental	Water Mgmt	EA Amendment	Do you plan to maximize the use of the TSF wells and tower drains? How will you maximize their use? Will these be a primary or contingency source for TCMC? These should be a primary source and should be identified as such in the dAAIR/application.	Yes we plan to maximize the use of these sources by utilizing the appropriate pumping equipment and techniques. We are currently conducting monitoring on these sources to determine how best to maximize their use. These sources will act as a primary contingency for operational water makeup; however, they are unreliable sources of long-term water supply and therefore external sources are still required even though these look promising. These primary sources will be identified in the dAAIR and application.		In progress	

Mt. Milligan Project - Issues Tracking Table First Nations Comments Only											
Last Updated	5-Dec-17		**Updated By:**	S.Righi							
Project Description - EA Amendment Self Determination and Permitting Requirements											
ID	**Comment/ Issue Date**	**Comment Stage**	**Comment Author**	**Comment Organization**	**Subject**	**Document**	**Issue Description or Comment**	**Response**	**Timing**	**Reference**	**Status ""In Progress" indicates comment will be addressed through the appropriate Application"**
Takla/MLIB-PA-040	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Indigenous Title and Rights	Short Term Water Use Approval	*dIR Requirement: General location of the project in relation to nearby communities* Recommended Change: Location should also be described in relation to the First Nations' (including Takla and MLIB) traditional territories	Four maps will be included showing the boundaries of the traditional territories for Nak'azdli Whut'en, McLeod Lake Indian Band, West Moberly First Nations, Halfway River First Nation, Takla Lake First Nation and nearby communites relative to the project.		In Progress	
Takla/MLIB-PA-041	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Water Mgmt	Short Term Water Use Approval	*dIR Requirement: General project timeline: when will construction of works begin, when will it conclude, and when will water diversion and use begin?* Recommended Change: Uncertainties regarding this timeline, and corresponding contingency plans, should also be provided	Tables will be included showing the construction and operation schedules. As well, contingency measures will be presented.		In Progress	
Takla/MLIB-PA-042	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Water Mgmt	Short Term Water Use Approval	*dIR Requirement: Required information on general characteristics is specified* Recommended Change: Include information on monitoring locations to measure impacts of water withdrawal on surface and ground waters	Descriptions and maps showing surface water level and flow monitoring stations at Esker Lakes and Philip Lakes will be included.		In Progress	
Takla/MLIB-PA-043	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Assessment Methods	Short Term Water Use Approval	*dIR Requirements: Required information on stream water characteristics is specified* Recommended Change: Include information on sensitive ecosystems that may be impacted by the proposed water withdrawal activities	Available information regarding fish and fish habitat in Rainbow Creek (downslope from Esker Lakes) and Philip Lake 1 (including Philip Creek) will be included. The assessment will evaluate whether the proposed water withdrawal activities have potential to affect sensitive vegetation communities, including rare ecosystems, and alter the conclusions of the original environmental assessment.		In Progress	
Takla/MLIB-PA-044	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Baseline Data	Short Term Water Use Approval	*dIR Requirement: Under Mining (Processing Ore), there is a requirement for available reports/studies* Recommended Change: Available reports/studies should also include information on existing environmental baseline studies, and recognized gaps therein	The application will present known environmental baseline information for Project areas outside of the original EA. The assessment of potential effects to water resources related to water withdrawals from Esker Lakes and Philip Lake 1 is being conducted using the best available information at the time of writing. This process necessarily requires the use of modelled groundwater and hydrologic data, and results of recent channel surveys and discharge measurements. These data introduce a degree of uncertainty into the assessment. TCMC will manage this uncertainty by monitoring groundwater and surface water levels throughout 2018 and 2019.		In Progress	
Takla/MLIB-PA-045	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	water Mgmt	Short Term Water Use Approval	*dIR Requirement: Requires information on quantity of water required for the project, including logic or calculations used to determine quaintly* Recommended Change: Include an updated water balance model in the rationale/justification for the quantity of water required	The operational Water Management System Water Deficit Investigations Report will be provided which includes an updated water balance and rationale for the quantity of water required.		In Progress	
Takla/MLIB-PA-046	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Assessment Methods	Short Term Water Use Approval	*dIR Requirement: Requires information on whether water use will be continuous or intermittent, and if intermittent, the duration of the diversion* Recommended Change: Include information on sensitive seasonal windows for fish/wildlife/vegetation in discussion on the continuous/intermittent water use, and duration thereof	Where applicable, information on sensitive seasonal windows will be provided for fish, wildlife, and vegetation with respect to pertinent phases (e.g. construction, operation) of the Project.		In Progress	
Takla/MLIB-PA-047	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Assessment Methods	Short Term Water Use Approval	*dIR Requirement: Technical information requirements listed for stream water* Recommended Change: Clearly describe the flow threshold analysis method	A Hydrologic and Hydraulic Modelling Report will be included that describes the flow threshold analysis method.		In Progress	
Takla/MLIB-PA-048	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Assessment Methods	Short Term Water Use Approval	*dIR Requirement: No alternatives discussion* Recommended Change: Include an alternatives analysis to meet the indicated water demand	An operational Water Management System Water Deficit Investigations Report will be included that describes an alternatives analysis for the Project.		In Progress	
Takla/MLIB-PA-049	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	General	Short Term Water Use Approval	*dIR Requirement: Environmental Management Plans required* Recommended Change: These plans should include information on fuel and contaminant storage and containment	A Water Seepage and Erosion Control Management Plan will be provided in the application that includes mitigation measures for fuel and contaminant storage and containment.		In Progress	
Takla/MLIB-PA-050	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	General	Short Term Water Use Approval	We also note that the dIR makes reference to a water allocation staff contact (page 2). This information is required, as it is not currently provided.	Contact information will be provided for TCMC staff responsible for the Project.		In Progress	
Takla/MLIB-PA-051	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Indigenous Title and Rights	Short Term Water Use Approval	there should be a section included in the Application that provides a preliminary discussion on possible impacts to Indigenous title, rights (including treaty rights) and interests, along with clear commitments by Centerra to work collaboratively with the First Nations, including Takla and MLIB, in: i. identifying and monitoring such impacts going forward; ii. avoiding such impacts to the maximum extent possible; and iii. developing and implementing effective mitigation measures for unavoidable impacts.	Information will be provided on assessment of potential project effects on indigenous title, rights, and interests. TCMC is committed to working with First Nations on avoiding project effects, mitigation and monitoring planning.		In Progress	

APPENDIX J
PUBLIC CONSULTATION MEMO

Mount Milligan Proposed Permit Amendment Summary

October 10, 2017

Mount Milligan is seeking short term as well as longer term amendments to our existing mine permits and Environmental Assessment Certificate. The summary below provides a brief overview of what our plans are for the mine site in coming months and why the amendments are required.

If you would like additional information on Mount Milligan's permit amendment activities, please contact Joanna Miller at jmiller@tcrk.com or Tim Caldwell at tcaldwell@tcrk.com

Phase 1: Water Requirements

Background

In 2016, it was found that Mount Milligan's current water balance (model) was over-calculating the supply of water contained in the Tailings Storage Facility (TSF). This, compounded by the fact that the site has experienced a number of dry winters in recent years, has resulted in a lower volume of water in the TSF than planned for by mine engineers.

The Meadows Creek Supply Pond (a project that was proposed in the Environmental Assessment for Mount Milligan to supply the mine with additional water) was never constructed, in part due to cost and environmental disturbance, but also due to the fact that the mine's water balance did not indicate that there was a need for the Pond - Milligan had ample water supplies (see Figure 1, page 3).

In late 2016, a bathymetric survey of the TSF proved that water levels were critically low. In an effort to obtain water, a temporary water license was received for Meadows Creek that enabled Mount Milligan to capture water flows during the freshet period, ensuring a minimum of 30 L/sec of flow remains within the creek for fishery needs. This amount of flow allowed a capture of approximately 650,000m3. The total amount needed to support Mount Milligan's operations is approximately 1,800,000m3, leaving us approximately 1,200,000m3 short.

What does this mean?

Without additional water resources, Mount Milligan is expecting to run out of water between February and March, 2018. Spring freshet will bring new water supplies, however there will be a period of approximately 6 weeks from the time the mine runs out of water and the start of freshet. In this period, unless the new permits the mine is seeking are received, Mount Milligan will have no water supply.

How do we plan to fix this?

To avoid a stoppage in operations, Mount Milligan is seeking the necessary permits to supply additional water to the mine in the short term. As part of this process, we are currently looking at all available, nearby sources of water. This includes Esker Lakes and Rainbow Creek, currently outlined in the approved Environmental Assessment Certificate for the mine, in addition to Heidi Lake and Philips Lake #1 (see Figure 1, page 3). With the exception of Philips Lake, all of the aforementioned water sources are for a short term usage only and not result in any permanent structures put in place.

We will be actively consulting with impacted First Nations as part of the review of nearby water sources to ensure there are no significant cultural issues or impacts.

We believe that the construction of the Meadows Creek Supply Pond is not an environmentally or economically responsible option. Over the long term, Philips Lake #1 is a more stable source of water with significantly fewer environmental risks and impacts.

Phase 2: Mine Expansion Activities

Background

Mount Milligan is designed as a 22-year mine, but was permitted for only 15 years. In addition to requiring permits that will see the mine achieve is full projected mine life, there are a number of improvement to be made at the mine to add efficiencies and increase production levels. To that end, Mount Milligan is proposing a number of amendments to facilitate the mine design and to increase efficiencies.

Increased Dam Height

The current TSF is permitted to a height of 1095 meters above sea level. This height is based on a mine life design of 15 years. To achieve Mount Milligan's necessary 22 year mine life, we need to increase the dam height to 1114 metres.

License to Cut Timber

In order to increase the dam height, additional material is needed for the construction of the dam to build the outside core with Filter & Transition material. This work is currently outside of the initially approved footprint of the mine, but is adjacent to the property nearby Esker Lakes. The area for this work is approximately 100 hectares (see boundary area in Figure 2, page 4).

Levell Stockpile

Levell Stockpile is an approved pile location that allows for blending of ore for mill feed, maximizing marketing ability for the sale of concentrate as well as increasing efficiencies for ore processing. To better enable this blending, Mount Milligan would like to increase the approved 6 million tonne capacity of the stockpile to 15 million tonnes (see Figure 3, page 4).

Philip Lake (#1)

As mentioned in Phase 1, we believe that Philips Lake #1 is a more economical and environmental responsible, long-term source of water for Mount Milligan (see location in Figure 1, page 3). In order to be able to use water from Philips Lake for the mine, we are seeking to pull approximately 65 L/sec of water for placement into the TSF. This would reduce any further pressure on Meadows Creek and Rainbow Creek as Philips Lake is large enough to supply all of the milling needs.

Figure 1: Overview of water sources in proximity to Mount Milligan mine

Figure 2: Footprint Expansion Boundary

Figure 3: Levell Stockpile Proposed Expansion

APPENDIX K
INFORMATION TRACKING TABLE (ITT)

Mt. Milligan Project - Issues Tracking Table

Last Updated 5-Dec-17 **Updated By:** S.Righi

Project Description - EA Amendment Self Determination and Permitting Requirements

ID	Comment/ Issue Date	Comment Stage	Comment Author	Comment Organization	Subject	Document	Issue Description or Comment	Response	Timing	Reference	Status ""In Progress" indicates comment will be addressed through the appropriate Application"
EAO-PA-001	23-Aug-17	Pre-application	K. St. James	EAO	Project Description	EA Amendment	Please provide list of each of the proposed changes (additional project mine life, water sources, gravel source, Level I stockpile, dam height, upper camp, production levels, and gold leaching) and confirm if each was included in the EAC in order to assist with your assessment whether an EAC amendment may be required.	TCMC has provided a revised project description. This description highlights water resources as the Phase 1 portion and the additional expansion requests as Phase 2.	Phase 1		Closed
EAO-PA-001	16-Nov-17	Pre-application	K. St. James	EAO	Project Description	EA Amendment	Thank you - moving the expansion elements to a future amendment, so we can focus on the short-term water needs, is appropriate here.		Phase 1		Closed
EAO-PA-002	23-Aug-17	Pre-application	K. St. James	EAO	Water Mgmt	EA Amendment	Please be more specific on what is proposed in relation to accessing additional make-up water (amount and duration of additional water required, from each water source).	Esker Lakes is anticipated to provide approximately 200,000m3 during the first 3 months of 2018. Philips Lake #1 is proposed to provide water at 75 L/sec from January 10, 2018 to September 2018.	Phase 1		Closed
EAO-PA-002	16-Nov-17	Pre-application	K. St. James	EAO	Water Mgmt	EA Amendment	Thank you, comment closed.		Phase 1		Closed
EAO-PA-003	23-Aug-17	Pre-application	K. St. James	EAO	Water Mgmt	EA Amendment	The Project Description states, "The most important component of this expansion application is a need for additional water to support mill processing." Is the additional water needed only for the proposed expansion? Or is the additional water needed for current operations based on a 15 year mine life?	The additional water is needed for current operations.	Phase 1		Closed
EAO-PA-003	16-Nov-17	Pre-application	K. St. James	EAO	Water Mgmt	EA Amendment	Thank you, comment closed.				Closed
EAO-PA-004	23-Aug-17	Pre-application	K. St. James	EAO	Water Mgmt	EA Amendment	The Project Description states, "The Volume 3 Appendix E Feasibility Study – Site Water Balance identifies Eskers and Rainbow pump stations as needed at some point." We can find no mention of the Eskers pump station in this document. Could you please provide document references (including page numbers) to the Eskers pump station (description, location, and scenarios under which it would be built and used) in the Schedule A documents? Is the Eskers Lake Conceptual Pump Location shown in Figure 3 of the Project Description also shown in the original Application, or is this a new proposal?	Agreed. There is no discussion of an Eskers Pump Station. This is a term that TCMC has coined to refer to this area. The references outlined in the revised project description describe the associated wording that Eskers Lakes are a source for make-up water.	Phase 1		Closed
EAO-PA-005	23-Aug-17	Pre-application	K. St. James	EAO	Water Mgmt	EA Amendment	Volume 6 of the original Application includes a Water Management Plan including "forecasting future water levels and requirements using the water balance model" and "conducting monitoring programs and preparing reports." The Application also provides additional information on the context/conditions under which other water sources may be considered, and there are references in some cases as to how it would be implemented (such as in Vol 3 App E – Water Balance). Are the proposed water use and site activities at Eskers Lake and Rainbow Creek consistent with the Water Management Plan and other sections of the Application that describes scenarios under which contingency water measures would be required, and how these would be carried out?	TCMC believes there is consistency between the original application and current operational needs. Both Eskers and Rainbow would be short term resources as discussed in the EA application. Please refer to the revised project description for further clarification. UPDATE Nov 15: Rainbow Creek is no longer a water source option Mount Milligan is pursuing due to concerns raised by by Nak'azdli Whut'en.	Phase 1		Open
EAO-PA-006	11-Oct-17	Pre-application	D.Grace	EAO	General	EA Amendment	In follow up to the Province's meeting with Takla Lake First Nation, Nak'azdli Whut'en and McLeod Lake Indian Band on September 28th regarding TCMC's proposed amendment to the Mount Milligan project, EAO and MMPO developed a list of draft questions that were raised at the meeting (see ID# EAO-PA-007 to EAO-PA-015).	Tim Caldwell provided written responses to each of the questions provided by David Grace (see rows 42 to 50 below). Tim also provided these answers during an EAO-organized meeting with regulators and First Nations (Nak'azdli Whut'en, McLeod Lake Indian Band, Takla Lake First Nation) in Vancouver, BC on Oct 18, 2017.	Phase 1		In Progress
EAO-PA-007	11-Oct-17	Pre-application	D.Grace	EAO	Water Mgmt	EA Amendment	Rationale for Requiring Additional Water: 1) Has TCMC provided data to support the need for additional make-up water (i.e. what is the current water balance? How are low flow or drought conditions being defined and can it be verified that the previous several years meet this definition?	1) Low flow/drought conditions are currently being defined by measured annual precipitation and are being compared to previous years. Observed flows from hydrology Station 23 on Meadows Creek were provided in table format as a percentage of the flows presented in the Hydrometerology Report. The table depicts flows on site that are approximately half of the expected values, with two notable exceptions during April and July 2016. The April flows in 2016 represent an early freshet (497% of expected flows) followed by a much dryer than expected May (47% of expected flows). Had the freshet flows of April come in May then they would have been 140% of the average May flows. This indicates that 2016 was about average, but with an early wetter freshet and very dry autumn. It is highly unlikely that Mt Milligan is experiencing a sustained drought of this magnitude, a more plausible explanation is that the expected flows presented in the Hydromet Report are higher than the true mean. A related error to the runoff flows is the runoff scaling factor. KP has reduced the number of scaling factors to two, disturbed and undisturbed, these factors are used to scale the observed flows at Meadows Creek to flows on site.	Phase 1		In Progress
EAO-PA-008	11-Oct-17	Pre-application	D.Grace	EAO	Water Mgmt	EA Amendment	Rationale for Requiring Additional Water: 2) Are there alternatives that TCMC can adopt to a) reduce or eliminate their need for additional water or b) find an alternate source other than Rainbow Creek?	2) TCMC has reviewed all waterbodies in the area and is also considering water sources where the permitting would not be a necessity. These areas include tower drains along the perimeter of the tailings facility and an additional number of wells drilled near the center of TSF. Pump tests for these wells are being performed with results expected in November, 2017.	Phase 1		In Progress
EAO-PA-009	11-Oct-17	Pre-application	D.Grace	EAO	Water Mgmt	EA Amendment	**Rationale for Requiring Additional Water:** 3) Why was the Meadows Creek Supply Pond not built and if it had been built, would additional water still be required and is there data to support this?	3) We continued to review the water balance model which reflected that there was no need for the construction of the pond. In early 2017, there was a shortfall of water. Available waters in the pond would have been utilized to make up for this shortfall. The company would still be in this same condition next year as well as in 2019.**UPDATE Nov 15**: Nak'azdli Whut'en does not support the construction of the Meadows Creek Water Supply Pond.	Phase 1		In Progress
EAO-PA-010	11-Oct-17	Pre-application	D.Grace	EAO	Water Mgmt	EA Amendment	**Assessment of Water Quality and Quantity Impacts and Baseline Information:** 4) The Nation River has experienced low flows in recent years and there is concern that reducing flows to Rainbow Creek will exacerbate this. Rainbow Creek is situated in important caribou, moose and fish habitat and there are concerns over potential impacts to ability to continue accessing this area given potential impacts to water quality and quantity.	4) TCMC is aware of the importance of Rainbow Creek. As mentioned above, this creek has been identified as an alternate water source in the approved EA application. Any flows captured from this stream would be monitored to ensure no negative impacts would occur. **UPDATE Nov 15**: Rainbow Creek is no longer a water source option Mount Milligan is pursuing due to concerns raised by by Nak'azdli Whut'en.	Phase 1		Closed
EAO-PA-011	11-Oct-17	Pre-application	D.Grace	EAO	Water Mgmt	EA Amendment	**Assessment of Water Quality and Quantity Impacts and Baseline Information:** 5) How much water is being taken from Rainbow Creek, when, for how long and what impacts will this have to the Nation River flows? How are potential impacts of reduced flow being assessed?	5) Esker Lakes have approximately 377,000m3 (2017 bathymetric survey) of water of which TCMC proposes to remove 200,000m3. The remaining deficit that was initially anticipated from Rainbow Creek would be from 500,000 to 900,000m3. An additional monitoring station had been implemented and will be monitored throughout the winter to assess flows in the stream. Impacts to flows on the Nation River are anticipated to be negligible, although numbers have not yet been calculated. **UPDATE Nov 15**: Rainbow Creek is no longer a water source option Mount Milligan is pursuing due to concerns raised by by Nak'azdli Whut'en. In its stead, Philips Lake #1 has been proposed as a water source.	Phase 1		Closed
EAO-PA-012	11-Oct-17	Pre-application	D.Grace	EAO	Water Mgmt	EA Amendment	**Assessment of Water Quality and Quantity Impacts and Baseline Information:** 6) Why is there less water in the TSF than was expected? Has water moved from the TSF into groundwater and has groundwater quality been impacted?	6) Groundwater quality is not impacted at Mount Milligan. We suspect that water had moved into gravel lenses that are suspended immediately below the TSF and Mount Milligan is actively investigating. This would have occurred prior to the sealing of the bottom of the facility with tailings.	Phase 1		Closed

Mt. Milligan Project - Issues Tracking Table										
Last Updated	5-Dec-17		**Updated By:**	S.Righi						
Project Description - EA Amendment Self Determination and Permitting Requirements										
ID	**Comment/ Issue Date**	**Comment Stage**	**Comment Author**	**Comment Organization**	**Subject**	**Document**	**Issue Description or Comment**	**Response**	**Timing**	**Reference**	**Status** ""In Progress" indicates comment will be addressed through the appropriate Application"
EAO-PA-013	11-Oct-17	Pre-application	D.Grace	EAO	Water Mgmt & Consultation with Impacted Indigenous Groups	EA Amendment	**Assessment of Water Quality and Quantity Impacts and Baseline Information:** 7) What baseline data is currently available to support the applications and what methodologies were used for collecting baseline data? What engagement has occurred with First Nations in determining how the baseline was collected?	7) The most important piece of information that is missing for baseline on Esker or Philips Lakes is flow information, especially on winter flows. Baseline information conducted started as part of the original EA application process and included engagement activities at the time. Mount Milligan has engaged both McLeod Lake and Nak'azdli Whut'en in the collection of data during the entire operational phase of the site to date.	Phase 1		In Progress
EAO-PA-014	11-Oct-17	Pre-application	D.Grace	EAO	Cumulative Effects	EA Amendment	**Cumulative Effects:** 8) How will the potential cumulative effects of the various water uses in the area (i.e. forestry, exploration, dust control on service road, existing and proposed camp facilities both mining and non-mining) be quantified and assessed?	8) Cumulative effects from other water uses can be difficult to measure. With regard to Rainbow Creek, this is more simple as there is limited access to this stream other than from Mount Milligan. Milligan applies a dust control product on roads where it is a primary user. This means that the Rainbow Road (entire length) and the Mackenzie Connector (entire length) have a dust control product applied, significantly conserving the water from both Rainbow and Philips Creeks. Exploration does use water but our program to date is fairly small, meaning that water usage will be negligible.	Phase 1		In Progress
EAO-PA-015	11-Oct-17	Pre-application	D.Grace	EAO	Cumulative Effects	EA Amendment	**Cumulative Effects:** 9) Nak'azdli has a strong interest in exploring issues related to access to Heidi Lake. Further discussions are required between TCMC, Nak'azdli and EAO to explore solutions for ensuring EA compliance and meeting the interests of Nak'azdli.	9) Agreed – we are looking to find a mutually agreeable solution that allows us to comply with our legislated requirements and maintain our positive relationship with Nak'azdli.	Phase 1		In Progress
EAO-PA-017	21-Nov-17	Pre-application	D.Grace	EAO	Water Mgmt	EA Amendment	Are you only planning to pump from Meadows Creek during freshet of 2018?	No, with the constraints of the newly proposed low pumping levels from Philip Lake and current pipeline/pumping limitations we will not be able to obtain the operationally required amount of water in 2018 or 2019 without also utilizing MCWSS in 2019 as well.	Phase 1		Closed
EAO-PA-018	21-Nov-17	Pre-application	D.Grace	EAO	Water Mgmt	EA Amendment	Do you plan to keep or remove Meadows Creek Water Supply Pond/Station in the Phase 1 EAC amendment? Currently authorized to construct the pond in original EAC. T.Goodsell also suggested that if MCWSS is proposed for continued use for the time being then TCMC should submit their Water License amendment at the same time as the rest of the permit applications (to keep everything as one consistent message).	We will include Meadows Creek Water Supply Station, not Pond, in Phase 1 amendment as it will be required for water sourcing for 2018 and possibly 2019. We will attempt to have Water License amendment application put together in time for submission with the permit applcaition package.	Phase 1		In progress
EAO-PA-019	21-Nov-17	Pre-application	D.Grace	EAO	Permitting	EA Amendment	EA Amendment approval must occur before any of the operation permits are valid. EAA Sec.31 (variance from current EAC requirements) theoretically may allow for use of operational permits (new MAPA mine boundary, OLTC, etc.) before. See Section 8 of the Act. Will need some additional research/work on this. Would be helpful to get a clear idea of the construction schedule and what the dependancies (permit requirements) are.	We can complete our preparation and construction within our mine boundary/under our current road use permit but cannot move forward with construction beyond that without EA Amendment and operation permit approvals or Sec.31 in place. To be consistent with the proposed schedule we would need to begin construction on December 10, 2017 with completion of all necessary infrastructure by January 10.	Phase 1		In progress
EAO-PA-020	28-Nov-17	Pre-application	D.Grace	EAO	Water Mgmt	EA Amendment	Do you plan to keep Meadows Creek Water Supply Station as a long-term water source?	No, MCWSS will not be a long-term water source. It is meant as a contingency to ensure adequate water levels to completion of Phase 2 permitting.	Phase 1		Closed
EAO-PA-021	28-Nov-17	Pre-application	D.Grace	EAO	Water Mgmt	EA Amendment	If planning on using MCWSS as a contingency going forward need to clean up EAC by removing requirements to build pond and need to change to supply station.	Plan to do this in Phase 2, agree pond must be removed from EAC.	Phase 2		In progress
EAO-PA-022	10-Nov-17	Pre-application	D.Grace	EAO	Environmental Assessment Process	dAAIR	Section 2: this section of the application will also include a figure showing the proposed locations of any new infrastructure (pipelines, pump stations, etc)	Section 2 of the dAAIR has been updated to clarify that a figure showing the location of project infrastructure will be included in the Application, including pipeline and pump station locations.	Phase 1		In progress
EAO-PA-023	10-Nov-17	Pre-application	D.Grace	EAO	Assessment Methods	dAAIR	Section 3: in the last paragraph, reviewers should also include the First Nations, for clarity	Section 3 of the dAAIR has been updated to clarify that the EAO's Assessment of the Application for a Certificate Amendment report will be reviewed by Working Group members, including Nak'azdli Whut'en, McLeod Lake Indian Band and Takla Lake First Nation.	Phase 1		In progress
EAO-PA-024	10-Nov-17	Pre-application	D.Grace	EAO	Valued Components	dAAIR	Table 1: For terrain, soils and geology and archaeology/heritage resources – does the proposal include any soil disturbance associated with the pipeline crossing Rainbow Forest Service Road or the installation of pump houses/stations? If so, these should be considered here.	The water pipeline will be buried; ground disturbance will be associated with trenching and cover within road rights-of-way, cut-blocks, and a cleared area near Philip Lake 1 where pump infrastructure will be placed. As a result, there is a potential for interaction with terrain/soil/geology and archaeology and heritage resources, which will be assessed as part of the Amendment.	Phase 1		In progress
EAO-PA-025	10-Nov-17	Pre-application	D.Grace	EAO	Valued Components	dAAIR	Table 1: For fisheries – any federal authorizations needed will be considered as well.	The fisheries and aquatic resources section of Table 1 of the dAAIR has been updated based on the rationale that a federal authorization under Section 35(2) of the Fisheries Act may be required.	Phase 1		In progress
EAO-PA-026	10-Nov-17	Pre-application	D.Grace	EAO	Valued Components	dAAIR	Table 1: For climate/air quality and noise – the new pump stations and associated power sources, the total number, their locations, sources of fuel, and associated noise levels/emissions will need to be considered in this application. The original EAC only considered one pump station on Rainbow Creek, and we have been told that this design would likely not be used.	For climate/air quality and noise, the additional diesel generators, pump stations, and emissions from the construction of the 5.4 km pipeline have been assessed qualitatively. Construction activities are similar to those assessed as part of the original EA (albeit very much smaller in magnitude and duration). Operational activities for pumping involve short-term (<2 years) use of two diesel generators rather than one, as was assessed in the original EA.	Phase 1		In progress
EAO-PA-027	10-Nov-17	Pre-application	D.Grace	EAO	Valued Components	dAAIR	Table 1: For non-traditional land use, public use of Philips Lakes (including the recreation site on Lake #3), as well as any land tenure holders in the area will also need to be considered.	It is anticipated that the changes to the Project will have negligible interactions with non-traditional land use. Effects on non-traditional land use are therefore expected to be similar to the conclusions of the original EA completed in 2008, and will not be assessed as part of the Amendment. The Esker Lakes infrastructure falls within the Project's existing license to cut and mining lease; no other active Crown tenures fall within this area. The Philip Lake water pipeline is sited primarily within areas of existing disturbance and the amount of clearing will be negligible. Prior engagement with the two overlapping interest holders outside of the Project's existing license to cut is anticipated to reduce incompatibility with other tenured land uses. Changes in access to lands used for guiding, trapping and non-tenured recreation (e.g., consumptive and non-consumptive recreation) are anticipated to have a negligible interaction as the Esker Lakes infrastructure falls within the Projects existing mining lease. The Philip Lake infrastructure will be primarily located near, or parallel to, existing disturbances.	Phase 1		In progress
EAO-PA-028	10-Nov-17	Pre-application	D.Grace	EAO	Cumulative Effects	dAAIR	Pg 9 – Takla Lake has expressed concern over cumulative effects methods used in the original EA. For this reason, it would be worth considering the inclusion of a cumulative effects analysis, even if the characterization of residual effects does not change from the original EA.	All methods used for the cumulative effects assessment in the original EA followed the guidelines set out by the CEA Agency in "Addressing Cumulative Environmental Effects under the Canadian Environmental Assessment Act" (CEA Agency 1999), and were concluded to be not significant. The conclusions are not anticipated to change as a result of the Amendment. TCMC will engage First Nations on cumulative effects assessments on water withdrawal from Philip Lakes, including installing hydrology stations in the first three lakes in the system. Additional cumulative effects assessment will be conducted as outlined in page 9 of the dAAIR.	Phase 2		In progress

Mt. Milligan Project - Issues Tracking Table

Last Updated 5-Dec-17 **Updated By:** S.Righi

Project Description - EA Amendment Self Determination and Permitting Requirements

ID	Comment/ Issue Date	Comment Stage	Comment Author	Comment Organization	Subject	Document	Issue Description or Comment	Response	Timing	Reference	Status ""In Progress" indicates comment will be addressed through the appropriate Application"
EAO-PA-029	10-Nov-17	Pre-application	D.Grace	EAO	Editorial	dAAIR	General comment – all reference to Centerra should be replaced by Thompson Creek Metals Company Inc., as they are the certificate holder.	Comment addressed.	Phase 1		Closed
EAO-PA-030	10-Nov-17	Pre-application	D.Grace	EAO	First Nations Consultation	dAAIR	Section 6.2 – any feedback from Takla Lake initial meetings should be included in this table as well.	Takla Lake First Nation has been added to Table 2 (Section 6.3) of the dAAIR, which provides a summary of preliminary feedback received from Aboriginal Groups on the dAAIR.	Phase 1		In progress
EAO-PA-031	10-Nov-17	Pre-application	D.Grace	EAO	Effects Assessment	dAAIR	General comment regarding section 6 Consultation: As discussed previously, we asked that you consider the EAO AIR template but scale it to the amendment. The EAO AIR template provides guidance on how to consider Aboriginal interest within the effects assessmenthttp://www.eao.gov.bc.ca/guidance.html.	Section 6.2 (Aboriginal Considerations) of the dAAIR currently states: " The proposed Project changes have the potential to interact with Aboriginal interests. The amendment Application will set out whether the proposed Project changes require revisions to the original assessment conclusions found in Section 2.0 "First Nations Considerations" of the EAC Application. This analysis will be informed by any relevant information provided to TCMC by Aboriginal groups involved in the original EA arising from consultation activities on the proposed Project changes." In our view, this approach: • Is scaled in an appropriate manner given the minor nature of the proposed changes, particularly taking into account the limited and temporary effects of the proposed water withdrawal request • Is consistent with the approach used in the example projects identified in EAO's email of September 26, 2017 (i.e., Narrows Inlet and Prince Rupert Gas Transmission Project), • Efficiently builds upon the assessment of Project effects on traditional land use as set out in the original Application for an environmental assessment certificate, which itself was based on an approach approved by the EAO (as set out in the April 29, 2008 Terms of Reference). • Effectively demonstrates whether (and to what extent) the original assessment findings and conclusions regarding effects on traditional land use would require revising based upon the proposed changes to the Project. This allows for a valuable "like-to-like" comparison. We trust that the above demonstrates that, given the nature of the proposed Project changes and the approved content of the original assessment, TCMC's proposed approach is a practical and reasonable one.	Phase 1		In progress
EAO-PA-032	20-Nov-17	Pre-application	K. St James	EAO	Water Mgmt	dAAIR	1) What are the dates of pumping from Esker and Philip Lake 1 you are applying for in your application? 2) Do you plan on following this schedule for one or two years and how many winters will you plan to pump through? 3) Do you plan on using MCWSS in spring 2018? 4) Do you have a construction schedule for the Philip Lake pipeline? Knowing this would help EAO/MMPO understand what permitting needs to be focussed on first.	1) Dates of proposed pumping: Esker Lakes: Jan-Mar, 2018; Philip Lake 1: Jan-Oct, 2018 and Apr-Oct, 2019 2) We plan on following this plan for up to two years, depending on the amount/quality of baseline information collected and the timing for approval on the Phase 2 EA amendment. 2-3) We are propsing to pump through one winter (Jan-Mar, 2018) but we will require the use of MCWSS in 2018 to ensure we have collected enough water that we won't be in a similar situation at the beginning of 2019. 4) A preliminary construction schedule for the Philip Lake pipeline has been drafted, with the intent of pumping water by January 15, 2018. This will be provided to EAO/MMPO Nov 23, 2017 along with proposed pumping schedule and map of proposed pipeline route.	Phase 1	KSJ has asked that the proposed pumping shcedule is included in various documents (dAAIR, Project Description, etc.) so that everyone involved in the process is aware of the new schedule.	In progress
EAO-PA-033	28-Nov-17	Pre-application	K. St James	EAO	Water Mgmt	dAAIR	You are applying to pump water from Philip Lake until April of 2018 versus taking water for rest of 2018 into 2019?	The mine needs water to get through until freshet of 2018 but as the Phase 1 EA amendment application and short-term use approval are for two years we are applying to use this water for this time-frame. 2019 is a contingency in the event that Phase 2 amendment processes are not completed.	Phase 1		In progress
EAO-PA-034	28-Nov-17	Pre-application	K. St James	EAO	Water Mgmt	HCA Permit	Can you insulate pipe and leave it unburied for the last km (within area that has not been AIA) so you are not disturbing potential archaeoligical sites?	MTM is checking into this possibility. At this point our engineers indicate that flows of 30L/sec will freeze during winter periods even if insulated.	Phase 1		In progress
EAO-PA-035	24-Nov-17	Pre-application	D.Grace	EAO	Editorial	EA Amendment	EAO's comments on the dAAIR Section 6.2, which should be considered in addition to our preliminary comments submitted on Nov 10, 2017 as well as all comments submitted by First Nations. Please update Sections 6.1 and 6.2 as follows: • Change the term 'Aboriginal Consultation' to 'Indigenous Consultation' • Change the term 'Aboriginal Considerations' to 'Indigenous Considerations' • Change the term 'Aboriginal groups' to 'First Nations' • Change the first reference of 'Aboriginal interests' to 'Aboriginal rights, including title, or treaty rights (Aboriginal Interests)' and use 'Aboriginal Interests' after that. Note that use of capitalization of 'Aboriginal Interests' is important. • Replace reference to 'traditional use' with 'Aboriginal Interests' • Please re-order the list of First Nations in Section 6.1 to put Takla Lake above West Moberly and Halfway River • Include a summary of the key issues and concerns raised by First Nations relevant to the amendment, TCMC's responses to those issues and concerns, and the status of resolution • Include a description of potential adverse effects of the proposed amendment on Aboriginal Interests • Include a description or summary of mitigation measures to avoid or reduce potential adverse effects on Aboriginal Interests • Include a characterization of the residual adverse effects on Aboriginal Interests after mitigation • Include a summary of any outstanding Aboriginal Interests issues identified by First Nations	Addressed and updated in dAAIR.	Phase 1		Closed
EMPR-PA-001	18-Aug-17	Pre-application	S. Shaw	EMPR	Water Mgmt	Mines Act Permit Amendment	Please provide a detailed site water balance for the current operations, including information on monthly and/or seasonal flow rates.	Excel and Goldsim Versions of the Water Balance are available and can be provided electronically.	Phase 1		In Progress
EMPR-PA-002	18-Aug-17	Pre-application	S. Shaw	EMPR	Water Mgmt	Mines Act Permit Amendment	Please provide an explanation of how the current water deficit was identified, this should include a comparison of the originally predicted water balance to the current and updated predicted balances.	Please see the revised Project Description for additional detail. In summary the original water balance from 2008 showed a water deficit that could be offset with pumping from an off stream storage located in Meadows Creek. The operational water balance provided in 2013 forecast that the TSF pond volume would shrink as the till interstial voids filled. In October 2016 a bathymetric survey of the TSF found that the measured volume of water was approximately 6 M m^3 less than predicted by the operational water balance. This is likely an overestimation of inflow and underestimation of take up by the underlying till material.	Phase 1		Closed

Mt. Milligan Project - Issues Tracking Table

Last Updated	5-Dec-17		**Updated By:**	S.Righi							
Project Description - EA Amendment Self Determination and Permitting Requirements											
ID	**Comment/ Issue Date**	**Comment Stage**	**Comment Author**	**Comment Organization**	**Subject**	**Document**	**Issue Description or Comment**	**Response**	**Timing**	**Reference**	**Status** ""In Progress" indicates comment will be addressed through the appropriate Application"
EMPR-PA-003	18-Aug-17	Pre-application	S. Shaw	EMPR	Water Mgmt	Mines Act Permit Amendment	Please clearly outline the amount and duration of additional water required to be sourced to maintain current operational levels on a monthly and/or seasonal basis.	The water balance calculations show a negative amount of water at the end of March 2018, to maintain operations through the winter MtM requires a minimum of 0.7 M m3 from external sources to be pumped into the TSF by January 2018. Rainbow Creek flows at WQ26 and near WQ5 on most recent measurements show a flow of 0.441m3/sec and 0.367m3/sec respectively. Instream flow threshold calculations will be calculated to determine this capability. The intent by TCMC is to obtain water initially from Eskers Lakes in the short term. Rainbow Creek would ideally capture water in freshet 2018 to further minimize flow impacts. A memo entitled "Instream Flow Threshold Calculations for Rainbow Creek" (December 12, 2008) will be updated to reflect operational data to better answer this question. During freshet, Rainbow Creek can supply the full amount of water required peak rate on the order of 0.4 m3/s. From the data collected to date this represents between 5% and 30% of the available peak flow during freshet. Alternatively if we pump at a constant, all-year pumping rate this would be 0.06m3/sec, which would represent approximately 16% of low flows. The design normal operating conditions of the TSF pond is a minimum (end of winter) pond volume of 5 M m3 that will require an additional 2 M m3 per year until the minimum pond volume is achieved in approximately 3 years (2021). Ongoing water balance observations/calculatuions will then determine the ongoing requirements.	Phase 1		Closed
EMPR-PA-004	18-Aug-17	Pre-application	S. Shaw	EMPR	Water Mgmt	Mines Act Permit Amendment	Please clearly outline the maximum drawing capacity of currently permitted water sources in use and/or available for site operations on a monthly and/or seasonal basis. The analyses should include average and upper bound estimates in order to identify the potential range of required water quantities. Additionally, the analyses should include both average, wet and dry year estimates in order to understand potential implications to the project under these scenarios.	TCMC is currently licenced to remove 1.8 M m3 from the Meadows Creek Water Supply Pond (MCWSP), during freshet 2017 we succssfully pumped 0.6 M m3 from the temporary Meadows Creek Water Supply Station (MCWSS) to the TSF. Additionally TCMC diverts 100% of site runoff into the TSF, this normally accounts for approximately 5 M m3 annually of which 4 M m3 flows into the TSF during freshet (Apr-Jun). The annual average runoff flows predicted in the initial water balance studied accounted for approximately 6 M m3 of the later water balance the average calculated runoff over the last 5 years is 4.9 M m3. TCMC have not undertaken any analysis to determine if this is a result of drought conditions or if it is a result of an overestimation of average flows during the initial studies. The data from the Pine Pass snow pillow indicate that the region has had considerably smaller freshet flows in recent years. TCMC has also started pumping from the Basin Underdrain Towers and this has provided a steady state flow of 0.2 M m3 / month to the TSF.	Phase 1		In Progress
EMPR-PA-005	18-Aug-17	Pre-application	S. Shaw	EMPR	Water Mgmt	Mines Act Permit Amendment	Please provide a discussion of the ability of Eskers Lake to provide the outlined additional water requirements for site operations on a monthly and/or seasonal basis, including its maximum drawing capacity. The analyses should include average and upper bound estimates in order to identify the potential range of required water quantities. Additionally, the analyses should include both average, wet and dry year estimates in order to understand potential implications to the project under these scenarios.	The original EA documents indicate a range of volume of 0.5 to 1.0 M m3, with a recharge capacity of 52 L/s. A recent bathymetric survey indicates that Esker Lakes hold a total volume of approximately 377,000m3. TCMC is proposing to withdraw approximately 200,000m3 over the winter months which provides approximately 10 days of mill run time.	Phase 1		In Progress
EMPR-PA-006	18-Aug-17	Pre-application	S. Shaw	EMPR	Water Mgmt	Mines Act Permit Amendment	Please provide a discussion of the ability of Rainbow Creek to provide the outlined additional water requirements for site operations on a monthly and/or seasonal basis, including its maximum drawing capacity. The analyses should include average and upper bound estimates in order to identify the potential range of required water quantities. Additionally, the analyses should include both average, wet and dry year estimates in order to understand potential implications to the project under these scenarios.	Rainbow Creek flows at WQ26 and near WQ5 on most recent measurements show a flow of 0.441m3/sec and 0.367m3/sec respectively. Instream flow threshold calculations will be made to determine this capability. The intent by TCMC is to obtain water initially from Eskers Lakes in the short term. Rainbow Creek would ideally capture water in freshet 2018 to further minimize flow impacts. A memo entitled "Instream Flow Threshold Calculations for Rainbow Creek" (December 12, 2008) will be updated to reflect operational data to better answer this question. During freshet, Rainbow Creek can supply the full amount of water (required peak rate on the order of 0.4 m3/s). From the data collected to date this represents between 5% and 30% of the available peak flow during freshet. Alternatively if we pump at a constant, all-year pumping rate this would be 0.06m3/sec, which would represent approximately 16% of low flows. UPDATE Nov 15: Rainbow Creek is no longer a water source option Mount Milligan is pursuing due to concerns raised by by Nak'azdli Whut'en.	Phase 1		Closed
ENV-PA-001	1-Dec-17	Pre-application		ENV	Permitting	EMA Permit	The Ministry of Environment (ENV) has confirmed that an amendment to EMA Permit 104777 held by TCMC is not required for the proposed works described in the dAIR submitted by TCMC on November 1, 2017. However ENV notes that TCMC will need to update the Water Seepage and Erosion Control Management Plan to account for the new works.	Noted. WSECMP updated and incorporated as part of MAPA application letter.	Phase 1		Closed
ENV-PA-002	1-Dec-17	Pre-application		ENV	Permitting	EMA Permit	ENV also recommends that TCMC reviews existing operations and contingency plans, specifically all plans required under EMA and other authorizations, and update those that are impacted by the revised water sources to ensure the proposed works do not require changes to these plans and/or create any non-compliances with existing authorizations. If the proposed works results in changes to other operational or contingency plans, please submit to ENV once complete to ensure records are up to date for future permit inspections.	Noted. Existing operations and contingency plans are currently under review and will be updated; to be completed during Phase 2.	Phase 2		In progress
FLNR-PA-001	23-Aug-17	Pre-application	P. Krauskopf	FLNR	Water Mgmt	Water License	There was some discussion about Rainbow Creek as a source. Very little information was provided to support the request to include Rainbow Creek as a potential water source and therefore the proposal to use water from Rainbow Creek is unclear. Please provide additional information regarding the proposed use of water from Rainbow Creek including physical works, location of withdrawal, timing of withdrawal and how withdrawal aligns with proposed use of water from Eskers Lake	IFC drawings showing Rainbow Creek pump station are included in attached memo. Rainbow Creek flows at WQ26 and near WQ5 on most recent measurements show a flow of 0.441m3/sec and 0.367m3/sec respectively. Instream flow threshold calculations will be calculated to determine this capability. The intent by TCMC is to obtain water initially from Eskers Lakes in the short term. Rainbow Creek would ideally capture water in freshet 2018 to further minimize flow impacts. A memo entitled "Instream Flow Threshold Calculations for Rainbow Creek" (December 12, 2008) will be updated to reflect operational data to better answer this question. During freshet, Rainbow Creek can supply the full amount of water required peak rate on the order of 0.4 m3/s. From the data collected to date this represents between 5% and 30% of the available peak flow during freshet. Alternatively if we pump at a constant, all-year pumping rate this would be 0.06m3/sec, which would represent approximately 16% of low flows. UPDATE Nov 15: Rainbow Creek is no longer a water source option Mount Milligan is pursuing due to concerns raised by by Nak'azdli Whut'en.	Phase 1		Closed
FLNR-PA-002	23-Aug-17	Pre-application	P. Krauskopf	FLNR	Water Mgmt	Water License	What volume of water is required?	In the short term TCMC requires a minimum of 0.8 M m3 prior to freshet 2018. Eskers would provide 0.5 - 1Mm3 and Rainbow Creek would supply the shortfall. In the long term TCMC requires up to 2 M m3 of water annually from sources external to the TSF to make up the TSF free volume of 5 Mm3. UPDATE Nov 15: Rainbow Creek is no longer a water source option Mount Milligan is pursuing due to concerns raised by by Nak'azdli Whut'en. Philips Lake 1 is now the focus of both short- and long-term water sourcing needs for TCMC.	Phase 1		In Progress
FLNR-PA-003	23-Aug-17	Pre-application	P. Krauskopf	FLNR	Water Mgmt	Water License	What is the rate of water withdrawal for each proposed source?	Eskers lake withdrawal rate will be set to match as closely as possible the recharge rate for the Lakes. Rainbow Creek would be at steady state pumping rate of 0.4 m3/s during freshet and 16% of the minimum observed flow outside of freshet. **UPDATE Nov 15**: Rainbow Creek is no longer a water source option Mount Milligan is pursuing due to concerns raised by by Nak'azdli Whut'en. The proposed water sources have now changed to focus on 2 sources outside of the TSF. These include Esker Lakes and Philips Lake. The rate of water withdrawal from Eskers is approximately 14 L/sec and from Philips Lake is 75L/sec.	Phase 1		Closed

Mt. Milligan Project - Issues Tracking Table

Last Updated	5-Dec-17		**Updated By:**	S.Righi							
Project Description - EA Amendment Self Determination and Permitting Requirements											
ID	**Comment/ Issue Date**	**Comment Stage**	**Comment Author**	**Comment Organization**	**Subject**	**Document**	**Issue Description or Comment**	**Response**	**Timing**	**Reference**	**Status** ""In Progress" indicates comment will be addressed through the appropriate Application"
FLNR-PA-004	23-Aug-17	Pre-application	P. Krauskopf	FLNR	Water Mgmt	Water License	What is the timing of water withdrawal for each proposed source?	Eskers lake would start as soon as the licence is issued. Rainbow Creek will start once the volume of Eskers has been transferred to the TSF. **UPDATE Nov 15**: Rainbow Creek is no longer a water source option Mount Milligan is pursuing due to concerns raised by by Nak'azdli Whut'en. Pumping is proposed to start on January 10, 2018 from Philips Lake #1 and January 1 from Esker Lakes. Pumping would occur from Eskers until 200,000m3 is withdrawn. Philips Lake withdrawal is proposed until September 2018.	Phase 1		In Progress
FLNR-PA-005	23-Aug-17	Pre-application	P. Krauskopf	FLNR	Water Mgmt	Water License	How much water will be stored in ponds 1 and 2?	Ponds 1 and 2 provide live storage for the seepage collection and recycle system. No water will be permanently stored in either of these ponds.	Phase 1		Closed
FLNR-PA-006	23-Aug-17	Pre-application	P. Krauskopf	FLNR	Water Mgmt	Water License	An application for Water Licence will require a Water Development Plan.	Noted	Phase 1		Closed
FLNR-PA-007	23-Aug-17	Pre-application	P. Krauskopf	FLNR	Water Mgmt	Water License	Does a Water Management Plan currently exist for the mine site? If so, Does it include the proposed emergency sources?	Yes, the construction Water Management Plan detailed the construction of the current water collection system on site. This infrastructure currently directs all site runoff to the TSF. The emergency water sources are outlined in the EA, and the Detailed Design Reports. The operational Water Management Plan does not include make-up water resources.	Phase 1		Closed
FLNR-PA-008	23-Aug-17	Pre-application	P. Krauskopf	FLNR	Water Mgmt	Water License	What type of works would be constructed and how will works be constructed in or about a stream?	IFC drawings showing Rainbow Creek pump station have been issued. It includes an off stream sump and pump. Eskers Lake will likely be pumped from a floating pump and traditional pipe to the Northeast Seepage Collection Pond #1. Philips Lake #1 pump system will consist of 18-inch HDPE pipe and a floating pump system for Phase 1 aspects. For Phase 1, the majority of the pipe will lay above ground to facilitate the short timelines in which water can be supplied to the operation. . **UPDATE Nov 15:** Rainbow Creek is no longer a water source option Mount Milligan is pursuing due to concerns raised by by Nak'azdli Whut'en.	Phase 1		In Progress
FLNR-PA-009	23-Aug-17	Pre-application	P. Krauskopf	FLNR	Effects Assessment	EA Amendment	What are the potential impacts from withdrawal (volume, ecosystem, temperature, fish etc…)?	Numerous baseline studies were completed as part of the initical EA Application. This information has been included in the revised project description. Updated information for Eskers as well as preliminary baseline information for Philps Lakes will be provided in the application documents.	Phase 1		In Progress
FLNR-PA-010	23-Aug-17	Pre-application	P. Krauskopf	FLNR	Water Mgmt	Water License	The project description identified that approximately 693,000 m3 of water may be stored in Eskers lakes. It also states that 500,000 to 1,000,000 m3 of runoff may be available from this source during dry conditions. It is assumed that the 693,000 m3 is at maximum pondage and less volume is available during dry conditions; however there appears to be a discrepancy. I know that the 2008 groundwater model predicted inflow of 50 l/s but that was likely from pre-mine conditions. What were the parameters of the model? Some quick mapping shows that a wetland complex, previously connected to the lakes may have been absorbed by the mine footprint, which would likely have a large effect on the modeled rate of inflow.	The upstream wetlands have been absorbed into the TSF footprint. The lake level will be lowered and then the pumping rate will be reduced to match as closely as possible the recharge rate that now exists. TCMC have engaged the local consulting firm DWB to conduct an updated bathymetric survey of the Lakes. A pump test is proposed to determine the influence and the actual recharge rate of the lakes.	Phase 1		In Progress
FLNR-PA-011	23-Aug-17	Pre-application	P. Krauskopf	FLNR	Effects Assessment	EA Amendment	The Eskers lakes and Rainbow Creek may have been identified in an earlier EA assessment as short-term emergency water supply sources, but in what capacity? Were questions related to potential impacts and effects to valued components addressed?	The capacity in which the Esker Lakes and Rainbow Creek were identified in the EA were as contingency supplies during consecutive dry years. Dry years has been interpreted by TCMC as conditions that are drier than normal climate conditions have shown. Questions realted to withdrawal of water and impacts and effects to valued components were addressed in the original application. Please note that Rainbow Creek has been removed from the list of water source options based on subsequent meetings with Nak'azdli Whut'en who have expressed concerns on habitat impacts to the creek.	Phase 1		Closed
FLNR-PA-012	23-Aug-17	Pre-application	P. Krauskopf	FLNR	Water Mgmt	Water License	Is it reasonable to use 10 year old information to make a current and well informed decision? What new information/data is required?	It is not reasonable in all cases to use 10-yr old information. Where necessary, updated information is being or has been collected either as part of the operations such as flow data from Meadows and Rainbow Creeks. TCMC is currently moving towards installing flow instrumentation on all water sources into the TSF in an attempt to eliminate our reliance on scaled flow data from Meadows Creek, when calculating the current pond storage. Scaled data will likely be used for forecasting.	Phase 1		Closed
FLNR-PA-013	23-Aug-17	Pre-application	P. Krauskopf	FLNR	Fish and Fish Habitat	Water License	How will offsetting/mitigations be considered if there are potential impacts (e.g. additional cumulative impact to Rainbow Creek – potential for reduced flows and warmer temperatures)?	Baseline information is being captured with regard to Esker and Philips Lake #1. In the event there are offsetting or mitigations need to prevent impacts, these will be proposed and entertained as necessary. Rainbow Creek is no longer being considerd an option for water resource to address habitat concerns raised by Nak'azdli Whut'en.	Phase 1		In Progress
FLNR-PA-014	23-Aug-17	Pre-application	P. Krauskopf	FLNR	Water Mgmt	Water License	The client currently has water licences which allows for storage and use of water from King Richards Creek and Meadow Creek. Both streams are tributaries to Rainbow Creek. How will this increased withdrawal affect flows in Rainbow Creek? What are the instream flow needs of the streams? This is an especially important consideration as these "emergency" water sources will be relied upon during low flow periods, when streams are most sensitive to withdrawal.	TCMC understands that streams are most sensitive to withdrawal during winter low flow periods. TCMC is currently licenced to remove 1.8 M m3 from the Meadows (Rainbow) System. The MCWSP was anticipated to store 2.3Mm3 of water in Meadows Creek for withdrawal of the 1.8Mm3 throughout the year. On an annual basis, there are no increased withdrawals from the system anticipated. UPDATE Nov 15: Rainbow Creek is no longer a water source option Mount Milligan is pursuing due to concerns raised by by Nak'azdli Whut'en. Nak'azdli does not support the construction of Meadows Creek Pump Station as is planned for in the current EA.	Phase 1		In Progress
FLNR-PA-015	23-Aug-17	Pre-application	P. Krauskopf	FLNR	Water Mgmt	Water License	Water Stewardship (Keri Dresen) was contacted this past spring by Tim Caldwell regarding the construction of works and testing of the pump station in Meadow Creek. How is this earlier communication/proposal related to this most recent request?	This was in relation to the pumping test conducted in freshet 2017. The test was successful and TCMC are currently developing plans for the permanant Meadows Creek Pump Station rather than full construction of MCWSP. The results of the test also indicate that TCMC may only be able to achieve approximately 1/3 of the total licenced withdrawal. If the full amount had been achievable the water balance indicates that there would be no need for the emergency measures considered above. This earlier communication is related to this request as it reflects that water is still needed for winter operations.	Phase 1		Closed
FLNR-PA-016	27-Oct-17	Pre-application	Z.Sary	FLNR	Indigenous Interests	Water License	What is First Nations' stance on sourcing water from Philips Lake?	Consultation is required for Philips Lake Keyoh holder family. McLeod Lake supports the use of Philips. Nak'azdli does not support the use of Rainbow Creek or the construction of Meadows Creek Water Supply Pond; however, they do support the use of Philips Lake.	Phase 1		In Progress
FLNR-PA-017	27-Oct-17	Pre-application	Z.Sary	FLNR	Water Mgmt	Water License	Are there expected effects from water withdrawal from Esker Lakes to Lower Rainbow Pond dissolved oxygen?	A pump test will be completed for Esker Lakes and flow monitoring will be done in conjunction in Lower Rainbow Pond inflow channel to monitor for changes to inflows to the pond. Monthlyissolved oxygen monitoring will be completed as part of TCMC's annual winter DO monitoring program.	Phase 1		In Progress
FLNR-PA-018	27-Oct-17	Pre-application	P.Krauskopf	FLNR	Water Mgmt	Water License	What is the proposed pipeline route to Philips Lake and what are the specifications of the pipeline and pumping system?	The pipeline will follow pre-existing roads (Rainbow FSR to Community Connector to deactivated FSR/cutblock). A 50-75m long by 10m wide corridor may need to be cleared through the trees to access the lake. The piping/pumping system is currently being designed by engineers from TCMC and consultant groups. Initial proposal is 18" HPDE pipe (placed above-ground for Phase 1), diesel-powered generator (electric for Phase 2) and floating barge pump.	Phase 1		In Progress

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Last Updated	5-Dec-17		**Updated By:**	S.Righi							
Project Description - EA Amendment Self Determination and Permitting Requirements											
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FLNR-PA-019	14-Nov-17	Pre-application	P.Krauskopf	FLNR	Water Mgmt	Water License	Esker Lakes: What is the reasonable expectation of drawdown effect through pump test/water withrawal? Is there expectation that rate of recharge will depend on water level of lake? Is the lake bed material very permeable?	Expecting a max of 0.5m drawndown during pump test (to stress the system for monitoring of recharge rate) and minimal to no drawdown during water withdrawal (based on expected recharge rate and withdrawal rate that will be determined after pump testing). To further monitor recharge rate and effects of water withdrawal on nearby water sources we will be monitoring for response of water levels in nearby wells and surface water sources. Our pump test will help to determine permeability of lake sediment. We may need to include further monitoring wells in nearby eskers to determine this. This will be further clarified on November 17 during the technical meeting.	Phase 1		In Progress
FLNR-PA-020	14-Nov-17	Pre-application	P.Krauskopf	FLNR	Water Mgmt	Water License	Philip Lake #1: What amount of water is needed for natural processes to occur? What are the minimum and maximum pump rates Mount Milligan is requestiong? Old maps show that a beaver dam was in location of current rock weir (located in Philips Lake 1 outlet); was this weir created through beaver damming?	The amount of water this system requires for natural processes to occur will need to be determined through analysis of the baseline data that are currently being collected and synthesized. Stantec is assessing current hydrology data from this system to determine safe pump rate ranges. Estimates based on the current hydrologic assessments and Milligan's needs are 75L/s during winter low flows and 200L/s during freshet high flows. Stantec biologists determine it is not possible that the rock weir located in Philips Lake 1 outlet was created through beaver damming; definitely man-made (no authorizations on record with FLNRO for the construction of this weir).	Phase 1		In Progress
FLNR-PA-021	28-Nov-17	Pre-application	P.Krauskopf	FLNRO	Water Mgmt	Water License	Where does 30 L/s threshold for MCWSS come from? Can you provide that information? FLNRO doesn't have this information on file (no Water Management Plan). This information is a condition of the license change.	MTM does not have information at this time that backs up the 30L/sec flows for Meadows Creek. A water management plan will be completed as part of the application.	Phase 1		Open
FLNR-PA-022	14-Nov-17	Pre-application	Z.Sary	FLNR	Water Mgmt	Water License	Esker Lakes: Do you expect impacts from pump test to Alpine Lake?	Stantec has performed a brief inspection of potential impacts to Alpine Lake from pump test/water withdrawal from Esker Lakes. It has been determined that the cone of depression does not extend from Esker Lakes to as far as Alpine Lake. Alpine Lake and nearby wells will be monitored during the pump test to confirm that these two water bodies are not connected and there are no impacts.	Phase 1		In Progress
FLNR-PA-023	16-Nov-17	Pre-Application	K.Hoekstra	FLNRO	Effects Assessment	dAAIR	5.4 – the proponent should ensure that potential impacts to waterfowl and moose are considered in the assessment, based on potential changes to wetlands, as indicated above.	The Amendment will evaluate the potential for the proposed Project changes to alter the conclusions of the original EA and Assessment reports for wildlife and wildlife habitat. As described in Sections 4 and 5.4 of the dAAIR, the Amendment will take into consideration how the proposed timing, volume, extraction, and transport methods of make-up water may lead to an interaction. The assessment of proposed Project changes will focus on wildlife components where a mechanism for effect is identified that would change previously described residual effects characterizations and significance determinations. If proposed Project changes have the potential to alter conclusions from the original EA and Assessment reports for waterfowl and moose, the Amendment will provide information on the mechanisms of effect and associated changes to previous conclusions. Where mechanisms are identified, the Amendment will also account for existing or additional Project mitigations that may be applied to avoid or reduce residual effects from proposed Project changes.	Phase 1		In progress
FLNR-PA-024	14-Nov-17	Pre-application	Z.Sary	FLNR	Water Mgmt	Water License	Philip Lake #1: What potential effect from water withdrawal would there be on Philips outflows? Will there be adaptability in the pumping system to compensate for low base flow vs. high flow? Will a winter hydrology program be established to monitor winter base flows?	Negligible effects are expected on Philips Lake outflows due to pumping. This expectation is based on preliminary modelling done by Stantec. Further baseline data are to be collected, analyzed and input into the model to determine potential impacts. The constructed pump and pipeline system for Philips will allow for some variability of pumping rates between low flow and high flow (engineers working to determine lowest pump rate that will not allow freeze-up in winter, drainage valves at low points built in to pipeline to drain system, variable frequency drive used to run pump(s)). A winter hydrology program has been established for the Philips Lakes system to monitor winter base flows through 2017/2018.	Phase 1		In Progress
FLNR-PA-025	16-Nov-17	Pre-Application	K.Hoekstra	FLNR	Effects Assessment	dAAIR	5.3 – the proposed changes have a potential of impacting wetlands associated with Philip and Eskers lakes. Water withdrawal may alter wetland communities by changing water levels. These changes could resulting in changes to habitat functions associated with the wetlands. I recommend the proponent include a description of the wetland functions provided by wetlands associated with the two lakes and an assessment of the potential effects.	As described in Sections 4 and 5.3 of the dAAIR, the assessment will evaluate the potential for the proposed changes to the Project to alter the conclusions of the original EA and Assessment Reports for vegetation and plant communities. For vegetation and plant communities, this includes changes to plants used traditionally by Aboriginal groups, biodiversity and plant community structure and composition, rare plant species, and plant communities at risk. If the changes to the proposed Project have the potential to alter the conclusions of the original EA and Assessment reports for vegetation and plant communities, including wetlands around Philips and Eskers Lakes, the Amendment will provide information about the habitat functions that the wetlands around these lakes provide for plants traditionally used by Aboriginal groups and rare plant species. Information about the habitat functions provided for wildlife will be addressed in Section 5.4 Wildlife and Wildlife Habitat, as applicable.	Phase 1		In progress
FLNR-PA-026	16-Nov-17	Pre-Application	Z.Sary	FLNR	Valued Components	dAAIR	Valued components should include amphibians as well as waterfowl as these groups may be especially sensitive to changes in water level in Philips and Eskers lakes.	The Amendment will evaluate the potential for the proposed Project changes to alter the conclusions of the original EA and Assessment reports for wildlife and wildlife habitat. As described in Sections 4 and 5.4 of the dAAIR, the Amendment will take into consideration how the proposed timing, volume, extraction, and transport methods of make-up water may lead to an interaction. The assessment of proposed Project changes will focus on wildlife components where a mechanism for effect is identified that would change previously described residual effects characterizations and significance determinations. If proposed Project changes have the potential to alter conclusions from the original EA and Assessment reports for amphibians and waterfowl, the Amendment will provide information on the mechanisms of effect and associated changes to previous conclusions. Where mechanisms are identified, the Amendment will also account for existing or additional Project mitigations measures that may be applied to avoid or reduce residual effects from proposed Project changes.	Phase 1		In progress
FLNR-PA-027	16-Nov-17	Pre-Application	Z.Sary	FLNR	Effects Assessment	dAAIR	Other species of fish could also be affected by potential change in lake levels (in addition to lake whitefish and rainbow trout), such as burbot, bull trout; the presence and habitat use in the lake of these species should be assessed.	Bull trout were not captured in Philip Lake #1 during the survey conducted in 2007 and there is no record of bull trout in any of the other headwater lakes in the Philip Creek Watershed. A survey will be conducted by TCMC in the summer of 2018 to confirm that the 2007 fish community composition data are accurate and up-to-date. However, it is TCMC's intent to focus the assessment on lake whitefish and rainbow trout as these two species are valued sport fish and are likely valued by local First Nations. In addition, lake whitefish represent a fall-spawning species that use lakes for all life stages. Mitigation measures that protect lake whitefish will typically protect other lake-dwelling species as well. Rainbow trout are spring spawners and use lake and stream habitats for spawning, rearing, and overwintering. Mitigation measures that protect rainbow trout will typically protect other lake and stream-dwelling species as well. When necessary, potential effects to mountain whitefish will also be assessed as they represent a fall-spawning species that use streams to spawn.	Phase 2		In progress
FLNR-PA-028	16-Nov-17	Pre-Application	Z.Sary	FLNR	Effects Assessment	dAAIR	In addition to potential change in lake levels, effects could also include reduced flow from Philips Lakes into outlet streams; effects of withdrawal from the lake on the instream flows of outlet streams should be assessed.	An assessment of potential effects to fish and fish habitat in Philip Creek downstream of Philip Lake #1 will be conducted as part of the EA Amendment.	Phase 1		In progress

Mt. Milligan Project - Issues Tracking Table

Last Updated	5-Dec-17		**Updated By:**	S.Righi							
Project Description - EA Amendment Self Determination and Permitting Requirements											
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FLNR-PA-029	16-Nov-17	Pre-Application	Z.Sary	FLNR	Project Description	dAAIR	Please clarify exactly what time-frame this amendment is seeking water for from each water source.	The Application is seeking approval for the use of Esker Lakes and Philip Lake 1 as temporary water sources for the Project. Water is required from Philip Lake 1 from January 2018 to October 2019, and from Esker Lakes from January to March 2018.	Phase 1		In progress
FLNR-PA-030	16-Nov-17	Pre-Application	Z.Sary	FLNR	Baseline Data	dAAIR	p10/11 Sec 5.2. Bull trout are excluded from the assessment based on previous information indicating their distribution being limited to the lowest reaches of watershed in the project area; however, this information should be confirmed with a current inventory of fish species in Philip Lakes.	Fish community composition in Philip Lake #1 is based on a survey conducted by Ecofor in 2007 as part of the Mt Milligan baseline fisheries program. During this survey, lake whitefish, mountain whitefish, rainbow trout, white sucker, northern pikeminnow, burbot, and redside shiner were captured in the lake. No bull trout were captured. TCMC will conduct fisheries surveys in Philip Lake #1, #2, and #3 in the summer of 2018 to update and expand on the existing data. These data will be included in the assessment of potential effects to fish and fish habitat from the proposed long-term water withdrawals from Philip Lake #1.	Phase 2		In progress
Mackenzie-PA-001	16-Nov-17	Pre-Application	D. Smith	District of Mackenzie	Editorial	dAAIR	On page 15 the McLeod Lake Indian Band is spelled wrong twice	Thank you; error has been corrected.	Phase 1		Closed
MMPO-PA-001	28-Aug-17	Pre-application	T. Goodsell	MMPO	Water Mgmt	EA Amendment	Why has the MCWSP not been constructed and are there plans for construction prior to 2018 to capture spring runoff?	Based on the water balance model of the day (up until late 2016), modeling showed there was no justification to construct MCWSP, especially given construction delays that allowed an extra year's worth of water to be collected by the TSF. There are currently no plans to construct MCWSP prior to 2018 freshet. TCMC feels that MCWSP is not a long term solution for water supply and is considering other avenues. UPDATE Nov 15: Nak'azdli Whut'en has stated on November 10, 2017 that they do not support the construction of the Meadows Creek Water Supply Pond.	Phase 1		Closed
MMPO-PA-002	28-Aug-17	Pre-application	T. Goodsell	MMPO	Water Mgmt	EA Amendment	**Water Storage:** For this year and previous years, why has TCMC not taken advantage of spring flows via storage as proposed and licensed?	Water balance modeling information did not indicate a need to capture these flows. This was not identified until late 2016. The license would also need modification due to the Meadows Creek Water Supply Pond not being constructed.	Phase 1		Closed
MMPO-PA-003	28-Aug-17	Pre-application	T. Goodsell	MMPO	Water Mgmt	EA Amendment	**Pumping test:** What were the results of the pumping test described in the Knight Piesold memo?	Pumping from Meadows Creek and capture of flows gained approximately 650,000m3 of water. At the same time, fisheries values were maintained during the Rainbow Trout spawning period by moving fish up and downstream of the barrier during the pump test.	Phase 1		Closed
MMPO-PA-004	28-Aug-17	Pre-application	T. Goodsell	MMPO	Water Mgmt	EA Amendment	**Water Balance:** The earlier water balance model identified that pumping water from Rainbow Creek only needs to occur under "extreme conditions". The model considered that the MCWSP would be constructed and water would be stored and utilized according to conditions of the water license. If the MCWSP is not constructed, will there be a regular reliance on water from the Eskers Lakes and Rainbow Creek?	TCMC is looking for alternatives for long term water supply and does not expect to have regular reliance on water from Eskers Lakes. A trade-off study will be conducted for Philips Lake or Rainbow for long term water supply for both costs and environmental impact. UPDATE Nov 15: Rainbow Creek is no longer a water source option Mount Milligan is pursuing due to concerns raised by by Nak'azdli Whut'en.	Phase 1		Closed
MMPO-PA-005	18-Aug-17	Pre-application	T. Goodsell	MMPO	Water Mgmt	EA Amendment	**Water Balance:** If the MCWSP is not to be constructed, are there other changes to the water balance and water requirements for mining operations? We believe that original modeling included the construction of the MCWSP. Will the model have to be re-run if plans have changed regarding construction of the MCWSP?	The original model did include MCWSP. The model is currently being re-run with updated data. The model will be re-run without the input of the MCWSP.	Phase 1		Closed
MMPO-PA-006	18-Aug-17	Pre-application	T. Goodsell	MMPO	Water Mgmt	EA Amendment	**Additional Water Requirements:** Is the requirement for additional water only a function of mine expansion activities?	The immediate requirement for additional water is to achieve current operational plans and requirements. Longer term, there may be additional needs, but this will require an EA amendment.	Phase 1		Closed
MMPO-PA-007	18-Aug-17	Pre-application	T. Goodsell	MMPO	Water Mgmt	EA Amendment	**Baseline Flow data: Has TCMC been monitoring flows in Meadows and Rainbow Creeks? It will be helpful if TCMC shares this data.**	TCMC has been monitoring flows in Meadows and Rainbow Creeks and can provide this data. Flows have not been monitored however during winter periods.	Phase 1		Closed
MMPO-PA-008	18-Aug-17	Pre-application	T. Goodsell	MMPO	Water Mgmt	EA Amendment	**Effects Assessments:** Have you completed an effects analysis of direct withdrawal on Rainbow, Meadows and King Richard Creeks and on Eskers lakes for the changes you propose? The effects of direct withdrawals from either Meadows Creek or Rainbow Creek, especially during lower flow periods (Summer - Fall - Winter) months is unknown to our knowledge. We understand that the Eskers Lakes are reflective of groundwater levels in the area and they are hydrologically connected (through groundwater inputs) to Rainbow Creek. It will be important to understand the effects of withdrawal from Eskers lakes on the waterbodies themselves and Rainbow Creek. Specifically, the Mount Milligan Project Description states that "Preliminary modelling indicates that from 0.5 to 1.0 Mm3/yr of runoff may be available from this source during dry conditions". During dry conditions streams may be sensitive to reductions to inputs, what are the effects of reducing groundwater inputs to Rainbow Creek during "dry conditions"?	An effects analysis was completed on withdrawal of water from Rainbow, Meadows and King Richard Creeks as well as Eskers Lakes as part of the original application. This has been included in the revised project description appendices. The original effects analysis did not include low flow periods in the fall and winter. These are currently being carried out. A pump test is proposed for Esker Lakes to determine the hydrological influence of pumping on Rainbow Creek which is approximately 1.1km from the lakes. Alpine Lake is approximately 1.5km away and will also be monitored during this pump test. Current analysis indicates pumping of Rainbow Creek would have negligible effects on flows in Rainbow Creek, however more analysis is being performed to confirm or deny. As stated above, Rainbow Creek is no longer within the scope of Phase 1.	Phase 1		Closed
MMPO-PA-009	18-Aug-17	Pre-application	T. Goodsell	MMPO	Water Mgmt	EA Amendment	**Licensing: Has TCMC given thought to licensing additional water requirements? Do you foresee applying for an additional water license and/or amendments to existing water licenses?**	As part of this Phase 1, 2 process, TCMC does foresee a need for additional licenses and/or amendments.	Phase 1		Closed
MMPO-PA-010	23-Oct-17 (initial data request) 27-Oct-17 (info request in table form)	Pre-application	T.Goodsell	MMPO	Water Mgmt	EA Amendment	The Province has prepared the attached Draft Water Source Options Summary for your review and comment. The table has been prepared per request by Nak'azdli, Takla Lake, McLeod Lake at our October 18th meeting for a summary of the short and long term water source options being contemplated by Thompson Creek Metals Company (TCMC). • The table is intended to summarize our current understanding of the options brought forward by TCMC to help narrow down the best options based on regulatory requirements, baseline information available and known concerns including those raised to date by Takla, McLeod Lake and Nak'azdli. • The Province has not identified a preferred option and in recognition of our collaboration, we hope the attached table can serve as a tool to collaboratively discuss and determine the preferred short and long term water source options. • The attached has been drafted based on information received to date. MMPO and EAO understand that we may not have up to date descriptions and therefore the table is missing some key information (e.g. available and proposed withdrawal water quantities, baseline information collected to date, and confirmation of option descriptions). Please complete the following: 1) Review / revise the front matter that precedes the table as required 2) Review / revise the option descriptions so that each accurately describes the conceptual proposal contemplated 3) Provide seasonal water capacity and withdrawal volumes as well as rate of withdrawal (currently blank) 4) Provide additional information such as comments for each option (e.g. TCMC no longer advancing option due to XYZ, option A to be used in conjunction with option B, etc.) 5) Provide comment on whether there is any additional information that can be included to assist our collective efforts in selecting the best option(s)	See summary and populated table: "20171101_Mount Milligan Water Source Options Summary_DRAFT Rev 2.docx". Document provided by TCMC to MMPO for review on Nov 1. Document provided by MMPO to First Nations groups, EAO and FLNRO on Nov 1 for review.	Phase 1		Closed

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Project Description - EA Amendment Self Determination and Permitting Requirements										
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MMPO-PA-011	10-Nov-17	Pre-application	T.Goodsell	MMPO	Land Tenures	EA Amendment	We need clarification on the land tenure in the area of Philip Lakes.	This information is being collected and should be available by November 17.**UPDATE:** 5-Dec-17 This information is being supplied in maps within the EA amendment and MAPA.	Phase 1		In Progress
MMPO-PA-012	10-Nov-17	Pre-application	D.Smyth	MMPO	Reclamation	Mines Act Permit Amendment	MMPO has received some input from EMPR on the draft Information Requirements Table (IRT) and in general what is required for the Mines Act permit amendment for the Philips Lake water withdrawal proposed by Thompson Creek Metals Company (TCMC) for the Mt. Milligan project (M-236). An amendment to permit M-236 is required because the full length of pipeline and pump station proposed by TCMC to move water from Philips Lake to the TSF does not fall within the current M-236 permit boundary. EMPR is requesting that TCMC submit a letter amendment request to the Chief Inspector of Mines to request the mine boundary change. At a minimum, the letter must include: • Request for mine boundary change (including figures of current and proposed boundary); • Overview of the proposed pipeline and pumphouse; • Design drawings of pipeline and pumphouse and any relevant electrical/mechanical information; • Figure of proposed route including current/proposed mine boundary; • Implementation/Construction schedule; and • a report detailing how the current water deficient occurred including a summary and discussion of water intake/usage since the start of operations and a comparison to what was predicted during initial permitting in 2008/09. The intent of the report is to provide EMPR with a clear understanding of the events that lead to the unpredicted water deficit. The IRT has been circulated for review to the MRC and First Nations and we may have additional feedback once their review is complete however, given the above mentioned information requirements, continued use of the IRT document is likely not necessary. The follow up technical meeting scheduled for Friday November 17 will also provide an opportunity to further discuss as a broader group. The letter amendment request described above should still be submitted as a package along with the EA amendment request and request to FLNRO for short-term water use.	TCMC understands that EMPR is now requesting submittal of a letter amendment request. The information requested, and any additionally requested information, will be included in the Mines Act Permit Amendment letter.	Phase 1		In progress
MMPO-PA-013	15-Nov-17	Pre-application	D.Smyth	MMPO	Recalamation	Mines Act Permit Amendment	MMPO has received some information requirements from EMPR's reclamation specialists in addition to what I provided on November 10. Please include the following information within the Mines Act permit amendment for the Philips Lake water withdrawal proposed by Thompson Creek Metals Company (TCMC) for the Mt. Milligan project (M-236): • Description of the values and footprint of the additional area to be included in the MA boundary • Summary/Description of the values and footprint to be disturbed • Description of how the disturbance will be reclaimed • Construction and Environmental Management Plan specific to the new the disturbance area and activities • Erosion and Sediment Control Plan update • Considerations for updates to other Management Plans such as Wildlife Management Plan and Invasive Plant Management Plan • The new disturbance area is required to be included in the next Reclamation and Closure Program update and liability cost update o EMPR will engage with TCMC in the near future to discuss timing of the Reclamation and Closure Program update and liability update submission Also, to help inform the development of your report detailing how the current water deficient occurred, EMPR may also provide some more detailed guidance on what they are seeking in this report.	The information requested will be included in the Mines Act Permit Amendment.	Phase 1		In progress
MMPO-PA-014	20-Nov-17	Pre-application	T.Goodsell	MMPO	Permitting	EA Amendment	Do you have a current road use permit/special use permit for the roadways that the Philip Lake pipeline may interact with?	Yes, TCMC holds a current road use permit and is designated as primary road user of the Rainbow FSR and Community Connector.	Phase 1	Road Use Permit (OTH10006) and associated amendments	In progress
MMPO-PA-015	21-Nov-17	Pre-application	T.Goodsell	MMPO	Water Mgmt	EA Amendment	As follow up from questions T.Goodsell and K.St. James had on 20-Nov-17 phone call, TCMC requested to provide: -Updated water pumping rates and duration for all proposed water sources (Esker Lakes, Philip Lake #1 and Meadows Creek Water Supply Station) -Mount Milligan Phase 1 map including the revised Philip Lake pipeline corridor route -Philip Lake preliminary construction schedule	Updated information requested, as well as memo addressing the reasoning behind the revised pump schedule, provided to MMPO/EAO for discussion and distribution at Nov 23 collaboration meeting. Further discussion at Nov 28 technical discussion meeting.	Phase 1		Closed
MMPO-PA-016	21-Nov-17	Pre-application	T.Goodsell	MMPO	Permitting	EA Amendment	What was the reasoning for the updated withdraw rate information and pumping duration from Philip Lake #1?	Stantec: Focusing on adaptive management, flows were adjusted as was pumping duration due to BC WaterTool Risk Level 1 constraints, limited baseline data for Philip Lake and limitations of proposed Phase 1 pipeline/pump station configuration. This Risk Level 1 constraint is proposed for 2018 and for 2019 to maintain as much conservatism as possible.	Phase 1		In progress
MMPO-PA-017	21-Nov-17	Pre-application	T.Goodsell	MMPO	Permitting	OLTC	Confirmation that an Occupational License to Cut (OLTC) will be required for any timber that needs to get removed due to the construction of Philip Lake pipeline and/or pump station.	Understood. TCMC will move forward with the application of this permit and will include the application with the permit application package.	Phase 1		In progress
MMPO-PA-018	21-Nov-17	Pre-application	T.Goodsell	MMPO	Water Mgmt	EA Amendment	BC WaterTool Risk Level 1 negates the need for Envronmental Flow Needs (EFN) study?	Stantec: Yes, can send PDF confirming this from BC WaterTool upon request	Phase 1		Closed
Nak'azdli-PA-001	11-Nov-17	Pre-application	A.Halleran	Technical Advisor - Takla Lake First Nation & McLeod Lake Indian Band	Water Mgmt	EA Amendment	Nak'azdli prefers that no water is taken from Rainbow Creek or its watershed. Nak'azdli does not support the construction of the Meadows Creek Water Supply Pond.	TCMC is no longer considering Rainbow Creek as a water source option. TCMC is looking for long-term water solutions other than Meadows Creek Supply Pond.	Phase 1		Closed
Nakazdli-PA-002	17-Nov-17	Pre-application	A.Halleran	Technical Advisor - Nak'azdli Whut'en	Water Mgmt	Water License	In the low flow months in the winter, I suspect that the lake level is low. So when you withdraw water, would you affect shoreline that would not normally be impacted by low water levels? Has it been modeled? The Keyoh holder is ok with lake levels decrease of up to 5cm but nothing more than that.	Waterline – there is always natural fluctuation in lakes, and we do not think this would fall outside of normal fluctuation. The assumption we've taken is a conservative approach, and we have done a water balance for the lake. The largest drop in water levels, if that occurs, would be at the outlet of the lake (the lowest point). We can vary the amount that is taken throughout the year. We want to make sure we are maintaining the flow. TCMC – In the long term we do not plan on taking water during low flow periods from this lake.	N/A		Closed
Nakazdli-PA-003	28-Nov-17	Pre-application	A.Halleran	Technical Advisor - Nak'azdli Whut'en	Water Mgmt	EA Amendment	Where does the 15% baseline flow come from that you are referring to and do you have data that you have collected yourselves?	Stantec: 15% baseline flow is based on Risk Level 1 of the BC WaterTool, result from TCMC's original EA and measured flows from Meadow's Creek. We do not have enough data on Philip Lake at this time; therefore, modelling is done with surrogate numbers for now.	Phase 1		In progress

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Nakazdli-PA-004	29-Nov-17	Pre-application	R.Sam	Nak'azdli	indigenous interests	EA Amendment	They do not have any additional comments on the dAAIR. Wanted to emphasize that Nak'azdli and the Keyoh holder would like to continue to work with TCMC regarding the Meadows Creek withdrawals, but they have no additional information requirements.	Noted	Phase 1		Closed
Takla/MLIB-PA-001	10-Nov-17	Pre-application	R.Freed	Source Environmental	Water Mgmt	EA Amendment	What is the evidence from TCMC to show the need for water? How much water are you seeking to obtain?	Evidence includes 2016 bathymetric survey and updated water balance in comparison to original water balance. TCMC is seeking to obtain 1.8Mm³ between January and April 2018.	Phase 1		In Progress
Takla/MLIB-PA-002	10-Nov-17	Pre-application	R.Freed	Source Environmental	Water Mgmt	EA Amendment	Does this application seek enough water for mill production and to keep tailings submerged? Is there PAG rock in the TSF? Will it remain fully submerged?	The application for Phase 1 is for the amount of water that the mill would require to keep running from when MtM is expected to run out of water (beginning to end of February 2018) to beginning of freshet (mid to end of April 2018). PAG rock is stored within a separate cell of the TSF. Water to submerge tailings and PAG rock is not a requirement during this phase.	Phase 1		Closed
Takla/MLIB-PA-003	27-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Water Mgmt	Mines Act Permit Amendment	Assessment of Impacts on the Regional Watershed 1) Greater baseline information on impacted water bodies: The dIR include a requirement to provide a report detailing how the current water deficient occurred, which is intended to provide a clear understanding of the events that led to the unpredicted water deficit. A second report should also be required that describes the baseline state of the water bodies that will be impacted by the proposed water withdrawal. This report must include the following information that is required to adequately assess the impacts of the increased water withdrawal on the local and regional watershed: Surface water bodies: o Baseline information (including seasonal flows and volumes) on each of the potentially implicated waterbodies (Eskers Lakes, Philips Lakes system (5 lakes and connecting streams), Meadows Creek, and Rainbow Creek); o Environmental flow needs (volume and timing of water flow required for the proper functioning of the aquatic ecosystem of the waterbody) for Eskers Lakes, Philips Lakes, Meadows Creek, and Rainbow Creek, including identification of environmental risk management levels for each of these waterbodies taking into account the drought conditions observed over the past few years and how climate change may be affecting streamflow hydrographs; and o Upstream / downstream connectivity effects of the increased water withdrawal. Groundwater: o Baseline information on the local and regional groundwater aquifer (in light of groundwater connection of Eskers Lakes and possibly other waterbodies); o Baseline information on the gravel aquifer under the Tailings Storage Facility (including potential rates of withdrawal, volume, porosity, depth, and lateral extent), along with a thorough description of the method for drilling for the water supply in this gravel aquifer (the "Aquifer Source"); and o Management decision framework that prioritizes water usage from the Aquifer Source over other water sources.	Report detailing how the deficit occurred and SWOT (Strengths, weaknesses, opportunities, threats) analysis were complete and will be included in the MAPA application. Regarding a secord report on the baseline state of water bodies impacted by the proposed water withdrawal, much of this information will be/is included in the EA application and will be found there. Rainbow Creek is no longer being contemplated as an option and will not require further assessment. Esker Lakes does not have flows and can not be assessed for Environmental Flow Needs. Environmental risk levels can be assessed but will take longer than the Phase 1 timing will allow. This will be evaluated more fully in Phase 2. Groundwater: Baseline on local and regional groundwater aquifer information will be more fully assessed for Esker Lakes and their connectivites will be assessed as part of the pump test and will be more fully assessed in Phase 2. The gravel aquifer under the TSF has been largely assessed and will be included as a separate appendix report in the application. It is important to note that the gravel aquifer under the TSF is not part of the application process.	See response for components included in Phase 1 EA application and proposed for Phase 2.		In Progress
Takla/MLIB-PA-004	27-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Water Mgmt	Mines Act Permit Amendment	**Assessment of Impacts on the Regional Watershed** **2) Defined plans and water withdrawal thresholds** **The dIR should be amended to ensure that the Application includes the following updates to applicable management plans, including the Construction and Environmental Management Plans, Erosion and Sediment Control Plan, Wildlife Management Plan, and such other Management Plans that require updating:** **a) monitoring requirements to continuously assess the impacts of water withdrawal on local and regional watersheds; and** **b) adaptive management processes and contingency measures (including limiting withdrawals) should water withdrawal operations exceed specified withdrawal thresholds (discussed below).** **Criteria or thresholds must be established for water withdrawal impacts for lake and stream changes in flow and/or volumes. Such thresholds must:** **a) be determined with Indigenous groups, including Takla and MLIB;** **b) be separately defined for all potentially impacted water bodies;** **c) consider the sensitivity of base-flow reductions in winter settings; and** **d) be supported by clear rationales.**	Monitoring and adaptive management components will be part of the EA application. Thresholds are currently being contemplated in the Phase 1 component and will be included in the in the EA application. Given the the timing of the comments provided (Nov 27) and the timing for the application submission (Dec 5), there is very limited timing in Phase 1 to discuss and agree on thresholds for each water body with all parties. MTM proposes to have further discussions as part of the Phase 2 component. Base flow reductions are being considerd and will be addressed as part of the EA application. More clarification is needed on the "clear rationales".	See response for components included in Phase 1 EA application and proposed for Phase 2.		In progress
Takla/MLIB-PA-005	27-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Water Mgmt	Mines Act Permit Amendment	**Assessment of Impacts on the Regional Watershed** **3) Protection of water quality** **Specific commitments to ensure that no contaminants or deleterious substances are discharged into the environment as a result of the activities outlined in the Application are required. Accordingly, the dIR should be amended to include a section on measures that will be implemented to ensure no contaminants or deleterious substances are released into the environment as a result of the activities proposed in the Application.**	Measures to ensure no contaminants/deleterious substances released into environment due to activities (include further verbage in CEMP/WSECMP) and will be a component of the EA application. Hydrocarbon- or other contaminant-based spills will be managemend under TCMC's Construction Environmental Management Plan and Spill Contingency Plan. Sediment and erosion control will be managed under TCMC's Water, Seepage and Erosion Control Management Plan.	Phase 1		In progress
Takla/MLIB-PA-006	27-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Indigenous Title and Rights	Mines Act Permit Amendment	Assessment of Impacts on Indigenous Title and Rights The dIR does not include any requirement for an independent assessment of the impacts of the proposed activities on Indigenous title and rights (including Indigenous and treaty rights). Significant amendments to the dIR are required in that regard, as described below. Moreover, the Carrier Sekani First Nations have a new framework for cumulative effects assessment that should be incorporated in the requisite evaluation of the cumulative effects of the proposed activities and corresponding impacts to Indigenous title and rights, including treaty rights.	Carrier-Sekani Tribal Council cumulative effects assessment framework will be considered as part of the Phase 2.	Phase 2		In progress
Takla/MLIB-PA-007	27-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Indigenous Title and Rights	Mines Act Permit Amendment	Assessment of Impacts on Indigenous Title and Rights a) Mapping of Project effects and impacts at a traditional territorial-level To help assess the impacts of the short-term water extraction on Takla Lake and McLeod Lake's Indigenous title and rights, figures showing the location of the proposed activities must include the boundaries of the potentially impacted First Nations' traditional territories, including Takla and MLIB's traditional territories. Figures must also be provided that show the location of vegetation corridors that may be cleared as a result of this work. This may require a series of figures to ensure the effects and impacts of the mine can be visually considered.	Indigenous traditional territory maps will be included as part of the EA application and where necessary as part of MAPA. This will include all Indigenous groups that may potentially be impacted.	Phase 1		In progress

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Takla/MLIB-PA-008	27-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Indigenous Title and Rights	Mines Act Permit Amendment	Assessment of Impacts on Indigenous Title and Rights b) Impacts on Indigenous title and rights associated with assessed values Takla Lake and McLeod Lake's Indigenous title and rights may be directly or indirectly impacted by effects on various values referred to in the dIR. Accordingly, the dIR must be amended to ensure that Takla and MLIB's ability to meaningfully exercise their Indigenous title and rights as a result of effects to those values is properly assessed.	Impacts on Indigenous title and rights will be further assessed as part of the Phase 2 assessment, as discussed on November 28 Technical Meeting.	Phase 2		In progress
Takla/MLIB-PA-009	27-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Indigenous Title and Rights	Mines Act Permit Amendment & EA Amendment	Assessment of Impacts on Indigenous Title and Rights c) General Indigenous considerations Finally, the dIR must clearly provide that the Application will meaningfully and adequately assess impacts of the proposed activities on Takla Lake and McLeod Lake's Indigenous rights, and seek to identify measures to avoid such impacts, and, if unavoidable, to mitigate them in a manner that is acceptable to Takla and MLIB.	As the timing of Phase 1 application and approval does not allow for the meaningful engagement and discussions required to adequately address this component, this process will be started early in 2018 as part of the First Nations engagement in preparation for Phase 2.	Phase 2		In progress
Takla/MLIB-PA-010	17-Nov-17	Pre-application	R. Freed	Source Environmental	Technical Meeting	EA Amendment	1) Map provided needs to be clearer and updated. 2) Geology of the area including gravel aquifer under the TSF needs to be described 3) Threshold/criteria for water levels and flows in the different water bodies needs to be included in the applications	1) A map will be provided to MRC. This will include updated information and clear pipeline corridors and crossings. 2)Gravel aquifer will be described as part of EA application appendices. 3)Scenarios for adaptive management are being incorporated into the EA application.	Phase 1		In progress
Takla/MLIB-PA-011	17-Nov-17	Pre-application	Takla/MLIB	Source Environmental	Water Mgmt	EA Amendment	Would Philip Lake be the sole source of water in the long-term?	Yes. Although we are also looking at groundwater sources as a potential long term source.	N/A		Closed
Takla/MLIB-PA-012	17-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Water Mgmt	EA Amendment	Climate change considerations? What if there are more or harsher dry conditions?	That is why we are also considering groundwater sources from deep aquifers. We are collecting additional baseline data in order to detect changes potentially due to climate change and make adaptive changes, however, we can't accurately predict these changes at this time.	N/A		Closed
Takla/MLIB-PA-013	17-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Water Mgmt	EA Amendment	What is the duration of proposed withdrawal? Are you proposing to withdraw water from Eskers from Jan – March 2018 and from Philips from Jan – Sept 2018?	Yes; however, we are considering applying for withdrawal from Philip Lake 1 from Jan – Sept for 2018 and 2019 as the short term use approval can be granted for up to 24 months. The 2019 component is only contingent on not receiving approval on Phase 2 permitting.	N/A		Closed
Takla/MLIB-PA-014	28-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Water Mgmt	EA Amendment	Why are you using Risk Level 1? Does this represent the amount of water you need rather than the lake sensitivity?	Yes, Risk Level 1 means the least risk to the water body (most conservative). We don't have enough baseline data to use high risk rating at this time.	Phase 1		Closed
Takla/MLIB-PA-015	28-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Water Mgmt	EA Amendment	Concerned about proposed water withdrawal volume from Philip Lake.	Stantec: We took the conservative approach for modelling our withdrawal rates. Used current information we have collected from Philip Lake 1 outlet (cross-sectional flows to create rating curve) for the model. Modelling our withdraw rates to focus on the most sensitive feature, the outlet.	Phase 1		Closed
Takla/MLIB-PA-016	28-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Water Mgmt	EA Amendment	Want to see adaptive management strategies in application.	MMPO: Beneficial to include description of adaptive management in the appication. EAO: As well as including how information will be included in Phase 2 application.	Phase 1		In progress
Takla/MLIB-PA-017	28-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Project Description	EA Amendment	Want to see timelines very clearly laid out in application regarding ongoing monitoring and adaptive management plans.	This will be included in the EA application.	Phase 1		In progress
Takla/MLIB-PA-018	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Project Description	EA Amendment	Want company's intentions to address First Nations' Title and Rights incorporated into formal document.	Agreed. Considerations on impacts to Indigenous title and rights will be formally addressed as part of the Phase 2 application.	Phase 1		Open
Takla/MLIB-PA-019	28-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG	Project Description	EA Amendment	Is Esker Lakes fed by groundwater movement from TSF?	These systems are not connected. TCMC conducts both GW/SW testing in this region and no effects are shown.	Phase 2		In progress
Takla/MLIB-PA-020	28-Nov-17	Pre-application	L.Krebs	Takla Lake First Nation	Water Mgmt	Water License	What does the review look like following this 24-month short-term use approval? If agreed to expedite this process should you run both Phase 1 and Phase 2 at the same time?	The 24-month short-term use approval is temporary only. Running Phase 1 and Phase 2 at the same time overlaps and would not be an efficient process.	Phase 1		In progress
Takla/MLIB-PA-021	28-Nov-17	Pre-application	L.Krebs	Takla Lake First Nation	Water Mgmt	Water License	Will year one of Phase 1 provide enough baseline data to move forward with Phase 2?	Stantec: Figures for 2018 and 2019 are very conservative, reducing potential withdrawal rate from Philip Lake significantly. 2018 baseline data could be used to update withdrawal rates for 2019. As a short term use we want to remain conservative. Calibrated rates from baseline information would inform the Phase 2 pumping rates.	Phase 1		In progress
Takla/MLIB-PA-022	28-Nov-17	Pre-application	R.Freed	Source Environmental	Water Mgmt	EA Amendment	Why do you still need Meadows Creek Water Supply Station?	We will not be able to collect enough water from Philips Lake #1 in 2018 and 2019 to meet orerational requirements so we need to continue using MCWSS for now.	Phase 1		Closed
Takla/MLIB-PA-023	28-Nov-17	Pre-application	R.Freed	Source Environmental	Water Mgmt	EA Amendment	How would you deal with the scenario where there is a very long flow through Philip Creek? Would like to see slide showing thresholds and how they work for various scenarios (ex. 15% mean monthly flow in low flow year). Would like to see graphs depicting our actual data. If you do not have enough data at this time would like to see estimates of data.	Stantec: Below 30% mean annual discharge (MAD) you cannot pump water as this is the critical flow. We are currently modelling for this using averaged flows based on best known information we currently have available to us. We will continue to collect data and update the model as we go (adaptive management strategy). We do not currently have enough Philip Lake data at this time to graph but data collected from Meadows Creek can be used as surrogate for now.	Phase 1		Closed
Takla/MLIB-PA-024	28-Nov-17	Pre-application	R.Freed	Source Environmental	Water Mgmt	Water License	The short-term use approval lasts for two years?	FLNRO: Short-term use approvals can be valid for up to 24 months. A conditional document will accompany the approval that can be updated as baseline data is collected and analyzed (after one year of pumping and baseline monitoring). Phase 2 will be covered by the next EA amendment but during permitting for Phase 2 TCMC may need further water sourcing through this short-term use approval. TCMC: Having a 24-month short-term use approval allows us to collect more baseline data through Phase 2 permitting process and consultation.	Phase 1		In progress

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Takla/MLIB-PA-025	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	First Nations Consultation	dAAIR	Incredulously, the dAAIR does not purport to assess the impacts of the water withdrawals on Indigenous title and rights.	In response to these comments, section 6.2 of the dAAIR has been revised and now reads as follows: "The proposed Project changes have the potential to interact with Aboriginal Interests. The amendment Application will set out whether the proposed Project changes require revisions to the original assessment conclusions found in Section 2.0 "First Nations Considerations" of the EAC Application and the corresponding conclusions presented in the EAO's Assessment Report (2009) and the Amendment Assessment Reports (2013, 2017) regarding the assessment of Project effects on Aboriginal Interests. This analysis will be informed by relevant information provided to TCMC by First Nations involved in the original EA arising from consultation activities on the proposed Project changes. Takla Lake First Nation did not participate in the original EA of the Project. However, since the EAC was issued in 2009, the Nation has asserted traditional territory which now includes the Project area. As a result, the Application will present an assessment of the effects which are expected to occur as a result of the proposed Project changes on Takla Lake First Nation's Aboriginal Interests. This analysis will be informed by the methodology used to undertake the assessment of Aboriginal Interests set out in the EAC Application, by publicly-available information on Takla Lake First Nation Aboriginal Interests, and by any relevant information provided to TCMC by Takla First Nation arising from consultation activities on the proposed Project changes. The amendment Application will include the following: • A figure showing the boundaries of First Nation traditional territories relative to the proposed water sources and cleared vegetation corridors; • A description of potential adverse effects of the proposed amendment on Aboriginal Interests; • A description or summary of mitigation measures to avoid or reduce potential adverse effects of the proposed amendment on Aboriginal Interests; • A characterization of the residual adverse effects of the proposed amendment on Aboriginal Interests after mitigation; and • A summary of outstanding Aboriginal Interests issues identified by First Nations."	Phase 2		In progress
Takla/MLIB-PA-026	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Project Description	dAAIR	1. Assessment of Impacts on the Regional Watershed (a) Mapping of waterbodies and mine infrastructure The dAAIR should be amended to specify that maps showing the locations of mine infrastructure and existing waterbodies be included in the Application, for clarity and ease of review.	The dAAIR has been amended to clarify that a description of proposed short-term water extraction needs including an updated figure showing the location of the proposed water sources and infrastructure relative to the approved Project will be included in the Application.	Phase 1		In progress
Takla/MLIB-PA-027	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Assessment Methods	dAAIR	1. Assessment of Impacts on the Regional Watershed (b) Greater baseline information on impacted water bodies Section 2 of the dAAIR outlines the information that Centerra intends to include in the Application to describe the proposed mine changes, including the following operational activities: "Water withdrawal locations, volumes, rates, timing, and durations from identified water sources into the water seepage return ponds (Pond 1 and Pond 2)". The dAAIR should be amended to ensure that more information is included in the Application to adequately assess the impacts of the increased water withdrawal on the local and regional watershed. Specifically, the dAAIR should be amended to ensure that the following information is described in the Application: (i) Surface water bodies: o Baseline information (including seasonal flows and volumes) on each of the potentially implicated waterbodies (Eskers Lakes, Philips Lakes system (5 lakes and connecting streams), Meadows Creek, and Rainbow Creek)	Baseline information will be provided for the water bodies and watercourses that are anticipated to be affected by the proposed water withdrawals from Esker Lakes and Philip Lake. Available or modeled baseline information is intended to support only the short-term water withdrawals from these two sources. More detailed baseline information is currently being collected and will continue to be collected in 2018; this information will be presented in support of the proposed long-term water withdrawal application. Baseline information for Meadows and Rainbow creeks will not be included in the Application because the amendment does not propose to withdraw more water from Meadows Creek than was originally assessed in 2008.	Phase 1, 2		In progress
Takla/MLIB-PA-028	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Assessment Methods	dAAIR	1. Assessment of Impacts on the Regional Watershed (b) Greater baseline information on impacted water bodies Section 2 of the dAAIR outlines the information that Centerra intends to include in the Application to describe the proposed mine changes, including the following operational activities: "Water withdrawal locations, volumes, rates, timing, and durations from identified water sources into the water seepage return ponds (Pond 1 and Pond 2)". The dAAIR should be amended to ensure that more information is included in the Application to adequately assess the impacts of the increased water withdrawal on the local and regional watershed. Specifically, the dAAIR should be amended to ensure that the following information is described in the Application: (ii) Surface water bodies: Environmental flow needs (volume and timing of water flow required for the proper functioning of the aquatic ecosystem of the waterbody) for Eskers Lakes, Philips Lakes, Meadows Creek, and Rainbow Creek, including identification of environmental risk management levels for each of these waterbodies taking into account the drought conditions observed over the past few years and how climate change may be affecting streamflow hydrographs; and	Environmental flow needs in Philip Creek have been considered during the selection of the proposed withdrawal rates from Philip Lake and will be included in the assessment. Esker Lakes are non-fish-bearing and do not have surface connection to fish-bearing water bodies or watercourses. However, these lakes are part of a larger groundwater system that provides water to Rainbow Creek and the Lower Rainbow Creek Offset Pond. The potential effect of short-term (3 months) water withdrawal from Esker Lakes on inflows to Rainbow Creek and the Lower Rainbow Creek Offset Pond will be assessed. Assessment of environmental flows in Meadows Creek and Rainbow Creek will not be included in the assessment. Proposed water withdrawals from Meadows Creek will not exceed those already assessed in the original EA application.I24	Phase 1		In progress
Takla/MLIB-PA-029	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Assessment Methods	dAAIR	1. Assessment of Impacts on the Regional Watershed (b) Greater baseline information on impacted water bodies Section 2 of the dAAIR outlines the information that Centerra intends to include in the Application to describe the proposed mine changes, including the following operational activities: "Water withdrawal locations, volumes, rates, timing, and durations from identified water sources into the water seepage return ponds (Pond 1 and Pond 2)". The dAAIR should be amended to ensure that more information is included in the Application to adequately assess the impacts of the increased water withdrawal on the local and regional watershed. Specifically, the dAAIR should be amended to ensure that the following information is described in the Application: (iii) Surface water bodies: o Upstream / downstream connectivity effects of the increased water withdrawal.	The application will include an assessment of the potential downstream effects on Philip Creek from water withdrawals from Philip Lake. Water withdrawals from Philip Lake are not anticipated to have an effect on any upstream lake or stream. However, the potential effect of lake draw-down on the connectivity to upstream tributaries will be addressed. The application will also include an assessment of the potential reduction of groundwater inflows to Rainbow Creek and the Lower Rainbow Creek Offset Pond. Esker Lakes are groundwater-fed and, therefore, the proposed water withdrawals will not affect upstream connectivity to any fish-bearing stream or lake.	Phase 1		In progress

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Takla/MLIB-PA-030	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Assessment Methods	dAAIR	1. Assessment of Impacts on the Regional Watershed (b) Greater baseline information on impacted water bodies Section 2 of the dAAIR outlines the information that Centerra intends to include in the Application to describe the proposed mine changes, including the following operational activities: "Water withdrawal locations, volumes, rates, timing, and durations from identified water sources into the water seepage return ponds (Pond 1 and Pond 2)". The dAAIR should be amended to ensure that more information is included in the Application to adequately assess the impacts of the increased water withdrawal on the local and regional watershed. Specifically, the dAAIR should be amended to ensure that the following information is described in the Application: (iv) Groundwater: Baseline information on the local and regional groundwater aquifer (in light of groundwater connection of Eskers Lakes and possibly other waterbodies); Baseline information on the gravel aquifer under the Tailings Storage Facility (including potential rates of withdrawal, volume, porosity, depth, and lateral extent), along with a thorough description of the option for drilling for the water supply in this gravel aquifer.	Baseline and modelled information from the original EA application regarding groundwater flow paths, recharge rates, and aquifer boundaries will be presented in the application as necessary to understand the potential effects of winter water withdrawals from Esker Lakes on Rainbow Creek. Centerra has collected additional groundwater information since 2008 and is currently conducting a detailed groundwater investigation around Esker Lakes. Data from the current groundwater program will not be ready for this application. However, the preliminary results of this data will be considered prior to implementation of the Esker Lakes withdrawal program.	Phase 1, 2		In progress
Takla/MLIB-PA-031	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Effects Assessment	dAAIR	1. Assessment of Impacts on the Regional Watershed (c) Defined plans and water withdrawal thresholds (i) The dAAIR should be amended to provide: Monitoring plans to continuously assess the impacts of water withdrawal on local and regional watersheds; and adaptive management plans and contingency plans (including limiting withdrawals) should water withdrawal operations exceed specified withdrawal thresholds (discussed below)	The Application will include an adaptive monitoring plan that identifies the current hydrology, groundwater, and water quality monitoring networks as well as the new stations that TCMC has recently established in the Philip Creek Watershed and near Esker Lakes. This monitoring plan will discuss the frequency and duration of sampling, methods used, and the data analysis that is and will be conducted on the collected data. The Adaptive Monitoring Plan will identify thresholds and outline how TCMC will respond to any threshold exceedances. This plan will identify any contingencies or actions that would be triggered by any threshold exceedances.	Phase 1, 2		in progress
Takla/MLIB-PA-032	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Assessment Methods	dAAIR	1. Assessment of Impacts on the Regional Watershed (c) Defined plans and water withdrawl thresholds (ii) It is critical that criteria or thresholds be established for water withdrawal impacts for lake and stream changes in flow and/or volumes. Such thresholds must: -be determined with Indigenous groups, including Takla and MLIB; -be defined for all potentially impacted water bodies; consider the sensitivity of base-flow reductions in winter settings; and -be supported by clear rationales	TCMC agrees that thresholds must be established to protect the aquatic environment in the Philip Lake system and in Rainbow Creek, downstream of Esker Lakes. These thresholds will be identified in an Adaptive Monitoring Plan and will focus on protecting the aquatic environment during low-flow periods. Thresholds will initially be set using available or modeled data. However, these thresholds will be revisited as new data from the monitoring program becomes available. As such, TCMC looks forward to working with the Takla Lake First Nation and McLeod Lake Indian Band to develop and refine these thresholds during the assessment of the long-term (Phase 2) water withdrawals required to keep the Project operating.	Phase 2		In progress
Takla/MLIB-PA-033	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Cumulative Effects	dAAIR	1. Assessment of Impacts on the Regional Watershed (c) Defined plans and water withdrawl thresholds (iii) We also stress that the Carrier Sekani First Nations have a new framework for cumulative effects assessment that should be incorporated in the requisite evaluation of the cumulative effects of the proposed activities.	A cumulative effects assessment will be conducted if the proposed changes are anticipated to adversely alter the characterization of residual effects from the original EA (e.g., an effect changes from being low magnitude to moderate magnitude or from being reversible to being permanent). The assessment methods noted above are consistent with the EAO's Guideline for the Selection of Valued Components and Assessment of Potential Effects (2013).	Phase 1, 2		In progress
Takla/MLIB-PA-034	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	Effects Assessment	dAAIR	1. Assessment of Impacts on the Regional Watershed (d) Protection of water quality Specific commitments to ensure that no contaminants are discharged into the environment as a result of the activities outlined in the Application are required. Accordingly, the dAAIR should be amended to include a section on measures that will be implemented to ensure no contaminants are released into the environment as a result of the activities carried out to withdraw water from the new water sources.	Existing environmental management plans (including the spill response plan, erosion and sediment control plan, and the hazardous materials handling plan) and operational procedures currently implemented at Mount Milligan will be implemented during all phases of the proposed water withdrawals from Philip Lake and Esker Lakes included in the EA amendment. These plans will be revised as necessary and will be made available in the Application.	Phase 1		In progress
Takla/MLIB-PA-035	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	First Nations Consultation	dAAIR	2. Assessment of Impacts on Indigenous Title and Rights (a) Map depiction of new activities in relation to Takla and MLIB's traditional territories As mentioned above, section 2 of the dAAIR outlines the information that Centerra intends to include in the Application to describe the proposed changes to mining operations. This includes a description of the proposed short-term water extraction needs with an updated figure showing the location of the proposed water sources relative to the approved mine. To help assess the impacts of the short-term water extraction on Takla and MLIB's Indigenous title and rights, this figure must include the boundaries of the potentially impacted First Nations' traditional territories, including Takla and MLIB's traditional territories. The figure must also show the location of vegetation corridors that may be cleared as a result of this work. This may require a series of figures to ensure the effects and impacts of the mine can be visually considered.	The dAAIR has been revised based on this feedback. A figure showing the boundaries of First Nation traditional territories relative to the proposed water sources and cleared vegetation corridor will be included in the Amendment Application.	Phase 1		In progress
Takla/MLIB-PA-036	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	First Nations Consultation	dAAIR	2. Assessment of Impacts on Indigenous Title and Rights (b) Impacts on Indigenous title and rights associated with valued components Takla and MLIB's Indigenous title and rights may be directly or indirectly impacted by environmental effects on various valued components recognized in Table 1 of the dAAIR, including: · Water Resources – extraction of make-up water has the potential to affect water resources located within Takla and MLIB's traditional territories, which Takla and MLIB rely on in exercising their Indigenous rights; · Fisheries and aquatic resources – extraction of make-up water and installation of water pipeline infrastructure has the potential to affect fish and fish habitat located within Takla and MLIB's traditional territories, which Takla and MLIB rely on in exercising their Aboriginal rights; · Vegetation and plant communities – extraction of make-up water and installation of water pipeline infrastructure has the potential to affect vegetation and plant communities located within Takla and MLIB's traditional territories, which Takla and MLIB rely on in exercising their Indigenous rights; and · Wildlife and wildlife habitat – extraction of make-up water and installation of water pipeline infrastructure has the potential to affect wildlife and wildlife habitat located within Takla and MLIB's traditional territories, which Takla and MLIB rely on in exercising their Indigenous rights. Accordingly, the dAAIR must be amended to ensure that Takla and MLIB's ability to meaningfully exercise their Indigenous title and rights as a result of environmental effects to those valued components is properly assessed.	TMCM recognizes that the proposed Project changes have the potential to interact with established or asserted Aboriginal rights or treaty rights ("Aboriginal Interests"). The amendment Application will set out whether the proposed Project changes require revisions to the original assessment conclusions found in Section 2.0 "First Nations Considerations" of the EAC Application and the corresponding conclusions presented in the EAO's Assessment Report (2009) and the Amendment Assessment Reports (2013, 2017) regarding the assessment of Aboriginal Interests. In addition, the amendment Application will present an assessment of the effects that are expected to occur as a result of the proposed Project changes on Takla Lake First Nation's Aboriginal Interests. This analysis will be informed by the methodology used to undertake the assessment of Aboriginal Interests set out in the EAC Application. The original assessment of Project effects on Aboriginal traditional use and Aboriginal Interests in the EAC Application relied on the conclusions for the following relevant VCs also assessed in the EAC Application: • Fish and Aquatic Resources • Vegetation and Plant Communities • Wildlife and Wildlife Habitat • Archaeology and Heritage Resources • Visual and Aesthetic Resources • Noise The analysis in the amendment Application will consider the effects of proposed Project changes on the VCs listed above, and examines how these effects could, in turn, affect Aboriginal Interests, including traditional use.	Phase 2		In progress

Mt. Milligan Project - Issues Tracking Table

Last Updated	5-Dec-17		**Updated By:**	S.Righi							
Project Description - EA Amendment Self Determination and Permitting Requirements											
ID	**Comment/ Issue Date**	**Comment Stage**	**Comment Author**	**Comment Organization**	**Subject**	**Document**	**Issue Description or Comment**	**Response**	**Timing**	**Reference**	**Status ""In Progress" indicates comment will be addressed through the appropriate Application"**
Takla/MLIB-PA-037	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	First Nations Consultation	dAAIR	2. Assessment of Impacts on Indigenous Title and Rights (c) Fisheries of importance to Aboriginal rights The dAAIR identifies rainbow trout and lake whitefish as the indicator species to assess the potential effects of the water withdrawals on fish and aquatic resources. As discussed above [Takla/MLIB-AP-014], however, Takla and MLIB's Indigenous title and rights may be directly or indirectly impacted by environmental effects on the fisheries and aquatic resources valued component. It is therefore critical that Takla and MLIB determine the appropriate indicator species to use to assess effects on this valued component, as well as impacts on Takla and MLIB's Indigenous title and rights. The dAAIR must be amended accordingly.	TCMC recognizes that the proposed Project changes have the potential to interact with Aboriginal Interests through potential effects to fish that may be important to Takla and MLIB community members. Rainbow trout and lake whitefish were selected as potential indicator species because they represent a spring and fall spawning species that, respectively, use streams and lakes for spawning. The assessment will also include potential effects to mountain whitefish because they are fall spawners that use streams for spawning and, therefore, their eggs are susceptible to stranding during winter. The intent of selecting these indicator species was to assess the effectiveness of mitigation measures to eliminate or reduce potential adverse effects to spring and fall spawning species with the assumption that these mitigations measures would also protect other spring and fall spawning species in Philip Lake and Philip Creek when implemented. Other fish species known to inhabit Philip Lake include burbot, white sucker, and redside shiner. No bull trout have been found in Philip Lake or in Philip Creek near the proposed water withdrawal site. Bull trout are only known to inhabit Philip Creek near its confluence with the Nation River. A survey will be conducted in 2018 to confirm the absence of bull trout from the lake.	Phase 2		In progress
Takla/MLIB-PA-038	23-Nov-17	Pre-Application	Takla/MLIB	Takla Lake First Nation and McLeod Lake Indian Band	First Nations Consultation	dAAIR	2. Assessment of Impacts on Indigenous Title and Rights (d) General Aboriginal considerations Finally, section 6.2 of the dAAIR outlines Indigenous considerations that Centerra intends to address in the Application. This section focuses on traditional use, and makes no reference to Indigenous title and rights, and potential impacts to them. As the mine is located within Takla and MLIB's traditional territories, and the proposed increase water withdrawal has the potential to significantly impact Takla and MLIB's Indigenous title and rights, section 6 must be revised to ensure the Application meaningfully and adequately assesses such impacts, and seeks to identify measures to avoid such impacts, and, if unavoidable, to mitigate them in a manner that is acceptable to Takla and MLIB.	In response to this comment, section 6.2 of the dAAIR has been revised to read as follows: "The proposed Project changes have the potential to interact with Aboriginal Interests. The amendment Application will set out whether the proposed Project changes require revisions to the original assessment conclusions found in Section 2.0 "First Nations Considerations" of the EAC Application and the corresponding conclusions presented in the EAO's Assessment Report (2009) and the Amendment Assessment Reports (2013, 2017) regarding the assessment of Project effects on Aboriginal Interests. This analysis will be informed by any relevant information provided to TCMC by First Nations involved in the original EA arising from consultation activities on the proposed Project changes. Takla Lake First Nation did not participate in the original EA of the Project. However, since the EAC was issued in 2009, the Nation has asserted traditional territory which now includes the Project area. As a result, the Application will present an assessment of the effects which are expected to occur as a result of the proposed Project changes on Takla Lake First Nation's Aboriginal Interests. This analysis will be informed by the methodology used to undertake the assessment of Aboriginal Interests set out in the EAC Application, by publicly-available information on Takla Lake First Nation Aboriginal Interests, and by any relevant information provided to TCMC by Takla First Nation arising from consultation activities on the proposed Project changes. The amendment Application will include the following: • a figure showing the boundaries of First Nation traditional territories relative to the proposed water sources and cleared vegetation corridors; • a description of potential adverse effects of the proposed amendment on Aboriginal Interests; • a description or summary of mitigation measures to avoid or reduce potential adverse effects of the proposed amendment on Aboriginal Interests; • a characterization of the residual adverse effects of the proposed amendment on Aboriginal Interests after mitigation; and • a summary of outstanding Aboriginal Interests issues identified by First Nations."	Phase 1		In progress
Takla/MLIB-PA-039	28-Nov-17	Pre-application	R.Freed	Source Environmental	Water Mgmt	EA Amendment	Do you plan to maximize the use of the TSF wells and tower drains? How will you maximize their use? Will these be a primary or contingency source for TCMC? These should be a primary source and should be identified as such in the dAAIR/application.	Yes we plan to maximize the use of these sources by utilizing the appropriate pumping equipment and techniques. We are currently conducting monitoring on these sources to determine how best to maximize their use. These sources will act as a primary contingency for operational water makeup; however, they are unreliable sources of long-term water supply and therefore external sources are still required even though these look promising. These primary sources will be identified in the dAAIR and application.	Phase 1		In progress
Takla/MLIB-PA-040	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Indigenous Title and Rights	Short Term Water Use Approval	*dIR Requirement: General location of the project in relation to nearby communities* Recommended Change: Location should also be described in relation to the First Nations' (including Takla and MLIB) traditional territories	Four maps will be included showing the boundaries of the traditional territories for Nak'azdli Whut'en, McLeod Lake Indian Band, West Moberly First Nations, Halfway River First Nation, Takla Lake First Nation and nearby communites relative to the project.	Phase 1		In Progress
Takla/MLIB-PA-041	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Water Mgmt	Short Term Water Use Approval	*dIR Requirement: General project timeline: when will construction of works begin, when will it conclude, and when will water diversion and use begin?* Recommended Change: Uncertainties regarding this timeline, and corresponding contingency plans, should also be provided	Tables will be included showing the construction and operation schedules. As well, contingency measures will be presented.	Phase 1		In Progress
Takla/MLIB-PA-042	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Water Mgmt	Short Term Water Use Approval	*dIR Requirement: Required information on general characteristics is specified* Recommended Change: Include information on monitoring locations to measure impacts of water withdrawal on surface and ground waters	Descriptions and maps showing surface water level and flow monitoring stations at Esker Lakes and Philip Lakes will be included.	Phase 1		In Progress
Takla/MLIB-PA-043	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Assessment Methods	Short Term Water Use Approval	*dIR Requirements: Required information on stream water characteristics is specified* Recommended Change: Include information on sensitive ecosystems that may be impacted by the proposed water withdrawal activities	Available information regarding fish and fish habitat in Rainbow Creek (downslope from Esker Lakes) and Philip Lake 1 (including Philip Creek) will be included. The assessment will evaluate whether the proposed water withdrawal activities have potential to affect sensitive vegetation communities, including rare ecosystems, and alter the conclusions of the original environmental assessment.	Phase 1		In Progress
Takla/MLIB-PA-044	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Baseline Data	Short Term Water Use Approval	*dIR Requirement: Under Mining (Processing Ore), there is a requirement for available reports/studies* Recommended Change: Available reports/studies should also include information on existing environmental baseline studies, and recognized gaps therein	The application will present known environmental baseline information for Project areas outside of the original EA. The assessment of potential effects to water resources related to water withdrawals from Esker Lakes and Philip Lake 1 is being conducted using the best available information at the time of writing. This process necessarily requires the use of modelled groundwater and hydrologic data, and results of recent channel surveys and discharge measurements. These data introduce a degree of uncertainty into the assessment. TCMC will manage this uncertainty by monitoring groundwater and surface water levels throughout 2018 and 2019.	Phase 1		In Progress
Takla/MLIB-PA-045	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	water Mgmt	Short Term Water Use Approval	*dIR Requirement: Requires information on quantity of water required for the project, including logic or calculations used to determine quaintly* Recommended Change: Include an updated water balance model in the rationale/justification for the quantity of water required	The operational Water Management System Water Deficit Investigations Report will be provided which includes an updated water balance and rationale for the quantity of water required.	Phase 1		In Progress
Takla/MLIB-PA-046	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Assessment Methods	Short Term Water Use Approval	*dIR Requirement: Requires information on whether water use will be continuous or intermittent, and if intermittent, the duration of the diversion* Recommended Change: Include information on sensitive seasonal windows for fish/wildlife/vegetation in discussion on the continuous/intermittent water use, and duration thereof	Where applicable, information on sensitive seasonal windows will be provided for fish, wildlife, and vegetation with respect to pertinent phases (e.g. construction, operation) of the Project.	Phase 1		In Progress

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Takla/MLIB-PA-047	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Assessment Methods	Short Term Water Use Approval	*dIR Requirement: Technical information requirements listed for stream water* Recommended Change: Clearly describe the flow threshold analysis method	A Hydrologic and Hydraulic Modelling Report will be included that describes the flow threshold analysis method.	Phase 1		In Progress
Takla/MLIB-PA-048	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Assessment Methods	Short Term Water Use Approval	*dIR Requirement: No alternatives discussion* Recommended Change: Include an alternatives analysis to meet the indicated water demand	An operational Water Management System Water Deficit Investigations Report will be included that describes an alternatives analysis for the Project.	Phase 1		In Progress
Takla/MLIB-PA-049	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	General	Short Term Water Use Approval	*dIR Requirement: Environmental Management Plans required* Recommended Change: These plans should include information on fuel and contaminant storage and containment	A Water Seepage and Erosion Control Management Plan will be provided in the application that includes mitigation measures for fuel and contaminant storage and containment.	Phase 1		In Progress
Takla/MLIB-PA-050	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	General	Short Term Water Use Approval	We also note that the dIR makes reference to a water allocation staff contact (page 2). This information is required, as it is not currently provided.	Contact information will be provided for TCMC staff responsible for the Project.	Phase 1		In Progress
Takla/MLIB-PA-051	29-Nov-17	Pre-application	Takla/MLIB	Gowlings WLG on behalf of McLeod Lake Indian Band and Takla Lake First Nation	Indigenous Title and Rights	Short Term Water Use Approval	there should be a section included in the Application that provides a preliminary discussion on possible impacts to Indigenous title, rights (including treaty rights) and interests, along with clear commitments by Centerra to work collaboratively with the First Nations, including Takla and MLIB, in: i. identifying and monitoring such impacts going forward; ii. avoiding such impacts to the maximum extent possible; and iii. developing and implementing effective mitigation measures for unavoidable impacts.	Information will be provided on assessment of potential project effects on indigenous title, rights, and interests. TCMC is committed to working with First Nations on avoiding project effects, mitigation and monitoring planning.	Phase 1		In Progress