

KINROSS

Great Bear

Great Bear Gold Project Impact Statement

Section 7: Analysis of Changes to Pathway Valued Components

**Water pVCs
Section 7.5 to Section 7.7**



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Acronyms and Abbreviations

λ	Population growth rate
%HA	Percent highly annoyed
AAQC	Ambient Air Quality Criteria
AEX	Advanced Exploration
ANA	Asubpeeschoseewagong Netum Anishinabek
asl	Above sea level
ATV	All-terrain vehicle
BC WQG	British Columbia Long-term Exposure Guidelines, Freshwater
BHR	Built Heritage Resource
BSR	Baseline receptor
CAAQS	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of the Environment
CHER	Cultural Heritage Evaluation Report
CHIA	Cultural Heritage Impact Assessment
CHL	Cultural Heritage Landscape
CHVI	Cultural Heritage Value or Interest
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWQG	Canadian Water Quality Guidelines for protection of aquatic life
DFO	Fisheries and Oceans Canada
DPM	Diesel particulate matter
E2 plan	Environmental emergency plan
ECCC	Environment and Climate Change Canada
ESA	<i>Endangered Species Act</i>
FEQG	Federal Environmental Quality Guidelines
FMU	Forest Management Unit
FMZ	Fisheries Management Zones
FRI	Forest Resource Inventory
fVC	Valued component under federal jurisdiction
FWCA	<i>Fish and Wildlife Conservation Act</i>
GIS	Geographic information system
Great Bear Resources	Great Bear Resources Ltd.
HC	Health Canada
iPWQO	Interim Provincial Water Quality Objectives for protection of aquatic life
ISEE	International Society of Explosive Engineers
ISID	Impact segment identification
L_{Aeq}	A-weighted, equivalent sound level
$L_{Aeq-1hr}$	Average cumulative A-weighted, equivalent sound level over a 1-hour period
L_{dn}	Day-night sound level
L_{LM}	Logarithmic mean impulse sound level
LGO	Low grade ore
LiDAR	Light Detection and Ranging
LPeak	Peak pressure level
LSA	Local study area
LSFN	Lac Seul First Nation
LWCB	Lake of the Woods Control Board
MBCA	<i>Migratory Birds Convention Act</i>
MCM	Ministry of Citizenship and Multiculturalism
MDMER	Metal and Diamond Mining Effluent Regulations of the <i>Fisheries Act</i>
MECP	Ministry of the Environment, Conservation and Parks
MEM	Ministry of Energy and Mines

ML / ARD	Mine leaching and acid rock drainage
MNR	Ministry of Natural Resources
MRS	Mine rock stockpile
MTO	Ministry of Transportation
MWP	Mine water pond
na	Not applicable
NAPS	National Air Pollutant Surveillance Program
NPAG	Non-potentially acid generating
NWOMC	Northwestern Ontario Métis Community
OLT	Ontario Landscape Tool
OVB	Overburden stockpile
P-P	Peak-production period
PA	Project Area
PAG	Potentially acid generating
PAH	Polycyclic aromatic hydrocarbon
PM ₁₀	Particulate matter less than 10 micrometres in diameter
PM _{2.5}	Particulate matter less than 2.5 micrometres in diameter
POI	Point of impingement
POR	Point of reception
PPeak	Peak pressure
PPV	Peak particle velocity
Project	Great Bear Project
Property	Great Bear Property
pVC	Pathway valued component
PWL	Sound power level
PWQO	Provincial Water Quality Objectives for protection of aquatic life
Q1	Quarry 1
Q2	Quarry 2
R	Average recruitment rate
ROM	Run of mine
RPD	Relative percent difference
RSA	Regional study area
SAR	Species at Risk
SARA	<i>Species at Risk Act</i>
SCA	<i>Species Conservation Act</i>
SDW	Specially Designated Waters
SEQG	Saskatchewan Environmental Quality Guidelines
SFL	Sustainable Forest License
SOCC	Species of Conservation Concern
SPM	Suspended particulate matter
TC	Transport Canada
TISG	Tailored Impact Statement Guidelines
TMF	Tailings management facility
U-P	Underground production period
UTM	Universal Transverse Mercator
VMF	Viggo management facility
VOC	Volatile organic compound
WFN	Wabauskang First Nation
WHO	World Health Organization
WMU	Wildlife Management Unit
WQG PAL	Water Quality Guideline for the Protection of Aquatic Life
WSC	Water Survey of Canada
WSP	WSP Canada Inc.



WTP
ZOI

Water treatment plant
Zone of influence

7.5 Analysis of Changes to Groundwater

Groundwater (flows and levels) is included as a pVC because it is a natural component which can be important to other ecosystem elements including surface water, wetlands and the aquatic ecosystem, is of provincial regulatory interest and was identified of interest during engagement. There are no groundwater water wells within the LSA and RSA which will be affected by the Project.

Changes to groundwater quantity (flows and levels) is considered in this section. Changes to groundwater quality are considered in Section 7.7.

7.5.1 Pathway Linkages to other Valued Components

7.5.1.1 Pathway Linkages to Groundwater

There is a pathway effects to groundwater quantity from surface water flows and levels (Section 7.6).

7.5.1.2 Pathway Linkages from Groundwater to fVCs

Changes to groundwater quantity may have linkages to, and inform, the analysis of potential effects on the fVC fish and fish habitat, and fVC Indigenous Peoples. Groundwater can be a key input to surface water flows and levels, and may affect where fish live. Changes in groundwater resulting from the Project may change the condition of adjacent vegetation and wetland communities and habitat during the construction, operation and closure of the Project, which may affect migratory birds (Section 9.1.1) and the current use of lands and resources for traditional purposes (Sections 10.6, 11.6, 12.6, 13.6 and 14.6).

Note that indirect linkages to fVCs if present, such as identified above for Indigenous people are considered in the pVC with the direct linkage to the fVC.

7.5.2 Assessment Approach

The approach to the assessment of potential changes to groundwater quantity includes:

- Description of the relevant regulatory and policy setting
- Description of the spatial and temporal boundaries used for this pVC
- Identification of criteria and indicators along with the associated rationale
- An outline of the analytical methodology conducted for the assessment and the key assumptions and use of the conservative approach.

The assessment of potential effects is supported by a description of the existing conditions for the pVC (Section 7.5.4), the identification and description of potential effects on the pVC (Section 7.5.5) and a description of applicable mitigation measures for the pVC (Section 7.5.6). With the application of mitigation measures to the potential effects on the pVC, the changes after mitigation are then characterized in Section 7.5.7.

7.5.2.1 Regulatory Setting

The PA is located in Ontario and will need to meet applicable federal and provincial legislation and regulatory requirements. Provincial and federal regulatory agencies have prescribed criteria, benchmarks, and standards. Government policies, objectives, standards or guidelines

most relevant to groundwater quantity are summarized below. Further information regarding anticipated approval requirements is provided in Section 19.

7.5.2.1.1 Federal

There is no federal legislation or regulation pertaining specifically to groundwater quantity.

7.5.2.1.2 Provincial

The *Ontario Water Resources Act* is the principal statute governing water quantity in Ontario. It is a general management statute that applies to groundwater and surface water. Administered by the MECP, the Act contains several important regulations that protect water resources, including the Water Taking and Transfer Regulation (Ontario Regulation 387/04), which specifies requirements and triggers for approval of surface or groundwater takings for various purposes.

The *Mining Act*, as amended by the *Building More Mines Act*, and Ontario Regulation 35/24 Mine Development and Closure under Part VII of the Act sets out standards and criteria for mine closure. Specifically, with respect to groundwater, these statutes and regulations identify monitoring and certification requirements for assessing the success of closure activities in protecting groundwater from potential mining effects. Additionally, these statutes and regulations provide guidance and direction regarding progressive rehabilitation to accelerate mine site rehabilitation in advance of close out activities. The monitoring requirements for the Project related to groundwater will be developed to meet the requirements under Ontario Regulation 35/24. A description of the applicable provincial legislation and / or regulations pertaining to groundwater quality are provided in Section 7.7.

7.5.2.2 Spatial and Temporal Boundaries

Spatial boundaries are used to bound the assessment of the potential effect of changes to the Project. The PA encompasses the anticipated footprint of the Project, including all temporary and permanent areas associated with the mine site, as well as a buffer to allow flexibility for design optimizations prior to construction and over the mine life (Section 6.4).

The spatial boundaries used for the assessment of groundwater are shown in Figure 7.5-1 and are defined as follows:

- LSA: Extends from the PA to the area encompassed by the natural groundwater flow boundary. Potential changes in groundwater to surface water interactions are typically focused at the shorelines of the nearest surrounding surface water bodies. The distribution of potential effects is bound by large surface water features surrounding the PA including Chukuni River to the east, Unnamed Watercourse 7 and Unnamed Watercourse 7A and Dixie Lake to the south, and a series of lakes to the north. The boundaries to the west are assumed to be no-flow boundaries represented by either local groundwater flow divides (i.e., along local bedrock ridges) or inferred local groundwater flow lines.
- RSA: For the purposes of the effects assessment, a separate study area has not been defined and the RSA is considered the same as the LSA for this pVC. The groundwater model domain utilized in the analysis incorporates regional boundaries outside of which effects are negligible. As such, effects on groundwater are not expected to extend beyond the boundaries encompassed by the LSA.

The purpose of a temporal boundary is to identify when a potential effect may occur in relation to specific Project phases (construction, operations and closure) and activities. The temporal boundaries for the assessment as defined in Section 6.5 and primary related activities are:

- Construction phase:
 - Years -3 to -1 representing the primary period of Project construction
 - Dewatering of the underground mine workings, Viggo pit and LP Central pit will occur
- Operations phase:
 - Years 1 to 26, during Year 1 the Project will transition from construction into operations and will not be at full capacity
 - Continued dewatering of the underground mine, VMF and LP Central pit
- Closure phase:
 - Years 27 to 29 represent the active closure period when the majority of the decommissioning and reclamation of the PA is completed, mine dewatering ceases and active and passive filling of the underground mine, VMF and LP Central pit starts
 - Year 30 is a passive closure period while the site is on care and maintenance as the filling of the underground mine, VMF and LP Central pit is completed
 - Year 31 is the final close out period when water treatment infrastructure is removed, and site waters are acceptable for passive release to the environment.

Effects on the groundwater quantity were assessed for each Project phase (i.e., construction, operations and closure).

7.5.2.3 Assessment Criteria

Project activities during the construction, operations and closure phases of the Project are expected to cause changes in groundwater conditions. To evaluate the potential effects to groundwater from the baseline conditions, an indicator of changes in groundwater quantity was evaluated using the following indicators in an integrated manner:

- Flow volumes at groundwater discharge locations in m³/day
- Groundwater levels in local wells as metres above sea level (masl).

These indicators were selected based on the TISG, with additional rationale presented in Table 7.5-1.

7.5.2.4 Analytical Methods

The assessment of the groundwater effects has been completed in accordance with generally and widely accepted assessment methodologies. The prediction and assessment of effects involved the following steps:

- Identify the key pathways of interaction of the Project with groundwater through development of the PA
- Construct and calibrate a numerical groundwater model utilizing baseline conditions data that can subsequently be used to simulate future conditions

- Identify the relevant regulatory standards and criteria, and establish the appropriate assessment criteria for a site in Ontario, noting that there may be more than one applicable criterion for some of the parameters
- Predict changes to groundwater using appropriate modelling methods and established data sources
- Compare the groundwater modelling outputs to the assessment criteria, comparing effects with the corresponding applicable criteria.

As described in Section 7.5.4 and Appendix H-2, there are no potential effects to local groundwater users from the Project and effects to groundwater users are not further assessed. No springs were identified in the area during baseline investigations and none were identified in the confidential traditional land use studies received from LSFN, NWOMC and WFN. Groundwater can be a key component of the surface water environment and thus potential effects to groundwater quantity are evaluated herein as a pathway to effects of the Project on other pVCs.

The specific objectives of the hydrogeological modelling related to groundwater flows and levels were to:

- Develop a three-dimensional numerical model which reflects pre-development hydrogeological conditions to be used for calibration purposes
- Predict the effects of dewatering of the underground mine workings (underground) and open pits and on local groundwater and surface water, including:
 - Volume of inflow to the open pit and underground (at different stages of development and refilling with water)
 - Dimensions of the potential groundwater level influenced area (i.e., ZOI)
 - Changes in local surface water features flow budgets (surface watercourses and waterbodies).

The analytical methodology, including quantitative hydrogeological modelling, used to support the assessment of groundwater flows is presented in Appendix H-2 and is summarized herein.

7.5.2.4.1 Conceptual Hydrogeological Model

A conceptual hydrogeological model was developed for the Project to provide a framework that forms the basis for the construction of the numerical groundwater model. The conceptualized groundwater flow in the PA is shown in Figure 7.5-2. This diagram illustrates a northwest to southeast cross section transecting main natural components of the groundwater system already present at site from recharge to discharge. The model domain is assumed to be bounded by a series of lakes to the north, Chukuni River to the east, Unnamed Watercourse 7 and 7A and Dixie Lake to the south, which represent likely groundwater discharge locations. The model boundaries to the west are assumed to be no-flow boundaries representing either local groundwater flow divides (i.e., along local bedrock ridges) or inferred local groundwater flow lines. Within the diagram, overburden is differentiated from the bedrock, which is subdivided into five hydrostratigraphic units and four subunits, respectively, based on variations of measured hydraulic conductivities with depths which are described in Section 7.5.4.1.

A three-dimensional version of the developed hydrostratigraphic model is shown in Figure 7.5-3. In the northern PA, glaciofluvial sediments or exposed till and bedrock are found, with

predominant sand and glacial till deposits acting as a conduit to groundwater flow and can be an important recharge zone. Glaciolacustrine layers further to the south are underlain by glacial till above slightly to moderately fractured bedrock. Glacial till also acts as a local aquifer here, though low recharge and discharge are anticipated from the glaciolacustrine unit and deeper bedrock. The physical processes that control the groundwater flow system include:

- Ground surface elevations with the highest water levels generally corresponding to the topographic high areas at the north portion of the PA. These areas are either coincident with the area of glacial sand and represent the inferred groundwater recharge area at the site or are located on bedrock highs in areas where bedrock permeability is thought to be quite low, resulting in slow drainage of water table.
- Steep groundwater gradients along the area of the bedrock ridge (both north and south) coincident with the northern drainage divide between the Dixie Creek and more northern watershed, likely reflects the lower bedrock hydraulic conductivity of this ridge area.

Groundwater flow across most of the site where infrastructure is to be installed is directed primarily south and west following the general topography through a combination of:

- Areas of thicker till under Dixie Creek and lower portion of Unnamed Watercourse 3, which both could possibly connect both to further downgradient areas via till units of moderate permeability (and a zone of higher bedrock permeability resulting from the presence of open exploration drillholes) beneath Dixie Creek, and locally to Dixie Creek in the two small cascade areas beneath the creek, although discharge through these two areas will be limited by the permeability of the bedrock
- Eastward groundwater flow under Unnamed Waterbody 6, likely to discharge zones associated with eastern esker discharge area, and perhaps to Unnamed Waterbody 6, along the southern shoreline where bedrock is exposed
- An area comprising the lower portion of Unnamed Watercourse 1 and upper portions of Unnamed Watercourses 2 and 4, where groundwater discharge is contributing the cool water conditions reported in these features, and the continuous, all year flow conditions in these watercourses.

A comprehensive description of the model is provided in Appendix H-2.

7.5.2.4.2 Numerical Model

Using the conceptual hydrogeologic model as a basis, numerical groundwater flow modelling was conducted in FEFLOW 8.0 (Diersch 2014) for two mine development conditions, corresponding to key hydrogeological conditions during the lifespan of the mine, specifically:

- Pre-mining site conditions for model calibration
- Mine operations conditions to predict the effects of Project development such as open pits, underground mine and operation of the TMF, mine rock stockpile (MRS) and low grade ore stockpile (LGO) on local groundwater and surface water.

The hydrogeological model calculates the effects of mining on the local groundwater regime for mine development with respect to groundwater flow. Detailed descriptions of the development of the numerical groundwater model are provided in Appendix H-2 and are summarized below.

The numerical groundwater flow model represents a three-dimensional, steady-state flow condition, with the bedrock represented using an equivalent porous media approach. Conditions are simulated for baseline and development conditions to focus the assessment on incremental changes predicted to occur specifically as a result of Project development.

The groundwater model domain is shown in Figure 7.5-3 and is inclusive of surface water features with and adjacent to the PA. Within the model, overburden is differentiated from the bedrock, which is sub-divided into five hydrostratigraphic units and four subunits, based on variations of measured hydraulic conductivities with depth which are described in Section 7.5.4.1. Overburden units include sand deposits, glaciolacustrine clay, glaciolacustrine silt and glacial till. Bedrock subunits include: shallow bedrock (0 to 20 m), intermediate bedrock (20 to 80 m), deep bedrock 1 (80 to 300 m) and deep bedrock 2 (greater than 300 m).

Boundary conditions in the numerical model were assigned for the watercourses and waterbodies based on measured data, as available, and groundwater recharge was assigned based on ranges determined from local flow monitoring and regional studies as shown in Figure 7.5-4. A cross section view of the operations phase model is shown in Figure 7.5-5. Additional details on model development and calibration are provided in the hydrogeology modelling report (Appendix H-2).

Following base case simulations for end of mine operations and post-closure conditions, a series of sensitivity simulations were conducted to assess variability of key model outputs (i.e. groundwater inflows, outflows and seepage) to model inputs. Only variants expected in increased environmental effects were selected for simulation. Model outputs for sensitivity simulations were selected based on the sensitivity case (i.e., end of mine operations cases focused on open pit and underground groundwater inflows and post-closure cases focused on long-term seepage rates). A summary of predictive simulations conducted as part of the model assessment is provided in Table 7.5-2.

7.5.3 Assumptions and the Use of the Conservative Approach

Conservative approaches are defined as those that provide predictions that will tend to be higher than expected, as a means to confirm that potential effects from the Project will not be underestimated and feasible mitigation measures will not be overlooked. For groundwater, those approaches include the following:

- Steady-state modelling has been conducted, which allows for infinite drawdown effects on surface water receivers to accumulate. In reality, however, potential effects to receivers will progress gradually due to the buffering effects of groundwater storage, with some receivers likely never experiencing the steady-state, maximum value.
- Parameterization of the groundwater model layers, namely the hydraulic conductivity of bedrock layers, is informed primarily by the extensive single well hydraulic testing conducted at site (including packer tests and slug / bail tests) which measure properties of the fractures connected to the test interval in the immediate vicinity of the borehole (i.e., up to tens of metres of test zone sensitivity). Many of these localized fractures will have limited connectivity over the spatial scales relevant for this study (i.e., hundreds to thousands of metres). As such, the hydraulic test data will generally overestimate the representative hydraulic conductivity of bedrock over the relevant spatial scale. The result of this is additional conservatism built-in to estimated seepages through bedrock layers and groundwater inflows to the underground mine and open pits.

7.5.4 Existing Conditions

A description of the baseline conditions is presented below to characterize the existing conditions related to groundwater quantity, and is based on four years of study that has resulted in a comprehensive groundwater dataset. The existing conditions are used to support the assessment of potential effects from the Project on groundwater and will support long-term monitoring for the Project. Further information on the baseline hydrogeological conditions can be found in the hydrogeology baseline report (Appendix H-1) and hydrogeology modelling report (Appendix H-2).

The PA is located in an unorganized township and is a part of the Kenora district in northwestern Ontario. The only nearby industrial developments to the PA are the active and inactive aggregate (sand and gravel) operations along Tuzyk's Road. A search of available water well records from the MECP online Water Well Information System indicates that there are no water supply wells on the Property. All of the water supply wells are north of the Property, to the northwest, close to Boyden Creek, or north and northeast close to Gullrock Lake, and lie on far sides of groundwater divides from aspects of the Project that are likely to affect groundwater.

Terrain can be characterized as rugged and is typical of northern Ontario. Overall topographic relief across the Property ranges from about 350 to 455 masl (Figure 7.5-6), where the topographic highs typically correspond to bedrock hills and lows being at watercourse and waterbody locations. The topography reflects the glacial history of the area which has left exposed bedrock and deposited sand eskers and outwash deposits (typically sand and gravel) across some of the higher elevation northern portions of the site and lacustrine deposits in the lower elevation areas.

The topography of the LSA is dominated by a local high ridge which runs roughly northwest to southeast and is parallel to Highway 105. This topographic high ground area shows bedrock outcrops and forms the southern extent of an extensive esker feature which runs in a roughly southwest direction parallel to the eastern shore of Gullrock Lake about 15 km to the north. This topographic high ground is inferred to form the major recharge area for the PA and it also represents the surface water catchment divide between Dixie Creek to the south and Gullrock Lake and Two Island Lake to the north of the divide. A local groundwater flow divide between Dixie Creek and Gullrock Lake / Two Island Lake is also inferred to coincide with this drainage divide.

Dixie Creek is the longest water feature in the area, and meanders through a large, relatively flat swampy area as it flows toward its confluence with the Chukuni River approximately 5 km downstream of the PA. The elevation of Dixie Creek as it crosses the Property, is less than 10 m above the elevation of its confluence with the Chukuni River which is roughly 16 km downstream of Dixie Lake, reflecting the low drainage potential of the lower portion of the Dixie Creek watershed.

The regional bedrock context is shown in Figure 7.5-7. The PA lies within the Red Lake greenstone belt of the Uchi Subprovince of the Archean Superior Province of the Canadian Shield. The southwestern portion of the Property is underlain by a folded sequence of mafic volcanic flows intercalated with argillite and siltstone, iron formation, minor local felsic volcanics and minor ultramafic rocks. The association of these rocks is interpreted to be the sequence formed in a marine setting, in proximity to active venting in pre-existing anoxic basins. Felsic to intermediate rocks dominate the central portion of the property. The mafic rocks are in contact with a largely felsic / sedimentary rocks in the northeast portion of the property. Mafic volcanic

dykes and sills are common throughout the Property. They range from lamprophyre to gabbro / diorite.

Three main bedrock structural features have been identified near the PA, two shear zones and one fault zone. The two shear zones are the LP Shear Zone and the Yauro Shear Zone, lie approximately parallel to one another, and are both northwest-southeast trending features that are steeply dipping to the north. The LP Shear Zone and the Yauro Shear Zone underlie the centre of the site, including the process plant and run of mine (ROM) stockpile, LGO stockpile and the LP Central pit. The Auro Fault trends roughly north-south and dips to the east, and underlies the LP Central pit, overburden stockpile 1 (OVB1) and the MRS. The rock quality designation values are lower (less than 80) along the Auro fault, but not along the LP Shear Zone or Yauro structure, where only localized zones of lower rock quality designation were observed. Both the LP and Yauro Shear Zones intercept the underground; however, the Yauro Shear Zone only does at high elevation near the ramp entrance, and only the LP Shear Zone passes near Dixie Creek. The LP Shear Zone also intersects the underground, but at the depth of the intermediate and deep bedrock.

The overburden geology in the PA is generally composed of four units:

- Organic deposits from approximately 1 to 4 m in thickness
- Glaciolacustrine deposits which can be differentiated into:
 - Deep water deposits comprised of clay, silt, and fine sand (generally 1 to 13 m thick)
 - Glaciofluvial outwash deposits comprised of esker sand with minor gravel (generally 1 m to greater than 40 m thick)
- Glacial till deposits (gravelly to bouldery, sand to sandy silt till; generally 1 to 6 m thick).

At the higher elevations across the Property, typically above 400 masl elevation, bedrock outcrops act as the surface water catchment divide between Dixie Creek to the south and Gullrock Lake / Two Island Lake. Northeast and west of the TMF, bedrock is frequently found at or near surface, with shallow deposits of glaciofluvial sands and glacial till overlying the bedrock to the south within the footprint of the TMF. At the centre of the PA, the general sequence of overburden material where present, is sand (glaciofluvial esker and glaciolacustrine near shore deposits) followed by glacial till which overlies the bedrock, which is primarily located north of the site infrastructure and intersect the open pits, TMF and stockpiles.

Sands associated with esker deposits can be quite thick, as noted above, but much of this is often present above the water table and as such, does not represent an important aquifer. These sands primarily intersect and / or underlie the TMF, and terminate at the western limit of the MRS. At the lower elevation portions of the site (i.e., below about 380 to 390 masl elevation), the general sequence is glaciolacustrine deposits (mostly silts and clays) followed by glacial till which overlies bedrock.

The glaciolacustrine deposits primarily intersect the remaining site infrastructure including the overburden stockpile east of the MRS, as well as the open pits, and continue south of the site. The glaciolacustrine sediments show a progression from relatively shallow water deposits closer to the contact with the older till and eskers deposits near the 380 to 390 masl contact to deeper water deposits below approximately 370 masl. Organic deposits (peat) are also found at the lower elevation portions of the site, such as around Unnamed Waterbody 6 and along Dixie Creek as well, and other flat lying areas with poor drainage. Total thickness ranges from absent, in the areas of bedrock outcropping, to greater than 50 m locally.

Hydraulic conductivity data has been acquired for site materials with a total of 234 hydraulic tests consisting of 71 single well response tests in the form of either a rising or falling head test (i.e., slug / bail tests); 12 single well response tests in the form of a constant head test; one pumping test (7 hour duration); and 136 packer tests conducted in the shallow and deep bedrock in the form of either a falling head test or a constant head injection test. A pumping test was successfully completed in the sand unit.

Hydraulic conductivity was also estimated for 208 locations using the Hazen method. The locations of these hydraulic tests are shown in Figure 7.5-8. Hydraulic conductivity data show that the glaciofluvial outwash sands intersecting the TMF, process plant and MRS have generally high permeabilities, with a geometric mean of 1.3×10^{-5} m/s. Conversely, permeabilities estimated in the glaciolacustrine clay below the OVB1 and intersecting the open pits were lower, with a geometric mean of 4.2×10^{-8} m/s. The permeability of the glacial till northeast and west of the site infrastructure generally ranges between values observed in the sands and glaciolacustrine clay (4.1×10^{-8} m/s to 9.1×10^{-4} m/s) with a geometric mean of 6.8×10^{-6} .

Hydraulic conductivity testing results from boreholes which intercepted a fault or shear zone indicate that the permeability is approximately an order of magnitude greater than the country bedrock. Topographic highs which were tested in shallow bedrock displayed lower hydraulic conductivity relative to shallow bedrock in lower lying areas, which may be related to more competent, resistant bedrock being observed in bedrock topographic high areas. The mean hydraulic conductivity values for shallow bedrock from testing conducted along the bedrock ridge that dominates the drainage divide between the Dixie Creek and more northern watersheds was 3.1×10^{-8} m/s compared to the geometric mean of all shallow bedrock results. Lower hydraulic conductivity values for these bedrock highs are consistent with the high elevation water table conditions reported in monitoring wells at these locations, which would drain seasonally if the bedrock were more permeable. No material association could be determined for the different major rock types encountered in the program, when mean hydraulic conductivity values were compared against major bedrock type.

The locations of groundwater monitoring installations are shown in Figure 7.5-9. Shallow groundwater levels at the site indicate several localized highs in the northern portion of the site that correspond with topographical highs.

The AEX Program which includes the construction of the advanced exploration portals and ramps below surface will interact with natural groundwater prior to the Project development. This activity results in a pathway to a localized potential effect on groundwater due to the requirement to manage surface water that would be directed into the portals, as well as groundwater management during excavation below the groundwater table.

In the area of most site infrastructure, hydraulic gradients in the baseline condition, indicate groundwater flow is largely from the north to the south, which includes infiltration from the areas of OVB1, OVB2 and MRS that will flow towards the nearby tributaries and Dixie Creek, with some flow passing through the area of the LP Central pit. The proposed TMF is located in a partial topographic basin, where groundwater from the north and southwest is mostly directed towards the southeast. This excludes water levels within Unnamed Waterbody 1 and Unnamed Waterbody 2, which are perched above the water table in the underlying aquifer. There is also local areas of infiltration in areas of higher ground near Dixie Creek. In the eastern and southeastern, downgradient portion of the site, upward gradients are observed across

shallow clay rich horizons in low lying areas indicating limited connectivity between aquifers in the shallow and deep bedrock zones and till horizons and surface water features.

7.5.5 Identification of Potential Effects

The initial step in the assessment process is to identify interactions between the Project and groundwater that can result in pathways to potential effects. These potential effects may be direct, indirect and / or positive effects, where applicable. Table 7.5-3 includes the potential interactions of the Project with groundwater, prior to the application of the mitigation measures. The professional judgement of technical experts experienced with mining projects in Ontario and Canada as well as input from Indigenous communities, government agencies and the public informed the identification of those interactions that are likely to result in a pathway to a potential effect due to a measurable change on groundwater.

These pathways to potential effects are further described below for each phase of the Project, along with the rationale for those interactions excluded from further assessment. Section 7.5.6 and Table 7.5-4 provide a description of the mitigation measures applied during all phases of the Project. The changes after the application of the mitigation measures are then described and further evaluated in Section 7.5.7.

7.5.5.1 Construction Phase

The construction phase of the Project is expected to occur over a three-year period and will include preparation of the site and the construction of mine infrastructure. The primary interactions with the Project result in pathways to potential effects on the groundwater quantity are related to dewatering activities as described below:

- Site preparation activities for the mine site, including clearing, grubbing and bulk earthworks, interact with groundwater. These activities result in a pathway to a potential effect on groundwater flows and levels, from localized dewatering activities associated with Project excavations, and changes in surface water catchment areas contributing to groundwater. This pathway is considered in the evaluation of changes in groundwater quantity.
- Initial development of the LP Central pit, Viggo pit, and underground mine will require dewatering activities, as the develop occurs below the groundwater table. This activity results in a pathway to a potential effect on groundwater flows and levels.
- The construction of the water management facilities, including the TMF, TMF pond, MWP, VMF, holding pond(s), and a collection water pond, result in a pathway to a potential effect on groundwater due to the requirement for excavation below the groundwater table and the associated water management. This activity results in a pathway to a potential effect on groundwater flows and levels.
- The development of the Project including stockpiling and other facilities will have an effect on the infiltration rates to groundwater. While this effect is not considered material to the overall assessment, it is fully considered as a pathway to changes in groundwater quantity.
- Change in surface water catchment areas resulting from development, and the requirement to manage contact surface waters that would otherwise contribute to groundwater, will result in a pathway to a potential effect on groundwater.

The construction of other site facilities, including buildings and infrastructure, are anticipated to occur above the water table, within a small area, or over a short period of time. These activities will be effectively managed with standard best practices, such as limiting the active construction area. Similarly, the development and operation of aggregate resources is not planned below the water table, and potential effects will be effectively managed with best practices during operations including surface water management and progressive rehabilitation. As a result, there is unlikely to be potential effects on groundwater.

7.5.5.2 Operations Phase

The operations phase is anticipated to occur over a 26-year period. The following are interactions with the Project result in pathways to potential effects on groundwater quantity:

- The controlled dewatering during operation of the underground mine, LP Central pit to safely access the ore body, as well as ongoing dewatering of the VMF interacts with groundwater. This activity results in a pathway to a potential effect on groundwater quantity demonstrated by the drawdown within the LSA. The assessment of potential effects on groundwater from this pathway includes the evaluation of changes in groundwater quantity.
- Operation of water management and treatment facilities, including the TMF, TMF pond, MWP, and the VMF, and construction of the MWP if required, interacts with groundwater. This activity results in a pathway to a potential effect on groundwater quantity due the requirement to collect and manage, runoff and groundwater seepage. The assessment of potential effects on groundwater from this pathway includes the evaluation of changes in groundwater quantity.
- Operation of the overburden stockpiles and ore stockpiles interacts with groundwater. This activity results in a pathway to a potential effect on groundwater due to changes to infiltration rates, the requirement to collect and manage runoff and in some cases, groundwater seepage. The assessment of potential effects on groundwater from this pathway includes the evaluation of changes in groundwater quantity.

The operation of the process plant and mine site infrastructure is not expected to interact with groundwater. Similarly, progressive reclamation activities are not anticipated to affect groundwater during operations.

7.5.5.3 Closure Phase

Dewatering activities will cease during the active closure period, accordingly the changes to groundwater quantity are positive. The following interactions with the Project result in pathways to potential changes in groundwater as described below:

- Closure and restoration of the LP Central pit, VMF and underground mine will commence with the termination of water management within the open pits and underground at the end of the mine life and the recovery of water levels through passive and active filling which occurs over approximately four years; Section 5.19.3, groundwater infiltration, precipitation and surface runoff. During this time, the local groundwater levels will gradually recover until the open pits and underground fills to pre-construction water levels, at which time groundwater levels will stabilize at their final post closure level similar to levels at baseline. The assessment of potential effects on

groundwater from these pathways includes the evaluation of changes in groundwater quantity.

- The reclamation of impacted areas includes stabilizing disturbed areas, such as by re-grading, placement of an appropriate cover to facilitate revegetation, if needed, and revegetation (active or passive) of the site. In addition, the closure of the water management facilities will change catchment areas for groundwater. These activities interact with groundwater and results in pathways to potential effects on groundwater quantity due to changes in water management from altered catchment areas, and changes in water quality from seepage. The assessment of potential effects on groundwater from these pathways includes the evaluation of changes in groundwater quantity.

During closure, the removal of assets, demolition of remaining materials, disposal of demolition-related wastes and monitoring are not expected to have an interaction with groundwater as excavation below the water table is not anticipated.

7.5.6 Mitigation and Enhancement

Measures to be implemented to avoid or minimize the effects of the Project on groundwater include:

- Development of a compact mine site to limit the areal extent of disturbance, and to limit the overall areas of contact water that requires management which will minimize reductions to groundwater infiltration associated with contact surface water management.
- During construction, operation and active closure, an integrated water management system will be operated to collect and control contact water from the stockpiles, TMF and plant site areas. Collected contact water will be used in ore processing to minimize requirements for fresh water that could potentially be sourced from groundwater. During construction and operations, ponds collecting water requiring treatment for parameters other than suspended solids will be designed for low permeability or located in areas where downgradient seepage is captured or contained.
- During construction and operations, grouting will be used to seal off open exploration drillholes and large open fractures proximal to the underground mine, to reduce inflows into the underground.
- During operations and closure phases, installation of a sheet pile / grout wall is anticipated to be completed to support open pit stability, which will limit the potential impacts of dewatering on potential flows within the Dixie Creek.
- During the closure phase, the LP Central pit, VMF and underground workings will be actively filled with redirected site runoff and fresh water from the Chukuni River, to accelerate the return of groundwater levels to baseline conditions (Section 5.19.3), faster than passive filling that would occur once dewatering ceases.

The application of mitigation measures for the pathways of potential effects is illustrated in Table 7.5-4. Mitigation measures described in this section are expected to be effective for their intended purposes given their effective implementation at similar projects.

Monitoring programs will be implemented to verify the accuracy of the predicted effects, assess the effectiveness of the implemented mitigation measures that may be further optimized in response to monitoring data.

7.5.7 Assessment of Changes

A numerical groundwater flow model incorporating pre-mining site conditions for model calibration, was used to predict the effects of Project development on local groundwater flows and levels in an integrated manner. Detailed descriptions of the numerical groundwater model are provided in Appendix H-2.

Changes to groundwater flows and levels, after the application of proposed mitigation, were subsequently characterized using both quantitative modelling as well as qualitative methods. After the application of mitigation measures, predicted changes to groundwater are driven by changes to local groundwater catchment area and flow regime as a result of the development of mine site infrastructure, including open pit development, underground, and dewatering activities. These changes are further considered for the potential to affect the water quantity of surface water features in the PA and LSA.

Changes to groundwater identified and discussed below have been integrated into the surface water modelling for the Project (Appendix I-3 and Appendix K-3) and the associated effects assessment for surface water system pVC (surface water flows and levels, Sections 7.6) and water quality pVC (Section 7.7) as applicable.

The modelled potential effects of the Project on groundwater levels and flows during mine construction and operation are that:

- Recharge will increase in the vicinity of the of the south TMF dam and MWP during mine operations. This is expected and typical of all similar mine facilities as they are built up over time.
- The underground mine, LP Central pit and Viggo pit / VMF will generally act as a sink to groundwater flow (i.e., hydraulic low), drawing groundwater into the underground and pits from areas immediately adjacent during mine operations. This is expected and typical of all underground and open pit mining operations and is reversible in closure.

A base case and sensitivity analyses were conducted to assess the variability of the modelled open pit and underground groundwater inflow rates, and groundwater - surface water interactions at other surface water bodies. Sensitivity analysis was done to illustrate how variation in input parameters could affect the results for the modelling and result in an increase environmental effect (e.g., increase groundwater inflow rates to the LP Central pit). Predicted inflows to the LP Central pit, VMF, and underground for end of mine operations phase for the base case and identified sensitivity variants, as well as the base case for post-closure conditions are provided in Appendix H-2.

Groundwater flows into the LP Central pit, VMF and underground will be pumped out to maintain a dry work environment during the first 10 years of operations. Subsequently, water levels will increase in the east and west VMF during operations. The ZOI is predicted to extend between less than 1 to 3 km from the centre of the PA (Figure 7.5-10). A few isolated groundwater drawdown cones observed further to the northwest of the PA are caused by local pumps and tailings ditches.

The 1 m drawdown head within the glacial till / shallow bedrock unit is not projected to extend outside the LSA, noting that this is considered a very conservative estimate as this assumes long-term, simultaneous full dewatering of the LP Central pit and Viggo pit / VMF, as well as the underground mine which are not expected to happen simultaneously.

Following the completion of mining activities, the LP Central pit, VMF and underground mine will also be passively and actively filled with water, returning to water levels that will be similar to the baseline condition within a period of approximately four years (Section 5.19.3). There is no dewatering effect to groundwater flows and levels remaining after recovery is complete.

Water budget analysis shows that the net inflow from the groundwater system to lakes is expected to change by less than 2%, which is within the range of normal interannual variability, with the exception of Unnamed Waterbody 6 and Unnamed Watercourse 4 and 6A. The average annual baseflow from groundwater in Dixie Creek is expected to decline by approximately 0.6%, though flow will be supplemented during operations with water from the MWP that has been processed through membrane filtration.

7.5.8 Change Pathway Outcome

7.5.8.1 Summary of Changes after Mitigation

After implementation of the proposed mitigation measures, there is a reduction of groundwater flows and levels during the construction and operations phases that is mitigated during closure. This temporary change during construction and operations will be reflected in some surface watercourses and waterbodies within or adjacent to the PA that will experience an overall reduction in groundwater contributions to baseflow to the watercourses and waterbodies, as mine dewatering will cause the LP Central pit, Viggo pit, and underground mine to act as local sinks for groundwater during the construction and operations phases, and has been carried forward to the analysis of changes in other pVCs and fVCs, as appropriate.

After the filling of the underground, LP Central pit and VMF with water, groundwater flows and levels will recover to near baseline conditions.

The predicted maximum areal extent of changes to groundwater level is illustrated in the Figure 7.5-10. The green lines represent the depth of the expected drawdown due to a fully dewatered state of the underground mine workings, Viggo pit, and LP Central pit. This simulation is intended to depict a conservative, worst-case scenario, and as these activities are not predicted to occur at their maximum extent simultaneously during any Project phase; the expected zone of change is expected to occur over a smaller geographic area. Appendix H-2 outlines the expected extent of the ZOI and changes in groundwater levels and flow volumes across the LSA in detail.

7.5.8.2 Change Management

The changes to groundwater flows and levels are managed through existing provincial regulatory mechanisms. In Ontario, an approval is required under the *Ontario Water Resources Act* for groundwater takings for various purposes. The approval will require monitoring of groundwater levels in accordance with an approved monitoring plan, as well as regular data reporting to the MECP, including water taking rates. Recording and reporting on complaints to the MECP is also required.

7.5.8.3 Confidence

The level of confidence in the prediction is considered to be high. The predicted effects are determined using well-established models and do not consider supplemental mitigation factors (i.e., bedrock grouting) beyond the measures already described, lag and travel times or naturally occurring attenuation processes and therefore likely over-predict effects. Input data used in predictive modelling are of high quality, and in the range of existing and projected variability in both the existing regime and the mine-influenced regime have been considered in the model sensitivity cases that have been applied (Appendix H-2). The conservative approach of the assessment demonstrates that predicted effects on groundwater as well as surface-groundwater interactions are not underestimated, and with the application of mitigation measures, there will be reliable environmental protection. Groundwater monitoring will be ongoing in the construction, operations, and closure phases and will support the validation of the predictions.

Table 7.5-1: Assessment Criterion, Indicators and Rationale

Criterion	Indicators	Rationale
Change in groundwater quantity	<ul style="list-style-type: none"> • Flow volumes at groundwater discharge locations (m³/day) • Groundwater levels in local wells (masl) 	<ul style="list-style-type: none"> • Groundwater to surface water interactions a key factor of environmental importance for groundwater, as they related to both groundwater-surface water balance effects due to open pit development dewatering and seepage management for site infrastructure to the receiving environment via subsurface pathways • Groundwater levels are the most reliable indicator of Project effects on the local groundwater system as they are readily measured and provide an assessment of the effects on groundwater flows.



Table 7.5-2: Groundwater Model Simulations

Scenario / Project Phase	Underground workings		Open Pits			Tailings	Stockpiles	MWP	TMF pond
	AEX Workings ⁽¹⁾	Project (Mine) Workings	LP Central pit	Viggo pit / West VMF	Viggo pit / East VMF				
Pre-Project (AEX Program)	Dewatered	na ⁽²⁾							
Maximum Dewatering Impacts Estimation	Dewatered	Dewatered	Dewatered	Dewatered	Dewatered	Yes	na ⁽²⁾	na ⁽²⁾	Yes
Operations Phase (10 years after Viggo pit finished)	Dewatered	Dewatered	Dewatered	Filled at 289 masl	Filled at 345 masl	Yes	MRS and LGO	na ⁽²⁾	Yes
Operations Phase (21 years after Viggo pit finished)	Dewatered	Dewatered	Dewatered	Filled at 304 masl	Filled at 345 masl	Yes	MRS and LGO	na ⁽²⁾	Yes
Operations Phase (with MWP constructed)	Dewatered	Dewatered	Dewatered	Filled at 304 masl	Filled at 345 masl	Yes	MRS and LGO	Yes	Yes
Closure Condition ⁽³⁾	Filled at 355 masl		Filled at 353 masl	Filled	Filled	Yes	MRS	na ⁽²⁾	na ⁽²⁾

Notes:

1. AEX workings are considered as part of underground mine workings.
2. na : not applicable indicates that this Project feature was not simulated in this scenario.
3. Under closure conditions, MWP and TMF pond will be removed, pump stations and related tailings ditches will be disabled.

Table 7.5-3: Potential Interactions of Project Components with Groundwater

Project Component / Activity	Groundwater
Construction Phase	
Site preparation activities	Yes
Establishment and operation of water management and treatment facilities	Yes
Open pit mining	Yes
Underground mining	Yes
Management of rock and unconsolidated materials in stockpiles	Yes
Establishment of onsite fish habitat and compensation measures	- ⁽¹⁾
Establishment of onsite aggregate operations	- ⁽¹⁾
Construction of the starter embankments for the TMF	Yes
Construction and operation of buildings and infrastructure	-
Waste management	-
Commissioning of the process plant	-
Power supply	-
Employment and expenditures	-
Operations Phase	
Underground mining	Yes
Mining of the LP Central pit	Yes
Management of rock and unconsolidated materials in stockpiles	Yes
Process plant operation	-
Management of desulphurized tailings in the TMF	Yes
Management of concentrate tailings and contact water in the VMF	Yes
Operation of water management and treatment facilities	Yes
Construction of a MWP	Yes
Operation and maintenance of buildings and infrastructure	-
Waste management	-
Power supply	-
Progressive reclamation activities	-
Employment and expenditures	-



Project Component / Activity	Groundwater
Closure Phase	
Active closure period	Yes ⁽²⁾
Passive closure period	Yes ⁽²⁾
Final reclamation period	-
Employment and expenditures	-

Notes:

- : The interaction is not expected to be material, and no further assessment is warranted.

1. The interaction is related to changes in infiltration rates and is not expected to be material to groundwater quantity, and no further assessment is warranted.
2. During the closure phase dewatering is discontinued and the mine workings are being passively and actively filled, resulting in a positive interaction with groundwater levels.

Table 7.5-4: Mitigation Measures for Changes to Groundwater

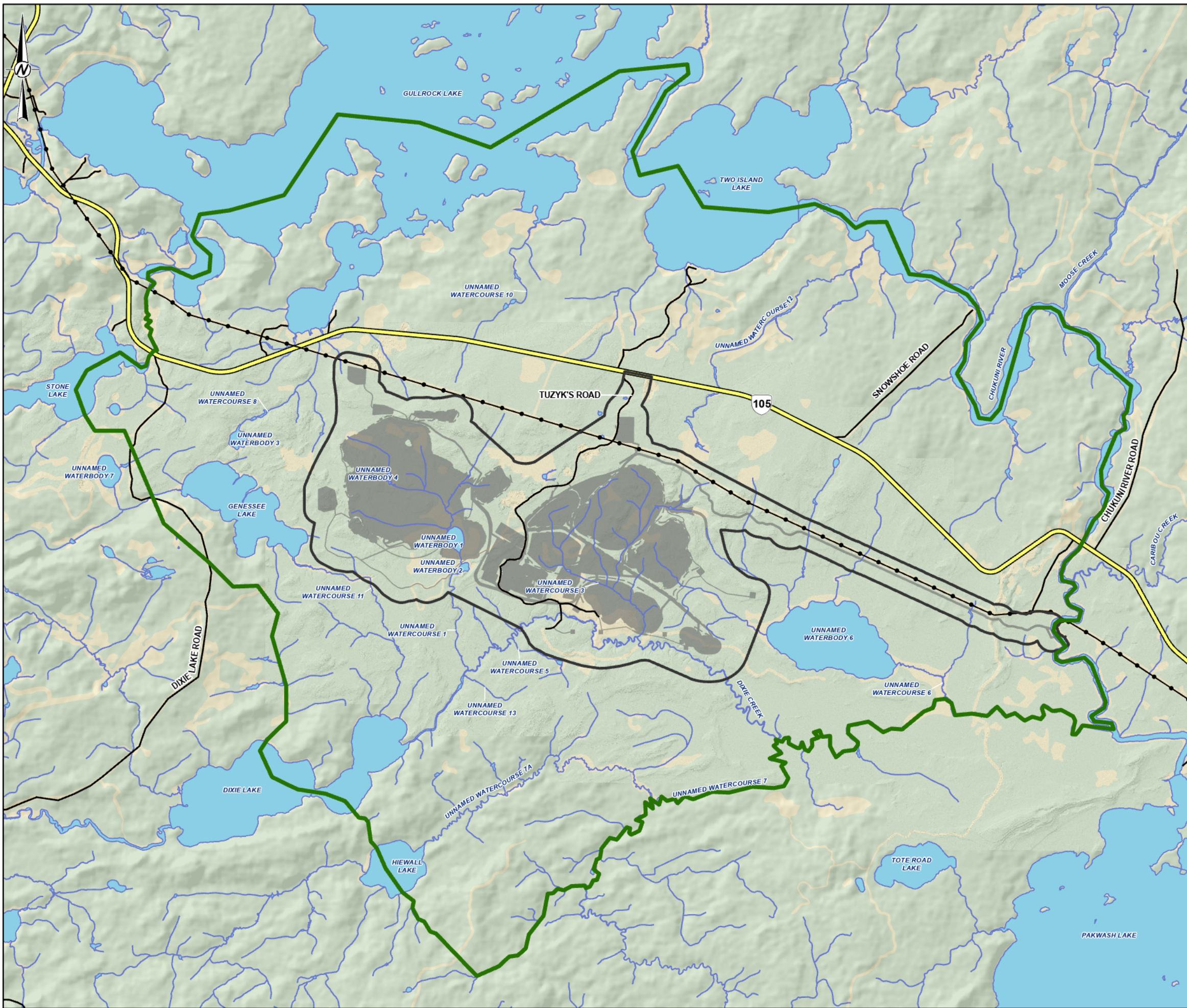
Pathways to Potential Effect	Phase			Proposed Mitigation Measures
	Con	Op	Cl	
Change in groundwater quantity	•	•	•	Development of a compact mine site to limit the areal extent of disturbance, and to limit the overall areas of contact water that requires management.
	•	•	-	Re-using collected contact water to minimize need for fresh water, including from groundwater source(s)
	•	•	-	Grouting will be used to seal off open exploration holes and large open fractures to reduce inflows into the underground. A sheet pile or grout wall will be placed between the LP Central pit and Dixie Creek where the open pit approaches the creek.
	-	-	•	Active filling in a controlled manner of the LP Central pit, VMF, and underground mine workings, to accelerate the return of groundwater levels to baseline conditions while maintaining water levels in the Chukuni River.

Notes:

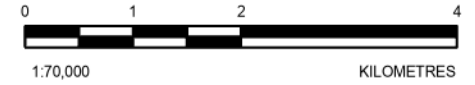
Con: Construction; Op: Operation; Cl: Closure

• : Mitigation is applicable.

- : Mitigation is not applicable.



- LEGEND**
- GREAT BEAR PROJECT FOOTPRINT
 - PROJECT AREA
 - LOCAL AND REGIONAL STUDY AREAS FOR GROUNDWATER
 - HIGHWAY
 - LOCAL ROAD
 - EXISTING TRANSMISSION LINE
 - WATERCOURSE
 - WATERBODY



NOTE(S)
 1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
 1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
 2. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
 3. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
 4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
 GREAT BEAR RESOURCES

PROJECT
 GREAT BEAR PROJECT

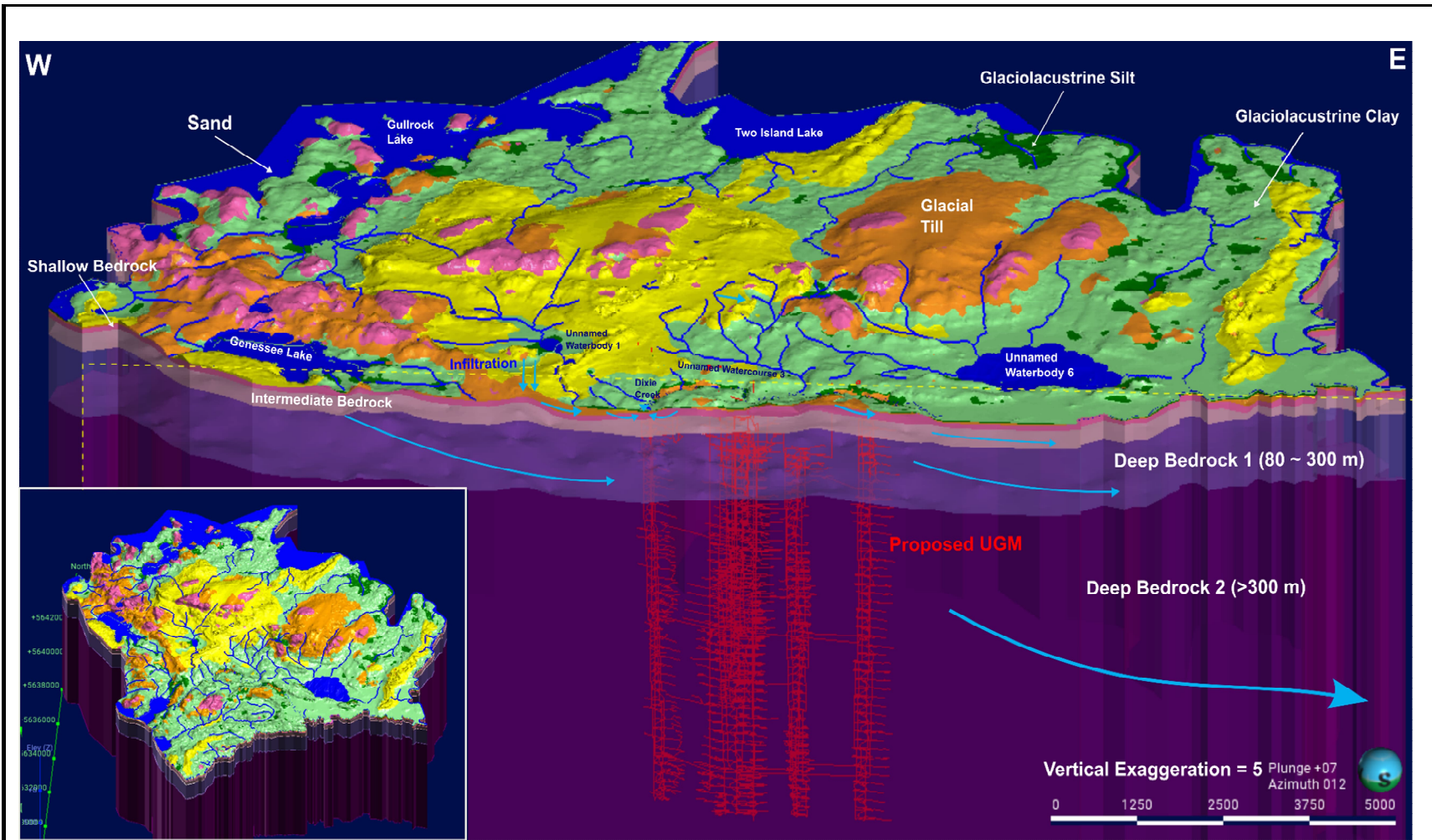
TITLE
 LOCAL AND REGIONAL STUDY AREAS FOR GROUNDWATER

CONSULTANT	YYYY-MM-DD	2026-03-31
	DESIGNED	---
	PREPARED	MD
	REVIEWED	---
	APPROVED	SD

PROJECT NO. CA0031271 CONTROL 0001 REV. A FIGURE 7.5-1

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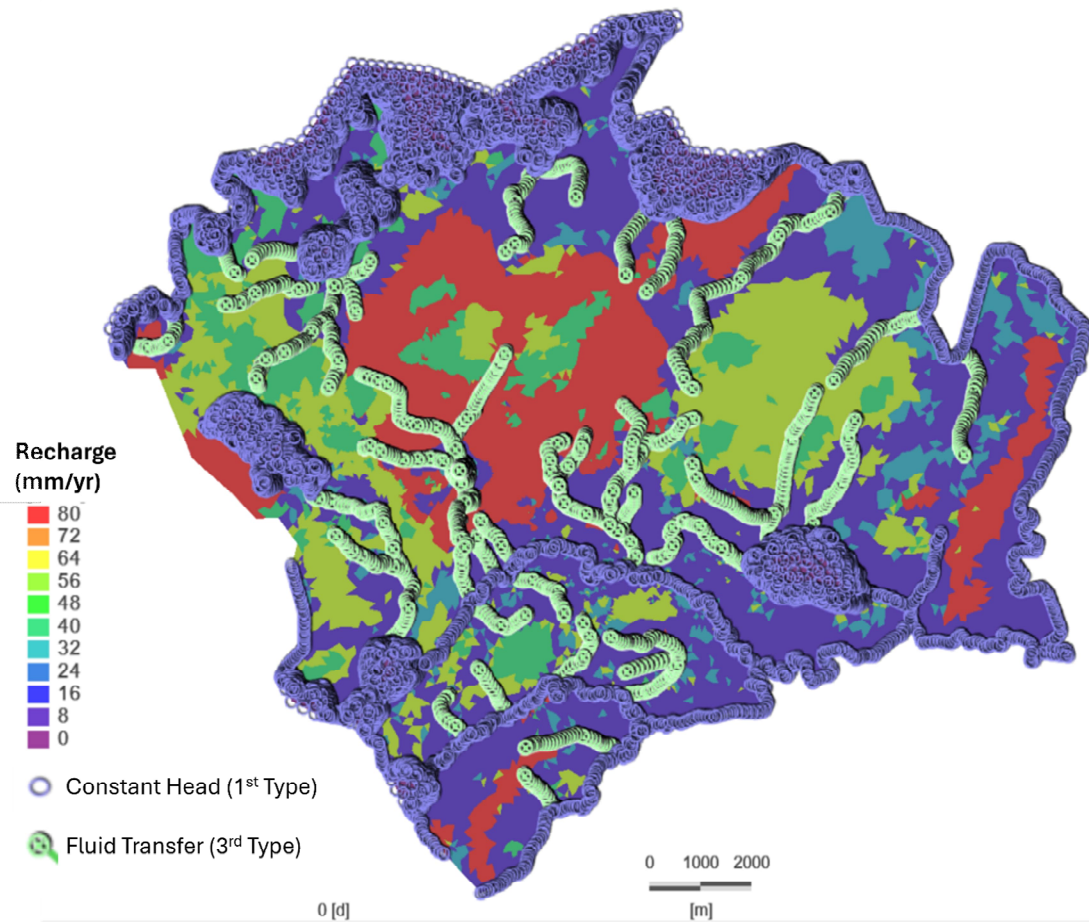
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Notes



3D Hydrostratigraphy Model			
Great Bear Project			
Great Bear Resources			
Figure Number		7.5-3	
Project Number		OMEMA2303	
Date		August 2024	
Drawn	TY	Reviewed	SG



Recharge
(mm/yr)

- 80
- 72
- 64
- 56
- 48
- 40
- 32
- 24
- 16
- 8
- 0

- Constant Head (1st Type)
- Fluid Transfer (3rd Type)

0 1000 2000
[m]

0 [d]

Notes

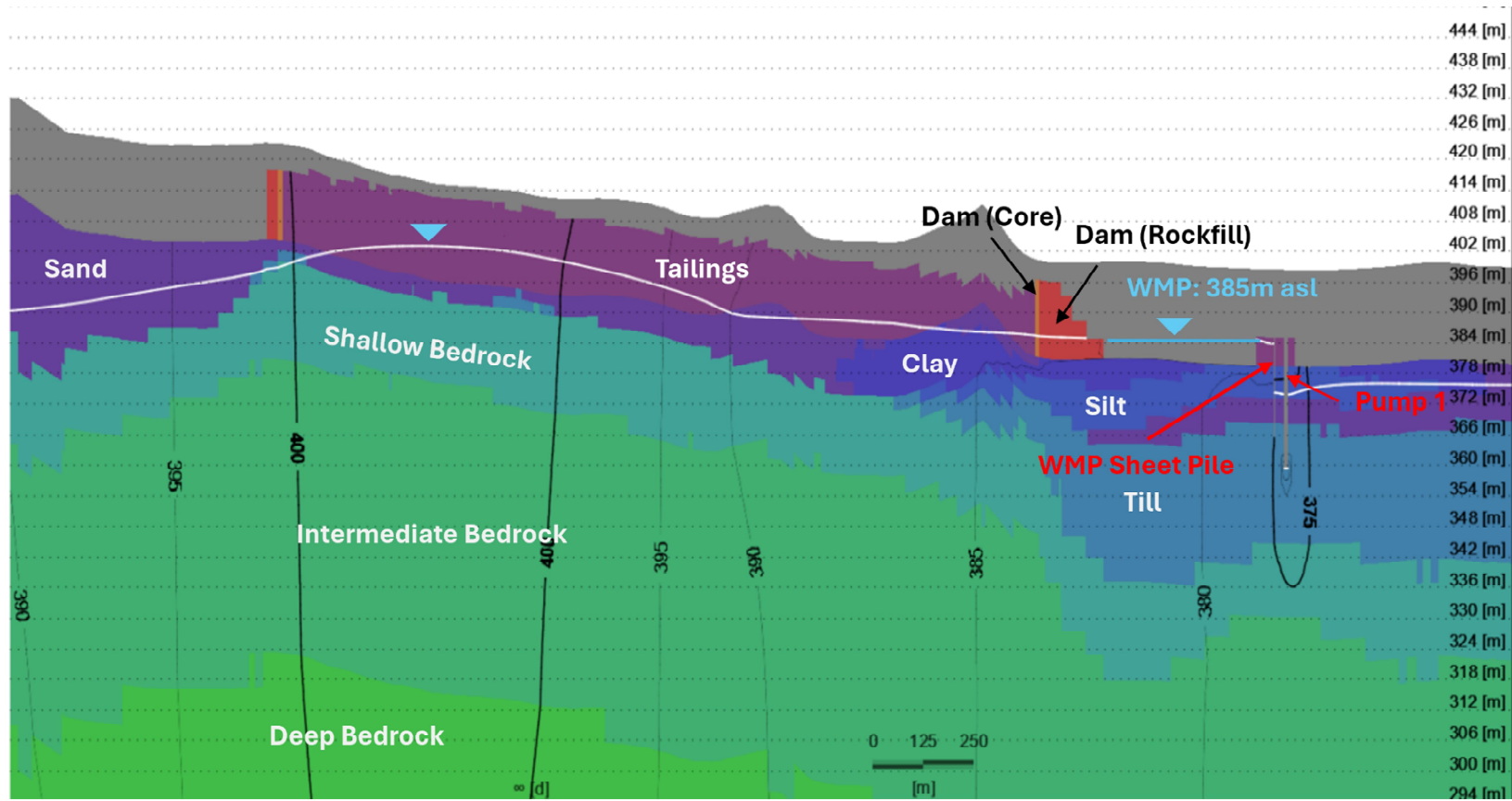


Model Boundary Conditions

Great Bear Resources

Great Bear Project

Figure Number		7.5-4	
Project Number		OMEMA2303	
Date		August 2024	
Drawn	TY	Reviewed	SG



Notes

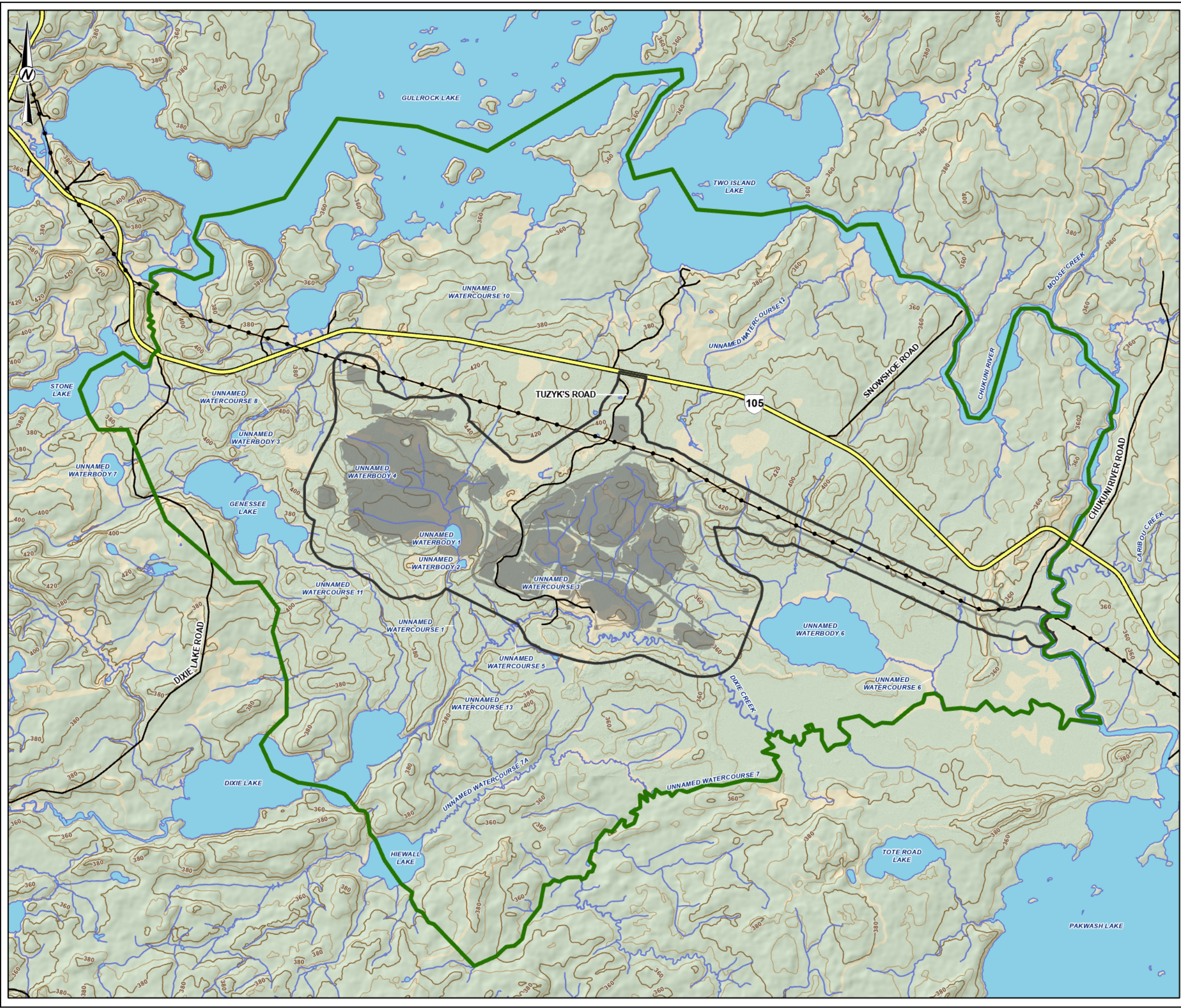


Numerical Model Cross Section

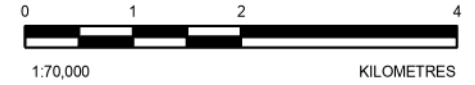
Great Bear Project

Great Bear Resources

Figure Number	7.5-5
Project Number	OMEMA2303
Date	August 2024
Drawn	TY
Reviewed	SG



- LEGEND**
- GREAT BEAR PROJECT FOOTPRINT
 - PROJECT AREA
 - LOCAL AND REGIONAL STUDY AREAS FOR GROUNDWATER
 - HIGHWAY
 - LOCAL ROAD
 - EXISTING TRANSMISSION LINE
 - MAJOR CONTOUR (20 M INTERVAL)
 - MINOR CONTOUR (10 M INTERVAL)
 - WATERCOURSE
 - WATERBODY



NOTE(S)
 1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
 1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
 2. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
 3. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
 4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
 GREAT BEAR RESOURCES

PROJECT
 GREAT BEAR PROJECT

TITLE
 SITE TOPOGRAPHY

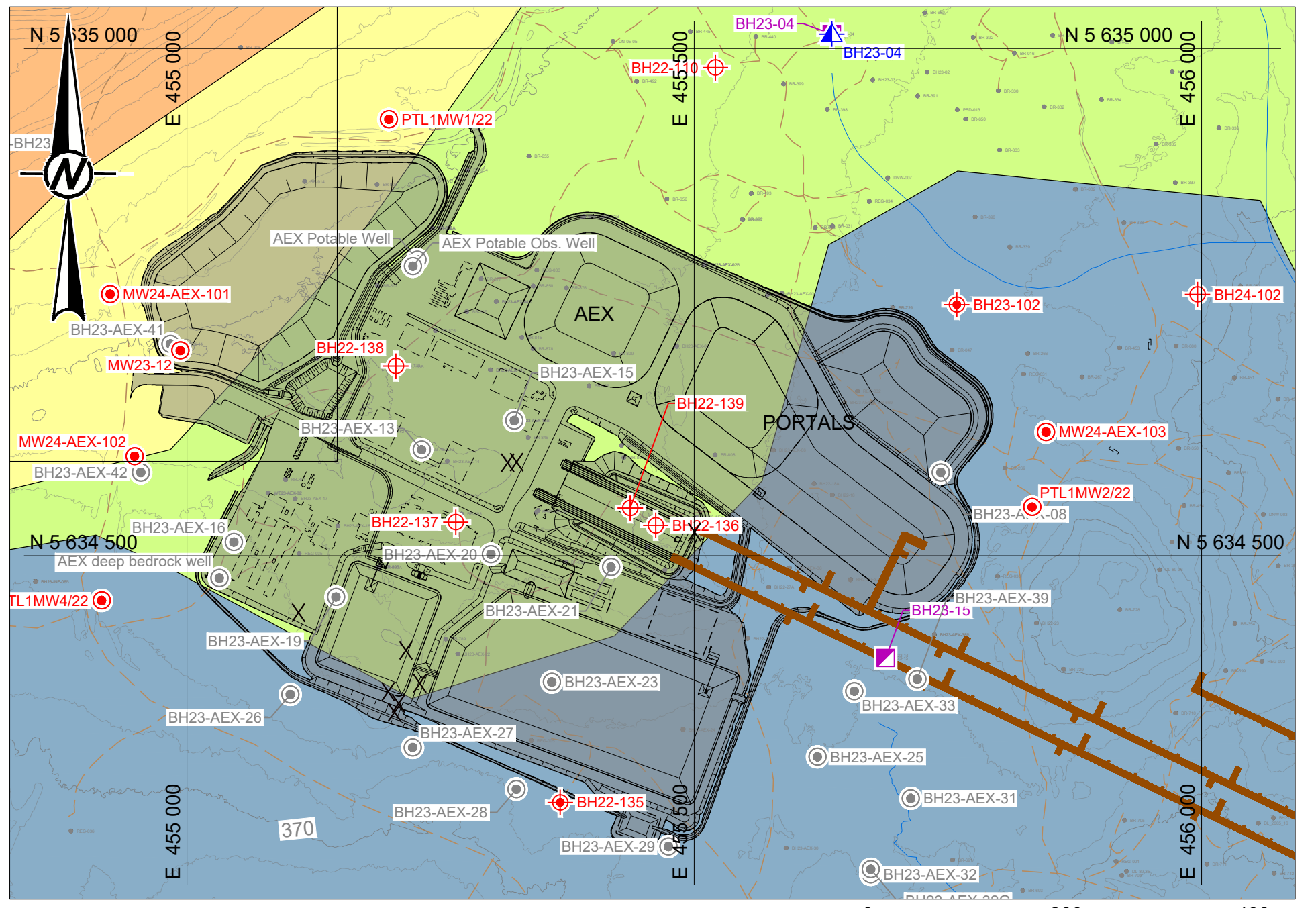
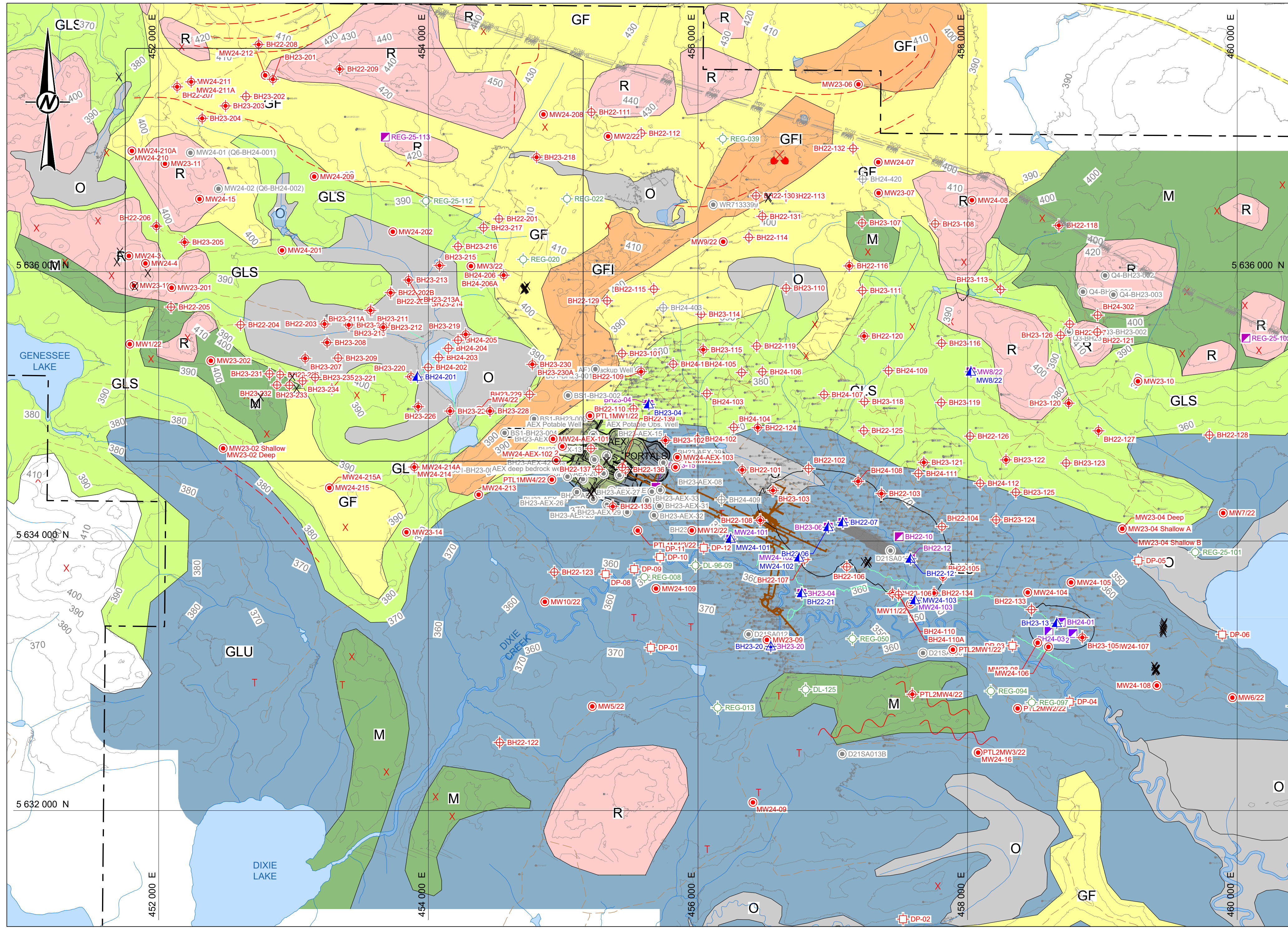
CONSULTANT	YYYY-MM-DD	2026-03-31
	DESIGNED	---
	PREPARED	MD
	REVIEWED	---
	APPROVED	SD

PROJECT NO. CA0031271 CONTROL 0001 REV. A FIGURE 7.5-6

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AEX AREA
SCALE 1:5,000 m
0 200 400
1:5,000 METRES

LEGEND

O	ORGANIC DEPOSITS: PRIMARILY PEAT, BUT CAN INCLUDE ORGANIC CLAY AND OTHER HOLOCENE DEPOSITS.
GLS	GLACIOLACUSTRINE SHORELINE: SAND AND SILT, INCLUDES GRAVEL AND COBBLES AT SOME LOCATIONS; SHORELINE AND SHALLOW WATER DEPOSITS.
GLU	GLACIOLACUSTRINE DEEP WATER: CLAY, OFTEN VARVED WITH SILT LAMINAE, AND SILTY CLAY; DEPOSITED IN GLACIAL LAKE AWAY FROM ICE MARGIN.
GL	GLACIOLACUSTRINE UNDIFFERENTIATED: CLAY, SILT, INCLUDING FINE SAND.
GF	GLACIOFLUVIAL: SAND AND SILTY SAND, CAN INCLUDE GRAVEL; OUTWASH DEPOSITS THAT MAY HAVE FORMED IN SUB-AQUEOUS FANS AND SIMILAR ENVIRONMENTS.
GFI	ICE CONTACT GLACIOFLUVIAL: SAND AND GRAVEL, INCLUDES COBBLES, BOULDERS AND MAY INCLUDE SOME FINER GRAINED STRATIFIED SEDIMENTS; FORMED IN ESKERS AND OTHER SUBGLACIAL AND ICE MARGIN ENVIRONMENTS.
M	GLACIAL TILL: MIXTURE OF SAND, SILT, GRAVEL, COBBLES, BOULDERS, AND SOME CLAY; LIKELY DEPOSITED SUBGLACIALLY; MAY INCLUDE SOME STRATIFIED DEPOSITS; ALSO REFERRED TO AS MORAINIC; OFTEN INTERSPERSED WITH BEDROCK OUTCROPS.
R	BEDROCK: ARCHEAN BEDROCK - INCLUDING METAVOLCANICS, METASEDIMENTS, AND PLUTONIC ROCKS; OFTEN INTERSPERSED WITH MORAINIC, WITH A DISCONTINUOUS VENEER OF TILL OR SAND.

	GEOLOGICAL BOUNDARY, APPROXIMATE		CONTOURS (10 m INTERVAL)
	SMALL BEDROCK OUTCROP		RIVER / CREEK
	BEDROCK OUTCROP (LOCATION PROVIDED BY KINROSS)		PROPERTY LINE
	SMALL OUTCROPS OF TILL		TRACE OF GEOPHYSICAL SURVEY
	TRANSVERSE MORAINIC RIDGE		ROAD / TRAIL
	ABANDONED SHORELINE FEATURE		HIGHWAY
	SAND OR GRAVEL PIT		TRANSMISSION LINE (EXISTING)

	BH24-101	WSP BOREHOLE		MW24-210	WSP MONITORING WELL		BR-499	EXPLORATION DRILLHOLE
	BH24-108	WSP BOREHOLE WITH MONITORING WELL		BS1-BH23-004	NON-WSP MONITORING WELL		DP-01	DRIVE POINTS
	BH24-201	WSP BOREHOLE WITH VIBRATING WIRE PIEZOMETER		BH22-10	PACKER TEST			

- REFERENCE(S)**
- EXISTING GROUND CONTOURS PROVIDED BY KINROSS, FILE NAME: "22_Kinross_GreatBear_MainArea_1m_Contours_EXT.dwg", SURVEYED: 29 SEPTEMBER 2022, RECEIVED: 24 JANUARY 2024.
 - WATERCOURSE AND WATERBODY DATA, LOCAL ROADS, AND HIGHWAYS OBTAINED FROM LAND INFORMATION ONTARIO (MNRF), AND MODIFIED TO MATCH AERIAL IMAGERY AND LIDAR.
 - AEX AND MINE SITE PLAN, PITS AND STOCKPILES (VERSION 20) PROVIDED BY KINROSS AS MULTIPLE SHAPEFILES, RECEIVED: 18 FEBRUARY 2025.
 - THE QUATERNARY GEOLOGY MAP IS FROM WSP (2025).

CLIENT	GREAT BEAR RESOURCES	CONSULTANT	WSP
DATE	YYYY-MM-DD	DATE	2025-10-08
DESIGNED		PREPARED	MM
REVIEWED		APPROVED	

PROJECT	GREAT BEAR PROJECT	TITLE	MONITORING WELL AND BOREHOLE LOCATIONS
PROJECT NO.	CA0031271_9255 0001	CONTROL	
REV.	A	FIGURE	7.5-9

NOT FOR CONSTRUCTION
0 500 1,000
1:17,500 METRES

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

7.6 Analysis of Changes to Surface Water Flows and Levels

Surface water flows and levels is included as a pVC because it is a key ecosystem element, is of provincial regulatory interest and was identified of importance during engagement. Changes to surface water quality are considered in Section 7.7.

7.6.1 Pathway Linkages to other Valued Components

7.6.1.1 Pathway Linkages to Surface Water Flows and Levels

There is a pathway effect from groundwater quantity (Section 7.5) to surface water flows and levels. Changes in groundwater quantity may affect surface water flows and levels.

7.6.1.2 Pathway Linkages from Surface Water Flows and Levels to fVCs

Changes to surface water flows and levels may have linkages to, and inform, the analysis of potential effects on the fVCs fish and fish habitat, migratory birds and Indigenous Peoples. Changes to surface water flows and levels may affect the availability of fish habitat where fish live. Surface water flow and level changes resulting from the Project may change the local vegetation communities and habitat used by migratory birds. Changes to surface water flows and levels may also affect the current use of lands and resources for traditional purposes, including access (Sections 10.6, 11.6, 12.6, 13.6 and 14.6).

7.6.2 Assessment Approach

The assessment of potential effects is supported by a description of the existing conditions for the pVC (Section 7.6.4), the identification and description of applicable pathways of potential effects on the pVC (Section 7.6.5) and a description of applicable mitigation measures for the pVC (Section 7.6.6).

The approach to the assessment of potential changes to surface water flows and levels includes:

- Description of the relevant regulatory and policy setting
- Description of the spatial and temporal boundaries used for this pVC
- Identification of criteria and indicators along with the associated rationale
- An outline of the analytical methodology conducted for the assessment and the key assumptions and use of the conservative approach.

With the application of mitigation measures to the potential effects on the pVC, the changes are then characterized in Section 7.6.7.

7.6.2.1 Regulatory Setting

The Project is located in Ontario and will need to meet applicable federal and provincial legislation and regulatory requirements. Provincial and federal regulatory agencies have prescribed criteria, benchmarks and standards. Government policies, objectives, standards or guidelines most relevant to surface water flows and levels are summarized below. Further information regarding anticipated approval requirements is provided in Section 19.

7.6.2.1.1 Federal

There is no federal legislation or regulation pertaining specifically to surface water flows or levels. Both the *Fisheries Act* and *Canadian Navigable Waters Act* have provisions related to maintaining surface water flows and levels for fish and navigation.

The responsibility for the management of fisheries resources in Canada falls under the *Fisheries Act* and is administered primarily by DFO. Section 35(1) prohibits any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat. The fish and fish habitat protection provisions apply to all fish and fish habitat throughout Canada. A 10% to 15% reduction or increase in instantaneous flows is considered to be unlikely to have detectable ecological effects on downstream habitat, based on guidance provided in Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada (DFO 2013a) and A Desk-top Method for Establishing Environmental Flows in Alberta Rivers and Streams (Locke and Paul 2011).

The *Canadian Navigable Waters Act* administered by Transport Canada (TC) regulates interference with the public right to navigation in both scheduled and non-scheduled navigable waterways. There are no watercourses or waterbodies listed on the Schedule to the *Canadian Navigable Waters Act* that may be affected by the Project.

7.6.2.1.2 Provincial

There are no specific criteria or benchmarks applicable to surface water flows and levels in Ontario. Water flows and levels are managed through Project approvals processes.

The *Ontario Water Resources Act* is the principal statute governing water quantity in Ontario. It is a general management statute that applies to groundwater and surface water. Administered by the MECP, the Act contains several important regulations that protect water resources, including:

- Ontario Regulation 387/04: Water Taking and Transfer Regulation, which requires a permit for water takings, generally more than 50,000 L/d. Section 34 of the Act requires the proponent to obtain a Permit to Take Water, and Section 9 of Ontario Regulation 387/04 requires all permit holders to collect, record and report data on daily volumes of water withdrawals.
- Section 53 of the Act requires that an Environmental Compliance Approval be obtained for industrial sewage systems that release or discharge, store, or transport contaminants to surface water and groundwater.

The *Environmental Protection Act* is the principal pollution control statute in Ontario and is used in conjunction with the *Ontario Water Resources Act* to manage development activity that may affect water quality. The *Environmental Protection Act* contains general provisions that can be used to protect surface water.

The *Lakes and Rivers Improvement Act* administered by the MNR, governs design, construction, operation, maintenance and safety of dams in any lake or river or any defined portion of a lake or river. MNR approval is required for any work that forwards, holds back or diverts water, such as channelization, pond creation or bypass, dams, weirs and locks. Thus, a mine cannot construct a dam or a feature acting as a dam in a watercourse or lake without written approval.

The Ontario *Mining Act*, as amended by the *Building More Mines Act* and related regulations sets out standards and criteria for mine closure, including related to surface water flows and levels. The monitoring requirements during closure for the Project related to surface water will be developed to meet the regulatory requirements.

The Operation, Maintenance, Surveillance and Safety Manual for the Snowshoe Rapids Dam (Hatch 2009) is a compilation of information used to operate, maintain and monitor the condition of the Snowshoe Rapids dam on the Chukuni River to support safe operation. It outlines objectives and provides seasonal target elevations for dam operation. Dam operations control the flow in the Chukuni River, including at the treated effluent discharge location for the Project.

7.6.2.2 Spatial and Temporal Boundaries

Spatial boundaries are used to support consistent descriptions across disciplines and bound the assessment of the potential effects of the Project. The PA is consistent for all pVCs and fVCs, and encompasses the anticipated footprint of the Project, including all temporary and permanent areas associated with the mine site, as well as a buffer to allow flexibility for design optimizations prior to construction and over the mine life (Section 6.4). The spatial boundaries used for the assessment of surface water flows and levels are defined as follows:

- LSA: The LSA for surface water flows and levels corresponds to the area around the PA where most of the surface water flow and level effects of the Project are expected to occur and can be predicted or measured with a reasonable degree of accuracy (Figure 7.6-1).
- RSA: The RSA for surface water flows and levels extends beyond the LSA, and is defined as the watershed area reporting to the southern end of Pakwash Lake. It encompasses the Dixie Creek, Chukuni River and Trout Lake watershed areas (Figure 7.6-2).

The purpose of a temporal boundary is to identify when an effect may occur in relation to specific Project phases and activities. The temporal boundaries are based on the timing and duration of Project activities, and the nature of the interactions with valued components. The temporal boundaries for the assessment as defined in Section 6.5 are:

- Construction phase:
 - Years -3 to -1 representing the primary period of Project construction
 - Mining of the Viggo pit will be completed during this phase and will be initiated in the last year of construction in the LP Central pit, requiring dewatering activities
 - Contact waters will be collected and managed during this phase
- Operations phase:
 - Years 1 to 26, during year 1 the Project will transition from construction into operations and will not be at full capacity
 - Mine dewatering and management of contact waters continues
- Closure phase:
 - Years 27 to 29 represent the active closure period when the majority of the decommissioning and reclamation of the PA is completed and contact waters are managed

- Year 30 is a passive closure period while the site is on care and maintenance while the mine workings are filled with water (water treatment infrastructure will remain in place and contact waters are managed as needed)
- Year 31 is the final close out period when water treatment infrastructure is removed, after the LP Central pit is filled with water, and site waters are acceptable for passive release to the environment.

Effects on the pVC were assessed for each Project phase (i.e., construction, operations and closure).

7.6.2.3 Assessment Criteria

Project activities during the construction, operations and closure phases of the Project will result in changes in surface water flows and levels. In undertaking the assessment of changes to the baseline surface water flows and levels, the following indicators were assessed:

- Change in surface water flows in watercourses
- Change in surface water levels.

Rationale for the selection of these indicators is presented in Table 7.6-1. The changes are calculated as a comparison to baseline conditions. Changes in flow are generally expressed as a percent change (%), while changes in water levels are expressed as an absolute change (m).

7.6.2.4 Analytical Methods

The assessment of the potential surface water flow and level effects of the Project has been completed in accordance with standard methods. The prediction and assessment of effects involved:

- Characterizing baseline surface water flow and level conditions
- Identifying potential interactions of the Project on surface water flows and levels
- Predicting changes to surface water flows and levels using appropriate surface water modelling methods and qualitative assessments
- Comparing the predicted changes to the assessment criteria.

The characterization of baseline conditions was conducted through a compilation and review of documentation and data collected from long-term regional Water Survey of Canada (WSC) gauges, Lake of the Woods Control Board (LWCB) monitoring data, and two years of site-specific monitoring data. The details of this analysis are presented in the Hydrology Baseline Report (Appendix I-1).

Interactions with the Project on surface water flows and levels were analysed and quantified using predictive modelling summarized in the Mine Site Water Balance Report (Appendix I-2) supported by the Hydrogeology Modelling Report (Appendix H-2).

Predictive modelling was completed to simulate the flows in the receiving environment resulting from the interactions of the Project with the environment, at each phase of the Project, and under various climate conditions. This analysis, as well as the comparison to existing conditions, is presented in the Receiver Water Balance Report (Appendix I-3).

7.6.3 Assumptions and the Use of the Conservative Approach

Conservative approaches are defined as those that provide effect predictions that will tend to be higher than expected, as a means to avoid the underestimation of potential effects from the Project. The changes in flow and water level presented in Appendix I-3 and discussed below represent the greatest simulated change in flow within each Project phase, for each assessment node. As such, they are a snapshot of the greatest change that may be observed in a year, and not truly representative of the change in flow or water level that will be present throughout the whole of the Project phase. Additionally, the changes presented for each node are not expected to occur at the same point in time since the watercourses and waterbodies around the Project will be impacted by different Project activities.

Additional optimization of the contact water management infrastructure may also occur that will reduce the water taking and discharge rates as engineering advances through to detailed design, and with optimizations during operations.

The conservative approach outlined above demonstrates that predicted effects on surface water flows and levels will not be underestimated, and with the application of mitigation measures, there will be reliable environmental protection of surface water quantity.

7.6.4 Existing Conditions

Detailed information about the surface waterbodies and watercourses on and near the Property is presented in the Hydrology Baseline Report included with the Impact Statement as Appendix I-1. Existing surface water flow and level conditions are characterized based on several years of in-field study, resulting in a comprehensive understanding of the local hydrologic conditions. The existing conditions are used to support the assessment of potential effects from the Project.

The characterization of existing climate conditions which is also important in the assessment of potential effects to hydrology is detailed in the climate dataset (Appendix W-3) of the Impact Statement.

7.6.4.1 Overview of Regional Hydrology

An overview of the regional hydrology, watersheds and key control structures are illustrated in Figure 7.6-3. The Project is located in the English River watershed above Pakwash Lake. The Manitou Falls Generating Station is located downstream of Pakwash Lake along the upper portion of the English River, with a total watershed area of 48,880 km² (Figure 7.6-3). The Manitou Falls Generating Station watershed receives inflows from Lac Seul, Cedar River, Trout Lake and the Chukuni River. The Chukuni River watershed, upstream of Pakwash Lake which includes the PA, contributes approximately 10% of the total contributing watershed area to the Manitou Falls Generating Station.

The Snowshoe Rapids Dam is located upstream of Pakwash Lake on the Chukuni River between Two Island Lake and Highway 105 and is used to control water levels of Red Lake, Gullrock Lake, Keg Lake, Ranger Lake, and Two Island Lake, and also controls flows released in the Chukuni River (Figure 7.6-3 and Figure 7.6-4). The MNR operates the dam to manage water levels and discharge from the system to address multiple objectives that consider flood protection, navigation, water supply and environmental considerations (Hatch 2009). Water levels and flows are managed based on a rule curve developed to balance these objectives.

The Dixie Creek watershed (365 km²) which includes a majority of the Great Bear Property (Property) discharges to the Chukuni River approximately 6 km downstream of Highway 105 and 4 km upstream of Pakwash Lake. The Dixie Creek watershed accounts for 8% of the Chukuni River watershed at their point of confluence (Figure 7.6-4). Water levels at the location of the confluence are influenced by Pakwash Lake, whose water level is regulated and controlled by the LWCB and Ontario Power Generation at the Manitou Falls Generating Station. Additional information regarding the history and operation of the Lake of the Woods watershed is presented in the Hydrology Baseline Report (Appendix I-1).

7.6.4.2 Local Hydrology

The PA is located primarily within the existing watershed of Dixie Creek, with a large portion of the Property located to the north of Dixie Creek (Figure 7.6-5). Dixie Creek generally flows eastward discharging to the Chukuni River, receiving inflow from Dixie Lake, Unnamed Waterbody 2, Unnamed Watercourse 3, Unnamed Watercourse 7, Unnamed Waterbody 6 and a number of smaller tributaries.

The characterization of existing local flows and water levels was developed using field monitoring data at 19 hydrometric stations, collected during 2022 to 2024, as well as desktop analyses on long-term LWCB data and WSC gauging station records. Desktop analyses included a review of water levels, hydrographs and annual runoff between onsite monitoring stations and three selected WSC stations at Long Legged River Below Long-Legged Lake, Golden Creek Near Red Lake and Chukuni River Near Ear Falls, as well as a LWCB water level data from Pakwash Lake (Appendix I-1).

Surface water flows were estimated for key points in the PA, LSA and RSA (Figure 7.6-6), referred to as assessment nodes herein, using methods consistent with the Hydrology Baseline Report (Appendix I-1). The resulting monthly flows are presented for average, 1:100 wet and 1:100 dry year conditions in Table 7.6-2 and the Receiver Water Balance Report (Appendix I-3).

7.6.4.2.1 Surface Water Flows

Flows in the Chukuni River are controlled by the Snowshoe Rapids Dam, and gauged by WSC at Chukuni River Near Ear Falls, located approximately 10 km upstream of the Project's treated effluent discharge location. The hydrometric station was established in 1962 and continues to record flow and water level. Flow statistics from this long-term record are pro-rated by watershed area to establish existing conditions and support the effects assessment at downstream nodes on the Chukuni River and Pakwash Lake (CHK-1, CHK-2 and PAK-OUT in Figure 7.6-6). Flows tend to peak in June, with low flows observed during the winter months, January through March. The calculated mean annual flow in the Chukuni River, downstream of the confluence with Dixie Creek (CHK-2) is 32.9 m³/s, with a seasonal high of 59.6 m³/s and low of 15.5 m³/s. Mean annual flows out of Pakwash Lake (PAK-OUT) are estimated to be 55.5 m³/s, with a seasonal high of 100 m³/s, and a low of 26.1 m³/s.

Flows in Dixie Creek and its tributaries are estimated using WSC Long Legged River Below Long-Legged Lake station, as the mean annual runoff aligned best with field monitoring data. The monthly hydrographs from the 43-year period of record indicate that flows tend to follow the same seasonal trend as the regulated Chukuni River. Hydrographs from the smaller sub-watersheds of Dixie Creek more closely align with the shape of hydrograph for the WSC Golden Creek station, which is attributed to a lack of storage features and smaller watershed area. Therefore, adjustments were applied to the smaller site sub-watersheds of less than 10 km² in

area, to adopt the Golden Creek hydrograph which tends to peak earlier in the spring (May) as well as in October, but maintains the Long Legged mean annual runoff.

The calculated mean annual flows through Dixie Creek at Tote Road (DIX-5) which is the furthest downstream assessment node from the Project on Dixie Creek, was 2.28 m³/s, with a monthly high of 4.68 m³/s and a low of 1.00 m³/s. Considerable beaver activity has been consistently observed in Dixie Creek during the field programs in 2022 through 2024, with several beaver dams controlling flow and level in the creek. Measured flows at this location have high variability and range from 0.31 to 11.79 m³/s. Measured flows at the upstream locations (Dixie Lake Outlet and Tuzyk's Road, represented by nodes DIX-1 and DIX-2, respectively) approached zero flows, with lowest measured flows of 0.008 m³/s. Flow measurements and hydrographs generated for Dixie Creek are presented in Appendix I-1.

7.6.4.2.2 Surface Water Levels

Water levels in the Chukuni River up to Highway 105, are controlled by backwater from Pakwash Lake. Pakwash Lake water levels are controlled and operated by the LWCB and Ontario Power Generation within a typical operating range between 346.1 and 346.3 masl (0.2 m variation) and an extreme water elevation of 348.8 masl (LWCB 2000). Measured baseline water levels in the Chukuni River at Highway 105 corroborate this variation, with measured water levels ranging from 346.2 to 348.5 masl. The peak was measured in June 2022, and was in fact associated with an extremely wet spring freshet.

The water levels in Dixie Creek are highly variable, particularly in the upper and middle reaches of Dixie Creek (represented by nodes DIX-2 and DIX-3 in Figure 7.6-6). The lower portion of Dixie Creek (represented by nodes DIX-4 and DIX-5) is a low-lying wetland and floodplain with a gradient of less than 0.01%. The water levels in the lower reach are controlled by backwater conditions from the Chukuni River, and indirectly the Pakwash Lake water level. A natural control point upstream of Unnamed Watercourse 7 reduces the influence of backwater conditions on the middle reach of Dixie Creek (DIX-3) to flood events. Another natural control point further upstream at Tuzyk's Road (DIX-2) prevents this influence from extending any further upstream. A rating curve (stage-discharge relationship) for Dixie Creek at DIX-2 is provided in Appendix I-1, and may be used to infer typical water level variation in the upper reach of Dixie Creek. As noted in Section 7.6.4.2.1, considerable beaver activity has been observed throughout Dixie Creek, with the presence of several beaver dams observed to be controlling the flow and water levels through 2022, 2023 and 2024. Although not documented in the baseline report (Appendix I-1), these dams remained in place through 2025.

Measured water levels in Unnamed Waterbody 6 varied from 346.9 to 347.4 masl (0.5 m) for the available period of record. Within this period of record, water levels in Unnamed Waterbody 6 were observed to be influenced by the water levels in the lower reach of Dixie Creek and the Chukuni River. Water levels followed the same trend as the downstream stations, but were typically approximately 0.5 m higher. The period of record for Unnamed Waterbody 6, however, began in August 2022 (following the peak in June 2022). As such, it can be expected that during an extreme wet freshet, such as that observed in June 2022, water levels in Unnamed Waterbody 6 may reach up to approximately 348.9 masl, which would represent 2.1 m in variation between June 2022 and October 2024.

7.6.5 Identification of Potential Effects

The initial step in the assessment process is to identify interactions between the Project and the pVC that can result in pathways to potential effects. These potential effects may be direct, indirect and / or positive effects, where applicable. Table 7.6-3 summarizes the potential interactions of the Project with surface water flows and levels, prior to the application of the mitigation measures. The professional judgment of technical experts experienced with mining projects in Ontario and Canada, as well as input from Indigenous communities, government agencies and the public, informed the identification of those interactions that are likely to result in a pathway to a potential effect due to a measurable change to surface water flows and levels.

Interactions with surface water flows and levels generally fall into one of the following categories:

- Change to watershed areas contributing to surface water features (watershed area size and / or land types). This is typically a result of the integrated contact water management systems established to collect contact water for treatment and discharge to a single location, which changes the watershed areas and the seasonal distribution of runoff reporting to local surface water features.
- Change to hydrogeological interactions with surface water features (groundwater / baseflow and seepage), quantified by hydrogeological modelling (Appendix H-2) and summarized in Section 7.5.
- Direct and controlled water takings or discharges to surface water features, estimated by the Mine Site Water Balance (Appendix I-2).

These pathways to potential effects are further described in Section 7.6.5.1 to Section 7.6.5.3 and in Table 7.6-3 for each phase of the Project. Section 7.6.6 and Table 7.6-4 provide a description of the mitigation measures applied to these pathways to potential effects during all phases of the Project. The changes after the application of the mitigation measures, are then described and further evaluated in Section 7.6.7.

7.6.5.1 Construction Phase

The construction phase of the Project is expected to occur over a three-year period and will include preparation of the site and the construction of mine infrastructure. The following interactions with the Project result in pathways to potential effects on surface water flows and levels as described below:

- Site preparation, construction activities, the establishment and operation of contact water management and treatment facilities and the commissioning of the process plant will result in the collection and treatment of surface water from portions of the Project site. This will change the watershed areas and land types, and therefore the surface water runoff quantities and patterns materially contributing to local water features within the LSA, primarily on and near the PA.
- Establishment of fish habitat compensation measures (East pond) and starter embankments for the TMF will result in the diversion of non-contact water to nearby surface waterbodies and watercourses, interacting with the watershed areas contributing flows to them.

- Viggo pit and underground mining will result in groundwater entering the mines, which will require collection and treatment. The presence of the Viggo pit and underground mines will also create a hydrogeological ZOI, and interact with the groundwater contributions to surface waterbodies and watercourses within the LSA, as described in Section 7.5.

7.6.5.2 Operations Phase

The operations phase is anticipated to occur over a 26-year period. The following interactions with the Project result in pathways to potential effects on surface water flows and levels as described below:

- Contact waters from the Project will be collected and treated as needed prior to discharge to the environment. The operation of the contact water management and water treatment system will result in the collection and treatment of surface waters from the Project site. The Project site will grow to its full extent in Year 16, with the construction of the MWP. This will change the watershed areas and land types, and therefore the surface water runoff quantities and patterns contributing surface water to local water features within the LSA.
- The operation of the Project will require water takings from the Chukuni River, which will interact with surface water flows and water levels.
- There will be a diversion of non-contact water to nearby surface waterbodies and watercourses associated with east pond and the TMF north dam that will result in a change to localized flow patterns and associated watersheds.
- LP Central pit and underground mining will result in groundwater entering the mines, which will require collection and treatment. The presence of the LP Central pit and underground mines will also create a hydrogeological ZOI, and interact with the groundwater contributions to surface waterbodies and watercourses on and near the Property, as described in Section 7.5.

7.6.5.3 Closure Phase

The following primary activities during the active and passive closure periods will result in potential changes in surface water flows and levels:

- Great Bear Resources proposes to reduce the length of time until the mine working would naturally fill to a stable water level with direct precipitation, runoff and groundwater inputs. To expedite this natural process, runoff from a larger area of the site than would flow naturally by gravity drainage will be pumped or otherwise directed to LP Central pit to support filling efforts. Discharge of treated effluent discharge to the Chukuni River will be paused.
- In addition, water will be taken from the Chukuni River in a controlled manner to further expedite the filling of the mine workings with water, which will affect flows within the Chukuni River.

After the mine workings are filled and water quality is acceptable for passive discharge to the environment, mine workings will be allowed to rise to steady-state levels. Under post-closure conditions, the pre-development watershed areas will generally be restored, with the exception of the permanent non-contact water diversions. Some changes to topography and land types

will remain at post-closure, such as those related to the rehabilitated TMF and MRS, as well as the LP Central pit lake, Viggo pit lake and east pond.

7.6.6 Mitigation and Enhancement Measures

Measures to be implemented to avoid or minimize the effects of the Project on surface water flows and levels include the following:

- Site plan optimizations:
 - Key Project components including the TMF and stockpiles, have been located to maintain a compact footprint to minimize disturbance to the natural environment as reasonable while providing for some operational flexibility
 - Two diversions have been incorporated into the site plan to divert non-contact water from entering the site and minimize creation of contact water
 - Project components avoid overprinting of watercourse and waterbodies wherever practical
 - Where reasonable, Project components have been sited to promote gravity drainage, which allows for efficient collection of contact water, including seepage
 - Development of the Viggo pit during the construction phase so that it is available for temporary storage of membrane filtration reject solution, permanent storage of concentrate tailings, and contact water during operations and active closure phases; this approach supports the Great Bear Resources sustainability-related initiatives for environmental management (Section 18.6.1) and reduces the need to disturb additional areas for the creation of contact water and tailings storage
- Surface water intake will meet all applicable federal and provincial regulatory requirements
- Water management infrastructure will be sized to meet appropriate design criteria
- Groundwater mitigations include:
 - During construction and operations, grouting will be used to seal off open exploration drillholes and large open fractures proximal to the underground mine, to reduce inflows into the underground
 - During operations and closure phases, installation of a sheet pile / grout wall is anticipated to be completed to support open pit stability, which will limit the potential effects of dewatering on potential flows within the Dixie Creek
- Water treatment:
 - Contact water from the site will be collected, recycled and re-used as practical, or treated prior to release which will lower the surface water intake demands and minimize final effluent discharge volumes
 - Effluent discharge to the environment will meet all federal and provincial regulatory requirements
 - Treated effluent will be discharged in the Chukuni River, at a location where sufficient flow exists to reduce the potential for erosion and promote rapid mixing

- Site reclamation:
 - Active filling of the LP Central pit and VMF with water pumped from the Chukuni River will occur in a controlled manner to reduce the fill time while maintaining flows in the Chukuni River within the same magnitude and scale as existing conditions natural variation
 - The PA will be restored to a naturalized state at closure, returning surface water runoff conditions closer to those present pre-development.

The application of mitigation measures for the pathways of potential effects is illustrated in Table 7.6-4. Mitigation measures described in this section are expected to be effective for their intended purposes given their effective implementation at similar projects.

Monitoring programs will be implemented to verify the accuracy of the predicted effects, assess the effectiveness of the implemented mitigation measures and may be further optimized in response to monitoring data.

7.6.7 Assessment of Effects

Quantitative modelling, as described in the Receiver Water Balance provided in Appendix I-3, as well as qualitative methods were used to predict the effects of Project development on local surface water flows and levels in an integrated manner. The estimated changes in surface water flows and levels have been compared to the existing conditions presented in Section 7.6.4, Appendix I-1 and Appendix I-3.

7.6.7.1 Change in Surface Water Flows

The change in surface water flow in the local water features adjacent and downstream of the Project was evaluated using a comprehensive water model (receiver water balance) presented in Appendix I-3. The change in flows were estimated at locations, referred to as assessment nodes, described in Section 7.6.4.2. These nodes are presented, with operations / closure phase watersheds in Figure 7.6-7. They extend across smaller local watercourses adjacent to the PA, as well as in Dixie Creek, Chukuni River and Pakwash Lake.

The assessment nodes were strategically located where a change in surface water flow or water quality was anticipated, in order to evaluate potential effects of the Project on existing watercourses. Surface water flows in the receiving environment were evaluated on a monthly basis, during each phase of the Project, under average, 1:100 wet, and 1:100 dry climate conditions, as well as under climate change conditions in the closure phase.

Table 7.6-5 presents a summary of the greatest change in annual flow within each phase, at each assessment node in watercourses that are retained after Project development. The changes presented in Table 7.6-5 and discussed in this section represent the annual change under average climate conditions. However, estimated monthly flows, as well as the annual percent change to flow during the 1:100 wet and dry year conditions as well as under climate change conditions are provided in Appendix I-3.

7.6.7.1.1 Construction Phase

The change in surface water flows during the construction phase was estimated for each assessment node as summarized in Table 7.6-5 and detailed in Appendix I-3. The following are the key findings:

- The estimated reduction in flow at the outlet of Unnamed Waterbody 6 is evaluated by node UN-3. The change in flow is attributed to a few pathways which counteract each other, such as the reduction in groundwater contributions as a result of the mining of the east and west Viggo pits, the development of OVB1 which will remove watershed area reporting to its tributary Unnamed Watercourse 6A, as well as the development of the east dam which will divert watershed into it. The net impact is a reduction of 1.2% to Unnamed Waterbody 6 outflows.
- There is a reduction in flows in Dixie Creek as a result of the reduced upstream watershed area reporting to it (collection of contact waters), with further reductions driven by the reduction of groundwater contributions. The greatest reduction in flow in Dixie Creek during the construction phase is estimated to be 6.0% (at node DIX-3).
- The reduction in flow in the Chukuni River downstream of Dixie Creek (CHK-2) is lesser due to the increased contributing watershed area. The estimated reduction in flow is 0.2%.
- There are limited reductions in flow (0.1%) at the edge of the RSA, at Pakwash Lake outlet (PAK-OUT).

As a result of required Project components initiated during the construction phase that will remain on the landscape after closure, flows in the following unnamed watercourses will be permanently altered (Figure 7.6-1):

- Upper reaches of Unnamed Watercourse 1 will be covered by the TMF (Unnamed Watercourse 1 below Unnamed Waterbody 2 will be retained)
- Unnamed Waterbody 1 will be drained and overprinted by the TMF pond and MWP
- Unnamed Watercourse 3 which is located in the PA will be removed as it is intersected by the LP Central pit and in part for that reason, the upper reaches have been selected for mine waste storage
- Unnamed Watercourse 8B will receive runoff from additional watershed area due to the TMF north dam.

The effects to fish and fish habitat resulting from these permanent changes are proposed to be mitigated (Section 8 and Appendix L-2). New surface ponds are proposed to be created during fish habitat offsetting and compensation as described Appendix L-2:

- East pond and channel connected to Unnamed Waterbody 6
- A new pond complex within the Dixie Creek floodplain.

7.6.7.1.2 Operations Phase

The Project's impact on surface water flows was evaluated throughout the 26-year operations phase. Reductions in flow at Unnamed Waterbody 6 and Dixie Creek are expected to continue to occur during the operations phase, at a greater magnitude, as a result of the increase in the Project footprint, mining of the LP Central pit and continued mine dewatering. The change in flow was estimated for each assessment node and is presented in Table 7.6-5. The following are the key findings:

- The net reduction in flow to the outlet of Unnamed Waterbody 6 (UN-3) is estimated to be 2.5%.

- The greatest reduction in flow in Dixie Creek is estimated to be 10.2% (at DIX-3), as a result of underground and open pit mining which will impact groundwater contributions to Dixie Creek, as well as the operation of the contact water management system, which collects contact water from the Dixie Creek watershed and discharges it to the Chukuni River. The physical extent of this magnitude in change (10.2%) is limited to a reach of Dixie Creek that is approximately 5 km in length. The effects are reduced downstream (at DIX-4) as a result of the additional flows contributed by Unnamed Watercourse 7.

A 10.2% reduction results in an average annual flow of 1.22 m³/s (down 0.14 m³/s from 1.36 m³/s), and will potentially reduce the lowest flow month of the year (March) to 0.53 m³/s (down 0.06 m³/s from 0.59 m³/s). For frame of reference, baseline monitoring data described in Section 7.6.4.2.1 and Appendix I-1 indicates that flows in Dixie Creek are highly variable and heavily influenced by beaver activity under existing conditions. Within the monitoring period, measured flows upstream at Tuzyk's Road (DIX-2) approached zero (0.008 m³/s) and reached 6.4 m³/s.

- There are limited changes in flow in the Chukuni River during the operations phase. Flows immediately downstream of the proposed water taking and discharge location (CHK-1) are estimated to increase by 0.7%. This increase is reduced to 0.3% after the Dixie Creek inflow (CHK-2).
- There are limited reductions in flow (0.2%) at the boundary of the RSA, at Pakwash Lake outlet (PAK-OUT).

7.6.7.1.3 Closure Phase

During the active and passive closure periods, similar reductions to surface water flow in Unnamed Waterbody 6 and Dixie Creek are expected as during previous phases, however the magnitude is lesser than during the operations phase. The change in flow during the active and passive closure periods for each assessment node are presented in Table 7.6-5. The following are the key findings:

- Reduction in flow to the outlet of Unnamed Waterbody 6 (UN-3) is estimated to be 1.7%
- Reduction in flow in Dixie Creek decreases from the operations phase to 10.0% (at DIX-3).
- Flows in the Chukuni River are estimated to decrease from the proposed water taking to actively fill the underground mine, VMF and LP Central pit. The greatest reduction is at node CHK-2 at 1.7%.
- There are limited reductions in flow (1.1%) at the boundary of the RSA, at Pakwash Lake outlet (PAK-OUT).

Climate change is not expected to impact the above estimates by more than $\pm 0.1\%$.

Long-term post-closure conditions are also presented in Table 7.6-5:

- Surface water flows in Unnamed Waterbody 6 (UN-3) are expected to increase by 9.1%. This is attributed to the increase in watershed area created by the east pond diversion, which was constructed to support fish habitat creation and divert non-contact water from entering the Project. The mechanisms that reduced flow to Unnamed Waterbody 6 in the earlier Project phases (reduction in groundwater contributions and watershed area

described in Section 7.6.7.1.1) will have ceased. This is estimated to result in average annual flows increasing from 0.096 to 0.10 m³/s.

- Surface water flows in Dixie Creek are generally restored to pre-development conditions, with the greatest change in flow expected at node DIX-2, where flow may increase by 1.1%. The increase in flow is attributed to the modified land types in the area draining to the creek.
- Flows in the Chukuni River and to Pakwash Lake outlet are estimated to return to baseline conditions, with change in flow estimated to increase by 0.1% or less.

Climate change is not expected to impact the above estimates by more than approximately 0.8%.

7.6.7.2 Change in Surface Water Levels

Potential changes in the water levels of local surface watercourses and waterbodies are characterized using a combination of the modeled changes in flow and stage-discharge relationships, or with qualitative analyses and comparisons to baseline conditions.

7.6.7.2.1 Construction Phase

Due to the limited magnitude of the predicted change in flow presented in Section 7.6.7.1, observable changes in water level are not expected in the watercourses and waterbodies upstream of the Project (represented by nodes UN-5, GEN-1 and DIX-1) or in Unnamed Waterbody 6 (UN-3).

Changes in water level in Dixie Creek are not expected to be observable due to the magnitude in the change in flow, as well as the water level controls described in Section 7.6.4.2.2. Similarly, observable changes in the water levels of the Chukuni River (CHK-1 and CHK-2) and Pakwash Lake (PAK-OUT) are not predicted.

As a result of required Project components that will remaining on the landscape, water levels in Unnamed Waterbody 1, Unnamed Watercourse 1, Unnamed Watercourse 3 and Unnamed Watercourse 8b will be altered permanently. The effects to fish and fish habitat resulting from these permanent changes are proposed to be mitigated as described in Section 8 and Appendix L-2.

7.6.7.2.2 Operations Phase

Water level changes are unlikely to be observable. Similar to the construction phase, measurable changes in water level are not expected at any of watercourses or waterbodies upstream of the Project as reflected in the assessment nodes UN-5, GEN-1 and DIX-1. Observable changes are also not expected in Unnamed Waterbody 6 (UN-3), Chukuni River (CHK-1 and CHK-2) or Pakwash Lake outlet (PAK-OUT), due to the limited magnitude of the predicted change in flow presented in Section 7.6.7.1.

The potential reduction in water levels in Dixie Creek is unlikely to be identifiable from natural variation. The reduction will vary with the cross sectional hydraulics and channel geometry. Within a typical cross section in the middle reach of Dixie Creek (DIX-3), with an average annual depth of 1 m, a 10.2% flow reduction is estimated to reduce water levels by less than 5 cm.

The smaller 4.7% reduction in flow in the upper reach of Dixie Creek (DIX-2) will drop the average annual flow from 1.28 to 1.22 m³/s, which represents less than 1 cm in water level, according to the stage-discharge curve generated and presented in Appendix I-1.

The estimated 6.4 to 6.8% reduction in flow at lower end of Dixie Creek (DIX-4 and DIX-5) will not result in an observable change in water level, because as described in Section 7.6.4.2.2, water level along this reach is controlled by the water levels in the Chukuni River and Pakwash Lake, which are not anticipated to change due to the magnitude of predicted change in flow.

7.6.7.2.3 Closure Phase

Similar to the earlier phases, no observable changes in water level are expected during the active and passive closure periods, at any of the watercourses or waterbodies upstream of the Project (UN-5, GEN-1, DIX-1), or Unnamed Waterbody 6 (UN-3), Chukuni River (CHK-1, CHK-2) and Pakwash Lake outlet (PAK-OUT), due to the magnitude of the predicted change in flow presented in Section 7.6.7.1.

The potential change in water levels in Dixie Creek will be less than those estimated for the operations phase, discussed above in Section 7.6.7.2.2. Changes to water level in Dixie Creek are temporary and will be reversed.

Under the post-closure conditions, water levels in Dixie Creek will be restored, and no observable changes are expected within any of its reaches.

Potential changes to water levels in Unnamed Waterbody 6, resulting from the increase in flows under post-closure conditions, are estimated to be minor based on the stage-discharge data collected from the field program. Average annual water levels are estimated to increase by approximately 1 cm. This is considered minor in comparison to the annual average fluctuation of 0.23 m, estimated using the same stage-discharge curve. Measured water levels from the field program ranged 0.54 m, but are expected to fluctuate as much as 2.1 m, as described in Section 7.6.4.2.2.

7.6.8 Change Pathway Outcome

7.6.8.1 Summary of Changes after Mitigation

A summary of the changes to surface water flows is provided below and is illustrated in Figure 7.6-8. The changes to surface water flows and levels are presented as an annual percent change under average climate conditions. A detailed presentation of the monthly flows, annual percent change to flow during the 1:100 wet and dry year conditions, as well as the effects of climate change conditions, is provided in Appendix I-3.

The use of 10% as a threshold change in flow was selected for Figure 7.6-8 based on guidance provided in Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada (DFO 2013a) and A Desk-top Method for Establishing Environmental Flows in Alberta Rivers and Streams (Locke and Paul 2011), which indicate that a 10% to 15% reduction or increase in instantaneous flows is unlikely to have detectable ecological effects on downstream habitat.

Figure 7.6-8 highlights that observable changes in flow are constrained to the LSA, with changes exceeding 10% limited to a reach of Dixie Creek, which is approximately 5 km in length. Reduction in flow is estimated during the construction, operations, and closure phases in Dixie Creek due to loss in contributing watershed area and groundwater contributions, peaking

in the operations phase, and reduced after the passive closure period. The greatest reduction in flow is estimated to be 10.2% during the operations phase. The temporary reduction in flow is expected to cause a small change in water level, which will vary along Dixie Creek depending on channel hydraulics and geometry. Within a typical cross section of this 5 km reach of Dixie Creek, the average annual water level may drop approximately 5 cm. This change is considered temporary and reversible, as flows and water levels are restored at post-closure.

Surface water flows reporting to Unnamed Waterbody 6 under post-closure conditions are estimated increase by 9.1%, from the east pond diversion which supports the fish habitat compensation and offsetting. This is estimated to increase flows to Unnamed Waterbody 6 during the highest flow month of May from 0.19 to 0.20 m³/s. The increase in flows is estimated to increase average annual water levels by approximately 1 cm, which is considered minor in comparison to natural water level fluctuations. Measured water levels over the monitoring period ranged by 0.54 m, but are expected to fluctuate as much as 2.1 m.

Estimated changes to flow and water level in the Chukuni River are not observable. The greatest change in flow is a reduction of 1.7%, which is estimated in the Chukuni River, downstream of Dixie Creek (node CHK-2) during the closure period when active water taking from the Chukuni River is proposed to fill the underground mine, LP Central pit and VMF. The impact to water levels resulting from this change in flow is not observable from the seasonal variability of the Chukuni River. The water taking is temporary and flows are restored thereafter.

Estimated changes to flow and water level at the RSA boundary at Pakwash Lake outlet (PAK-OUT) are not observable.

7.6.8.2 Change Management

The changes to surface water flows and levels are managed through provincial regulatory mechanisms. In Ontario, approvals are required under the *Ontario Water Resources Act* for surface water takings and discharges for various purposes. As part of the provincial permitting process, a rigorous surface water hydrology monitoring program will track surface water flows and levels. Surface water monitoring results will be evaluated against established triggers, with adaptive management measures implemented as needed to maintain compliance and environmental protection.

Adaptive management is a recognised best practice in Ontario mining operations. It provides a structured yet flexible framework that allows for timely responses to changing site conditions, monitoring results and potential risks based on empirical site-specific data. By incorporating predefined triggers and thresholds, adaptive management enables operators to implement corrective actions proactively before adverse effects occur. This approach supports continuous improvement, regulatory compliance and environmental protection. Recording and reporting on complaints to the MECP is also required.

7.6.8.3 Confidence

The level of confidence in the estimate provided is considered to be high. Input data used in predictive modelling are extensive and of high quality; and the range of existing and projected variability in both the existing regime and the mine influenced regime are well constrained by extreme climate conditions in both the receiver and mine site water balance modelling (Appendix I-2 and Appendix I-3) The predicted effects were determined using well-established models and the changes to surface water flows and levels presented for each phase of the Project are the greatest simulated in that Phase. Furthermore, with the application of mitigation

measures, there will be reliable environmental protection of surface water flows and levels. Hydrometric monitoring will be ongoing during construction, operation and closure phases and will support the validation of the predictions.

Table 7.6-1: Assessment Criteria, Indicators and Rationale

Criteria	Indicator	Rationale for Selection
Change in surface water flows and levels	<ul style="list-style-type: none"> • Surface water flows (m³/s) in watercourses environments ⁽¹⁾, expressed as a percent change (%) from existing conditions • Surface water levels (m) 	<ul style="list-style-type: none"> • Natural component important to other ecosystem elements • Provincial regulatory interest • Identified of interest during engagement • May interact with water quality • May interact with fVCs (fish and fish habitat, and Indigenous peoples)

Note:

1. The assessment of surface water flows is limited by the accuracy / error bounds of measuring velocity and flow. Flow may not be measurable in slow moving waters or small tributaries / watersheds.



Table 7.6-2: Existing Monthly Surface Water Flows at Assessment Nodes

Assessment Node ID and Location		Climate Condition	Watershed Area (km ²)	Calculated Flow (m ³ /s)												Annual Average	Mean Annual Runoff (mm)
				January	February	March	April	May	June	July	August	September	October	November	December		
UN-1	Unnamed Watercourse 1	Average Year	9.40	0.0049	0.0031	0.0109	0.0888	0.1873	0.1018	0.0530	0.0531	0.0640	0.0796	0.0515	0.0142	0.0596	199.99
		1:100 Dry Year		0.0011	0.0007	0.0024	0.0199	0.0420	0.0228	0.0119	0.0119	0.0143	0.0178	0.0115	0.0032	0.0134	44.82
		1:100 Wet Year		0.0108	0.0069	0.0241	0.1964	0.4142	0.2251	0.1171	0.1175	0.1415	0.1760	0.1138	0.0314	0.1318	442.24
UN-2	Unnamed Watercourse 6A	Average Year	2.88	0.0015	0.0010	0.0033	0.0272	0.0573	0.0312	0.0162	0.0163	0.0196	0.0244	0.0158	0.0043	0.0183	199.99
		1:100 Dry Year		0.0003	0.0002	0.0007	0.0061	0.0129	0.0070	0.0036	0.0036	0.0044	0.0055	0.0035	0.0010	0.0041	44.82
		1:100 Wet Year		0.0033	0.0021	0.0074	0.0601	0.1268	0.0689	0.0358	0.0360	0.0433	0.0539	0.0348	0.0096	0.0404	442.24
UN-3	Unnamed Waterbody 6 Outlet	Average Year	15.21	0.0476	0.0411	0.0391	0.0827	0.1937	0.1933	0.1483	0.1045	0.0880	0.0863	0.0732	0.0557	0.0964	199.99
		1:100 Dry Year		0.0107	0.0092	0.0088	0.0185	0.0434	0.0433	0.0332	0.0234	0.0197	0.0193	0.0164	0.0125	0.0216	44.82
		1:100 Wet Year		0.1053	0.0909	0.0865	0.1829	0.4284	0.4274	0.3280	0.2311	0.1946	0.1909	0.1620	0.1231	0.2133	442.24
UN-4	Unnamed Watercourse 8B	Average Year	1.99	0.0010	0.0007	0.0023	0.0188	0.0397	0.0216	0.0112	0.0113	0.0136	0.0169	0.0109	0.0030	0.0126	199.99
		1:100 Dry Year		0.0002	0.0001	0.0005	0.0042	0.0089	0.0048	0.0025	0.0025	0.0030	0.0038	0.0024	0.0007	0.0028	44.82
		1:100 Wet Year		0.0023	0.0015	0.0051	0.0417	0.0879	0.0478	0.0248	0.0249	0.0300	0.0373	0.0241	0.0067	0.0280	442.24
UN-5	Unnamed Watercourse 11	Average Year	15.4	0.0437	0.0376	0.0371	0.0902	0.2076	0.1920	0.1429	0.1035	0.0906	0.0918	0.0751	0.0526	0.0974	199.99
		1:100 Dry Year		0.0098	0.0084	0.0083	0.0202	0.0465	0.0430	0.0320	0.0232	0.0203	0.0206	0.0168	0.0118	0.0218	44.82
		1:100 Wet Year		0.0967	0.0831	0.0821	0.1994	0.4590	0.4246	0.3161	0.2289	0.2003	0.2030	0.1660	0.1164	0.2154	442.24
GEN-1	Genessee Lake Outlet	Average Year	11.1	0.0415	0.0362	0.0322	0.0500	0.1228	0.1460	0.1190	0.0795	0.0616	0.0558	0.0518	0.0462	0.0704	199.99
		1:100 Dry Year		0.0093	0.0081	0.0072	0.0112	0.0275	0.0327	0.0267	0.0178	0.0138	0.0125	0.0116	0.0104	0.0158	44.82
		1:100 Wet Year		0.0918	0.0800	0.0712	0.1106	0.2716	0.3227	0.2631	0.1757	0.1362	0.1234	0.1145	0.1022	0.1557	442.24
DIX-1	Dixie Lake Outlet	Average Year	187	0.6849	0.596	0.534	0.862	2.104	2.446	1.980	1.330	1.042	0.953	0.874	0.766	1.184	199.99
		1:100 Dry Year		0.1535	0.134	0.120	0.193	0.471	0.548	0.444	0.298	0.233	0.214	0.196	0.172	0.265	44.82
		1:100 Wet Year		1.5145	1.318	1.181	1.907	4.652	5.408	4.378	2.942	2.304	2.108	1.933	1.694	2.619	442.24
DIX-2	Upper Reach Dixie Creek at Tuzyk's Road	Average Year	202	0.6929	0.601	0.552	1.007	2.410	2.612	2.066	1.417	1.146	1.083	0.958	0.789	1.282	199.99
		1:100 Dry Year		0.1553	0.135	0.124	0.226	0.540	0.585	0.463	0.318	0.257	0.243	0.215	0.177	0.287	44.82
		1:100 Wet Year		1.5322	1.329	1.221	2.227	5.328	5.775	4.569	3.134	2.535	2.395	2.119	1.745	2.834	442.24
DIX-3	Middle Reach Dixie Creek downstream of Unnamed Watercourse 3	Average Year	214	0.7374	0.640	0.587	1.061	2.541	2.768	2.194	1.502	1.212	1.143	1.014	0.839	1.357	199.99
		1:100 Dry Year		0.1652	0.143	0.131	0.238	0.569	0.620	0.492	0.337	0.272	0.256	0.227	0.188	0.304	44.82
		1:100 Wet Year		1.6305	1.414	1.297	2.345	5.619	6.121	4.851	3.322	2.681	2.527	2.242	1.854	3.001	442.24
DIX-4	Lower Reach Dixie Creek downstream of Unnamed Watercourse 7	Average Year	333	1.1826	1.027	0.932	1.597	3.858	4.333	3.469	2.354	1.873	1.741	1.569	1.334	2.112	199.99
		1:100 Dry Year		0.2650	0.230	0.209	0.358	0.865	0.971	0.777	0.528	0.420	0.390	0.352	0.299	0.473	44.82
		1:100 Wet Year		2.6151	2.272	2.060	3.531	8.531	9.581	7.672	5.206	4.142	3.850	3.469	2.950	4.670	442.24
DIX-5	Lower Reach Dixie Creek at Tote Road	Average Year	360	1.2736	1.106	1.004	1.732	4.180	4.678	3.742	2.542	2.025	1.886	1.696	1.438	2.282	199.99
		1:100 Dry Year		0.2854	0.248	0.225	0.388	0.937	1.048	0.839	0.570	0.454	0.423	0.380	0.322	0.511	44.82
		1:100 Wet Year		2.8163	2.446	2.221	3.829	9.243	10.346	8.274	5.620	4.478	4.170	3.751	3.179	5.046	442.24
CHK-1	Chukuni River downstream of proposed intake/discharge location	Average Year	4,415	17.5	14.8	14.4	22.7	51.4	54.8	45.5	32.8	32.4	30.2	27.3	21.7	30.5	218.11
		1:100 Dry Year		5.6	4.8	4.6	7.3	16.5	17.6	14.6	10.5	10.4	9.7	8.8	7.0	9.8	70.15
		1:100 Wet Year		36.4	30.7	29.9	47.1	106.6	113.7	94.4	68.1	67.2	62.7	56.7	45.0	63.4	452.78
CHK-2	Chukuni River downstream of Dixie Creek	Average Year	4,786	18.8	15.9	15.5	24.5	55.7	59.6	49.3	35.4	34.5	32.2	29.1	23.2	32.9	216.75
		1:100 Dry Year		5.9	5.0	4.9	7.7	17.5	18.7	15.5	11.1	10.9	10.2	9.2	7.3	10.4	68.24
		1:100 Wet Year		39.3	33.2	32.2	51.1	116.1	124.3	102.9	73.9	71.8	67.1	60.6	48.3	68.6	451.99
PAK-OUT	Pakwash Lake Outlet	Average Year	8,047	31.8	26.9	26.1	41.3	93.6	100.0	82.9	59.6	58.4	54.5	49.3	39.2	55.5	217.31
		1:100 Dry Year		10.1	8.5	8.3	13.1	29.7	31.7	26.3	18.9	18.6	17.3	15.7	12.5	17.6	69.03
		1:100 Wet Year		66.2	55.9	54.3	85.9	194.8	208.2	172.6	124.2	121.5	113.4	102.5	81.5	115.4	452.31

Note: Watershed area represents cumulative area to the respective modelling node.

Table 7.6-3: Potential Interactions of Project Activities with Surface Water Flows and Levels

Project Component / Activity	Surface Water Flows / Levels
Construction Phase	
Site preparation activities	Yes
Establishment and operation of water management and treatment facilities	Yes
Open pit mining	Yes
Underground mining	Yes
Management of rock and unconsolidated materials in stockpiles	Yes
Establishment of onsite fish habitat and compensation measures	Yes
Establishment of onsite aggregate operations	Yes
Construction of the starter embankments for the TMF	Yes
Construction and operation of buildings and infrastructure	Yes
Waste management	-
Commissioning of the process plant	Yes
Power supply	-
Employment and expenditures	-
Operations Phase	
Underground mining	Yes
Mining of the LP Central pit	Yes
Management of rock and unconsolidated materials in stockpiles	Yes
Process plant operation	Yes
Management of desulphurized tailings in the TMF	Yes
Management of concentrate tailings and contact water in the VMF	Yes
Operation of water management and treatment facilities	Yes
Construction of a MWP	Yes
Operation and maintenance of buildings and infrastructure	Yes
Waste management	-
Power supply	-
Progressive reclamation activities	Yes
Employment and expenditures	-



Project Component / Activity	Surface Water Flows / Levels
Closure Phase	
Active closure period	Yes
Passive closure period	Yes
Final reclamation period	Yes
Employment and expenditures	-

Note:

- : The interaction is not expected to be material, and no further assessment is warranted.

Table 7.6-4: Mitigation Measures for Changes to Surface Water Flows and Levels

Pathways to Potential Effect	Phase			Proposed Mitigation Measures
	Con	Op	Cl	
Change in Surface Water Flows / Levels	•	•	•	Minimize creation of contact water by diverting non-contact water from entering the site
	•	•	•	Minimize creation of contact water by locating Project components within a compact footprint, to minimize disturbance to the natural environment and reduce the creation of contact water.
	-	•	-	Recycle contact water in the process plant to lower water demand and minimize final effluent discharge volumes.
	•	•	•	The surface water intake rate and schedule will meet all federal and provincial regulatory requirements
	•	•	•	Effluent discharge rate and schedule to the environment will meet all federal and provincial regulatory requirements
	-	•	•	Restoration of the site to a naturalized state through progressive reclamation and at closure, to restore runoff conditions closer to those present pre-development.

Notes:

Con: Construction; Op: Operations; Cl: Closure

• : Mitigation is applicable.

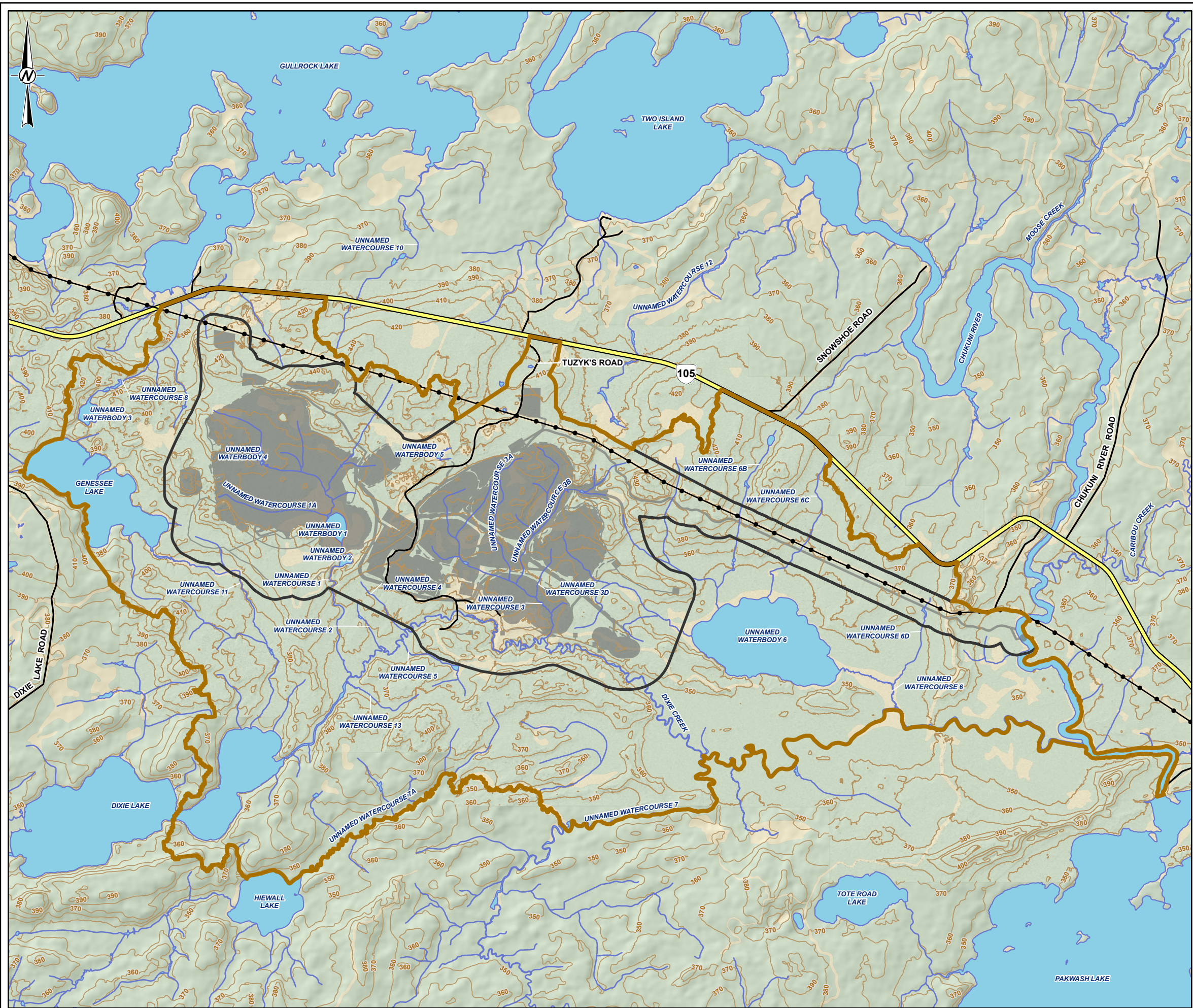
- : Mitigation is not applicable.



Table 7.6-5: Annual Percent Change in Flow – Average Climate Conditions

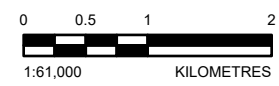
Watercourse	Unnamed Waterbody 6 Outlet	Unnamed Watercourse 11	Genessee Lake Outlet	Dixie Lake Outlet	Upper Reach Dixie Creek at Tuzyk's Road	Middle Reach Dixie Creek	Lower Reach Dixie Creek	Low Reach Dixie Creek at Tote Road	Chukuni River downstream of water intake and discharge	Chukuni River downstream of Dixie Creek	Pakwash Lake Outlet
Node	UN-3	UN-5	GEN-1	DIX-1	DIX-2	DIX-3	DIX-4	DIX-5	CHK-1	CHK-2	PAK-OUT
Construction	-1.2%	-0.2%	-0.1%	-0.1%	-3.5%	-6.0%	-3.9%	-3.7%	-0.1%	-0.2%	-0.1%
Operations	-2.5%	0.4%	-0.1%	-0.1%	-4.7%	-10.2%	-6.8%	-6.4%	0.7%	0.3%	0.2%
Closure	-1.7%	0.7%	0.2%	-0.1%	-4.5%	-10.0%	-6.6%	-6.2%	-1.3%	-1.7%	-1.1%
Closure under Climate Change	-1.7%	0.7%	0.2%	-0.1%	-4.5%	-10.0%	-6.6%	-6.1%	-1.3%	-1.6%	-1.0%
Post-Closure	9.1%	0.7%	0.2%	0.1%	1.1%	0.5%	0.4%	0.7%	0.0%	0.1%	0.0%
Post-Closure under Climate Change	9.9%	0.7%	0.2%	0.1%	1.4%	1.1%	0.8%	1.1%	0.0%	0.1%	0.1%

Notes:
 The change in flows presented are from a single year, selected within each Project phase, which produced the most substantial change in flow within the phase. The selected year will vary between nodes, and climate conditions.
 This table represents the annual change under average climate conditions. However, estimated monthly flows, as well as the annual percent change to flow during the 1:100 wet and dry year conditions are provided in Appendix I-3.
 Watercourses or major reaches which have been permanently removed by Project components are not detailed in this table, but are discussed in Section 7.6.7.1.1. Detailed calculated change in flow at these watercourses can be found in Appendix I-3.



LEGEND

- GREAT BEAR PROJECT FOOTPRINT
- PROJECT AREA
- LOCAL STUDY AREA FOR SURFACE WATER FLOWS AND LEVELS
- HIGHWAY
- LOCAL ROAD
- EXISTING TRANSMISSION LINE
- CONTOURS (10 M INTERVAL)
- WATERCOURSE
- WATERBODY



NOTE(S)
 1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
 1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
 2. CONTOURS ACQUIRED FROM LAND INFORMATION ONTARIO (LMRF), 2022 AND DERIVED FROM 2022 LIDAR PROVIDED BY GREAT BEAR RESOURCES
 3. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
 4. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
 5. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT

TITLE
LOCAL STUDY AREA FOR SURFACE WATER FLOWS AND LEVELS

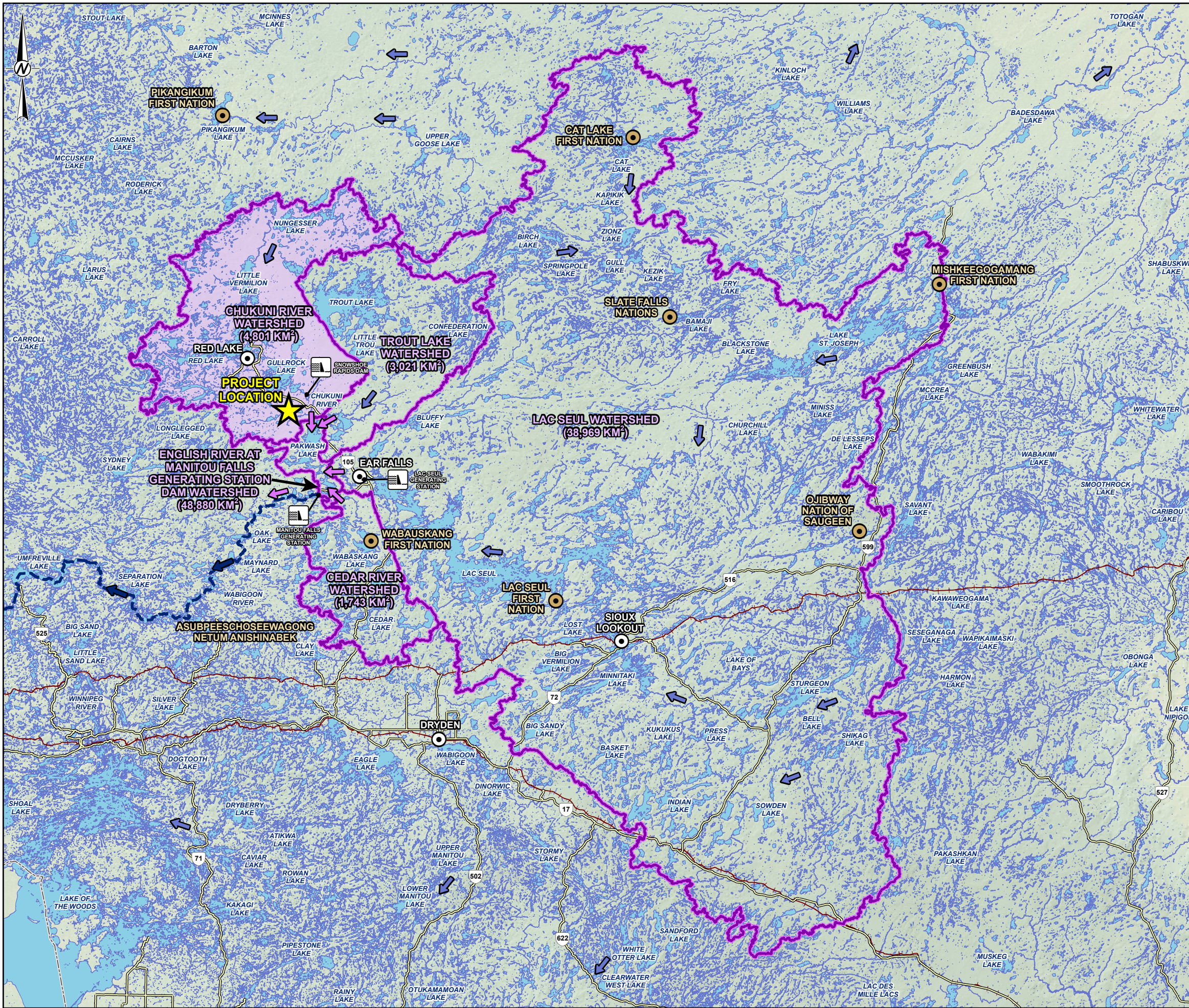
CONSULTANT	YYYY-MM-DD	2026-03-31
DESIGNED	---	
PREPARED	MD	
REVIEWED	---	
APPROVED	SD	



PROJECT NO. CA0031271 CONTROL 0001 REV. A FIGURE 7.6-1

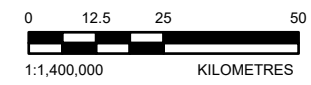
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



LEGEND

- PROJECT LOCATION
- FIRST NATION RESERVE
- TOWN
- DAM / GENERATING STATION
- CHUKUNI RIVER WATERSHED
- OTHER WATERSHED
- APPROXIMATE FLOW DIRECTION OF THE ENGLISH RIVER SYSTEM
- HIGHWAY
- RAILWAY
- NATIONAL BOUNDARY
- WATERSHED OUTLET
- FLOW DIRECTION



NOTE(S)
 1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
 1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
 2. WATERSHEDS DELINEATED USING ONTARIO WATERSHED INFORMATION TOOL (MNRF)
 3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT

TITLE
REGIONAL WATERSHED BOUNDARIES

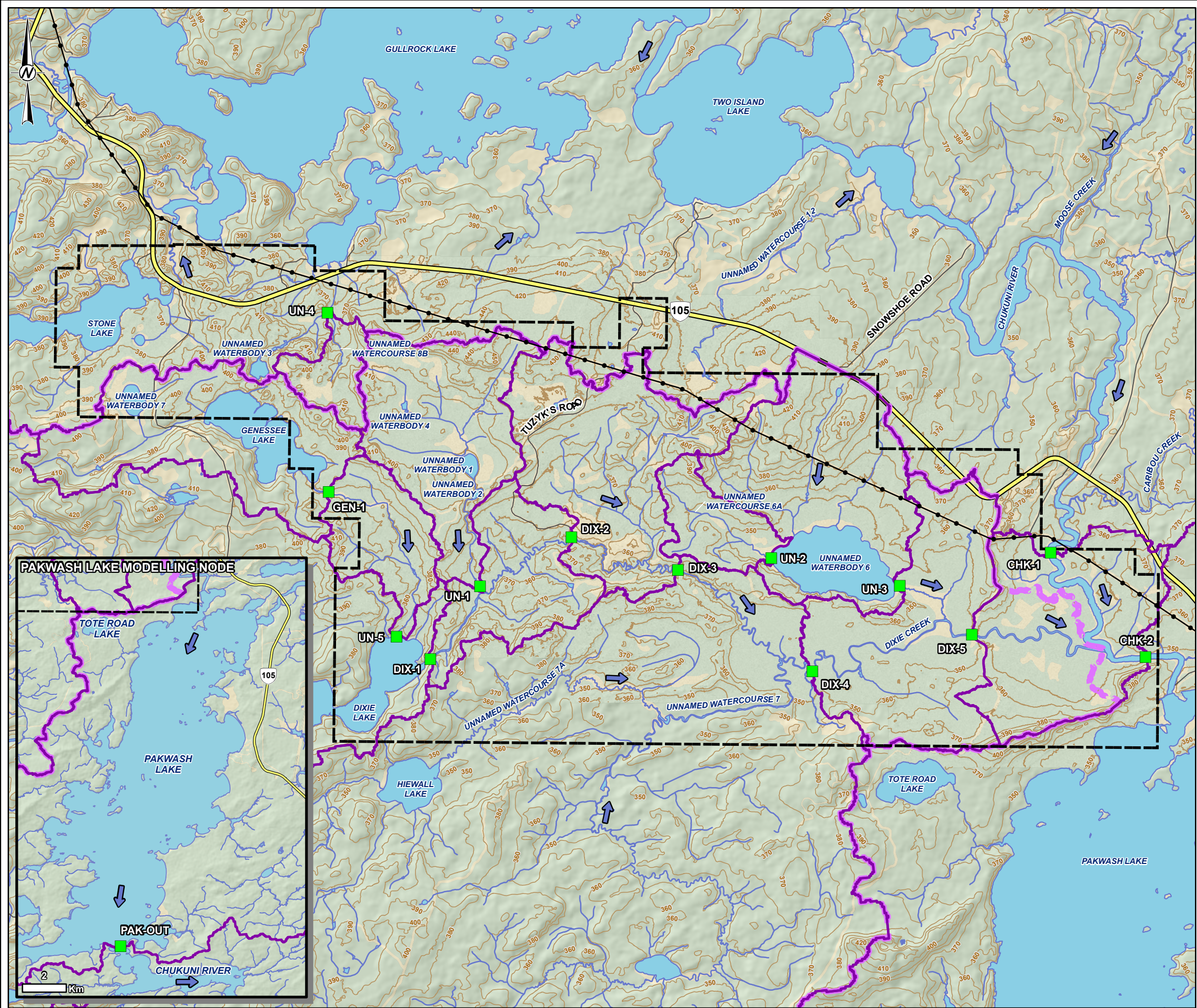
CONSULTANT	YYYY-MM-DD	2026-03-31
	DESIGNED	---
	PREPARED	MD
	REVIEWED	---
	APPROVED	SD



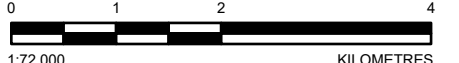
PROJECT NO. CA0031271	CONTROL 0001	REV. A	FIGURE 7.6-3
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



- LEGEND**
- PROPERTY BOUNDARY
 - HYDROLOGY MODELLING NODE
 - DIXIE CREEK WATERSHED
 - MODELLING NODE WATERSHED
 - HIGHWAY
 - LOCAL ROAD
 - EXISTING TRANSMISSION LINE
 - CONTOURS (10 M INTERVAL)
 - WATERCOURSE
 - WATERBODY
 - FLOW DIRECTION



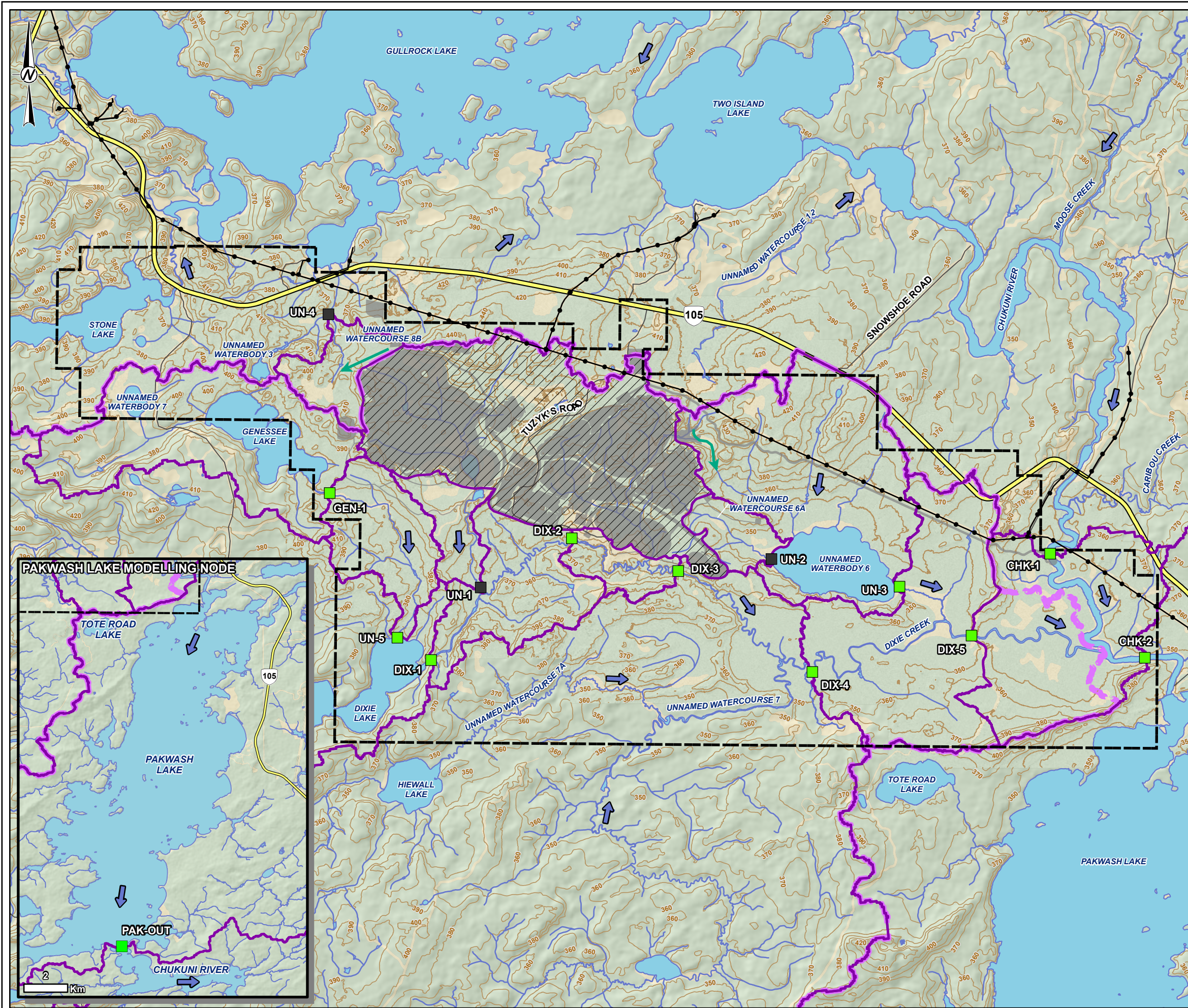
NOTE(S)
 1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
 1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
 2. PROPERTY BOUNDARY PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2024.
 3. CONTOURS ACQUIRED FROM LAND INFORMATION ONTARIO (LMRF), 2022 AND DERIVED FROM 2022 LIDAR PROVIDED BY GREAT BEAR RESOURCES.
 4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT		
GREAT BEAR RESOURCES		
PROJECT		
GREAT BEAR PROJECT		
TITLE		
EXISTING CONDITIONS WATERSHEDS AT ASSESSMENT NODES		
CONSULTANT	YYYY-MM-DD	2026-03-31
	DESIGNED	---
	PREPARED	MD
	REVIEWED	---
	APPROVED	SD
PROJECT NO.	CONTROL	REV.
CA0031271	0001	A
		FIGURE
		7.6-6

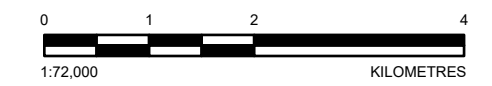
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LEGEND

- PROPERTY BOUNDARY
- GREAT BEAR PROJECT FOOTPRINT
- CLEAN WATER DIVERSION
- HYDROLOGY MODELLING NODE
- HYDROLOGY MODELLING NODE, UNNAMED WATERCOURSES REPORTING TO THESE NODES HAVE BEEN COMPENSATED FOR IN THE FISH HABITAT AND COMPENSATION PLAN (APPENDIX L-2)
- DIXIE CREEK WATERSHED
- MODELLING NODE WATERSHED
- PROJECT WATERSHED
- HIGHWAY
- LOCAL ROAD
- EXISTING TRANSMISSION LINE
- CONTOURS (10 M INTERVAL)
- WATERCOURSE
- WATERBODY
- FLOW DIRECTION



NOTE(S)
 1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
 1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
 2. PROPERTY BOUNDARY PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2024.
 3. CONTOURS ACQUIRED FROM LAND INFORMATION ONTARIO (LMRF), 2022 AND DERIVED FROM 2022 LIDAR PROVIDED BY GREAT BEAR RESOURCES.
 4. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
 5. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT

TITLE
OPERATIONS / CLOSURE PHASE WATERSHEDS AT ASSESSMENT NODES

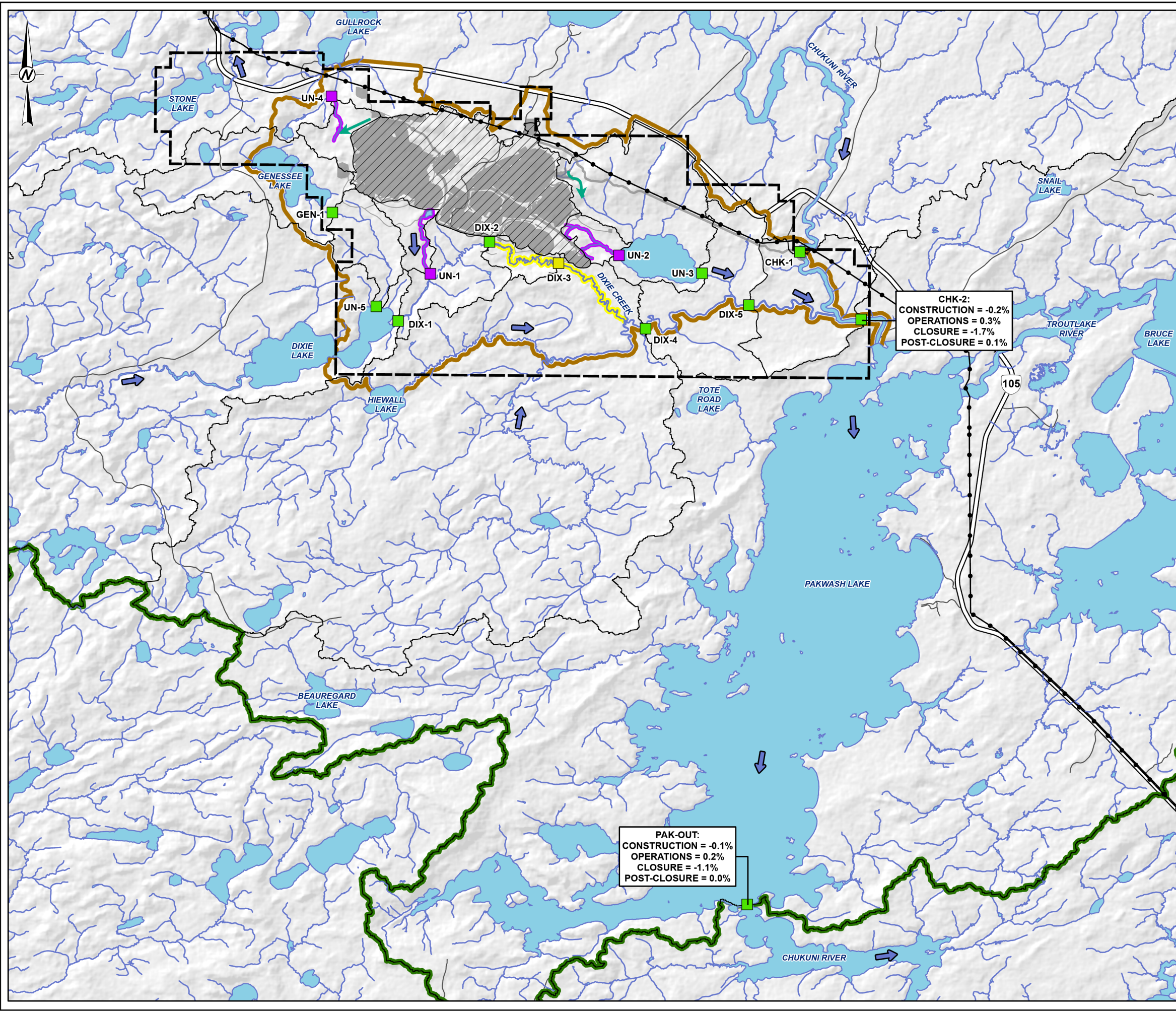
CONSULTANT

YYYY-MM-DD	2026-03-31
DESIGNED	---
PREPARED	MD
REVIEWED	---
APPROVED	SD

PROJECT NO. CA0031271 CONTROL 0001 REV. A FIGURE 7.6-7

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LEGEND

- PROPERTY BOUNDARY
- GREAT BEAR PROJECT FOOTPRINT
- CLEAN WATER DIVERSION
- LOCAL STUDY AREA FOR SURFACE WATER FLOWS AND LEVELS
- REGIONAL STUDY AREA FOR SURFACE WATER FLOWS AND LEVELS
- MODELLING NODE WATERSHED
- PROJECT WATERSHED
- HIGHWAY
- LOCAL ROAD
- EXISTING TRANSMISSION LINE
- WATERCOURSE
- WATERBODY
- FLOW DIRECTION

**HYDROLOGY MODELLING NODE
(MAXIMUM CHANGE IN FLOW +/-)**

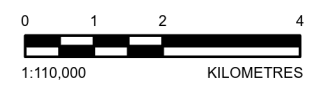
- 0% - 10%
- 10% - 15%
- > 15%, COMPENSATED FOR IN THE FISH HABITAT COMPENSATION PLAN (APPENDIX L-2)

**WATERCOURSE / WATERBODY WITH CHANGES TO FLOW >10%
(MAXIMUM CHANGE IN FLOW +/-)**

- 10% - 15%
- > 15%, COMPENSATED FOR IN THE FISH HABITAT COMPENSATION PLAN (APPENDIX L-2)

CHK-2:
 CONSTRUCTION = -0.2%
 OPERATIONS = 0.3%
 CLOSURE = -1.7%
 POST-CLOSURE = 0.1%

PAK-OUT:
 CONSTRUCTION = -0.1%
 OPERATIONS = 0.2%
 CLOSURE = -1.1%
 POST-CLOSURE = 0.0%



NOTE(S)
 1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
 1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
 2. PROPERTY BOUNDARY PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2024.
 3. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
 4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT

TITLE
ZONE OF CHANGES – SURFACE WATER FLOW

CONSULTANT	YYYY-MM-DD	2026-03-31
	DESIGNED	---
	PREPARED	MD
	REVIEWED	---
	APPROVED	SD

PROJECT NO. CA0031271	CONTROL 0001	REV. A	FIGURE 7.6-8
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7.7 Water Quality

The water quality pVC encompasses both surface water quality and groundwater quality. It is identified as a pVC because changes in water quality parameters, such as concentrations of metals, metalloids, nutrients and ions, resulting from Project development have the potential to affect environmental and human health. Water quality is a fundamental determinant of the health and sustainability of aquatic and terrestrial ecosystems as well as the well-being of humans. It has also been identified to be of value to local Indigenous Nations. Great Bear Resources recognizes and respects the importance of Nibi (water), and acknowledges our collected responsibility to protect Nibi today and for future generations. Great Bear Resources is expected to consider the importance of Nibi (water) as a holistic valued component for First Nations as per the Nibi Declaration of Treaty #3 which indicates in part that “*Nibi (water) is alive and has a spirit. It is the lifeblood of our mother (Aki) and connects everything. It can give, sustain and take life*”.

7.7.1 Pathway Linkages to other Valued Components

7.7.1.1 Pathway Linkages to Water Quality

There is a pathway effect from groundwater quantity (Section 7.5) and surface water flows and levels (Section 7.6) to water quality. Changes in groundwater quantity, and surface water flows and levels may affect water quality.

7.7.1.2 Pathway Linkages from Water Quality to fVCs

Changes in water quality may have direct and indirect linkages to the assessment of effects on fVCs, including fish and fish habitat, migratory birds and Indigenous Peoples. Alterations in water quality can influence the availability and suitability of aquatic habitats supporting fish populations. Project-related changes to water quality could directly affect migratory birds, and / or indirectly through changes in local vegetation communities, which may also affect the current use of lands and resources for traditional purposes by Indigenous people (Sections 10.6, 11.6, 12.6, 13.6 and 14.6) and health of Indigenous people (Sections 10.9, 11.9, 12.9, 13.9 and 14.9), as appropriate.

7.7.2 Assessment Approach

The assessment of potential effects is supported by a description of the existing conditions for this pVC (Section 7.7.4), the identification and description of applicable pathways of potential effects on the pVC (Section 7.7.5) and a description of applicable mitigation measures for the pVC (Section 7.7.6).

The approach to the assessment for water quality, which encompasses surface water quality and groundwater quality, includes:

- Description of the relevant regulatory and policy setting
- Description of the spatial and temporal boundaries
- Identification of criteria and indicators along with the associated rationale
- An outline of the analytical methodology conducted for the assessment, key assumptions and use of the conservative approach.

With the application of mitigation measures to the potential effects on the pVC, the changes are then characterized in Section 7.7.7.

7.7.2.1 Regulatory Setting

The Project is located in Ontario and will need to meet applicable federal and provincial legislation and regulatory requirements. Provincial and federal regulatory agencies have prescribed criteria, benchmarks and standards. Government policies, objectives, standards or guidelines most relevant to water quality are summarized below. Further information regarding anticipated approval requirements is provided in Section 19.

7.7.2.1.1 Federal

Surface water quality is a component of the environment important to fish, which in Canada is governed under the *Fisheries Act* administered primarily by DFO. The pollution prevention provisions of the *Fisheries Act* (Section 36) are administered by ECCC. Specifically, the Metal and Diamond Mining Effluent Regulations (MDMER) of the *Fisheries Act*, regulate the deposition of deleterious substances, such as mine effluent, into natural waters frequented by fish per subsection 36(3). Schedule 4 of the MDMER provides the maximum allowable concentrations of prescribed deleterious substances, identified as: parameters (arsenic, copper, cyanide, lead, nickel, zinc, radium-226, suspended solids and unionized ammonia) in effluent from mining operations. The MDMER also provides the acceptable range for pH in mine effluent discharged to natural water frequented by fish (pH of 6.0 though 9.5). In addition, environmental effects monitoring requirements for mining operations are specified in Schedule 5 of the MDMER.

Water quality guidelines available at the federal level provide numeric or narrative criteria that define acceptable concentrations of substances in water. These criteria are designed to be protective of intended water uses and receptors such as aquatic life, wildlife, livestock, agriculture and drinking water. Water quality guidelines serve as benchmarks for evaluating water quality conditions and assessing potential effects; however, in and of themselves they are not legally enforceable. Instead, water quality guidelines are intended to serve as guidance rather than a regulation. The Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG) were established by the Canadian Council of Ministers of the Environment (CCME; 2017). Similarly, Federal Environment Quality Guidelines (FEQG) provide recommended threshold for parameters not covered by CWQG and represent recommended chemical thresholds to support federal initiatives. The CWQG and FEQG are parameter-specific and are based on rigorous peer-reviewed scientific research, derived from toxicological data across a range of species and environmental conditions. These guidelines are designed to safeguard the most sensitive life stage of the most sensitive aquatic species for periods of indefinite exposure and are conservative in nature, providing a high level of protection for aquatic ecosystems.

7.7.2.1.2 Provincial

Water quality associated with industrial projects is managed in Ontario during all Project phases through a Provincial approvals process.

The *Ontario Water Resources Act* is the principal statute governing water in Ontario. It is a general management statute that applies to groundwater and surface water. The *Environmental Protection Act* is the principal pollution control statute in Ontario and is used in conjunction with

the *Ontario Water Resources Act* to manage development activities that may affect water quality. Both acts are administered by the MECP. There are two primary regulations that protect water resources in Ontario:

- Ontario Regulation 387/04: Water Taking and Transfer Regulation requires a permit for water takings, generally more than 50,000 L/d. Section 34 of the Act requires the proponent to obtain a Permit to Take Water, and Section 9 of Ontario Regulation 387/04 requires all permit holders to collect, record and report data on daily volumes of water withdrawals.
- Section 53 of the Act requires that an Environmental Compliance Approval be obtained for industrial sewage systems, such as for collecting and treating mine contact water that is discharged to the environment.

The *Mining Act*, as amended by the *Building More Mines Act*, and related regulations, sets out standards and criteria for mine closure. With respect to water quality, these statutes and regulations identify water quality parameters to be monitored, as well as monitoring and certification requirements for assessing the success of closure activities in protecting surface water and groundwater quality after mining operations cease.

As indicated in Section 7.7.2.1.1, water quality guidelines are criteria established to define acceptable concentrations of substances in water, that are intended to serve as guidance rather than to regulate. In Ontario, surface water quality assessments typically utilize water quality guidelines for the protection of aquatic life (WQG PAL), as these are generally more stringent than those for other uses or receptors. WQG PAL are derived from peer-reviewed toxicological data across multiple species and conditions, are parameter-specific, and are intended to protect the most sensitive life stage of the most sensitive aquatic species under indefinite exposure conditions. Conservative safety factors are also often incorporated in WQG PAL to address uncertainties such as species variability and environmental differences. Where relevant (e.g., substances that bioaccumulate), WQG PAL can specify thresholds below which adverse effects are unlikely, ensuring robust protection of aquatic ecosystems (BC MOE 2001).

The WQG PAL used in this Impact Statement are listed in Table 7.7-1 and have been identified based on recent provincial (MECP) guidance, which has recommended the utilization of the most current and scientifically defensible WQG PAL sourced from the following:

- Provincial Water Quality Objectives (PWQO) and interim PWQO (iPWQO) for protection of aquatic life developed by the MECP through its responsibilities under the *Ontario Water Resources Act* and *Environmental Protection Act*, along with associated management policies and guidelines
- CWQG established by the CCME to provide a science-based benchmark for a nationally consistent level of protection for aquatic life in Canada
- FEQG, developed for parameters which CCME guidelines do not yet exist or are not reasonably expected to be updated in the near future, representing recommended chemical thresholds to support federal initiatives
- Other provinces where more recent and defensible guidelines are available beyond those than those listed above (e.g., British Columbia Water Quality Guidelines; BC WQG and Saskatchewan Environmental Quality Guidelines; SEQG).

To protect aquatic ecosystems, water quality must not be further degraded where existing conditions already greater than identified PWQO or iPWQO in Ontario. This guidance is specified in Policy 2 of MECP guidance document B-1-5: Deriving Receiving Water-Based Point Source Effluent Requirements for Ontario Waters (MOEE 1994)

7.7.2.2 Spatial and Temporal Boundaries

Spatial boundaries are used to support consistent descriptions across disciplines and bound the assessment of the potential effects of the Project. The PA is consistent for all pVCs and fVCs, and encompasses the anticipated footprint of the Project, including all temporary and permanent areas associated with the mine site, as well as a buffer to allow flexibility for design optimizations prior to construction and over the mine life (Section 6.4). The spatial boundaries used for the assessment of water quality, which includes both surface water quality and groundwater quality, are aligned to the boundaries for fish and fish habitat (Section 8.2.2) and are defined as follows:

- LSA: The LSA for water quality corresponds to the area around the PA where most of the water quality effects of the Project are expected to occur, taking into account the water management plans, drainage patterns and potential changes to flow and groundwater systems (Figure 7.7-1). The LSA includes sub-watersheds of Dixie Creek that intersect with the PA, as well as the Chukuni River (the receiving environment). The north boundary of the LSA is defined as the southern edge of Highway 105 as the linear corridor and associated ditching dictates drainage patterns and flow direction. The LSA also includes the Chukuni River upstream to the Snowshoe Rapids Dam, which is a barrier to fish movement, and downstream to the outlet of Pakwash Lake.
- RSA: The RSA for water quality encompasses LSA and extends into the Dixie Creek watershed, encompassing Dixie Lake and Hiewall Lake. Upstream, it follows the Chukuni River to include Two-Island Lake, Gullrock Lake, Keg Lake and Red Lake. Downstream, the RSA continues through Pakwash Lake and along the Chukuni River to its confluence with the English River (Figure 7.7-2).

The purpose of a temporal boundary is to identify when an effect may occur in relation to specific Project phases and activities. The temporal boundaries are based on the timing and duration of Project activities and the nature of the interactions with valued components. The temporal boundaries for the assessment as defined in Section 6.5 are:

- Construction phase:
 - Years -3 to -1 representing the primary period of Project construction
 - Mining of the Viggo pit will be completed during this phase and will be initiated in the last year of construction in the LP Central pit, requiring dewatering activities
 - Contact waters will be collected and managed LSA during this phase; as needed, treated effluent will be discharged to the Chukuni River (the receiving environment)
- Operations phase:
 - Years 1 to 26; during year 1 the Project will transition from construction into operations and will not be at full capacity
 - Mine dewatering and management of contact waters and treated effluent discharge to the Chukuni River continues

- Closure phase:
 - Years 27 to 29 represent the active closure period when the majority of the decommissioning and reclamation of the PA is completed and contact waters are managed. There is no discharge to the Chukuni River during this time.
 - Years 30 is a passive closure period while the site is on care and maintenance while the mine workings are filled with water (water treatment infrastructure will remain in place and contact waters are managed as needed)
 - Year 31 is the final close out period when water treatment infrastructure is removed, after the LP Central pit is filled with water, and site waters are acceptable for passive release to the environment. Gravity runoff from the reclaimed site will occur to watercourses within the Dixie Creek watershed, and LP Central pit will passively discharge to Dixie Creek.

Effects on water quality were assessed for each Project phase (i.e., construction, operations and closure).

7.7.2.3 Assessment Criteria

Project activities during the construction, operations and closure are expected to influence water quality, which includes surface water and groundwater quality. To evaluate these potential changes, this assessment considered the following single indicator to reflect the interrelationship of surface water and groundwater quality (Table 7.7-2):

- Change in water quality.

The parameters used to indicate changes to water quality are metals, metalloids, nutrients and anions with WQG PAL, identified in Table 7.7-1. Changes to water quality are discussed as a relative percent change (%) compared to baseline conditions and in relation to WQG PAL to support the assessment.

7.7.2.4 Analytical Methods

The assessment of water quality effects has been completed in accordance with standard methods. The prediction and assessment of effects involved:

- Characterizing baseline surface water and groundwater quality conditions
- Identifying potential interactions of the Project on surface water and groundwater quality
- Predicting changes to water quality using appropriate geochemical baseline characterization data, quantitative modelling methods and qualitative assessments
- Comparing the predicted changes to the assessment criteria.

Interactions between the Project and water quality were evaluated and quantified through predictive modelling, as detailed in the Receiver Water Quality Model Report (Appendix K-3). The receiver water quality model was developed to simulate changes in water quality resulting from Project activities across all Project phases and under a range of climatic conditions. The model incorporates projected changes in loadings reporting to the environment (e.g., shifts in land use that change the amount of natural runoff reporting to the surface water receiving environment), as well as changes in resulting concentrations to characterize the potential effects on water quality. Projected loadings and concentrations describe related but distinct aspects of

water quality prediction. Loadings represent the mass of a substance released over time (e.g., mg/day). In the receiving water quality model, loadings are the quantity of a parameter entering the environment over a specific time period. In contrast, concentrations represent the amount of that substance present in a volume of water at a specific location (e.g., mg/L). Concentrations reflect conditions in the receiving environment and depend on hydrologic conditions and existing baseline water quality. While loadings describe the inputs to the environment, concentrations reflect the resulting water quality, i.e. the water quality outcome. For example, a loading rate from treated effluent discharge does not necessarily lead to higher concentrations where receiving waters have substantial flow or if upstream natural loadings are relatively higher. Conversely, even low loading rates (e.g., from groundwater seepage) may be associated with higher concentrations in receiving environments where flows and baseline concentrations are low.

In the receiving water quality model, a base case scenario (i.e., the conservative expected case) was defined with respect to predicted Project loadings, treated effluent discharge rates and changes in surface - groundwater interactions. Conceptually, the base case represents the most likely set of conditions based on current Project design, operational assumptions and environmental conditions. Evaluating sensitivity scenarios provides a more complete understanding of the potential range of water quality outcomes, supports assessment of the resilience of proposed water management strategies, and enhances confidence in the predictive reliability of the model.

Sensitivity analyses were completed to characterize and define water quality changes across a range of plausible future scenarios. The sensitivity analyses included evaluation of water quality changes under extreme hydrologic conditions (e.g., wet and dry years), potential climate change influences, and variations in baseline water quality assumptions. Similarly, a scenario was evaluated to be conservative and in support of the Impact Statement, in which site water quality may not be suitable for passive discharge immediately following pit filling. In this modelling scenario, passive closure is assumed to extend for approximately three years after the LP Central pit and VMF have been filled. During this period, the overall water management strategy remains unchanged; however, water from the LP Central pit lake and Viggo pit lake is assumed to require treatment prior to discharge to the Chukuni River. Additional details regarding data inputs and assumptions for base case versus sensitivity cases are provided in Appendix K-3.

In the receiving water quality model, water quality predictions are generated at specific surface water receiver locations (i.e., nodes) across the PA, LSA and RSA. The location of the nodes are shown on Figure 7.7-3. Water quality predictions were generated for 20 modelling nodes within PA, LSA and RSA. This node-based modelling approach is an industry-standard method for predicting water quality changes across a large area, providing a structured framework for evaluating water quality changes at key locations, while maintaining a defensible balance between model complexity and practicality.

Changes in groundwater quality that discharges to surface water are also included in the receiving water quality model, as applicable. The Project may influence groundwater quality within the PA and the LSA adjacent to the PA, as a result of fugitive groundwater seepage from Project facilities. Changes to groundwater quality are important because they can affect the quality of groundwater discharging to surface water features in the PA and LSA. To be conservative, it has been assumed that the predicted quality of fugitive groundwater seepage from Project components is representative of all groundwater contributing to surface water features. Detailed predictions of fugitive seepage quality are provided in Appendix K-3.

The water quality modelling incorporates the results of the metal leaching and acid rock drainage (ML / ARD) characterization programs, including estimates of the quality of contact waters to be managed on site and the quality of fugitive groundwater seepage. The approach and testing methods used in the extensive ML / ARD characterization studies completed for the Project, were based on the requirements described under the Ontario *Mining Act*; guidance found within the Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (MEND 2009), which represents best practice and industry-standard approaches and methodologies for ML / ARD sampling and characterization in Canada. The overall goal of the ML / ARD program was to generate the data needed to inform mine planning and management decisions, including related to mined materials, exposed mine surfaces and tailings. Results of the ML / ARD program are summarized in Appendix J. Corresponding contact water quality and groundwater seepage quality predictions are presented in Appendix K-2.

Key results from the ML / ARD program integrated into the receiving water quality model are as follows:

- Overburden materials are non-potentially acid generating (NPAG), with very low sulphur content and low solid phase metal contents. Steady state leachate from kinetic test work indicated water quality parameter concentrations in leachate from overburden materials are similar to, or lower than, concentrations of baseline surface water quality data observed in the PA for all water quality parameters.
- Some mine rock types are potentially acid generating (PAG). Approximately 80% of tested drill core samples were classified as PAG based on static test work, including 78% of mine rock samples. Most mine rock samples from the LP Central pit (85%) and Viggo pit (67%) were classified as PAG, along with approximately half of the samples (50%) from the underground mine. Corresponding humidity cell tests (35 samples over 19 to 66 weeks) confirmed these classifications but also showed that sulphide oxidation rates were generally low, indicating long lag times (often 10 years or more) for typical pyrite and pyrrhotite-bearing materials. High-sulphide samples with low neutralization capacity showed similar slow oxidation, though some may acidify within a shorter timeframe under certain conditions.
- Production of two segregated (NPAG and PAG) tailings streams, determined through studies to be the best means to manage ML / ARD in the long term (Section 5.6.3). With respect to tailings, the desulphurization flotation circuit in the process plant will produce a larger volume of desulphurized tailings (NPAG) and lower volume of sulphide-containing concentrate tailings (PAG). Producing a larger volume desulphurized tailings that are NPAG and lower volume of concentrate tailings which are PAG allows for separate management approaches, providing environmental benefits to water quality during operation and after closure. Additional information on tailings geochemistry is provided in Appendix J.

Water quality modelling results were compared to WQG PAL based on recent MECP guidance and WSP experience for other Ontario mining projects (Section 7.7.2.3, Table 7.7-1). The WQG PAL, sourced from federal, provincial or CCME guidelines, are scientifically defensible and designed to protect the most sensitive aquatic life stages under indefinite exposure.

Modelled water quality results were also evaluated against baseline conditions using a 20% relative percent difference (RPD) threshold to identify changes likely to be observable and potentially meaningful. The RPD metric provides a quantitative measure of the difference

between predicted concentrations and baseline values, expressed as a percentage of the baseline. The use of RPD as a screening tool here is appropriate in the context of this conservative mass balance model, an assumption that will result in higher predicted concentrations than would likely occur under real-world conditions for many parameters. As such, a calculated RPD serves as a useful screening tool for flagging potential changes and identifying the key incremental changes relative to existing conditions. The selected 20% threshold corresponds to general analytical resolution capabilities of water quality lab tests and considers that a calculated RPD of 20 to 25% are generally used in quality assurance and quality control protocols of environmental monitoring programs to define data as measurably different (BC MOE 2013; CCME 2016).

During consultation and engagement with Indigenous Nations, potential Project-related contributions to methylmercury production in downstream watersheds were identified as a concern. To address this, supplemental modelling was undertaken to support the Impact Statement by simulating the relationship between potential sulphate loadings from treated effluent discharge to the Chukuni River and methylmercury production in downstream waterbodies. Details of the modelling approach are presented in Appendix T.

7.7.3 Assumptions and the Use of the Conservative Approach

Conservative approaches are defined as methodologies that intentionally produce effect predictions that will be on the higher end of the plausible range, as a means to avoid the underestimation of potential effects from the Project. For water quality, these conservative approaches include the following:

- Steady-state modelling to simulate changes in surface water - groundwater interactions, as detailed in Section 7.5.3. Steady-state modelling assumes infinite drawdown effects on surface water receiver(s), providing for less assimilation capacity. In reality however, potential effects to receivers will progress gradually due to the buffering effects of groundwater storage, with some receivers likely never experiencing the steady-state, maximum values estimated by the hydrogeological model developed to support the Impact Statement (Appendix H-2).
- It has been assumed that the predicted quality of fugitive groundwater seepage from Project components is representative of all of the groundwater contributing to surface water features (i.e., is not diluted by or mixed with baseline groundwater), resulting in an overestimation for most parameters.
- Fugitive groundwater seepage volumes reporting to the receiving environment have been conservatively predicted as detailed in Section 7.5.3. Hydraulic conductivity values for bedrock are mainly based on site field tests, like packer and slug tests, which measure water movement through fractures near the borehole (within tens of metres). Many of these fractures do not connect over the larger distances relevant to this study (hundreds to thousands of metres). This means the test results tend to overestimate how easily water moves through the bedrock at a broader scale, adding a layer of conservatism to both fugitive groundwater seepage to surface water receivers and groundwater inflows to the underground mine and open pits.
- Along fugitive groundwater seepage pathways from Project components to Dixie Creek, Unnamed Waterbody 6, Unnamed Watercourse 1, Unnamed Watercourse 2, Unnamed Watercourse 5, water quality parameters behave conservatively and are assumed to not

be reduced by natural processes and mechanisms, such as secondary mineral formation, dilution by regional groundwater, attenuation through sorption processes or biogeochemical reactions such as assimilation or biodegradation, resulting in an overestimation for most parameters.

- Within the treated effluent discharge flow pathway, water quality parameters have been assumed to behave conservatively, and are not reduced by natural processes and mechanisms such as secondary mineral formation, attenuation through sorption processes or biogeochemical reactions such as biodegradation, resulting in an overestimation for most parameters.
- Sulphate availability is assumed to be the limiting factor for methylmercury production (i.e., as opposed to organic carbon supply, inorganic mercury supply or other potentially limiting factors) as detailed in Appendix T, such that any additional sulphate load from the treated Project effluent will result in enhanced methylmercury production. All new methylmercury produced in from sulphate loadings is released into the water column and is available, without accounting for any destruction of methylmercury (via microbial demethylation process or photodegradation) as described in Appendix T.

Additional optimization of the contact water management infrastructure may also occur that will reduce the water taking and discharge rates as engineering advances through to detailed design, and with optimizations during operations.

The conservative approach outlined above demonstrates that effects on water quality will likely be better than predicted, and with the application of mitigation measures, there will be reliable environmental protection of water quality.

7.7.4 Existing Conditions

The robust surface water and groundwater quality monitoring programs for the Project were developed in alignment with the applicable regulatory framework for proposed mining projects in Ontario to characterize environmental baseline conditions. The baseline conditions forming the basis for assessing potential Project-related effects for water quality are summarized in Section 2.10 and the subsections that follow. A comprehensive summary of baseline water quality is provided in Appendix K-1. The characterization of existing surface water and groundwater conditions, which are also important in the assessment of potential effects to water quality, is presented in Appendix I-1 and Appendix H-1, respectively.

7.7.4.1 Surface Water Quality

A comprehensive surface water quality baseline database is available for the Project and incorporates long-term seasonal sampling to capture natural variability and to characterize pre-Project conditions (Appendix K-1). Sampling locations were strategically selected to represent areas that may be directly or indirectly affected by the Project, as well as representative upstream and downstream locations. Sampling sites were also chosen to capture spatial variability, account for variability in natural influences (e.g., geology, anoxic environments and riverine versus lake systems) and to fully support the Impact Statement.

Baseline surface water quality sampling locations are presented in Figure 7.7-4. As part of the baseline program to support the Impact Statement preparation, 37 stations were monitored, and more than 600 samples were collected between 2020 and 2024 across the following areas:

- Dixie Creek
- Chukuni River
- Named waterbodies (Genessee Lake, Dixie Lake, Pakwash Lake and Gullrock Lake)
- Unnamed watercourses and unnamed waterbodies.

Sampling was carried out year-round, typically on a monthly basis, to characterize potential seasonal variations in water quality. Monitoring included the analyses of physicochemical parameters (such as temperature, pH, dissolved oxygen and conductivity), as well as concentrations of nutrients, anions, cyanides, metals and metalloids (including mercury and methylmercury identified of particular Indigenous interest). Quantification of mercury species included analyses both by standard procedures (cold vapor atomic absorption spectroscopy) and specialized, ultra-low detection procedures (cold vapor atomic fluorescence spectroscopy). Physicochemical profiling of deep basin waterbodies (such as Genessee Lake, Unnamed Waterbody 6, Pakwash Lake and Gullrock Lake) was also conducted to support identification of any stratification influences on water quality, such as seasonal anoxic zone formation and lake turnover. This approach aligns with request from LSFN and WFN (January 2025) to harmonize methods with their Nation-led regional monitoring program. Baseline surface water quality monitoring results presented in this section are included in predictive water quality modelling and provide the foundation for assessing potential Project-related effects on water quality, while also providing regional context. All reported concentrations are for total concentrations, unless explicitly stated otherwise (e.g., as dissolved concentrations). Detailed information for all baseline monitoring stations is provided in the Water Quality Baseline Report (Appendix K-1).

At a regional scale, the Project is within the Red Lake mining district in northwestern Ontario, which has a long history of gold exploration and mining production. There are historical and currently operating mines in the region and within the Chukuni River watershed. Locally, the Project lies within the Dixie Creek watershed, which flows into the Chukuni River before ultimately draining into Pakwash Lake. Dixie Creek joins the Chukuni River approximately 6 km downstream of Highway 105 and about 4 km upstream of Pakwash Lake. Pakwash Lake is a large waterbody, with a surface area of more than 98 km² and a maximum recorded depth of 17.4 m. It has a watershed area of approximately 8,020 km² and receives inflows from the Chukuni River, Troutlake River, Lac Seul and Cedar River (Figure 7.7-5).

Overall, monitoring results indicate that baseline surface water quality is typical of what would be expected in the vicinity of proposed mining developments in northern Ontario, including circumneutral to slightly acidic pH, low concentrations of nitrogen species (ammonia, nitrate and nitrite), and low concentrations of anions and total dissolved solids. Concentrations of certain total metals, most frequently arsenic and phosphorus, were above WQG PAL across the baseline study area. Naturally elevated levels of some metals are common in areas with planned or proposed mining activities; such conditions typically arise from natural weathering processes, where rocks and other geological materials exposed to water release metals and other parameters into groundwater and surface water. Additionally, nearby wetlands in the Dixie Creek watershed likely influence surface water chemistry by contributing low dissolved oxygen levels and high concentrations of dissolved organic carbon, both of which promote the retention of metals in solution and / or suspension within the water column. Considerable beaver activity has been consistently observed in Dixie Creek, with several beaver dams controlling flow and levels locally. Historical and existing mining activities in the RSA may also have contributed to observed elevated concentrations of select water quality parameters.

Baseline monitoring results are summarized in Table 7.7-3 to Table 7.7-6 and discussed below, for waterbodies and watercourses that may have water quality changes resulting from the Project.

7.7.4.1.1 Dixie Creek

The Project will be located primarily within the drainage area of Dixie Creek and its tributaries. Dixie Creek itself crosses the southern portion of the Property before its confluence with the Chukuni River. Baseline water quality of Dixie Creek is summarized in Table 7.7-3. Dixie Creek is of circumneutral to slightly acidic pH, with low concentrations of nitrogen species. Concentrations of dissolved organic carbon were higher in Dixie Creek relative to other monitored watercourses in the baseline study area, with concentrations ranging from 2.0 to 64.0 mg/L; this likely reflects influences of wetlands in the vicinity. Sulphate concentrations are low in Dixie Creek (0.35 to 7.0 mg/L).

Concentrations of mercury and methylmercury were low, but variable along Dixie Creek with large, seasonal variations and the highest concentrations were typically observed in summer. Ultra low-level mercury analyses showed mercury concentrations ranging from 0.41 to 18.2 ng/L (0.00000041 to 0.0000182 mg/L) and methylmercury concentrations from 0.032 to 0.70 ng/L (0.000000032 to 0.0000007 mg/L). These values are below the identified federal WQG PAL for total mercury (26 ng/L or 0.000026 mg/L) and methylmercury (4 ng/L or 0.000004 mg/L). Concentrations of most total and dissolved metals were low in Dixie Creek.

Parameters frequently observed in the baseline condition to be greater than WQG PAL are:

- Total aluminum in approximately 11% of observations
- Total arsenic in approximately 5% of observations
- Total iron in approximately 42% of observations
- Total phosphorus in approximately 61% of observations.

7.7.4.1.2 Chukuni River

The Chukuni River is the proposed receiving environment for the Project. Baseline monitoring results for the Chukuni River are summarized in Table 7.7-4. The Chukuni River is of circumneutral pH, with low concentrations of nitrogen species, total dissolved solids and major anions. Sulphate concentrations ranged from approximately 1.0 to 8.0 mg/L along the Chukuni River, with concentrations similar across upstream versus downstream of the Dixie Creek confluence.

Ultra low-level mercury analyses showed mercury concentrations ranging from 0.52 to 11.3 ng/L (0.00000052 to 0.0000113 mg/L). Methylmercury concentrations ranged from 0.019 to 0.63 ng/L (0.000000019 to 0.00000063 mg/L). These values are well below the identified federal WQG PAL for total mercury and methylmercury.

Concentrations of most total and dissolved metals were low in the Chukuni River. Parameters frequently observed to be greater than WQG PAL in baseline conditions are:

- Total arsenic in approximately 96% of observations
- Total phosphorus in approximately 32% of observations.

There are no discernable trends along the Chukuni River flow path for arsenic and phosphorus, and concentrations of these parameters are similar upstream and downstream of the Dixie Creek confluence.

7.7.4.1.3 Unnamed Watercourses and Unnamed Waterbodies

Water quality for small unnamed watercourses is summarized in Table 7.7-5. The unnamed watercourses are characterized by very low flow conditions and seasonally consist of isolated, disconnected pools. Field observations indicate the unnamed watercourses typically freeze to the bottom during the late fall and winter. Water in the unnamed watercourses is moderately hard, exhibit large seasonal temperature fluctuations and contains high levels of total and dissolved organic carbon.

Ultra low-level mercury analyses showed concentrations ranging from 1.1 to 18.4 ng/L (0.0000011 to 0.0000184 mg/L) for mercury and from 0.04 to 0.75 ng/L (0.00000004 to 0.00000075 mg/L) for methylmercury. These values are below the identified federal WQG PAL for total mercury and methylmercury.

Parameters frequently observed to be greater than WQG PAL in baseline conditions for unnamed watercourses are:

- Total aluminum in approximately 53% of observations
- Total arsenic in approximately 34% of observations
- Total cobalt in approximately 25% of observations
- Total iron in approximately 68% of observations
- Total phosphorus in approximately 65% of observations.

Unnamed Waterbody 6 is within LSA, and baseline water quality is summarized in Table 7.7-5. It is a shallow waterbody with wide riparian habitat dominated by shrubs, grasses and sedges along its margins and ultimately outlets to Dixie Creek, upstream of its confluence with the Chukuni River. Physicochemical profiling indicates that Unnamed Waterbody 6 presents minor stratification in both the summer and winter, with dissolved oxygen concentrations reaching 0.54 and 1.04 mg/L, respectively, at the bottom. Overall results indicate that the surface water in Unnamed Waterbody 6 is of circumneutral to slightly acidic pH with high hardness. Sulphate concentrations were very low and range from 0.36 to 1.0 mg/L.

Ultra low-level mercury analyses showed mercury concentrations in Waterbody 6 ranging from 1.2 to 5.6 ng/L (0.0000012 to 0.0000056 mg/L) and methylmercury concentrations ranging from 0.016 to 0.097 ng/L (0.000000016 to 0.000000097 mg/L). These values are below the identified federal WQG PAL for total mercury and methylmercury. Total and dissolved metal concentrations in Unnamed Waterbody 6 were consistently low and remained below the identified WQG PAL.

The only parameter frequently observed to be greater than WQG PAL in baseline conditions is:

- Total phosphorus in approximately 68% of observations.

7.7.4.1.4 Other Locations

Genessee Lake is within the LSA, and is upstream of Dixie Lake, which outlets to Dixie Creek. Baseline water quality is presented in Appendix K-1. The lake has an average depth of

approximately 4 m and a maximum depth of approximately 11 m. Seasonal stratification occurs in summer (June to September) and winter (January to April). Genesee Lake is of circumneutral pH, moderate hardness with low nitrogen and major anion concentrations. Sulphate is very low (0.5 to 4.0 mg/L). Total and dissolved metals are generally very low and below WQG PAL. Occasional values greater than WQG PAL (less than 5% of observations) were observed for nitrite, cadmium, selenium and arsenic. However, overall concentrations for these parameters are low, and 75th percentile concentrations for these parameters are below the identified WQG PAL.

Pakwash Lake is a large lake within the RSA, downstream of the Chukuni River. Baseline water quality monitoring results Pakwash Lake are summarized in Table 7.7-6. Pakwash Lake is of circumneutral pH, with low concentrations of nutrients (nitrate, nitrite and ammonia) and low concentrations of total dissolved solids in the baseline condition. Physicochemical profiling indicates that Pakwash Lake water column remains oxygenated throughout the year, with dissolved oxygen concentrations averaging 6.4 mg/L during the summer and 14 mg/L during the winter. Sulphate concentrations ranged from approximately 1.5 to 5.9 mg/L, with the highest concentrations generally observed in Pakwash Lake at station PL-01, directly downstream of inflows from the Chukuni River. Ultra low-level mercury analyses in Pakwash Lake showed very low baseline mercury concentrations, ranging from 0.58 to 5.0 ng/L (0.00000058 to 0.0000005 mg/L), and very low baseline methylmercury concentrations, ranging from 0.016 to 0.15 ng/L (0.00000016 to 0.00000015 mg/L). There were no consistent spatial or seasonal trends for mercury and methylmercury concentrations, and these values are below the identified federal WQG PAL for total mercury and methylmercury. Total metal and dissolved metal concentrations were low in Pakwash Lake. Parameters frequently observed to be greater than WQG PAL in baseline conditions are:

- Total arsenic in approximately 55% of observations
- Total phosphorus in approximately 78% of observations.

7.7.4.2 Groundwater Quality

A comprehensive groundwater quality baseline database is available for the Project. Baseline groundwater quality conditions presented in this section inform predictive modelling and provide the foundation for assessing potential Project-related effects on water quality. For groundwater, analyses were completed for dissolved concentrations for applicable parameters, as is standard practice.

A description of the baseline hydrogeological conditions is presented in Section 7.5.4, including groundwater flow regime, flow volumes at groundwater discharge locations and groundwater levels. Sampling locations are shown Figure 7.7-6 and Figure 7.7-7. Detailed groundwater quality information is presented in Appendix K-1.

Baseline groundwater quality results are compared to WQG PAL herein, to provide context and to support the assessment of potential changes in groundwater - surface water interactions for the Impact Statement. These WQG PAL are not intended for groundwater and are used here solely to provide a conservative comparison relative to surface water quality results.

Groundwater occurs in the subsurface, where environmental conditions differ considerably from those of surface water, resulting in distinct water quality profiles. Natural, undisturbed groundwater often contains concentrations of parameters higher than those in surface waters and above WQG PAL. Drinking water quality guidelines, which are generally more relevant for

groundwater, are generally less stringent than WQG PAL and for that reason have not been used.

More than 230 groundwater quality samples have been collected since 2021 in overburden and bedrock. Groundwater quality has remained consistent over the period of record and results indicate minimal seasonal or interannual variation. Overall, groundwater is circumneutral to slightly alkaline, with high hardness, low chloride and moderate to high conductivity. Nitrogen species (ammonia, nitrate and nitrite) are very low, often at the low detection limits used, and always below WQG PAL. Concentrations of most metals are also low, with most parameters at or below detection limits or WQG PAL.

Key observations for baseline groundwater quality are:

- Dissolved phosphorus: frequently above available WQG PAL for total phosphorus, approximately 51% of observations
- Occasional elevated dissolved concentrations of aluminium, arsenic, cobalt, copper, iron, tungsten and uranium were observed, ranging from approximately 5% to 32% of observations above WQG PAL, recognizing the guidelines are for total metals, with the exception of aluminum iPWQO
- Higher concentrations were most often associated with bedrock wells, particularly for dissolved concentrations of phosphorus, cobalt and tungsten.

7.7.5 Identification of Potential Effects

The initial step in the assessment process is to identify interactions between the Project and water quality, that could result in potential effects. These potential effects may be direct, indirect and / or positive effects, where applicable.

Table 7.7-7 summarizes the potential interactions of the Project with water quality, prior to the application of the mitigation measures (Section 7.7.6). The professional judgment of technical experts experienced with mining projects in Ontario and Canada, as well as input from Indigenous communities, government agencies and the public, informed the identification of those interactions that are likely to result in a measurable change to water quality, which encompasses both surface water quality and groundwater quality.

Project interactions with water quality generally fall into the following categories:

- Project activities or components that result in the creation of contact water, defined for the Project as any water that interacts with Project facilities. Contact water may contain elevated concentrations of metals, metalloids, and nutrients compared to WQG PAL and / or baseline water quality conditions, and such water must be appropriately collected, managed, and discharged, as applicable. Contact water qualities are predicted by the Mine Site Water Quality Model (Appendix K-2).
- Project discharges to surface water features, as predicted by the Mine Site Water Balance (Appendix I-2). This includes treated effluent discharge to the Chukuni River, discharge from the closed out site from LP Central pit lake, and passive drainage from reclaimed site areas in the final closure period.
- Changes to groundwater - surface water interactions, as identified and quantified by hydrogeological modelling (Appendix H-2). These changes can affect both the quality

groundwater (i.e., fugitive groundwater seepage from Project components) and the quantity of baseline groundwater discharging to surface water features.

- Changes to existing catchment areas and associated natural catchment loadings to surface water features, as predicted by the Receiving Water Balance Model (Appendix I-3). These changes typically result from the integrated water management system for the Project, which is designed to divert non-contact water away from the PA and collect contact water for treatment and discharge at a single location. Natural watershed / catchment boundaries are altered diverting non-contact water away and collected contact water, which can affect loadings from natural catchment areas and reduce water flows and volumes to surface water features.
- Fugitive dust deposition on surface water features, as predicted by the air quality modelling (Appendix D-2), generated from activities such as rock crushing and road traffic.

These pathways to potential effects are further described in Section 7.7.5.1 to Section 7.7.5.3 and summarized in Table 7.7-7 for each phase of the Project. Section 7.7.6 and Table 7.7-8 provide a description of the mitigation measures applied to these pathways to potential effects during all phases of the Project. The changes to water quality, after the application of the mitigation measures, are then described and further evaluated in Section 7.7.7.

7.7.5.1 Construction Phase

The construction phase of the Project is expected to occur over a three-year period and will include preparation of the site and the construction of mine infrastructure. The following interactions with the Project result in pathways to potential effects to water quality, without application of the mitigation measures proposed in Section 7.7.6:

- Erosion and sedimentation effects to local water features due to ground disturbances and changes in drainage patterns during site preparation activities, the establishment of onsite aggregate operations and the construction of the starter embankments for the TMF.
- Fugitive dust emissions and subsequent deposition on surface water features; key activities include operation of equipment during site preparation activities, mining of the Viggo pit, management of rock and unconsolidated materials in stockpiles, the establishment of onsite aggregate operations and the construction of the starter embankments for the TMF.
- Changes to existing catchment area and associated natural catchment loadings to surface water features due to:
 - Site preparation activities, construction activities, the establishment and operation of water management and treatment facilities and the commissioning of the process plant will result in the collection of surface water from portions of the Project site. This will change surface water catchment areas and groundwater quantity reporting to surface water features within the LSA, primarily within and near the PA.
 - Dewatering of the Viggo pit and underground mine workings will change existing flow paths of some groundwater, as the groundwater entering the mine workings, will require collection and treatment. The presence of the Viggo pit and underground mines will also create a hydrogeological ZOI and interact with the groundwater

- contributions to surface waterbodies and watercourses within the LSA, primarily on and near the PA, as described in Section 7.5.
- Establishment of starter embankments for the TMF will result in the diversion of non-contact water to nearby surface waterbodies and watercourses, interacting with the watershed areas that would otherwise contribute flows.
 - Blasting residue will remain on mine rock from explosive use during mining, which will influence runoff quality from the MRS as well as mine dewatering water quality. These waters will be collected and sent to the integrated water treatment system, influencing concentrations in treated effluent discharged to the Chukuni River. Additional discussion of water treatment is provided in Section 7.7.6.

7.7.5.2 Operations Phase

The operations phase is anticipated to occur over a 26-year period. The following interactions with the Project result in pathways to potential effects to water quality, without application of the mitigation measures proposed in Section 7.7.6:

- Discharge of excess contact waters from the Project that will be collected and treated to the Chukuni River; key contact water sources are from the following activities:
 - Contact water management associated with desulphurized tailings in the TMF and the management of contact water in the VMF influences influent chemistry sent to the integrated water treatment system and concentrations in treated effluent discharged to the Chukuni River. Additional discussion of water treatment is provided in Section 7.7.6.
 - Blasting of mine rock during underground mining and mining of the LP Central pit will expose new rock faces available to leach metals and introduce blasting residues from explosives use, affecting the water quality of runoff from the MRS and mine dewatering water. These waters will be sent to the integrated water treatment system and influence concentrations in treated effluent discharged to the Chukuni River.
- Fugitive groundwater seepage from the MWP, TMF and TMF pond to surface water features.
- The operation of buildings and infrastructure will produce domestic sewage for management, treatment and discharge to the Chukuni River.
- Change to existing catchment area and associated natural catchment loadings to surface water features due to:
 - Diversion of non-contact water to nearby surface waterbodies and watercourses associated with east pond and the TMF north dam
 - LP Central pit and underground mining that will result in groundwater entering the mine workings, requiring collection and treatment. The presence of the LP Central pit and underground mines will also create a hydrogeological ZOI and interact with groundwater contributions to surface waterbodies and watercourses within the LSA, primarily on and near the PA, as described in Section 7.5.
 - Process plant operation that will require water takings from the Chukuni River, although the majority of process water needs will be met by water recycling.

- Fugitive dust emissions and subsequent deposition on surface water features from the mining of the LP Central pit and management of rock and unconsolidated materials in stockpiles, the construction of a MWP and progressive reclamation activities.

7.7.5.3 Closure Phase

The following activities during the active, passive and final closure periods will result in potential changes in water quality, without application of the mitigation measures proposed in Section 7.7.6:

- Discharges from the LP Central pit lake in the final closure period. After the mine workings are filled and water quality is acceptable for passive discharge to the environment, mine workings will be allowed to rise to steady-state levels. Once the water quality in the LP Central pit lake meets, and is predicted to continue meet, all quality requirements, the pit lake water level will be allowed to rise to the final elevation which will be controlled by means of a spillway connected to the residual channel of Unnamed Watercourse 3 which flows by gravity to Dixie Creek.
- Fugitive groundwater seepage to surface water features from the TMF pond and the MWP during active closure and passive closure.
- Fugitive groundwater seepage to surface water features from the VMF and TMF in the closure phase. Fugitive seepage from the Viggo pit lake will begin to report to Dixie Creek when pit filling is complete (no surface water overflow from the Viggo pit lake is predicted; Section 5.19.3.4).
- Passive drainage from reclaimed site areas in the final closure period. In the final closure period, the pre-Project watershed areas will have generally been restored, except for the permanent non-contact water diversions, and the reclaimed site will passively discharge to the environment. Closure of the water management facilities and the reclamation of impacted areas by re-grading, placement of an appropriate cover to facilitate revegetation, if needed, and revegetation (active or passive) of the site will result in changes to catchment area contributions to surface water features
- Reclamation activities will result in disturbances and changes in drainage patterns that could lead to erosion and sedimentation in local water features, and the operation of equipment will generate dust that may be deposited on local water features.
- Water will be taken from the Chukuni River during the active closure in a controlled manner, to expedite the filling of the mine workings with water, which will have a limited effect on the Chukuni River (the required fresh water taking at the maximum pipeline capacity, will be approximately 3% of the flow in the Chukuni River during the driest month; Section 5.19.3.1) and will influence discharge quality from the LP Central pit lake in the final closure period.

7.7.6 Mitigation and Enhancement Measures

A comprehensive integrated water management system has been developed to minimize potential effects on water quality throughout all phases of the Project (Section 5.14). Both contact water (water interacting with Project facilities and activities) and non-contact water will occur within the PA. The Project incorporate strategies for managing these waters to provide

environmental protection and maintain regulatory compliance. Measures to be implemented to avoid or minimize the effects of the Project on water quality include the following:

- Reduce the generation of contact water by diverting non-contact water away from the site where feasible, and by collecting and transferring contact water to the integrated site water management system. This system will be established during the construction phase and maintained through the operations phase and will continue into the closure phase, as appropriate.
- Mitigation measures related to water treatment and discharge:
 - The water treatment plant (WTP) will be designed to produce water that is suitable for re-use, or discharge to the Chukuni River in accordance with applicable regulatory requirements, including the MDMER, and the anticipated effluent criteria required by the MECP to protect the environment. Treated effluent discharged to the Chukuni River will meet all regulatory requirements.
 - Excess contact water from the TMF will undergo enhanced treatment using membrane filtration technology to reduce sulphate concentrations in treated effluent discharged to the Chukuni River. Membrane filtration uses a semi-permeable membrane to separate components of a liquid based on their size and properties. The contact water to be treated is passed through the membrane by differential pressure to produce clear water and a reject solution. This treatment chain, with the membrane filtration step, has been designed to remove 95 to 98% of incoming sulphate concentrations (Appendix K-3). Excess treated water will be discharged to the Chukuni River in accordance with applicable regulatory requirements.
 - Tailings thickener underflow will be pumped to two parallel, cyanide destruction tanks for additional retention and treatment. Cyanide destruction is expected to use the SO₂/air process with sodium metabisulphite used as the source of SO₂. The target concentration of total cyanide in the tailings after the cyanide destruction circuit in the process plant will be compliant with the International Cyanide Management Code (ICMI 2021) which sets a limit that is protective of wildlife and birds. The residual cyanide concentrations will naturally degrade when exposed to sunlight within the TMF and east VMF. This reduces cyanide concentrations in the contact water, fugitive groundwater seepage from the TMF, and in treated effluent discharged to the Chukuni River.
 - Following cyanide destruction, the majority of detoxified tailings will be pumped to a desulphurization flotation circuit to generate a larger volume of desulphurized tailings that are NPAG for placement in the TMF, and a lower volume of sulphide-containing concentrate tailings for management in the east VMF. This reduces sulphur, sulphate and metal concentrations in the TMF contact water, fugitive groundwater seepage from the TMF, and in treated effluent discharged to the Chukuni River.
 - Open exploration drillholes and large open fractures proximal to the underground mine will be sealed off by grouting, to limit inflows into the underground, reducing contact water quality generation and discharge volume requirements.
 - Treated effluent will be discharged in the Chukuni River, at a location where sufficient flow exists to minimize the potential for erosion and promote rapid mixing

- The use of the desulphurization flotation circuit to generate a larger volume of desulphurized tailings that are NPAG for placement in the TMF allows for separate management of the lower volume sulphide-containing (concentrate) PAG tailings, providing benefits to water quality during the operations and closure phases. Concentrate tailings will be permanently stored in the east VMF. During the operations phase, the east VMF will not interact with the receiving environment, as fugitive groundwater seepage will report to the underground mine. In final closure the interaction will be limited to fugitive groundwater seepage from the filled Viggo pit lake.
- During the operations phase, membrane filtration reject solution generated from treating TMF contact water that cannot be used in paste backfill or held in the holding pond will be temporarily stored in the west VMF rather than the TMF. This approach reduces sulphate concentrations in TMF contact water and fugitive groundwater seepage from the TMF and TMF pond. Water levels in the west VMF will be managed to direct fugitive groundwater seepage to the east VMF and underground mine. In closure, the reject solution will be permanently stored in the underground mine to minimize potential loadings to the environment.
- Key Project components, including the TMF and stockpiles, have been sited to maintain a compact footprint to minimize disturbance to the natural environment as reasonable while providing for some operational flexibility. Siting of the MRS upgradient of the open pits reduces the amount of fugitive groundwater seepage to the environment
- During the construction phase (and other phases as applicable), a site-specific erosion and sediment control plan will be implemented to mitigate the entry of sediment into surrounding waterbodies. The plan will outline the installation of suitable measures, maintenance and describe monitoring to assess the effectiveness of the measures.
- A dust management plan will identify sources of dust, outline control measures and specify inspection and record-keeping to support effective management and to minimize the potential for fugitive dust deposition on the surface water receiving environment. For example, dust from roads and stockpiles will be controlled with water sprays and, if needed, dust suppressants; additional mitigation and management measures for fugitive dust are provided in Section 7.2.6.
- During the construction and operations phases, ponds collecting water requiring treatment for parameters other than suspended solids will be lined or located in areas where downgradient groundwater seepage is captured or contained to minimize fugitive seepage to the environment.

Additional mitigation measures relevant to other pVCs that may affect water quality indirectly are discussed within their respective sections, such as strategies for groundwater (Section 7.5.6) and surface water flows and levels (Section 7.6.6)

The application of mitigation measures for the pathways of potential effects is illustrated in Table 7.7-8. Mitigation measures that have been described in this section are expected to be effective for their intended purposes given their effective implementation at similar projects. Water treatment engineering for this stage of the Project was completed by Hatch Engineering, and anticipated treatment efficiencies for modelled parameters are provided in Appendix K-3.

Monitoring programs will be implemented to verify the accuracy of the predicted effects, assess the effectiveness of the implemented mitigation measures and may be further optimized in response to monitoring data.

7.7.7 Assessment of Effects

This section presents the expected changes in water quality resulting from Project development, inclusive of the mitigation measures identified in Section 7.7.6. All reported concentrations are for totals unless explicitly stated otherwise (e.g., dissolved concentrations). The modelling methodology undertaken to support the assessment of effects on water quality is summarised in Section 7.7.2.4, with detailed information available in Appendix K-3 and Appendix T.

Predictions for all model nodes and for all Project years form the basis of the effects assessment. Table 7.7-9 to Table 7.7-22 present predicted changes in surface water quality changes for the operations phase and the final closure period. Additional modelling results beyond those presented in these tables are provided in Appendix K-3.

Operations phase predictions correspond to the greatest predicted change in surface water quality relative to baseline conditions of all Project phases and the final closure period represents long-term equilibrium conditions (i.e., is the longest time period). Table 7.7-9 to Table 7.7-22 provide representative predicted water quality results for 7 of the 20 model nodes, corresponding to Dixie Creek, Chukuni River, Pakwash Lake, Unnamed Watercourse 1, and Unnamed Watercourse 8. These nodes were selected as representative locations to support the discussion as they are:

- Within the PA
- Located at the downstream boundary of the LSA (Chukuni River, node CHK-2)
- Located at the downstream boundary of the RSA (Pakwash Lake outlet, node PAK-OUT)
- Represent locations where there are predicted changes in water quality relative to existing conditions as result of the Project.

As discussed in Section 7.7.2.4, water quality modelling results are compared to WQG PAL based on recent MECP guidance and WSP experience for Ontario mining projects (Section 7.7.2.3, Table 7.7-1). These guidelines, sourced from federal, provincial or CCME guidelines, are scientifically defensible and designed to protect the most sensitive aquatic life stages under indefinite exposure. Modelled water quality results are also evaluated against baseline conditions using a 20% RPD threshold to identify changes as different than baseline (Section 7.7.2.4).

Model results indicate that water quality of the following surface water systems are less than WQG PAL and / or equivalent to baseline conditions (Appendix K-3) for all Project phases and accordingly, are not discussed further in this section:

- Dixie Lake (modelled at the outlet, node DIX-1)
- Genessee Lake (nodes GEN-L and GEN-1)
- Unnamed Waterbody 6 (nodes UN-2, UN-L6 and UN-3)
- Unnamed Watercourse 10 (node UN-6).

As outlined in Section 7.7.5, the Project may influence local groundwater quality within the PA and the LSA adjacent to the PA because of fugitive groundwater seepage from Project facilities. Changes to local groundwater quality could affect the quality of groundwater discharging to surface water features in the PA and LSA. It has been assumed to be conservative, that the predicted quality of fugitive groundwater seepage from Project components is representative of the groundwater contributing to surface water features (i.e., is not diluted by or mixed with baseline groundwater). Detailed predictions of fugitive seepage quality are provided in Appendix K-3.

7.7.7.1 Construction Phase

During the construction phase, Project interactions with water quality, after the implementation of mitigation measures (Section 7.7.6), are predicted to occur within the LSA, primarily in and near the PA. Predicted changes to water quality are associated with the following Project activities:

- Discharge of treated effluent to the Chukuni River (0.31 to 0.78 Mm³/year)
- Fugitive dust deposition to watercourses and waterbodies within the PA and some in the LSA, at predicted rates of 0.047 to 2.8 g/m²/month

The predicted change in water quality during the construction phase is detailed in Appendix K-3. The following are the key findings:

- Predicted concentrations are less than the WQG PAL for all modelled watercourses and waterbodies and parameters throughout construction, or are equivalent to baseline conditions (for arsenic and phosphorus which are elevated relative to WQG PAL in baseline in the Chukuni River, Unnamed Watercourse 1).
- There are no predicted changes to water quality relative to baseline conditions for Unnamed Watercourse 1 (node UN-1), Unnamed Watercourse 8 (node UN-4). There is no surface water discharge or fugitive groundwater seepage from the Project to these unnamed watercourses as predicted by water balance modelling
- There are no predicted changes to water quality relative to baseline conditions for Dixie Creek (nodes DIX-2, DIX-3, DIX-4 and DIX-5). The interaction of Dixie Creek with the Project during the construction phase is limited to fugitive dust deposition from Project activities, as predicted by the air quality model. There is no surface water discharge or fugitive groundwater seepage from the Project to Dixie Creek as predicted by water balance modelling.
- Downstream of the treated effluent discharge location in the Chukuni River (nodes CHK-1 and CHK-2) some modelled water quality parameters are predicted to increase relative to baseline; however, predicted concentrations remain well below WQG PAL. Parameters with a predicted relative increase in baseline concentrations of at least 20% include nitrate-N, ammonia-N and sulphate.
- There are no predicted changes to water quality relative baseline conditions in Pakwash Lake (nodes PAK-IN, PAK-IN-2, PAK-L and PAK-OUT).

Sensitivity analyses assessed changes in water quality under extreme hydrologic conditions (e.g., 1:100 wet and dry years), potential climate change impacts and variations in baseline assumptions. While predicted values for water quality parameters varied by scenario relative to

the base case, no additional effects were identified beyond those already captured in the conservative base case (Appendix K-3).

7.7.7.2 Operations Phase

The potential effects of the Project on water quality were evaluated by modelling throughout the 26-year operations phase. During the operations phase, Project interactions with water quality, after the implementation of mitigation measures (Section 7.7.6), are associated with:

- Discharge of treated effluent to the Chukuni River (4.64 to 7.22 Mm³/year).
- Fugitive groundwater seepage from Project components, reporting to Unnamed Watercourse 1, Unnamed Watercourse 8 and Dixie Creek. Predictive modelling indicates that fugitive groundwater seepage will occur from the MWP, TMF and TMF pond to these surface water features, with seepage rates varying by Project component (Appendix K-3). The highest predicted seepage rate is from the MWP (102.4 m³/d), reporting to Unnamed Watercourse 1. Fugitive seepage is predicted to contain elevated concentrations of several water quality parameters compared to baseline groundwater conditions, with some parameters greater than WQG PAL (Appendix K-3). WQG PAL are not applicable to groundwater, and are used here solely to provide a conservative comparison relative to surface water quality results.
- Fugitive dust deposition to watercourses and waterbodies within the PA and some in the LSA, at predicted rates of 0.033 to 2.7 g/m²/month. The predicted loading from dust deposition is very low relative to predicted loadings from treated effluent discharge and fugitive groundwater seepage.
- Flow reductions in Unnamed Watercourse 1, Unnamed Watercourse 8 and Dixie Creek as a result of changes to catchment areas. This reduces the flow rate of these watercourses and the assimilative capacity (for fugitive seepage, dust deposition etc.).

The predicted change in water quality during the operations phase, after the implementation of mitigation measures is detailed in Appendix K-3. The key findings are as follows.

The Chukuni River will receive treated effluent discharge during the operations phase. Project contact waters will be treated in the integrated water management system, which will include conventional water treatment and a membrane filtration component, to produce high quality effluent (Section 5.14.7). The Chukuni River is a high flow river system (Section 7.6.4.2.1) and the predicted required treated effluent discharge rate constitutes a small fraction of the total flow. For example, at the maximum required discharge rate (1,330 m³/h) the treated effluent volumes represent approximately:

- 1.2% of the Chukuni River annual average flow (108,000 m³/h).
- 2.6% of the Chukuni River minimum monthly flow (March, 51,898 m³/h).

There are no predicted concentrations greater than WQG PAL, or greater than baseline conditions for phosphorus and arsenic, which are above WQG PAL in baseline. A small mixing zone is predicted within the Chukuni River downstream of treated effluent discharges. Under average flow conditions, the mixing zone extends approximately 10 m from the discharge point (Figure 7.7-8). The size of the mixing zone is consistent with the requirements of Policy B-1-5 and has been assessed to confirm that it does not adversely affect existing water users. Water quality modelling indicates that there is no acute lethality within the mixing zone and that all

discharges to the Chukuni River will comply with applicable regulatory requirements. There are no predicted concentrations greater than WQG PAL downstream of the mixing zone (nodes CHK-1 and CHK-2), nor any increases above baseline conditions for phosphorus and arsenic, which are already above WQG PAL under existing conditions in the Chukuni River.

Model results indicate that downstream of the mixing zone in the Chukuni River at nodes CHK-1 and CHK-2, several parameters increase relative to baseline, i.e. are at least 20% different from baseline concentrations are: ammonia, cadmium, nitrate, nitrite, molybdenum, thallium, tungsten and sulphate; however, these predicted concentrations are well below WQG PAL.

Sensitivity analyses assessed changes in water quality under extreme hydrologic conditions (e.g., 1:100 wet and dry years), potential climate change impacts, and variations in baseline assumptions. While predicted values for water quality parameters in the Chukuni River varied by scenario relative to the base case, no additional effects were identified beyond those already captured in the conservative base case (Appendix K-3).

A sensitivity analysis was also conducted on mixing zone size within the Chukuni River, in accordance with MECP Policy B-1-5, which provides guidance on characterizing the theoretical maximum mixing zone under a worst-case discharge scenario. This scenario assumes that the maximum required discharge rate occurs during the 7Q20 low-flow condition, defined as the lowest seven-day average river flow expected once every 20 years. It is highly unlikely that the peak discharge rate of 1,330 m³/h, which is intended for wet conditions and contingency planning, would coincide with an extreme drought event. Only under this highly unlikely sensitivity case, modelling results indicate that the mixing zone could extend up to approximately 300 m downstream from the discharge point (considerably upstream of Pakwash Lake).

The change in water quality of Dixie Creek, Unnamed Watercourse 1, Unnamed Watercourse 8 and the outlet of Pakwash Lake are presented in Table 7.7-9 to Table 7.7-22. Dixie Creek and the unnamed watercourses are predicted to receive fugitive groundwater seepage from Project components during operations. Pakwash Lake is downstream of all Project influences. The following are the key findings:

- All modelled parameters are predicted to be less than WQG PAL in Dixie Creek and Pakwash Lake.
- Values greater than WQG PAL are predicted for Unnamed Watercourse 1 (node UN-1) related to predicted changes in baseflow and fugitive groundwater seepage contributions from the TMF and MWP (Appendix K-3), noting that this watercourse is proposed to be compensated for in the Fish Habitat Offset and Compensation Plan (Appendix L-2). The greatest increase in concentrations are predicted for cobalt and phosphorus, which are consistently greater than guidelines in operations.
- Several water quality parameters in Dixie Creek are predicted to be greater than baseline conditions, i.e. are at least 20% different from baseline concentrations. These parameters are: ammonia, cadmium, lead, tungsten and sulphate. Note that the concentrations of these parameters are well below WQG PAL. The highest relative increases relative to baseline concentrations occur in low flow winter months (December, January, February and March). The largest predicted changes are downstream of the Unnamed Watercourse 1 confluence (node DIX-2). These concentrations progressively approach baseline conditions downstream towards the

Dixie Creek and Chukuni River confluence (node DIX-5), where only sulphate is predicted to be greater than baseline conditions.

- Several water quality parameters in Unnamed Watercourse 8 are predicted to be greater than baseline conditions, i.e. are at least 20% different from baseline concentrations. These parameters are: ammonia, antimony, cadmium, cobalt, lead, molybdenum, nitrate, nitrite, selenium, sulphate, tungsten, uranium and weak acid dissociable cyanide. Note that the concentrations of these parameters are well below WQG PAL. The highest relative increases relative to baseline concentrations occur in low flow winter months (January, February and March).
- Some water quality parameters in Pakwash Lake are predicted to be greater than baseline conditions, i.e. are at least 20% different from baseline concentrations. These parameters are ammonia, nitrate, nitrite, sulphate, thallium and tungsten. Note that the concentrations of these parameters are well below WQG PAL. The highest concentrations were predicted at the inlet of Pakwash Lake (node PAK-IN), directly downstream of the Chukuni River confluence. Note, while RPD is a useful screening tool for identifying key parameters, it should be interpreted alongside absolute concentrations. In this case, the predicted increases are minor in magnitude. For example, baseline sulphate concentrations at the outlet of Pakwash Lake (node PAK-OUT) range from approximately 3.8 to 4.2 mg/L and are projected to increase to between 4.9 and 5.4 mg/L during the operations phase (Table 7.7-21).

As discussed in Section 7.7.3, these results were generated using a conservative modelling approach, which results in an overestimation of most parameters in all modelled watercourses and waterbodies.

Sulphate concentrations are predicted to be greater than baseline conditions in the operations phase downstream of the treated effluent discharge location within the Chukuni River and in Pakwash Lake. Sulphate is not a regulated parameter under the MDMER, however Great Bear Resources is aware of the linkages between sulphate reducing bacteria and methylmercury production under specific conditions, which have been documented in literature. Supplemental methylmercury modelling was performed to evaluate the potential influence of increased sulphate concentrations on mercury and methylmercury concentrations (Appendix T).

Results showed a non-detectable, maximum projected increase in methylmercury of 0.0000004 ng/L (0.0000000000004 mg/L) in the Chukuni River and 0.000022 ng/L (0.000000000022 mg/L) in Pakwash Lake (base case). Modelling for the upper case scenario, which represents the theoretical maximum loading to the environment using the predicted maximum annual effluent discharge quality for sulphate and the maximum required discharge rate for the operations phase, projected the increase in methylmercury to be 0.0000012 ng/L (0.0000000000012 mg/L) in the Chukuni River and 0.000067 ng/L (0.000000000067 mg/L) in Pakwash Lake. These increases would not be detectable using best available analytical testing methods for mercury and methylmercury (including ultra-low level methylmercury analyses at specialized laboratories). Detailed methylmercury modelling results and interpretation of the results are presented in Appendix T.

Sensitivity analyses assessed changes in water quality under extreme hydrologic conditions (e.g., 1:100 wet and dry years), potential climate change impacts, and variations in baseline assumptions. While predicted values for water quality parameters varied by scenario relative to the base case, no additional effects were identified beyond those already captured in the conservative base case (Appendix K-3).

7.7.7.3 Closure Phase

The Project will transition to the closure phase following the end of operations, when mining and process plant activities cease. The active closure period is expected to span approximately three years when the majority of site reclamation is completed. During this period, contact water from the site will be redirected to the LP Central pit to help expedite the filling of the pit with water. Freshwater will also be drawn from the Chukuni River via the treated effluent pipeline to fill the LP Central pit, VMF, and underground workings. No treated effluent will be discharged to the Chukuni River during this time. Filling of the LP Central pit, VMF and underground workings are anticipated to be complete by the end of Year 30 (Section 5.19.3.1).

As discussed in Section 7.7.5.3, for modelling purposes, an extended passive closure period of approximately three additional years after filling of the mine workings has been assumed in the predictive models to be conservative and may not be required. If required, during this time water from the LP Central pit lake will be treated in the WTP, and treated effluent will be discharged to the Chukuni River (1.35 to 4.57 Mm³/year).

Once site water quality is acceptable for passive discharge to the environment, the site will enter the final closure period. Water levels in the mine workings and pit lakes will be allowed to rise to steady-state levels. Residual Chukuni River pipelines and other remaining site infrastructure, including the WTP, will be decommissioned and passive discharge from the reclaimed site to the environment will commence.

During the closure phase, Project interactions with water quality, after the implementation of mitigation measures, are predicted to occur within the LSA, primarily in and near the PA. Predicted changes to water quality are associated with the following Project activities:

- LP Central pit lake discharge once water quality meets regulatory standards, via a spillway to the residual Unnamed Watercourse 3 and into Dixie Creek.
- Fugitive groundwater seepage to surface water features from the TMF pond and the MWP during the active closure and passive closure periods.
- Fugitive groundwater seepage to surface water features from the VMF and TMF in the closure phase. Fugitive seepage only from the Viggo pit lake will begin to report to Dixie Creek when pit filling is complete.

The change in water quality for Dixie Creek, Chukuni River and the outlet of Pakwash Lake in final closure are presented in Table 7.7-9 to Table 7.7-22. Results for all watercourses and waterbodies for all Project years are presented Appendix K-3. The following are the key findings:

- For the entire closure phase, all modelled parameters are predicted to be well below WQG PAL in Dixie Creek, Unnamed Waterbody 6, Unnamed Watercourse 1 and Unnamed Watercourse 8.
- Similarly, in the Chukuni River, all modelled parameters are predicted to be well below WQG PAL, or in the case of phosphorus and arsenic (which are already above WQG PAL under existing conditions), there are no increases relative to baseline conditions.
- In the final closure period, some parameters are predicted to be greater than baseline concentrations in Dixie Creek downstream of discharge from the LP central pit lake (node DIX-3). These parameters are at least 20% different from baseline concentrations and are: cadmium, chloride, cobalt, mercury, molybdenum, selenium, sulphate,

tungsten, uranium and zinc. Note that the concentrations of these parameters are well below WQG PAL. All modelled parameters in Dixie Creek are predicted to be well below WQG PAL and these concentrations progressively approach baseline conditions downstream towards the Dixie Creek and Chukuni River confluence (node DIX-5), where only antimony, cadmium, molybdenum and sulphate remain greater than baseline. Note, while RPD is a useful screening tool for identifying key parameters, it should be interpreted alongside absolute concentrations. In this case, the predicted increases are relatively low in magnitude. For example, baseline zinc concentrations at node DIX-3 range from approximately 0.0016 to 0.0021 mg/L and are projected to increase to between 0.0021 to 0.0029 mg/L during in final closure period (Table 7.7-12)

- During the final closure period, water quality in the Chukuni River, both upstream and downstream of the Dixie Creek confluence, is predicted to be equivalent to baseline conditions.
- Water quality of Pakwash Lake during the final closure period is predicted to be equivalent to baseline conditions.
- During the modelled three years of treated effluent discharge in the extended passive closure period, water quality parameters are predicted to be above baseline conditions downstream of discharge in the Chukuni River for some parameters, i.e. are at least 20% different from baseline concentrations. These parameters include ammonia, nitrate, nitrite and sulphate. Predicted concentrations are well below WQG PAL.

Sulphate concentrations are predicted to be greater than baseline conditions downstream of the treated effluent discharge within the Chukuni River during the closure phase. Supplemental methylmercury modelling results for the active closure period showed increases in dissolved methylmercury concentrations in surface water of 0.00000011 ng/L (0.00000000000011 mg/L) in the Chukuni River and 0.0000062 ng/L (0.0000000000062 mg/L) in Pakwash Lake. These increases would not be detectable using best available testing methods (i.e., ultra-low level methylmercury analyses possible at specialized laboratories). Detailed methylmercury modelling results and interpretation are presented in Appendix T.

Sensitivity analyses assessed changes in water quality under extreme hydrologic conditions (e.g., 1:100 wet and dry years), potential climate change impacts, and variations in baseline assumptions. While predicted values for water quality parameters varied by scenario relative to the base case, no additional effects were identified beyond those already captured in the conservative base case (Appendix K-3).

7.7.8 Change Pathway Outcome

7.7.8.1 Summary of Changes after Mitigation

A summary of the modelled changes in water quality is illustrated in Figure 7.7-9 for the operations phase. This phase reflects the greatest predicted change in water quality across all Project phases. The changes are expressed as relative difference from baseline conditions.

Figure 7.7-9 highlights that observable changes in water quality from baseline conditions are constrained to the LSA. All predicted concentrations for all modelling nodes are well below the identified WQG PAL (Table 7.7-1), with the exception for cobalt concentrations in Unnamed Watercourse 1 (UN-1) in the operations phase. During the closure phase (and post-

closure), all modelled parameters are predicted to be less than WQG PAL, or equivalent to baseline conditions where baseline concentrations are greater than WQG PAL.

Changes to overall water quality at the RSA boundary at Pakwash Lake outlet (node PAK-OUT) do not occur for all Project phases. As the Manitou Falls Generating Station Dam and the confluence of the Chukuni-English River and the Wabigoon River are located downstream of node PAK-OUT, changes to water quality at those locations are also not predicted.

7.7.8.2 Change Management

Changes to water quality associate with industrial projects are managed through provincial regulatory mechanisms in Ontario. Approvals are required under the *Ontario Water Resources Act* for surface water and groundwater takings and discharges for various purposes. As part of the provincial permitting process, a rigorous water quality monitoring program will track groundwater and surface water quality. Water quality monitoring results will be evaluated against established triggers, with adaptive management measures implemented as needed to maintain compliance and environmental protection. Adaptive management is a recognised best practice in Ontario mining operations. It provides a structured yet flexible framework that allows for timely responses to changing site conditions, monitoring results and potential risks based on empirical site-specific data. By incorporating predefined triggers and thresholds, adaptive management enables operators to implement corrective actions proactively before adverse effects occur. This approach supports continuous improvement, regulatory compliance and environmental protection. Recording and reporting on complaints to the MECP is also required.

7.7.8.3 Confidence

The level of confidence in the estimate provided is considered to be high. Input data used in predictive modelling are extensive and of high quality; and the range of existing and projected variability in both the existing regime and the mine influenced regime are well constrained by model sensitivity cases including mine site water balance modelling (Appendix I-2), receiver water balance modelling (Appendix I-3), mine site water quality modelling (Appendix K-2), receiver water quality modelling (Appendix K-3) and hydrogeological modelling (Appendix H-2). The predicted effects were determined using well-established models and conservative assumptions. Furthermore, with the application of mitigation measures, there will be reliable environmental protection of water quality. Water quality monitoring will be ongoing during construction, operation and closure phases and will support the validation of the predictions

Table 7.7-1: Water Quality Guidelines for the Protection of Aquatic Life

Parameter	Unit	Protection of Aquatic Life Guidelines ^(1, 2, 3, 4, 5)	
		Value	Source
pH	s.u.	6.5 to 8.5	PWQO
Sulphate ⁽⁶⁾	mg/L	Site-specific, calculated	BC WQG
Ammonia (as N)	mg/L	Site-specific, calculated	CCME
Ammonia, Un-ionized (as N)	mg/L	0.019	CCME
Chloride	mg/L	120	CCME
Nitrate (as N)	mg/L	3	CCME
Nitrite (as N)	mg/L	0.06	CCME
Cyanide, WAD	mg/L	0.005	PWQO
Aluminum	mg/L	Site-specific, calculated	FEQG
Antimony	mg/L	0.02	iPWQO
Arsenic ⁽⁷⁾	mg/L	0.005	iPWQO
Boron	mg/L	1.5	CCME
Beryllium	mg/L	Site-specific, calculated	PWQO
Cadmium	mg/L	Site-specific, calculated	CCME
Chromium ⁽⁸⁾	mg/L	0.0089	iPWQO
Cobalt	mg/L	0.0009	iPWQO
Copper	mg/L	0.005	iPWQO
Iron	mg/L	Site-specific, calculated	FEQG
Lead	mg/L	Site-specific, calculated	FEQG
Mercury	ng/L	26	CCME
Methylmercury	ng/L	4	CCME
Molybdenum	mg/L	31	SEQG
Nickel	mg/L	Site-specific, calculated	CCME
Phosphorus	mg/L	0.03 (rivers); 0.02 (lakes)	iPWQO
Selenium ⁽⁹⁾	mg/L	0.002	BC WQG
Silver	mg/L	0.00025	CCME
Thallium	mg/L	0.008	CCME
Uranium	mg/L	0.015	CCME
Vanadium	mg/L	0.12	FEQG
Tungsten	mg/L	0.03	iPWQO
Zinc	mg/L	Site-specific, calculated	CCME

Notes:

1. Ontario Provincial Water Quality Objectives (PWQO) and interim PWQO (iPWQO).
2. Canadian Council of Ministers of the Environment (CCME) water quality guidelines for the protection of aquatic life (long-term exposure).
3. Federal Environmental Quality Guidelines (FEQG); these are issued to support federal environmental quality monitoring and risk assessment for parameters for which CCME guidelines do not yet exist or are not reasonably expected to be updated in the near future.
4. British Columbia long-term exposure guidelines, freshwater (BC WQG).
5. Saskatchewan Environmental Quality Guidelines (SEQG)
6. BC WQG are accessed here in the absence of available suitable Ontario or Federal guidelines (sulphate).
7. Existing arsenic concentrations in the Chukuni River (the receiving environment) are greater than available water quality guidelines; the most appropriate environmental benchmark is the baseline condition (75th percentile arsenic = 0.0096 mg/L).
8. There is no guideline for concentrations of total chromium; it is most common to adopt the PWQO and CCME guidelines for hexavalent (0.001 mg/L) or trivalent (0.0089 mg/L) chromium, dependent on-site conditions and in consultation with regulators.
9. BC WQG are accessed here as the CCME guideline is an alert concentration and only applicable to sensitive lacustrine environments (selenium).

Table 7.7-2: Assessment Criteria, Indicators and Rationale

Criteria	Indicator	Rationale for Selection
Change in Water Quality	<ul style="list-style-type: none">• Concentration of total and dissolved metals and metalloids (mg/L)• Concentration and of mercury and methylmercury (mg/L)• Concentration of nutrients and anions (mg/L)	<ul style="list-style-type: none">• Natural component important to other ecosystem elements• Provincial regulatory interest• Identified of interest during engagement• May interact with fVCs (fish and fish habitat, migratory birds, and Indigenous peoples)



Table 7.7-3: Dixie Creek Baseline Water Quality

Parameter	WQG PAL	SW-03				SW-04				SW-08				SW-09				SW-15			
		Count	25 th	Average	75 th	Count	25 th	Average	75 th	Count	25 th	Average	75 th	Count	25 th	Average	75 th	Count	25 th	Average	75 th
Field pH (s.u.)	6.5 - 8.5	27	6.9	7.3	7.8	34	6.4	6.8	7.2	33	6.6	7.0	7.4	20	6.9	7.2	7.4	21	6.6	6.9	7.1
Total Ammonia (as N)	1.8	8	0.006	0.025	0.023	10	0.019	0.029	0.033	9	0.021	0.033	0.041	6	0.012	0.023	0.037	4	0.004	0.013	0.022
Nitrate (as N)	3	27	0.03	0.13	0.16	37	0.03	0.07	0.10	35	0.03	0.08	0.11	22	0.02	0.06	0.08	28	0.03	0.07	0.11
Nitrite (as N)	0.06	27	0.001	0.006	0.015	37	0.001	0.012	0.015	35	0.001	0.008	0.015	22	0.001	0.007	0.015	28	0.003	0.019	0.015
Phosphorus	0.03	27	0.026	0.050	0.056	37	0.027	0.036	0.041	35	0.027	0.038	0.042	22	0.033	0.045	0.048	28	0.017	0.033	0.033
Sulphate	218	27	1.1	2.5	3.2	37	0.77	0.88	1.0	34	0.864	1.4	1.1	22	0.73	1.3	1.0	26	1.0	1.1	1.0
Chloride	120	27	0.75	1.3	1.5	37	0.35	0.711	0.99	35	0.38	1.6	1.8	22	0.33	1.0	1.2	28	0.50	1.3	2.0
Cyanide (free)	0.005	19	0.0005	0.0010	0.0013	25	0.0005	0.0011	0.0018	24	0.0005	0.0011	0.0016	14	0.0005	0.0007	0.0005	13	0.0005	0.0015	0.0025
Aluminum	0.8	27	0.15	0.65	0.81	37	0.21	0.33	0.38	35	0.21	0.55	0.48	22	0.22	0.85	0.55	28	0.22	0.36	0.45
Antimony	0.02	27	0.00005	0.0002	0.00045	37	0.00005	0.00024	0.00045	34	0.00005	0.000221	0.00045	22	0.00005	0.0002	0.00045	28	0.000095	0.000338	0.00045
Arsenic	0.005	27	0.0014	0.0024	0.0029	37	0.0019	0.0025	0.0027	35	0.0019	0.0025	0.0029	22	0.0021	0.0027	0.0034	28	0.0022	0.0026	0.0030
Cadmium	0.00007	27	0.000003	0.000015	0.000016	37	0.000003	0.000010	0.000009	35	0.000005	0.000010	0.000011	22	0.000003	0.000015	0.000010	28	0.000004	0.000007	0.000009
Chromium	0.0089	27	0.0004	0.0014	0.0018	37	0.0006	0.0008	0.0010	35	0.0005	0.0012	0.0011	22	0.0007	0.0018	0.0013	28	0.0007	0.0010	0.0013
Cobalt	0.0009	27	0.00015	0.00045	0.00056	37	0.00016	0.00025	0.00028	35	0.00016	0.00029	0.00028	22	0.00021	0.00042	0.00032	28	0.00017	0.00025	0.00030
Copper	0.005	27	0.0006	0.0021	0.0034	37	0.0010	0.0013	0.0014	35	0.0010	0.0015	0.0016	22	0.0011	0.0018	0.0015	28	0.0010	0.0012	0.0015
Iron	0.8	27	0.29	0.90	1.2	37	0.60	0.79	0.91	35	0.55	0.94	0.95	22	0.62	1.2	0.95	28	0.50	0.75	0.98
Lead	0.02	27	0.00006	0.00026	0.00031	37	0.00015	0.00022	0.00027	35	0.00015	0.00029	0.00028	22	0.00020	0.00039	0.00031	28	0.00014	0.00022	0.00027
Molybdenum	31	27	0.00066	0.00069	0.00078	37	0.00021	0.00028	0.00028	35	0.00022	0.00034	0.00038	22	0.00021	0.00264	0.00033	28	0.00030	0.00052	0.00060
Nickel	0.025	27	0.0007	0.0018	0.0024	37	0.0008	0.0010	0.0011	35	0.0008	0.0017	0.0013	22	0.0010	0.0016	0.0013	28	0.0009	0.0011	0.0012
Selenium	0.002	27	0.00010	0.00014	0.00017	37	0.00009	0.00018	0.00014	35	0.00009	0.00015	0.00013	22	0.00011	0.00021	0.00014	28	0.00008	0.00010	0.00013
Silver	0.00025	27	0.000005	0.000040	0.000025	37	0.000005	0.000040	0.000025	34	0.000005	0.000017	0.000025	22	0.000005	0.000014	0.000025	28	0.000014	0.000020	0.000025
Strontium	2.5	27	0.049	0.052	0.056	37	0.024	0.033	0.037	35	0.026	0.035	0.036	22	0.025	0.033	0.035	28	0.028	0.037	0.046
Thallium	0.008	27	0.000005	0.000006	0.000006	34	0.000005	0.000006	0.000006	33	0.000005	0.000006	0.000009	21	0.000005	0.000014	0.000011	24	0.000003	0.000006	0.000008
Tungsten	0.03	27	0.000050	0.000587	0.000125	37	0.000030	0.000330	0.000050	34	0.000050	0.000231	0.000245	22	0.000050	0.000125	0.000105	28	0.000030	0.000045	0.000050
Uranium	0.015	27	0.00105	0.00116	0.00139	37	0.00019	0.00027	0.00029	35	0.00021	0.00037	0.00038	22	0.00022	0.00033	0.00037	28	0.00017	0.00024	0.00029
Vanadium	0.12	27	0.0012	0.0023	0.0029	37	0.0011	0.0013	0.0014	35	0.0010	0.0017	0.0015	22	0.0014	0.0025	0.0018	28	0.0010	0.0013	0.0014
Zinc	0.03	27	0.0015	0.0042	0.0043	37	0.0015	0.0022	0.0030	34	0.0015	0.0036	0.0036	22	0.0015	0.0030	0.0020	28	0.0015	0.0035	0.0031
Zirconium	0.004	27	0.0003	0.0009	0.0010	36	0.0003	0.0006	0.0010	35	0.0004	0.0008	0.0010	22	0.0005	0.0010	0.0010	27	0.0009	0.0010	0.0010
Standard Mercury (ng/L)	26	27	2.5	5.3	5.0	34	2.5	6.3	5.0	34	2.5	3.7	5.0	22	2.5	5.6	5.0	22	3.1	5.0	5.0
Ultra-low Mercury (ng/L)	26	21	1.0	4.2	5.6	4	1.7	1.9	1.9	24	1.8	2.8	3.6	6	1.5	2.0	1.9	5	2.7	3.8	3.4
Methylmercury (ng/L)	4	20	0.066	0.15	0.20	4	0.048	0.070	0.085	23	0.066	0.16	0.18	5	0.060	0.076	0.086	5	0.30	0.35	0.31

Notes:
 All results are reported as total concentrations (e.g., total metals), unless otherwise indicated.
 All units are mg/L (unless otherwise indicated).
 Grey highlighted values are greater than identified water quality guideline for the protection of aquatic life (WQG PAL).
 For applicable parameters, WQG PAL values were calculated using site-specific cofactors (pH, dissolved organic carbon, and 25th percentile hardness to be conservative).
 Table presents a summary of baseline water quality of Dixie Creek monitoring stations for parameters with WQG PAL; data for all monitored parameters are provided in Appendix K-1.



Table 7.7-4: Chukuni River Baseline Water Quality

Parameter	WQG PAL	CR-REF				CR-FDP				CR-DS			
		Count	25th	Average	75th	Count	25th	Average	75th	Count	25th	Average	75th
Field pH (s.u.)	6.5 - 8.5	31	7.2	7.5	7.7	27	6.9	7.3	7.7	23	6.6	7.1	7.6
Total Ammonia (as N)	1.8	9	0.005	0.018	0.027	8	0.005	0.018	0.022	7	0.014	0.021	0.021
Nitrate (as N)	3	40	0.005	0.052	0.071	29	0.006	0.051	0.078	28	0.006	0.036	0.030
Nitrite (as N)	0.06	40	0.001	0.009	0.015	28	0.001	0.006	0.015	28	0.001	0.011	0.015
Phosphorus	0.03	40	0.017	0.027	0.033	29	0.022	0.033	0.032	28	0.020	0.028	0.032
Sulphate	218	38	4.9	5.7	6.6	29	4.8	5.5	6.2	27	4.1	4.8	6.0
Chloride	120	40	2.3	2.9	3.0	29	2.4	2.9	3.0	28	2.2	2.8	3.0
Cyanide (free)	0.005	27	0.0005	0.0010	0.0009	23	0.0005	0.0010	0.0008	18	0.0005	0.0010	0.0011
Aluminum	1.0	40	0.067	0.20	0.21	29	0.11	0.18	0.20	28	0.12	0.20	0.24
Antimony	0.02	40	0.00031	0.00038	0.00045	29	0.00030	0.00038	0.00045	28	0.00028	0.00036	0.00045
Arsenic	0.005	40	0.0061	0.0084	0.0091	29	0.0062	0.0082	0.0095	28	0.0057	0.0081	0.0096
Cadmium	0.00007	40	0.0000025	0.0000098	0.0000080	29	0.0000025	0.0000224	0.0000083	28	0.0000025	0.0000228	0.0000085
Chromium	0.0089	40	0.00029	0.00071	0.00067	29	0.00032	0.00064	0.00061	28	0.00036	0.00066	0.00074
Cobalt	0.0009	40	0.00009	0.00016	0.00018	29	0.00010	0.00014	0.00015	28	0.00011	0.00015	0.00017
Copper	0.005	40	0.0014	0.0018	0.0017	29	0.0014	0.0017	0.0017	28	0.0014	0.0035	0.0016
Iron	0.8	40	0.10	0.24	0.26	29	0.15	0.29	0.26	28	0.17	0.26	0.33
Lead	0.01	40	0.000052	0.00015	0.00015	29	0.000070	0.00012	0.00012	28	0.000091	0.00014	0.00014
Molybdenum	31	40	0.00019	0.00022	0.00024	29	0.00019	0.00023	0.00024	28	0.00020	0.00026	0.00029
Nickel	0.025	40	0.0012	0.0015	0.0015	29	0.0012	0.0019	0.0015	28	0.0012	0.0014	0.0014
Selenium	0.002	40	0.000090	0.00012	0.00013	29	0.000092	0.00028	0.00012	28	0.000090	0.00042	0.00012
Silver	0.00025	40	0.0000050	0.000015	0.000025	28	0.0000050	0.000015	0.000025	28	0.000005	0.000017	0.000025
Strontium	2.5	40	0.029	0.030	0.031	29	0.028	0.030	0.032	28	0.028	0.030	0.031
Thallium	0.008	35	0.000003	0.000005	0.000005	28	0.000003	0.000005	0.000005	24	0.000005	0.000005	0.000005
Tungsten	0.03	40	0.000038	0.000049	0.000050	28	0.000040	0.000043	0.000050	28	0.000030	0.000065	0.000050
Uranium	0.015	40	0.00009	0.00012	0.00013	29	0.00009	0.00012	0.00013	28	0.00009	0.00012	0.00014
Vanadium	0.12	40	0.00041	0.00072	0.00081	29	0.00044	0.00070	0.00082	28	0.00063	0.00081	0.00088
Zinc	0.03	40	0.0014	0.0024	0.0023	28	0.0015	0.0027	0.0023	28	0.0014	0.0025	0.0020
Zirconium	0.004	39	0.0001	0.0006	0.0010	29	0.0001	0.0005	0.0010	28	0.0002	0.0006	0.0010
Standard Mercury (ng/L)	26	34	2.5	3.5	5.0	28	2.5	3.3	5.0	25	2.5	5.5	5.0
Ultra-Low Mercury (ng/L)	26	24	0.7	1.2	1.6	22	0.7	1.5	1.4	17	0.8	1.2	1.8
Methylmercury (ng/L)	4	23	0.029	0.046	0.057	21	0.035	0.072	0.049	16	0.050	0.055	0.062

Notes:

All results are reported in total concentrations (e.g., total metals), unless otherwise indicated.

All units are mg/L (unless otherwise indicated).

Grey highlighted values are greater than identified water quality guideline for the protection of aquatic life (WQG PAL).

For applicable parameters, WQG PAL values were calculated using site-specific cofactors (pH, dissolved organic carbon, 25th percentile hardness to be conservative).

Table presents a summary of baseline water quality of Chukuni River monitoring stations for parameters with WQG PAL; data for all monitored parameters are provided in Appendix K-1.



Table 7.7-5: Unnamed Watercourses and Waterbodies Baseline Water Quality

Parameter	WQG PAL	Unnamed Watercourses			WQG PAL		Unnamed Waterbody 6			
		Count	25th	Average	75th		Count	25th	Average	75th
Field pH (s.u.)	6.5 - 8.5	131	6.1	6.5	7.0	6.5 - 8.5	22	6.9	7.2	7.8
Total Ammonia (as N)	1.8	33	0.017	0.163	0.050	1.8	6	0.005	0.015	0.024
Nitrate (as N)	3	144	0.011	0.138	0.069	3	29	0.003	0.028	0.030
Nitrite (as N)	0.06	144	0.0005	0.0088	0.015	0.06	29	0.0005	0.010	0.015
Phosphorus	0.03	144	0.024	0.053	0.057	0.02	29	0.018	0.029	0.032
Sulphate	218	121	0.79	2.3	1.9	218	29	0.48	0.76	1.0
Chloride	120	144	0.50	10.2	6.0	120	29	4.0	5.5	7.0
Cyanide (free)	0.005	88	0.0005	0.0012	0.0017	0.005	18	0.0005	0.0011	0.0014
Aluminum	0.33	144	0.15	0.56	0.57	0.9	29	0.036	0.060	0.067
Antimony	0.02	144	0.00009	0.00027	0.00045	0.02	29	0.00005	0.00026	0.00045
Arsenic	0.005	144	0.0028	0.0044	0.0047	0.005	29	0.0019	0.0031	0.0033
Cadmium	0.00006	144	0.000006	0.000022	0.000021	0.000073	29	0.000002	0.000018	0.000004
Chromium	0.0089	144	0.0006	0.0015	0.0016	0.0089	29	0.00025	0.00040	0.00045
Cobalt	0.0009	144	0.00021	0.00073	0.00085	0.0009	29	0.000047	0.000079	0.000058
Copper	0.005	144	0.00072	0.00151	0.0017	0.005	29	0.00030	0.00059	0.00057
Iron	0.76	144	0.61	1.4	1.8	0.8	29	0.11	0.27	0.30
Lead	0.02	144	0.00009	0.00025	0.00028	0.016	29	0.000045	0.000093	0.00011
Molybdenum	31	144	0.00018	0.00052	0.00049	31	29	0.00015	0.00033	0.00022
Nickel	0.025	144	0.00080	0.0019	0.0021	0.025	29	0.00025	0.00045	0.00054
Selenium	0.002	144	0.00009	0.00023	0.00018	0.002	29	0.00009	0.00028	0.00014
Silver	0.00025	144	0.000005	0.000017	0.000025	0.00025	29	0.000005	0.000017	0.000025
Strontium	2.5	144	0.026	0.042	0.050	2.5	29	0.026	0.043	0.037
Thallium	0.008	136	0.0000050	0.00012	0.000080	0.008	26	0.0000025	0.0000055	0.0000050
Tungsten	0.03	144	0.000030	0.00014	0.000103	0.03	29	0.000010	0.000035	0.000050
Uranium	0.015	144	0.00010	0.00033	0.00023	0.015	29	0.00005	0.00018	0.00007
Vanadium	0.12	144	0.00080	0.00182	0.0021	0.12	29	0.00025	0.00035	0.00042
Zinc	0.03	144	0.0015	0.0077	0.0052	0.03	29	0.0015	0.0033	0.0030
Zirconium	0.004	142	0.00047	0.00091	0.00100	0.004	29	0.00010	0.00057	0.00100
Standard Mercury (ng/L)	26	136	2.5	5.6	5.7	26	24	2.5	4.2	5.0
Ultra-Low Mercury (ng/L)	26	38	2.9	5.2	6.6	26	11	2.0	2.5	2.6
Methylmercury (ng/L)	4	37	0.18	0.45	0.63	4	11	0.029	0.047	0.061

Notes:
 All results are reported as total concentrations (e.g., total metals), unless otherwise indicated.
 All units are mg/L (unless otherwise indicated).
 Grey highlighted values are greater than identified water quality guideline for the protection of aquatic life (WQG PAL).
 For applicable parameters, WQG PAL values were calculated using site-specific cofactors (pH, dissolved organic carbon, 25th percentile hardness to be conservative).
 Table presents a summary of baseline water quality for parameters across monitored unnamed watercourses and Unnamed Waterbody 6; data for all monitored parameters and all unnamed waterbodies are provided in Appendix K-1.



Table 7.7-6: Pakwash Lake Baseline Water Quality

Parameter	WQG PAL	Pakwash Lake (Surface Waters)				Pakwash Lake (1 m from Bottom)			
		Count	25th	Average	75th	Count	25th	Average	75th
Field pH (s.u.)	6.5 - 8.5	38	7.3	7.5	7.8	13	6.5	6.7	7.0
Total Ammonia (as N)	1.8	15	0.005	0.011	0.015	0	-	-	-
Nitrate (as N)	3	38	0.003	0.027	0.046	13	0.024	0.046	0.069
Nitrite (as N)	0.06	38	0.00050	0.00066	0.00050	13	0.00050	0.0013	0.0016
Phosphorus (colourmetric)	0.02	38	0.019	0.023	0.028	13	0.025	0.031	0.033
Sulphate	218	38	3.0	3.5	4.0	13	3.6	3.8	4.0
Chloride	120	38	1.3	1.7	2.0	13	1.6	1.7	1.8
Cyanide (free)	0.005	38	0.0005	0.00067	0.00050	13	0.00050	0.00085	0.0013
Aluminum	0.69	38	0.0742	0.146	0.163	13	0.126	0.222	0.239
Antimony	0.02	38	0.00016	0.00018	0.00023	13	0.00014	0.000167	0.0002
Arsenic	0.005	38	0.00382	0.0051	0.0067	13	0.00446	0.0058	0.0073
Cadmium	0.00007	38	0.0000025	0.0000034	0.0000025	13	0.0000025	0.0000055	0.0000084
Chromium	0.0089	38	0.00025	0.000411	0.000545	13	0.00034	0.000522	0.00055
Cobalt	0.0009	38	0.00005	0.0000866	0.00012	13	0.00005	0.00013	0.00015
Copper	0.005	38	0.00124	0.00134	0.00141	13	0.00137	0.00147	0.0015
Iron	0.8	38	0.088	0.18	0.25	13	0.16	0.29	0.31
Lead	0.01	38	0.000025	0.00008	0.00010	13	0.00008	0.00013	0.00013
Molybdenum	31	38	0.00020	0.00022	0.00024	13	0.00020	0.00022	0.00023
Nickel	0.025	38	0.00087	0.0010	0.0012	13	0.0010	0.0012	0.0014
Selenium	0.002	38	0.00008	0.000092	0.00010	13	0.000025	0.00009	0.00011
Silver	0.00025	38	0.000005	0.000005	0.000005	13	0.000005	0.000005	0.000005
Strontium	2.5	38	0.026	0.027	0.028	13	0.027	0.028	0.028
Thallium	0.008	38	0.0000050	0.0000050	0.0000050	13	0.0000050	0.0000055	0.0000050
Tungsten	0.03	38	0.000050	0.000050	0.000050	13	0.000050	0.000050	0.000050
Uranium	0.015	38	0.000092	0.00010	0.00011	13	0.00010	0.00012	0.00012
Vanadium	0.12	38	0.00032	0.00064	0.00077	13	0.00077	0.00090	0.00090
Zinc	0.03	38	0.0015	0.0016	0.0015	13	0.0015	0.0017	0.0015
Zirconium	0.004	38	0.00010	0.00016	0.00022	13	0.00022	0.00027	0.00031
Mercury (ng/L)	26	38	2.5	2.5	2.5	13	2.5	2.5	2.5
Ultra-Low Mercury (ng/L)	26	38	0.72	1.2	1.4	13	1.0	1.7	1.7
Methylmercury (ng/L)	4	38	0.024	0.036	0.048	13	0.033	0.052	0.059

Notes:

All results are reported as total concentrations (e.g., total metals), unless otherwise indicated.

All units are mg/L (unless otherwise indicated).

Grey highlighted values are greater than identified water quality guideline for the protection of aquatic life (WQG PAL).

For applicable parameters, WQG PAL values were calculated using site-specific cofactors (pH, dissolved organic carbon, 25th percentile hardness to be conservative).

Table presents a summary of baseline water quality of Pakwash Lake monitoring stations for parameters with WQG PAL; data for all monitored parameters as well as all named lakes are provided in Appendix K-1.

Table 7.7-7: Potential Interactions of Project Activities with Water Quality

Project Component / Activity	Water Quality
Construction Phase	
Site preparation activities	Yes
Establishment and operation of water management and treatment facilities	Yes
Open pit mining	Yes
Underground mining	Yes
Management of rock and unconsolidated materials in stockpiles	Yes
Establishment of onsite fish habitat and compensation measures	Yes
Establishment of onsite aggregate operations	Yes
Construction of the starter embankments for the TMF	Yes
Construction and operation of buildings and infrastructure	Yes
Waste management	-
Commissioning of the process plant	Yes
Power supply	-
Employment and expenditures	-
Operations Phase	
Underground mining	Yes
Mining of the LP Central pit	Yes
Management of rock and unconsolidated materials in stockpiles	Yes
Process plant operation	Yes
Management of desulphurized tailings in the TMF	Yes
Management of concentrate tailings and contact water in the VMF	Yes
Operation of water management and treatment facilities	Yes
Construction of a MWP	Yes
Operation and maintenance of buildings and infrastructure	Yes
Waste management	-
Power supply	-
Progressive reclamation activities	Yes



Project Component / Activity	Water Quality
Employment and expenditures	-
Closure Phase	
Active closure period	Yes
Passive closure period	Yes
Final reclamation period	Yes

Note:

- : The interaction is not expected to be material, and no further assessment is warranted.

Table 7.7-8: Mitigation Measures for Changes to Water Quality

Pathways to Potential Effect	Phase			Proposed Mitigation Measures
	Con	Op	CI	
Change in Water Quality	•	•	•	Locate Project components within a compact footprint, to minimize disturbance to the natural environment and reduce the creation of contact water.
	•	•	•	Minimize creation of contact water by diverting non-contact water from entering the site
	•	•	•	Employ a dust management strategy to support effective dust management and to minimize fugitive dust deposition on the surface water receiving environment. For example, dust from roads and stockpiles will be controlled with water sprays and, if need, dust suppressants.
	•	•	•	Implement a site-specific erosion and sediment control plan to mitigate entry of sediment and suspended solids into surrounding waterbodies. This plan will outline installation of suitable measures, maintenance and describe monitoring to assess effectiveness of the measures.
	-	•	-	Recycle contact water in the process plant to lower water demand and minimize final effluent discharge volumes requiring discharge to the Chukuni River.
	-	•	•	Reduce sulphur in tailings stored in the TMF by the use of the desulphurization flotation circuit, producing NPAG tailings for deposition and enabling separate management of the smaller volume of PAG tailings in the re-purposed Viggo pit. This reduces sulphur and sulphate concentrations in contact waters and in fugitive groundwater seepage from the TMF.
	-	•	-	Tailings will undergo cyanide distribution to reduce cyanide concentrations in TMF contact waters and in treated effluent discharge.
	-	•	-	A portion of the contact water treatment stream (excess water from the TMF) will be subject to enhanced water treatment (membrane filtration) to reduce sulphate concentrations in treated effluent.

Pathways to Potential Effect	Phase			Proposed Mitigation Measures
	Con	Op	Cl	
	•	•	•	The WTP will be designed to produce water that is suitable for re-use or discharge to the environment in accordance with applicable regulatory requirements.
	•	•	•	Effluent discharge rate and schedule to the environment will meet all federal and provincial regulatory requirements. The surface water intake rate and schedule will meet all federal and provincial regulatory requirement
	-	•	•	Restoration of the site to a naturalized state through progressive reclamation and at closure, to restore runoff conditions closer to those present pre-development. This returns natural catchment loadings and high quality passive drainages to the environment

Notes:

Con: Construction; Op: Operations; Cl: Closure

• : Mitigation is applicable.

- : Mitigation is not applicable.



Table 7.7-9: Dixie Creek (DIX-2) Water Quality Model Results, Operations

Parameter	WQG PAL ⁽¹⁾	Source	Model Baseline Water Quality		Model Results, Median Monthly Water Quality During Operations												Predicted Overall Range	
			Median	95th	January	February	March	April	May	June	July	August	September	October	November	December	Median	95th
Sulphate	218	BC WQG	1.0	1.0	2.7	2.9	3.1	2.3	1.9	1.5	1.5	1.6	1.8	2.1	1.9	2.5	1.9	3.1
Chloride	120	CCME	0.51	1.2	1.2	0.53	0.53	0.51	0.38	0.37	0.48	0.48	0.48	0.49	1.2	1.2	0.49	1.2
Aluminum	0.8	FEQG	0.14	0.21	0.15	0.12	0.13	0.12	0.19	0.19	0.15	0.15	0.12	0.12	0.14	0.15	0.14	0.19
Antimony	0.02	iPWQO	0.00039	0.00042	0.00045	0.00046	0.00046	0.00041	0.00024	0.00024	0.00041	0.00041	0.00025	0.00025	0.00041	0.00044	0.00041	0.00046
Arsenic	0.005	iPWQO	0.0021	0.0032	0.0020	0.0024	0.0025	0.0024	0.0019	0.0018	0.0032	0.0032	0.0021	0.0022	0.0020	0.0020	0.0021	0.0032
Beryllium	0.011	PWQO	0.000012	0.000023	0.000023	0.000012	0.000012	0.000012	0.000011	0.000011	0.000013	0.000013	0.000010	0.000010	0.000022	0.000023	0.000012	0.000023
Boron	1.5	CCME	0.0059	0.0062	0.0062	0.0059	0.0059	0.0058	0.0055	0.0055	0.0059	0.0059	0.0055	0.0055	0.0061	0.0062	0.0059	0.0062
Cadmium	0.000078	CCME	0.0000059	0.000020	0.000022	0.0000088	0.0000094	0.0000084	0.0000058	0.0000054	0.0000093	0.000010	0.0000041	0.0000044	0.000021	0.000022	0.0000090	0.000022
Calcium	-	-	12	15	12	15	15	14	10	10	11	11	10	10	12	12	11	15
Chromium	0.0089	iPWQO ⁽²⁾	0.00056	0.00071	0.00045	0.00062	0.00062	0.00060	0.00052	0.00052	0.00068	0.00068	0.00041	0.00041	0.00044	0.00044	0.00052	0.00068
Cobalt	0.0009	iPWQO	0.00015	0.00019	0.00019	0.00021	0.00021	0.00019	0.00015	0.00014	0.00019	0.00019	0.00015	0.00016	0.00017	0.00019	0.00018	0.00021
Copper	0.005	iPWQO	0.0011	0.0012	0.0012	0.0011	0.0011	0.0010	0.0010	0.0010	0.00093	0.00093	0.00079	0.00079	0.0011	0.0012	0.0010	0.0012
Iron	0.8	FEQG	0.49	0.58	0.47	0.48	0.48	0.47	0.46	0.47	0.55	0.55	0.39	0.39	0.46	0.47	0.47	0.55
Lead	0.016	FEQG	0.00017	0.00021	0.00026	0.00026	0.00028	0.00025	0.00020	0.00019	0.00023	0.00024	0.00018	0.00018	0.00024	0.00025	0.00024	0.00028
Magnesium	-	-	3.3	4.2	3.1	4.1	4.1	4.0	3.0	3.0	3.3	3.3	2.9	2.9	3.1	3.1	3.1	4.1
Manganese	-	-	0.021	0.049	0.020	0.044	0.043	0.042	0.019	0.019	0.044	0.044	0.017	0.017	0.020	0.020	0.020	0.044
Mercury	0.000026	CCME	0.0000013	0.0000017	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013
Molybdenum	31	SEQG	0.00024	0.00026	0.00028	0.00029	0.00029	0.00027	0.00020	0.00019	0.00026	0.00026	0.00024	0.00025	0.00025	0.00027	0.00026	0.00030
Nickel	0.025	CCME	0.00072	0.00086	0.00087	0.00070	0.00070	0.00068	0.00065	0.00065	0.00075	0.00075	0.00067	0.00067	0.00084	0.00086	0.00070	0.00087
Phosphorus	0.03	iPWQO	0.031	0.037	0.037	0.025	0.026	0.025	0.036	0.036	0.020	0.020	0.030	0.030	0.036	0.037	0.030	0.037
Potassium	-	-	1.1	1.2	1.2	1.3	1.3	1.2	1.0	1.0	1.0	1.0	0.9	0.9	1.2	1.2	1.1	1.3
Selenium	0.002	BC WQG	0.00011	0.00015	0.00065	0.00015	0.00015	0.00014	0.00010	0.00010	0.00011	0.00011	0.000079	0.000080	0.000064	0.000065	0.00010	0.00015
Silver	0.00025	CCME	0.000023	0.000024	0.000023	0.000023	0.000023	0.000022	0.000014	0.000014	0.000022	0.000022	0.000014	0.000014	0.000022	0.000023	0.000022	0.000023
Thallium	0.008	CCME	0.0000038	0.0000055	0.0000040	0.0000040	0.0000040	0.0000041	0.0000051	0.0000051	0.0000036	0.0000037	0.0000057	0.0000057	0.0000040	0.0000040	0.0000040	0.0000057
Tungsten	0.03	iPWQO	0.000023	0.000036	0.000026	0.000036	0.000038	0.000035	0.000041	0.000037	0.000019	0.000021	0.000040	0.000042	0.000023	0.000025	0.000035	0.000042
Uranium	0.015	CCME	0.00021	0.00024	0.00022	0.00019	0.00019	0.00018	0.00019	0.00020	0.00015	0.00015	0.00018	0.00018	0.00022	0.00022	0.00019	0.00022
Vanadium	0.12	FEQG	0.00082	0.0010	0.00081	0.00075	0.00075	0.00073	0.00089	0.00090	0.00078	0.00077	0.00070	0.00071	0.00079	0.00080	0.00078	0.00090
Zinc	0.03	CCME	0.0016	0.0021	0.0016	0.0025	0.0025	0.0024	0.0017	0.0017	0.0021	0.0022	0.0016	0.0016	0.0015	0.0015	0.0017	0.0025
Zirconium	0.004	iPWQO	0.00090	0.00094	0.00093	0.00094	0.00093	0.00086	0.00057	0.00058	0.00089	0.00089	0.00058	0.00058	0.00089	0.00092	0.00089	0.00094
Ammonia (as N)	1.8	CCME	0.047	0.048	0.095	0.10	0.11	0.081	0.055	0.043	0.058	0.062	0.069	0.076	0.069	0.090	0.069	0.11
Ammonia, Unionized (as N)	0.019	CCME	0.00041	0.00041	0.00082	0.00087	0.00092	0.00070	0.00047	0.00037	0.00050	0.00053	0.00059	0.00066	0.00060	0.00078	0.00060	0.00092
Nitrite (as N)	0.06	CCME	0.013	0.014	0.017	0.018	0.018	0.015	0.0087	0.0079	0.014	0.014	0.0085	0.0090	0.015	0.017	0.014	0.018
Nitrate (as N)	3	CCME	0.059	0.20	0.072	0.20	0.20	0.18	0.025	0.022	0.029	0.029	0.054	0.054	0.066	0.070	0.058	0.20
Cyanide, WAD	0.005	PWQO ⁽³⁾	0.0045	0.0047	0.0046	0.0047	0.0046	0.0042	0.0020	0.0020	0.0020	0.0044	0.0043	0.0043	0.0044	0.0046	0.0043	0.0047

Notes:

All units mg/L.

Grey highlighted values are greater than identified WQG PAL.

WQG PAL: Water Quality Guidelines for the Protection of Aquatic Life.

PWQO: Provincial Water Quality Objectives; iPWQO: interim PWQO.

CWQG: Corresponds to the most up-to date CCME Federal Environmental Quality Guideline for the Protection of Aquatic Life.

FEQG: Federal Environmental Quality Guidelines.

BC WQG: British Columbia Water Quality Guidelines.

SEQG: Saskatchewan Environmental Quality Guidelines.

1. Where applicable, receiving environment guidelines are here calculated using 25th percentile hardness and pH of baseline monitoring station to be conservative.

2. Guideline corresponds to Cr(III).

3. The PWQO is for free cyanide.



Table 7.7-10: Dixie Creek (DIX-2) Water Quality Model Results, Final Closure Period

Parameter	WQG PAL ⁽¹⁾	Source	Model Baseline Water Quality		Model Results, Median Monthly Water Quality, Final Closure Period												Predicted Overall Range	
			Median	95th	January	February	March	April	May	June	July	August	September	October	November	December	Median	95th
Sulphate	218	BC WQG	1.0	1.0	1.8	1.9	2.0	1.9	1.2	1.1	1.2	1.4	1.5	1.4	1.2	1.7	1.4	2.0
Chloride	120	CCME	0.5	1.2	1.4	0.7	0.7	0.8	0.56	0.50	0.57	0.64	0.71	0.70	1.2	1.4	0.7	1.4
Aluminum	0.8	FEQG	0.14	0.21	0.13	0.10	0.099	0.10	0.17	0.17	0.14	0.13	0.10	0.10	0.12	0.13	0.12	0.17
Antimony	0.02	iPWQO	0.00039	0.00042	0.00043	0.00044	0.00044	0.00040	0.00024	0.00024	0.00040	0.00040	0.00025	0.00025	0.00039	0.00042	0.00040	0.00044
Arsenic	0.005	iPWQO	0.0021	0.0032	0.0018	0.0022	0.0022	0.0022	0.0018	0.0018	0.0031	0.0030	0.0020	0.0020	0.0019	0.0018	0.0020	0.0031
Beryllium	0.011	PWQO	0.000012	0.000023	0.000023	0.000012	0.000012	0.000012	0.000011	0.000011	0.000013	0.000013	0.000011	0.000011	0.000022	0.000023	0.000012	0.000023
Boron	1.5	CCME	0.0059	0.0062	0.0069	0.0067	0.0068	0.0066	0.0058	0.0057	0.0061	0.0063	0.0060	0.0060	0.0063	0.0068	0.0063	0.0069
Cadmium	0.000078	CCME	0.0000059	0.000020	0.000020	0.0000060	0.0000060	0.0000058	0.0000046	0.0000045	0.0000082	0.0000081	0.0000027	0.0000027	0.000019	0.000019	0.0000060	0.000020
Calcium	-	-	12	15	12	15	15	14	10	10	11	11	10	10	12	12	11	15
Chromium	0.0089	iPWQO ⁽²⁾	0.00056	0.00071	0.00045	0.00063	0.00063	0.00064	0.00055	0.00054	0.00069	0.00069	0.00045	0.00045	0.00043	0.00045	0.00055	0.00069
Cobalt	0.0009	iPWQO	0.00015	0.00019	0.00017	0.00018	0.00018	0.00017	0.00013	0.00012	0.00018	0.00018	0.00013	0.00013	0.00014	0.00016	0.00016	0.00018
Copper	0.005	iPWQO	0.0011	0.0012	0.0011	0.0010	0.0010	0.0010	0.0010	0.0010	0.00093	0.00093	0.00080	0.00079	0.0011	0.0011	0.0010	0.0011
Iron	0.8	FEQG	0.49	0.58	0.45	0.46	0.46	0.42	0.43	0.44	0.53	0.52	0.36	0.36	0.44	0.45	0.45	0.53
Lead	0.016	FEQG	0.00017	0.00021	0.00016	0.00015	0.00015	0.00014	0.00015	0.00015	0.00019	0.00019	0.00011	0.00011	0.00016	0.00016	0.00015	0.00019
Magnesium	-	-	3.3	4.2	3.1	4.1	4.0	3.8	2.9	2.9	3.3	3.2	2.8	2.8	3.1	3.1	3.1	4.1
Manganese	-	-	0.021	0.049	0.021	0.045	0.044	0.040	0.019	0.019	0.043	0.043	0.017	0.017	0.020	0.021	0.021	0.045
Mercury	0.000026	CCME	0.0000013	0.0000017	0.0000016	0.0000016	0.0000017	0.0000019	0.0000017	0.0000016	0.0000015	0.0000016	0.0000018	0.0000017	0.0000014	0.0000016	0.0000016	0.0000019
Molybdenum	31	SEQG	0.00024	0.00026	0.00032	0.00034	0.00035	0.00047	0.00032	0.00028	0.00032	0.00037	0.00039	0.00038	0.00026	0.00030	0.00033	0.00047
Nickel	0.025	CCME	0.00072	0.00086	0.00085	0.00068	0.00067	0.00064	0.00062	0.00063	0.00073	0.00073	0.00064	0.00063	0.00081	0.00084	0.00068	0.00085
Phosphorus	0.03	iPWQO	0.031	0.037	0.036	0.025	0.024	0.024	0.034	0.035	0.019	0.019	0.028	0.028	0.036	0.036	0.028	0.036
Potassium	-	-	1.1	1.2	1.3	1.4	1.4	1.4	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.3	1.2	1.4
Selenium	0.002	BC WQG	0.00011	0.00015	0.00083	0.00017	0.00017	0.00017	0.00012	0.00012	0.00012	0.00013	0.00011	0.00011	0.000069	0.000080	0.00012	0.00017
Silver	0.00025	CCME	0.000023	0.000024	0.000024	0.000024	0.000024	0.000023	0.000015	0.000015	0.000023	0.000023	0.000015	0.000015	0.000022	0.000024	0.000023	0.000024
Thallium	0.008	CCME	0.0000038	0.0000055	0.0000041	0.0000041	0.0000042	0.0000044	0.0000052	0.0000051	0.0000037	0.0000039	0.0000058	0.0000058	0.0000040	0.0000041	0.0000041	0.0000058
Tungsten	0.03	iPWQO	0.000023	0.000036	0.000035	0.000047	0.000049	0.000064	0.000054	0.000048	0.000028	0.000036	0.000060	0.000059	0.000024	0.000033	0.000048	0.000064
Uranium	0.015	CCME	0.00021	0.00024	0.00026	0.00023	0.00024	0.00028	0.00025	0.00024	0.00018	0.00020	0.00025	0.00024	0.00023	0.00025	0.00024	0.00028
Vanadium	0.12	FEQG	0.00082	0.0010	0.00085	0.00080	0.00080	0.00092	0.00101	0.00099	0.00083	0.00087	0.00085	0.00084	0.00080	0.00084	0.00085	0.00101
Zinc	0.03	CCME	0.0016	0.0021	0.0011	0.0020	0.0020	0.0021	0.0016	0.0016	0.0020	0.0020	0.0014	0.0014	0.0011	0.0011	0.0016	0.0021
Zirconium	0.004	iPWQO	0.00090	0.00094	0.00095	0.00096	0.00095	0.00088	0.00060	0.00060	0.00089	0.00089	0.00061	0.00061	0.00087	0.00093	0.00089	0.0010
Ammonia (as N)	1.8	CCME	0.047	0.048	0.055	0.056	0.057	0.051	0.030	0.029	0.047	0.049	0.049	0.049	0.047	0.053	0.049	0.057
Ammonia, Ionized (as N)	0.019	CCME	0.00041	0.00041	0.00047	0.00048	0.00049	0.00044	0.00025	0.00025	0.00041	0.00042	0.00042	0.00042	0.00040	0.00046	0.00042	0.00049
Nitrite (as N)	0.06	CCME	0.013	0.014	0.013	0.013	0.013	0.011	0.0063	0.0065	0.013	0.012	0.0065	0.0064	0.012	0.013	0.012	0.013
Nitrate (as N)	3	CCME	0.059	0.20	0.066	0.19	0.19	0.17	0.024	0.022	0.028	0.029	0.051	0.050	0.063	0.065	0.057	0.19
Cyanide, WAD	0.005	PWQO ⁽³⁾	0.0045	0.0047	0.0044	0.0044	0.0044	0.0039	0.0019	0.0019	0.0020	0.0042	0.0041	0.0040	0.0042	0.0044	0.0041	0.0044

Notes:
 All units mg/L.
 Grey highlighted values are greater than identified WQG PAL.
 WQG PAL: Water Quality Guidelines for the Projection of Aquatic Life.
 PWQO: Provincial Water Quality Objectives; iPWQO: interim PWQO.
 CWQG: Corresponds to the most up-to date CCME Federal Environmental Quality Guideline for the Protection of Aquatic Life.
 FEQG: Federal Environmental Quality Guidelines.
 BC WQG: British Columbia Water Quality Guidelines.
 SEQG: Saskatchewan Environmental Quality Guidelines.
 1. Where applicable, receiving environment guidelines are here calculated using 25th percentile hardness and pH of baseline monitoring station to be conservative.
 2. Guideline corresponds to Cr(III).
 3. The PWQO is for free cyanide.



Table 7.7-11: Dixie Creek (DIX-3) Water Quality Model Results, Operations

Parameter	WQG PAL ⁽¹⁾	Source	Model Baseline Water Quality		Model Results, Median Monthly Water Quality During Operations												Predicted Overall Range	
			Median	95th	January	February	March	April	May	June	July	August	September	October	November	December	Median	95th
Sulphate	218	BC WQG	1.0	1.0	2.7	2.9	3.1	2.3	1.9	1.5	1.5	1.6	1.8	2.0	1.9	2.5	1.9	3.1
Chloride	120	CCME	0.54	1.2	1.2	0.53	0.53	0.51	0.38	0.37	0.48	0.48	0.48	0.49	1.2	1.2	0.49	1.2
Aluminum	0.82	FEQG	0.15	0.22	0.15	0.13	0.13	0.12	0.19	0.19	0.15	0.15	0.12	0.12	0.14	0.15	0.14	0.19
Antimony	0.02	iPWQO	0.00038	0.00040	0.00045	0.00046	0.00046	0.00041	0.00024	0.00024	0.00041	0.00041	0.00025	0.00025	0.00041	0.00044	0.00041	0.00046
Arsenic	0.005	iPWQO	0.0021	0.0032	0.0020	0.0025	0.0025	0.0024	0.0019	0.0018	0.0032	0.0032	0.0021	0.0022	0.0020	0.0020	0.0021	0.0032
Beryllium	0.011	PWQO	0.000013	0.000023	0.000023	0.000012	0.000012	0.000012	0.000011	0.000011	0.000013	0.000013	0.000010	0.000010	0.000022	0.000023	0.000012	0.000023
Boron	1.5	CCME	0.0058	0.0061	0.0062	0.0059	0.0059	0.0058	0.0055	0.0055	0.0059	0.0059	0.0055	0.0055	0.0061	0.0062	0.0059	0.0062
Cadmium	0.000072	CCME	0.0000066	0.000020	0.000023	0.0000089	0.0000095	0.0000085	0.0000058	0.0000054	0.0000093	0.000010	0.0000042	0.0000044	0.000021	0.000022	0.0000091	0.000023
Calcium	-	-	12	15	12	15	15	14	10	10	11	11	10	10	12	12	11	15
Chromium	0.0089	iPWQO ⁽²⁾	0.00059	0.00072	0.00045	0.00062	0.00062	0.00060	0.00052	0.00052	0.00068	0.00068	0.00041	0.00042	0.00044	0.00044	0.00052	0.00068
Cobalt	0.0009	iPWQO	0.00015	0.00019	0.00019	0.00021	0.00021	0.00019	0.00015	0.00014	0.00019	0.00019	0.00015	0.00016	0.00017	0.00019	0.00018	0.00021
Copper	0.005	iPWQO	0.0011	0.0012	0.0012	0.0011	0.0011	0.0010	0.0010	0.0010	0.00093	0.00094	0.00079	0.00079	0.0011	0.0012	0.0010	0.0012
Iron	0.8	FEQG	0.50	0.60	0.47	0.48	0.48	0.47	0.47	0.47	0.55	0.55	0.39	0.39	0.46	0.47	0.47	0.55
Lead	0.016	FEQG	0.00017	0.00021	0.00027	0.00027	0.00028	0.00025	0.00020	0.00019	0.00023	0.00024	0.00018	0.00018	0.00024	0.00025	0.00024	0.00028
Magnesium	-	-	3.3	4.2	3.1	4.1	4.1	4.0	3.0	3.0	3.3	3.3	2.9	2.9	3.1	3.1	3.1	4.1
Manganese	-	-	0.022	0.050	0.020	0.044	0.043	0.042	0.019	0.019	0.044	0.044	0.017	0.017	0.020	0.020	0.020	0.044
Mercury	0.000026	CCME	0.0000014	0.0000018	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013
Molybdenum	31	SEQG	0.00025	0.00026	0.00028	0.00029	0.00029	0.00027	0.00020	0.00019	0.00026	0.00026	0.00024	0.00025	0.00025	0.00027	0.00026	0.00029
Nickel	0.025	CCME	0.00073	0.00086	0.00087	0.00070	0.00071	0.00068	0.00065	0.00065	0.00075	0.00075	0.00067	0.00067	0.00084	0.00086	0.00070	0.00087
Phosphorus	0.03	iPWQO	0.031	0.037	0.037	0.025	0.026	0.025	0.036	0.036	0.020	0.020	0.030	0.030	0.036	0.037	0.030	0.037
Potassium	-	-	1.1	1.3	1.2	1.3	1.3	1.2	1.0	1.0	1.0	1.0	0.94	0.95	1.2	1.2	1.1	1.3
Selenium	0.002	BC WQG	0.00011	0.00016	0.00065	0.00015	0.00015	0.00014	0.00010	0.00010	0.00011	0.00011	0.000079	0.000080	0.000064	0.000065	0.00010	0.00015
Silver	0.00025	CCME	0.000022	0.000023	0.000023	0.000023	0.000023	0.000022	0.000014	0.000014	0.000022	0.000022	0.000014	0.000014	0.000022	0.000023	0.000022	0.000023
Thallium	0.008	CCME	0.0000040	0.0000056	0.0000040	0.0000040	0.0000040	0.0000041	0.0000051	0.0000051	0.0000036	0.0000037	0.0000057	0.0000057	0.0000040	0.0000040	0.0000040	0.0000057
Tungsten	0.03	iPWQO	0.000024	0.000042	0.000026	0.000036	0.000038	0.000035	0.000041	0.000037	0.000019	0.000021	0.000040	0.000042	0.000023	0.000025	0.000035	0.000042
Uranium	0.015	CCME	0.00022	0.00025	0.00023	0.00019	0.00019	0.00018	0.00019	0.00020	0.00015	0.00015	0.00018	0.00018	0.00022	0.00022	0.00019	0.00023
Vanadium	0.12	FEQG	0.00085	0.0010	0.00081	0.00075	0.00075	0.00073	0.00089	0.00090	0.00078	0.00078	0.00071	0.00071	0.00079	0.00080	0.00078	0.00090
Zinc	0.03	CCME	0.0016	0.0021	0.0016	0.0025	0.0026	0.0024	0.0018	0.0017	0.0021	0.0022	0.0016	0.0017	0.0015	0.0015	0.0017	0.0026
Zirconium	0.004	iPWQO	0.00089	0.00092	0.00093	0.00094	0.00093	0.00087	0.00057	0.00058	0.00089	0.00089	0.00058	0.00058	0.00089	0.00092	0.00089	0.00094
Ammonia (as N)	1.8	CCME	0.047	0.055	0.095	0.10	0.11	0.081	0.054	0.043	0.058	0.062	0.069	0.076	0.069	0.090	0.069	0.11
Ammonia, Ionized (as N)	0.019	CCME	0.00040	0.00047	0.00081	0.00087	0.00091	0.00069	0.00047	0.00037	0.00050	0.00053	0.00059	0.00066	0.00059	0.00077	0.00059	0.00091
Nitrite (as N)	0.06	CCME	0.013	0.014	0.017	0.018	0.018	0.015	0.0086	0.0079	0.014	0.014	0.0085	0.0090	0.015	0.017	0.014	0.018
Nitrate (as N)	3	CCME	0.059	0.20	0.072	0.20	0.20	0.18	0.025	0.022	0.029	0.029	0.054	0.054	0.066	0.070	0.058	0.20
Cyanide, WAD	0.005	PWQO ⁽³⁾	0.0043	0.0045	0.0046	0.0047	0.0046	0.0042	0.0020	0.0020	0.0020	0.0044	0.0043	0.0043	0.0044	0.0046	0.0043	0.0047

Notes:
 All units mg/L.
 Grey highlighted values are greater than identified WQG PAL.
 WQG PAL: Water Quality Guidelines for the Projection of Aquatic Life.
 PWQO: Provincial Water Quality Objectives; iPWQO: interim PWQO.
 CWQG: Corresponds to the most up-to date CCME Federal Environmental Quality Guideline for the Protection of Aquatic Life.
 FEQG: Federal Environmental Quality Guidelines.
 BC WQG: British Columbia Water Quality Guidelines.
 SEQG: Saskatchewan Environmental Quality Guidelines.
 1. Where applicable, receiving environment guidelines are here calculated using 25th percentile hardness and pH of baseline monitoring station to be conservative.
 2. Guideline corresponds to Cr(III).
 3. The PWQO is for free cyanide.



Table 7.7-12: Dixie Creek (DIX-3) Water Quality Model Results, Final Closure Period

Parameter	WQG PAL ⁽¹⁾	Source	Model Baseline Water Quality		Model Results, Median Monthly Water Quality, Final Closure Period												Predicted Overall Range	
			Median	95th	January	February	March	April	May	June	July	August	September	October	November	December	Median	95th
Sulphate	218	BC WQG	1.0	1.0	2.2	2.3	2.5	3.6	2.3	2.1	1.8	2.2	2.7	2.7	1.5	2.0	2.3	3.6
Chloride	120	CCME	0.5	1.2	1.4	0.8	0.8	1.1	0.7	0.7	0.7	0.8	0.9	0.9	1.3	1.4	0.9	1.4
Aluminum	0.82	FEQG	0.15	0.22	0.12	0.098	0.097	0.087	0.16	0.17	0.13	0.13	0.094	0.094	0.12	0.12	0.12	0.17
Antimony	0.02	iPWQO	0.00038	0.00040	0.00045	0.00046	0.00046	0.00050	0.00031	0.00030	0.00044	0.00045	0.00033	0.00033	0.00041	0.00044	0.00044	0.00050
Arsenic	0.005	iPWQO	0.0021	0.0032	0.0019	0.0023	0.0023	0.0023	0.0019	0.0019	0.0031	0.0031	0.0021	0.0021	0.0019	0.0019	0.0021	0.0031
Beryllium	0.011	PWQO	0.000013	0.000023	0.000023	0.000012	0.000012	0.000011	0.000010	0.000010	0.000012	0.000012	0.0000100	0.0000100	0.000022	0.000023	0.000012	0.000023
Boron	1.5	CCME	0.0058	0.0061	0.0069	0.0068	0.0069	0.0069	0.0061	0.0060	0.0062	0.0064	0.0063	0.0062	0.0064	0.0068	0.0064	0.0069
Cadmium	0.000072	CCME	0.0000066	0.000020	0.000026	0.000013	0.000014	0.000033	0.000022	0.000019	0.000017	0.000021	0.000022	0.000022	0.000024	0.000025	0.000022	0.000033
Calcium	-	-	12	15	12	15	15	15	10	10	11	11	11	11	12	12	12	15
Chromium	0.0089	iPWQO ⁽²⁾	0.00059	0.00072	0.00045	0.00062	0.00062	0.00059	0.00053	0.00053	0.00067	0.00067	0.00044	0.00043	0.00043	0.00044	0.00053	0.00067
Cobalt	0.0009	iPWQO	0.00015	0.00019	0.00020	0.00021	0.00022	0.00028	0.00020	0.00019	0.00022	0.00023	0.00022	0.00021	0.00017	0.00019	0.00021	0.00028
Copper	0.005	iPWQO	0.0011	0.0012	0.0011	0.0010	0.0010	0.00098	0.00098	0.00099	0.00092	0.00092	0.00080	0.00079	0.0011	0.0011	0.00098	0.0011
Iron	0.8	FEQG	0.50	0.60	0.44	0.45	0.44	0.38	0.40	0.42	0.51	0.50	0.33	0.33	0.43	0.44	0.44	0.51
Lead	0.016	FEQG	0.00017	0.00021	0.00016	0.00015	0.00015	0.00013	0.00014	0.00015	0.00019	0.00018	0.00011	0.00011	0.00015	0.00016	0.00015	0.0002
Magnesium	-	-	3.3	4.2	3.1	4.0	4.0	3.7	2.9	2.9	3.3	3.2	2.9	2.9	3.1	3.1	3.1	4.0
Manganese	-	-	0.022	0.050	0.022	0.045	0.045	0.044	0.023	0.022	0.045	0.045	0.021	0.021	0.021	0.022	0.022	0.045
Mercury	0.000026	CCME	0.0000014	0.0000018	0.0000019	0.0000019	0.0000020	0.0000029	0.0000024	0.0000022	0.0000019	0.0000021	0.0000025	0.0000025	0.0000016	0.0000018	0.0000021	0.0000029
Molybdenum	31	SEQG	0.00025	0.00026	0.00035	0.00038	0.00039	0.00059	0.00041	0.00036	0.00037	0.00043	0.00049	0.00048	0.00029	0.00033	0.00038	0.00059
Nickel	0.025	CCME	0.00073	0.00086	0.0009	0.00074	0.00075	0.0009	0.0008	0.00076	0.00081	0.0008	0.0008	0.0008	0.00085	0.00089	0.00081	0.0009
Phosphorus	0.03	iPWQO	0.031	0.037	0.036	0.024	0.024	0.023	0.033	0.034	0.019	0.019	0.027	0.027	0.035	0.036	0.027	0.036
Potassium	-	-	1.1	1.3	1.4	1.5	1.5	1.6	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.3	1.2	1.6
Selenium	0.002	BC WQG	0.00011	0.00016	0.00011	0.00020	0.00020	0.00027	0.00019	0.00018	0.00016	0.00018	0.00019	0.00018	0.00009	0.00010	0.00018	0.00027
Silver	0.00025	CCME	0.000022	0.000023	0.000025	0.000026	0.000026	0.000027	0.000018	0.000017	0.000024	0.000025	0.000019	0.000019	0.000023	0.000025	0.000024	0.000027
Thallium	0.008	CCME	0.0000040	0.0000056	0.0000043	0.0000044	0.0000044	0.0000053	0.0000057	0.0000056	0.0000041	0.0000043	0.0000063	0.0000063	0.0000042	0.000004	0.0000044	0.0000063
Tungsten	0.03	iPWQO	0.000024	0.000042	0.000048	0.000061	0.000066	0.00012	0.000089	0.000077	0.000047	0.000062	0.00010	0.00010	0.000035	0.000045	0.000064	0.00012
Uranium	0.015	CCME	0.00022	0.00025	0.00028	0.00025	0.00026	0.00035	0.00029	0.00028	0.00021	0.00024	0.00030	0.00029	0.00024	0.00027	0.00027	0.00035
Vanadium	0.12	FEQG	0.00085	0.0010	0.00087	0.00082	0.00083	0.00098	0.00104	0.00102	0.00086	0.00090	0.00090	0.00089	0.00082	0.00086	0.00088	0.00104
Zinc	0.03	CCME	0.0016	0.0021	0.0015	0.0024	0.0024	0.0033	0.0025	0.0023	0.0024	0.0026	0.0024	0.0024	0.0014	0.0014	0.0024	0.0033
Zirconium	0.004	iPWQO	0.00089	0.00092	0.0010	0.0010	0.0010	0.0011	0.00073	0.00071	0.00095	0.0010	0.00076	0.00075	0.00091	0.0010	0.00096	0.0011
Ammonia (as N)	1.8	CCME	0.047	0.055	0.055	0.056	0.057	0.053	0.032	0.031	0.048	0.049	0.050	0.050	0.047	0.053	0.050	0.057
Ammonia, Ionized (as N)	0.019	CCME	0.00040	0.00047	0.00047	0.00048	0.00049	0.00045	0.00027	0.00026	0.00041	0.00042	0.00043	0.00043	0.00040	0.00046	0.00043	0.00049
Nitrite (as N)	0.06	CCME	0.013	0.014	0.013	0.013	0.013	0.011	0.0065	0.0067	0.013	0.012	0.0068	0.0067	0.012	0.013	0.012	0.013
Nitrate (as N)	3	CCME	0.059	0.20	0.067	0.19	0.19	0.16	0.029	0.026	0.031	0.032	0.054	0.053	0.063	0.066	0.059	0.19
Cyanide, WAD	0.005	PWQO ⁽³⁾	0.0043	0.0045	0.0044	0.0044	0.0043	0.0037	0.0019	0.0019	0.0020	0.0041	0.0040	0.0039	0.0042	0.0044	0.0040	0.0044

Notes:
 All units mg/L.
 Grey highlighted values are greater than identified WQG PAL.
 WQG PAL: Water Quality Guidelines for the Projection of Aquatic Life.
 PWQO: Provincial Water Quality Objectives; iPWQO: interim PWQO.
 CWQG: Corresponds to the most up-to date CCME Federal Environmental Quality Guideline for the Protection of Aquatic Life.
 FEQG: Federal Environmental Quality Guidelines.
 BC WQG: British Columbia Water Quality Guidelines.
 SEQG: Saskatchewan Environmental Quality Guidelines.
 1. Where applicable, receiving environment guidelines are here calculated using 25th percentile hardness and pH of baseline monitoring station to be conservative.
 2. Guideline corresponds to Cr(III).
 3. The PWQO is for free cyanide.



Table 7.7-13: Dixie Creek (DIX-4) Water Quality Model Results, Operations

Parameter	WQG PAL ⁽¹⁾	Source	Model Baseline Water Quality		Model Results, Median Monthly Water Quality During Operations												Predicted Overall Range	
			Median	95th	January	February	March	April	May	June	July	August	September	October	November	December	Median	95th
Sulphate	218	BC WQG	1.0	1.2	2.1	2.2	2.3	1.8	1.5	1.2	1.3	1.4	1.5	1.6	1.5	1.9	1.5	2.3
Chloride	120	CCME	0.74	1.4	1.2	0.57	0.88	0.82	0.38	0.37	0.61	0.55	0.50	0.55	1.1	1.1	0.59	1.2
Aluminum	0.82	FEQG	0.22	0.30	0.18	0.16	0.17	0.16	0.22	0.22	0.22	0.18	0.15	0.18	0.19	0.16	0.18	0.22
Antimony	0.02	iPWQO	0.00026	0.00032	0.00039	0.00039	0.00039	0.00036	0.00021	0.00021	0.00039	0.00035	0.00021	0.00026	0.00037	0.00037	0.00036	0.00039
Arsenic	0.005	iPWQO	0.0022	0.0030	0.0019	0.0023	0.0024	0.0024	0.0019	0.0019	0.0030	0.0032	0.0023	0.0023	0.0021	0.0019	0.0023	0.0032
Beryllium	0.011	PWQO	0.000016	0.000022	0.000023	0.000013	0.000014	0.000013	0.000011	0.000011	0.000015	0.000013	0.000012	0.000012	0.000022	0.000021	0.000013	0.000023
Boron	1.5	CCME	0.0056	0.0059	0.0060	0.0058	0.0058	0.0057	0.0054	0.0055	0.0058	0.0057	0.0057	0.0055	0.0060	0.0060	0.0058	0.0060
Cadmium	0.000072	CCME	0.0000080	0.000018	0.000023	0.000011	0.0000089	0.0000083	0.0000056	0.0000052	0.0000091	0.0000091	0.0000045	0.0000042	0.000019	0.000019	0.0000090	0.000023
Calcium	-	-	12	16	13	15	15	15	10	10	11	11	11	12	12	12	12	15
Chromium	0.0089	iPWQO ⁽²⁾	0.00071	0.00088	0.00052	0.00067	0.00071	0.00068	0.00060	0.00060	0.00078	0.00069	0.00049	0.00052	0.00050	0.00046	0.00060	0.0008
Cobalt	0.0009	iPWQO	0.00018	0.00024	0.00019	0.00020	0.00022	0.00020	0.00016	0.00015	0.00021	0.00020	0.00016	0.00017	0.00017	0.00018	0.00018	0.00022
Copper	0.005	iPWQO	0.0011	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010	0.0010	0.0010	0.00089	0.00087	0.0012	0.0011	0.0011	0.0012
Iron	0.8	FEQG	0.60	0.76	0.51	0.52	0.59	0.58	0.51	0.52	0.61	0.59	0.46	0.47	0.50	0.48	0.52	0.61
Lead	0.016	FEQG	0.00019	0.00023	0.00024	0.00024	0.00025	0.00023	0.00019	0.00019	0.00023	0.00024	0.00017	0.00019	0.00022	0.00022	0.00023	0.00025
Magnesium	-	-	3.6	4.4	3.4	4.2	4.2	4.1	3.1	3.0	3.3	3.5	3.1	3.4	3.2	3.2	3.4	4.2
Manganese	-	-	0.033	0.058	0.024	0.044	0.047	0.047	0.021	0.021	0.047	0.050	0.022	0.023	0.0204	0.020	0.024	0.050
Mercury	0.000026	CCME	0.0000018	0.0000026	0.0000015	0.0000015	0.0000015	0.0000015	0.0000018	0.0000018	0.0000017	0.0000016	0.0000015	0.0000014	0.0000015	0.0000013	0.0000015	0.0000018
Molybdenum	31	SEQG	0.00025	0.00031	0.00028	0.00029	0.00028	0.00026	0.00020	0.00019	0.00025	0.00026	0.00025	0.00028	0.00025	0.00026	0.00026	0.00029
Nickel	0.025	CCME	0.00088	0.00095	0.00087	0.00072	0.00078	0.00076	0.00070	0.00069	0.00084	0.00082	0.00075	0.00075	0.00088	0.00084	0.00077	0.00088
Phosphorus	0.03	iPWQO	0.035	0.037	0.037	0.027	0.029	0.028	0.036	0.036	0.022	0.024	0.032	0.031	0.037	0.036	0.032	0.037
Potassium	-	-	1.2	1.3	1.2	1.3	1.3	1.3	1.1	1.0	1.0	1.1	1.0	1.0	1.1	1.2	1.1	1.3
Selenium	0.002	BC WQG	0.00011	0.00034	0.00017	0.00024	0.00014	0.00014	0.00011	0.00010	0.00011	0.00011	0.000088	0.000084	0.000071	0.000070	0.00011	0.00024
Silver	0.00025	CCME	0.000018	0.000024	0.000021	0.000021	0.000021	0.000020	0.000012	0.000012	0.000023	0.000020	0.000013	0.000014	0.000023	0.000020	0.000020	0.000023
Thallium	0.008	CCME	0.0000047	0.0000063	0.0000041	0.0000041	0.0000041	0.0000042	0.0000051	0.0000050	0.0000047	0.0000039	0.0000055	0.0000059	0.0000047	0.0000041	0.0000044	0.0000059
Tungsten	0.03	iPWQO	0.000038	0.000078	0.000027	0.000035	0.000036	0.000035	0.000041	0.000038	0.000023	0.000033	0.000052	0.000058	0.000029	0.000031	0.000035	0.000058
Uranium	0.015	CCME	0.00025	0.00037	0.00029	0.00026	0.00021	0.00021	0.00020	0.00020	0.00017	0.00019	0.00020	0.00023	0.00024	0.00024	0.00021	0.00029
Vanadium	0.12	FEQG	0.0010	0.0012	0.00090	0.00085	0.00086	0.00084	0.00099	0.00099	0.00096	0.00094	0.00082	0.00086	0.00089	0.00086	0.00087	0.0010
Zinc	0.03	CCME	0.0016	0.0023	0.0016	0.0023	0.0024	0.0023	0.0017	0.0016	0.0023	0.0020	0.0015	0.0016	0.0014	0.0014	0.0017	0.0024
Zirconium	0.004	iPWQO	0.00076	0.0009	0.0009	0.00088	0.00090	0.00084	0.00058	0.00058	0.00092	0.00083	0.00060	0.00063	0.00091	0.0008	0.00083	0.0009
Ammonia (as N)	1.8	CCME	0.046	0.097	0.096	0.10	0.084	0.068	0.047	0.039	0.055	0.056	0.061	0.065	0.058	0.069	0.060	0.0995
Ammonia, Ionized (as N)	0.019	CCME	0.00040	0.00084	0.00082	0.00086	0.00072	0.00059	0.00040	0.00034	0.00047	0.00048	0.00052	0.00056	0.00050	0.00060	0.00052	0.00086
Nitrite (as N)	0.06	CCME	0.0099	0.014	0.015	0.015	0.016	0.014	0.0070	0.0066	0.014	0.012	0.0086	0.0086	0.014	0.013	0.013	0.016
Nitrate (as N)	3	CCME	0.061	0.20	0.081	0.19	0.20	0.19	0.026	0.022	0.029	0.028	0.050	0.055	0.066	0.068	0.060	0.20
Cyanide, WAD	0.005	PWQO ⁽³⁾	0.0030	0.0042	0.0040	0.0040	0.0040	0.0037	0.0019	0.0019	0.0025	0.0041	0.0039	0.0041	0.0045	0.0039	0.0039	0.0045

Notes:
 All units mg/L.
 Grey highlighted values are greater than identified WQG PAL.
 WQG PAL: Water Quality Guidelines for the Projection of Aquatic Life.
 PWQO: Provincial Water Quality Objectives; iPWQO: interim PWQO.
 CWQG: Corresponds to the most up-to date CCME Federal Environmental Quality Guideline for the Protection of Aquatic Life.
 FEQG: Federal Environmental Quality Guidelines.
 BC WQG: British Columbia Water Quality Guidelines.
 SEQG: Saskatchewan Environmental Quality Guidelines.
 1. Where applicable, receiving environment guidelines are here calculated using 25th percentile hardness and pH of baseline monitoring station to be conservative.
 2. Guideline corresponds to Cr(III).
 3. The PWQO is for free cyanide.



Table 7.7-14: Dixie Creek (DIX-4) Water Quality Model Results, Post-Closure

Parameter	WQG PAL ⁽¹⁾	Source	Model Baseline Water Quality		Model Results, Median Monthly Water Quality, Final Closure Period												Predicted Overall Range	
			Median	95th	January	February	March	April	May	June	July	August	September	October	November	December	Median	95th
Sulphate	218	BC WQG	1.0	1.2	1.9	2.0	2.0	2.8	1.9	1.7	1.5	1.9	2.2	2.2	1.3	1.7	1.9	2.8
Chloride	120	CCME	0.7	1.4	1.3	0.8	1.1	1.2	0.6	0.6	0.7	0.7	0.8	0.8	1.1	1.2	0.8	1.3
Aluminum	0.82	FEQG	0.22	0.30	0.16	0.14	0.14	0.13	0.20	0.20	0.20	0.16	0.13	0.15	0.18	0.14	0.16	0.20
Antimony	0.02	iPWQO	0.00026	0.00032	0.00040	0.00040	0.00040	0.00043	0.00026	0.00025	0.00041	0.00039	0.00028	0.00031	0.00037	0.00038	0.00038	0.00043
Arsenic	0.005	iPWQO	0.0022	0.0030	0.0018	0.0022	0.0023	0.0023	0.0019	0.0019	0.0030	0.0031	0.0023	0.0022	0.0020	0.0019	0.0022	0.0031
Beryllium	0.011	PWQO	0.000016	0.000022	0.000023	0.000013	0.000013	0.000013	0.000010	0.000010	0.000014	0.000013	0.000012	0.000012	0.000022	0.000021	0.000013	0.000023
Boron	1.5	CCME	0.0056	0.0059	0.0065	0.0064	0.0064	0.0065	0.0058	0.0058	0.0061	0.0061	0.0062	0.0061	0.0062	0.0064	0.0062	0.0065
Cadmium	0.000072	CCME	0.0000080	0.000018	0.000025	0.000014	0.000012	0.000025	0.000016	0.000014	0.000014	0.000016	0.000016	0.000016	0.000020	0.000021	0.000016	0.000025
Calcium	-	-	12	16	13	16	15	15	10	10	11	11	11	12	12	12	12	16
Chromium	0.0089	iPWQO ⁽²⁾	0.00071	0.00088	0.00051	0.00066	0.00070	0.00067	0.00060	0.00059	0.00077	0.00068	0.00050	0.00053	0.00049	0.00046	0.00059	0.00077
Cobalt	0.0009	iPWQO	0.00018	0.00024	0.00019	0.00020	0.00022	0.00026	0.00019	0.00018	0.00023	0.00023	0.00020	0.00021	0.00017	0.00018	0.00020	0.00026
Copper	0.005	iPWQO	0.0011	0.0012	0.0011	0.0010	0.0011	0.0011	0.0010	0.0010	0.0010	0.0010	0.00088	0.00086	0.0011	0.0011	0.0010	0.0011
Iron	0.8	FEQG	0.60	0.76	0.49	0.49	0.56	0.50	0.47	0.48	0.59	0.55	0.42	0.43	0.48	0.46	0.49	0.59
Lead	0.016	FEQG	0.00019	0.00023	0.00017	0.00017	0.00017	0.00015	0.00015	0.00016	0.00020	0.00020	0.00013	0.00013	0.00016	0.00016	0.00016	0.0002
Magnesium	-	-	3.6	4.4	3.4	4.2	4.2	3.9	3.0	3.0	3.3	3.4	3.0	3.3	3.2	3.2	3.3	4.2
Manganese	-	-	0.033	0.058	0.026	0.046	0.048	0.048	0.023	0.023	0.047	0.050	0.025	0.026	0.021	0.021	0.026	0.050
Mercury	0.000026	CCME	0.0000018	0.0000026	0.0000018	0.0000019	0.0000019	0.0000026	0.0000025	0.0000023	0.0000021	0.0000022	0.0000023	0.0000022	0.0000017	0.0000016	0.0000021	0.0000026
Molybdenum	31	SEQG	0.00025	0.00031	0.00033	0.00035	0.00034	0.00049	0.00034	0.00030	0.00032	0.00037	0.00042	0.00043	0.00028	0.00030	0.00034	0.00049
Nickel	0.025	CCME	0.00088	0.00095	0.00089	0.00075	0.00081	0.0009	0.00079	0.00077	0.00087	0.0009	0.0008	0.0008	0.00089	0.00086	0.00085	0.0009
Phosphorus	0.03	iPWQO	0.035	0.037	0.036	0.026	0.028	0.026	0.034	0.035	0.022	0.023	0.030	0.030	0.036	0.035	0.030	0.036
Potassium	-	-	1.2	1.3	1.3	1.4	1.4	1.5	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.3	1.2	1.5
Selenium	0.002	BC WQG	0.00011	0.00034	0.00019	0.00026	0.00018	0.00023	0.00016	0.00015	0.00014	0.00015	0.00016	0.00015	0.000089	0.00009	0.00016	0.00026
Silver	0.00025	CCME	0.000018	0.000024	0.000022	0.000023	0.000023	0.000024	0.000015	0.000015	0.000024	0.000022	0.000017	0.000018	0.000023	0.000021	0.000022	0.000024
Thallium	0.008	CCME	0.0000047	0.0000063	0.0000043	0.0000044	0.0000044	0.0000050	0.0000055	0.0000054	0.0000049	0.0000043	0.0000060	0.0000063	0.0000048	0.0000043	0.0000049	0.0000063
Tungsten	0.03	iPWQO	0.000038	0.000078	0.000042	0.000052	0.000055	0.000091	0.000073	0.000064	0.000041	0.000059	0.000090	0.000094	0.000037	0.000044	0.000057	0.000094
Uranium	0.015	CCME	0.00025	0.00037	0.00032	0.00029	0.00026	0.00032	0.00027	0.00025	0.00020	0.00024	0.00027	0.00030	0.00026	0.00027	0.00027	0.00032
Vanadium	0.12	FEQG	0.0010	0.0012	0.00094	0.00089	0.00091	0.00100	0.0011	0.0011	0.00100	0.0010	0.00093	0.00097	0.00090	0.00089	0.00095	0.0011
Zinc	0.03	CCME	0.0016	0.0023	0.0015	0.0023	0.0023	0.0030	0.0022	0.0020	0.0025	0.0023	0.0021	0.0021	0.0013	0.0014	0.0021	0.0030
Zirconium	0.004	iPWQO	0.00076	0.00094	0.00091	0.00092	0.00094	0.0010	0.00068	0.00066	0.00095	0.00089	0.00071	0.00074	0.00092	0.00085	0.00090	0.0010
Ammonia (as N)	1.8	CCME	0.046	0.097	0.071	0.072	0.054	0.051	0.032	0.032	0.048	0.048	0.049	0.048	0.045	0.047	0.048	0.072
Ammonia, Ionized (as N)	0.019	CCME	0.00040	0.00084	0.00061	0.00062	0.00046	0.00044	0.00028	0.00028	0.00041	0.00041	0.00042	0.00041	0.00039	0.00041	0.00041	0.00062
Nitrite (as N)	0.06	CCME	0.0099	0.014	0.012	0.012	0.013	0.011	0.0057	0.0059	0.013	0.011	0.0074	0.0071	0.013	0.011	0.011	0.013
Nitrate (as N)	3	CCME	0.061	0.20	0.077	0.18	0.19	0.17	0.029	0.024	0.030	0.030	0.050	0.055	0.065	0.065	0.060	0.19
Cyanide, WAD	0.005	PWQO ⁽³⁾	0.0030	0.0042	0.0038	0.0038	0.0038	0.0034	0.0018	0.0019	0.0024	0.0039	0.0037	0.0038	0.0044	0.0038	0.0038	0.0044

Notes:
 All units mg/L.
 Grey highlighted values are greater than identified WQG PAL.
 WQG PAL: Water Quality Guidelines for the Projection of Aquatic Life.
 PWQO: Provincial Water Quality Objectives; iPWQO: interim PWQO.
 CWQG: Corresponds to the most up-to date CCME Federal Environmental Quality Guideline for the Protection of Aquatic Life.
 FEQG: Federal Environmental Quality Guidelines.
 BC WQG: British Columbia Water Quality Guidelines.
 SEQG: Saskatchewan Environmental Quality Guidelines.
 1. Where applicable, receiving environment guidelines are here calculated using 25th percentile hardness and pH of baseline monitoring station to be conservative.
 2. Guideline corresponds to Cr(III).
 3. The PWQO is for free cyanide.



Table 7.7-15: Dixie Creek (DIX-5) Water Quality Model Results, Operations

Parameter	WQG PAL ⁽¹⁾	Source	Model Baseline Water Quality		Model Results, Median Monthly Water Quality During Operations												Predicted Overall Range	
			Median	95th	January	February	March	April	May	June	July	August	September	October	November	December	Median	95th
Sulphate	218	BC WQG	1.0	1.2	2.1	2.2	2.3	1.8	1.5	1.2	1.3	1.4	1.5	1.6	1.5	1.9	1.5	2.3
Chloride	120	CCME	0.74	1.4	1.2	0.57	0.88	0.82	0.38	0.37	0.61	0.55	0.50	0.55	1.1	1.1	0.59	1.2
Aluminum	0.73	FEQG	0.22	0.30	0.18	0.16	0.17	0.16	0.22	0.22	0.22	0.18	0.15	0.18	0.19	0.16	0.18	0.22
Antimony	0.02	iPWQO	0.00026	0.00032	0.00039	0.00039	0.00039	0.00036	0.00021	0.00021	0.00039	0.00035	0.00021	0.00026	0.00037	0.00037	0.00036	0.00039
Arsenic	0.005	iPWQO	0.0022	0.0030	0.0019	0.0023	0.0024	0.0024	0.0019	0.0019	0.0030	0.0032	0.0023	0.0023	0.0021	0.0019	0.0023	0.0032
Beryllium	0.011	PWQO	0.000016	0.000022	0.000023	0.000013	0.000014	0.000013	0.000011	0.000011	0.000015	0.000013	0.000012	0.000012	0.000022	0.000021	0.000013	0.000023
Boron	1.5	CCME	0.0056	0.0059	0.0060	0.0058	0.0058	0.0057	0.0054	0.0055	0.0058	0.0057	0.0057	0.0055	0.0060	0.0060	0.0058	0.0060
Cadmium	0.000083	CCME	0.0000080	0.000018	0.000023	0.000011	0.0000089	0.0000083	0.0000056	0.0000052	0.0000091	0.0000091	0.0000045	0.0000042	0.000019	0.000019	0.0000090	0.000023
Calcium	-	-	12	16	13	15	15	15	10	10	11	11	11	12	12	12	12	15
Chromium	0.0089	iPWQO ⁽²⁾	0.00071	0.00088	0.00052	0.00067	0.00071	0.00068	0.00060	0.00060	0.00078	0.00069	0.00049	0.00052	0.00050	0.00046	0.00060	0.0008
Cobalt	0.0009	iPWQO	0.00018	0.00024	0.00019	0.00020	0.00022	0.00020	0.00016	0.00015	0.00021	0.00020	0.00016	0.00017	0.00017	0.00018	0.00018	0.00022
Copper	0.005	iPWQO	0.0011	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010	0.0010	0.0010	0.00089	0.00087	0.0012	0.0011	0.0011	0.0012
Iron	0.8	FEQG	0.60	0.76	0.51	0.52	0.59	0.58	0.51	0.52	0.61	0.59	0.46	0.47	0.50	0.48	0.52	0.61
Lead	0.017	FEQG	0.00019	0.00023	0.00024	0.00024	0.00025	0.00023	0.00019	0.00019	0.00023	0.00024	0.00017	0.00019	0.00022	0.00022	0.00023	0.00025
Magnesium	-	-	3.6	4.4	3.4	4.2	4.2	4.1	3.1	3.0	3.3	3.5	3.1	3.4	3.2	3.2	3.4	4.2
Manganese	-	-	0.033	0.058	0.024	0.044	0.047	0.047	0.021	0.021	0.047	0.050	0.022	0.023	0.0204	0.020	0.024	0.050
Mercury	0.000026	CCME	0.0000018	0.0000026	0.0000015	0.0000015	0.0000015	0.0000015	0.0000018	0.0000018	0.0000017	0.0000016	0.0000015	0.0000014	0.0000015	0.0000013	0.0000015	0.0000018
Molybdenum	31	SEQG	0.00025	0.00031	0.00028	0.00029	0.00028	0.00026	0.00020	0.00019	0.00025	0.00026	0.00025	0.00028	0.00025	0.00026	0.00026	0.00029
Nickel	0.025	CCME	0.00088	0.00095	0.00087	0.00072	0.00078	0.00076	0.00070	0.00069	0.00084	0.00082	0.00075	0.00075	0.00088	0.00084	0.00077	0.00088
Phosphorus	0.03	iPWQO	0.035	0.037	0.037	0.027	0.029	0.028	0.036	0.036	0.022	0.024	0.032	0.031	0.037	0.036	0.032	0.037
Potassium	-	-	1.2	1.3	1.2	1.3	1.3	1.3	1.1	1.0	1.0	1.1	1.0	1.0	1.1	1.2	1.1	1.3
Selenium	0.002	BC WQG	0.00011	0.00034	0.00017	0.00024	0.00014	0.00014	0.00011	0.00010	0.00011	0.00011	0.000088	0.000084	0.000071	0.000070	0.00011	0.00024
Silver	0.00025	CCME	0.000018	0.000024	0.000021	0.000021	0.000021	0.000020	0.000012	0.000012	0.000023	0.000020	0.000013	0.000014	0.000023	0.000020	0.000020	0.000023
Thallium	0.008	CCME	0.0000047	0.0000063	0.0000041	0.0000041	0.0000041	0.0000042	0.0000051	0.0000050	0.0000047	0.0000039	0.0000055	0.0000059	0.0000047	0.0000041	0.0000044	0.0000059
Tungsten	0.03	iPWQO	0.000038	0.000078	0.000027	0.000035	0.000036	0.000035	0.000041	0.000038	0.000023	0.000033	0.000052	0.000058	0.000029	0.000031	0.000035	0.000058
Uranium	0.015	CCME	0.00025	0.00037	0.00029	0.00026	0.00021	0.00021	0.00020	0.00020	0.00017	0.00019	0.00020	0.00023	0.00024	0.00024	0.00021	0.00029
Vanadium	0.12	FEQG	0.0010	0.0012	0.00090	0.00085	0.00086	0.00084	0.00099	0.00099	0.00096	0.00094	0.00082	0.00086	0.00089	0.00086	0.00087	0.0010
Zinc	0.03	CCME	0.0016	0.0023	0.0016	0.0023	0.0024	0.0023	0.0017	0.0016	0.0023	0.0020	0.0015	0.0016	0.0014	0.0014	0.0017	0.0024
Zirconium	0.004	iPWQO	0.00076	0.0009	0.0009	0.00088	0.00090	0.00084	0.00058	0.00058	0.00092	0.00083	0.00060	0.00063	0.00091	0.0008	0.00083	0.0009
Ammonia (as N)	1.8	CCME	0.046	0.097	0.096	0.10	0.084	0.068	0.047	0.039	0.055	0.056	0.061	0.065	0.058	0.069	0.060	0.0995
Ammonia, Ionized (as N)	0.019	CCME	0.00040	0.00084	0.00082	0.00086	0.00072	0.00059	0.00040	0.00034	0.00047	0.00048	0.00052	0.00056	0.00050	0.00060	0.00052	0.00086
Nitrite (as N)	0.06	CCME	0.0099	0.014	0.015	0.015	0.016	0.014	0.0070	0.0066	0.014	0.012	0.0086	0.0086	0.014	0.013	0.013	0.016
Nitrate (as N)	3	CCME	0.061	0.20	0.081	0.19	0.20	0.19	0.026	0.022	0.029	0.028	0.050	0.055	0.066	0.068	0.060	0.20
Cyanide, WAD	0.005	PWQO ⁽³⁾	0.0030	0.0042	0.0040	0.0040	0.0040	0.0037	0.0019	0.0019	0.0025	0.0041	0.0039	0.0041	0.0045	0.0039	0.0039	0.0045

Notes:
 All units mg/L.
 Grey highlighted values are greater than identified WQG PAL.
 WQG PAL: Water Quality Guidelines for the Projection of Aquatic Life.
 PWQO: Provincial Water Quality Objectives; iPWQO: interim PWQO.
 CWQG: Corresponds to the most up-to date CCME Federal Environmental Quality Guideline for the Protection of Aquatic Life.
 FEQG: Federal Environmental Quality Guidelines.
 BC WQG: British Columbia Water Quality Guidelines.
 SEQG: Saskatchewan Environmental Quality Guidelines.
 1. Where applicable, receiving environment guidelines are here calculated using 25th percentile hardness and pH of baseline monitoring station to be conservative.
 2. Guideline corresponds to Cr(III).
 3. The PWQO is for free cyanide.



Table 7.7-16: Dixie Creek (DIX-5) Water Quality Model Results, Final Closure Period

Parameter	WQG PAL ⁽¹⁾	Source	Model Baseline Water Quality		Model Results, Median Monthly Water Quality, Final Closure Period												Predicted Overall Range	
			Median	95th	January	February	March	April	May	June	July	August	September	October	November	December	Median	95th
Sulphate	218	BC WQG	1.0	1.2	1.8	1.9	1.9	2.7	1.8	1.6	1.5	1.8	2.1	2.1	1.3	1.6	1.8	2.7
Chloride	120	CCME	0.9	1.6	1.4	0.9	1.2	1.4	0.8	0.7	0.9	0.9	1.0	1.0	1.3	1.4	1.0	1.4
Aluminum	0.73	FEQG	0.22	0.29	0.16	0.14	0.14	0.13	0.20	0.20	0.20	0.16	0.13	0.15	0.18	0.14	0.16	0.20
Antimony	0.02	iPWQO	0.00028	0.00033	0.00040	0.00040	0.00040	0.00042	0.00026	0.00026	0.00041	0.00038	0.00028	0.00032	0.00037	0.00038	0.00038	0.00042
Arsenic	0.005	iPWQO	0.0023	0.0031	0.0019	0.0022	0.0023	0.0023	0.0019	0.0019	0.0030	0.0031	0.0023	0.0023	0.0021	0.0019	0.0022	0.0031
Beryllium	0.011	PWQO	0.000016	0.000022	0.000022	0.000013	0.000013	0.000013	0.000010	0.000010	0.000014	0.000013	0.000012	0.000012	0.000021	0.000020	0.000013	0.000022
Boron	1.5	CCME	0.0057	0.0059	0.0065	0.0063	0.0063	0.0064	0.0058	0.0058	0.0061	0.0061	0.0062	0.0060	0.0061	0.0064	0.0061	0.0065
Cadmium	0.000083	CCME	0.0000078	0.000017	0.000024	0.000013	0.000011	0.000023	0.000015	0.000013	0.000014	0.000015	0.000016	0.000015	0.000019	0.000020	0.000015	0.000024
Calcium	-	-	12	16	13	16	15	15	10	10	11	11	11	12	12	12	12	16
Chromium	0.0089	iPWQO ⁽²⁾	0.00071	0.00087	0.00052	0.00066	0.00070	0.00066	0.00060	0.00060	0.00076	0.00067	0.00050	0.00053	0.00049	0.00046	0.00060	0.00076
Cobalt	0.0009	iPWQO	0.00018	0.00023	0.00019	0.00020	0.00022	0.00026	0.00019	0.00018	0.00022	0.00022	0.00020	0.00021	0.00017	0.00018	0.00020	0.00026
Copper	0.005	iPWQO	0.0011	0.0012	0.0011	0.0010	0.0011	0.0010	0.0010	0.0010	0.0010	0.0010	0.00088	0.00085	0.0011	0.0011	0.0010	0.0011
Iron	0.8	FEQG	0.59	0.75	0.48	0.49	0.56	0.50	0.47	0.48	0.58	0.55	0.42	0.43	0.48	0.46	0.48	0.58
Lead	0.017	FEQG	0.00018	0.00022	0.00017	0.00016	0.000164	0.000152	0.000152	0.00016	0.00020	0.00019	0.00013	0.00013	0.00016	0.00016	0.00016	0.00020
Magnesium	-	-	3.7	4.5	3.5	4.2	4.2	4.0	3.1	3.1	3.3	3.5	3.1	3.4	3.3	3.3	3.4	4.2
Manganese	-	-	0.033	0.058	0.027	0.046	0.049	0.048	0.024	0.024	0.047	0.051	0.026	0.027	0.022	0.022	0.027	0.051
Mercury	0.000026	CCME	0.0000019	0.0000026	0.0000019	0.0000019	0.0000020	0.0000026	0.0000025	0.0000023	0.0000021	0.0000022	0.0000023	0.0000022	0.0000018	0.0000017	0.0000022	0.0000026
Molybdenum	31	SEQG	0.00026	0.00031	0.00032	0.00034	0.00033	0.00047	0.00033	0.00029	0.00032	0.00036	0.00041	0.00042	0.00028	0.00029	0.00033	0.00047
Nickel	0.025	CCME	0.00087	0.00093	0.00088	0.00075	0.00081	0.0009	0.00078	0.00076	0.00086	0.00086	0.0008	0.00083	0.00087	0.00085	0.00084	0.0009
Phosphorus	0.03	iPWQO	0.034	0.036	0.035	0.026	0.028	0.026	0.033	0.034	0.022	0.023	0.030	0.029	0.036	0.035	0.030	0.036
Potassium	-	-	1.2	1.4	1.3	1.4	1.4	1.5	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.3	1.2	1.5
Selenium	0.002	BC WQG	0.00011	0.00032	0.00019	0.00026	0.00017	0.00022	0.00016	0.00015	0.00014	0.00015	0.00015	0.00015	0.000091	0.00010	0.00015	0.00026
Silver	0.00025	CCME	0.000018	0.000024	0.000022	0.000023	0.000023	0.000024	0.000016	0.000015	0.000024	0.000022	0.000017	0.000018	0.000024	0.000021	0.000022	0.000024
Thallium	0.008	CCME	0.0000046	0.0000062	0.0000043	0.0000044	0.0000044	0.0000050	0.0000054	0.0000053	0.0000050	0.0000043	0.0000059	0.0000062	0.0000049	0.0000043	0.0000049	0.0000062
Tungsten	0.03	iPWQO	0.000038	0.000075	0.000041	0.000050	0.000053	0.000086	0.000069	0.000062	0.000040	0.000057	0.000086	0.000091	0.000037	0.000043	0.000055	0.000091
Uranium	0.015	CCME	0.00024	0.00035	0.00031	0.00029	0.00025	0.00030	0.00026	0.00025	0.00020	0.00023	0.00026	0.00029	0.00025	0.00026	0.00026	0.00031
Vanadium	0.12	FEQG	0.0010	0.0012	0.00092	0.00088	0.00089	0.00097	0.00105	0.00104	0.00099	0.0010	0.00092	0.00095	0.00089	0.00088	0.00094	0.0011
Zinc	0.03	CCME	0.0016	0.0024	0.0015	0.0022	0.0023	0.0029	0.0021	0.0020	0.0024	0.0023	0.0020	0.0020	0.0014	0.0014	0.0021	0.0029
Zirconium	0.004	iPWQO	0.00078	0.00094	0.00091	0.00092	0.00094	0.0010	0.00069	0.00067	0.00095	0.00089	0.00072	0.00075	0.00092	0.00085	0.00090	0.0010
Ammonia (as N)	1.8	CCME	0.049	0.10	0.073	0.074	0.056	0.054	0.037	0.036	0.051	0.051	0.052	0.051	0.047	0.049	0.051	0.074
Ammonia, Ionized (as N)	0.019	CCME	0.00042	0.00084	0.00063	0.00064	0.00048	0.00046	0.00031	0.00031	0.00044	0.00044	0.00045	0.00044	0.00041	0.00042	0.00044	0.00064
Nitrite (as N)	0.06	CCME	0.011	0.015	0.012	0.012	0.013	0.011	0.0061	0.0062	0.013	0.011	0.0078	0.0075	0.013	0.011	0.011	0.013
Nitrate (as N)	3	CCME	0.059	0.19	0.076	0.18	0.19	0.17	0.029	0.024	0.030	0.030	0.049	0.054	0.063	0.064	0.058	0.19
Cyanide, WAD	0.005	PWQO ⁽³⁾	0.0031	0.0042	0.0038	0.0038	0.0038	0.0034	0.0019	0.0020	0.0025	0.0039	0.0037	0.0038	0.0044	0.0038	0.0038	0.0044

- Notes:
 All units mg/L.
 Grey highlighted values are greater than identified WQG PAL.
 WQG PAL: Water Quality Guidelines for the Projection of Aquatic Life.
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 SEQG: Saskatchewan Environmental Quality Guidelines.
- Where applicable, receiving environment guidelines are here calculated using 25th percentile hardness and pH of baseline monitoring station to be conservative.
 - Guideline corresponds to Cr(III).
 - The PWQO is for free cyanide.



Table 7.7-17: Chukuni River (CHK-1) Water Quality Results, Operations

Parameter	WQG PAL ⁽¹⁾	Source	Model Baseline Water Quality		Model Results, Median Monthly Water Quality During Operations												Predicted Overall Range	
			Median	95th	January	February	March	April	May	June	July	August	September	October	November	December	Median	95th
Sulphate	218	BC WQG	5.7	6.1	6.7	6.9	6.9	8.6	7.0	6.7	5.8	7.8	7.7	7.4	6.6	6.6	6.9	8.4
Chloride	120	CCME	2.7	3.2	2.8	3.3	3.3	3.5	2.8	2.7	2.9	2.7	2.7	2.7	2.8	2.8	2.8	3.5
Aluminum	0.98	FEQG	0.12	0.22	0.10	0.058	0.058	0.06	0.16	0.16	0.19	0.17	0.14	0.25	0.10	0.10	0.12	0.25
Antimony	0.02	iPWQO	0.00038	0.00045	0.00043	0.00048	0.00048	0.00052	0.00032	0.00031	0.00041	0.00041	0.00042	0.00042	0.00042	0.00042	0.00043	0.00051
Arsenic	0.005	iPWQO	0.0081	0.011	0.0081	0.0085	0.0085	0.0084	0.0055	0.0055	0.0070	0.0076	0.012	0.0094	0.0081	0.0081	0.0081	0.012
Beryllium	0.011	PWQO	0.000010	0.000020	0.000011	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.0000097	0.000032	0.000011	0.000011	0.000010	0.000032
Boron	1.5	CCME	0.0050	0.0080	0.0084	0.0054	0.0055	0.0062	0.0058	0.0057	0.0058	0.0061	0.0065	0.0067	0.0083	0.0083	0.0061	0.0084
Cadmium	0.000067	CCME	0.0000068	0.0000084	0.0000091	0.0000100	0.0000101	0.000014	0.0000079	0.0000070	0.0000087	0.0000117	0.0000105	0.000017	0.0000089	0.0000087	0.0000098	0.000018
Calcium	-	-	11	12	11	12	12	12	10	10	11	9.0	11	12	11	11	11	12
Chromium	0.0089	iPWQO ⁽²⁾	0.00049	0.00076	0.00043	0.00050	0.00050	0.00050	0.00052	0.00052	0.00048	0.00029	0.00037	0.00105	0.00043	0.00043	0.00050	0.0011
Cobalt	0.0009	iPWQO	0.00010	0.00018	0.00010	0.000093	0.000094	0.00013	0.00017	0.00017	0.00015	0.00011	0.00014	0.00024	0.00010	0.00011	0.00012	0.00023
Copper	0.005	iPWQO	0.0016	0.0017	0.0016	0.0017	0.0017	0.0017	0.0015	0.0015	0.0015	0.0013	0.0013	0.0017	0.0016	0.0016	0.0016	0.0017
Iron	0.8	FEQG	0.16	0.27	0.15	0.15	0.15	0.15	0.23	0.23	0.22	0.20	0.16	0.31	0.15	0.15	0.16	0.31
Lead	0.012	FEQG	0.000093	0.00018	0.00009	0.000047	0.000047	0.000050	0.00012	0.00012	0.00010	0.000099	0.00021	0.00015	0.000092	0.00009	0.000096	0.00021
Magnesium	-	-	2.8	2.9	2.8	2.9	2.9	2.9	2.6	2.6	2.7	2.2	2.6	2.9	2.8	2.8	2.8	2.9
Manganese	-	-	0.0095	0.012	0.0078	0.0086	0.0086	0.0087	0.010	0.010	0.012	0.012	0.012	0.012	0.0078	0.008	0.010	0.012
Mercury	0.000026	CCME	0.00000081	0.0000013	0.00000088	0.00000072	0.00000074	0.00000087	0.0000015	0.0000015	0.00000092	0.00000098	0.0000010	0.0000010	0.00000088	0.00000087	0.00000092	0.0000015
Molybdenum	31	SEQG	0.00021	0.00029	0.00023	0.00027	0.00028	0.00037	0.00026	0.00025	0.00027	0.00025	0.00030	0.00041	0.00024	0.00023	0.00027	0.00041
Nickel	0.025	CCME	0.0014	0.0016	0.0014	0.0016	0.0016	0.0016	0.0014	0.0014	0.0013	0.00095	0.0012	0.0017	0.0014	0.0014	0.0014	0.0017
Phosphorus	0.03	iPWQO	0.026	0.049	0.023	0.028	0.028	0.028	0.021	0.021	0.034	0.020	0.042	0.057	0.023	0.023	0.026	0.057
Potassium	-	-	1.1	1.1	1.1	1.2	1.2	1.2	1.0	1.0	1.0	0.91	1.1	1.1	1.1	1.1	1.1	1.2
Selenium	0.002	BC WQG	0.00010	0.00012	0.00013	0.00011	0.00011	0.00014	0.00013	0.00012	0.00014	0.00012	0.00014	0.00013	0.00013	0.00013	0.00013	0.0001
Silver	0.00025	CCME	0.000015	0.000022	0.000015	0.000019	0.000019	0.000020	0.0000062	0.0000060	0.0000061	0.0000065	0.000013	0.000028	0.000015	0.000015	0.000015	0.000028
Thallium	0.008	CCME	0.0000050	0.0000059	0.0000056	0.0000040	0.0000041	0.0000129	0.0000106	0.0000100	0.0000063	0.0000065	0.0000064	0.0000093	0.0000052	0.0000061	0.0000073	0.0000132
Tungsten	0.03	iPWQO	0.000050	0.000050	0.000073	0.000078	0.000080	0.000126	0.000104	0.000096	0.000100	0.000119	0.000118	0.000115	0.000070	0.000070	0.000096	0.00012
Uranium	0.015	CCME	0.00012	0.00013	0.00013	0.00012	0.00012	0.00014	0.00010	0.00010	0.00011	0.00013	0.00012	0.00014	0.00013	0.00013	0.00013	0.00014
Vanadium	0.12	FEQG	0.00058	0.00087	0.00056	0.00041	0.00041	0.00042	0.00063	0.00063	0.00078	0.00061	0.00074	0.00098	0.00056	0.00056	0.00059	0.0010
Zinc	0.03	CCME	0.0015	0.0020	0.0015	0.0020	0.0020	0.0020	0.0015	0.0015	0.0015	0.0015	0.0014	0.0020	0.0015	0.002	0.0015	0.0021
Zirconium	0.004	iPWQO	0.00061	0.00078	0.00070	0.00078	0.00078	0.00078	0.00023	0.00023	0.00044	0.00044	0.00040	0.00051	0.00070	0.00070	0.00061	0.00078
Ammonia (as N)	1.8	CCME	0.034	0.046	0.057	0.071	0.078	0.14	0.076	0.068	0.068	0.088	0.11	0.099	0.058	0.055	0.073	0.13
Ammonia, Ionized (as N)	0.019	CCME	0.00029	0.00040	0.00049	0.00061	0.00067	0.00117	0.00065	0.00058	0.00058	0.00076	0.00094	0.00085	0.00049	0.00048	0.00063	0.00114
Nitrite (as N)	0.06	CCME	0.0068	0.0085	0.0086	0.0094	0.0098	0.012	0.0027	0.0024	0.0022	0.0029	0.0078	0.0082	0.0086	0.0085	0.0083	0.012
Nitrate (as N)	3	CCME	0.034	0.13	0.073	0.18	0.19	0.28	0.110	0.096	0.091	0.12	0.13	0.16	0.074	0.070	0.11	0.28
Cyanide, WAD	0.005	PWQO ⁽³⁾	0.0024	0.0027	0.0028	0.0028	0.0028	0.0030	0.0007	0.0007	0.0018	0.0018	0.0021	0.0021	0.0028	0.0028	0.0025	0.0030

- Notes:
 All units mg/L.
 Grey highlighted values are greater than identified WQG PAL.
 WQG PAL: Water Quality Guidelines for the Projection of Aquatic Life.
 PWQO: Provincial Water Quality Objectives; iPWQO: interim PWQO.
 CWQG: Corresponds to the most up-to date CCME Federal Environmental Quality Guideline for the Protection of Aquatic Life.
 FEQG: Federal Environmental Quality Guidelines.
 BC WQG: British Columbia Water Quality Guidelines.
 SEQG: Saskatchewan Environmental Quality Guidelines.
- Where applicable, receiving environment guidelines are here calculated using 25th percentile hardness and pH of baseline monitoring station to be conservative.
 - Guideline corresponds to Cr(III).
 - The PWQO is for free cyanide.



Table 7.7-18: Chukuni River (CHK-1) Water Quality Model Results, Final Closure Period

Parameter	WQG PAL ⁽¹⁾	Source	Model Baseline Water Quality		Model Results, Median Monthly Water Quality, Final Closure Period												Predicted Overall Range		
			Median	95th	January	February	March	April	May	June	July	August	September	October	November	December	Median	95th	
Sulphate	218	BC WQG	5.7	6.1	6.0	6.1	6.1	6.1	6.1	5.1	5.1	4.0	5.3	5.2	5.1	6.0	6.0	5.7	6.1
Chloride	120	CCME	2.7	3.2	2.7	3.2	3.2	3.3	2.6	2.6	2.7	2.5	2.5	2.5	2.7	2.7	2.7	2.7	3.3
Aluminum	0.98	FEQG	0.12	0.22	0.10	0.058	0.058	0.059	0.16	0.16	0.19	0.17	0.14	0.25	0.10	0.10	0.12	0.25	
Antimony	0.02	iPWQO	0.00038	0.00045	0.00040	0.00045	0.00045	0.00045	0.00027	0.00027	0.00036	0.00034	0.00035	0.00036	0.00040	0.00040	0.00038	0.00045	
Arsenic	0.005	iPWQO	0.0081	0.011	0.0081	0.0085	0.0085	0.0085	0.0055	0.0055	0.0070	0.0077	0.012	0.0095	0.0081	0.0081	0.0081	0.012	
Beryllium	0.011	PWQO	0.000010	0.000020	0.000011	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.0000094	0.000032	0.000011	0.000011	0.000010	0.000032	
Boron	1.5	CCME	0.0050	0.0080	0.0080	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0053	0.0057	0.0080	0.0080	0.0050	0.0080	
Cadmium	0.000067	CCME	0.0000068	0.000008	0.0000068	0.0000071	0.0000071	0.0000071	0.0000025	0.0000025	0.0000036	0.0000046	0.0000031	0.000010	0.0000068	0.0000068	0.0000068	0.00001	
Calcium	-	-	11	12	11	12	12	12	10	10	10	8.4	11	11	11	11	11	12	
Chromium	0.0089	iPWQO ⁽²⁾	0.00049	0.00076	0.00043	0.00050	0.00050	0.00050	0.00052	0.00052	0.00047	0.00029	0.00037	0.0011	0.00043	0.00043	0.00049	0.0011	
Cobalt	0.0009	iPWQO	0.00010	0.00018	0.00010	0.000090	0.000090	0.000091	0.00014	0.00014	0.00014	0.000091	0.00011	0.00022	0.00010	0.00010	0.00010	0.00022	
Copper	0.005	iPWQO	0.0016	0.0017	0.0016	0.0016	0.0016	0.0016	0.0014	0.0014	0.0015	0.0013	0.0013	0.0017	0.0016	0.0016	0.0016	0.0017	
Iron	0.8	FEQG	0.16	0.27	0.15	0.15	0.15	0.15	0.23	0.23	0.22	0.20	0.16	0.31	0.15	0.15	0.16	0.31	
Lead	0.012	FEQG	0.000093	0.00018	0.000091	0.000045	0.000045	0.000045	0.00012	0.00012	0.000098	0.000095	0.00021	0.00015	0.000091	0.000091	0.000093	0.00021	
Magnesium	-	-	2.8	2.9	2.8	2.9	2.9	2.9	2.6	2.6	2.7	2.2	2.5	2.9	2.8	2.8	2.8	2.9	
Manganese	-	-	0.0095	0.012	0.0078	0.0086	0.0086	0.0087	0.010	0.010	0.012	0.012	0.012	0.012	0.0079	0.0078	0.0095	0.012	
Mercury	0.000026	CCME	0.00000081	0.0000013	0.00000082	0.00000065	0.00000065	0.00000066	0.0000013	0.0000013	0.00000078	0.00000079	0.00000082	0.00000082	0.00000082	0.00000082	0.00000082	0.0000013	
Molybdenum	31	SEQG	0.00021	0.00029	0.00021	0.00025	0.00025	0.00025	0.00018	0.00018	0.00022	0.00017	0.00022	0.00033	0.00021	0.00021	0.00021	0.00033	
Nickel	0.025	CCME	0.0014	0.0016	0.0014	0.0016	0.0016	0.0016	0.0014	0.0014	0.0012	0.00094	0.0012	0.0017	0.0014	0.0014	0.0014	0.0017	
Phosphorus	0.03	iPWQO	0.026	0.049	0.023	0.028	0.028	0.028	0.021	0.021	0.034	0.021	0.042	0.057	0.023	0.023	0.026	0.057	
Potassium	-	-	1	1.1	1.1	1.1	1.1	1.1	0.99	0.99	0.98	0.84	0.99	1.1	1.1	1.1	1.1	1.1	
Selenium	0.002	BC WQG	0.00010	0.00012	0.00012	0.00010	0.00010	0.00010	0.00010	0.00010	0.00012	0.000090	0.00011	0.0001	0.00012	0.00012	0.00010	0.0001	
Silver	0.00025	CCME	0.000015	0.000022	0.000015	0.000018	0.000018	0.000018	0.0000050	0.0000050	0.0000050	0.0000050	0.000012	0.000027	0.000015	0.000015	0.000015	0.000027	
Thallium	0.008	CCME	0.0000050	0.0000059	0.0000050	0.0000038	0.0000038	0.0000038	0.0000050	0.0000050	0.0000050	0.0000050	0.0000042	0.0000070	0.0000050	0.0000050	0.0000050	0.0000070	
Tungsten	0.03	iPWQO	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000047	0.000047	0.000050	0.000050	0.000050	0.000050	
Uranium	0.015	CCME	0.00012	0.00013	0.00013	0.00012	0.00012	0.00012	0.000093	0.000092	0.00010	0.00012	0.00011	0.00013	0.00013	0.00013	0.00012	0.00013	
Vanadium	0.12	FEQG	0.00058	0.00087	0.00056	0.00041	0.00041	0.00041	0.00062	0.00062	0.00078	0.00060	0.00073	0.00098	0.00056	0.00056	0.00058	0.00098	
Zinc	0.03	CCME	0.0015	0.0020	0.0015	0.0020	0.0020	0.0020	0.0015	0.0015	0.0015	0.0015	0.0013	0.0020	0.0015	0.0015	0.0015	0.0020	
Zirconium	0.004	iPWQO	0.00061	0.00078	0.00070	0.00079	0.00078	0.00078	0.00023	0.00023	0.00044	0.00044	0.00040	0.00052	0.00070	0.00070	0.00061	0.00079	
Ammonia (as N)	1.8	CCME	0.034	0.046	0.034	0.046	0.046	0.046	0.014	0.014	0.021	0.022	0.039	0.030	0.034	0.034	0.034	0.046	
Ammonia, Ionized (as N)	0.019	CCME	0.00029	0.00040	0.00029	0.00040	0.00040	0.00039	0.00012	0.00012	0.00018	0.00019	0.00034	0.00026	0.00029	0.00029	0.00029	0.00040	
Nitrite (as N)	0.06	CCME	0.0068	0.0085	0.0077	0.0085	0.0085	0.0085	0.00051	0.00050	0.00050	0.00050	0.0053	0.0058	0.0077	0.0077	0.0068	0.0085	
Nitrate (as N)	3	CCME	0.034	0.13	0.034	0.13	0.13	0.13	0.0073	0.0073	0.012	0.013	0.015	0.042	0.034	0.034	0.034	0.13	
Cyanide, WAD	0.005	PWQO ⁽³⁾	0.0024	0.0027	0.0027	0.0027	0.0027	0.0027	0.00050	0.00050	0.0017	0.0017	0.0020	0.0020	0.0027	0.0027	0.0024	0.0027	

- Notes:
 All units mg/L.
 Grey highlighted values are greater than identified WQG PAL.
 WQG PAL: Water Quality Guidelines for the Projection of Aquatic Life.
 PWQO: Provincial Water Quality Objectives; iPWQO: interim PWQO.
 CWQG: Corresponds to the most up-to date CCME Federal Environmental Quality Guideline for the Protection of Aquatic Life.
 FEQG: Federal Environmental Quality Guidelines.
 BC WQG: British Columbia Water Quality Guidelines.
 SEQG: Saskatchewan Environmental Quality Guidelines.
- Where applicable, receiving environment guidelines are here calculated using 25th percentile hardness and pH of baseline monitoring station to be conservative.
 - Guideline corresponds to Cr(III).
 - The PWQO is for free cyanide.



Table 7.7-19: Chukuni River (CHK-2) Water Quality Results, Operations

Parameter	WQG PAL ⁽¹⁾	Source	Model Baseline Water Quality		Model Results, Median Monthly Water Quality During Operations												Predicted Overall Range	
			Median	95th	January	February	March	April	May	June	July	August	September	October	November	December	Median	95th
Sulphate	218	BC WQG	5.3	5.8	6.4	6.6	6.6	8.1	6.6	6.3	5.5	7.4	7.4	7.1	6.3	6.3	6.6	8.0
Chloride	120	CCME	2.6	3.1	2.7	3.1	3.2	3.3	2.6	2.5	2.7	2.6	2.6	2.6	2.7	2.7	2.7	3.3
Aluminum	0.86	FEQG	0.13	0.22	0.11	0.065	0.065	0.066	0.16	0.16	0.19	0.17	0.14	0.25	0.11	0.11	0.12	0.25
Antimony	0.02	iPWQO	0.00038	0.00044	0.00043	0.00047	0.00047	0.00051	0.00031	0.00031	0.00041	0.00041	0.00041	0.00042	0.00042	0.00042	0.00042	0.00050
Arsenic	0.005	iPWQO	0.0078	0.010	0.0077	0.0081	0.0081	0.0081	0.0053	0.0052	0.0067	0.0073	0.011	0.0090	0.0078	0.0078	0.0078	0.011
Beryllium	0.011	PWQO	0.000010	0.000020	0.000012	0.000010	0.000010	0.000011	0.000010	0.000010	0.000011	0.000011	0.0000098	0.000031	0.000012	0.000012	0.000011	0.000031
Boron	1.5	CCME	0.0051	0.008	0.0082	0.0054	0.0055	0.0062	0.0058	0.0057	0.0058	0.0061	0.0064	0.0067	0.0082	0.0082	0.0061	0.0082
Cadmium	0.000069	CCME	0.0000072	0.0000086	0.00001	0.00001	0.00001	0.000014	0.0000078	0.0000069	0.0000087	0.0000115	0.0000102	0.000016	0.0000094	0.0000093	0.0000100	0.00002
Calcium	-	-	11	12	12	12	12	12	10	10	11	9.1	11	12	11	11	11	12
Chromium	0.0089	iPWQO ⁽²⁾	0.00051	0.00076	0.00044	0.00051	0.00051	0.00052	0.00053	0.00053	0.00050	0.00032	0.00038	0.0010	0.00044	0.00043	0.00051	0.0010
Cobalt	0.0009	iPWQO	0.00010	0.00018	0.00011	0.00010	0.00010	0.00014	0.00017	0.00016	0.00015	0.00011	0.00014	0.00023	0.00011	0.00011	0.00012	0.00022
Copper	0.005	iPWQO	0.0016	0.0017	0.0016	0.0016	0.0016	0.0016	0.0014	0.0014	0.0015	0.0013	0.0013	0.0017	0.0016	0.0016	0.0016	0.0017
Iron	0.8	FEQG	0.19	0.29	0.18	0.18	0.18	0.18	0.25	0.25	0.25	0.23	0.18	0.32	0.17	0.17	0.18	0.32
Lead	0.012	FEQG	0.00010	0.00018	0.00010	0.000061	0.000061	0.000062	0.00013	0.00013	0.00011	0.00011	0.00021	0.00015	0.000100	0.00010	0.00011	0.00021
Magnesium	-	-	2.9	3.0	2.9	3.0	3.0	3.0	2.7	2.7	2.8	2.3	2.6	2.9	2.9	2.9	2.9	3.0
Manganese	-	-	0.012	0.015	0.0090	0.011	0.011	0.011	0.011	0.011	0.014	0.014	0.013	0.013	0.0086	0.009	0.011	0.014
Mercury	0.000026	CCME	0.00000088	0.0000014	0.00000093	0.00000078	0.00000079	0.00000091	0.0000015	0.0000015	0.0000010	0.0000010	0.0000010	0.0000010	0.00000092	0.00000090	0.0000010	0.0000015
Molybdenum	31	SEQG	0.00022	0.00029	0.00023	0.00028	0.00028	0.00036	0.00025	0.00024	0.00027	0.00025	0.00030	0.00040	0.00024	0.00023	0.00026	0.00040
Nickel	0.025	CCME	0.0014	0.0016	0.0014	0.0015	0.0015	0.0015	0.0013	0.0013	0.0012	0.00094	0.0012	0.0016	0.0014	0.0014	0.0014	0.0016
Phosphorus	0.03	iPWQO	0.026	0.048	0.024	0.028	0.028	0.028	0.022	0.022	0.033	0.021	0.041	0.056	0.024	0.024	0.026	0.056
Potassium	-	-	1.1	1.2	1.1	1.2	1.2	1.2	1.0	1.0	1.0	0.9	1.1	1.1	1.1	1.1	1.1	1.2
Selenium	0.002	BC WQG	0.00010	0.00013	0.00014	0.00012	0.00011	0.00014	0.00013	0.00012	0.00014	0.00012	0.00014	0.0001	0.00013	0.00013	0.00013	0.0001
Silver	0.00025	CCME	0.000015	0.000022	0.000016	0.000019	0.000019	0.000020	0.0000066	0.0000065	0.0000073	0.0000074	0.000013	0.000027	0.000016	0.000016	0.000016	0.000027
Thallium	0.008	CCME	0.0000050	0.0000059	0.0000055	0.0000041	0.0000041	0.0000123	0.0000102	0.0000096	0.0000062	0.0000063	0.0000064	0.0000091	0.0000052	0.0000060	0.0000072	0.0000127
Tungsten	0.03	iPWQO	0.000049	0.000050	0.000070	0.000075	0.000077	0.000120	0.000100	0.000091	0.000094	0.000113	0.000114	0.000111	0.000067	0.000067	0.000092	0.00012
Uranium	0.015	CCME	0.00013	0.00014	0.00014	0.00013	0.00013	0.00014	0.00011	0.00011	0.00011	0.00013	0.00012	0.00015	0.00014	0.00014	0.00013	0.00015
Vanadium	0.12	FEQG	0.00062	0.00089	0.00058	0.00044	0.00044	0.00044	0.00065	0.00065	0.00080	0.00063	0.00075	0.00098	0.00058	0.00058	0.00061	0.0010
Zinc	0.03	CCME	0.0015	0.0020	0.0015	0.0020	0.0020	0.0021	0.0016	0.0015	0.0016	0.0016	0.0014	0.0020	0.0015	0.0015	0.0016	0.0021
Zirconium	0.004	iPWQO	0.00061	0.00079	0.00071	0.00079	0.00079	0.00078	0.00026	0.00026	0.00047	0.00046	0.00041	0.00052	0.00071	0.00071	0.00061	0.00079
Ammonia (as N)	1.8	CCME	0.035	0.048	0.060	0.073	0.078	0.13	0.074	0.066	0.067	0.086	0.11	0.097	0.058	0.056	0.073	0.13
Ammonia, Ionized (as N)	0.019	CCME	0.00030	0.00042	0.00051	0.00063	0.00068	0.00113	0.00064	0.00057	0.00058	0.00074	0.00092	0.00083	0.00050	0.00048	0.00062	0.00111
Nitrite (as N)	0.06	CCME	0.0069	0.0088	0.0090	0.0098	0.010	0.012	0.0030	0.0027	0.0031	0.0035	0.0079	0.0082	0.0089	0.0088	0.0084	0.012
Nitrate (as N)	3	CCME	0.036	0.14	0.073	0.18	0.19	0.28	0.104	0.091	0.086	0.12	0.13	0.15	0.074	0.070	0.11	0.27
Cyanide, WAD	0.005	PWQO ⁽³⁾	0.0024	0.0028	0.0029	0.0028	0.0028	0.0031	0.0008	0.0008	0.0018	0.0020	0.0022	0.0022	0.0029	0.0029	0.0026	0.0031

Notes:
 All units mg/L.
 Grey highlighted values are greater than identified WQG PAL.
 WQG PAL: Water Quality Guidelines for the Projection of Aquatic Life.
 PWQO: Provincial Water Quality Objectives; iPWQO: interim PWQO.
 CWQG: Corresponds to the most up-to date CCME Federal Environmental Quality Guideline for the Protection of Aquatic Life.
 FEQG: Federal Environmental Quality Guidelines.
 BC WQG: British Columbia Water Quality Guidelines.
 SEQG: Saskatchewan Environmental Quality Guidelines.
 1. Where applicable, receiving environment guidelines are here calculated using 25th percentile hardness and pH of baseline monitoring station to be conservative.
 2. Guideline corresponds to Cr(III).
 3. The PWQO is for free cyanide.



Table 7.7-20: Chukuni River (CHK-2) Water Quality Results, Final Closure Period

Parameter	WQG PAL ⁽¹⁾	Source	Model Baseline Water Quality		Model Results, Median Monthly Water Quality, Final Closure Period												Predicted Overall Range	
			Median	95th	January	February	March	April	May	June	July	August	September	October	November	December	Median	95th
Sulphate	218	BC WQG	5.3	5.8	5.7	5.8	5.8	5.8	4.9	4.8	3.8	5.1	5.0	4.9	5.7	5.7	5.4	5.8
Chloride	120	CCME	2.6	3.1	2.6	3.1	3.1	3.1	2.5	2.4	2.6	2.4	2.4	2.4	2.7	2.6	2.6	3.1
Aluminum	0.86	FEQG	0.13	0.22	0.11	0.063	0.063	0.064	0.16	0.16	0.19	0.17	0.14	0.24	0.11	0.11	0.12	0.24
Antimony	0.02	iPWQO	0.00038	0.00044	0.00040	0.00045	0.00045	0.00045	0.00027	0.00027	0.00036	0.00034	0.00034	0.00036	0.00040	0.00040	0.00038	0.00045
Arsenic	0.005	iPWQO	0.0078	0.010	0.0077	0.0081	0.0081	0.0081	0.0053	0.0052	0.0067	0.0073	0.011	0.0090	0.0078	0.0078	0.0078	0.011
Beryllium	0.011	PWQO	0.000010	0.000020	0.000012	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.0000095	0.000031	0.000012	0.000012	0.000010	0.000031
Boron	1.5	CCME	0.0051	0.0079	0.0079	0.0051	0.0051	0.0051	0.0051	0.0051	0.0051	0.0051	0.0054	0.0057	0.0079	0.0079	0.0051	0.0079
Cadmium	0.000069	CCME	0.0000072	0.000009	0.0000079	0.0000075	0.0000074	0.0000083	0.0000035	0.0000034	0.0000043	0.0000054	0.0000039	0.000010	0.0000075	0.0000076	0.0000074	0.00001
Calcium	-	-	11	12	11	12	12	12	10	10	10	9	11	11	11	11	11	12
Chromium	0.0089	iPWQO ⁽²⁾	0.00051	0.00076	0.00044	0.00051	0.00051	0.00051	0.00053	0.00053	0.00050	0.00032	0.00038	0.0010	0.00043	0.00043	0.00050	0.0010
Cobalt	0.0009	iPWQO	0.00010	0.00018	0.00011	0.00010	0.00010	0.00010	0.00014	0.00014	0.00014	0.00010	0.00012	0.00022	0.00010	0.00010	0.00010	0.00022
Copper	0.005	iPWQO	0.0016	0.0017	0.0016	0.0016	0.0016	0.0016	0.0014	0.0014	0.0014	0.0013	0.0013	0.0017	0.0016	0.0016	0.0016	0.0017
Iron	0.8	FEQG	0.19	0.29	0.17	0.17	0.18	0.18	0.25	0.25	0.24	0.23	0.18	0.32	0.17	0.17	0.18	0.32
Lead	0.012	FEQG	0.00010	0.00018	0.00010	0.00005	0.000053	0.000053	0.00012	0.00012	0.00011	0.00010	0.00021	0.00015	0.000095	0.00009	0.00010	0.0002
Magnesium	-	-	2.9	3.0	2.9	3.0	3.0	2.9	2.7	2.7	2.7	2.3	2.6	2.9	2.8	2.8	2.8	3.0
Manganese	-	-	0.012	0.015	0.0091	0.011	0.011	0.012	0.011	0.011	0.014	0.015	0.013	0.013	0.0087	0.0087	0.011	0.015
Mercury	0.000026	CCME	0.00000088	0.0000014	0.00000089	0.00000074	0.00000074	0.00000081	0.0000014	0.0000014	0.00000089	0.00000089	0.00000091	0.00000091	0.00000088	0.00000087	0.00000089	0.0000014
Molybdenum	31	SEQG	0.00022	0.00029	0.00022	0.00025	0.00025	0.00027	0.00019	0.00019	0.00023	0.00019	0.00023	0.00034	0.00021	0.00021	0.00022	0.00034
Nickel	0.025	CCME	0.0014	0.0016	0.0014	0.0015	0.0015	0.0015	0.0013	0.0013	0.0012	0.00093	0.0012	0.0016	0.0014	0.0014	0.0014	0.0016
Phosphorus	0.03	iPWQO	0.026	0.048	0.024	0.028	0.028	0.028	0.022	0.022	0.033	0.021	0.042	0.056	0.024	0.024	0.026	0.056
Potassium	-	-	1.1	1.2	1.1	1.2	1.2	1.2	1.0	1.0	1.0	0.87	1.0	1.1	1.1	1.1	1.1	1.2
Selenium	0.002	BC WQG	0.00010	0.00013	0.00013	0.00011	0.00010	0.00011	0.00010	0.00010	0.00012	0.000094	0.00011	0.0001	0.00012	0.00012	0.00011	0.0001
Silver	0.00025	CCME	0.000015	0.000022	0.000015	0.000019	0.000019	0.000019	0.0000058	0.0000058	0.0000065	0.0000063	0.000012	0.000026	0.000015	0.000015	0.000015	0.000026
Thallium	0.008	CCME	0.0000050	0.0000059	0.0000050	0.0000038	0.0000038	0.0000039	0.0000050	0.0000050	0.0000050	0.0000050	0.0000043	0.0000070	0.0000050	0.0000050	0.0000050	0.0000070
Tungsten	0.03	iPWQO	0.000049	0.000050	0.000049	0.000050	0.000050	0.000053	0.000052	0.000051	0.000049	0.000051	0.000049	0.000049	0.000049	0.000050	0.000050	0.000053
Uranium	0.015	CCME	0.00013	0.00014	0.00014	0.00013	0.00013	0.00013	0.00011	0.00010	0.00011	0.00013	0.00012	0.00014	0.00014	0.00014	0.00013	0.00014
Vanadium	0.12	FEQG	0.00062	0.00089	0.00058	0.00044	0.00044	0.00045	0.00065	0.00065	0.00079	0.00063	0.00075	0.00098	0.00058	0.00058	0.00061	0.0010
Zinc	0.03	CCME	0.0015	0.0020	0.0015	0.0020	0.0020	0.0021	0.0016	0.0015	0.0016	0.0016	0.0014	0.0020	0.0015	0.0015	0.0016	0.0021
Zirconium	0.004	iPWQO	0.00061	0.00079	0.00071	0.00079	0.00079	0.00080	0.00027	0.00027	0.00048	0.00047	0.00042	0.00053	0.00071	0.00071	0.00062	0.00080
Ammonia (as N)	1.8	CCME	0.035	0.048	0.037	0.048	0.047	0.046	0.016	0.016	0.023	0.024	0.040	0.032	0.035	0.035	0.035	0.048
Ammonia, Ionized (as N)	0.019	CCME	0.00030	0.00042	0.00031	0.00041	0.00040	0.00040	0.00014	0.00014	0.00020	0.00021	0.00034	0.00027	0.00030	0.00030	0.00030	0.00041
Nitrite (as N)	0.06	CCME	0.0069	0.0088	0.0081	0.0088	0.0088	0.0087	0.00094	0.00096	0.0015	0.0013	0.0055	0.0059	0.0080	0.0080	0.0069	0.0088
Nitrate (as N)	3	CCME	0.036	0.14	0.037	0.14	0.14	0.14	0.009	0.009	0.013	0.014	0.017	0.042	0.036	0.036	0.036	0.14
Cyanide, WAD	0.005	PWQO ⁽³⁾	0.0024	0.0028	0.0028	0.0028	0.0028	0.0028	0.00061	0.00062	0.0018	0.0019	0.0021	0.0021	0.0028	0.0028	0.0025	0.0028

Notes:
 All units mg/L.
 Grey highlighted values are greater than identified WQG PAL.
 WQG PAL: Water Quality Guidelines for the Projection of Aquatic Life.
 PWQO: Provincial Water Quality Objectives; iPWQO: interim PWQO.
 CWQG: Corresponds to the most up-to date CCME Federal Environmental Quality Guideline for the Protection of Aquatic Life.
 FEQG: Federal Environmental Quality Guidelines.
 BC WQG: British Columbia Water Quality Guidelines.
 SEQG: Saskatchewan Environmental Quality Guidelines.
 1. Where applicable, receiving environment guidelines are here calculated using 25th percentile hardness and pH of baseline monitoring station to be conservative.
 2. Guideline corresponds to Cr(III).
 3. The PWQO is for free cyanide.



Table 7.7-21: Pakwash Lake (PAK-OUT) Water Quality Results, Operations

Parameter	WQG PAL ⁽¹⁾	Source	Model Baseline Water Quality		Model Results, Median Monthly Water Quality During Operations												Predicted Overall Range	
			Median	95th	January	February	March	April	May	June	July	August	September	October	November	December	Median	95th
Sulphate	218	BC WQG	3.8	4.2	5.1	5.2	5.2	5.2	4.9	4.5	4.4	4.4	4.7	4.9	5.0	5.1	4.9	5.4
Chloride	120	CCME	1.8	1.9	2.0	2.0	2.0	2.1	2.0	1.8	1.7	1.8	1.9	1.9	1.9	2.0	1.9	2.1
Aluminum	1.4	FEQG	0.19	0.20	0.20	0.20	0.20	0.19	0.18	0.17	0.17	0.18	0.19	0.19	0.20	0.20	0.19	0.20
Antimony	0.02	iPWQO	0.00023	0.00026	0.00028	0.00028	0.00029	0.00029	0.00028	0.00024	0.00023	0.00023	0.00025	0.00026	0.00027	0.00027	0.00027	0.00030
Arsenic	0.005	iPWQO	0.0055	0.0060	0.0058	0.0060	0.0060	0.0061	0.0057	0.0049	0.0044	0.0044	0.0047	0.0051	0.0054	0.0057	0.0055	0.0061
Beryllium	0.011	PWQO	0.000012	0.000013	0.000013	0.000013	0.000013	0.000013	0.000012	0.000011	0.000010	0.000010	0.000011	0.000011	0.000012	0.000012	0.000012	0.000013
Boron	1.5	CCME	0.0054	0.0060	0.0062	0.0064	0.0065	0.0065	0.0062	0.0056	0.0053	0.0054	0.0056	0.0057	0.0058	0.0060	0.0059	0.0065
Cadmium	0.000073	CCME	0.0000047	0.0000055	0.0000083	0.0000084	0.0000085	0.0000085	0.0000081	0.0000072	0.0000066	0.0000066	0.0000070	0.0000073	0.0000078	0.0000081	0.0000079	0.000101
Calcium	-	-	12	12	12	12	12	12	12	11	11	11	11	12	12	12	12	12
Chromium	0.0089	iPWQO ⁽²⁾	0.00054	0.00057	0.00058	0.00058	0.00058	0.00058	0.00055	0.00051	0.00051	0.00052	0.00053	0.00053	0.00054	0.00056	0.00055	0.00058
Cobalt	0.0009	iPWQO	0.00013	0.00013	0.00014	0.00014	0.00014	0.00014	0.00013	0.00012	0.00013	0.00013	0.00014	0.00014	0.00014	0.00015	0.00014	0.00015
Copper	0.005	iPWQO	0.0014	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0014	0.0013	0.0014	0.0014	0.0014	0.0014	0.0015	0.0014	0.0015
Iron	0.79	FEQG	0.26	0.27	0.27	0.27	0.26	0.26	0.25	0.23	0.24	0.25	0.26	0.26	0.26	0.27	0.26	0.27
Lead	0.013	FEQG	0.00012	0.00013	0.00013	0.00013	0.00013	0.00013	0.00012	0.00011	0.00011	0.00011	0.00012	0.00012	0.00013	0.00013	0.00013	0.00013
Magnesium	-	-	2.9	3.0	3.0	3.0	3.0	3.0	2.9	2.7	2.7	2.7	2.8	2.9	2.9	2.9	2.9	3.0
Manganese	-	-	0.012	0.013	0.013	0.012	0.012	0.012	0.012	0.011	0.011	0.011	0.012	0.012	0.013	0.013	0.012	0.013
Mercury	0.000026	CCME	0.0000012	0.0000012	0.0000013	0.0000013	0.0000013	0.0000012	0.0000012	0.0000011	0.0000012	0.0000012	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013	0.0000013
Molybdenum	31	SEQG	0.00022	0.00024	0.00027	0.00027	0.00027	0.00027	0.00026	0.00024	0.00023	0.00024	0.00024	0.00025	0.00026	0.00027	0.00026	0.00027
Nickel	0.025	CCME	0.0011	0.0012	0.0011	0.0012	0.0012	0.0012	0.0011	0.0010	0.0010	0.0010	0.0011	0.0011	0.0011	0.0011	0.0011	0.0012
Phosphorus	0.02	iPWQO	0.029	0.031	0.031	0.032	0.032	0.031	0.029	0.026	0.025	0.025	0.026	0.028	0.029	0.031	0.029	0.032
Potassium	-	-	1.1	1.1	1.1	1.1	1.2	1.2	1.1	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.2
Selenium	0.002	BC WQG	0.00010	0.00011	0.00012	0.00012	0.00012	0.00012	0.00011	0.00010	0.00010	0.00011	0.00011	0.00011	0.00012	0.00012	0.00012	0.00012
Silver	0.00025	CCME	0.0000090	0.000011	0.000010	0.000011	0.000011	0.000012	0.000011	0.000010	0.0000085	0.0000079	0.0000077	0.0000079	0.0000088	0.000010	0.000010	0.000012
Thallium	0.008	CCME	0.0000051	0.0000054	0.0000066	0.0000066	0.0000066	0.0000065	0.0000065	0.0000065	0.0000068	0.0000070	0.0000071	0.0000070	0.0000070	0.0000070	0.0000069	0.0000077
Tungsten	0.03	iPWQO	0.000051	0.000053	0.000084	0.000083	0.000082	0.000080	0.000075	0.000070	0.000070	0.000073	0.000077	0.000081	0.000083	0.000084	0.000079	0.00008
Uranium	0.015	CCME	0.00011	0.00012	0.00012	0.00013	0.00013	0.00013	0.00012	0.00011	0.00011	0.00011	0.00011	0.00011	0.00012	0.00012	0.00012	0.00013
Vanadium	0.12	FEQG	0.00078	0.00081	0.00082	0.00082	0.00081	0.00080	0.00075	0.00069	0.00068	0.00072	0.00075	0.00077	0.00079	0.00081	0.00078	0.00082
Zinc	0.03	CCME	0.0016	0.0017	0.0017	0.0017	0.0017	0.0017	0.0016	0.0015	0.0015	0.0015	0.0016	0.0016	0.0016	0.0016	0.0016	0.0017
Zirconium	0.004	iPWQO	0.00039	0.00046	0.00041	0.00043	0.00045	0.00047	0.00046	0.00040	0.00035	0.00034	0.00035	0.00036	0.00037	0.00039	0.00040	0.00047
Ammonia (as N)	1.8	CCME	0.023	0.026	0.057	0.056	0.056	0.055	0.053	0.049	0.047	0.048	0.050	0.053	0.056	0.057	0.053	0.059
Ammonia, Ionized (as N)	0.019	CCME	0.00019	0.00022	0.00049	0.00048	0.00048	0.00048	0.00046	0.00042	0.00040	0.00041	0.00043	0.00046	0.00048	0.00049	0.00046	0.00051
Nitrite (as N)	0.06	CCME	0.0026	0.0038	0.0040	0.0043	0.0046	0.0049	0.0049	0.0041	0.0034	0.0031	0.0029	0.0030	0.0033	0.0037	0.0038	0.0049
Nitrate (as N)	3	CCME	0.024	0.035	0.077	0.076	0.076	0.078	0.081	0.077	0.072	0.071	0.072	0.074	0.077	0.078	0.076	0.084
Cyanide, WAD	0.005	PWQO ⁽³⁾	0.0013	0.0016	0.0015	0.0016	0.0016	0.0017	0.0017	0.0014	0.0012	0.0011	0.0012	0.0012	0.0013	0.0014	0.0014	0.0017

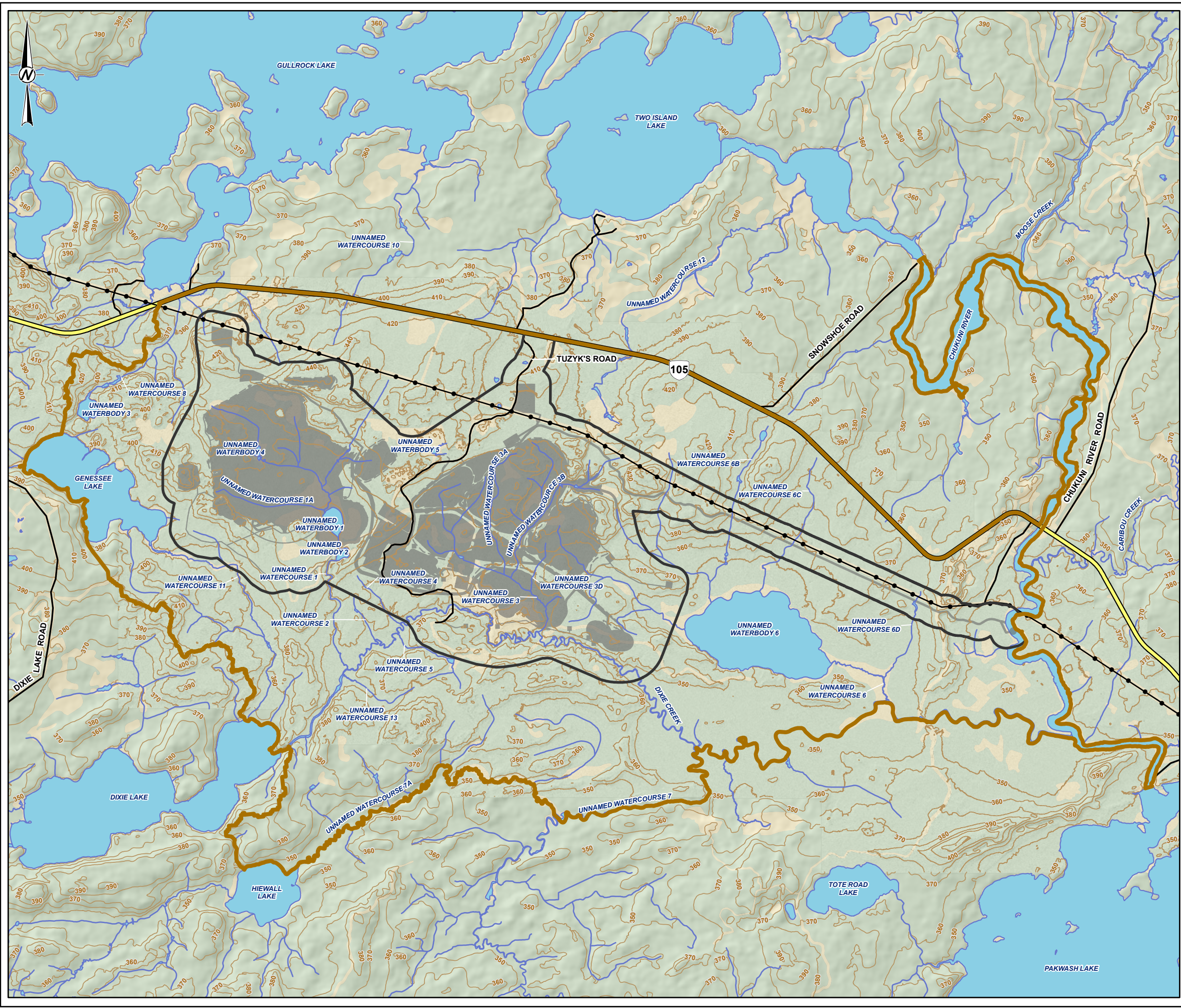
Notes:
 All units mg/L.
 Grey highlighted values are greater than identified WQG PAL.
 WQG PAL: Water Quality Guidelines for the Projection of Aquatic Life.
 PWQO: Provincial Water Quality Objectives; iPWQO: interim PWQO.
 CWQG: Corresponds to the most up-to date CCME Federal Environmental Quality Guideline for the Protection of Aquatic Life.
 FEQG: Federal Environmental Quality Guidelines.
 BC WQG: British Columbia Water Quality Guidelines.
 SEQG: Saskatchewan Environmental Quality Guidelines.
 1. Where applicable, receiving environment guidelines are here calculated using 25th percentile hardness and pH of baseline monitoring station to be conservative.
 2. Guideline corresponds to Cr(III).
 3. The PWQO is for free cyanide.



Table 7.7-22: Pakwash Lake (PAK-OUT) Water Quality Results, Final Closure Period

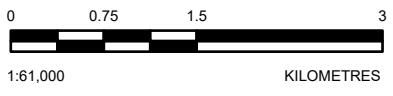
Parameter	WQG PAL ⁽¹⁾	Source	Model Baseline Water Quality		Model Results, Median Monthly Water Quality, Final Closure Period												Predicted Overall Range	
			Median	95th	January	February	March	April	May	June	July	August	September	October	November	December	Median	95th
Sulphate	218	BC WQG	3.8	4.2	4.0	4.1	4.2	4.3	4.1	3.7	3.6	3.6	3.7	3.8	3.9	3.9	3.9	4.3
Chloride	120	CCME	1.8	1.9	1.9	1.9	1.9	2.0	1.9	1.7	1.6	1.7	1.8	1.8	1.8	1.8	1.8	2.0
Aluminum	1.4	FEQG	0.19	0.20	0.20	0.20	0.20	0.19	0.18	0.17	0.17	0.18	0.19	0.19	0.20	0.20	0.19	0.20
Antimony	0.02	iPWQO	0.00023	0.00026	0.00025	0.00026	0.00026	0.00027	0.00026	0.00022	0.00021	0.00021	0.00022	0.00023	0.00024	0.00024	0.00024	0.00027
Arsenic	0.005	iPWQO	0.0055	0.0060	0.0058	0.0060	0.0060	0.0061	0.0057	0.0049	0.0044	0.0044	0.0047	0.0051	0.0054	0.0057	0.0055	0.0061
Beryllium	0.011	PWQO	0.000012	0.000013	0.000013	0.000013	0.000013	0.000013	0.000012	0.000011	0.000010	0.000010	0.000010	0.000011	0.000011	0.00001	0.000012	0.000013
Boron	1.5	CCME	0.0054	0.0060	0.0057	0.0059	0.0060	0.0061	0.0058	0.0052	0.0050	0.0050	0.0052	0.0053	0.0053	0.0055	0.0054	0.0061
Cadmium	0.000073	CCME	0.0000047	0.0000055	0.0000054	0.0000056	0.0000058	0.0000059	0.0000058	0.0000051	0.0000046	0.0000044	0.0000045	0.0000046	0.0000048	0.0000051	0.0000051	0.0000059
Calcium	-	-	12	12	12	12	12	12	12	11	11	11	11	11	11	12	12	12
Chromium	0.0089	iPWQO ⁽²⁾	0.00054	0.00057	0.00057	0.00058	0.00058	0.00058	0.00055	0.00051	0.00051	0.00052	0.00053	0.00053	0.00054	0.00056	0.00055	0.00058
Cobalt	0.0009	iPWQO	0.00013	0.00013	0.00014	0.00014	0.00014	0.00013	0.00013	0.00012	0.00012	0.00013	0.00013	0.00013	0.00013	0.00014	0.00013	0.00014
Copper	0.005	iPWQO	0.0014	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0013	0.0013	0.0013	0.0014	0.0014	0.0014	0.0014	0.0014	0.0015
Iron	0.79	FEQG	0.26	0.27	0.27	0.26	0.26	0.26	0.24	0.23	0.23	0.25	0.26	0.26	0.26	0.27	0.26	0.27
Lead	0.013	FEQG	0.00012	0.00013	0.00013	0.00013	0.00013	0.00012	0.00011	0.00010	0.00010	0.00011	0.00011	0.00012	0.00013	0.00013	0.00012	0.00013
Magnesium	-	-	2.9	3.0	3.0	3.0	3.0	3.0	2.9	2.7	2.7	2.7	2.8	2.8	2.9	2.9	2.9	3.0
Manganese	-	-	0.012	0.013	0.013	0.013	0.012	0.012	0.012	0.011	0.011	0.011	0.012	0.012	0.013	0.013	0.012	0.013
Mercury	0.000026	CCME	0.0000012	0.0000012	0.0000012	0.0000012	0.0000012	0.0000012	0.0000011	0.0000011	0.0000011	0.0000012	0.0000012	0.0000012	0.0000012	0.0000012	0.0000012	0.0000012
Molybdenum	31	SEQG	0.00022	0.00024	0.00023	0.00024	0.00024	0.00024	0.00023	0.00021	0.00020	0.00020	0.00021	0.00022	0.00022	0.00023	0.00023	0.00024
Nickel	0.025	CCME	0.0011	0.0012	0.0011	0.0012	0.0012	0.0012	0.0011	0.0010	0.0010	0.0010	0.0011	0.0011	0.0011	0.0011	0.0011	0.0012
Phosphorus	0.02	iPWQO	0.029	0.031	0.031	0.032	0.032	0.031	0.029	0.026	0.025	0.025	0.026	0.028	0.030	0.031	0.029	0.032
Potassium	-	-	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1
Selenium	0.002	BC WQG	0.00010	0.00011	0.00010	0.00011	0.00011	0.00011	0.00010	0.00009	0.00009	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00011
Silver	0.00025	CCME	0.0000090	0.000011	0.000010	0.000010	0.000011	0.000011	0.000011	0.0000095	0.0000081	0.0000075	0.0000073	0.0000074	0.0000082	0.0000092	0.0000093	0.000011
Thallium	0.008	CCME	0.0000051	0.0000054	0.0000053	0.0000054	0.0000054	0.0000054	0.0000050	0.0000046	0.0000046	0.0000047	0.0000049	0.0000050	0.0000051	0.0000053	0.0000051	0.0000054
Tungsten	0.03	iPWQO	0.000051	0.000053	0.000052	0.000053	0.000053	0.000053	0.000051	0.000047	0.000047	0.000048	0.000050	0.000051	0.000052	0.000052	0.000051	0.000053
Uranium	0.015	CCME	0.00011	0.00012	0.00012	0.00012	0.00012	0.00013	0.00012	0.00011	0.00010	0.00011	0.00011	0.00011	0.00011	0.00012	0.00012	0.00013
Vanadium	0.12	FEQG	0.00078	0.00081	0.00082	0.00082	0.00081	0.00080	0.00075	0.00069	0.00068	0.00072	0.00075	0.00077	0.00079	0.00081	0.00078	0.00082
Zinc	0.03	CCME	0.0016	0.0017	0.0016	0.0017	0.0017	0.0017	0.0016	0.0015	0.0015	0.0015	0.0016	0.0016	0.0016	0.0016	0.0016	0.0017
Zirconium	0.004	iPWQO	0.00039	0.00046	0.00041	0.00043	0.00045	0.00047	0.00047	0.00041	0.00036	0.00035	0.00036	0.00037	0.00038	0.00039	0.00040	0.00047
Ammonia (as N)	1.8	CCME	0.023	0.026	0.024	0.025	0.026	0.027	0.026	0.023	0.020	0.019	0.020	0.021	0.022	0.023	0.023	0.027
Ammonia, Ionized (as N)	0.019	CCME	0.00019	0.00022	0.00021	0.00021	0.00022	0.00023	0.00023	0.00020	0.00017	0.00017	0.00017	0.00018	0.00019	0.00020	0.00020	0.00023
Nitrite (as N)	0.06	CCME	0.0026	0.0038	0.0028	0.0032	0.0035	0.0038	0.0039	0.0032	0.0025	0.0020	0.0018	0.0019	0.0021	0.0024	0.0026	0.0039
Nitrate (as N)	3	CCME	0.024	0.035	0.023	0.024	0.026	0.031	0.037	0.034	0.028	0.024	0.022	0.021	0.021	0.022	0.024	0.037
Cyanide, WAD	0.005	PWQO ⁽³⁾	0.0013	0.0016	0.0014	0.0015	0.0016	0.0017	0.0016	0.0013	0.0011	0.0010	0.0011	0.0012	0.0012	0.0013	0.0013	0.0017

- Notes:
 All units mg/L.
 Grey highlighted values are greater than identified WQG PAL.
 WQG PAL: Water Quality Guidelines for the Projection of Aquatic Life.
 PWQO: Provincial Water Quality Objectives; iPWQO: interim PWQO.
 CWQG: Corresponds to the most up-to date CCME Federal Environmental Quality Guideline for the Protection of Aquatic Life.
 FEQG: Federal Environmental Quality Guidelines.
 BC WQG: British Columbia Water Quality Guidelines.
 SEQG: Saskatchewan Environmental Quality Guidelines.
- Where applicable, receiving environment guidelines are here calculated using 25th percentile hardness and pH of baseline monitoring station to be conservative.
 - Guideline corresponds to Cr(III).
 - The PWQO is for free cyanide.



LEGEND

- GREAT BEAR PROJECT FOOTPRINT
- PROJECT AREA
- LOCAL STUDY AREA FOR WATER QUALITY
- HIGHWAY
- LOCAL ROAD
- EXISTING TRANSMISSION LINE
- CONTOURS (10 M INTERVAL)
- WATERCOURSE
- WATERBODY



- NOTE(S)**
1. ALL LOCATIONS ARE APPROXIMATE
- REFERENCE(S)**
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
 2. CONTOURS ACQUIRED FROM LAND INFORMATION ONTARIO (MNR), 2022 AND DERIVED FROM 2022 LIDAR PROVIDED BY GREAT BEAR RESOURCES
 3. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
 4. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
 5. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT

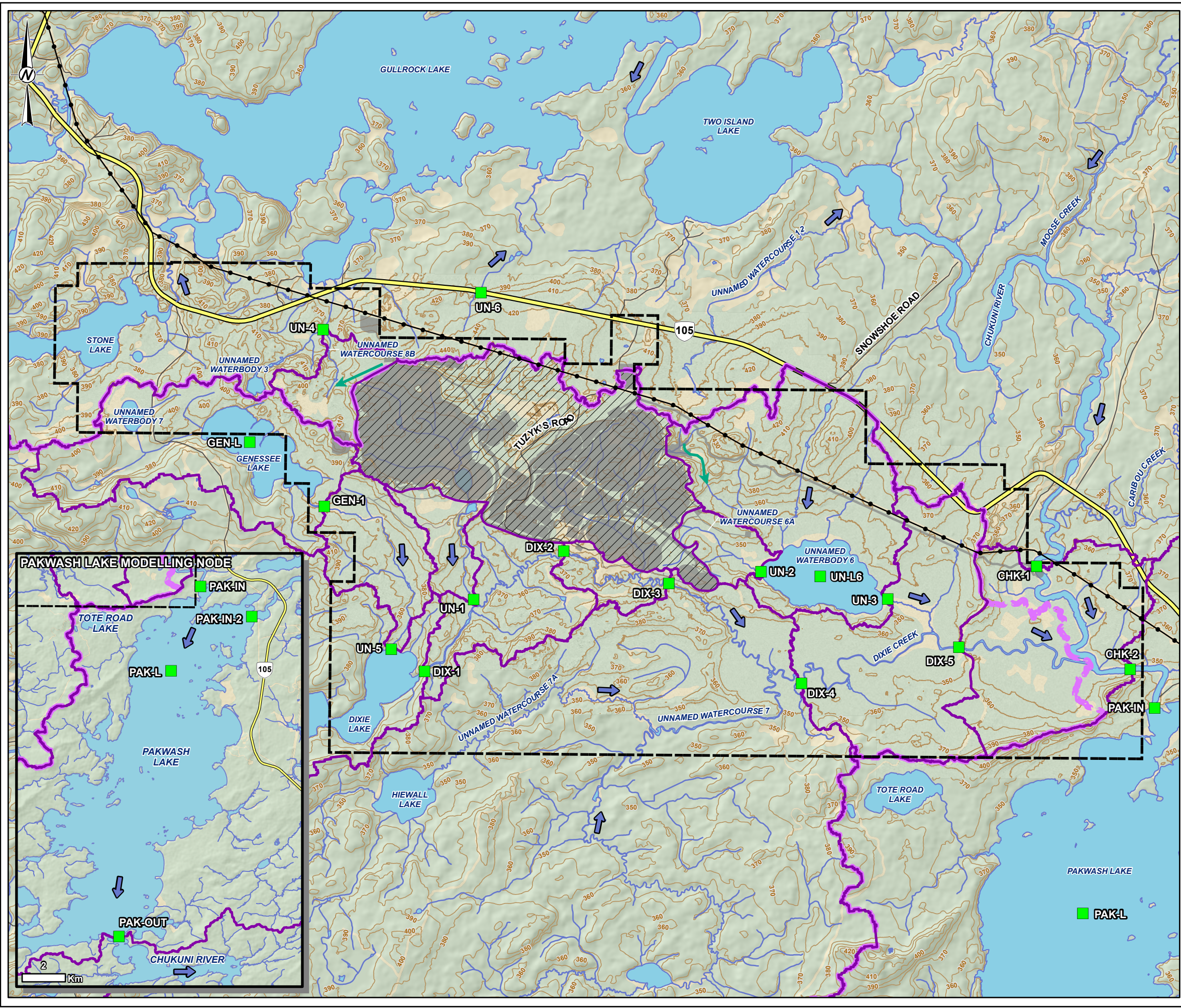
TITLE
LOCAL STUDY AREA FOR WATER QUALITY

CONSULTANT	YYYY-MM-DD	2026-03-31
	DESIGNED	---
	PREPARED	MD
	REVIEWED	---
	APPROVED	SD

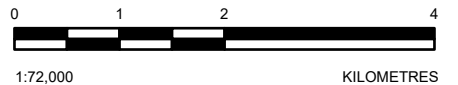
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



- LEGEND**
- PROPERTY BOUNDARY
 - GREAT BEAR PROJECT FOOTPRINT
 - CLEAN WATER DIVERSION
 - SURFACE WATER QUALITY MODELLING NODE
 - DIXIE CREEK WATERSHED (NOT USED FOR NODE AREAS)
 - MODELLING NODE WATERSHED
 - PROJECT WATERSHED
 - HIGHWAY
 - LOCAL ROAD
 - EXISTING TRANSMISSION LINE
 - CONTOURS (10 M INTERVAL)
 - WATERCOURSE
 - WATERBODY
 - FLOW DIRECTION



NOTE(S)
 1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
 1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
 2. WATERCOURSES AND WATERBODY ACQUIRED FROM LAND INFORMATION ONTARIO (MNR) AND MODIFIED TO MATCH AERIAL IMAGERY AND LIDAR.
 3. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
 4. PROPERTY BOUNDARY PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2024.
 5. CONTOURS ACQUIRED FROM LAND INFORMATION ONTARIO (MNR), 2022 AND DERIVED FROM 2022 LIDAR PROVIDED BY GREAT BEAR RESOURCES.
 6. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
 7. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT

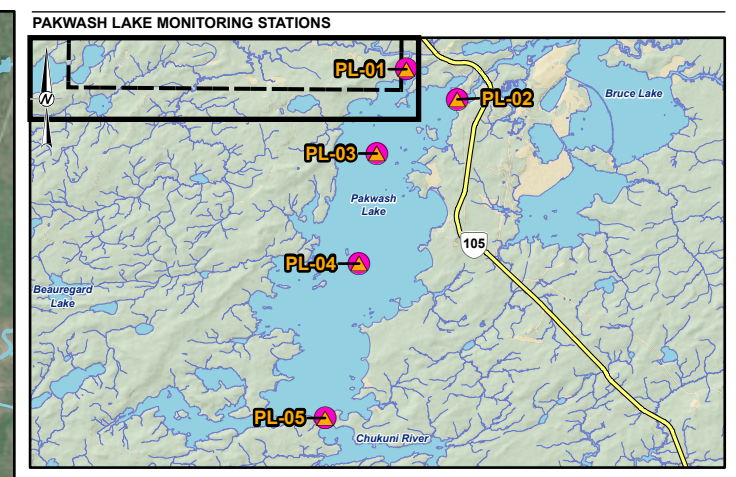
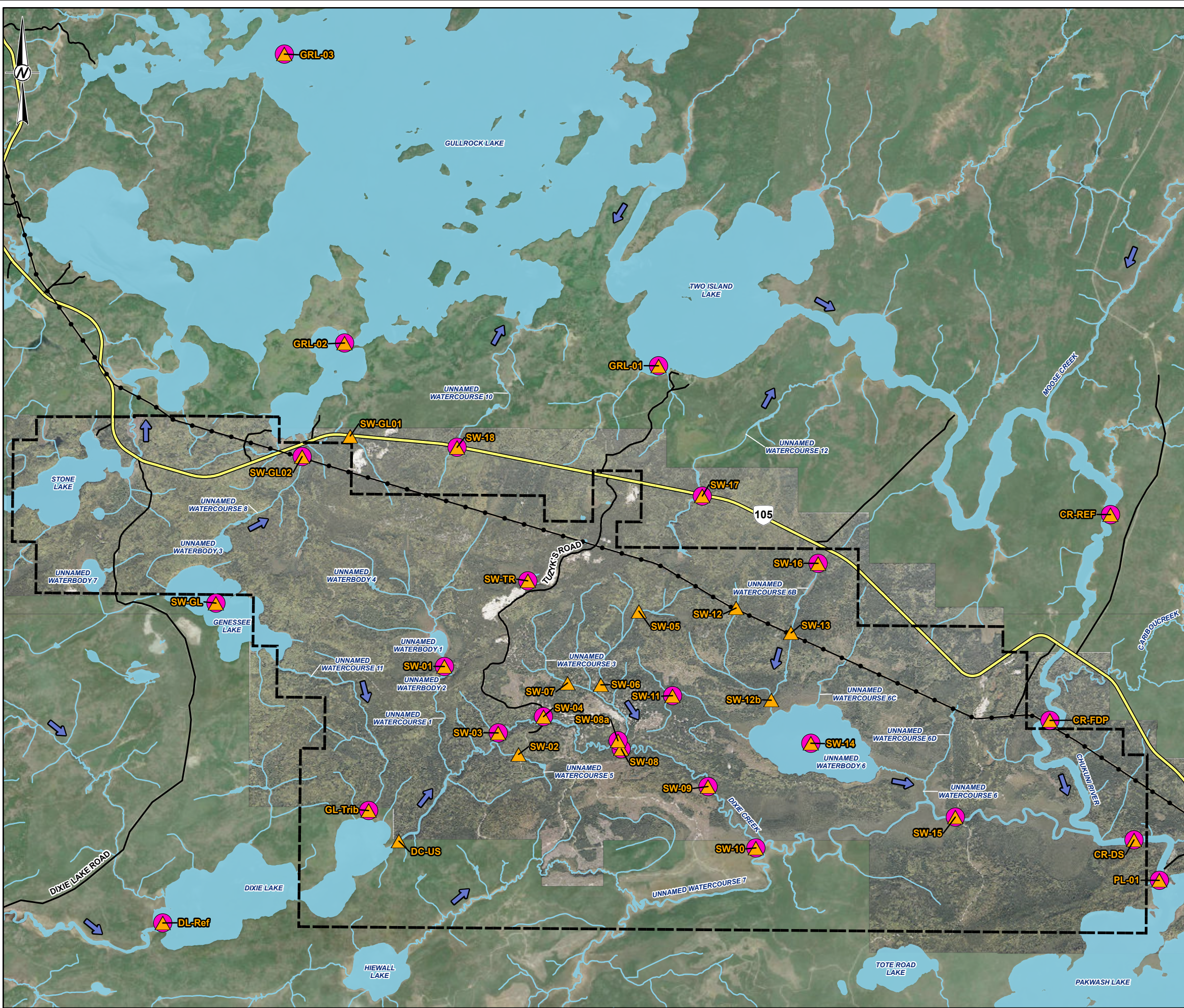
TITLE
WATER QUALITY ASSESSMENT NODES

CONSULTANT	YYYY-MM-DD	2026-03-31
	DESIGNED	---
	PREPARED	MD
	REVIEWED	---
	APPROVED	SD

PROJECT NO. CA0031271	CONTROL 0001	REV. A	FIGURE 7.7-3
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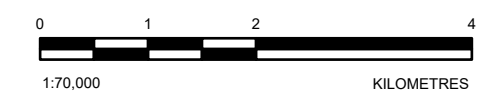
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



SCALE: 1:350,000

- LEGEND**
- PROPERTY BOUNDARY
 - SURFACE WATER QUALITY MONITORING STATION
 - METHLYMERCURY AND SUPPLEMENTAL ULTRALOW MERCURY MONITORING STATION
 - HIGHWAY
 - LOCAL ROAD
 - EXISTING TRANSMISSION LINE
 - WATERCOURSE
 - WATERBODY
 - FLOW DIRECTION

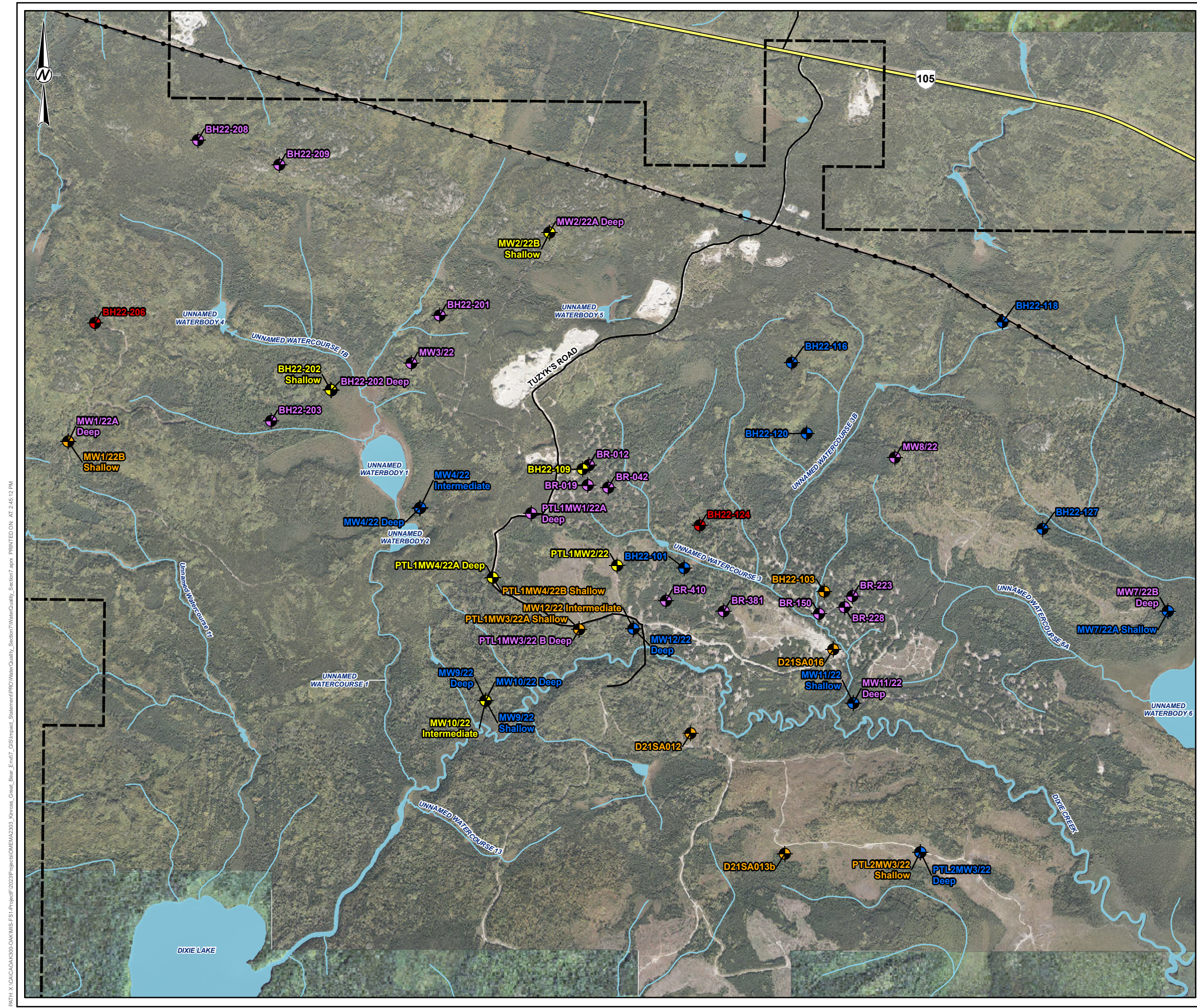


- NOTE(S)**
1. ALL LOCATIONS ARE APPROXIMATE
- REFERENCE(S)**
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
 2. AERIAL IMAGERY PROVIDED BY GREAT BEAR RESOURCES (SCENE DATE: SEPTEMBER 2022).
 3. PROPERTY BOUNDARY PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2024.
 4. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
 5. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT GREAT BEAR RESOURCES		
PROJECT GREAT BEAR PROJECT		
TITLE SURFACE WATER QUALITY MONITORING STATIONS		
CONSULTANT	YYYY-MM-DD	2026-03-31
	DESIGNED	---
	PREPARED	MD
	REVIEWED	---
	APPROVED	SD
PROJECT NO. CA0031271	CONTROL 0001	REV. A
		FIGURE 7.7-4

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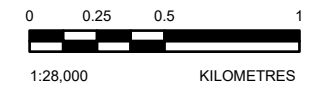
LEGEND

- PROPERTY BOUNDARY
- HIGHWAY
- LOCAL ROAD
- EXISTING TRANSMISSION LINE
- WATERCOURSE
- WATERBODY

GROUNDWATER QUALITY MONITORING STATION

STRATIGRAPHIC UNIT

- BEDROCK
- CLAY
- GLACIAL
- SAND
- SILT



NOTE(S)
 1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
 1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
 2. AERIAL IMAGERY PROVIDED BY GREAT BEAR RESOURCES (SCENE DATE: SEPTEMBER 2022).
 3. PROPERTY BOUNDARY PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2024.
 4. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
 5. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
 GREAT BEAR RESOURCES

PROJECT
 GREAT BEAR PROJECT

TITLE
**GROUNDWATER QUALITY MONITORING STATIONS,
 2022 TO 2023**

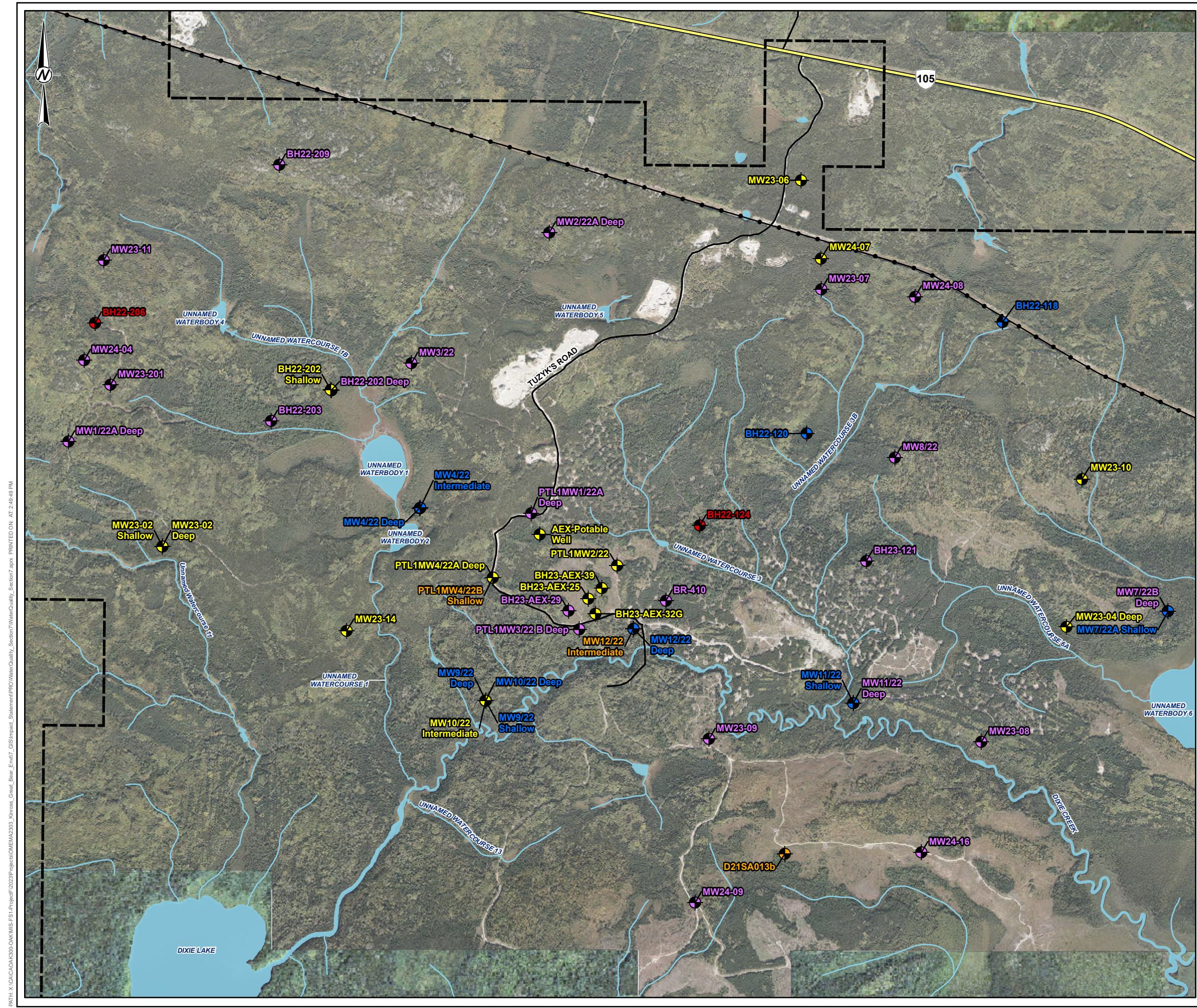
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DESIGNED	----	
PREPARED	MD/DB	
REVIEWED	----	
APPROVED	SD	



PROJECT NO. CA0031271 CONTROL 0001 REV. A FIGURE 7.7-6

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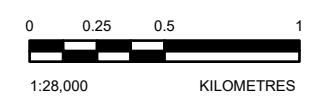
LEGEND

- PROPERTY BOUNDARY
- HIGHWAY
- LOCAL ROAD
- EXISTING TRANSMISSION LINE
- WATERCOURSE
- WATERBODY

GROUNDWATER QUALITY MONITORING STATION

STRATIGRAPHIC UNIT

- BEDROCK
- CLAY
- GLACIAL
- SAND
- SILT



NOTE(S)
 1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
 1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
 2. AERIAL IMAGERY PROVIDED BY GREAT BEAR RESOURCES (SCENE DATE: SEPTEMBER 2022).
 3. PROPERTY BOUNDARY PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2024.
 4. ROADS INFORMATION PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2022.
 5. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT

TITLE
GROUNDWATER QUALITY MONITORING STATIONS, 2024

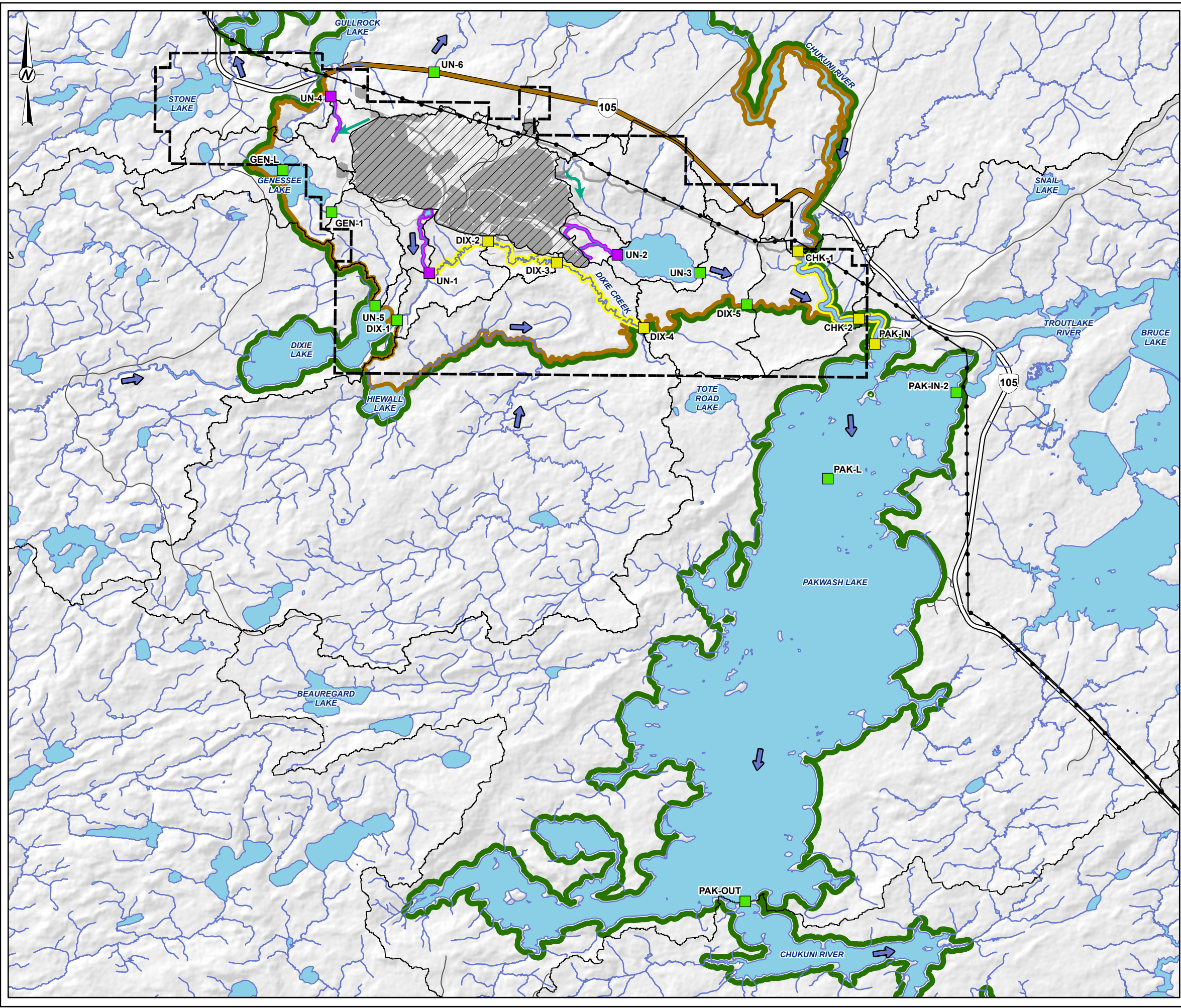
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	PREPARED	MD/DB
	REVIEWED	---
	APPROVED	SD

PROJECT NO. CA0031271 CONTROL 0001 REV. A FIGURE 7.7-7

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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LEGEND

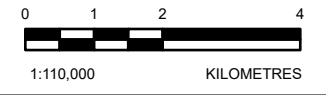
- PROPERTY BOUNDARY
- GREAT BEAR PROJECT FOOTPRINT
- CLEAN WATER DIVERSION
- LOCAL STUDY AREA FOR WATER QUALITY
- REGIONAL STUDY AREA FOR WATER QUALITY
- MODELLING NODE WATERSHED
- PROJECT WATERSHED
- HIGHWAY
- LOCAL ROAD
- EXISTING TRANSMISSION LINE
- WATERCOURSE
- WATERBODY

SURFACE WATER QUALITY MODELLING NODE (MAXIMUM CHANGE IN FLOW +/-)

- NO PREDICTED CHANGE FROM BASELINE CONDITIONS
- PREDICTED CHANGE FROM BASELINE CONDITIONS, ALL CONCENTRATIONS LESS THAN WATER QUALITY GUIDELINES FOR THE PROTECTION OF AQUATIC LIFE
- WATERCOURSE COMPENSATED FOR IN THE FISH HABITAT AND COMPENSATION PLAN (APPENDIX L-2)

WATERCOURSE / WATERBODY WITH CHANGES TO FLOW >10% (MAXIMUM CHANGE IN FLOW +/-)

- PREDICTED CHANGE FROM BASELINE CONDITIONS, ALL CONCENTRATIONS LESS THAN WATER QUALITY GUIDELINES FOR THE PROTECTION OF AQUATIC LIFE
- WATERCOURSE COMPENSATED FOR IN THE FISH HABITAT AND COMPENSATION PLAN (APPENDIX L-2)



NOTE(S)
 1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
 1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
 2. PROPERTY BOUNDARY PROVIDED BY GREAT BEAR RESOURCES, AUGUST 2024.
 3. SITE PLAN BASED ON INFORMATION PROVIDED BY GREAT BEAR RESOURCES, DECEMBER 2024 / JUNE 2025.
 4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 15N

CLIENT
GREAT BEAR RESOURCES

PROJECT
GREAT BEAR PROJECT

TITLE
ZONE OF CHANGES, WATER QUALITY

CONSULTANT	DATE	REVISION
	YYYY-MM-DD	2026-03-31
	DESIGNED	---
	PREPARED	DB
	REVIEWED	---
	APPROVED	SD

PROJECT NO. CA0031271 CONTROL 0001 REV. A FIGURE 7.7-9

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B