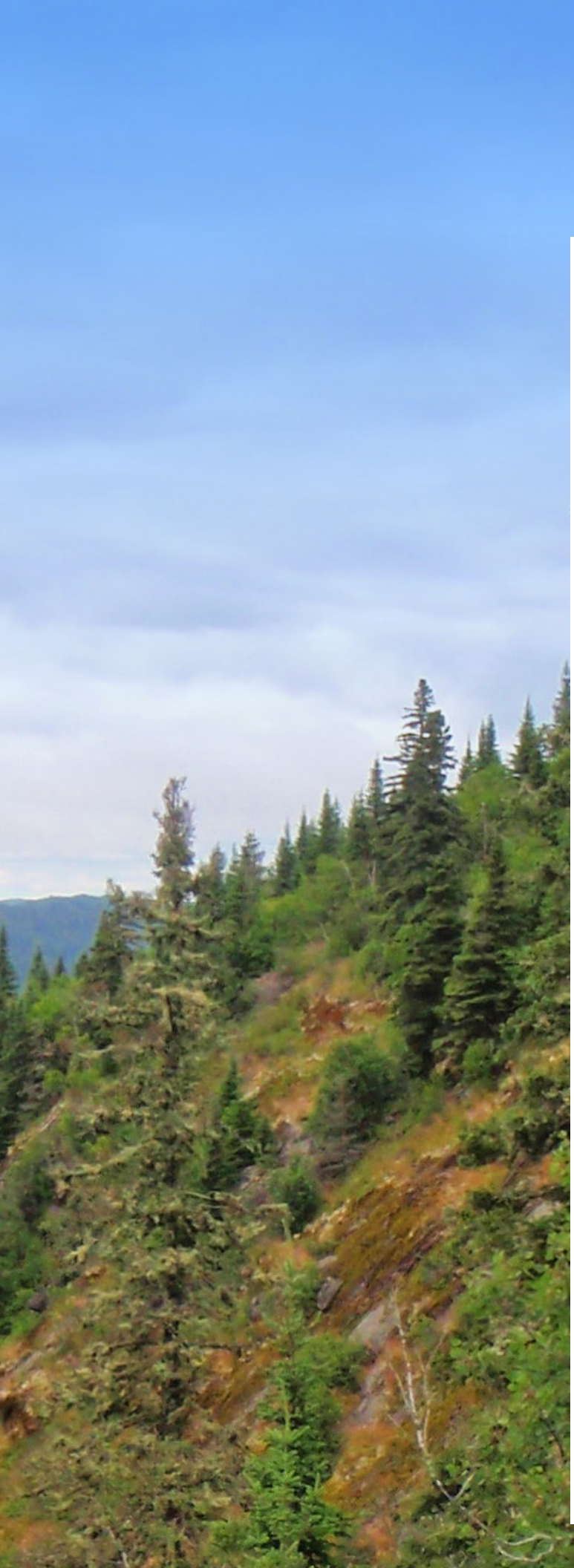

Marathon Palladium Project Environmental Impact Statement Addendum

VOLUME 2 OF 2

6.2.4 Fish and Fish Habitat

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Abbreviations

AIRs	additional Information requests
CIAR	Canadian Impact Assessment Registry
CoPCs	constituent of potential concern
CRA	commercial, recreational and aboriginal
CWQG-FAL	Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life
DFO	Fisheries and Oceans Canada
ECCC	Environment and Climate Change Canada
EEM	Environmental Effects Monitoring
ESA	*Endangered Species Act*
ESCP	Erosion and Sediment Control Plan
FMZ	Fisheries Management Zone
HADD	harmful alteration, disruption or destruction
IR	Information Request
LRIA	*Lakes and Rivers Improvement Act*
LSA	Local Study Area
MAF	Mean Annual Flow
MDMER	Metal and Diamond Mining Effluent Regulation
MECP	Ministry of Environment, Conservation and Parks
MMF	Mean Monthly Flows
MNR	Ministry of Natural Resources (now MNRF)

MNRF	Ministry of Natural Resources and Forestry
MRSA	Mine Rock Storage Area
OPSS	Ontario Provincial Standard Specifications
PPV	Peak particle velocity
PSMF	Process Solids Management Facility
PWQO	Ontario Provincial Water Quality Objectives
RSA	Regional Study Area
SARA	*Species at Risk Act*
SIR	Supplemental Information Requests
SPRP	Spill Prevention and Response Plan
SSA	Site Study Area
TLRU	Traditional Land Resource Use
VEC	Valued Ecosystem Component

6.2.4 Fish and Fish Habitat

6.2.4.1 Summary of Original Fish and Fish Habitat Assessment

6.2.4.1.1 Assessment of Residual Effects in Original EIS

Section 6.2.4 of the original EIS (2012) and subsequent responses to information requests from the Panel provided an assessment of the following effects to fish and fish habitat as result of the Project:

- Change in fish habitat resulting in Harmful alteration, disruption or destruction of fish habitat
- Change to recreational fisheries
- Change to commercial fisheries
- Change to indigenous fisheries

Additional information on the assessment of effects on fish and fish habitat was provided in responses to the following IRs and Supporting Information documents:

- Responses to IRs 13.1, 13.2.2 (CIAR #445), 13.3-13.5.6 (CIAR #409), 13.7-13.8 (CIAR #397)
- Response to SIR 5 (CIAR #582)
- Responses to AIRs 10 (CIAR #655), 11 (CIAR #656), 19 (CIAR #662)
- Response to additional agency information request dated April 24, 2013 (CIAR #417)

In 2012, fish habitat was referenced in terms of commercial, recreational and aboriginal (CRA) fisheries in accordance with the *Fisheries Act* in place at that time. Indicators associated with commercial fisheries included commercial bait fish operations and/or commercial food fish operations. Indicators associated with Aboriginal and recreational fisheries included fish species such as Lake Trout, Brook Trout, Northern Pike, Yellow Perch and migratory salmonids that may be exploited for Aboriginal and recreational purposes in the study area.

There are six primary subwatersheds that drain the Project site, four of which drain to the Pic River. Waterbodies and watercourses in the interior of the Project site include small streams, ponds and lakes, many of which are maintained by active or inactive beaver dams, or debris jams. The interior of the Project site is isolated from both the Pic River and Lake Superior by steep relief (i.e., topography) and therefore much of this area is fishless. In the instances where fish do occur the community is generally limited to small-bodied or forage fish.

The Pic River watershed tributaries in the immediate vicinity of the Project site afford limited nursery and potentially spawning habitats within their lowest reaches for migratory (e.g., Rainbow Trout, Chinook Salmon), as well as resident (e.g., Brook Trout, Slimy Sculpin) species. The fish community of the Pic River is diverse, with a variety of coolwater and coldwater fish species reported, including Lake Sturgeon and Walleye. Lake Sturgeon move extensively up and down the Pic River during spawning migration and

utilize the lower river for foraging. Lake Sturgeon have previously been identified as a species of importance in the Pic River by Indigenous groups, but not necessarily in the LSA. Lake Sturgeon are listed under the *Provincial Endangered Species Act* (ESA) and as such, are discussed in Section 6.2.8 of this EIS Addendum (Vol 2).

Lake Superior tributaries include the Bamoos Lake – Hare Lake corridor and the Stream 6 subwatershed. Bamoos Lake supports a diverse coldwater community, including Lake Trout, Brook Trout and Cisco. The Hare Lake fish community is comprised primarily of coolwater species, including Northern Pike and Yellow Perch. The Hare Lake outlet creek, below the Highway 17 crossing, supports a coldwater fish community and affords spawning and nursery habitats for both migratory and resident salmonids. Within its lowest reaches, below a cascade barrier, Stream 6 provides a limited amount of nursery habitat and some spawning habitat for coldwater migratory species from Lake Superior. The upper reaches of Stream 6 are largely fishless with some areas having Brook Stickleback.

Fish Habitat

The original Project design was expected to interact both directly and indirectly with fish and fish habitat during all Project phases.

The site preparation and construction phase was identified as resulting in the clearing of land, including existing aquatic habitat, to facilitate the development of Project-related infrastructure, such as the open pits, process solids management facility (PSMF), mine rock storage area (MRSA) and road network. This phase was assumed to account for the full measure of footprint related effects of the original Project, although some would likely not occur until early in the operations phase as site construction is completed. Direct footprint effects included the loss of aquatic habitat, with indirect effects being associated with the potential loss of flow in surface water features, through surface water diversion or management. Road crossing (culvert) installation at several locations was identified as directly effecting fish habitat or disrupting fish passage. Ground disturbance during this phase may result in erosion and subsequent sedimentation of surface waters, thereby reducing water quality and physical habitat for fish.

During the operation phase, the primary potential fisheries-related concern was surface water discharge from the site into local receiving waters. During operations excess water from the PSMF would be discharged to Hare Lake. MRSA drainage would ultimately report to the Pic River.

During the decommissioning and site closure phase natural surface water drainage patterns would be restored after mine closure to the extent possible.

Recreational Fishery

No recreational fishery was identified in the SSA. Recreational fisheries of potential relevance in the LSA were found in Bamoos Lake, Hare Lake and the lower reaches of its outlet creek, as well as in Lake Superior (near shore area) and the Pic River. A limited recreational fishery for Rainbow Trout (steelhead) was also identified in the lower reach of Stream 6, as a limited number of fish can migrate into the stream during high freshet flows. Reductions in flow to Stream 6 due to PSMF development were identified as a

potential harmful alteration, disruption or destruction (HADD) and needing to be compensated for via Fisheries and Oceans Canada (DFO) Fisheries Authorization. However, the limited fishery in the Stream 6 subwatershed does not contribute in a significant way to the fishery in Lake Superior. No recreational fishery was identified in the lower ends of the Streams 2 and 3 subwatersheds, and the contribution of these two stream reaches to the recreational fishery in the Pic River (i.e., limited nursery and potential spawning habitats for salmonids) is relatively low. The current and most convenient access to Bamoos Lake will be affected by the Project, yet continued access via alternate routes will still remain available (i.e., via Hare Lake).

Indigenous Fishery

Reported use for fishing by Indigenous peoples largely focused on Bamoos Lake, Hare Lake and the lower reaches of its outlet creek, as well as Lake Superior (near shore area) including the lower reaches of Stream 6 (Angler Creek) and the Pic River. Access to Bamoos Lake would be temporarily affected but the lake would continue to be accessible through a “trail” identified by Indigenous communities from Hare Lake to Bamoos Lake and by means other than the existing site access road, and specific arrangements to permit potential continued access for Indigenous peoples were to be arranged.

Commercial Fishery

There is no commercial food fishery in study area lakes, or in the near shore area of Lake Superior in the vicinity of the streams draining the Project site. A commercial bait fish license holder does collect forage fish periodically at a single location in the LSA (L19 or Claw Lake).

The original EIS predicted the following potential effects on the fish and fish habitat:

- the creation of a HADD equivalent to approximately 9.4 ha of potential fish habitat, of which 1.8 ha is fish frequented
- installation of culverts and stream crossings, in particular in the Stream 1 subwatershed which may disrupt fish habitat either directly or indirectly, through the potential to impairment of fish passage or water conveyance
- the potential mobilization of solids into local water courses in the vicinity of work areas

In addition, without mitigation there would be restricted access for a commercial bait fish license holder to a water body used from time-to-time as a bait fish source and temporary reduced access to a location (Bamoos Lake) used for recreational and Indigenous fishery purposes.

Key mitigation measures originally proposed to avoid, reduce and/or offset potential effects of the Project on fish and fish habitat include:

- Implementation of fish habitat compensation work in consultation with the DFO and other stakeholders. Compensation requirements under both Section 35(2) of the *Fisheries Act* and Section 27.1 of the former Metal Mining Effluent Regulations

- Culvert design, installation and maintenance would follow and conform to appropriate DFO and MNR operational statements, guidance and protocols. Important considerations include: sizing the culverts to ensure conveyance of water under high flow conditions; maintaining fish passage under low flow conditions; and embedding the culverts to allow the creation of natural substrates
- Implementing avoidance where possible or maintaining setbacks from sensitive features where necessary
- Providing for the collection of drainage from disturbed areas in channels and settling basins
- The restoration of disturbed areas as soon as is practical
- Continuation and/or provision of alternate means of access to the recreational and Indigenous fisheries associated with Bamoos Lake

6.2.4.1.2 Determination of Significance in Original EIS

For fish and fish habitat, the original EIS (2012) and relevant responses to information requests concluded that there would be no significant adverse effects, provided mitigation measures identified above, including fish habitat offsetting, were implemented.

6.2.4.2 Approach to Update the Assessment

The following subsections provide an update to the assessment of residual environmental effects of the Project, including a determination of their significance based on the following:

- Updated environmental conditions within the SSA, LSA and RSA, as appropriate
- Recognition of updated standards, criteria, guidelines, or other thresholds that inform the determination of significance
- Consideration and recognition of Project refinements, including changes to the Project components and activities, that may affect potential Project interactions, mitigation measures and residual effects

Any changes to the results of the previous assessment have been highlighted and discussed below, as appropriate. Supplementary rationale and explanation for the conclusions of the assessment have been provided based on the previous responses to the information requests (IRs, SIRs, AIRs) and additional input from the various technical discipline leads based on the current assessment.

6.2.4.3 Scope of the Assessment

6.2.4.3.1 Regulatory and Policy Setting

Fisheries Act

The Government of Canada is responsible for the management of fisheries resources in Canada through the *Fisheries Act*, as administered primarily by DFO with some provisions of the Act administered by Environment and Climate Change Canada (ECCC).

In 2015, the Government of Canada began the process of updating and modernizing the Fisheries Act. On June 21, 2019, Bill C-68 received Royal Assent and became law. On August 28th, 2019 provisions of the modernized *Fisheries Act* came into force. The purpose of the *Act* is to provide a framework for: The proper management and control of fisheries and the conservation and protection of fish and fish habitat, including by preventing pollution.

The modernized Act provides two core prohibitions against persons carrying out works, undertakings or activities that result in the "death of fish by means other than fishing" (subsection 34.4(1)), and the "harmful alteration, disruption or destruction of fish habitat" (subsection 35(1)). A more comprehensive definition of fish habitat under subsection 2(1) of the modernized *Fisheries Act* includes all waters frequented by fish and any other areas upon which fish depend directly or indirectly to carry out their life processes. The types of areas that can directly or indirectly support life processes include but are not limited to: spawning grounds and nursery; rearing; food supply and migration areas.

The previous prohibition under the 2012 Act against works, undertakings or activities causing "serious harm to fish" that are part of, or support a commercial, recreational or Aboriginal fishery was rescinded.

The modernized *Fisheries Act* also includes prohibition of the deposit of deleterious substances of any type in water frequented by fish (Section 36(3)), which is administered by ECCC. When death to fish or a harmful alteration, disruption or destruction of fish habitat cannot be avoided or mitigated, an authorization under subsections 34.4(2) and 35(2), respectively, maybe provided by the Minister of Fisheries and Oceans with the provision of appropriate offsetting of residual adverse effects. Factors that may be taken into account by the Minister when considering approval of an authorization include (but are not limited to):

(a) the contribution to the productivity of relevant fisheries by the fish or fish habitat that is likely to be affected

(b) fisheries management objectives

(c) whether there are measures and standards to avoid the death of fish or to mitigate the extent of their death or offset their death, or to avoid, mitigate or offset the harmful alteration, disruption or destruction of fish habitat

(d) whether any measures and standards to offset the harmful alteration, disruption or destruction of fish habitat give priority to the restoration of degraded fish habitat

(e) Traditional knowledge of the Indigenous peoples that has been provided to the Minister

(f) any other factor that the Minister considers relevant

In support of the modernized *Fisheries Act*, DFO has published updated policy statement and guidance documents and interim standards and codes of practice. These include but are not limited to:

- *Fish and Fish Habitat Protection Policy Statement* (DFO 2019a)
- *Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the Fisheries Act* (DFO 2019b)
- *Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada* (DFO 2013b)

The first of these two documents replaces the previous policy with regards to fish and fish habitat protection and offsetting measures associated with the former version of the *Fisheries Act*.

Fisheries Act – Metal and Diamond Mining Effluent Regulations

The *Metal Mining Effluent Regulations* as developed under Section 36 of the *Fisheries Act* were amended in 2018 and are now known as the *Metal and Diamond Mining Effluent Regulations* (MDMER). The MDMER is administered by ECCC. The MDMER authorize the deposit of effluent in waters frequented by fish. The regulations form the basis of the federal mine effluent standards by, among other requirements, defining authorized limits for releasing selected deleterious substances outlined in the regulation (Schedule 4) including pH, arsenic, copper, cyanide, lead, nickel, zinc, suspended solids and radium 226. The MDMER specifies requirements for carrying out effluent sampling, reporting and Environmental Effects Monitoring (EEM). The MDMER also provides for authorization of mine waste disposal to waters frequented by fish (under Schedule 2) when certain conditions are met including compensation (MDMER term similar to offsetting). The requirements of a compensation plan are provided under Section 27.1 of the MDMER. Owners or operators of mines can request an amendment to Schedule 2 of the MDMER for the purposes of designating a water body frequented by fish as a tailings impoundment.

Species at Risk Act

The responsibility for aquatic species under the federal *Species at Risk Act* (SARA) is delegated to the Minister of Fisheries and Oceans by the Minister of Environment. The purposes of the SARA is to prevent wildlife species from being extirpated or becoming extinct, to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity and to manage species of special concern to prevent them from becoming endangered or threatened. The SARA prohibits killing, harming, capturing, or harassing species listed as endangered, threatened, or extirpated (where introduction to the wild is recommended) and provides protection for habitat that supports these species.

A discussion on the effects of the Project on aquatic SAR is provided in Section 6.2.8 of this EIS Addendum [Vol 2].

Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life

The Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life (CWQG-FAL) are established by the Canadian Council of Ministers of the Environment (CCME 2021). These guidelines are developed collaboratively among provincial, territorial, and federal jurisdictions and regularly updated to reflect current toxicology information and guideline derivation approaches. The CWQG-FAL are used to assess surface water quality. For the parameters analyzed as part of the Project, the CWQG-FAL generally have the same values as the Ontario Provincial Water Quality Objectives (PWQO). Where the criteria for the CWQG-FAL and PWQO differed, the criteria based on most recent update was used for comparison to the data.

Provincial Water Quality Objectives

The PWQOs developed by the Ministry of Environment, conservation and Parks (MECP) through its responsibilities under the OWRA and EPA, along with management policies and guidelines, were developed for the protection of aquatic life recreational uses; they are numerical and narrative ambient surface water quality criteria that represent a desirable level of surface water quality. PWQOs for the protection of aquatic life are conservative values that, when met, are intended to be protective of all forms of aquatic life and all aspects of the aquatic life cycle during an indefinite exposure to water (MOE 1999). Applicable PWQOs and Interim PWQOs for selected chemical and physical parameters were used to compare to surface water quality. For the parameters analyzed as part of the Project, the PWQO generally have the same values as the CWQG-FAL. Where the criteria for the PWQO and CWQG-FAL differed, the criteria based on most recent update was used for comparison to the data.

Endangered Species Act

The provincial *Endangered Species Act* (ESA 2007) is administered by the MECP. The ESA provides a science-based assessment of species inclusive of Indigenous Traditional Knowledge, species protection of provincially listed species at risk including their habitat. A discussion on the effects of the Project on aquatic SAR is provided in Section 6.2.8 of this EIS Addendum [Vol 2].

Lakes and Rivers Improvement Act

The purpose of the *Lakes and Rivers Improvement Act* (LRIA) is to:

- Manage, protect and preserve the water of the lakes and river of Ontario and the land under them
- Protect the public rights in or over the lakes and rivers of Ontario
- Protect the interests of riparian owners
- The management, perpetuation and use of the fish and wildlife and other natural resources dependent on lakes and rivers

- The protection of persons and property

The LRIA as updated in 2019 provides the Ministry of Natural Resources and Forestry (MNRF) with the legislative authority to govern the:

- design, construction, operation, maintenance and safety of dams in Ontario
- assessment and management of any impact on fish, wildlife and other natural resources, including those that may result from the above

Approval from the MNRF to construct, alter, improve or repair water control infrastructure is required under the LRIA in Ontario. Under the LRIA, approval must be obtained for:

- dams
- water crossings – bridges, culverts, and causeways
- river channels – channelization of rivers, including dredging, diverting, or enclosing a channel, except for the installation or maintenance of a drain subject to the *Drainage Act*
- buried pipelines and cables – installing cables and pipelines where they will hold back, forward or divert water
- municipal and other drains

Fish and Wildlife Conservation Act

During the life of the Project, the Proponent will be required to collect fish for the purpose of monitoring potential adverse effects and to remove fish from in-water work areas. To conduct these works, authorization will be required from the MNRF under the provisions of the *Fish and Wildlife Conservation Act*. Section 39 of the *Fish and Wildlife Conservation Act* states that the Minister may authorize a person to capture, kill, or possess wildlife for educational or scientific purposes (S.O. 1997).

Ontario Provincial Fish Strategy: Fish for the Future

The Provincial Fish Strategy (MNRF 2015) provides "*management direction to MNRF staff and will better position the ministry to respond to evolving environmental, economic, social, technological and policy challenges facing fisheries in Ontario. The main purposes of the strategy are to improve the conservation and management of Ontario's fisheries resources; and to promote, facilitate and encourage fishing as an activity that contributes to the nutritional needs, and the social, cultural and economic well-being of individuals and communities in Ontario*."

The strategy is intended to inform MNRF fisheries policy development, decision making and science priorities and will provide input into other natural resource management policy and planning. It assists MNRF in prioritizing its efforts and coordinating activities to addresses new and emerging issues impacting Ontario's fisheries resources. When decision makers must balance competing objectives for the management of aquatic systems, the strategy may help to provide a fisheries perspective.

The Project is located in MNRF Fisheries Management Zone 7 (FMZ 7). At this time a Fisheries Management Plan has not been developed for this zone.

6.2.4.3.2 Influence of Consultation and Engagement on the Assessment

Consultation for the Project has been ongoing since 2004 and will continue throughout the life of the Project. Chapter 4 of the original EIS (2012) and Chapter 5 of this EIS Addendum (Vol 2) covers the consultation process and activities undertaken by GenPGM and formerly by Stillwater. Comments and feedback received throughout the consultation process pertaining to fish and fish habitat are summarized below:

- Concerns relating to potential effects to fish and fish habitat as a result of Project blasting
- Request for information on fish survey methodologies
- Concern relating to the loss of fish bearing habitat as a result of the Project
- Information was requested on the remediation of mine infrastructure (i.e. open pits, MRSA and PSMF) into potentially productive fish habitat
- Information was requested on fish survey methodologies

Feedback related to fish and fish habitat has been addressed through the effects assessment completed in this EIS Addendum and supporting materials, responses, and meetings with communities and stakeholders, as appropriate.

Traditional knowledge and Traditional Land and Resource Use (TLRU) information that contributes to the fish and fish habitat was provided by Indigenous communities. Specifically, fish species of importance to Indigenous peoples with an interest in the Project has been incorporated into the effects assessment, mitigation and monitoring. However, given the confidentiality of this material explicit details are not included nor are communities identified. Section 6.2.12 of this EIS Addendum (Vol 2) provides further details on how TLRU and traditional knowledge have been incorporated into the assessment.

6.2.4.3.3 Potential Effects, Pathways and Measurable Parameters

Table 6.2.4-1 summarizes the potential environmental effects of the Project on fish and fish habitat, as well as the measurable parameters, effect pathway and rationale for their selection. These potential environmental effects and measurable parameters were selected based on the most recent updates to regulations and policies, most specifically the *Fisheries Act*. Most notably, the potential effects are consistent with the modernized *Fisheries Act* specific to Sections 34.4(1) “death of fish”, 35(1) “harmful alteration, disruption or destruction of fish habitat”, and 36(1) “deposit of deleterious substances”. The original EIS included potential effects that were based on the previous version of the *Act*, namely “serious harm” or changes to commercial, recreational, and Aboriginal fisheries.

The potential effects, pathways and measurable parameters were also based on professional judgment, consistency with other EIS components, recent EAs for mining projects in Ontario, and comments provided during consultation.

Table 6.2.4-1: Potential Effects, Effects Pathways and Measurable Parameters for Fish and Fish Habitat

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Fish Mortality / Death of fish by means other than fishing (Section 34.4 of Fisheries Act)	• Work in or around water can cause direct mortality of fish, which are protected by Section 34.4(1) of the Fisheries Act • Direct overprinting (infilling) of waters frequented by fish • Blasting activities can cause lethal or sub-lethal effects on fish eggs and larval fish • Blasting activities causing vibrations that result in lethal or sublethal effects to fish	• Area (ha) of fish habitat overprinted • Peak particle velocity (PPV) • Overpressure (kPa)
Change resulting in direct physical harmful alteration, disruption, or destruction of fish habitat (Section 35 of *Fisheries Act*)	• Physical alteration or loss of instream and/or riparian habitat through the development of the project site • Creation of barriers to fish passage	• Areal extent of altered, disrupted or destroyed habitat (ha)
Change in water quantity (flow)	• Change in surface drainage flow rates and patterns from surface water withdrawal / diversions or increased discharge to the aquatic environment that alter stream flows or lake levels required for fish mobility and productivity during all life stages	• Mean Annual Flow (MAF) (m^3/s) • Mean Monthly Flows (MMF) (m^3/s)
Change in water quality (Section 36(1) of the Fisheries Act and the MDMER)	• Mobilization of solids into local watercourses • Deposit of deleterious substances into the receiving environment as a result of tailings impoundment, mine effluent and/or surface run-off.	• Area (ha) of fish habitat to be identified for use as tailings impoundment / management (Schedule 2 MDMER) • Change from baseline concentrations of CoPCs directly related to Project activities in mg/L and/or exceedance of most appropriate water quality guideline or criteria for the protection of the aquatic environment
Change to benthic invertebrate communities	• Project-related changes in water and sediment quality can affect benthic invertebrate communities which are integral to the aquatic	• Change from baseline surface water concentrations of CoPCs directly related to Project activities in mg/L and/or exceedance of

Table 6.2.4-1: Potential Effects, Effects Pathways and Measurable Parameters for Fish and Fish Habitat

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
	food web, providing food for higher trophic levels (fish)	most appropriate water quality guideline or criteria for the protection of the aquatic environment • Change from baseline surficial sediment concentrations of CoPCs directly related to Project activities in µg/g and/or exceedance of most appropriate sediment quality guideline or criteria for the protection of the aquatic environment

6.2.4.3.4 Assessment Boundaries

In general, the spatial boundaries for the assessment of environmental effects are presented in Section 2.4 of the EIS Addendum (Vol 1) (CIAR #727), while the LSA and RSA are defined based on the extent of potential effects specific to each Valued Ecosystem Component (VEC).

- **Site Study Area**: The SSA is the direct footprint of the Project, and is consistent across all VEC's. The SSA has been revised from the original EIS to reflect changes and refinements to the Project design.
- **Local Study Area**: The Fish and Fish Habitat LSAs represent the maximum area within which changes to fish habitat from Project activities and components can be predicted or measured with a reasonable degree of accuracy and confidence. Separate LSAs have been created for fish and fish habitat to best reflect the extent of VEC-specific effects. These LSAs consist of the SSA and adjacent areas where Project-related environmental effects are reasonably expected to occur based on available information and professional judgment. This definition of the LSA is consistent with the original EIS.
- **Regional Study Area**: The Fish and Fish Habitat RSA is the area within which residual environmental effects from Project activities and components may interact cumulatively with the residual environmental effects of other past, present and future (i.e., certain or reasonably foreseeable) physical activities. The RSA is based on the potential for interactions between the Project and other existing or future potential projects in regard to fish and fish Habitat.

  The Fish and Fish Habitat RSA includes the SSA and LSA, as well as the northwest basin of Lake Superior and its associated drainages as well as the lower reaches of the Pic River extending from the LSA to its confluence with Lake Superior.

The Fish and Fish Habitat LSA and RSA boundaries are included on Figure 6.2.4-1.

The temporal boundaries for the Project that have been considered in the determination of environmental effects are described in Section 2.5 of the EIS Addendum (Vol 1) (CIAR # 727). The temporal boundaries used to assess potential effects on the fish and fish habitat VEC span all phases of Project life.

Bamoos Lake
Lake 8
Hare Lake
Shack Lake
Manitouwadge
Ashburton Bay
Pic Island
Peninsula Bay
Marathon
Lake Superior
Outlet of Pic River
bing
N
0 1.25 2.5 5
1:75,000
Kilometers
0 5 10 20
1:275,000
Kilometers

Figure 6.2.4-1: Fish and Fish Habitat Spatial Boundaries

- Pic River
- Lake Superior/Pic River Watershed Divide
- Waterbodies
- Regional Study Area
- Site Study Area Boundary
- Local Study Area Aquatic Enviornment

"W:\Generation PGM Inc\Projects\20-2722 Marathon Palladium Project\GIS\Regional Context" Updated: 17 March 2021 by NW

Ecometrix

6.2.4.3.5 Residual Effects Characterization

Table 6.2.4-2 summarizes how residual environmental effects are characterized in terms of direction, magnitude, geographic extent, timing, duration, frequency, reversibility, and ecological / societal value. The characterization of residual effects is consistent with the original EIS, which were qualitative definitions, and have been further defined to include quantitative measures, where applicable, as part of this EIS Addendum.

Table 6.2.4-2: Characterization of Residual Effects on Fish and Fish Habitat

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive** – Effect moves measurable parameters in a direction beneficial to fish and fish habitat relative to baseline conditions. For example, an increase in productivity of the fish population as associated with fish and fish habitat. **Adverse** – Effect moves measurable parameters in a direction detrimental to fish and fish habitat relative to baseline conditions. For example, an increase in productivity of the fish population as associated with fish and fish habitat.
Magnitude	The amount of change in measurable parameters of the VEC relative to existing conditions	**For Fish Habitat Quality** **Negligible –** no measurable change in habitat area (ha), monthly flows (m^3/sec),lake surface elevation (m), or surface water quality in a waterbody or watercourse from baseline conditions. **Low –** a measurable change in habitat area (ha), monthly flows (m^3/sec),lake surface elevation (m) (but that is within the range of natural variability) or surface water quality (but below relevant water quality objectives or criteria) in a waterbody or watercourse **Medium –** a measurable change in habitat area (ha), monthly flows (<10%) or lake surface elevation (m) in a waterbody or watercourse that is greater than the range of natural variability, but that does not affect the ability of fish to use this habitat to carry out one or more of their life processes, or a measurable change in water quality that is not within the variability of baseline conditions and not within applicable guidelines, legislated requirement, and/or federal and provincial management objectives but is unlikely to have an adverse effect on fish and fish habitat in the LSA. **High –** a measurable change in habitat area (ha), monthly flows (<10%) or lake surface elevation (m) in a waterbody or watercourse that is greater than the range of natural variability and large enough that fish can no longer rely on this habitat to carry out one or more of their life processes or a measurable change in water quality that is not within the variability of baseline conditions and not within applicable guidelines, legislated requirement, and/or

Table 6.2.4-2: Characterization of Residual Effects on Fish and Fish Habitat

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
		federal and provincial management objectives and is likely to have an adverse effect fish and fish habitat in the LSA.
Geographic Extent	The geographic area in which a residual effect occurs	**Negligible (SSA) –** residual effects are limited to SSA **Low –** residual effects are restricted to the SSA or immediate surroundings **Medium (LSA) –** residual effects extend into the LSA **High (RSA) –** residual effects extend into the RSA
Timing	Considers when the residual effect is expected to occur, where relevant to the VEC.	**Low sensitivity** - Effect does not occur during critical life stages (e.g., outside of the fish migration, spawning and nursery (larval) stages). **Medium sensitivity** - Effect may occur during a lower sensitive period of a critical life stage; for many species this is the start (e.g., during early phases of the migration period). **High sensitivity** - Effect occurs during a critical life stage (e.g., the fish migration, spawning and nursery (larval) stages))
Duration	The time required until the measurable parameter or the VEC returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	**Negligible –** residual effect is limited to a single event **Low (short-term) –** the residual effect is limited to short term events (a few years or less) **Medium –** the residual effect is limited to the operational/decommissioning phases (years to decades) **High (Long-term) –** the residual effect extends beyond the life of the project (centuries)
Frequency	Considers whether the residual effect is expected to occur once, at regular or irregular intervals or continuously	**Negligible –** the condition of phenomena causing the effect rarely occurs **Low (Multiple irregular event) –** occurs at no set schedule and are unlikely to occur **Medium (Multiple regular event) –** occurs at regular intervals (i.e., >1% of the time) **High (Continuous) –** occurs continuously
Reversibility	Considers whether the residual effect is reversible or irreversible.	**Negligible –** effect ceases immediately once source or stressor is removed **Low –** effect ceases once source or stressor is removed **Medium –** effect persists for some time after source or stressor is removed **High (Irreversible) –** the residual effect is unlikely to be reversed

Table 6.2.4-2: Characterization of Residual Effects on Fish and Fish Habitat

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Ecological/Societal Value	Considers the magnitude that the residual effect is expected to have on the ecological or societal community, as determined through consultation and engagement.	**Negligible –** the VEC has no value from a cultural or societal context **Low –** the VEC is common in the LSA and/or has little to no value from a cultural or societal context **Medium –** the VEC is abundant in the RSA, though may be less so in the LSA, and/or has moderate cultural or societal value **High –** the VEC is rare and/or of high cultural or societal value

Note: Timing was not included in the original EIS.

6.2.4.3.6 Significance Definition

A significant adverse residual effect on freshwater fish and fish habitat is one that, following the application of avoidance, mitigation, and offset measures, results in an unavoidable alteration, disruption, or destruction of fish habitat or an unavoidable change in fish abundance, health, growth, or survival that is likely to cause a measurable change in the productivity of relevant fish populations, including those of cultural or traditional importance.

The definitions of significance consider updates to legislation (*Fisheries Act*) and the identified indicators of potential impacts and characterization of residual effects as listed in Table 6.2.4-1 and Table 6.2.4-2.

The following thresholds have been established to define a significant residual adverse environmental effect on fish and fish habitat:

- Activities that would result in peak particle velocity (PPV) in excess of 13 mm/sec through the use of explosives and therefore cause lethal effects on fish eggs and larval fish
- Blasting activities that result in overpressure in excess of 100 kPa will result in lethal effects to fish
- Activities that would result in a change in the Mean Annual Flow (m^3/s) from baseline environmental flow of greater than ±10%
- Change in water quality for constituents of potential concern (CoPCs) directly related to Project activities in mg/L beyond the capacity for fish to survive or maintain current levels of productivity (e.g., provincial or federal Guidelines for the Protection of Freshwater Aquatic Life)
- Change in surficial sediment quality for CoPCs directly related to Project activities in µg/g beyond the capacity for fish to survive or maintain current levels of productivity (e.g., provincial or federal Guidelines for the Protection of Freshwater Aquatic Life)

- An effect that is not authorized under the *Fisheries Act*, or one that, despite authorization and associated mitigation and offsetting, would result in the harmful alteration, disruption or deletion of fish habitat and/or directly cause the death of fish

6.2.4.4 Existing Conditions for Fish and Fish Habitat

Existing conditions are described in Section 4.6 of the EIS Addendum (Vol 1) (CIAR # 727). The Aquatic Baseline Update Report (Ecometrix 2020b) (CIAR #722) provides an overview of how baseline conditions have changed since the original EIS (2012) and/or how the understanding of the baseline conditions has evolved.

6.2.4.5 Determining Project Interactions with Fish and Fish Habitat

Table 6.2.4-3 identifies, for each potential effect, the project's physical activities that might interact with the VEC and result in the identified effect. This table is based on a similar table from the original EIS and has been updated to reflect changes to the Project.

Table 6.2.4-3: Project Interactions with Fish and Fish Habitat

Physical Activities	Effects				
	Lethal Effects to Fish	Change resulting in direct physical HADD	Change in Water Quantity	Change in Water Quality	Changes to Benthic Invertebrate Community
Site Preparation / Construction					
Clearing, grubbing and stripping of vegetation, topsoil and other organic material	-	-	✓	✓	✓
Grading with topsoil	-	-	✓	✓	✓
Drilling and blasting to develop the open pits and plant site area	✓	-	-	✓	✓
Excavation and pre-stripping to remove mine rock and overburden	-	-	✓	✓	✓
Preparation of construction surfaces and installation of temporary construction facilities	-	-	-	-	-
Site preparation for waste management	-	-	-	-	-
Construction of administration buildings, storage buildings, other ancillary structures and site services such as parking lots, area fencing, and security systems	-	-	-	-	-
Construction of explosives facilities	-	-	-	-	-
Construction of PSMF containment dams and MRSA	✓	✓	✓	✓	✓

Table 6.2.4-3: Project Interactions with Fish and Fish Habitat

Physical Activities	Effects				
	Lethal Effects to Fish	Change resulting in direct physical HADD	Change in Water Quantity	Change in Water Quality	Changes to Benthic Invertebrate Community
Management of surface water and groundwater on the site, including seepage and run-off	✓	✓	✓	✓	✓
Maintenance and management of mine rock stockpiles, overburden, and PSMF	✓	✓	✓	✓	✓
Construction of water management facilities and drainage works (including but not limited to pipelines, dewatering facilities, stormwater management, control ponds, and water management pond)	✓	✓	✓	✓	✓
Dewatering of natural water bodies in the project area	✓	✓	✓	✓	✓
Construction of new mine site access and haul roads, including any water crossings and water body shoreline works or undertaking	✓	✓	✓	✓	✓
Upgrading of the existing mine access road(s) and entrance(s) to the project area including any water crossings and water body shoreline works or undertakings	✓	✓	✓	✓	✓
Construction of a 115kV electrical transmission line within a new right-of-way from the M2W Transmission corridor	-	-	-	✓	✓
Aggregate sources and amounts	-	-	-	-	-
Management of waste	-	-	-	-	-
Any works or undertakings associated with upgrading a rail load-out facility for mine concentrate and off-site accommodation complex	-	-	-	-	-
Operating vehicles	-	-	-	-	-
Hiring and management of workforce	-	-	-	-	-
Taxes, contracts and purchases	-	-	-	-	-
Operations					
Drilling, blasting, loading and hauling of mine rock from the pits to ROM stockpile pad, crusher or the MRSA	✓	✓	✓	✓	✓
Operation of explosives facilities	-	-	-	-	-
Handling, transportation, use and disposal of explosives	-	-	-	-	-

Table 6.2.4-3: Project Interactions with Fish and Fish Habitat

Physical Activities	Effects				
	Lethal Effects to Fish	Change resulting in direct physical HADD	Change in Water Quantity	Change in Water Quality	Changes to Benthic Invertebrate Community
Transportation of crushed material to coarse ore stockpile	-	-	-	-	-
Transportation of mill feed (ore) to the Process Plant	-	-	-	-	-
Process Plant operation	✓	✓	✓	✓	✓
Transportation of filtered concentrate					
Management and maintenance of the entire mine waste stream, including but not limited to process solids and mine rock	✓	✓	✓	✓	✓
Decommissioning of the temporary process water pond (proposed during mine operations), including removal or breaching of dams	✓	✓	✓	✓	✓
Dewatering activities (e.g., open pit)	✓	✓	✓	✓	✓
Management of surface water and groundwater on the site; including seepage, run-off, contact water, process water and storm water	✓	✓	✓	✓	✓
Management of surface water on site during dam removal or breaching	✓	✓	✓	✓	✓
Management of domestic waste from the mine site	-	-	-	-	-
Management of hazardous waste	-	-	-	-	-
Environmental safety procedures	-	-	-	-	-
Operating vehicles	-	-	-	-	-
Hiring and management of workforce	-	-	-	-	-
Taxes, contracts and purchases	-	-	-	-	-
Decommissioning and Closure					
Installation of barriers around the pit perimeters	-	-	-	-	-
Management of inputs from groundwater and surface water run-off into pits	-	-	-	-	-
Decommissioning, dismantling and/or disposal of equipment	-	-	-	-	-
Demolition/removal of surface buildings and associated infrastructure and disposal of resulting rubble	-	-	-	-	-
Decommissioning/removal of explosives facilities	-	-	-	-	-

Table 6.2.4-3: Project Interactions with Fish and Fish Habitat

Physical Activities	Effects				
	Lethal Effects to Fish	Change resulting in direct physical HADD	Change in Water Quantity	Change in Water Quality	Changes to Benthic Invertebrate Community
Removal of power lines and electrical equipment	-	-	-	✓	✓
Decommissioning of the potable water and sewage treatment systems (e.g. water treatment plant and membrane bioreactor)	-	-	-	-	-
Maintenance and management of mine rock stockpiles and PSMF	✓	✓	✓	✓	✓
Following removal of infrastructure, soil, groundwater, and surface water testing for residual contamination, and disposal of contaminated soils and treatment of groundwater and surface water, as required	-	-	-	-	-
Reclamation and restoration of landscape (including water bodies) to productive capacity including management and monitoring	-	-	✓	✓	✓
Management of flooded pits to protect groundwater and surface water quality during flooding and pit overflow	-	-	-	-	-
Operating vehicles	-	-	-	-	-
Hiring and management of workforce	-	-	-	-	-
Taxes, contracts and purchases	-	-	-	-	-

Notes:
✓ = Potential interaction
– = No interaction
** minor wording changes to the physical activities list have been made to better align with the updated Project description covered in Chapter 1 (EIS Addendum [Vol 1])

Interactions as identified above are consistent with those identified in the original EIS (2012). The majority of interactions will occur initially during the site preparation and construction phase. The interactions are generally a result of the overprinting of fish habitat and the potential increase in sedimentation through surface run-off and site water management due to mine site development.

Construction of buildings and associated infrastructure will occur away from watercourses and waterbodies and will not interact with fish and fish habitat. Ancillary facilities (fuel supply, storage and distribution) and aggregate sources) will be located away from fish and fish habitat and therefore will not result in a loss of fish habitat.

Interactions during operation are driven by continued water balance (mine water and surface drainage) on the site and the discharge of mine effluent to Hare Lake, which has the potential to change water and sediment quality and quantity. During operation, ore processing will not interact with fish and fish habitat as this is conducted in enclosed surroundings, eliminating exposure to fish and fish habitat. If unmitigated, open pit mining (drilling, blasting, loading, and hauling of ore rock) has the potential for lethal and sub-lethal effects, permanent alteration and loss of fish habitat.

Activities during active closure (primary decommissioning and rehabilitation) and post-closure will not result in any additional loss of fish habitat beyond that which occurs during construction. Offsetting measures will continue to be implemented through this phase to further support fish and fish habitat productivity.

6.2.4.6 Assessment of Residual Effects on Fish and Fish Habitat

The residual effects on fish and fish habitat are consistent with those identified in the original EIS (2012). However, the modernization of the *Fisheries Act* and inclusion of *Act* consistent indicators for the fish and fish habitat VEC results in a different pathway of effects assessment as described below. Consistent with the original EIS, expected residual effects will include the creation of a HADD as a result of overprinting of fish habitat by Project components. The potential mobilization of solids into the local surface water courses at work areas in the vicinity of surface water features is also a likely residual effect. Installation of culverts and stream crossings, in particular in the Stream 101 and 106 subwatersheds, which may disrupt fish habitat either directly or through the potential to impair fish passage or water conveyance.

6.2.4.6.1 Fish Mortality / Death of Fish by Means other than Fishing

Analytical Assessment Techniques

Quantitative assessment of potential lethal effects to fish was undertaken by the following:

Calculated estimation of the areal extent of fish habitat overprinted (i.e., the bankfull width multiplied by the length of stream and/or the area of a water body (pond or lake) overprinted. The area (ha) of fish habitat overprinted is described in more detail in Section 6.2.4.6.2 of this report. Where fish have been documented at a sampling location, they are assumed to be present throughout the entire length or area of homogenous habitat.

Following the methods described by Wright and Hopky (1998) estimates of the required setback distance from a water body to meet the thresholds of peak particle velocity (PPV) and overpressure were used. The thresholds for identifying setback distance and therefore assess potential lethal effects to fish were:

- PPV in excess of 13 mm/sec
- Overpressure in excess of 100 kPa

Project Pathways

Direct overprinting fish habitat during site preparation and construction may include the infilling or dewatering of existing water bodies and loss of riparian areas which may result in the direct destruction of inhabited fish habitat. This would result in the subsequent and immediate death of fish. The detonation of explosives near water has the potential to cause lethal or sub-lethal effects on fish as rapid changes to water pressure or particle velocities in the substrates can result in morphological and physiological damage to fish, larvae and eggs.

Mitigation and Enhancement Measures

Mitigation measures that will be used to protect fish from lethal effects are listed below. Where mitigation measures are consistent with lethal effects to fish and direct physical HADD to fish habitat, they are provided in detail in Section 6.2.4.6.2 of this report and summarized as follows:

- Losses of aquatic habitat, and again by extension the benthic invertebrate communities therein, will also be mitigated through fish habitat offsetting works that will be required under the *Fisheries Act*. A more detailed discussion of fish habitat offsetting is provided in Section 6.2.4.6.2 of this report and in the Fish and Fish Habitat Offsetting Plan Update (Appendix D6 of this EIS Addendum [Vol 2])
- Planning and design of the Project was informed through consultation with local land users and Indigenous communities to avoid waterbodies considered important to those communities and individuals
- Avoiding using explosives in or near water. Where this is necessary use the guidelines for the DFO *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters* (Wright and Hopky 1998) to identify appropriate setback distances to avoid lethal or sub-lethal effects to fish
- Planning in-water work, undertaking or activity to respect timing windows to protect fish, including their eggs, juveniles, spawning adults, the organisms upon which they feed and migrate. In this case in-water work should be deferred based on the specific water body and consistent with the known species which inhabit that waterbody and/or the appropriate fish thermal guild (i.e., cold, cool or warmwater fish community);
    - Comply with coldwater timing window for in-water work associated with those tributaries that support salmonid species (spring spawning species –avoid work between April 1 and June 15; fall spawning species – avoid work between September 1 and June 15)
    - Comply with coolwater timing window for in-water works associated with those tributaries that support a coolwater spring spawning fish community (spring spawning species – avoid work between April 1 and June 15)
- Where possible conduct instream work during periods of low flow (e.g., summer or winter) to further reduce the risk to fish

- In discussion with responsible authorities, prepare a fish salvage plan to relocate fish prior to in-water work
- Design treated effluent discharge or freshwater intake infrastructure to prevent entrainment or impingement of fish
- Implementation of an Erosion and Sediment Control (ESC) Plan for the site to reduce potential sedimentation of waterbodies and potential lethal impacts to fish, larvae and eggs. Ensure ESC measures are maintained as applicable throughout the duration of the Project

Project Residual Effect

Work in or around water can cause direct mortality of fish, which are protected by Section 34.4(1) of the *Fisheries Act*. Occurrence of lethal effects to fish through direct overprinting (infilling) of waters frequented by fish or through localized blasting procedures are possible. These types of effects are primarily limited to the construction and operation phases of the Project.

The Project related lethal effects to fish associated with overprinting of existing fish habitat will require Authorization under Section 34.4(2) of the *Fisheries Act.* The conditions of the authorization will include offsetting to account for potential death of fish. The direct overprinting of fish habitat that may result in death to fish is estimated to be 9.22 ha as this represents the total area of fish bearing habitat as identified through baseline study and for which will be overprinted by the updated Project layout. The total amount of habitat offset required will be no less than 9.22 ha. Salvage and/or relocation of fish, that may be impacted by overprinting, will be undertaken to a reasonable level of effort and in consultation and approval by applicable agencies (DFO and MNRF) prior to construction to avoid fish mortality. It is understood that not every fish will be salvageable, yet the level of effort will be consistent with ensuring the productivity and biodiversity of the areas associated with offset planning.

Blasting during operation will occur near but not in water. The use of explosives has the potential to produce instantaneous pressure changes that can cause damage to fish swim bladders and internal organs. Vibrations (PPV) from the use of explosives may also kill or damage fish eggs or larvae. Guideline thresholds have been identified by DFO for instantaneous pressure change (recommended 100 kPa) and PPV (13 millimeters/sec) and are used in this assessment. Calculations for instantaneous pressure changes and PPV were based on formulas from Wright and Hopky (1998).

Estimates of blasting setback distance requirements were undertaken for the construction phase (PSMF and on-site road construction) and operation phase (open pit construction including north and south pits) using a charge weight of 12.2 kg/delay and 384.17 kg/delay, respectively and assuming a rock substrate (Appendix D2 [Noise Updated Effects Assessment]). Table 6.2.4-4 summarizes the prescribed setback distances for both general fish habitat and spawning habitat.

Table 6.2.4-4 Estimate of Required Setback Distances for Blasting Activities

Phase	Activity	Location of Blast	Fish Habitat Type	Required Setback Distance (m)
Construction	PSMF / On-site road construction	Edge of PSMF / Edge of road right-of-way	General	18
			Spawning	53
Operation	Open pit extraction	Edge of open pit footprint	General	98
			Spawning	296

Notes:
Required setback distances estimates based on recommended thresholds of 100 kPa (instantaneous pressure change) and 13 millimeters/sec (PPV)
Estimates are based on the use charge weights of 12.2 kg/delay (Construction) and 384.17 kg/delay (Operation).

In all cases, the estimated setbacks to meet thresholds will be attainable, and therefore lethal effects to fish as a result of these activities are not expected. If the charge size is larger than those discussed herein, the potential vibration and overpressure levels emanating from blasting operations will be reassessed in a detailed study to confirm that the predicted levels are within guideline limits. Potential changes to water quality as a result of blasting residues are further discussed in Section 6.2.4.6.4 of this report.

Overall, the potential lethal effects on fish during construction are characterized as adverse, of high magnitude as there will be a measurable change to a waterbody or watercourse that is greater than the natural range of variability and large enough that fish can no longer rely on this habitat to carry out life processes, of low geographic extent as they are limited to the SSA or immediate surroundings, of medium sensitivity for timing as will occur over the period of critical life stages for fish, of medium duration, of medium frequency, irreversible with respect to overprinting of fish and fish habitat, yet reversible with respect to effects of blasting as the effect ceases once the source or stressor is removed, and of high value due to the importance of the survival of fish in supporting fish and fish habitat, which is important both ecologically and societally. The potential lethal effects on fish during operation would be limited to the effects of blasting and therefore adverse in direction, negligible in magnitude as no additional change to habitat loss will occur, negligible with respect to geographic extent as highly localized, high sensitivity with respect to timing as could occur throughout periods sensitive life stages for fish, medium in duration, medium in frequency, and reversible as the effect will cease once the stressor is removed.

Determination of Significance

The primary adverse residual effect on lethal effects to fish is the overprinting of fish habitat by mine infrastructure. The primary means of mitigation will be through implementation of fish habitat offsetting in consultation with DFO and other interested parties. It has been determined that a HADD will be created by the Project, for which a minimum of 9.22 ha of offset will be required. Further detail associated with the offset strategy is provided in Section 6.2.4.6.2 of this report and the Fish and Fish Habitat Offsetting Plan Update (Appendix D6 of this EIS Addendum [Vol 2]). The threshold for significance as defined in Section 6.2.4.3.6 of this report relates to measurable (or predicted) change. A significant residual effect to mortality of fish is one that is not authorized under the *Fisheries Act*, or one that, despite authorization and associated mitigation and offsetting, would directly cause the death of fish. Significance of residual lethal effects to fish associated with blasting are specified by exceedances of thresholds of 100 kPa instantaneous pressure change and 13 millimeters/sec PPV. Following the implementation of offsetting and further conditions under a *Fisheries Act* authorization (including fish salvage) and adherence to minimum setback distances to mitigate effects of blasting to fish, residual effect to fish as a result of fish mortality will be not significant.

6.2.4.6.2 Harmful, Alteration, Disruption or Destruction of Fish Habitat

Analytical Assessment Techniques

Methods used to predict Project effects on fish and fish habitat included quantification of permanent habitat alteration and habitat loss. Where needed further qualitative assessment of the sensitivity of potential alterations or disruptions to fish and fish habitat were undertaken. The quantitative method followed was the calculated estimation of the areal extent of fish habitat that is affected (disturbed or overprinted) (i.e., the bankfull width multiplied by the length of stream and/or the area of a water body (pond or lake) overprinted. Assumptions associated with this assessment include:

- The maximum potential Project footprint was assessed
- Where fish (or fish species) have been documented at a sampling location, they are assumed to be present throughout the entire length or area of a consistent habitat type
- Where fish are present in upper stream reaches or headwater lakes and ponds, it is assumed that those species have the potential to inhabit all downstream areas unless otherwise stated, due to known barriers to movement
- The most sensitive habitats (as associated with sensitive fish species and life stages) were used to assess potential effects to fish and fish habitat

Project Pathways

The Project may directly affect fish and fish habitat during all Project phases and relate to those associated with the Project footprint.

Site Preparation and Construction

The site preparation and construction phase will result in the clearing of land, including existing aquatic habitat, to facilitate the development of mine-related infrastructure, such as the open pits, PSMF, MRSA and road network. For the purposes of the assessment, it is assumed that the full complement of footprint related effects is realized in this phase of the Project, even though some will likely not occur until early in the operations phase as site construction is completed. Direct footprint effects include the loss of aquatic habitat as it is supplanted to accommodate Project infrastructure. The road network will also require the development of road crossings (culverts) at three locations in Stream 1 (101 subwatershed). The effluent pipeline and associated service road will require a single crossing at Stream 6 (106 subwatershed) to carry mine water from the site to the Hare Lake discharge location. The construction of the mine water discharge outfall structure to Hare Lake will also cause the alteration of loss of riparian and nearshore fish habitat. Other crossings on minor ephemeral, drainage features will also be necessary. These crossings, and in particular the two crossings in Stream 1, may disrupt fish habitat either directly or through the potential to impair fish passage.

Activities that result in disturbing the ground surface around surface water features may result in the erosion and subsequent transport of sediment loads into surface waters. The suspended sediment load can alter fish habitat by covering the aquatic environment with deposits of fine-grained material. This type of effect may occur anywhere where site development and construction activities occur in relative proximity to surface water features. The use of explosives in or near fish habitat may also result in the physical alteration of that habitat. For example, sedimentation resulting from the use of explosives may cover spawning areas or may reduce or eliminate bottom-dwelling life forms that fish use for food.

Operation

No effects to fish habitat beyond those already discussed above under site preparation and construction are envisioned. Water quantity and quality discharges to surface water are assessed in sections 6.2.4.6.3 and 6.2.4.6.4 of this report.

Decommissioning and Site Closure

Decommissioning and closure activities will include the removal of Project infrastructure such as buildings, power lines and roads, the re-grading of surface landscape features and the subsequent reclamation of previously disturbed areas. The mobilization of sediments into waterbodies or watercourses could result from any of these activities. For the first five years of closure, drainage from the MRSA and PSMF will be directed to the Water Management Pond and subsequently to the open pits. For planning purposes, it has been assumed that after this period, and to the extent possible, natural surface water drainage patterns will be restored. Post-closure drainage to the natural environment will not be realized until water quality of these sources is confirmed to meet applicable criteria or guidelines for the protection of the aquatic environment. The PSMF will be reclaimed (covered and revegetated) and surface water features created to restore the natural drainage patterns in Stream 6 (106 subwatershed). Portions of the MRSA will be reclaimed and surfaces re-graded as necessary to improve drainage to the remnant portions of Streams 2 and 3. No adverse effects on fish habitat are anticipated during mine

decommissioning and closure. Most of the fish habitat compensation works proposed to mitigate the HADD created during site preparation and construction would be implemented after mine closure and therefore a net benefit to fish habitat would occur during this stage.

Mitigation and Enhancement Measures

The development of the Project site will result in the HADD as defined by the Fisheries Act. The HADD is associated with, and has accounted for, both direct and indirect effects. The direct (or footprint) effects include several small waterbodies and associated connecting channels that will be within the footprint of mine-related infrastructure (pits, MRSA, PSMF) in the SSA. The HADD is largely confined to the Streams 2, 3 and 6 subwatersheds.

Offsetting for the HADD will be required under Section 35(2) of the *Fisheries Act* and Section 27.1 of MDMER. The offset is specifically related to fish-frequented areas of the Stream 6 subwatershed that will be incorporated into the PSMF and fish-frequented areas of the Stream 2 and 3 subwatersheds that will be incorporated into the MRSA. A detailed accounting of the HADD, and offset requirements associated with the HADD, are provided in the Fish and Fish Habitat Offsetting Plan Update (Appendix D6 of this EIS Addendum [Vol 2]). Other mitigations measures proposed to address the HADD are similar to those identified in the original EIS (2012) and include the following:

- Design the project to reduce disturbance footprint to limit the areal extent of disturbance to creeks, and bound the design to subwatersheds to limit the overall areas of site contact water that requires management
- Planning and design of the Project was informed through consultation with local land users and Indigenous communities to avoid waterbodies considered important to those communities and individuals
- Avoidance of more sensitive habitats to the extent practicable
- Design infrastructure including pipeline crossings and outfalls, and road crossings using best management practices to minimize disturbance to the existing water courses
- Adherence, as applicable, to the Interim Code of Practice: End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater (DFO, 2020)
- Adherence, as applicable, to the Interim Code of Practice for Temporary Cofferdams and Diversion Channels (DFO, 2020)
- Adherence, as applicable, to the Interim Code of Practice for Temporary Stream Crossings (DFO, 2020)

Project Residual Effect

With implementation of proposed mitigation measures, the residual effect of the Project will be the loss of approximately 15.07 ha of aquatic habitat, of which approximately 59% (or 9.22 ha) is considered habitat frequented by fish.

The total amount of required offset associated with the HADD, as a result of the development (and subsequent operation) of the site, has been estimated to be 9.22 ha. Of this, approximately 2.5 ha are specific to indirect impacts to fish habitat due to flow reduction in Stream 6 (106) subwatershed (further discussed in Section 6.2.4.6.3 of this report). The area of fish bearing aquatic habitat that will be directly overprinted by the Project are summarized in Table 6.2.4-5.

Table 6.2.4-5: Estimated Area of Project Impacted to Fish Habitat by Subwatershed

Watershed	Fish Bearing			Non Fish Bearing			Total Aquatic Habitat		
	Lentic	Lotic	Sub-Total	Lentic	Lotic	Sub-Total	Lentic	Lotic	Total
101	1.12	0.00	1.12	0.17	0.00	0.17	1.29	0.00	1.29
102	1.78	0.45	2.23	0.30	0.00	0.30	2.08	0.45	2.53
103	0.20	0.29	0.49	3.30	0.58	3.88	3.50	0.87	4.37
104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
106	2.78	2.60	5.38	0.01	1.49	1.50	2.79	4.09	6.88
109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	5.88	3.34	**9.22**	3.78	2.07	**5.85**	9.66	5.41	**15.07**

Note:

[A] - 2.64 ha HADD at 106 is constituted by 0.13 ha due to direct habitat loss and 2.51 ha of indirect impact by flow reduction of greater than 30% MAF

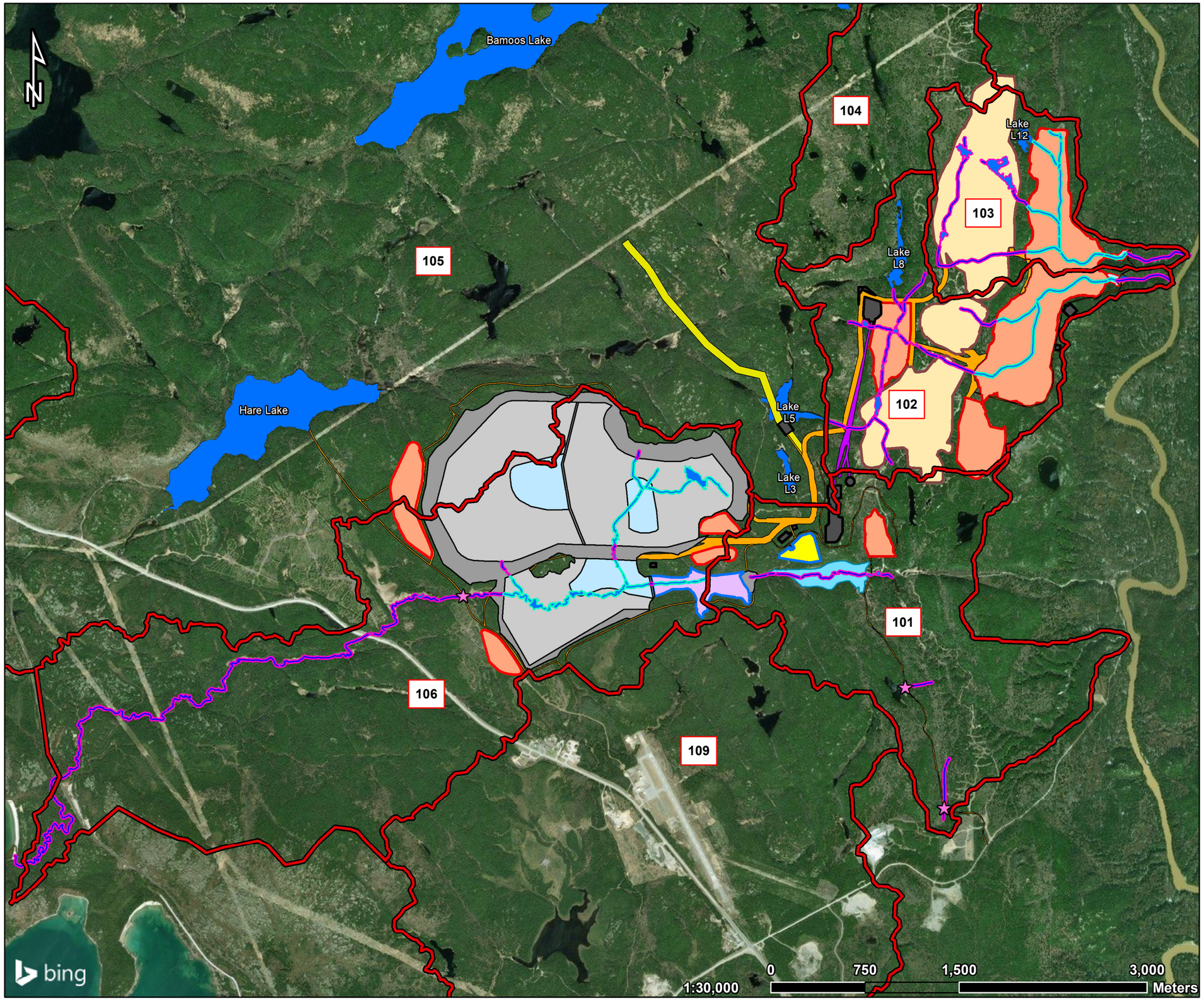
The direct (or footprint) effects include several small waterbodies and associated connecting channels that will be within the footprint of mine-related infrastructure (open pits, MRSA, PSMF) in the SSA.The primary fish bearing subwatersheds that will be overprinted are 101, 102, 103 and 106 which is generally consistent with the original EIS with some increase in overprinting of the 101 subwatershed a due to the realignment of the Project site access road which now crosses subwatershed 101 at two locations (culvert crossings) as shown in Figure 6.2.4-2. No direct impacts are expected with respect to the Pic River. An additional road and pipeline crossing will be necessary at subwatershed 106 to for the mine water discharge pipeline / maintenance road to Hare Lake. An additional yet small area associated with the overall HADD will be associated with the mine effluent discharge outfall / pipeline as it's direct outlet to Hare Lake. The design of which will be consistent with applicable best practices and standard codes as associated with works below the high-water mark and projects near water.

Bamoos Lake, which is known to support a local Lake Trout and Brook Trout recreational fishery, was avoided as part of the conceptual mine design included in the original EIS (2012) based on input received from Indigenous communities and the public at that time. The avoidance of Bamoos Lake within the footprint of the Project and as a receiving of mine discharge has continued as part of the updated Project

design. As such, direct and indirect effects on Bamoos Lake and its fish and fish habitat are not anticipated.

The loss of habitat will be realized through the construction and early operation phases dependant on the schedule of the construction and implementation of mine site water balance and associated infrastructure. Additional effects are not expected during the remainder of operation or closure phases. Construction / implementation of offsetting measures are likely to occur during the phased approach of closure when the PSMF will be reclaimed and surface water features will be created to restore the natural drainage patterns in Stream 6 (106 subwatershed). The restoration of natural drainage patterns in Stream 6 are further discussed in Section 6.2.4.6.3 of this report. Portions of the MRSA will be reclaimed and surfaces re-graded as necessary to improve drainage during this period and the natural surface water drainages for Streams 2 and 3 will be restored.

Overall, the HADD predicted to occur during construction and operation are characterized as adverse, of high magnitude as there will be a measurable change to a waterbody or watercourse that is greater than the natural range of variability and large enough that fish can no longer rely on this habitat to carry out life processes, of low geographic extent as they are limited to the SSA or immediate surroundings, of medium sensitivity for timing as will occur over the period of critical life stages for fish, of medium duration, of high frequency during the period of construction and operation, is reversible for 101 and 106, yet irreversible for 102 and 103, and of high value due to the importance of water quantity the VEC both ecologically and societally.



Notes:

Site plan and features obtained from Stantec on November 24, 2020.

Waterbody and watercourse data extracted from Land Information Ontario, MNR and altered based on files from PGM and satellite imagery (Bing, Google Earth and AG Maps: LIO).

Digital elevation model (DEM) was provided by Stantec.

All elevations and grid coordinates are in metres UTM NAD 1983 UTM Zone 16 Datum.

Legend

Mine Component

- Watercourse Crossing
- Site Roads
- Transmission Line
- Main Watershed Divide
- Open Pits
- PSMF Ponds
- PSMF
- Mine Rock
- Dams
- Facility Footprint
- Laydown Area
- Conveyer
- Event Pond
- PSMF Water Management Pond
- Mine Rock Storage Catch Basin

Altered or Displaced Waters

- Schedule 2 Impacts
- Section 35 Impacts

Altered, Displaced Waters Frequented by Fish
(Section 35, Schedule 2 Impacts)

Ecometrix

Marathon Palladium Project

GENERATION MINING

Generation PGM Inc.

February, 2021

Scale As Shown

Figure 6.2.4-2

Determination of Significance

The primary adverse residual effect resulting from direct physical HADD is through direct overprinting of fish habitat by mine infrastructure. The primary means of mitigation will be through avoidance. The secondary means is through the implementation of fish habitat offsetting in consultation with DFO and other interested parties. It has been determined that a HADD of 9.22 ha will be created by the Project, which is the minimum area of offset that will be required. The threshold for significance as defined in Section 6.2.4.3.6 of this report relates to measurable (or predicted) change. A significant residual environmental effect on fish and fish habitat is one that is not authorized under the *Fisheries Act*, or one that, despite authorization, associated mitigation and/or offsetting, affects the productivity and sustainability of the fish and fish habitat there. Following the implementation of offsetting and further conditions under a *Fisheries Act* authorization, the residual effects of a change resulting in a HADD of fish habitat will be not significant.

6.2.4.6.3 Change in Water Quantity

Analytical Assessment Techniques

Effects due to a change in water quantity (flow or water level) have been assessed consistent with that detailed in the surface water quantity VEC assessment (Section 6.2.3.6.3 of this EIS Addendum [Vol 2]). The impacts to water quantity associated with changes in surface drainage indirectly impact fish habitat as they have the potential to reduce flow volumes, velocities and water depth, thereby changing the overall wetted margins of water bodies and potentially available fish habitat. Expected changes to watersheds during the phases of mine life were delineated and compared to the watershed delineations from baseline. Mean Annual Flow (MAF) was calculated for each of the subwatersheds. Groundwater discharge to watercourses and lakes under dewatered and post-closure conditions were calculated and added to the estimated MAF to represent the balance in total flow. The MMF was calculated for each subwatershed using the revised delineations for construction, operation and closure phases. Discharge to Hare Lake was also accounted for and water levels of Hare Lake estimated for the phases of mine-life.

Change in MAF from pre-disturbance (environmental flow) conditions was used as a screening threshold to determine whether further assessment of changes in flow were required. Watersheds with an expected change in MAF of greater than 10% were carried forward to subsequent assessment steps.

For watersheds with an expected MAF decrease of over 10%, the MMF was compared with baseline environmental flows. A residual effect was identified if the predicted change in MMF was greater than 10% of the baseline environmental flows. Changes of less than 10% are not anticipated to require offsetting under Section 35 of the *Fisheries Act*.

Project Pathways

Indirect effects to fish and fish habitat during the preparation and construction phase are associated with reduced flows that will result from the realignment of subwatersheds within the SSA, due to both water management needs and the development of site infrastructure. The primary potential fisheries-related concern related to the operations phase of the Project is surface water discharge from the site into local receiving waters. During operations excess water from the PSMF and MRSA will be discharged to Hare Lake, however, the potential increase in flow is expected to be negligible, it is assessed herein. The installation of culverts at water course crossings has the potential to change the conveyance of water thereby affecting flow regime and fish habitat during all stages of the Project.

Due to overprinting of a portion of the Stream 6 (106 subwatershed), downstream flows in reaches of the tributary not overprinted will be impacted due to flow reduction.

Lake L8, which is located within subwatershed 102, is situated in close proximity to the proposed open pits. Due to the overprinting of the downstream sections of this watershed by the Project, the lake will no longer discharge through its original outlet, but will be isolated. However, lake L8 will continue to receive drainage from its northern and western drainage sources. This will impact the water level of L8 as the natural flow regime will be changed.

During the closure phase, the PSMF will be reclaimed and surface water features will be created to restore the natural drainage patterns in Stream 6 (106 subwatershed). Portions of the MRSA will be reclaimed and surfaces re-graded as necessary to improve drainage. The natural surface water drainages for Streams 2 and 3 will be restored.

Mitigation and Enhancement Measures

Mitigation of effects to fish and fish habitat through changes to water quantity are provided in Section 6.2.3.6.3 of this EIS Addendum (Vol 2) and these should be considered within the context of additional measures listed below, which may be more specific to fish and fish habitat. The primary means of mitigation of changes to flow that are above the threshold for identification of a residual effect (i.e., 10% decrease in MAF and/or MMF) is through the identification of a HADD under the *Fisheries Act* and the implementation of a fish habitat offsetting plan in consultation with DFO and other interested parties. Additionally, the following mitigation measures will be provided:

- Culvert design, installation and maintenance will follow and conform to appropriate DFO and MNRF operational statements, guidance and protocols. Important considerations include:
    - sizing the culverts to ensure conveyance of water under high flow conditions
    - maintaining fish passage under low flow conditions
    - embedding the culverts to allow the creation of natural substrates

Project Residual Effect

An indirect HADD to fish and fish habitat is expected as a result of overprinting portions of subwatersheds in the SSA. Due to the loss and redirection of the water from the upper portions of these systems, a reduction in the flow at more downstream reaches of the tributaries will occur. Subwatershed specific reductions in drainage area and changes to MAF and MMF are discussed in Section 6.2.3.6.3 of this EIS Addendum (Vol 2) for each phase of the Project. Table 6.2.4-6 summarizes the tributaries expected to have an indirect effect to fish and fish habitat through reductions in flow. The larges changes will occur for subwatersheds 101, 102, 103 and 106, which remains consistent with the original EIS (2012).

Table 6.2.4-6: Changes in Hydrology Through Project Mine Phases

Sub-watershed ID	Catchment Area (km^2)			Mean Annual Flow (m^3/s)			Largest Change in MAF (%)
	Baseline	Construction / Operation[A]	Closure	Baseline	Construction / Operation[A]	Closure	
101	4.54	2.99	4.78	0.074	0.05	0.08	**-33%**
102	3.5	0.07	1.18	0.058	0.001	0.002	**-98%**
103	1.87	0.07	4.2	0.032	0.001	0.002	**-96%**
104	3.46	3.41	3.41	0.057	0.056	0.06	5%
105	47.83	58.39	47.18	0.691	0.713	0.683	12%
106	10.52	6.54	10.15	0.164	0.105	0.157	**-36%**
109	12.04	12.27	12.35	0.187	0.19	0.196	5%

Notes:

[A] – Numbers listed are for the area or flow of greatest reduction during either construction or operation

Bolded numbers indicate the Project phase with the largest change in mean annual flows compared to baseline conditions

The flow in subwatersheds102 and 103 will essentially be lost due to their overprinting by the open pit and mine rock stockpile footprints. Flows in Stream 6 will be reduced during the construction and operation phases by 36% and will also constitute an indirect HADD. As previously discussed, this HADD of fish habitat will be mitigated through authorization under Section 35(2) of the *Fisheries Act* and is contingent on an offset plan accepted by DFO and other parties.

Stream 1 (subwatershed 101) flows will be diminished for the operational life of the mine but will be returned to a similar MAF (+8%) following closure and report to the Pic River.

Despite the reduction in flow reporting to the Pic River from subwatersheds 101, 102 and 103, impacts to the Pic River is negligible as the change in river MAF, for any phase of the Project, is reported as less than or equal to 0.15% (See Section 6.2.3.6.3 of this EIS Addendum (Vol 2) for further detail).

Under closure conditions and during the PSMF contribution to pit filling, the subwatershed of Stream 6 (subwatershed 106) will remain the same as operations with 6.54 km^2 contributing to the natural watershed area. Following the acceptability of water quality in the rehabilitated PSMF, discharge from the PSMF will be directed to the environment. The total contributing watershed area will be increased to 10.15 km^2, leaving a reduction of 4% in MAF from the baseline in Stream 6, during post-closure.

Overall, The potential direct effects of changes to water quantity are characterized as adverse, of high magnitude as there will be a measurable change to a waterbody or watercourse that is greater than the natural range of variability and large enough that fish can no longer rely on this habitat to carry out life processes, of low geographic extent as they are limited to the SSA or immediate surroundings, of medium sensitivity for timing as will occur over the period of critical life stages for fish, of medium duration, of medium frequency, medium with respect to reversibility as the majority of flow in the majority of tributaries will be returned to near baseline conditions, and of high value due to the importance of fish ecologically and societally.

Determination of Significance

The primary adverse residual effect resulting from changes to water quantity is via the overprinting of portions of subwatersheds by Project infrastructure. The primary means of mitigation will be through implementation of fish habitat offsetting in consultation with DFO and other interested parties. It has been determined that a HADD of 9.22 ha will be created by the Project, which is the minimum area of offset that will be required (Appendix D6 of this EIS Addendum [Vol 2]). Additionally, the flow reduction that will be realized in Stream 6 (Angler Creek) was estimated to a 2.5 ha indirect effect by flow reduction of greater than 30% MAF. This HADD will continue for the period of construction and operation and therefore will also require offset. However, flows will be returned to near normal and below the threshold for the effect following post-closure. The threshold for significance as defined in Section 6.2.4.3.6 of this report relates to measurable (or predicted) change. A significant residual effect resulting from direct HADD to fish habitat is one that is not authorized under the *Fisheries Act*, or one that, despite authorization and associated mitigation and offsetting, would directly cause a HADD. Following the implementation of offsetting and further conditions under a *Fisheries Act* authorization and adherence to minimum setback distances to mitigate effects of blasting to fish, the residual effects of a change in water quantity on fish and fish habitat will be not significant.

6.2.4.6.4 Change in Water Quality

Analytical Assessment Techniques

The analytical assessment of potential changes to water quality is detailed in Section 6.2.3.6.4 of this EIS Addendum (Vol 2) and the Surface Water Quality Effects Assessment Update (Appendix D11 of this EIS Addendum [Vol 2]). The assessment was carried out in a manner similar to that described in the original EIS (2012), yet incorporating updated information as applicable. The predictions of surface water quality were then assessed against the background water quality and/or the most appropriate assessment benchmarks for the protection of aquatic life. The results of this analysis were then used to identify the potential effects to fish and fish habitat as protection of aquatic biota, by definition, is inclusive of fish (for all life stages), their food sources and habitat.

Project Pathways

The water that fish inhabit is the medium responsible for their ability to carry out the majority of their life processes. A detrimental alteration to the water quality in the aquatic environment can impact fish and fish habitat.

Project activities may interact with surface water quality in all project phases. In general, the interactions can be characterized as being primarily associated with controlled, routine discharges from the site. The interactions and project pathways were initially described in Section 6.2.3.6.4 of this EIS Addendum (Vol 2).

During site preparation and construction, the primary effect pathway relates to the mobilization of suspended material into natural surface water features as the result of land disturbance and clearing. By-products from the detonation of explosives may, include ammonia or similar compounds, may also contribute as they can be toxic to fish and other aquatic biota.

During operations, excess water from the PSMF and MRSA will be released to the environment via Hare Lake. This is a significant departure from the original EIS (2012) where water associated with the MRSA was to be released to the Pic River. Upon reaching acceptable water quality levels, site closure will involve the restoration of natural site drainage to the extent possible and the cessation of discharge to Hare Lake. For the PSMF, this involves directing runoff from the rehabilitated PSMF to the Stream 106 subwatershed. For the MRSA, this involves allowing runoff to drain into the Pic River, as well as eventually allowing the water in the open pits to overflow naturally, once filled, into Pic River associated subwatersheds. Other pathways of effect include:

- Entry of deleterious materials into fish habitat through minor spills or leaks from vehicles, equipment, storage containers/facilities (Major spills are covered in Section 6.3 of this EIS Addendum [Vol 2])
- Increased siltation as a result of maintenance or replacement of in-water structures (e.g., culvert replacement or maintenance on water discharge structures)

Mitigation and Enhancement Measures

Mitigations and enhancements specific to surface water quality are consistent with those previously identified for the soil, water quality and water quantity VECs. Additionally, to mitigate adverse effects to fish and fish habitat via changes in water quality, the following have been considered and will be implemented:

- Planning and design of the Project was informed through consultation with local land users and Indigenous communities to avoid waterbodies considered important to those communities and individuals
- Plan activities near water such that deleterious materials including, but not limited to, paint, primers, blasting abrasives, rust solvents, degreasers, grout, or other chemicals do not enter the watercourse

- Wash, refuel, and service machinery and store fuel and other materials for the machinery in a manner that prevents deleterious substances from entering the water
- Implement a Spill Prevention and Response Plan (SPRP)
- Whenever possible, operate machinery on land above the high-water mark, on ice, or from a floating barge in a manner that limits disturbance to the banks and bed of the waterbody
- Limit access to waterbodies and banks to protect riparian vegetation and limit bank erosion
- Promptly stabilize shoreline or banks disturbed by activities associated with the Project to prevent erosion and/or sedimentation, preferably through revegetation with native species appropriate for the site
- Implementation of an ESC Plan for the site to reduce potential sedimentation of waterbodies during all phases of the Project. ESC measures will be maintained until all disturbed ground has been permanently stabilized, suspended sediment have resettled to the bed of the waterbody or settling basin and runoff water is clear. The ESC Plan will be based on standard specifications such as Ontario Provincial Standard Specifications (OPSS), in particular, OPSS 805 (Construction Specification for temporary ESC measures), OPPS, PROV 182 (General Specification for Environmental Protection for construction in Waterbodies and on Waterbody Banks) and OPSS 206 (Grading)
- To avoid actions that may cause increased sedimentation, follow the DFO interim code of practice for temporary stream crossing, culvert maintenance and the waster rock management plan.
- Implement Follow-up Monitoring and Environmental Management Plans (FUMP and EMP) on waterbodies such as Pic River extending downstream of the Project site to the mouth of Lake Superior, the outlet of Hare Creek at Port Munro and Stream 6 (Angler Creek) and the outlet at Sturdee Cove that have significance to Indigenous communities.

Project Residual Effect

A detailed analysis of the residual effects of the Project on surface water quality is provided in the Surface Water Quality Effects Assessment Update (Appendix D11 of this EIS Addendum [Vol 2]). A summary of the Project residual effects on water quality are provided in Section 6.2.3.6.4 of this EIS Addendum (Vol 2). The following provides a summary of the implications to the fish and fish habitat VEC associated with changes to water quality for each phase.

Site Preparation and Construction

The primary potential impact to water quality during this phase of the Project is the mobilization of suspended material in the natural surface water features as a result of land clearing, excavation and material movement. These impacts are mitigatable through the adoption of standard erosion and sediment control methods including soil stabilization practices. The potential effects on fish and fish

habitat due to changes in water quality are characterized as adverse, of low magnitude as no exceedances of assessment benchmarks are predicted, of medium geographic extent as they are limited to the LSA, of high sensitivity for timing as will occur over the period of critical life stages for fish, medium duration, high frequency, reversible as the effect ceases once the source or stressor is removed, and of high value due to the importance of water quality in supporting fish and fish habitat, which is important both ecologically and societally.

Operations

During operations, the primary potential water quality effect from the project is the discharge of excess water from the site water management system to Hare Lake. For planning purposes, the water balance has assumed discharge will occur between April and November. Rates of discharge vary within and among years according to the development of the site and Process Plant needs. Such discharges have the potential to change the concentrations of water quality constituents from background. No other routine mine-related discharges to other receiving environments are proposed. Effluent discharged to Hare Lake is expected to meet benchmarks, within 150 m (or less) of the discharge point, for the protection of aquatic biota and therefore will be protective of fish and fish habitat.

Overall, The potential effects on fish and fish habitat due to changes in water quality during operations are characterized as adverse, of low magnitude as no exceedances of assessment benchmarks are predicted, of medium geographic extent as they are limited to the LSA, of high sensitivity for timing as will occur over the period of critical life stages for fish, of medium duration, of high frequency, reversible as the effect ceases once the source or stressor is removed, and of high value due to the importance of water quality in supporting fish and fish habitat, which is important both ecologically and societally.

Closure

Following the cessation of mining operations, the discharge to Hare Lake will cease. The site wide water management system will continue to operate such that site water will be directed toward and controlled via the water management pond. From the water management pond, the water will be directed to the open pit complex, which will provide decades of storage capacity. This strategy ensures control of water quality on and off site. For planning purposes, it is assumed that these diversions will continue for a period of five years, during which site aspects (PSMF, MRSA) will be rehabilitated and the water quality associated with these site aspects will have stabilized. At that time (once acceptable water quality has been confirmed), it is expected that natural surface water drainages will be restored. For the PSMF, that means surface runoff will be re-directed into the subwatershed 106. It is expected that the runoff water quality will be similar to existing baseline conditions once the natural flow regime in subwatershed 106 has been restored. For the MRSA, that means that drainage (run-off and shallow seepage) that will be collected by ditching and catch basins will be allowed to flow to the Pic River, rather than diverting it to the water management system. The pit complex is expected to fill with water following mine closure, after which the water from the pit will drain into subwatershed 103, through the MRSA and subsequently into the Pic River. No exceedances of water quality benchmarks in the Pic River as the result of closure scenario drainages are predicted.

Overall, The potential effects on fish and fish habitat due to changes in water quality during closure are characterized as adverse, of low magnitude as no exceedances of assessment benchmarks are predicted, of medium geographic extent as they are limited to the LSA, of high sensitivity for timing as they will occur over the period of critical life stages for fish, of medium duration, of high frequency, reversible as the effect ceases once the source or stressor is removed, and of high value due to the importance of water quality in supporting fish and fish habitat, which is important both ecologically and societally.

Determination of Significance

Consistent with the original EIS, the main adverse residual environmental effect on fish and fish habitat as a result of surface water quality relates to the incremental change in concentrations of constituent's relative to baseline in water bodies and water courses into which mine associated waters will be released. The potential effect extends to all phases of the mine life since water will be released from the site to the environment during all phases.

The threshold for significance as defined in Section 6.2.4.3.6 of this report relates to measurable (or predicted) change in the concentrations of a water quality parameters in receiving waters that exceed relevant water quality assessment benchmarks that are protective of aquatic biota.

With the proposed mitigation and environmental protection measures (outlined in this section and Section 6.2.3.6.4 of this EIS Addendum [Vol 2]), the residual effects of a change in water quality on fish and fish habitat will be not significant. This determination is supported by the fact that the predicted changes in water quality do not result in exceedances of assessment benchmarks in the LSA and no effects on aquatic biota will accrue. Predicted changes to water quality are within relevant objectives for the protection of aquatic life as developed for the most sensitive species and life stages of aquatic biota. This determination is consistent with the original EIS (2012). Consideration of Project related effects to fish tissue concentrations and human consumption is provided in Section 6.2.10 of this EIS Addendum (Vol 2).

6.2.4.6.5 Change in Benthic Invertebrate Communities

Analytical Assessment Techniques

The analytical assessment of changes to the benthic invertebrate community was based on the following:

- The quantitative estimation of the areal extent of fish habitat that is affected (disturbed or overprinted) (i.e., the bankfull width multiplied by the length of stream and/or the area of a water body (pond or lake) overprinted
- The quantitative assessment of required setback distances during blasting activities for the protection of aquatic biota (Section 6.2.4.6.1 of this report).
- The quantitative estimate of potential flow or water level reduction due to changes in drainage area using the threshold of 10% MAF as a benchmark for identifying a residual effect.

- The quantitative assessment of changes to water quality (as discussed in Sections 6.2.3.6.2 of this EIS Addendum [Vol 2] and 6.2.4.6.4 of this report) including the use of benchmarks that are protective of aquatic biota.
- The qualitative assessment of changes to sediment quality (Section 6.2.3.6.5 of this EIS Addendum [Vol 2]). The basis for this analysis was to identify the potential interaction of discharged mine water to the LSA, including the release of effluent from the water management pond to Hare Lake. Using partition coefficients to estimate the potential increase in sediment chemical concentrations. The predicted constituent concentrations were compared to assessment benchmarks to understand the significance of any predicted changes. These assessment benchmarks represent published sediment quality thresholds provided by the provincial and federal governments for the protection of aquatic biota.

Project Pathways

Project pathways that may impact benthic invertebrate communities are consistent with those identified that may impact fish and their habitat (Sections 6.2.4.6.1, 6.2.4.6.2, and 6.2.4.6.3 of this report) as benthic invertebrates inhabit the same waterbodies and are subject to the same stressors. Direct overprinting fish habitat by mine development may include the infilling of existing water bodies and riparian areas which may result in the direct destruction of inhabited benthic invertebrate habitat. This would result in the subsequent and immediate death of benthic invertebrates and the HADD of their habitats. The use of explosives in and near fish habitat may also result in the physical and/or chemical alteration of that habitat. For example, sedimentation resulting from the use of explosives may cover spawning areas or may reduce or eliminate bottom-dwelling life forms that fish use for food. Additional pathways of effects for the benthic invertebrate community indicator are also consistent with those as described for changes to water quantity and water quality (provided in Sections 6.2.4.6.3 and 6.2.4.6.4 of this report). Changes to the flow regime (velocity and water level) and water quality (lethal and sub-lethal toxicity) may impact the density, diversity and survival of benthic invertebrates.

It is anticipated that residual effects to sediment may accrue as a result of Project-related activities that could result in sediment releases from disturbed ground into local water sources and through routine releases of surface waters that may increase the concentrations of select constituents in local water courses resulting in accumulation of these constituents in bottom sediments. This in turn can further impact density, diversity and survival (effects of lethal and sub-lethal toxicity) of benthic invertebrate communities.

Mitigation and Enhancement Measures

Mitigations measures to minimize potential impacts to the benthic invertebrate community are consistent with those provided for mitigation in Sections 6.2.4.6.1 and 6.2.4.6.2 of this report. Minimizing the potential loss of aquatic habitat, and by extension the benthic invertebrate communities therein, was a primary consideration of the original mine design process as discussed in the original EIS. Avoidance as a mitigation was carried forward as part of the updated conceptual mine plan process, in that all reasonable attempts were made to reduce the level of interaction between aquatic habitat features and

Project infrastructure. The primary means of mitigation will be through implementation of a fish habitat offsetting plan in consultation with DFO and other interested parties. The offset plan is designed to meet the requirement of Section 27.1 of the MDMER and Section 35(2) of the *Fisheries Act* (see Appendix D6). Additional mitigation with respect to blasting procedures and setback distances, maintenance of approved site water balance facilities, and best practices and measures to control erosion and sedimentation will minimize impacts to the benthic invertebrate community. These will include:

- isolating disturbed areas with sediment curtains or similar structures
- maintaining appropriate work area setbacks from surface water features
- grading and/or covering surfaces to reduce erosion potential
- controlling run-off from erosion-sensitive features
- providing settling ponds or basins in which solids can be collected

Project Residual Effect

Both direct (overprinting) and indirect impacts (reduced flow / water level) to the fish and fish habitat were identified as a result of overprinting and reductions in flow due to the development of the Project. As such, direct and indirect impacts to the benthic invertebrate community will be realized through the same pathways and will be require offset under the *Fisheries Act* and MDMER. These have been discussed in greater detail the previous sections, yet consideration of the benthic invertebrate community as an important trophic level in the aquatic ecology, including as a food resource to fish will be considered in the preparation of the offset strategy.

Residual effects as a result of blasting activities are unlikely with the use of previously identified guidance from DFO and adhering to the estimated setback distances as calculated herein based on charge size and rock material.

A summary of the Project residual effects on water quality and sediment quality are provided in Sections 6.2.3.6.2 and 6.2.3.6.5 of this EIS Addendum (Vol 2). The assessment of water quality and sediment quality spans all life phases. For surface waters, the closure phase extends to the time where the open pit has filled with water and begins to drain (overflow) naturally into the local watershed.

Residual effects due to changes in water quality were not identified for the Project. During construction, the main source of change to water quality and by extension sediment quality is through siltation, which can be mitigated through the use of standard and effective mitigative erosion and sediment control measures. Effluent discharged to Hare Lake during operation is expected to meet benchmark standards, within 150 m (or less) of the discharge point and the protection of aquatic biota will therefore be protective of benthic invertebrates.

No effects to sediment quality or benthic invertebrates are anticipated in Hare Lake due to the discharge water released from the WMP during operations or in the Pic River due to drainage from the MRSA and/or open pits during the closure period. The incremental increases seen in sediment constituent concentrations is less than the background variability seen for individual constituents in Hare Lake based

on baseline data. It can be concluded therefore that the predicted incremental increases in constituent sediment levels are on average essentially indistinguishable from existing constituent levels. Following the cessation of mining operations, the discharge to Hare Lake will cease. It would be expected at this time that since water quality will return to background levels a new water-sediment equilibrium will be reached over time that sees sediment recovery to pre-discharge conditions.

Overall, The potential effects on benthic invertebrate community during site preparation and construction are characterized as adverse, of high magnitude due to a measurable change of habitat loss and flow, of medium geographic extent as they are limited to the LSA, of high sensitivity for timing as will occur over the period of critical life stages for benthic invertebrates, of low duration as contained to the construction phase, of high frequency, reversible as the effect ceases once the source or stressor is removed, and of high value due to the importance of benthic invertebrates in supporting fish and fish habitat, which is important both ecologically and societally.

For the operation phase the potential effects are adverse, of low magnitude as water quality and sediment quality criteria will be met, of medium geographic extent as they are limited to the LSA, of high sensitivity for timing as will occur over the period of critical life stages for benthic invertebrates, of medium duration, high frequency and reversible after a short time after the source or stressor is removed.

Determination of Significance

The primary adverse residual effects to the benthic invertebrate community are due to the direct overprinting of fish habitat and subsequent loss of flow in affected watercourses by the overprinting by Project infrastructure. The primary means of mitigation will be through implementation of fish habitat offsetting in consultation with DFO and other interested parties. It has been determined that a HADD of 9.22 ha will be created by the Project, which is the minimum area of offset that will be required (see Appendix D6 [Fish and Fish Habitat Offsetting Plan Update]). The threshold for significance as defined in Section 6.2.4.3.6 of this report relates to measurable (or predicted) change. A significant residual environmental effect on benthic invertebrates is one that is not authorized under the *Fisheries Act*, or one that, despite authorization, associated mitigation and/or offsetting, affects the productivity and sustainability of the benthic invertebrate communities there. Following the implementation of offsetting and further conditions under a *Fisheries Act* authorization, there will be no significant residual HADD to benthic invertebrate community.

A significant residual adverse effect will also be identified to the benthic invertebrate community where surface water quality or sediment quality has a measurable change that exceeds relevant quality assessment benchmarks that represent concentrations that are protective of aquatic biota in water courses and water bodies that receive mine effluent or mine-affected drainage. With the proposed mitigation and environmental protection measures as outlined in this section as well as Section 6.2.3.6.5 of this EIS Addendum (Vol 2) (i.e., appropriate site water management prior to effluent discharge), water and sediment quality will remain below criteria for the protection of aquatic biota and therefore not constitute a significant residual effect.

The determination of no significant residual adverse effect to the benthic invertebrate community is consistent with the original EIS.

6.2.4.7 Prediction Confidence

Confidence of predictions associated with the overprinting of fish habitat is high as the assessment was conducted using industry standard as stipulated by the *Fisheries Act,* MDMER and associated policies with respect to effects (both physical and chemical) and fish habitat offsetting. The main mitigation of habitat offset incorporates the input of applicable agencies, interested parties and Indigenous peoples.

Confidence associated with predictions on indirect impacts to fish and fish habitat as a result of changes to surface water flow is considered high and is previously discussed in Section 6.2.3.7 of this EIS Addendum (Vol 2).

Confidence with respect to surface water quality and sediment quality predictions which may influence fish and fish habitat indicators are considered high as they are based on conservative numerical assumptions and industry standard practices with respect to the assessment of potential effects to aquatic biota (see Section 6.2.3.7 of this EIS Addendum (Vol 2) for further detail). Additionally, potential effects to surface water quality and sediment quality are readily mitigatable.

6.2.4.8 Summary of Project Residual Effects

Table 6.2.4-7: Project Residual Effects on Fish and Fish Habitat

Residual Effect	Residual Effects Characterization									
	Project Phase	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Ecological/ Societal Value	Significance Determination
Lethal Effects to Fish	C, O	A	H	L	MS	M	M	L	H	NS
Change resulting in direct physical HADD	C, O	A	H	L	MS	M	H	M	H	NS
Change in Water Quantity	C, O, D	A	H	L	MS	M	M	M	H	NS
Change in Water Quality	C, O, D	A	L	M	HS	M	H	L	H	NS
Change in Benthic Invertebrate Community	C, O, D	A	H	M	HS	M	H	M	H	NS

Table 6.2.4-7: Project Residual Effects on Fish and Fish Habitat

Residual Effect	Residual Effects Characterization									
	Project Phase	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Ecological/ Societal Value	Significance Determination
KEY See Section 2.5 of the EIS Addendum (Vol 1) and Table 6.2.4-2 for detailed definitions **Project Phase:** C: Site Preparation / Construction O: Operation D: Decommissioning **Direction:** P: Positive A: Adverse **Magnitude:** N: Negligible L: Low M: Medium H: High N/A: Not applicable				**Geographic Extent:** N: Negligible L: Low M: Medium H: High **Timing:** NS: Low sensitivity MS: Medium sensitivity HS: High sensitivity **Duration:** N: Negligible L: Low M: Medium H: High **Significance Determination** S: Significant NS: Not Significant			**Frequency:** N: Negligible L: Low M: Medium H: High **Reversibility:** N: Negligible L: Low M: Medium H: High **Ecological / Societal Value:** N: Negligible L: Low M: Medium H: High			
Note: Timing was not included in the original EIS.										

6.2.4.9 References

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