Crawford Nickel Project Impact Statement

Chapter 15 Assessment of Potential Effects on Surface Water

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Acronyms and Abbreviations

CCME	Canadian Council of Minister of the Environment
CWQG-FAL	Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life
EEM	environmental effects monitoring
FDP	final discharge point
HEC-HMS	Hydrologic Engineering Centre Hydrologic Modelling System
kt/d	kilotonnes per day
MDMER	Metal and Diamond Mining Effluent Regulations
MECP (MOE)	Ontario Ministry of the Environment, Conservation, and Parks; previously known as the Ministry of the Environment (MOE)
MFL	million fibres per litre
MNR	Ministry of Natural Resources (formerly Ministry of Natural Resources and Forestry [MNRF])
ML/ARD	metal leaching and acid rock drainage
MRCA	Mattagami Region Conservation Authority
O. Reg.	Ontario Regulation
OWRA	*Ontario Water Resources Act*
PA	Project Area
PoPC	Parameter of Potential Concern
PWQMN	Provincial Water Quality Monitoring Network
PWQO	Provincial Water Quality Objectives
TSS	total suspended soils
US EPA	United States Environmental Protection Agency

Glossary of Technical Terms

Acid Rock Drainage	The acidic water that is created when sulphide minerals are exposed to air and water and produce sulphuric acid.
Baseline Conditions	Pre-project environmental conditions
Catchment Area	The area of land which drains into a body of water.
Contact Water	Water that comes into contact with mine activities
Dewatering	To remove groundwater or surface water from an area for construction purposes.
Effluent	The wastewater discharged to a receiving water body.
Effluent Limit	A legally enforceable effluent requirement.
Grubbing	The removal and disposal of stumps and roots remaining after vegetation clearing.
pH	A measure of the hydronium ion concentration ions relative to hydroxide, also referred to as the acidity or basicity of an aqueous solution.
Potable water	Water suitable for drinking.
Spillway	A gated or ungated hydraulic structure used to discharge water from a reservoir. An emergency spillway is a spillway that is designed to provide additional protection against overtopping of dams and is intended for use under extreme flood conditions or malfunction of the service spillway.

Tailings	Crushed or ground rock and process effluents that are generated in a mine processing plant.
Watercourse	Any flowing water including rivers, streams, and overland flow paths.
Watershed	A catchment basin or area including all of the land that is drained by a watercourse and its tributaries. Watershed boundaries are defined by heights of land. Boundaries are set where a height of land causes water to flow away from the watercourse.

15 Assessment of Potential Effects on Surface Water

Surface Water was selected as a Valued Component (VC) as it has the potential to both influence and be influenced by Project activities. Surface water is an integral part of the hydrological cycle and effects of the Crawford Nickel Project ('the Project') will be considered for both surface water quantity and quality, and how changes in these two areas may influence human and ecological use. Surface water is an integral part of the local environment, providing habitat for fish, vegetation, and aquatic populations, and contributing to local socio-economic drivers.

The Tailored Impact Statement Guidelines (TIS Guidelines) (Appendix A.1 of the Impact Statement) require an assessment of the effects of the Project on surface water. For this assessment, 'surface water' is defined as all water running or in storage above the ground surface. This section will expand upon the definition of surface water and its place in the hydrologic cycle and water quality. More specifically, surface water was selected as a VC for the following reasons:

- Importance as an ecosystem function (recreation and aquatic life habitat)
- Requirements of the TIS Guidelines
- Potential for Project-related effects on both surface water quality and quantity, including or resulting from:
  - potential changes to surface water quality associated with effluent releases (including hazardous materials), surface water runoff, and process water management
  - potential changes to hydrological or hydrometric conditions, and effects of lowering the water table on aquatic ecosystems
  - management of pit water quality during operations and closure

Surface Water is linked to other VCs, including:

- Groundwater (Chapter 14), whereby surface water can interact directly with groundwater resources at areas of groundwater discharge and recharge.
- Vegetation, Riparian and Wetland Environments (Chapter 16), whereby changes in surface water quality and quantity can affect vegetation communities (wetlands) that are influenced by surface water runoff.
- Fish and Fish Habitat (Chapter 17), whereby changes in the quantity or quality of surface water have the potential to affect fish health and habitat.
- Health (Chapter 21), whereby surface water is a transport pathway to humans through the consumption of surface water and organisms that inhabit and/or use surface water.

- Indigenous Interests (Chapters 25-28), whereby changes in surface water quality and quantity can affect the ability or desire of Indigenous nations to participate in traditional water-based activities, such as fishing, hunting, and trapping. Additionally, changes in surface water quality and quantity can affect features on the landscape considered to be of importance to Indigenous nations.

15.1 Scope of Assessment

There are several federal and provincial regulatory requirements that may apply to the Project, including environmental assessment and other environmental permitting obligations. The scope of the assessment of potential effects to surface water was guided by the TIS Guidelines developed for the Project (Appendix A.1 of the Impact Statement) and various federal and provincial laws, regulations, policies, and guidelines protecting surface water quantity and quality in Canada and Ontario.

In addition to regulations, policies, and guidelines, this section describes how engagement with the public and local Indigenous nations has influenced the scope of the assessment; the understanding of potential effects and pathways between the Project and surface water quantity and quality during construction, operations, decommissioning/closure and post-closure of the Project; measurable parameters to be used to quantify potential effects of the Project on surface water quantity and quality; spatial and temporal boundaries of the assessment; and the approach for characterizing residual effects.

15.1.1 Regulatory and Policy Setting

There are several federal and provincial regulatory requirements that may apply to the Project from a surface water quantity or quality perspective, including environmental assessment and other environmental permitting obligations. The most current standards, criteria or guidelines are presented herein. The Project is being assessed in accordance with the *Impact Assessment Act,* 2019.

15.1.1.1 Federal Regulatory and Policy Setting

Fisheries Act

There are several sections and subsections of the *Fisheries Act* that pertain to surface water and potential interactions with the Project; these are listed below:

- Sections 34.3, 34.4(1), 35(1) and 36(3) – The federal *Fisheries Act* requires the protection of fish habitat, prohibits the death of fish, and prohibits deposit of deleterious substance in all watercourses that are fish bearing.
- *Metal and Diamond Mining Effluent Regulations* (MDMER) – The MDMER, promulgated under the *Fisheries Act*, provides exemptions to the general prohibition against depositing deleterious substances in waters frequented by fish. The MDMER sets out the maximum allowable limits for specific metals and other parameter concentrations in discharge resulting from the Project. The MDMER also sets forth a variety of effluent monitoring requirements, as well as the Environmental Effects Monitoring (EEM) criteria to be implemented and reported on during the

operational phase of the Project. MDMER limits for new metal and diamond mines (effective June 1, 2021) from Table 1 of Schedule 4 were used in this assessment.

– The MDMER contains provisions to allow for the disposal of mine waste in waters frequented by fish under certain conditions. The use of waters frequented by fish for mine waste disposal can be authorized through an amendment to MDMER by listing the water body in Schedule 2 as a tailings impoundment area, and development of fish habitat compensation plans to offset the loss of fish habitat for mine waste management.

Navigation Protection Act

The *Navigation Protection Act*, administered by Transport Canada, applies to the activities that alter navigable water or inhibit the ability for waterways to be navigable. Approval from the Minister of Transport is required for construction of any structure in, over, under, or through navigable water that would interfere with navigation (e.g., bridge, boom, pipeline, outfall, effluent diffuser, dam, or diversion), whereas an exemption is required for the deposition of materials within a navigable water body.

15.1.1.2 Provincial Regulatory and Policy Setting

Mining Act

The *Mining Act*, administered by the Ontario Ministry of Mines, relates to prospecting mineral exploration, mine development and rehabilitation in Ontario, in a manner consistent with the recognition and affirmation of existing Aboriginal and treaty rights in section 35 of the *Constitution Act*, 1982, including the duty to consult, and to limit the impact of these activities on public health and safety and the environment. Approval is required for mine closure plans by the Ministry of Mines pursuant to Ontario Regulation (O.Reg.) 35/24, which include permitting of offline mine dams in the closure plans. Specifically, with respect to surface waters, these statutes and regulations identify surface water quality parameters to be monitored from mines, as well as monitoring and certification requirements for assessing the success of closure activities in protecting surface waters from potential mining effects. Additionally, these statutes and regulations provide guidance regarding progressive rehabilitation to accelerate mine site rehabilitation in advance of close out activities.

Lakes and Rivers Improvement Act

The *Lakes and Rivers Improvement Act*, administered by the Ministry of Natural Resources, applies to the design, construction, operations, maintenance, and safety of waterbodies and watercourses in Ontario. For the purposes of the *Lakes and Rivers Improvement Act*, this includes online dams, channelizations, water crossings, enclosures, and pipeline installations. Approval is required from the Minister of Natural Resources for the construction of online dams, culverts, bridges, and channelizations which may alter fish habitat, natural amenities, and riparian owner rights.

Ontario Water Resources Act and Related Regulations

The *Ontario Water Resources Act* (OWRA) is the principal statute governing water quality and quantity in Ontario. It is a general management statute that applies to groundwater and surface water. Administered by the Ministry of the Environment, Conservation and Parks (MECP), the OWRA contains important regulations that protect water resources, including:

- O. Reg. 387/04: Water Taking and Transfer Regulation (O. Reg. 387/04), which requires a permit for water takings of more than a total of 50,000 L/d (with some exceptions). Section 34 of the OWRA requires the proponent to obtain a Permit to Take Water and section 9 of O. Reg. 387/04 requires all permit holders to collect, record, and report data on daily volumes of water withdrawals.

- Section 53 of the OWRA states that subject to section 47.3 of the *Environmental Protection Act*, no person shall use, operate, establish, alter, extend, or replace new or existing sewage works except under and in accordance with an environmental compliance approval. 2010, c. 16, Sched. 7, s. 3 (9).

Conservation Authorities Act

In 2024, the Province updated the *Conservation Authorities Act* and its associated regulations. Effective April 1, 2024, Mattagami Region Conservation Authority's (MRCA) regulation, under section 28 of the *Conservation Authorities Act*, is known as O. Reg. 41/24: Prohibited Activities, Exemptions and Permits. O. Reg. 41/24 empowers the MRCA to control development (e.g., placement of fill or alteration of a watercourse) within regulated areas (flooding, erosion, dynamic beaches). Construction within a Conservation Authority regulated area may require a permit in accordance with O. Reg. 41/24.

Jocko Creek is located within the MRCA jurisdiction, potentially requiring a conservation authority permit for works within the watershed. The West Buskegau River and North Driftwood River watersheds are not managed by conservation authorities.

15.1.1.3 Regulatory Guidance and Criteria to Evaluate Surface Water Quality

The primary regulatory guidance and criteria applicable to this study include the following:

- Ontario Provincial Water Quality Objectives (PWQOs) (MOEE 1994b)

- Ontario Ministry of the Environment and Energy (MOEE) Policy B-1-5 (MOEE 1994a)

- Canadian Council of Ministers of the Environment's Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life (CCME CWQG-FAL) (CCME 2024)

- British Columbia Ministry of Environment and Climate Change Strategy (BC MECCS) for the protection of aquatic life guideline for sulphate was used as a sulphate guideline

The MECP will require an Industrial Sewage Works - Environmental Compliance Approval for the operation of the industrial sewage works (water management infrastructure) at the site. The PWQOs (MOEE 1994b) are used to evaluate surface water quality with respect to discharges at a site and requires effluent receiving water assessments to follow its Policy B-1-5 (MOEE 1994a) in the development of effluent criteria.

CCME CWQG-FALs are guidelines that identify baseline water quality thresholds for this Project site (CCME 2024). The CCME CWQG-FAL water quality guidelines are used to assess baseline water quality. The BC MECCS for the protection of aquatic life used to evaluate sulphate concentrations.

15.1.2 The Influence of Consultation and Engagement on the Assessment

The Canada Nickel Company (Canada Nickel) has engaged with potentially affected Indigenous communities, regulators, the public, and other stakeholders. Table 15.1 provides a summary of the topics, key information including Indigenous knowledge, and concerns that Canada Nickel identified as part of their engagement efforts that relate to hydrology, as well as a summary of the influence that the outcomes of this engagement had on the assessment.

This information was considered when evaluating whether Canada Nickel’s planned mitigation will effectively manage the identified potential interactions, or whether additional or refined mitigation is warranted. Additional and specific mitigation measures were added to address one or more of the concerns, as described in Table 15.1.

Table 15.1 Summary of Key Information, Indigenous Knowledge, and Concerns for the Project Related to Surface Water

Topic	Key Information, Indigenous Knowledge, and Concerns	Influence on the Assessment	Where Information is Addressed in the Impact Statement
Water Management Plans, Contamination and Surface Water Quality	• Members of the public and other stakeholders expressed concern regarding: - potential increased levels of iron, mercury, arsenic, and cobalt in surface water due to Project activities - potential effects of seepage and runoff from ore, mine rock, tailings, and overburden on surface water quality - potential effects of effluent discharge in the Mattagami River - water storage capacity in the water storage ponds and whether it will be necessary to discharge untreated contact water to the environment at any point - need for information on water management facilities and drainage works for all phases of the Project, including how and where seepage and mine contact water will be collected, monitored, and treated as necessary - the proximity of tailings to waterbodies and potential contamination from any seepage - water crossings being potential inputs of contamination - increased risk of mercury mobilization in selected source-water intake locations. - need for further information on how the release of nitrogen into the aquatic environment from the use of explosives will be limited. - apply more conservative water quality criteria for the protection of aquatic life at the point of effluent discharge, with no mixing zone. - provide additional information on source of water supply at seasonal-use properties near the proposed tailings management facility (TMF), and potential water quality effects. - Potential changes to water quality at the Big Water Campground. • Members of the public and other stakeholders recommend Canada Nickel: - develop receiver-based effluent discharge criteria, taking into account the physical, chemical, and biological conditions of the receiving waterbody, the receiver's assimilative capacity, mixing zone requirements, the identification of contaminants of concern, and potential impacts to other water uses. - develop a receiving environment water quality model to identify mitigation needs. - plan sediment control and identify the potential residual effects of sedimentation downstream of Project activities. - provide further information on how tailings storage facilities will be isolated from surface water sources, on land and in open pits, during operations and after closure. - characterize temporal variability and trends in surface water quality in areas that might be affected by the Project. • Flying Post First Nation, Matachewan First Nation and Mattagami First Nation expressed concern regarding dewatering and diversion of waterbodies as water management is a sacred First Nation responsibility to protect. • Matachewan First Nation expressed concern regarding the Water Management Plan, including how water recycling will be used and how tailings will be managed. • Taykwa Tagamou Nation expressed concern regarding effects of climate change on all aspects of the Project, with an emphasis on water management infrastructure and water dependent design components such as waterbodies or waterways that the Project will collect water from. • Apitipi Anicinapek Nation, Flying Post First Nation, Matachewan First Nation, Mattagami First Nation, Métis Nation of Ontario – Region 3, and Taykwa Tagamou Nation expressed concern regarding surface water contamination from discharge, runoff, or seepage from water-crossings, waste rock stockpile, ore stockpiles, overburden stockpiles, mixing zones, potential for methylmercury accumulations and dispersion, and the TMF. • Apitipi Anicinapek Nation, Flying Post First Nation, Matachewan First Nation, Mattagami First Nation, Métis Nation of Ontario – Region 3, and Taykwa Tagamou Nation expressed concern regarding: - water quality, including risks of mercury mobilization - discharge in waterbodies from mine waste and seepage - changes in water quality in the Abitibi, Mattagami, North Driftwood and West Buskegau Rivers • Matachewan First Nation and Mattagami First Nation expressed concern regarding shoreline erosion and sedimentation on the Mattagami River.	• Contributed to an understanding of existing conditions for surface water pertaining to surface water quality, water management plans, and contamination. • Potential for increased levels of iron, mercury, arsenic, and cobalt considered in the selection of parameters considered potentially present in mine effluent (Chapter 15 of the Impact Statement [Assessment of Potential Effects on Surface Water]). • Potential effects of TMF and mine waste seepage considered in the development of mitigation measures (seepage collection ditches). • Considered in the assessment of predicted changes to water quality related to the use of explosives resulting in residual nitrogen (Chapter 15 of the Impact Statement [Assessment of Potential Effects on Surface Water]). • Project design was modified to avoid any direct impacts to Mattagami River. Follow up and monitoring commitments discussed in Section 15.8. • Informed the assessment of climate change in Chapter 20 of the Impact Statement (Assessment of Potential Effects on Climate Change) as it relates to water management infrastructure and water dependent design components. • Informed the assessment on Indigenous interests, including water management as a sacred First Nation responsibility, in Chapters 25 to 28 of the Impact Statement (Assessment of Potential Effects on Indigenous Interests). • Canada Nickel's response to mitigation recommendations made by Indigenous nations are provided in Chapters 25 to 28 of the Impact Statement (Assessment of Potential Effects on Indigenous Interests).	• Chapter 15 (Assessment of Potential Effects on Surface Water), Sections 15.2, 15.4 • Chapter 15 (Assessment of Potential Effects on Surface Water) • Chapter 20 (Assessment of Potential Effects on Climate Change), Section 20.3 • Chapters 25 to 28 (Assessment of Potential Effects on Indigenous Interests) • Groundwater Assessment (Appendix C.4 of the Impact Statement) • Surface Water Resources Assessment (Appendix C.5 of the Impact Statement)

Topic	Key Information, Indigenous Knowledge, and Concerns	Influence on the Assessment	Where Information is Addressed in the Impact Statement
	• Métis Nation of Ontario – Region 3 expressed concern regarding sediment entering surface water. • Taykwa Tagamou Nation recommends: - investigation into the risk of mercury mobilization in any source watercourses that may be selected. - if water is sourced externally to the Project site, ongoing monitoring of mercury and methyl mercury must be conducted in the downstream environment of any or all water sources, for the duration of the Project. - provide further information on how the Project design will limit the release of nitrogen into the environment from the use of explosives.		
Surface Water Quantity	• Members of the public and other stakeholders expressed concern regarding: - water used for dust control, and whether it would be sourced from the natural environment or recycled from site - effects to water levels and flow rates from effluent discharge - changes to water levels • Members of the public and other stakeholders recommend Canada Nickel characterize temporal variability and trends in surface water quantity in areas that might be affected by the Project. • Apitipi Anicinapek Nation, Flying Post First Nation, Matachewan First Nation, Mattagami First Nation, Métis Nation of Ontario – Region 3, and Taykwa Tagamou Nation expressed concern regarding: - water quantity including the loss of natural waterbodies - changes in water quantity in the Abitibi, Mattagami, North Driftwood and West Buskegau Rivers • Apitipi Anicinapek Nation expressed concern regarding the number of hydro dams in Apitipi Anicinapek Nation territory and the potential impacts of flooding to water flow, fluctuation, eutrophication, and algal blooms. • Matachewan First Nation expressed concern regarding the disruption of the natural flow of waterways and waterbodies due to landscape alteration and excavation from open pit mining.	• Considered in the development of mitigation and management measures and supported scope of issues assessed relating to changes to water levels and flow rates, temporal variability in surface water quantity, and the potential loss of natural waterbodies. • Project design was modified to avoid any direct impacts to Mattagami River. Follow up and monitoring commitments discussed in Section 15.8. • Potential cumulative interactions with hydroelectric dams are considered in Chapter 29 of the Impact Statement (Cumulative Effects Assessment). • Informed the assessment on Indigenous interests in Chapters 25 to 28 of the Impact Statement (Assessment of Potential Effects on Indigenous Interests).	• Chapter 15 (Assessment of Potential Effects on Surface Water), Sections 15.2, 15.4.2 • Chapter 15 (Assessment of Potential Effects on Surface Water) • Chapters 25 to 28 (Assessment of Potential Effects on Indigenous Interests) • Groundwater Assessment (Appendix C.4 of the Impact Statement) • Surface Water Resources Assessment (Appendix C.5 of the Impact Statement)
Indigenous Cultural and Traditional Use of Waterways	• Apitipi Anicinapek Nation, Flying Post First Nation, Matachewan First Nation, Mattagami First Nation, Métis Nation of Ontario – Region 3, and Taykwa Tagamou Nation expressed concern regarding the ability to practice water related ceremonies. • Flying Post First Nation expressed concern relating to paddling and other recreational activities due to changes in water quality and quantity. • Flying Post First Nation, Matachewan First Nation and Mattagami First Nation expressed concern regarding effects to navigable waters and navigation by Indigenous peoples. • Flying Post First Nation, Matachewan First Nation and Mattagami First Nation recommend Canada Nickel engage the Nations regarding the navigability of waterways, traditional use of waterways and proposed mitigation measures. • Matachewan First Nation reported that harvesting water from the land has occurred for generations. Water is an important way of life as waterbodies facilitate cultural activities. • Mattagami First Nation indicated that waterbodies could have multiple layers of significance, and a single waterway could be a fishing area, a spawning habitat, a ceremonial site, a drinking water sources, a navigation route, among many other values. • Taykwa Tagamou Nation expressed concern regarding changes to cultural practices and spiritual connections in relation to surface water.	• Contributed to an understanding of existing conditions for Indigenous cultural and traditional use of waterways regarding navigable waters and changes to cultural practices. • Considered in the development of mitigation and management measures and supported scope of issues assessed. • Informed the assessment on Indigenous interests in Chapters 25 to 28 of the Impact Statement (Assessment of Potential Effects on Indigenous Interests).	• Chapter 15 (Assessment of Potential Effects on Surface Water), Sections 15.2, 15.4 • Chapters 25 to 28 (Assessment of Potential Effects on Indigenous Interests)

Topic	Key Information, Indigenous Knowledge, and Concerns	Influence on the Assessment	Where Information is Addressed in the Impact Statement
Drinking Water	• Apitipi Anicinapek Nation, Flying Post First Nation, Matachewan First Nation, Mattagami First Nation, Métis Nation of Ontario – Region 3, and Taykwa Tagamou Nation expressed concern regarding: - changes in drinking water quality - potential effects to potable water sources and water intake at Smooth Rock Falls	• Contributed to an understanding of existing conditions for drinking water regarding effects to potable water sources and changes in drinking water quality. • Considered in the development of mitigation and management measures and supported scope of issues assessed. • Informed the assessment on Indigenous interests in Chapters 25 to 28 of the Impact Statement (Assessment of Potential Effects on Indigenous Interests).	• Chapter 15 (Assessment of Potential Effects on Surface Water), Sections 15.2, 15.4 • Chapters 25 to 28 (Assessment of Potential Effects on Indigenous Interests)
Interactions between Surface Water and Groundwater	• Apitipi Anicinapek Nation, Flying Post First Nation, Matachewan First Nation, Mattagami First Nation, Métis Nation of Ontario – Region 3, and Taykwa Tagamou Nation expressed concern regarding changes to groundwater-surface water interactions.	• Considered in the development of a three-dimensional numerical groundwater flow model to assess potential effects on groundwater/surface water interactions. • Informed the assessment on Groundwater in Chapter 14 of the Impact Statement (Assessment of Potential Effects on Groundwater). • Informed the assessment on Indigenous interests in Chapters 25 to 28 of the Impact Statement (Assessment of Potential Effects on Indigenous Interests).	• Chapter 15 (Assessment of Potential Effects on Surface Water) • Chapter 14 (Assessment of Potential Effects on Groundwater) • Chapters 25 to 28 (Assessment of Potential Effects on Indigenous Interests) • Groundwater Baseline Report (Appendix B.5 of the Impact Statement) • Surface Water Resources Baseline Report (Appendix B.6 of the Impact Statement) • Groundwater Assessment (Appendix C.4 of the Impact Statement) • Conceptual Closure Plan (Appendix F of the Impact Statement)

Where made available by Indigenous nations through engagement, information gathering, and voluntary information sharing, Indigenous knowledge has been considered and incorporated into the Impact Statement, as applicable. Refer to the Description of Engagement with Indigenous Peoples (Chapter 7 of the Impact Statement) for detailed methods regarding the incorporation of Indigenous knowledge to the Impact Statement.

15.1.3 Potential Effects, Pathways and Measurable Parameters

Table 15.2 summarizes the potential environmental effects of the Project on surface water resources, effect pathways, and measurable parameters. These potential environmental effects and measurable parameters are selected based on professional judgement, understanding of the Project, recent environmental assessments for mining projects in Canada, and comments provided during engagement.

Table 15.2 Potential Effects, Effect Pathways and Measurable Parameters for Surface Water

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in surface water quantity	Project activities may have an effect or alter the natural flow regime through changes to surface vegetation cover, imperviousness, topography and drainage divides, seepage from stockpiles, Project water use and management of surface water runoff.	• Stream discharge (variety of flow statistics including daily flow and event-based discharges) • Lake water levels (mean and range of expected levels) • River morphology
Change in surface water quality	Project activities may have an effect or alter water quality through changes to the natural flow regime, contact water seepage and runoff, sedimentation and erosion rates, Project effluent discharges, and spills of hazardous materials.	• Water quality parameter concentrations (local and regional means concentrations and expected ranges) • Parameters of Potential Concern • Development of site-specific effluent criteria for Parameters of Potential Concern (mg/L) • Sedimentation and erosion potential and total suspended solids (TSS) loads

15.1.4 Boundaries

15.1.4.1 Spatial Boundaries

The **Project Area (PA)** encompasses the Project footprint and is the anticipated area of physical disturbance associated with the construction, operations, and decommissioning and closure of the Project. The PA includes the Open Pit, Stockpiles, two ore Processing Plants, and other mine related infrastructure, as well as a new rail spur line, the relocation of Highway 655 and existing 500 kilovolt (kV) transmission line. The extent of the PA for the Project is shown on Figure 15.1.

The **Local Study Area (LSA)** encompasses the area in which Project-related effects (direct or indirect) were predicted or measured with a level of confidence appropriate for the assessment and in which there is a reasonable expectation that the potential effects in the LSA are of public interest. This includes the PA and, to comply with provincial regulatory requirements and capture the potential effects of the Project on surface water, includes portions of Jocko Creek, the North Driftwood River and the West Buskegau River. The extent of the LSA for surface water is shown on Figure 15.1.

The **Regional Study Area (RSA)** includes the area within which cumulative effects on surface water are likely to occur, depending on the location of other past, present, or reasonably foreseeable future projects or activities. The RSA for the Surface Water includes the PA and LSA and extends farther downstream than the LSA along the North Driftwood River, West Buskegau River and Jocko Creek. The extent of the RSA for surface water is shown on Figure 15.1.

15.1.4.2 Temporal Boundaries

The temporal boundary of the assessment includes all Project phases from the start of construction through the end of closure. Based on the current Project schedule, the Project phases include:

- Construction (Year -3 to Year -1)
- Operations
  - Operations phase 1 (Year 1 to Year 5): 60 kilotonnes per day (kt/d) milling capacity with ore extraction
  - Operations phase 2 (Year 5 to Year 30): 120 kt/d milling capacity with ore extraction
  - Operations phase 3 (Year 30 to Year 41): 120 kt/d milling capacity with no ore extraction
- Decommissioning and closure
  - Active closure (Year 41 to Year 46)
  - Passive closure (Year 46+)

15.1.5 Residual Effects Characterization

The characterizations used to assess residual effects on surface water are provided in Table 15.3.

Table 15.3 Characterization of Residual Effects on Surface Water

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive –** a residual effect that moves measurable parameters in a direction beneficial to surface water resources relative to baseline **Adverse –** a residual effect that moves measurable parameters in a direction detrimental to surface water resources relative to baseline **Neutral –** no net change in measurable parameters for the surface water resources relative to baseline

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The amount of change in surface water quality and quantity relative to existing conditions	**Negligible –** no measurable change in the effect can be noted **Low –** a measurable change is detectable and within the normal variability that would be expected (baseline) **Moderate –** a measurable change occurs that is considered elevated above baseline and within acceptable limits **High –** a measurable change occurs that is considered elevated above acceptable limits or regulatory objectives
Geographic Extent	The geographic area in which a residual effect occurs	**PA –** residual effects are restricted to the PA **LSA –** residual effects extend into the LSA **RSA –** residual effects extend into the RSA
Timing	Considers when the residual effect is expected to occur, where relevant to the VC.	**No sensitivity** – timing does not affect VC **Moderate sensitivity**– timing may affect VC during lower sensitivity period, but the effects are manageable with proper planning and mitigation measures **High sensitivity** – residual effects occur during high sensitivity period
Duration	The time required until surface water quality or quantity returns to its existing condition, a regulatory threshold, or the residual effect can no longer be measured or otherwise perceived	**Short-term –** the residual effect is restricted to construction or decommissioning, rehabilitation, and active closure phases **Medium-term –**the residual effect extends through Project operations and is expected to subside when operations cease **Long-term –** the residual effect extends beyond the life of the Project
Frequency	Identifies how often the residual effect occurs and how often during the project or in a specific phase	**Single event** **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	**Reversible –** the residual effect is likely to be reversed after activity completion and reclamation **Irreversible –** the residual effect is unlikely to be reversed

15.2 Existing Conditions for Surface Water

Existing surface water quantity and quality conditions for the Project are presented in detail in the Surface Water Resources Baseline Report (Appendix B.6 of the Impact Statement). The following information provides a summary of surface water resources conditions within the RSA.

15.2.1 Methods

The existing surface water resources conditions within the RSA were developed based on desktop modelling and field surveys that included the installation of nine hydrometric stations, manual and automated water level monitoring, and surface water quality sampling program at 32 watercourses and 13 waterbodies over a period of three years.

15.2.2 Overview

15.2.2.1 Surface Water Quantity

Key findings of the Surface Water Baseline Report (Appendix B.6 of the Impact Statement) on surface water quantity include:

- Regional hydrologic data was obtained from five Water Survey of Canada stations within 200 kilometres (km) of the PA, with watershed area no greater than one order of magnitude difference to the Project-impacted watershed and having a period of record greater than 20 years. An additional criterion of the station having a period of record that falls within one climate normal period - preferably the most recent Environment and Climate Change Canada (ECCC) climate normal period currently being estimated for climate stations in Canada (1991 to 2020) (ECCC 2023b) - was included for this assessment.
- As the Meteorological Service of Canada had not updated local climate station climate normals at the time of writing the Surface Water Resources Baseline Report (Appendix B.6 of the Impact Statement), the 1991 2020 climate normal precipitation and temperature data was developed using Timmins Victor Power Airport observations. The climate normal monthly mean temperature ranges from -16.4 degrees Celsius (ºC) in January to 17.6ºC in July. The annual climate normal precipitation was found to be 801.8 millimetres (mm).
- Data collected by the local hydrometric monitoring program was utilized for the generation of station-specific rating curves and hydrographs within the Jocko Creek, West Buskegau River, and North Driftwood River watersheds. These results provide a quantitative measure of the hydrological nature of the LSA.
- Three Hydrologic Engineering Centre Hydrologic Modelling System (HEC-HMS) models were developed, one for each watershed. For the baseline assessment, model calibration was performed to match historical recorded flows from nearby Water Survey of Canada Station Porcupine River at Hoyle.

15.2.2.2 Surface Water Quality

Key findings of the Surface Water Resources Baseline Report (Appendix B.6 of the Impact Statement) on surface water quality include:

- Regional water quality data was obtained from seven Provincial Water Quality Monitoring Network (PWQMN) stations. For local water quality, a total of 317 surface water quality samples were collected from 2021 to December 2023 at 33 watercourse locations and 13 waterbody locations across three main watersheds (Jocko Creek, North Driftwood River, and West Buskegau River).
- Local general water quality in the watercourses and waterbodies identified slightly acidic conditions with 25th percentile values below the CWQG-FAL and PWQO lower limit (6.5). Alkalinity is relatively low with limited acid buffering potential. Waters within the Project Area are typically classified as medium hard with soft waters in the Jocko Creek and West Buskegau watersheds.
- Three parameters were identified as parameters of potential concern (PoPCs) where local watercourse and waterbody 75th percentile values exceeded the corresponding guideline, in particular the PWQOs. Total phosphorus (TP) had a 75th percentile value of 0.032 milligram per litre (mg/L) for watercourses and 0.021 mg/L for waterbodies with PWQO TP values of 0.030 mg/L and 0.020 mg/L, respectively. For the assessment of aluminum, CWQG-FAL criteria was used to evaluate total aluminum and PWQO criteria (clay-free samples) used to evaluate dissolved aluminum. The 75th percentile value for dissolved aluminum exceeded the PWQO criteria of 75 micrometre per litre (µg/L) for the 0.2 µm filtered samples, with a value of 107 µg/L in watercourses. Total iron is identified as a PoPC as the 75th percentile values of both the watercourses and waterbodies exceeded the CWQG-FAL and PWQO value of 300 µg/L. There were no substantial differences in water quality parameter results between the three PA watersheds (Jocko Creek, North Driftwood River, and West Buskegau).
- Other metals and metalloids that reported at least one exceedance of the applicable guideline values as part of the local watercourse and waterbody monitoring program include: total cadmium, total cobalt, total copper, total lead, dissolved manganese, mercury, total selenium, total silver, total zinc, and total zirconium.
- Common PoPCs identified in the comparison of local and regional water quality datasets include total phosphorus, total aluminum, and total iron. Regional water quality data identified total arsenic, total cadmium, total cobalt, total copper, total lead, total silver, and total zinc as additional PoPCs at the regional scale that were not observed in the local data and are not considered PoPCs in the PA.
- Both the regional and local water quality exhibited seasonal trends for various parameters. Concentrations of parameters were typically higher in the late fall and winter months and lower in the spring and summer months (total ammonium/total ammonia (as N), total phosphorus, aluminum, iron, lead, and zinc).

- A 95th percentile confidence interval was calculated for both local and regional datasets to capture the water quality natural range of variability with the regional dataset typically having greater variability – potentially due to the longer monitoring period.

15.3 Project Interactions with Surface Water

Table 15.4 identifies, for each potential effect, the physical activities that might interact with the VC and result in the identified effect. These interactions are indicated by a check mark (✓) and are discussed in detail in Section 15.4, in the context of effects pathways, standard and Project-specific mitigation and enhancement, and residual effects.

Table 15.4 Project Interactions with Surface Water

Physical Activities	Effects	
	Change to surface water quality	**Change to surface water quantity**
Construction		
Mobilization of construction equipment and materials on site.	✓	–
Vegetation clearing, including the removal and disposal of trees, brush, shrubs, and other foliage.	✓	✓
Stripping, including the removal of topsoil and other organic materials, as well as storing of some materials for use in reclamation.	✓	✓
Grading of overburden to be used as fill.	✓	✓
Handling and use of explosives, including blasting.	✓	✓
Excavating and pre-stripping of mine rock from the Open Pit and surrounding area.	✓	✓
Development of the Impoundment Facility for storage of rock, clay, sand, and till.	✓	✓
Preparation of construction surfaces, including hauling reclaimed graded material and crushed mine rock to construction locations.	✓	✓
Construction of water management systems to collect, manage, treat and discharge contact water from mine components to the receiving waterbodies via collection ponds, ditches, and water treatment plants.	✓	✓
Construction of minor water diversions around perimeter of the mine site to collect and divert flows.	✓	✓
Dewatering of natural water bodies within the PA.	✓	✓
Waste management, including collection and temporary storage.	✓	✓
Construction of mine infrastructure, including crusher facilities, process plant and TMF, as well as the potable water well, and ancillary infrastructure (e.g., offices, workshop, fuel farm, magazine storage and explosives pad).	✓	✓

Physical Activities	Effects	
	Change to surface water quality	**Change to surface water quantity**
Construction of internal haul roads and internal access roads, including water crossings.	✓	✓
Construction of power supply and distribution systems.	✓	✓
Construction of temporary Highway 655 by-pass and overpass.	✓	✓
Construction of the rail spur.	✓	✓
Vehicle operation within the PA.	✓	–
Employment and expenditures[1].	–	–
Operations (Mining and Processing)		
Construction of Project infrastructure, including the expansion of ore processing components.	✓	✓
Relocation and decommissioning of Highway 655 and associated infrastructure.	✓	✓
Relocation of 500 kV transmission line.	✓	✓
Construction of the North Driftwood Diversion Channel.	✓	✓
Handling and use of explosives, including blasting.	✓	✓
Ore extraction in the Main Zone and East Zone of the Open Pit, including drilling, loading and hauling of mine rock from the pit.	✓	✓
Maintenance and management of mine rock stockpiles, overburden, and TMF.	✓	✓
Ore processing, including conveyor, crushing and processing activities with and between the Stockpiles, crusher facilities and Process Plant.	✓	✓
Operation of water management systems, including the collection, management, treatment and discharge of contact water from mine components to the receiving waterbodies via collection ponds, ditches and water treatment plants.	✓	✓
Transportation of Ore via the rail spur line.	✓	–
Waste management, including collection and temporary storage.	✓	–
Vehicle operation within the PA.	✓	–
Progressive reclamation of disturbed areas.	✓	✓
Employment and expenditures[1].	–	–
Decommissioning and Closure		
Pit flooding through the creation of channels from the collection ponds towards the Open Pit.	✓	✓
Water management, including groundwater and surface water.	✓	✓
Decommissioning, dismantling and/or disposal of buildings and mine infrastructure.	✓	✓

Physical Activities	Effects	
	Change to surface water quality	Change to surface water quantity
Removal of power lines and electrical equipment.	✓	✓
Decommissioning of potable water and sewage systems.	✓	✓
Vehicle operation within the PA.	✓	–
Reclamation, including the placement of overburden, seeding and re-grading.	✓	✓
Monitoring and maintenance.	✓	✓
Employment and expenditures[1].	–	–

Notes:
✓ = Potential interaction
– = No interaction
1. Project employment and expenditures are generated by most Project activities and are the main drivers of many potential socio-economic effects. Rather than acknowledging this by placing a checkmark against each of these activities, 'employment and expenditures' is listed as a separate item under each phase of the Project.

Project components and activities that will not directly change the surface water quantity or quality are as follows:

- Employment and expenditure will not directly result in changes to the physical environment, including surface water, during any Project phase.
- Mobilization of construction equipment and materials on site and vehicle operation within the PA will not directly result in changes to surface water quantity.

15.4 Assessment of Residual Effects on Surface Water

The main residual effect of the Project on surface water quantity is predicted to be the change in watershed areas due to the construction of Project infrastructure (i.e., Open Pit, the Impoundment Facility, TMF, and Stockpiles). The main residual effect of the Project on surface water quality is predicted to be from the Project final discharge points and seepage from the stockpiles. The changes to surface water quantity and quality may also affect groundwater resources and fish and fish habitat.

15.4.1 Analytical Assessment Techniques

The effects analysis for surface water quantity and quality was carried out using a number of analytical methods and tools and includes a hydrologic model, a water balance model, laboratory analytical data, water quality modeling and an assimilative capacity assessment. The techniques are described in detail in the Surface Water Resources Assessment (Appendix C.5 of the Impact Statement).

15.4.1.1 Analytical Assessment Techniques for Surface Water Quantity

Flows and water levels under pre-development conditions were used as the baseline against which Project-related changes during the construction, operations, decommissioning, and closure phases were assessed. Baseline hydrological conditions were assessed on a local and regional scale and are presented in the Surface Water Resources Baseline Report (Appendix B.6 of the Impact Statement). Placement of infrastructure and mine waste was designed for improved water management, proximity to the Open Pit and Process Plants and reduced overall footprint and impact to surface water and groundwater systems. The changes in watershed areas are primarily a result of construction of mine infrastructure and the implementation of measures to manage water on site.

To account for the extended mine life and globally driven changes in climate, climate change effects were integrated into the development of a future climate year which was downscaled to daily meteorological conditions. A climate normal for the time period 2071-2100 was generated based on the Shared Socio-economic Pathway (SSP) 2-4.5 emissions scenario for input daily temperature and precipitation data.

A site-wide water balance model was developed in GoldSim™ to predict the water quantity changes on a daily basis through the Project phases. The water balance model includes the Open Pit, TMF, overburden Stockpiles, Impoundment Facility (waste rock, sand and till, clay), lower value ore Stockpiles, Process Plant and ancillary infrastructure, and water management infrastructure.

A HEC-HMS hydrological model was setup with climate change adjusted meteorological inputs (air temperature, precipitation) at a daily scale to estimate baseline conditions from which Project change would be assessed. Changes in daily flows from climate change adjusted baseline flows were used as a screening threshold to determine whether further assessment of predicted changes in flow were required. Changes in daily flows were calculated during each phase of mine development for a modelled year of daily flows. Subwatersheds with an expected change in daily flow of greater than 10% were carried forward to subsequent assessment steps. The +/- 10% threshold was selected based on case studies presented by Richter et. al. (2011), Acreman and Ferguson (2010) and DFO (2013), which indicate that when flow alterations are within 10% of the natural flow a high level of ecological protection is provided.

For subwatersheds with an expected daily flow decrease of over 10%, the daily flows were compared with the climate change adjusted baseline predicted environmental flows. If environmental flows were maintained, the residual effect was not substantial. If environmental flows were not maintained, a local residual effect was assigned. Environmental flows have been updated from the baseline assessment to account for climate change. Environmental flows were derived using the Tessman Method (1980), based on mean monthly flow and mean annual flow taken from the updated HEC-HMS models that incorporate climate change. If the expected daily flows were lower than the baseline environmental flows, a local surface water quantity residual effect is expected within the LSA.

For watersheds with an expected increase in daily flows of over 10%, expected flood flows (100-year return period, 24-hour duration event) were compared with the baseline condition flood flow to assess the potential for flooding, erosion, and scour.

15.4.1.2 Analytical Assessment Techniques for Surface Water Quality

Baseline surface water quality was used as the baseline against which changes to surface water quality during Project phases were assessed. Baseline water quality thresholds were developed using regional and local surface water quality data. The regional water quality assessment examined water quality data at seven PWQMN sites, allowing for many years of water quality data from regional PWQMN sites to be analyzed to capture and assess the average and natural variability of parameters. Local water quality assessment examined water quality data collected at 32 watercourses and 13 waterbodies in the RSA between 2021 and 2023. Baseline surface water quality values were compared to applicable regulatory guidelines. These include both the PWQOs (and Interim PWQOs where applicable) and CWQG-FAL. Summary statistics were calculated for each parameter and include mean, minimum, maximum, standard deviation and 75th percentile where applicable.

The potential for metal leaching and acid rock drainage (ML/ARD) from materials generated, exposed, and stored at the Project was investigated by WSP in the Crawford Geochemistry Characterization Report (Appendix H of the Impact Statement). The geochemical assessment was based on 299 waste rock samples, 109 ore samples, four tailings samples, and 50 overburden samples. The samples underwent static testing (mineralogical analysis, acid-base counting, shake flask extraction tests, and solid phase elemental analysis) and kinetic (humidity cell tests) testing to characterize their ML/ARD potential.

A list of PoPCs was established using the baseline water quality and geochemical analysis, and changes in these parameters were assessed to determine Project effects on surface water quality. Selection of the PoPCs is discussed in detail in the Surface Water Resources Assessment (Appendix C.4 of the Impact Statement), and the selection criteria are listed below:

- Parameters found to exceed PWQOs or CWQG-FAL in baseline monitoring (total phosphorous, total and dissolved aluminum, and total iron).
- Parameters considered potentially present in mine effluent as a result of mining activities (chloride, fluoride, nitrite (as N), nitrate (as N), total and dissolved aluminum, total arsenic, total antimony, total boron, total cadmium, total chromium (III), total chromium (VI), total cobalt, total copper, total iron, total nickel, total selenium, total thallium, total uranium, total vanadium and total and dissolved zinc).

To analyze environmental effects for changes in surface water quality, a site-wide water quality GoldSim™ model was developed, utilizing the contaminant transport module of this model. Contact water quality was predicted by integrating geochemical contact water predictions into the GoldSim™ water quantity model (the water balance model). Through modelling in GoldSim™, water movement was refined throughout the Project at a daily time scale, and a number of factors (i.e., contact runoff and seepage estimates, water management infrastructure storage/sedimentation characteristics, and geochemical results) were used to predict contact water quality at the water management ponds and in seepage to the regional groundwater system from the TMF, impoundment facility and ore stockpiles. The GoldSim™ water quality model, developed by Lorax (Appendix K of the Impact Statement [Water Quality Assessment]), predicts raw water quality prior to supplemental water treatment and release to receivers (North Driftwood River, West Buskegau River).

The near-field mixing model CORMIX (Version 12.0) was used to determine the length to the point of full mixing when the watercourse receives effluent discharge. Mass balance assessment was conducted to predict water quality under both regulatory and normal discharge scenarios for the North Driftwood River, the West Buskegau River, and Jocko Creek. CORMIX is a 3D effluent mixing model with limitations to its ability to predict mixing zones beyond 200 m. As Project effluent mixing zones are expected to extend beyond the CORMIX model boundary, CORMIX will be used to estimate the point in the mixing zone where full mixing of effluent and receiver is achieved. Beyond the CORMIX boundary, a mass balance assessment is used to determine the mixing zone extent that is the distance between final discharge points (FDPs) and the point where concentration decrease to values below the regulatory objective/guidelines.

The results of the Assimilative Capacity Study (provided in Appendix C of the Surface Water Resources Assessment [Appendix C.5 of the Impact Statement]), in conjunction with an effluent treatment assessment of the limits of reasonable and practical treatment, are used to propose effluent criteria or limits for each PoPC. The effluent criteria typically take the form of a daily limit not to be exceeded and a monthly mean limit. The effluent criteria for PoPCs are used to define the mixing zone needed to assimilate each PoPC and are used to define the largest or maximum extent of the mixing zone. The effluent criteria represent the result of a series of Project mitigations to eliminate or reduce Project effects on local surface water quality.

Assessment of contact water used the following assessment sequence:

- Baseline water quality monitoring (regional and local) to identify PoPCs.
- Geochemical testing and assessment to determine water quality source terms and aging predictions.
- Water quantity and quality modelling in GoldSim™ refined water movement throughout the Project at a monthly time scale and used contact runoff and seepage estimates, water management infrastructure storage/sedimentation characteristics, and geochemical results to predict water quality at the FDPs and groundwater seepage quality.
- An assimilative capacity assessment at FDPs using near-field (CORMIX) to determine extent to the point of full mixing within the receiver in conjunction with a mass balance assessment to predict water quality for the North Driftwood River, West Buskegau River and Jocko Creek.
- Supplemental water quality assessments for individual PoPCs based on literature review, professional judgement, water quality and air quality model outputs and empirical loading model results.

15.4.2 Change to Surface Water Quantity

15.4.2.1 Project Pathways

During construction without implementation of mitigation measures, the Project environmental effects listed in Table 15.2 can alter surface water quantity through changes in runoff, evapotranspiration, evaporation, infiltration characteristics, changes in watershed areas, point source discharges, and watercourse alterations and realignments. Project activities that could results in a residual effect on surface water quantity in the LSA during the construction phase include:

- Site preparation and ground disturbance, which includes clearing and grubbing, for the development of the east portion of the Impoundment Facility, East Stockpile, Process Plant Area, Open Pit, Collection Pond 1, Collection Pond 3 and temporary sedimentation pond. These activities have the opportunity to alter drainage areas to the North Driftwood River and West Buskegau River systems, increase runoff and flooding potential and reduce infiltration and evapotranspiration due to increases in imperviousness and reduction of vegetated cover. Some project components will overprint small watercourses and wetland features further altering local drainage patterns.
- Construction of site access roads and associated construction of new hydraulic structures (e.g., culverts, bridges), which have the potential to increase flooding and alter overland drainage patterns.
- Construction of facilities, including temporary dewatering, for building ore stockpiles, impoundment facility, water management infrastructure, TMF starter dams and building foundations could potentially alter groundwater seepage rates to local receivers. Dewatering of the East Zone of the Open Pit, and other trenches and excavations has the potential to temporarily lower groundwater levels (Chapter 14 of the Impact Statement), which could change groundwater discharge to surface water features.
- Development of water management infrastructure causing changes to surface water drainage related to contact water collection in perimeter collection ditches:
  - Flow reductions for watersheds that lose drainage area to mine water infrastructure
  - Increased flows to watersheds that gain area from establishment of water management infrastructure and add flows due to increased surface water runoff from more impervious surfaces, including discharge at up to four FDPs
    - Two discharging to the North Driftwood River (FDP-SP-TEMP_01 or FDP-TMF-SP and FDP-SP-02)
    - Two discharging to the West Buskegau River (FDP-SP-01 and FDP-SP-03).[1]

[1] Six FDPs are currently shown on the Project Site Plan (Figure 3.2 in Chapter 3 of the Impact Statement [Project Description]); however, two of which are for emergency overflow only for the TMF NE Pond. Based on the current Water Management Plan, discharge is only anticipated from four of the six FDPs.

  - Reductions in flows due to watershed drainage area managed through point discharge FDPs
  - Potential flow reduction due to water extraction for dust suppression and construction activities within the water management infrastructure

During operations phase 1, Project activities that could result in a residual effect on surface water quantity in the LSA include:

- Development of the TMF Impoundment Facility, East Stockpile, Process Plant Area, Open Pit, Collection Pond 1, Collection Pond 3, Collection Pond 2, TMF NE Pond and TMF NW Pond, which will alter runoff, flooding potential, infiltration, and evapotranspiration. These activities have the opportunity to alter drainage areas to the North Driftwood River and West Buskegau River systems, increase runoff and flooding potential and reduce infiltration and evapotranspiration due to increases in imperviousness and reduction of vegetated cover. Some project components will overprint small watercourses and wetland features further altering local drainage patterns.
- Dewatering of the expanded Open Pit, and other trenches and excavations has the potential to temporarily lower groundwater levels (Chapter 14 of the Impact Statement [Assessment of Potential Effects on Groundwater]), which could change groundwater discharge to surface water features. The zone of influence around the pit can lower groundwater levels, including to local surface water receivers.
- Non-contact water diversion conveying flow from the east side of the TMF to the Martin Lake and Gerry lake subwatershed
- Water management infrastructure will be expanded with the construction of Collection Pond 2, TMF NE Pond and TMF NW Pond, which along with previously constructed Collection Ponds 1 and 3 will discharge through four FDPs (FDP-SP-02, FDP-TMF-SP (both TMF ponds), FDP-SP-01 and FDP-SP-03, respectively), which have the potential to increase flooding downstream of the discharge points and alter upstream watercourse flows based on watershed drainage area changes.
- Process plant water demand to be met by internal recycling of contact water from the TMF via the TMF ponds and supplementing with pit dewatering discharge
- Potential flow reduction due to water extraction for dust suppression and construction activities within the water management infrastructure
- Further haul road, watercourse crossing hydraulic structure and drainage ditch construction, which can potentially increase runoff potential via impervious surfaces and land cover

During operations phase 2, in addition to the project pathways identified during operations phase 1, the following Project activities that could result in a residual effect on surface water quantity in the LSA include:

- The Open Pit, Impoundment Facility, TMF and ore stockpiles and associated water management infrastructure will reach their full footprint size, which will alter runoff, flooding potential, infiltration, and evapotranspiration, including alterations to the North Driftwood River, West Buskegau River and Jocko Creek watershed areas. Some project components will overprint small watercourses and wetland features further altering local drainage patterns.
- The North Driftwood River Diversion Channel will be constructed and realign the watercourse from Martin Lake to an existing downstream section of the North Driftwood River, which has the potential to increase flooding and alter overland flow drainage patterns.
- Beginning in Mine Year 18
  - Tailings will be deposited in the Main Zone of the Open Pit, which will potentially alter local groundwater levels and change groundwater discharge to surface water features
  - The TMF rehabilitation will be initiated with appropriate cover materials and vegetation to stabilize soils, reduce overland flow and surface erosion, increase evapotranspiration and reduce infiltration with the vegetation established within five years (Year 23)
- In Year 23, the rehabilitated TMF will be direct to drain towards Martin Lake and Gerry Lake that will reduce contact water being managed at the site and direct flows to the North Driftwood River watershed and realignment
- The TMF NE Pond will be naturalized with vegetation plantings and construction of a spillway overflow following rehabilitation of the TMF with flow directed towards an area’s pre-development watershed to the extent reasonably feasible

During operations phase 3, in addition to the project pathways identified during operations phases 1 and 2, the following Project activities that could result in a residual effect on surface water quantity in the LSA include:

- The Impoundment Facility and Collection Pond 1 will be rehabilitated to stabilize soils, reduce overland flow and surface erosion, increase evapotranspiration and reduce infiltration with the vegetation established within five years, and surface water runoff directed towards an area’s pre-development watershed, to the extent reasonably feasible with no discharge via FDP-SP-01
- In Year 30, the TMF NW Collection Pond will be rehabilitated and surface water runoff directed towards an area’s pre-development watershed, to the extent reasonably feasible with no discharge via FDP-TMF-SP

During passive closure, the following Project activities that could result in a residual effect on surface water quantity in the LSA include:

- The East and West Stockpile areas will be graded and vegetated to stabilize soils, reduce overland flow and surface erosion and increase evapotranspiration with the vegetation established within five years and flows directed to the extent reasonably feasible towards their pre-development watersheds
- Following rehabilitation of the East and West Stockpile areas, Collection Ponds 2 and 3 will be rehabilitated with an overflow spillway and surface water runoff directed towards an area's pre-development watershed, to the extent reasonably feasible with no discharge via FDP-SP-02 and FDP-SP-03, respectively.
- As the open pit fills, groundwater levels will slowly rise and alter groundwater flow directions and discharge locations that developed during operation, which potentially will alter groundwater seepage flows to surface water receivers

During the pit-full phase, the following Project activities that could result in a residual effect on surface water quantity in the LSA include:

- The open pit will be filled with groundwater inflows and direct precipitation, once the pit lake reaches its discharge elevation, water levels will be controlled by the outflow channels/spillways to the North Driftwood River and West Buskegau River, which will subsequently alter flows downstream of the spillway outlets and groundwater seepage flows to surface water receivers and

Potential effects to groundwater, wetlands, and fish and fish habitat in construction, operations, and decommissioning and closure are further assessed in Chapters 14 (Assessment of Potential Effects on Groundwater), 16 (Assessment of Potential Effects on Vegetation, Riparian and Wetland Environments), and 17 (Assessment of Potential Effects on Fish and Fish Habitat) of the Impact Statement, respectively.

15.4.2.2 Mitigation and Enhancement Measures

The following mitigation measures have been incorporated into the design of the Project and/or are proposed to avoid or reduce Project-related effects on surface water quantity and flow:

- Canada Nickel will limit the construction footprint (i.e., Project Area) to the extent possible to limit the number of subwatersheds overprinted by the Project Area. Canada Nickel will develop and implement a Site-Wide Water Management Plan (Appendix J of the Impact Statement).
- The water management system will be designed to manage the 100-year return period, 24-hour duration storm event through the use of collection ponds and the Open Pit. This Plan will include:
  - Collection ditches have been sized to convey the 100-year return period, 24-hour duration storm event with freeboard.
  - Sedimentation ponds have been sized to store up to the 10-year return period, 24-hour duration storm event with freeboard.

- Flows above the 10-year return period, 24-hour duration storm event and up to the 100-year return period, 24-hour duration storm event will be managed by controlled release to the Open Pit to provide additional temporary storage.
- In the event of a flood event in excess of 100-year return period parameters, a secondary emergency overflow spillway will direct controlled overflow to the receiving environment has been designed. Spillways have been sized for a 200-year event.
- Gravity collection/conveyance ditches will be employed, where possible, inclusive of overflows from sedimentation ponds to the Open Pit.
- Erosion control measures such as vegetation controls and/or stabilization with stone resistant to erosive forces will be employed in erosion-susceptible zones in drainage ditching, pond inlets, outlets, and spillway discharge ditches.
- Water discharges to the North Driftwood River and West Buskegau River will be balanced to the extent feasible to maintain watercourse flows.

15.4.2.3 Project Residual Effects

15.4.2.3.1 Construction

Days with a flow reduction greater than 10% were not predicted in the Jocko Creek, West Buskegau River, or North Driftwood River watersheds for the outlet of the respective watershed models and limits of the LSA (Table 15.5).

Days with a flow increase greater than 10% were not predicted in the Jocko Creek watershed for the outlet of the watershed model limits. At the model outlet of the West Buskegau River watershed model, flow increases greater than 10% were predicted. The maximum predicted flow associated with a daily flow increase greater than 10% were associated with low flow conditions and would not increase scour and erosion potential. The estimated 100-year instantaneous peak flow (Q_{100}) flood flows at WB1 are not predicted to exceed the baseline condition flood flow. For the North Driftwood River at the watershed model outlet, ND1, daily flow increases greater than 10% from baseline condition flows were predicted (Table 15.5). The estimated Q_{100} flood flows at ND1 are not predicted to exceed the baseline condition flood flow and there would be no increase to scour and erosion potential in the channel.

During the construction phase, Jocko Creek and two lake waterbodies within its watershed are predicted to have small reductions in groundwater seepage (<5%) from baseline conditions, which represents seepage reductions of 0.001 m^3/s to 0.003 m^3/s, which is within the natural variability of the surface water systems. The West Buskegau River main channel is predicted to have a groundwater seepage decrease, hydrologic modeling with FDP discharges do not predict flow decreases that exceed the 10% threshold at the watershed model outlet. The North Driftwood River headwater lakes (Mel Lake, Sutherland Lake, Jack Lake, Gerry Lake, and Martin Lake) are predicted to have a decrease in groundwater seepage rates equating to an approximate decrease in lake water level of 0.05 m. The reduction in water level is estimated to be similar across the five lakes as they are located within an esker hydrogeological unit with a high hydraulic conductivity allowing increased groundwater to surface water connectivity in the coarse grained sand layer compared to the surrounding clay and clay till units. The 0.05 m water level reduction is within the expected natural water level variability for the waterbodies. The North Driftwood River main channel groundwater seepage rate is predicted to increase from baseline, which does not cause an increase in the Q100 flood flow.

15.4.2.3.2 Operations

Days with a flow reduction greater than 10% were not predicted in the Jocko Creek or West Buskegau River for the outlet of the respective watershed models and limits of the LSA. Days with flow reductions greater than 10% were predicted at the North Driftwood River watershed model outlet (ND1) for the operations phase 2 (Year 17), where the outlet is located ~24.1 km downstream of the most downstream subwatershed with impacts to its drainage area (ND5). Of the days predicted in Year 17 below the 10% threshold for reductions at ND1, none were below the environmental flow values (Table 15.5).

Days with a flow increase greater than 10% were predicted in the Jocko Creek watershed for the outlet of the watershed model, for the operations phase 2, which was assessed at Year 17. The flow increases were not associated with an increased Q_{100} flood flow rate and are due to increased groundwater seepage from the TMF. The predicted increases were associated with a maximum flow rate of less than 0.9 m^3/s, which would be considered a low flow condition and not associated with increase scour or erosion in the channel. The other mine life phases assessed did not have flow increases greater than 10% from the baseline values (Table 15.5).

At the model outlet of the West Buskegau River watershed model, flow increases greater than 10% were predicted. The maximum predicted flow associated with a daily flow increase greater than 10% were associated with low flow conditions and would not increase scour and erosion potential (Table 15.5). The estimated Q100 flood flows at WB1 are not predicted to exceed the baseline condition flood flow.

For the North Driftwood River at the watershed model outlet, ND1, daily flow increases greater than 10% from baseline condition flows were predicted (Table 15.5). The estimated Q_{100} flood flows at ND1 are not predicted to exceed the baseline condition flood flow and there would be no increase to scour and erosion potential in the channel.

In operations phase 2 when the TMF is receiving tailings, groundwater seepage rates to the Jocko Creek watershed are predicted to increase by up to 100% and, following TMF rehabilitation (Mine Year 23) and in operations phase 3, groundwater seepage decreases to be ±3% from baseline rates, which is within the range of natural variability. Hydrologic modeling for the West Buskegau River does not predict flow reductions greater than 10% for the operations phases even with decrease in seepage rates (operations phase 1 and 3) and increases in groundwater seepage rates (operations phase 2) are not associated with increases in Q100 flood flow rates. The North Driftwood River headwater lakes are predicted to have an increase in groundwater seepage during operations phase 2 and no change from baseline in operations phase 3 with the increases associated with no increase in Q_{100} flood flows. The Unnamed Lake (West Stockpile) is predicted to have a decrease in groundwater seepage rate equating to an approximate decrease in water level of approximately 0.02 m for operations phase 2 and 3, which is within the expected natural variability of the waterbody. The North Driftwood River main channel is predicted to have a decrease in groundwater seepage with the hydrologic model not predicting reductions in flow at the downstream watershed model outlet.

15.4.2.3.3 Passive Closure

Days with a flow reduction greater than 10% were not predicted in the Jocko Creek, West Buskegau River, or North Driftwood River watersheds for the outlet of the respective watershed models and limits of the LSA (Table 15.5).

Days with a flow increase greater than 10% were not predicted in the Jocko Creek or West Buskegau River watershed for the outlet of the respective watershed model limits. For the North Driftwood River at the watershed model outlet, ND1, daily flow increases greater than 10% from baseline condition flows were predicted (Table 15.5). The estimated Q_{100} flood flows at ND1 are not predicted to exceed the baseline condition flood flow and there would be no increase to scour and erosion potential in the channel.

The Jocko Creek main channel and two waterbodies within the watershed are predicted to have ±3% changes in groundwater seepage rates from baseline, which are within the expected natural variability of the systems. Groundwater seepage in the West Buskegau River main channel in the passive closure phase is predicted to decrease with the hydrologic model not predicting flow decreases below the 10% threshold. During passive closure, the North Driftwood River headwater lakes groundwater seepage rates are expected to be similar to baseline. The Unnamed Lake (West Stockpile) is predicted to have a decrease in groundwater seepage rate equating to an approximate decrease in water level of approximately 0.02 m for passive closure, which is within the expected natural variability of the waterbody. The North Driftwood River main channel is predicted to have a decrease in groundwater seepage with the hydrologic model not predicting reductions in flow at the downstream watershed model outlet.

15.4.2.3.4 Pit Full

Days with a flow reduction greater than 10% were not predicted in the Jocko Creek, West Buskegau River, or North Driftwood River watersheds for the outlet of the respective watershed models and limits of the LSA (Table 15.5).

Days with a flow increase greater than 10% were not predicted in the Jocko Creek or West Buskegau River watershed for the outlet of the respective watershed model limits. For the North Driftwood River at the watershed model outlet, ND1, daily flow increases greater than 10% from baseline condition flows were predicted (Table 15.5). The estimated Q_{100} flood flows at ND1 are not predicted to exceed the baseline condition flood flow and there would be no increase to scour and erosion potential in the channel.

When the open pit is full, the Jocko Creek main channel and two waterbodies within the watershed are predicted to have an increase in groundwater seepage rates of up to 10% from baseline. Within the West Buskegau River main channel, the groundwater seepage rate is estimated to increase with the hydrologic model not predicting exceedances of the 10% threshold for the increase in flow and the corresponding Q_{100} flood flow rate. The groundwater seepage rate in the North Driftwood River headwater lakes and Unnamed Lake (West Stockpile) are predicted to have increases from baseline. The North Driftwood

River main channel is predicted to have a decrease in groundwater discharge rates with the hydrologic model not predicting a decrease in flow at the watershed model outlet below the 10% threshold.

The LSA is expected to completely accommodate changes in surface water quantity for all mine life phases. For the Jocko Creek, West Buskegau River, and North Driftwood River watersheds days with decreases to flow in exceedance of 10% that fall below environmental thresholds are not predicted at the respective downstream boundary of the LSA. Offsetting is being developed for loss of fish habitat in consideration of the environmental effects of construction and operations. This offsetting will potentially provide mitigation for local predicted decreases in flow upstream of the LSA boundary in the Jocko Creek, West Buskegau River, and North Driftwood River watersheds, if required. The offsetting plan for fish and fish habitat and identified loss of fish habitat is discussed in Chapter 17 of the Impact Statement (Assessment of Potential Effects on Fish and Fish Habitat).

Table 15.5 Summary of Instantaneous Flow Changes for the Project in Jocko Creek, West Buskegau River and North Driftwood River at Watershed Model Outlets

Mine Life Phase	Exceedance Threshold	Jocko Creek (JC_DS) No. of Days	West Buskegau River (WB_1) No. of Days	North Driftwood River (ND_1) No. of Days
Construction (Modelled Years -3 to -1 – Year -1)	+10% Reduction Days	NA	0	0
	+10% Reduction & Below Environmental Flow Days	NA	0	0
	+10% Increase Days	NA	106	91
	Q_{100} Flood Flow Increase	NA	**No**	**No**
Operations Phase 1 (Modelled Years 1 to 4 – Year 2)	+10% Reduction Days	NA	0	0
	+10% Reduction & Below Environmental Flow Days	NA	0	0
	+10% Increase Days	NA	88	119
	Q_{100} Flood Flow Increase	NA	**No**	**No**
Operations Phase 1 and 2 (Modelled Years 4 to 18 – Year 17)	+10% Reduction Days	0	0	20
	+10% Reduction & Below Environmental Flow Days	0	0	**0**
	+10% Increase Days	112	151	203
	Q_{100} Flood Flow Increase	**No**	**No**	**No**
Operations Phase 2 (Modelled Years 18 to 30 – Year 23)	+10% Reduction Days	0	0	0
	+10% Reduction & Below Environmental Flow Days	0	0	0
	+10% Increase Days	0	145	136
	Q_{100} Flood Flow Increase	**No**	**No**	**No**

Mine Life Phase	Exceedance Threshold	Jocko Creek (JC_DS) No. of Days	West Buskegau River (WB_1) No. of Days	North Driftwood River (ND_1) No. of Days
Operations Phase 3 (Modelled Years 30 to 41 – Year 35)	+10% Reduction Days	-	0	0
	+10% Reduction & Below Environmental Flow Days	-	0	0
	+10% Increase Days	-	3	74
	Q_{100} Flood Flow Increase	-	**No**	**No**
End of Operations (Modelled Year 41)	+10% Reduction Days	-	0	0
	+10% Reduction & Below Environmental Flow Days	-	0	0
	+10% Increase Days	-	0	61
	Q_{100} Flood Flow Increase	-	**No**	**No**
Passive Closure (Modelled Year 46 onward – Year 47)	+10% Reduction Days	-	0	0
	+10% Reduction & Below Environmental Flow Days	-	0	0
	+10% Increase Days	-	0	29
	Q_{100} Flood Flow Increase	-	**No**	**No**
Pit Filled	+10% Reduction Days	-	0	0
	+10% Reduction & Below Environmental Flow Days	-	0	0
	+10% Increase Days	-	0	29
	Q_{100} Flood Flow Increase	-	**No**	**No**

15.4.3 Change to Surface Water Quality

15.4.3.1 Project Pathways

During construction, in the absence of mitigation, the Project activities identified in Table 15.4 have the potential to affect surface water quality through erosion and sedimentation and contact water. In terms of erosion and sedimentation, site preparation and ground disturbance, including clearing and grubbing for the processing facilities, Impoundment Facility, ore crusher facility, TMF, ore stockpiles, erosion and sedimentation control features, water management facilities for contact water including collection ditches and ponds, and site roads can increase runoff, which can convey sediment (as TSS) to receiving waters. Contact water has the potential to affect surface water quality as ground disturbance during construction will expose loose soil and rock to precipitation and runoff. Runoff will be discharged to temporary ditching and ponds and ultimately to the receiving environment (West Buskegau River and North Driftwood River). Additionally, blasting activities during construction have the potential to affect water quality due to blasting residuals.

During operations, in the absence of mitigation, the Project activities identified in Table 15.4 have the potential to affect surface water quality through the following mechanisms:

- Erosion and sedimentation
  - waste rock and ore handling, which increase TSS loading from disturbed and unstabilized ground surfaces and active work zones
  - progressive rehabilitation of the Impoundment Facility, collection ponds, and other disturbed areas with installation of a soil cover and vegetation, to reduce surface erosion; however, during the installation and vegetation stabilization, there is a potential for increased erosion
- Contact water
  - surface water and inflows within the Open Pit that may be affected by geochemical reactions (ML/ARD) within the Open Pit walls and rubble on benches
  - groundwater originating from ore Stockpiles and rock impoundment that does not report to the Open Pit or is not captured by the contact water management infrastructure could discharge into surface water receptors (i.e., Jocko Creek, West Buskegau River and North Driftwood River)
  - use of explosives for the Open Pit, resulting in residual nitrogen (nitrate, nitrite, and ammonia) from incomplete combustion of explosives materials in the rock impoundment and TMF, and therefore in contact water from the waste rock piles and TMF
  - the Project will divert the North Driftwood River. Flooding of wetlands and organic soil riparian areas releases mercury which may cause an increase in the receiving environment through processes such as methylation. The channel realignment will potentially flood organic soils within the main channel.
  - lowering of groundwater levels due to dewatering the Open Pit will result in a change in groundwater quality by introducing unsaturated zones in the groundwater zone of influence. Groundwater from beneath the rock impoundment will be redirected to the open pit where it will be collected during dewatering and treated prior to discharge. This results in a reduction in loading from groundwater to some local surface water features and an increase to others, and therefore a potential change in surface water quality for watercourses receiving a change in groundwater flow.
  - discharge of treated effluent to the North Driftwood River and West Buskegau River

During decommissioning and closure, in the absence of mitigation, the Project activities identified in Table 15.4 have the potential to affect surface water quality through the following pathways:

- Erosion and sedimentation
  - removal of Project infrastructure and buildings could generate increases in suspended sediment in runoff
  - rehabilitation of disturbed areas, including ore stockpiles, with supplemental soils and vegetation to reduce soil erosion may increase erosion prior to vegetation establishment.

  - maintenance and use of site access roads to reach monitoring locations may cause erosion into adjacent watercourses
- Contact water
  - the Open Pit will be allowed to fill naturally from incidental precipitation and groundwater inflows, as well as directing runoff from upgradient portions of Project watersheds. The pit lake will be filled to allow for development of a stratified pit lake and eventual discharge to the North Driftwood River and West Buskegau River.
  - the amount of contact water seepage emanating from Project infrastructure will be reduced as the Open Pit are filled and groundwater flow directions return to conditions similar to baseline. Additionally, the rock impoundment will be capped with soil covers and the amount of precipitation able to infiltrate and become contact water seepage will be reduced.
  - once the Open Pit lake is filled, the contact water collection ponds will be decommissioned and water will be discharged naturally overland to the environment
  - when the Open Pit lake is filled, the seepage from the TMF, filled pit, and rock impoundment will enter surface watercourses and waterbodies
  - when mine infrastructure is decommissioned, the water management infrastructure downstream will be decommissioned once water quality is determined to comply with regulatory requirements. This will allow drainage patterns to return to baseline conditions to the extent possible. Some watersheds will not return to baseline as a result of permanent mine infrastructure landscape alterations.

15.4.3.2 Mitigation and Enhancement Measures

The following mitigation measures have been incorporated into the design of the Project and/or are proposed to avoid or reduce Project-related effects on surface water quality:

- Canada Nickel will limit the Project footprint (i.e., Project Area) and disturbed areas to the extent possible.
- Canada Nickel will routinely monitor construction areas to identify areas of potential erosion and apply appropriate erosion and sedimentation control measures in accordance with the Erosion and Sediment Control Plan.
- Canada Nickel will maintain haul roads, site roads, and access roads in good condition to reduce erosion, improve water flow and manage vegetation growth within the ditches.
- Canada Nickel will develop and implement a Site-Wide Water Management Plan (Appendix J of the Impact Statement). This system will be designed to manage the 100-year return period, 24-hour duration storm event through the use of collection ponds and the Open Pit.
- Canada Nickel will recycle contact water for use onsite (e.g., dust suppression, makeup water in the Process Plant), where practical.
- Canada Nickel will collect runoff and groundwater inflows from the Open Pit and pump water to sedimentation ponds prior to being discharged to the receiving environment.

- Canada Nickel will design the seepage collection ditches to intercept shallow groundwater seepage from the Tailings Management Facility, ore Stockpiles and Impoundment Facility.
- Canada Nickel will design contact water collection and sedimentation ponds (Collection Pond 1, Collection Pond 2, Collection Pond 3, Tailings Management Facility Northwest Collection Pond, and Tailings Management Facility Northeast Collection Pond) to provide onsite storage of local runoff with the size and residence times necessary to promote sediment removal.
- Canada Nickel will treat water effluents prior to discharge to the receiving environment, as required, to meet regulatory criteria including an Environmental Compliance Approval issued by the Ministry of the Environment, Conservation and Parks (MECP) as well as criteria developed through the receiving watercourse Assimilative Capacity Study (Appendix G of the Surface Water Resources Assessment [Appendix C.5 of the Impact Statement]), in addition to the Metal and Diamond Mining Effluent Regulations (MDMER).
- Canada Nickel will implement water treatment through use of a water treatment plant to receive discharge from the TMF, collection ponds and will use proven processes to treat the water to meet regulatory effluent criteria prior to discharge to the environment.
- Canada Nickel will develop and implement a Metal Leaching and Acid Rock Drainage Management Plan to reduce and limit the known and potential risks of ML/ARD associated with the Project, thereby reducing potential effects to water quality.

15.4.3.3 Project Residual Effects

Residual Project effects, following the incorporation of mitigation measures described in Section 15.4.3.2, are described in the following sections for the construction, operations, passive closure, and pit full phases of the Project. Residual effects for construction and operations were considered together as changes to water quality are anticipated to be limited through construction and largest changes captured during the operations phase.

15.4.3.3.1 Construction and Operations

Erosion and Sedimentation

- Erosion and sedimentation have the potential to alter surface water quality from the initiation of earthworks related to site preparation during construction through the end of operations. The Site-Wide Water Management Plan (Appendix J of the Impact Statement) provides details on the planned use of collection ponds to receive and treat contact water prior to discharging to FDPs.
- Project Infrastructure and ground disturbance activities will take place upstream of a collection pond which will treatment before discharge to the receiving environment.
- Collection Pond 1 and Collection Pond 3 will be constructed early and progressively as upstream mine infrastructure is constructed and will be initiated so they are functioning during construction activities to the extent possible.

- During operations phase 2, Collection Pond 2 will be constructed early and progressively as upstream mine infrastructure is constructed and will be initiated so they are functioning during construction activities to the extent possible.
- The system overall has been sized to convey the 100-year return period, 24-hour duration storm event without any untreated water being discharged to the environment.
- Ponds are designed with adequate residence time to treat the expected TSS loads resulting from a 1:10 annual exceedance probability, attenuate flows up to the 1:100 year storm event with diversion of flows to the Open Pit that are above the 1:10 year storm event, and to safely release flows to the environment resulting from a 1:200 year storm event. Details regarding proposed pond sizes and expected TSS treatment potential are provided in the Site-Wide Water Management Plan (Appendix J of the Impact Statement).
- Non-contact water will be diverted from mine infrastructure to reduce the load entering collection ponds

Contact Water

As described in the Site-Wide Water Management Plan (Appendix J of the Impact Statement), contact water will be diverted to collection ponds and subsequently routed through water treatment plants prior to being discharged at an FDP. The water quality in the receiving environment is dependent on both the water quality and quantity of the effluent, and the background water quality and quantity expected to be in the receiver (baseline). The receiving water assessment was run for a conservative regulatory scenario (high effluent concentrations [maximum water quality model results or daily treatment objective], maximum FDP discharge rates, climate change adjusted low flow rate in receiver [7Q20] and poor water quality [75th percentile local baseline]) and a normal operating scenario (average effluent concentrations [average water quality model results or target treatment objective], average FDP discharge rates, climate change adjusted mean annual flow rate in receiver and average water quality [local baseline]).

As the FDPs drain to one of two ultimate receivers (West Buskegau River or North Driftwood River), a mixing zone assessment of these receivers was completed using CORMIX and a water quality mass balance. The Surface Water Resources Assessment (Appendix C.5 of the Impact Statement) and Assimilative Capacity Study (Appendix C to the Surface Water Resources Assessment [Appendix C.5 of the Impact Statement]) provides further details on the mass balance and CORMIX modelling results.

Generally, for both the regulatory and the normal operating scenarios, full mixing of effluent with the receiver is seen approximately 200 m to 1.2 km downstream of the FDPs. Mixing rapidly improves once other tributaries enter the main stem of these river reaches. The four FDPs and mixing zones are discussed in detail below, listed in order of upstream to downstream for the West Buskegau River (FDP-03 and FDP-01) and North Driftwood River (FDP-TMF and FDP-02).

FDP-SP-03

FDP-SP-03 will receive contact water from Collection Pond 3. The near-field mixing assessment for the West Buskegau River FDP-SP-03 accounting from PA associated groundwater seepage to the receiver predicted the point of full mixing was achieved within 23 m downstream of the FDP for the normal condition and 199 m downstream of the FDP for the regulatory condition. FDP-SP-01 enters the West Buskegau River downstream of FDP-SP-03 therefore the full extent of the mixing zone is extended to the edge of the mixing zone for the combined FDP-SP-03 and FDP-SP-01. For the regulatory condition, the full extent of the mixing zone on the West Buskegau River was predicted to be downstream of the confluence with the Frederick House River (40.2 km downstream of the most downstream FDP [SP-01]) for the parameters nitrite, total aluminum, and the Policy 2 parameters (total iron and total phosphorus). For the normal condition, the full extent of the mixing zone on the West Buskegau River was predicted to be 0.166 km downstream of FDP-SP-01 and defined by nitrate and a number of other parameters at the point of full mixing.

FDP-SP-01

FDP-SP-01 will receive contact water from Collection Pond 1. The near-field mixing assessment for the West Buskegau River FDP- SP-01 accounting from PA associated groundwater seepage to the receiver predicted the point of full mixing was achieved within 30 m downstream of the FDP for the normal condition and 166 m downstream of the FDP for the regulatory condition. As mentioned above, for the regulatory condition, the full extent of the mixing zone on the West Buskegau River was predicted to be downstream of the confluence with the Frederick House River (40.2 km downstream of FDP-SP-01) for the parameters nitrite, total aluminum, and the Policy 2 parameters (total iron and total phosphorus). As per the FDP-SP-03 summary, the normal condition full extent of the mixing zone is 0.166 km downstream of FDP-SP-01.

FDP-TMF-SP

FDP-SP-TMF will receive contact water from the TMF-NW and the TMF-NE Collection Ponds. The near-field mixing assessment for the North Driftwood River FDP- SP-TMF accounting from PA associated groundwater seepage to the receiver predicted the point of full mixing was achieved within 30 m downstream of the FDP for both the normal and regulatory conditions. FDP-SP-02 enters the North Driftwood River downstream of FDP-TMF-SP therefore the full extent of the mixing zone is extended to the edge of the mixing zone for the combined FDP-TMF-SP and FDP-SP-02. The regulatory condition assimilative capacity assessment predicted the full extent of the mixing zone to be downstream of the confluence with the Abitibi River (87 km downstream of the FDP-SP-02). The full extent of the mixing zone for the normal condition was predicted to be 3.6 km downstream of FDP-SP-02 for the parameter nitrate with other PoPCs being below regulatory objective/guideline values closer to or at FDP-SP-02.

FDP-SP-02

FDP-SP-02 will receive contact water from Collection Pond 2 and discharges to the North Driftwood River. The near-field mixing assessment for the North Driftwood River FDP- SP-02 accounting from PA associated groundwater seepage to the receiver predicted the point of full mixing was achieved within 30 m downstream of the FDP for the normal condition and 185 m downstream of the FDP for the regulatory condition. The regulatory condition assimilative capacity assessment predicted the full extent of the mixing zone to be downstream of the confluence with the Abitibi River (87 km downstream of the FDP). The full extent of the mixing zone for the normal condition was predicted to be 3.6 km downstream of FDP-SP-02 for the parameter nitrate with other PoPCs being below regulatory objective/guideline values closer to or at the FDP.

Jocko Creek

The assimilative capacity assessment of PA associated groundwater seepage into the Jocko Creek channel and its waterbodies predicted no increases in PoPC parameters above the regulatory objective/guidelines (PWQO or CCME CWQG-FAL value and no increase in Policy 2 parameter receiver concentration) for the regulatory and normal conditions.

Effluent Criteria

Based on the assimilative capacity assessment, the recommended effluent criteria are presented in Table 15.6, which includes effluent limits/objectives for PoPCs as well as maximum monthly discharge from FDPs in the PA.

Table 15.6 Recommended Effluent Criteria

Parameter	MDMER		Regulatory Guidelines in the Receiving Environment (mg/L) *	Target Effluent Objective (mg/L)	Monthly Mean Limit	Target Daily Maximum (mg/L)
	Maximum Authorized Monthly Mean Concentration (mg/L)	Maximum Authorized Concentration in a Grab Sample (mg/L)				
Nitrite (as N)	-	-	0.06*	0.5	0.75	1
Nitrate (as N)	-	-	3*	6	10	12
Ammonia (un-ionized) (as N)	1	0.5	0.0165*	- B	- B	- B
Fluoride	-	-	0.12*	0.18	0.24	0.36
Aluminum (Total)	-	-	0.1*	0.12	0.15	0.225
Aluminum (Dissolved)	-	-	0.075	0.018	0.023	0.034
Arsenic (Total)	0.1	0.2	0.005	0.0075	0.01	0.015
Boron (Total)	-	-	0.2	0.3	0.4	0.6
Cobalt (Total)	-	-	0.0009	0.0018	0.0027	0.0036
Chromium III	-	-	0.0089	0.013	0.018	0.027
Chromium VI	-	-	0.001	0.0015	0.002	0.003
Copper (Total)	0.1	0.2	0.005	0.0075	0.01	0.015
Iron (Total)	-	-	0.3	0.5	0.6	0.9
Nickel (Total)	0.25	0.5	0.025	0.0375	0.05	0.075
Selenium (Total)	-	-	0.001*	0.001	0.002	0.003
Uranium (Total)	-	-	0.005	0.0075	0.01	0.015
Vanadium (Total)	-	-	0.006	0.01	0.012	0.018
Zinc (Total)	0.4	0.8	0.02	0.03	0.04	0.06
Zinc (Dissolved)	-	-	0.075-0.079*,A	0.03	0.04	0.06
Phosphorus	-	-	0.03	0.05	0.06	0.09

Parameter	MDMER		Regulatory Guidelines in the Receiving Environment (mg/L) *	Target Effluent Objective (mg/L)	Monthly Mean Limit	Target Daily Maximum (mg/L)
	Maximum Authorized Monthly Mean Concentration (mg/L)	Maximum Authorized Concentration in a Grab Sample (mg/L)				
Suspended Solids	15	30	Note*,[C]	-	15	30
Maximum Discharge from Management Ponds:						
FDP			Maximum Discharge (m^3/d)		Receiving Water	
FDP-SP-03			10,000		West Buskegau River	
FDP-SP-01			28,000			
FDP-TMF-SP			56,000		North Driftwood River	
FDP-SP-02			28,000			

Notes:

PWQO or CWQG-FAL when PWQO is not available (the latter is shown with *)

A. Varies across receivers based on pH, hardness, and dissolved organic carbon concentration
B. Not a PoPC in the effluent. It is included in the list of PoPCs because it is a PoPC based on seepage quality, but untreated FDP discharge quality is not expected to exceed PWQO and/or CWQG-FAL values.
C. Clear flow: Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).

Due to the presence of chrysotile in the orebody, an assessment of baseline asbestos fibre concentrations was conducted. Health Canada does not have a quantitative water quality guideline for asbestos fibres, and there is no PWQO or CCME CWQG-FAL for asbestos fibres. The United States Environmental Protection Agency (US EPA) water quality criteria for human health for the consumption of water is 7 million fibres/L (MFL) (US EPA 2024). Local water quality baseline results reported chrysotile asbestos samples were collected in December 2023 at 12 watercourse monitoring locations and one waterbody location. The water samples were analyzed for determination of asbestos structures of lengths ≥0.5 µm and >10 µm. The samples analyzed were below the RDL of 0.20 MFL at the 12 watercourse locations. The waterbody location sampled, Martin Lake (MARLK), had a detected fibre ≥0.5 µm with a concentration of 0.51 MFL which falls below the US EPA standard of 7 MFL.

Baseline local surface water asbestos fibre (chrysotile) concentrations were typically below the laboratory RDL and the single result slightly above detection was below US EPA human health water quality criteria (2024). Chrysotile is not expected to be produced by the Project in surface water discharges at concentrations identifying it as a PoPC.

Water Temperature & Dissolved Oxygen

Water temperatures and dissolved oxygen concentrations in receivers (Jocko Creek, the West Buskegau River and North Driftwood River) are not expected to change due to Project activities with planned water management system mitigation measures (e.g., bottom draw pump intakes from sedimentation ponds, aeration within treatment plants and discharge channels).

Eutrophication

Phosphorus is typically the limiting nutrient in freshwater environments with respect to productivity in aquatic ecosystems. The average TP concentrations in the West Buskegau River and North Driftwood Rivers are below the PWQO of 30 µg/L. The maximum average FDP TP discharge concentration and maximum average TP concentration at the point of complete mixing in the receiver in both the West Buskegau River and North Driftwood River are predicted to be below the PWQO value (Table 15.7). The PWQO of 30 µg/L was developed as a criteria value to prevent excessive plant growth in rivers and streams (MOEE 1994b).

Table 15.7 Average Condition Total Phosphorus Concentrations in Receiver, FDPs and Point of Complete Mixing

Watercourse	Watercourse Average Total Phosphorus Concentration (µg/L)	Final Discharge Point	Maximum Average FDP Total Phosphorus Concentration (µg/L) *	Maximum Point of Complete Mixing Total Phosphorus Concentration in Receiver (µg/L)
North Driftwood River	23	SP-TMF	29	26
		SP-02		
West Buskegau River	28	SP-03		28
		SP-01		

Notes:
* FDP discharge quality predicted maximum average raw water concentration in sedimentation ponds as it is lower than the treatment plant target objective

Nitrogen is transported from the Project to surface waterbodies and watercourses by atmospheric particulate deposition, and discharge via FDPs. The West Buskegau River average Total Inorganic Nitrogen (TIN) discharge via the FDPs is not expected to cause a substantial increase in eutrophication within the watercourse. The North Driftwood River average TIN discharge via FDPs would be expected to increase the potential for eutrophication in the watercourse segment from FDP-TMF-SP to up to 3.6 km downstream of FDP-SP-02.

Mercury

A parameter of concern raised during consultation was mercury methylation as a result of flooding of wetlands. Flooding of wetlands and organic soil riparian areas releases mercury, which can be up taken in primary producer microorganisms and then biomagnified in the food chain through each trophic level to fish which are consumed by people and wildlife. While mercury is not anticipated to increase as a result of mining operations, the potential exists for increased mercury in conjunction with the flooding of organic soils as part of the construction of the North Driftwood Diversion Channel.

An empirical loading assessment for methyl mercury for the main channel sections of the North Driftwood Diversion Channel alignment that intersect organic soils extending deeper than 140 cm below surface estimated potential concentration increases due to the North Driftwood Channel realignment ranging from 0.005 to 0.009 ng/L during the first year of inundation. The expected methyl mercury concentrations in the channel realignment accounting for the watercourse baseline concentration would be 0.105 ng/L and 0.109 ng/L, which represent a 9% increase in concentration. The predicted North Driftwood River methylmercury concentrations do not exceed the CWQG-FAL value of 4 nanograms per litre (ng/L), which is 37 times greater than the average predicted methyl mercury concentration attributable to the construction of the North Driftwood Diversion Channel. The net yield of methyl mercury would be expected to decline in subsequent years. The Project is not expected to flood additional upland areas or raise lake levels beyond the channel realignment area.

Predicted total mercury concentrations at the FDPs for the normal condition are approximately equal to the half detection limit value of 5 ng/L, which was applied to below detection limited source terms in the water quality model. The below detection source term mercury concentration values would be expected to be similar to total mercury average concentrations in the receivers, which range from 2.47 to 4.77 ng/L in the North Driftwood River and West Buskegau Rivers, respectively. As such, the total mercury concentrations in the North Driftwood River and West Buskegau Rivers downstream of the FDPs would be assumed to not increase due to Project discharges and would be below the CWQG-FAL value of 26 ng/L.

Acid Deposition

Deposition of sulphur and nitrogen compounds on waterbodies was assessed with respect to increase in lake acidity for the construction and operations phases on select waterbodies predicted to receive maximum deposition rates. The potential acid input loading rates from the Project and low acid sensitivity of the receivers predicts negligible changes to existing acidity in waterbodies outside the PA.

15.4.3.3.2 Decommissioning and Passive Closure

At the end of operations phase 2 and 3 (or earlier for some features), the main features requiring rehabilitation will include the open pit, water management infrastructure, the TMF, the Impoundment Facility, site roads, buildings, and associated infrastructure. The closure concept is to rehabilitate the pit by flooding to create a pit lake and to cover the Impoundment Facility and TMF with a vegetated soil cover, such that overland runoff will be non-contact and will no longer require treatment.

Erosion and Sedimentation

Erosion and sedimentation can alter surface water quality during the decommissioning and passive closure phase as rehabilitation activities occur. The water management infrastructure outlined in the Site-Wide Water Management Plan (Appendix J of the Impact Statement), will remain in place until upstream infrastructure has been decommissioned and rehabilitated at the Project site. Non-contact water will continue to be diverted from mine surface water infrastructure to reduce the load entering collection ponds, and mine surfaces rehabilitated with a vegetated soil cover will produce non-contact runoff.

Contact Water

Water infiltrating through and seeping from the rehabilitated piles and TMF will be considered contact water until monitoring has confirmed seepage quality meets applicable regulatory standards and/or baseline groundwater quality . Seepage quality is predicted to be substantially below MDMER criteria during passive closure. Seepage will be collected in ditches around the impoundment facility and TMF will be sent to collection ponds until upstream rehabilitation takes place and will only be removed once upstream works are complete. The removal of the seepage collection ditches will route seepage to natural groundwater flow paths downgradient to local surface water receivers. Seepage quality will be improved during downgradient migration via monitored natural attenuation.

During passive closure, the TMF and Impoundment Facility will be rehabilitated and reclaimed. The TMF Northwest Collection Pond will stop receiving dewatering discharge in Mine Year 30 and is naturalized with an overflow spillway installed.

15.4.3.3.3 Post-Closure and Pit Full

Erosion and Sedimentation

Erosion and sedimentation can alter surface water quality during the closure and pit full phases of mine life through the maintenance of mine monitoring infrastructure. Roads to access monitoring locations will be maintained to mitigate erosion and sedimentation.

Contact Water

During closure and pit full, seepage from the TMF and rock impoundment, and overflow from the pit lake will migrate toward the North Driftwood and West Buskegau Rivers. The GoldSim™ model predicted water quality of the seepage and overflow from the open pit and an assimilative capacity model was assessed for overflow discharge in the pit full scenario. During the pit-full life of mine phase, water quality in the pit lake was predicted to be below regulatory objective/guideline values for the regulatory and normal conditions and therefore there would be no mixing zone in the West Buskegau River and North Driftwood River receiving pit lake outflows.

15.4.4 Summary of Project Residual Effects

Table 15.8 summarizes Project residual effects on surface water.

Table 15.8 Project Residual Effects on Surface Water

Residual Effect	Residual Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Surface Water Quantity	C	A	M	LSA	NS	MT	IR	R
	O	A	M	LSA	NS	MT	IR	R
	D	N	L	LSA	NS	LT	C	R
Change to Surface Water Quality	C	A	L	LSA	NS	MT	IR	R
	O	A	M	LSA	NS	MT	IR	R
	D	N	L	LSA	NS	LT	C	R

KEY
See Table 15.3 for detailed definitions

Project Phase
C: Construction
O: Operations
D: Decommissioning

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LSA: Local Study Area
RSA: Regional Study Area

Timing
NS: No sensitivity
MS: Moderate sensitivity
HS: High sensitivity

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term

Frequency:
S: Single event
IR: Multiple Irregular event
R: Multiple Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

N/A: Not applicable

15.4.4.1 Summary of Adverse Residual Effects

The residual effects of the Project on surface water quantity will result in measurable decreases in flows as a result of Open Pit dewatering, centralized mine water management, sequestration of water into tailings pore spaces and other mine water uses. Days with decreases to flow in exceedance of 10% that fall below environmental thresholds are predicted locally for the Jocko Creek, West Buskegau River, and North Driftwood River watershed during construction and operations upstream of the LSA boundary. All flows within the North Driftwood River and West Buskegau River recover to within 10% of baseline flows at the LSA boundary. Natural seasonal variations in flow are not considered a Project-related effect. The North Driftwood River headwater lakes (Mel Lake, Sutherland Lake, Jack Lake, Gerry Lake, and Martin Lake), which are located within an esker hydrogeologic unit with good groundwater to surface water connectivity maintaining similar water levels across the lakes, and Unnamed Lake (West Stockpile) are predicted to have between 0.02 to 0.05 m water level reductions due to changes in groundwater seepage to the waterbodies, which is within the natural variability of the waterbody water levels. The predicted reductions are estimated to occur in the North Driftwood River headwater lakes during the construction phase, and for Unnamed Lake (West Stockpile) during the operations phases 2 and 3 and the passive closure phase. Two waterbodies in Jocko Creek are estimated to have small reductions in groundwater seepage (<5%) during the construction phase, would but be within the natural variability of the waterbody water levels. Groundwater seepage rate increases to Jocko Creek, the North Driftwood River and the West Buskegau River during different life of mine phases are predicted via hydrologic modeling to not increase Q_{100} flood flows. The residual effect of changes in surface water quantity on fish and fish habitat is discussed in Chapter 17 of the Impact Statement (Assessment of Potential Effects on Fish and Fish Habitat).

The predicted residual effects on surface water quality are not predicted to be substantial as effluent will comply with regulatory requirement limits/guidelines at the FDPs and no watershed management targets will be contravened. The LSA is expected to completely accommodate changes in surface water quality for all mine life phases. Local water quality immediately downstream of some FDPs (within the mixing zones) will experience increases of PoPCs above baseline levels and CWQG-FAL, however, these changes are expected to be contained within the boundaries of the LSA and to be dissipated at the edge of the mixing zone.

Offsetting is being developed for loss of fish habitat in consideration of the environmental effects of construction and operations Project activities. This offsetting is potential mitigation for local predicted decreases in flow upstream of the LSA boundary in the Jocko Creek, West Buskegau River, and North Driftwood River watersheds, as well as impacts to water quality due to the losses of fish habitat, if required. The offsetting plan for fish and fish habitat and identified loss of fish habitat is discussed in Chapter 17 of the Impact Statement (Assessment of Potential Effects on Fish and Fish Habitat); the Conceptual Fish Habitat Offsetting Plan is provided as Appendix M to the Impact Statement.

A monitoring program as outlined in Section 15.8 will be implemented to confirm the predictions of the effects of the Project on surface water quantity and quality.

15.5 Potential Effects on Federal Lands

There are no federal lands within the LSA or RSA. The closest Federal lands are the Taykwa Tagamou Nation Reserve lands located approximately 37 km away (straight line) from the PA (14 km southeast of Cochrane). No additional mitigation measures beyond those identified are specifically required for federal lands.

15.6 Prediction Confidence

15.6.1 Change in Surface Water Quantity

The level of confidence in the assessment of residual environmental effects on surface water quantity is high. The predicted effects are common to mining operations and are well-understood. As discussed in Appendix C.5 (Surface Water Resources Assessment) of the Impact Statement, effects on surface water quantity were characterized by a credible worst-case of environmental effects. It is likely that environmental effects of the Project will be less than predicted as a result of the assumptions and conservatism applied in the assessment.

Flows and water levels under pre-development conditions were used as the baseline against which Project-related changes during the construction, operations, decommissioning, and closure phases were assessed. The effects were quantified using the HEC-HMS hydrological model setup with climate change adjusted meteorological inputs (air temperature, precipitation) at a daily scale to estimate baseline conditions from which Project change would be assessed. Potential effects on water quantity are addressed through standard and site-specific mitigation measures as discussed in Section 15.4.2.2. The models used for quantifying the results on surface water quantity are considered reliable.

15.6.2 Change in Surface Water Quality

The level of confidence in the assessment of residual environmental effects on surface water quality is high. The predicted effects are common to mining operations and are well-understood. As discussed in Appendix C.5 (Surface Water Resources Assessment) of the Impact Statement, effects on surface water quality were characterized conservatively, using credible, worst-case environmental effects. It is likely that environmental effects of the Project will be less than predicted as a result of the assumptions and conservatism applied in the assessment.

Effects on surface water quality were assessed with respect to sedimentation and treated process and contact water discharge. Potential effects on water quality were quantified through extensive field monitoring, and water quality modelling (CORMIX, mass balance, GoldSim™). The inputs of the water quality models were generated using conservative approaches from hydrogeological modelling, geochemical results, and surface water quality data collected from the baseline study. The CORMIX model predicted the water quality within the mixing zones under conservative conditions. The results predicted using mass balance modelling are conservative, as the model does not account for reduction in concentrations due to processes such as sedimentation, reduction/ oxidation reactions, absorption, and biodegradation. The models used for quantifying the results on surface water quality are considered reliable.

15.7 Assumptions

The following are the main assumptions made during the construction and calibration of surface water quality and quantity models used to predict the effects of the Project on surface water. Further details are presented in the Surface Water Resources Assessment (Appendix C.5 of the Impact Statement) and supporting baseline study (Appendix B.6 of the Impact Statement).

Environmental Water Balance

Groundwater watersheds are assumed to align with surface watersheds and all baseflow returns to a local watershed where infiltration occurred. For the purpose of the water balance calculations, it is assumed that runoff, evapotranspiration, and infiltration are negligible in months with average monthly temperatures below 0°C.

Hydrologic Model

The following assumptions apply to the development of the hydrologic model and interpretation of results:

- Ontario provincial land cover compilation and soils complex were adequate to define subwatershed characteristics, including the hydrologic Curve Number.
- The Porcupine River Hydrometric Data (HYDAT) station is the closest WSC regional flow station, with a total record from 1977-1995, and 2007-2014 and was selected for model calibration due to its available data, proximity to the PA watersheds (37 km SE), similar watershed size (408 km^2), and similar watershed characteristics.

Water Management Plan

The following assumptions apply to the Site-Wide Management Plan (Appendix J of the Impact Statement):

- As much water as possible will be decanted and reclaimed from tailings deposition. The remaining required water, including high quality water, will be taken from the Open Pit via dewatering operations. Make-up water from other sources, including the Impoundment Facility and Stockpile ponds is not anticipated to be required at this stage.
- It is estimated that Open Pit dewatering and water reclaimed from the tailings will be sufficient to supply the milling/processing operations through all seasons, including winter months.
- A five-year active closure period has been assumed for reclamation activities prior to fully decommissioning / closing water management structures.

- At the end of operations, tailings deposition into the Open Pit will stop; it is estimated that the top of the tailings will be approximately 150 m below the surface of the Main Zone of the Open Pit and 280 m below the surface of the East Zone of the Open Pit.
- From available soil samples collected at the site, clay (<5 µm) makes up 20 to 30% of each sample. Based on Stokes Law, the retention time for a 1 um particle size is estimated to be around 28 hrs. The pond will be sized to provide this for typical monthly inflows.
- Sedimentation pond discharges will be treated via a mine water treatment plant prior to discharge at an FDP.
- Climate change adaptation for water management infrastructure sizing is for the 2071-2100 Shared Socioeconomic Pathway (SSP) 2-4.5 emissions scenario.

Water Balance Model

The following assumptions apply to the development of the water balance model and interpretation of results:

- Reclaimed slurry water within the tailings (bleed water) is not included within the water balance. This water is considered within the process mass balance and is assumed to be reclaimed.
- The difference between reclaimable water and the process plant requirements is assumed to be supplied through pit dewatering and precipitation runoff from the TMF.
- Daily time-step model was setup with monthly and daily climate data for average conditions over the anticipated life of mine.
- During rehabilitation of the Impoundment Facility and TMF, cover material will be placed and slopes contoured to increase infiltration.

Water Quality Model

The following assumptions apply to the development of the water quality model and interpretation of results:

- Mixing occurs instantaneously and mass is conserved within the model.
- No segregation of material with elevated metal leaching is incorporated into the sources terms and is evenly distributed.
- The impoundment facility is composed of waste rock for source term calculations.
- Humidity cell leachate concentrations used for source terms that are below the method detection limit are assumed to be 0.5x the detection limit value.
- Waste rock and tailings within a given facility are contacted by water in similar conditions to humidity cell tests.

- Chromium is the species VI in metallurgical and tailings supernatant.
- Nitrogen compounds are transferred to process water during milling of the ore.
- The nitrogen compound loads in ore are representative of those in waste rock.
- The impoundment facility once capped in Year 30 will have no drainage with concentrations of N compounds.

Assimilative Capacity Study

The prediction of effects of effluent water quality entering the receiving environment is based on a mass balance model run under two operating scenarios. The regulatory operating condition scenario (derived from MECP Procedure B-1-5 [1994a]) assumes low receiver flow (7Q20), poor effluent water quality (maximum daily concentrations at FDPs after water treatment during the Project lifetime), maximum mine effluent flow rate, 75th percentile baseline water quality in the receiving watercourses, and seepage (basal) flow out of the mine contributing directly to local receiver flow. This represents a conservative scenario and does not fully account for increased assimilation realized due to biogeochemical reactions in the receiver and during periods of higher water levels/flow in the receivers. The normal condition scenario assumes mean annual flow with climate change, average FDP discharge rates, average effluent or target effluent objective quality, average receiver quality and average groundwater seepage quality and flow out of the mine contributing directly to local receiver flow. As with the regulatory condition, it is conservatively assumed that no biogeochemical reactions occur along the groundwater seepage path or in the receiver.

Predictions of changes to water quality did not account for the natural degradation of ammonia. Similarly, predicted seepage water quality at the receivers did not account for the attenuation processes that naturally occur as groundwater flows through the aquifer.

15.8 Follow-up and Monitoring

Canada Nickel will implement follow-up and monitoring programs to verify the accuracy of effects and to evaluate the effectiveness of mitigation measures, the results of which will be used to identify and implement adaptive management measures, as appropriate. As it relates to surface water quantity and quality, follow-up and monitoring measures will be implemented at key Project locations to verify and confirm the predicted effects identified and meet regulatory requirements related to surface water. The focus on monitoring activities will be at the FDP locations, as well as upstream and downstream locations. Chapter 34 of the Impact Statement includes additional details on follow-up and monitoring programs proposed by Canada Nickel.

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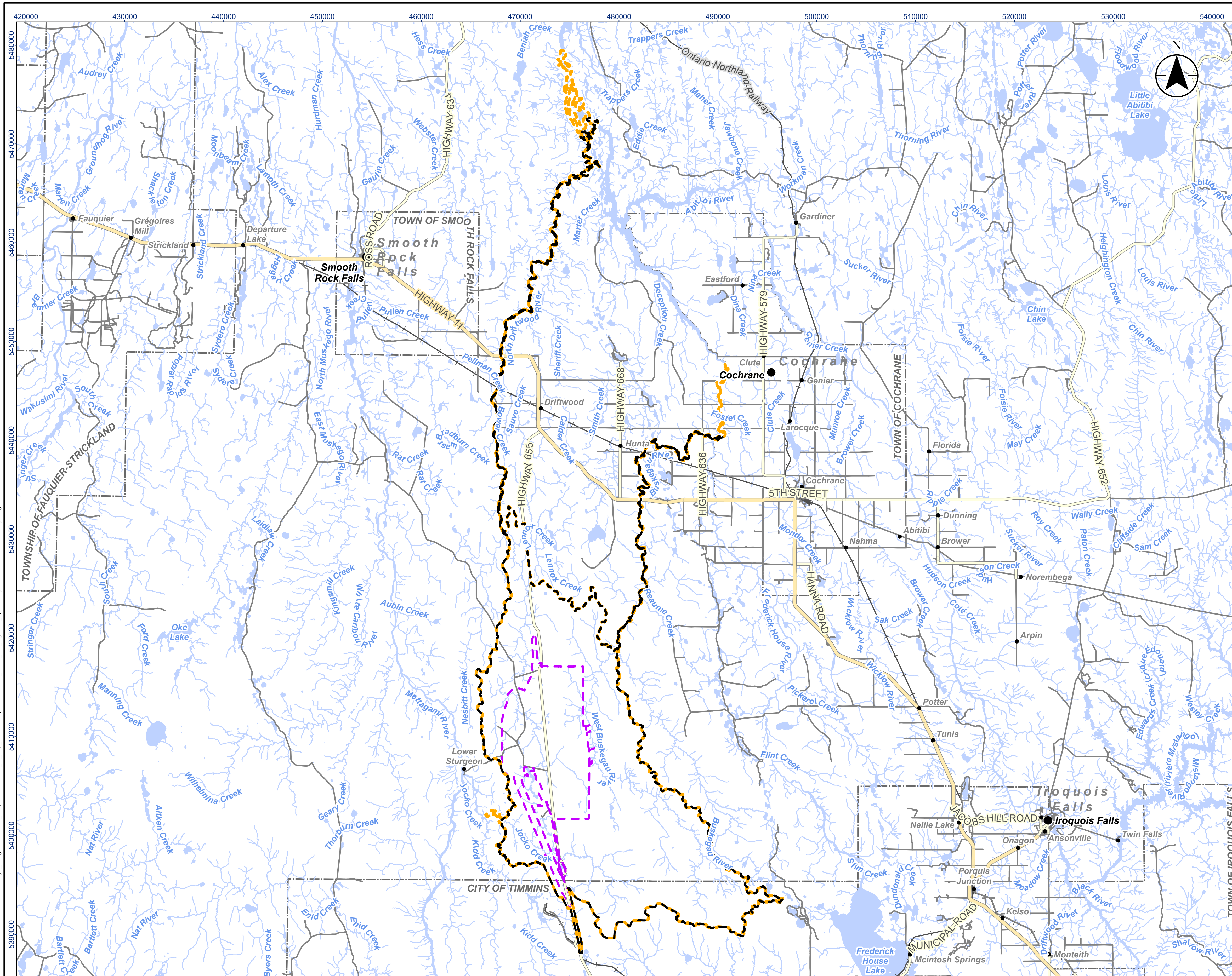
15.10 Figures



Stantec

CANADA NICKEL COMPANY

Legend

- Project Area
- Local Study Area
- Regional Study Area

Base Features

- Expressway / Highway
- Major Road
- Minor Road
- Railway
- Watercourse
- Municipal Boundary - Lower Tier
- Waterbody

0 5 10 km

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Notes

1. Coordinate System:NAD 1983 UTM Zone 17N
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Project Location 160930456 REVA

Timmins, Ontario Prepared by tcoghlan on 2024-09-27

Client/Project

Canada Nickel Company (CNC)

Crawford Nickel Project

Figure No.

15.1

Title

Local and Regional Study Area for Surface Water

Revised: 2024-09-27 By: tcoghlan

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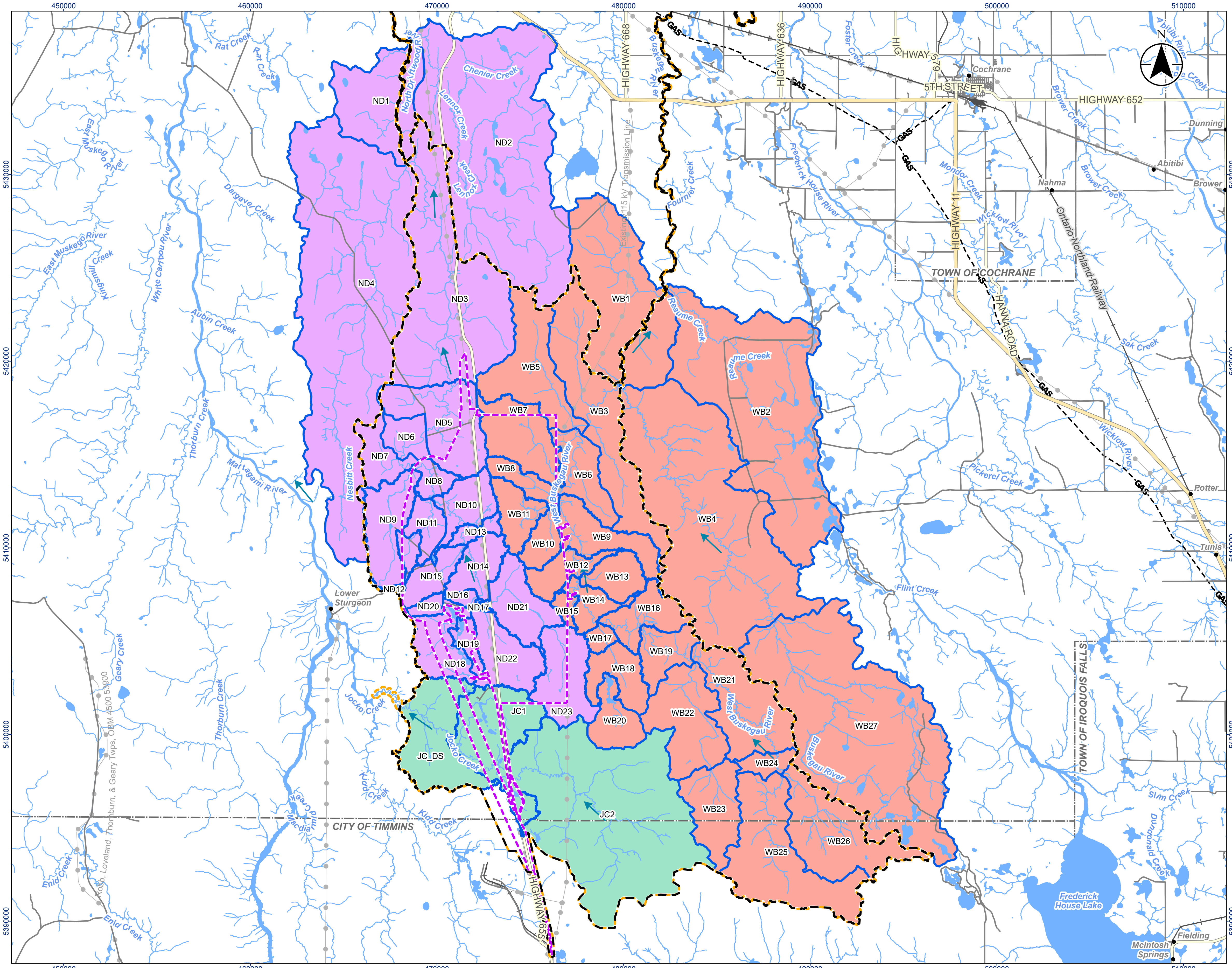

Stantec

CANADA NICKEL COMPANY

Legend

- Project Area
- Local Study Area
- Regional Study Area

Base Features

- Expressway / Highway
- Major Road
- Minor Road
- Railway
- Existing Transmission Line
- GAS Natural Gas Pipeline
- Watercourse
- Municipal Boundary - Lower Tier
- Waterbody
- Sub Watershed
- Jocko Creek Watershed
- North Driftwood River Watershed
- West Buskegau River Watershed
- Watercourse Flow Direction

0 5 10 km

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Project Location
Timmins, Ontario

160930456 REVA
Prepared by tcoghlan on 2024-09-27

Client/Project
Canada Nickel Company (CNC)
Crawford Nickel Project

Figure No.
15.2

Title
Project Area Existing Watersheds and Subwatersheds

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