Marathon Palladium Project Environmental Impact Statement Addendum

VOLUME 2 OF 2

6.2.6 Vegetation

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GENERATIONPGM

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Abbreviations

AIR	Additional information requests
CIAR	Canadian Impact Assessment Registry
EIS	Environmental Impact Statement
ELC	Ecological Land Classification
ESA	*Endangered Species Act*
FMP	Forest Management Plan
FMU	Forest Management Unit
FRI	Forest Resource Inventory
GenPGM	Generation PGM Inc.
GIS	geographic information system
ha	Hectare
IR	Information Request
LSA	Local Study Area
MRSA	Mine Rock Storage Area
N/A	Not applicable
NHIC	Natural Heritage Information Cent
PSMF	Process Solids Management Facility
ROM	Run of Mill
RSA	Regional Study Area
SAR	Species at Risk

SARA	*Species at Risk Act*
SIR	Supplemental Information Request
SSA	Site Study Area
TLRU	Traditional Land Resource Use
VEC	Valued Ecosystem Component

6.2.6 Vegetation

Vegetation includes forest communities such as upland forests and forested wetlands (i.e., swamps, treed fens and bogs) as well as non-forested wetlands (i.e., thicket swamps, open bogs and fens, meadow marshes, emergent marshes, and open-water marshes) and other non-forested plant communities such as rock barrens, cliffs and talus, and anthropogenic communities (e.g., transmission corridors). Vegetation also includes rare plants as well as plants and fungi of importance to Indigenous communities. Vegetation was selected as a VEC due its intrinsic ecological importance, its value to species at risk and other wildlife, as well as its traditional use by Indigenous peoples and other communities.

Vegetation is linked to other VECs, including:

- Atmospheric Environment (Section 6.2.1 of this EIS Addendum [Vol 2]) due to potential effects of fugitive dustfall
- Water (Section 6.2.3 of this EIS Addendum [Vol 2]) since changes in groundwater and surface water levels have potential impacts on vegetation (particularly wetlands)
- Wildlife (Section 6.2.7 of this EIS Addendum [Vol 2]) since changes in vegetation have the potential to affect wildlife habitat including availability of food and cover
- Indigenous traditional land and resource use (Section 6.2.12 of this EIS Addendum [Vol 2]) since changes in vegetation have the potential to affect traditional land and resource use (TLRU) by Indigenous communities of plants and fungi of food, medicine, or other cultural significance
- Human health (Section 6.2.10 of this EIS Addendum [Vol 2]) since vegetation affected by dust deposition could potentially affect organisms or humans that ingest this vegetation

6.2.6.1 Summary of Original Vegetation Environment Assessment

6.2.6.1.1 Assessment of Residual Effects in Original EIS

Section 6.2.6 of the original EIS (2012) and subsequent responses to information requests from the Panel provided an assessment of the following effects to vegetation as result of the Project:

- change in forest cover
- change in non-forest cover (e.g., thicket swamp, shore fen/meadow marsh, and rock barren)
- change to regionally or provincially rare species
- change to protected species
- change to plant and fungus species of importance to Indigenous communities

Additional information on the assessment of effects on vegetation was provided in responses to the following IRs:

- Responses to IRs 15.1, 15.2, and 23.4 (CIAR #426, 476, 448 and 428)
- Responses to SIR 11 (CIAR #586)
- Responses to AIR 9 (CIAR #654)

Main predicted effects to vegetation included the following:

- approximately 612 ha of forest cover, predominantly white birch (80%) and black spruce (15.3%), will be removed for site development
- land clearing and general disturbance may increase the potential for the introduction of non-native plant species to previously unaffected areas
- approximately 18 ha of non-forest cover (including 16 ha of thicket swamp, 1.4 ha of shore fen and meadow marsh, and 0.6 ha of rock barrens) will be removed for site development
- potential for dusting on remaining forest and other habitats
- removal of some provincially rare (e.g., alga pondweed) and regionally rare species [1] (e.g., broad-lipped twayblade, common ragweed, Oakes' pondweed, northern St. John's wort, marsh speedwell) for mine infrastructure and transmission line construction
- loss of some plant and fungus species of importance to Indigenous communities.

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

- optimizing the mine footprint to reduce forest clearing and loss of non-forested habitats during construction
- selective clearing along transmission line corridor during construction and operations
- design measures to reduce dust and active dust suppression activities (e.g., water sprays), regular road surface maintenance and implementation of speed limits during construction and operation
- implementing an invasive species awareness and control program
- selective re-vegetation

[1] many no longer considered regionally rare

6.2.6.1.2 Determination of Significance in Original EIS

For vegetation, the original EIS (2012) concluded that there would be no significant adverse effect. The forested area of the SSA was considered to represent a negligible portion of the Pic Forest Management Unit. Approximately 70% of the forest to be cleared for site infrastructure was proposed to be replanted, resulting in a net loss of 200 ha of forest. Removal of non-forest vegetation was limited to the SSA and was considered partially reversible through reclamation, and of low ecological importance since it was considered common in the LSA and RSA. Removal of rare plants was limited to the SSA and was proposed to be selective, and partially reversible through reclamation utilizing these species.

6.2.6.2 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.

6.2.6.3 Scope of the Assessment

6.2.6.3.1 Regulatory and Policy Setting

The regulatory and policy setting since the preparation of the original EIS remains relatively unchanged. As described in Section 5.2 of the Terrestrial Environment Baseline Update Report (Northern Bioscience 2020) (CIAR #722), there have been some changes to the ranking of some provincially and regionally rare species.

The environmental effects assessment for vegetation has been prepared in accordance with the requirements of the EIS Guidelines (Appendix B of this EIS Addendum [Vol 2]). Concordance tables, indicating where EIS Guidelines have been addressed, are provided in Appendix A of the EIS Addendum (Vol 2).

6.2.6.3.2 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 vegetation are summarized below:

- Concern for the protection of plant species of cultural importance
- Concern that the original EIS (2012) did not recognize the occurrence of plant species of cultural importance

Feedback related to wildlife has been addressed through updates to the EIS Addendum and supporting materials, responses and meetings with communities and stakeholders, as appropriate.

Traditional knowledge and TLRU information provided by Indigenous communities identified the importance of plants, fungi, and wildlife to these communities. Specifically, plant and fungi species of interest to Indigenous peoples with an interest in the Project were identified in Table 12 of the Terrestrial Environment Baseline Update Report (Northern Bioscience 2020) (CIAR #722), and has been incorporated into the effects assessment, mitigation and monitoring, where appropriate. However, given the confidentiality of this material, explicit details on the location of know species 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.

6.2.6.3.3 Potential Effects, Pathways and Measurable Parameters

Table 6.2.6-1 summarizes the potential environmental effects of the Project on vegetation, the effect pathway, and the measurable parameters. These potential environmental effects and measurable parameters were selected based on professional judgment, recent EAs for mining projects in Ontario, and comments provided during consultation.

Table 6.2.6-1: Potential Effects, Effects Pathways and Measurable Parameters for Vegetation

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in forest cover	• Direct loss of forest through the development of the project site, including access roads and utility corridors • Increased potential for introduction of invasive species in disturbed areas • Dusting of forest cover near SSA and other edge effects	• Area (ha) of forest lost • Area (ha) of remaining forest within fugitive dustfall i.e., within approximately 30 m of SSA

Table 6.2.6-1: Potential Effects, Effects Pathways and Measurable Parameters for Vegetation

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in non-forest cover (e.g., thicket swamp, shore fen/meadow marsh, and rock barrens)	• Direct loss of non-forest cover through the development of the project site, including access roads and utility corridors • Increased potential for introduction of invasive species in disturbed areas • Dusting of non-forest cover near SSA and other edge effects	• Area (ha) of non-forested wetland lost • Area (ha) of non-forested rock barren lost • Area (ha) of other non-forested habitat lost • Area (ha) of remaining non-forest within fugitive dustfall i.e., within approximately 30 m of SSA
Change to regionally or provincially rare plant species	• Removal of occurrences through the development of the project site, including access roads and utility corridors • Increased potential for introduction of invasive species in disturbed areas • Dusting of regionally or provincially rare species near SSA and other edge effects	• # of occurrences directly lost • area (ha) of ecosite (potential habitat) lost • # of occurrences within fugitive dustfall i.e., within approximately 30 m of SSA
Change to plants of interest to Indigenous communities	• Removal of occurrences through the development of the project site, including access roads and utility corridors • Dusting of plants of significance to Indigenous communities and other edge effects	• Area (ha) of forested or non-forested vegetation communities that support plant or fungi species of interest to Indigenous communities

6.2.6.3.4 Assessment Boundaries

In general, the spatial boundaries for the assessment of environmental effects are presented in Section 2.4 of 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. The SSA encompasses 1,116 ha.
- **Local Study Area**: The Vegetation LSA represents the area within which changes to vegetation from Project activities and components can be predicted or measured with a reasonable degree of accuracy and confidence. In the original EIS (2012), to be consistent with terrestrial VECs (except for woodland caribou), the Vegetation LSA consisted of a 5 km buffer from the approximate centroid of the Project footprint or SSA. This LSA was overly conservative for

assessing impacts on vegetation VECs as most indirect effects such as impacts from dust, light, noise and hydrology will likely not extend more than 1 km from the SSA. As such, the LSA has been refined to a 1 km buffer from the SSA to better reflect potential direct and indirect effects on vegetation.

The revised LSA has been developed based on available information and professional judgment to encompass the predicted extent of the following effects:

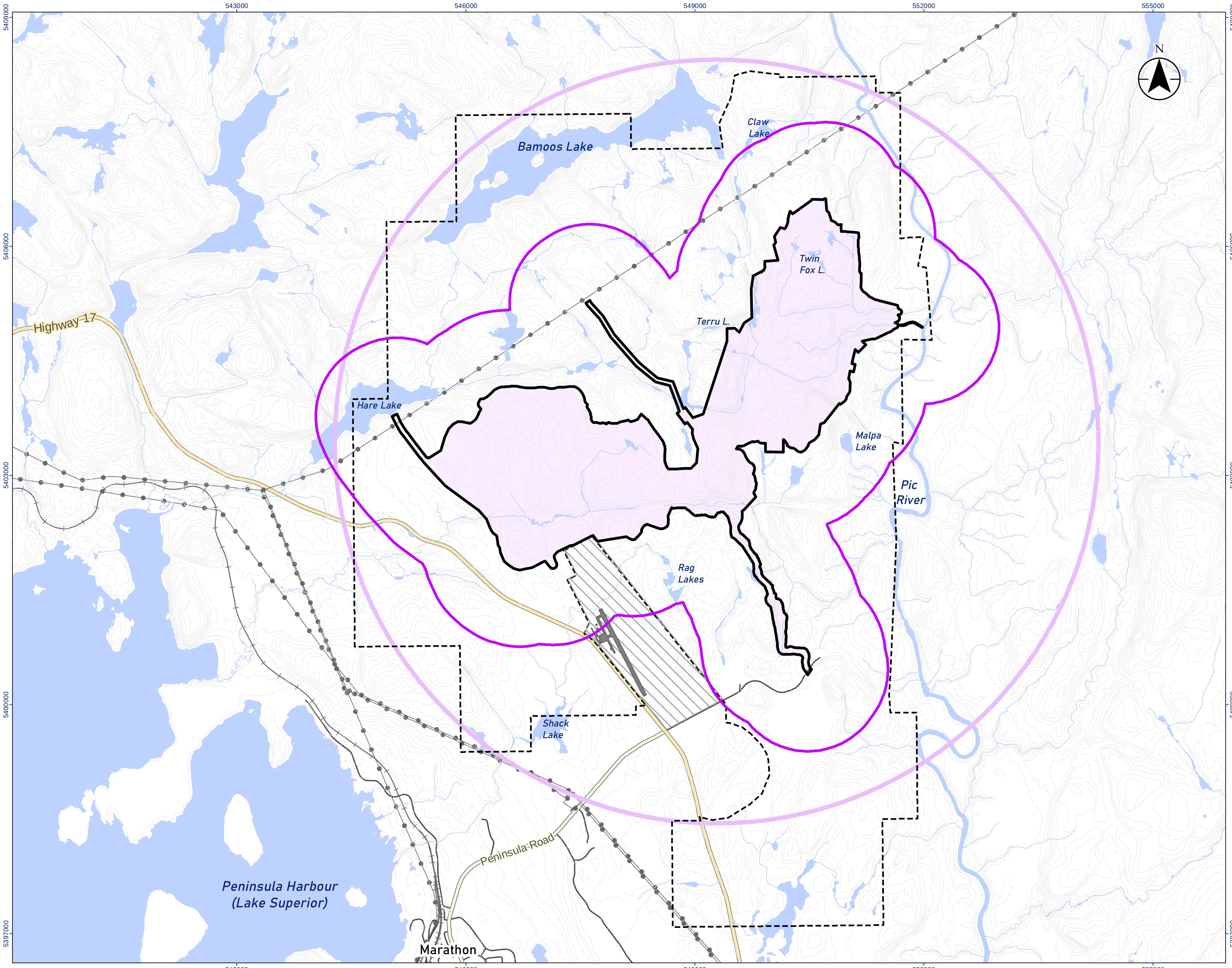
  - a 10 m buffer from the outer boundary of the SSA to encompass any potential edge effects from increased sunlight, wind, and resultant evapotranspiration.
  - a 30 m buffer around the edge of the SSA to reflect where effects due to fugitive dust deposition may occur on vegetation. The greatest concentration of dust deposition typically occurs within 10 m of the source (Spatt and Miller 1981), but some generated dust particles can disperse beyond 20 m from the source (Farmer 1993). Since dust dispersion can be affected by many factors (e.g., dust origin, the size and density of dust particles, prevailing winds, topography, and mitigation measures), a buffer of 30 m was chosen as the area in which dustfall effects are expected to have the greatest potential effect on vegetation, with dustfall levels beyond this buffer decreasing with distance from the SSA.
  - areas of the LSA adjacent to the SSA where groundwater is predicted to decrease (drawdown) or increase (mounding effect) 0.5 m or greater (as discussed in Section 6.2.3 of the EIS Addendum [Vol 2]). A threshold of 0.5 m was selected given that wetland communities (forested or non-forested) are generally adapted to seasonal water level fluctuations of up to 0.5 m at least (Aldous and Bach 2014). Groundwater drawdowns of more than 0.5 m are more likely to have impacts on wetland vegetation and cause a shift in plant community composition. Conversely, a rising groundwater table can cause a shift in plant community composition, with species more tolerant of xeric conditions being replaced over time with those adapted to a more mesic or hydric environment.
  - areas adjacent to the SSA where surface water hydrology is predicted to change (increase or decrease) because of drainage alterations in the SSA during Project construction and operation.

- **Regional Study Area**: The Vegetation 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 with regard to vegetation effects. The original EIS did not explicitly define the spatial extent of the RSA for vegetation. To facilitate a more quantitative assessment of VEC-specific effects, separate RSAs have been defined for this EIS Addendum for forest cover and non-forested vegetation VECs.

- Since the predominant vegetation community in the LSA is forest, the RSA for forests is the Pic Forest Management Unit. Commercial forestry has by far the largest footprint of any reasonably foreseeable project in the landscape surrounding the Project, and forests are managed for sustainability at the Forest Management Unit (FMU) scale. This RSA encompasses 1,153,240 ha and includes both the SSA and LSA.
- Ecodistrict 3W-5 is the RSA for wetlands, rock barrens, and other non-forested vegetation communities as well as regionally and provincially rare plants. Ecodistrict 3W-5 encompasses the SSA and LSA and represents the most ecologically meaningful RSA for non-forested vegetation VECs that are not directly managed for commercial forestry. Ecodistricts are the ecological land classification unit that is above the level of ecosites (Banton et al. 2009) in the provincial Ecological Land Classification (ELC) hierarchy, with ecosites as delineated in the Forest Resource Inventory (FRI) being the ELC unit used as the basis of vegetation mapping for the SSA and LSA. Ecodistrict 3W-5 is part of the larger Lake Nipigon 3W Ecoregion and encompasses approximately 735,000 hectares along the north shore of Lake Superior. The Schreiber Ecodistrict (3W-5) is characterized by rolling to rugged, bedrock-controlled topography with very shallow mineral soils, and a cool, foggy, moist conditions influenced by Lake Superior (Wester et al. 2018). Like the forested RSA, it includes both the SSA and LSA.

The modified and original vegetation LSA boundaries are depicted on Figure 6.2.6-1 and the RSA boundaries are depicted on Figure 6.2.6-2.

The temporal boundaries for the Project that have been considered in the determination of environmental effects are described in Section 1.5 of EIS Addendum (Vol 1) (CIAR #727). The temporal boundaries used to assess potential effects on the vegetation VEC span all phases of Project life.



Legend

- Site Study Area
- Local Study Area
- Original Terrestrial Local Study
- Project Boundary (MLAS, MENDM Changed 2017)
- Airport Property
- Airport Infrastructure
- Waterbody (LIO)
- Watercourse (LIO)
- Contour
- Hydro Line
- Highway
- Major Road
- Minor Road
- Railway

0 1 2 3 km

1:51,254 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.

Project Location
Marathon

Prepared by D Harvey & R. Foster on 2021-03-02

Client/Project
GENERATION MINING LTD.
MARATHON PALLADIUM PROJECT

Figure No.
6.2.6-1

Title
Spatial Boundaries of the Vegetation Local Study Area and Site Study Area

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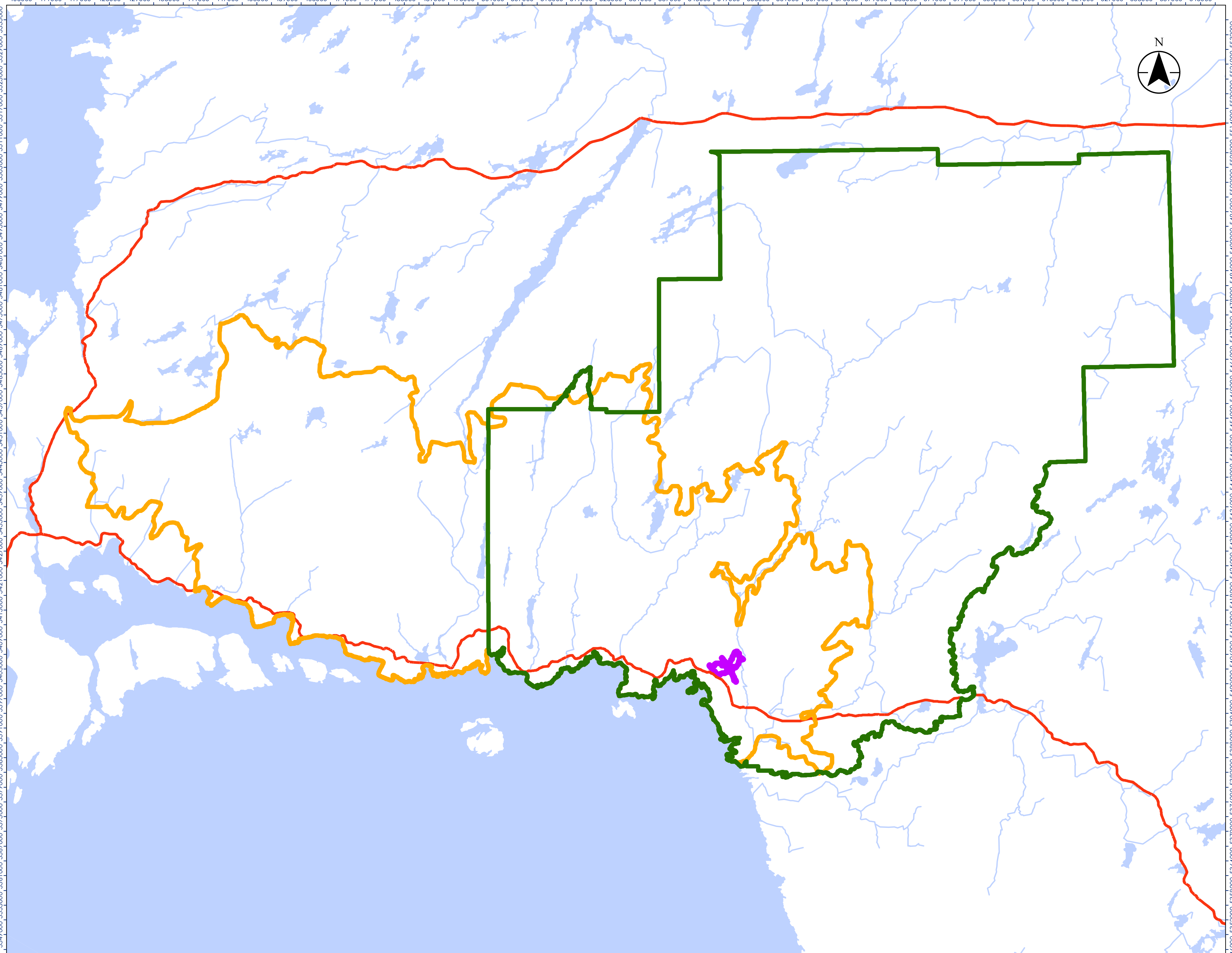

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Legend
- Regional Study Area: Forest
- Regional Study Area: Non-forested Vegetation VECs
- Site Study Area Boundary
- Expressway / Highway
- Waterbody (LIO 1:2M)
- Watercourse (LIO 1:5M)

0 8 16 24 32 40 48 km

1:800,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.

Project Location
Marathon

Prepared by R. Foster on 2021-03-02

Client/Project
GENERATION MINING LTD.
MARATHON PALLADIUM PROJECT

Figure No.
6.2.6-2

Title
Spatial Boundaries of the Vegetation Regional Study Area and Local Study Area

6.2.6.3.5 Residual Effects Characterization

Table 6.2.6-2 summarizes how residual environmental effects are characterized in terms of direction, magnitude, geographic extent, timing, frequency, duration, reversibility, and ecological and socio-economic context. Quantitative measures or definitions for qualitative categories are provided.

Table 6.2.6-2: Characterization of Residual Effects on Vegetation

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 vegetation relative to baseline conditions. **Adverse** – Effect moves measurable parameters in a direction detrimental to vegetation relative to baseline conditions.
Magnitude	The amount of change in measurable parameters (ha or # of occurrences) of the VEC relative to existing conditions	**Negligible –** no measurable change **Low –** a measurable change in the count, area (ha) or quality of vegetation communities (upland and/or wetland), where the change does not threaten long-term viability of that vegetation community type in the RSA **Medium –** a measurable change in the count, area (ha) or quality of vegetation communities (upland and/or wetland), where the change may affect the resiliency to future changes of that vegetation community type in the RSA **High –** a measurable change in the count, area (ha) or quality of vegetation communities (upland or wetland), compared to baseline conditions, where the change is likely to threaten the long-term viability of that vegetation community type in the RSA
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.	Not Applicable (N/A) – seasonal aspects are unlikely to affect the residual environmental effect on vegetation communities. Applicable – seasonal aspects may affect the residual environmental effect on vegetation communities.
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)

Table 6.2.6-2: Characterization of Residual Effects on Vegetation

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
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
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.

6.2.6.3.6 Significance Definition

A significant residual environmental effect on Vegetation is defined as one that:

- results in long-term, irreversible loss of a species listed on Schedule 1 of the *Species at Risk Act* SARA) or listed as threatened or endangered under the *Endangered Species Act* (ESA), or identified as provincially/regionally rare or of interest to Indigenous communities
- results in a decrease in the count or area of a vegetation community that threatens the long-term viability of that VEC in the RSA
- results in a change in the quality of one or more vegetation communities (upland and/or wetland), compared to baseline conditions, where the change is likely to threaten the long-term functions of that vegetation community in the RSA

6.2.6.4 Existing Conditions for Vegetation

Existing conditions are described in Chapter 4 of EIS Addendum (Vol 1) (CIAR #727). The Terrestrial Environment Updated Baseline Report (Northern Bioscience 2020) (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.

6.2.6.5 Determining Project Interactions with Vegetation

Table 6.2.6-3 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 (2012) and has been updated to reflect changes to the Project.

Table 6.2.6-3: Project Interactions with Vegetation

	Effects			
Physical Activities	**Change in Forest Cover**	**Change in Non-forest Cover**	**Change to Provincially or Regional Rare Plant Species**	**Change to Plant Species of Interest to Indigenous Communities**
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	–	–	–	–
Management of surface water and groundwater on the site, including seepage and run-off	–	–	–	–
Maintenance and management of mine rock stockpiles, overburden, and PSMF	–	–	–	–

Table 6.2.6-3: Project Interactions with Vegetation

Physical Activities	Effects			
	Change in Forest Cover	Change in Non-forest Cover	Change to Provincially or Regional Rare Plant Species	Change to Plant Species of Interest to Indigenous Communities
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 accommodations complex	✓	✓	✓	✓
Operating vehicles	–	–	–	–
Hiring and management of workforce	–	–	–	–
Taxes, contracts and purchases	–	–	–	–
Operation				
Drilling, blasting, loading and hauling of mine rock from the pits to the ROM stockpile pad, crusher or the MRSA	✓	✓	✓	✓
Operation of explosives facilities	–	–	–	–
Handling, transportation, use and disposal of explosives	–	–	–	–
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	✓	✓	✓	✓

Table 6.2.6-3: Project Interactions with Vegetation

Physical Activities	Effects			
	Change in Forest Cover	Change in Non-forest Cover	Change to Provincially or Regional Rare Plant Species	Change to Plant Species of Interest to Indigenous Communities
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/Post-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	–	–	–	–
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	–	–	–	–

Table 6.2.6-3: Project Interactions with Vegetation

Physical Activities	Effects			
	Change in Forest Cover	Change in Non-forest Cover	Change to Provincially or Regional Rare Plant Species	Change to Plant Species of Interest to Indigenous Communities
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])

Potential environmental effects during Project construction are primarily associated with vegetation clearing and removal activities and are considered direct effects on vegetation communities. During Project operation and closure, vegetation removal will have already occurred, and additional vegetation removal is not anticipated; therefore, no Project interaction with vegetation communities is anticipated because of clearing and removal activities. The potential environmental effects on vegetation communities during operation are associated with indirect effects (from dust and changes in groundwater regime) only. For Project activities with no interaction these activities are not sources of dust. The potential environmental effects on vegetation communities during decommissioning and active closure are associated with land reclamation and re-vegetation activities and are considered direct and indirect effects on vegetation communities.

6.2.6.6 Assessment of Residual Effects on Vegetation

6.2.6.6.1 Change in Forest Cover

Analytical Assessment Techniques

The assessment of Project environmental effects on vegetation communities used a geographic information system (GIS) (ESRI ArcMap) to overlay the Project components and physical activities and predicted indirect effects on ecosite mapping presented in the Terrestrial Environment Baseline Report Update (Northern Bioscience 2020) (CIAR #722). Existing disturbed areas (e.g., roads, trails, mineral exploration trenching) and anthropogenic vegetation communities (e.g., transmission rights-of-way) were not included in the assessment of vegetation loss.

The assessment conservatively assumes that rehabilitation and revegetation activities will only commence during the closure phase, although progressive rehabilitation will occur during operation as Project components reach design capacities. Additional details are provided in the Conceptual Closure Plan (See Section 1.5.2.3 of the EIS Addendum [Vol 1]) (CIAR #727). Vegetation communities along the edge of the SSA are predicted to experience some fragmentation, which may indirectly affect wildlife habitat, such as forest interior breeding bird habitat. Direct and indirect effects on wildlife and species at risk habitat resulting from vegetation removal or impairment are discussed in Sections 6.2.7 and 6.2.8 of this EIS Addendum (Vol 2), respectively.

Project Pathways

Site Preparation and Construction

The primary mechanism for change in the abundance of vegetation communities is the removal of vegetation during site preparation and construction activities. It is conservatively assumed that all vegetation in the SSA will be removed or substantially altered. Most of the clearing will occur during the site preparation phase, while recognizing this may somewhat overestimate the impacts on vegetation during early stages of the Project.

Areas adjacent to the SSA may experience fugitive dustfall and other impairment from fugitive dustfall, as well as indirect changes such as edge effects (i.e., increased light, wind, and evapotranspiration), fragmentation, invasive species, and changes in groundwater and/or surface water conditions due to adjacent Project-related ground disturbance.

Potential sources of fugitive dust include clearing activities, vehicle traffic on unpaved surfaces, and the initial development of the open pits, mine rock storage area (MRSA), process solids management facility (PSMF) and other mine infrastructure. Fugitive dustfall can impair vegetation health (and potentially herbivores and other consumers higher up the food chain) by physical coverage or chemical toxicity (Farmer 1993; McCune 1991; Pyatt and Haywood 1989; Walker and Everett 1991). Any impairment of vegetation associated with fugitive dustfall during site preparation and construction are more likely to be physical in nature at the mine site, as the chemical nature of the overburden material in areas that are to be cleared is benign. Further, any effects are likely to be limited to the immediate vicinity of any cleared areas as fugitive dust emissions are generally predicted to be low (see Section 6.2.1 of this EIS Addendum [Vol 2]).

Effects on vegetation from potentially increased sunlight, wind, ambient temperature, and rates of evapotranspiration will occur along the margins of the SSA and where linear corridors (i.e., roads, transmission/distribution line corridors) have fragmented the existing forest of the LSA. These edge effects on microclimate are expected to encourage regrowth of early successional tree species such as white birch and balsam poplar and herbaceous and shrub species adapted to disturbance conditions.

The disturbance of the SSA during site preparation may also increase the potential for the introduction of non-native plant species to previously unaffected areas. Forty (40) non-native species were identified in the SSA during baseline studies of which only purple loosestrife and potentially bull thistle and tansy, and common St. John's wort could be considered invasive. Clearing and site development in the SSA will create a large, poorly vegetated area that may be susceptible to colonization by non-native plant species already present on site (including the soil bank) or from elsewhere. Propagation of non-native species into disturbed habitats may occur by the movement of machinery, equipment, and vehicles along transportation corridors. Invasive species can displace native vegetation, although effects on forest communities in the LSA are most likely to be felt in understory species composition.

As discussed in Section 6.2.3 of this EIS Addendum (Vol 2), site development and construction will alter local topography and drainage patterns within the SSA, and forest vegetation in the adjacent LSA may be affected indirectly. Changes to surface water hydrology may affect the soil moisture regimes in riparian areas, with subsequent effects on vegetation if beyond the natural variation in hydrology due to seasonal and annual variation, as well as beaver activity. Surface water and groundwater effects on vegetation are likely to be minimal during the brief site preparation and construction phase due to the lag time for vegetation to respond to any changes in hydrology or groundwater.

Operation

No additional vegetation communities will be removed during operation. However, it is predicted that limited vegetation regrowth or regeneration in the SSA will occur, and progressive rehabilitation of select areas will commence. Progressive rehabilitation is discussed in the Conceptual Closure Plan (see Section 6.2.1 of this EIS Addendum [Vol 2])).

In the absence of mitigation, indirect effects such as fugitive dust deposition and other edge effects (i.e., increased sunlight, wind, and evapotranspiration) will continue during this phase, as will impacts from invasive and other non-native species. Vegetation communities within 30 m of the SSA may be indirectly affected by dust deposition from operation activities. Dust during operation is anticipated to result from traffic movement on unpaved roads; handling and transferring of extracted ore, waste rock and overburden, ore stockpile, storage areas of waste rock and overburden, the open pits; and ore processing (crushing, grinding, refining). As with site development and construction, effects on vegetation communities within 30 m of Project components are associated with the introduction of exotic or invasive species by vehicles or imported fill.

Predicted impacts on groundwater and surface water will increase during this phase of the Project as changes to the mine footprint intensifies e.g., deepening and enlargement of pits, expansion of MRSA and PSMF. During operation there is the potential for forests to experience indirect effects due to groundwater changes as a result of dewatering the open pits and constructing the PSMF. Changes in groundwater levels could result in changes to surface water flow patterns and a reduction or increase in downstream flow, with the following results:

- reduction or increase in the amount of standing water
- reduction or increase of flow in associated watercourses
- reduction or increase in shallow groundwater flow and input
- changes in the rates of accumulation of organic material
- changes in vegetation reflecting soil moisture regimes, (quicker for herbaceous and graminoid understory but slower for woody species and overstory)

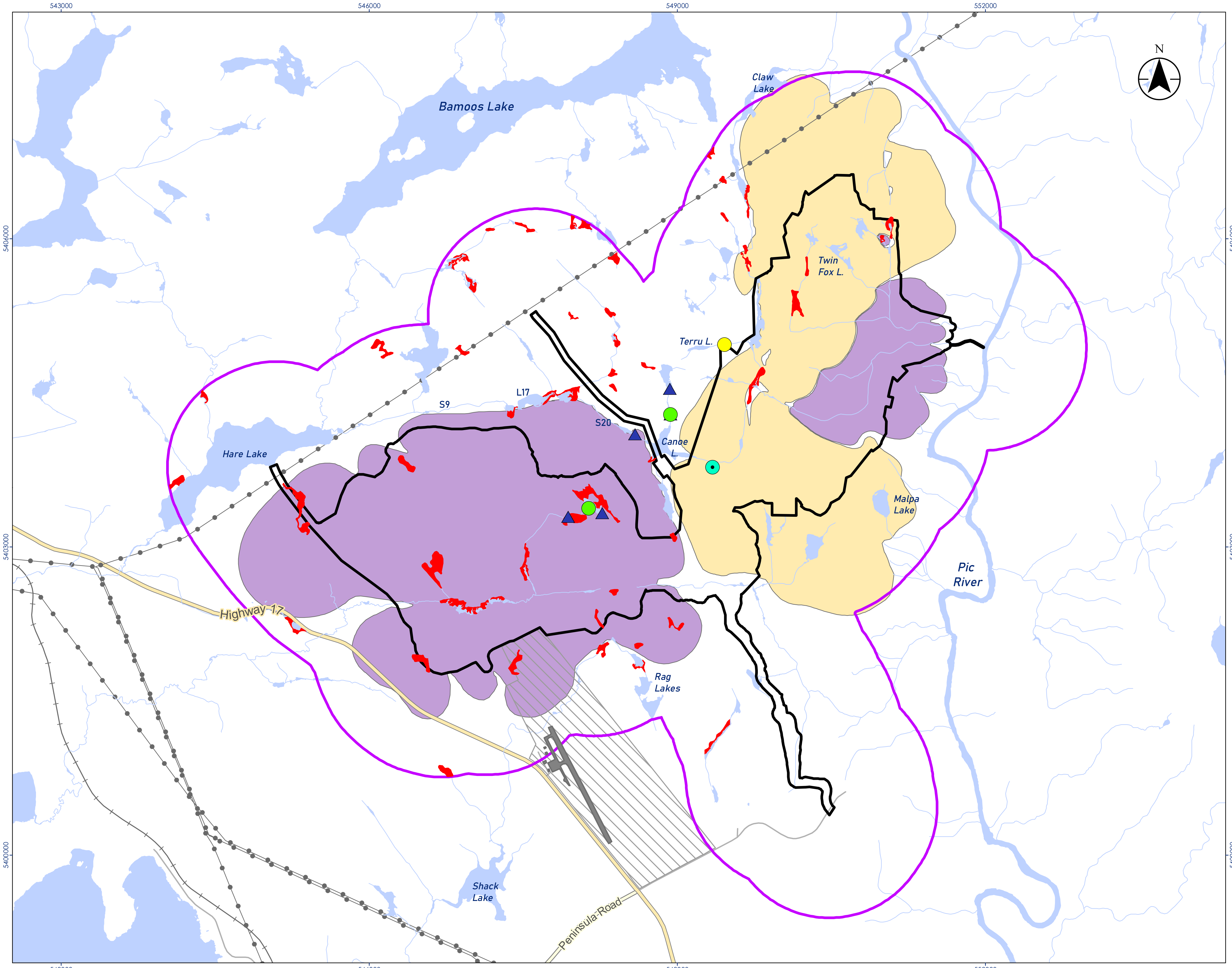
Closure

No additional vegetation removal will occur during closure. Potential impairment from fugitive dustfall and edge effects will lessen as the site activity decreases and progressive rehabilitation activities implemented during operation will continue as outlined in the Conceptual Closure Plan (see Section 6.2.1 of this EIS Addendum [Vol 2]).

Vegetation within 30 m of Project components may be subject to indirect effects from dust generated by decommissioning and rehabilitation activities. Vegetation communities within 30 m of Project components may also be affected by the introduction of invasive species by equipment, vehicles, and imported fill.

Potential effects to forest vegetation from predicted increases or decreases in groundwater levels, as well as any changes to surface water hydrology, will be limited to the LSA. Figure 6.2.6-3 depicts the predicted spatial extent of groundwater increases or decreases with respect to the LSA in closure, when the pit lakes have formed. Approximately 442 ha in the LSA, outside the limits of the SSA, are predicted to have at least a 0.5 m increase in groundwater level in closure compared to baseline conditions due to mounding of the water table associated with the MRSA and PSMF. Approximately 400 ha in the LSA, outside the limits of the SSA, are predicted to have at least a 0.5 m decrease in groundwater level in closure compared to baseline conditions due to the pit lake water level elevations being lower than original baseline water table elevation.

Predicted effects on vegetation from changes in groundwater or surface water would be due to water quantity, rather than quality. With appropriate mitigation as discussed in Section 6.2.3 of this EIS Addendum (Vol 2), surface water quality is predicted to meet regulatory requirements.



Stantec

NORTHERN BIOSCIENCE

Legend

Provincially Rare Plants

- Alga Pondweed
- Alpine Woodsia
- Braun's Holly Fern

Regionally Rare Plants

- Oakes' Pondweed
- Non-forested Wetland
- Local Study Area
- Site Study Area
- Groundwater >0.5 m increase at Closure
- Groundwater >0.5 m decrease at Closure
- Airport
- Waterbody (LIO)
- Watercourse (LIO)
- Hydro Line
- Railway
- Highway
- Major Road

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Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.

Project Location
Marathon

Prepared by D Harvey & R. Foster on 2021-03-02

Client/Project
GENERATION MINING LTD.
MARATHON PALLADIUM PROJECT

Figure No.
6.2.6-3

Title
Predicted Effects Pathway on Vegetation in the Local Study Area and Site Study Area

Mitigation and Enhancement Measures

Direct Loss

During Project planning and optimization of the conceptual mine design, efforts have been made to adjust the Project footprint and reduce the environmental impact including area of vegetation clearing. Existing disturbed areas were incorporated into the SSA to accommodate Project components and where possible to reduce direct effects on forest cover and other vegetation communities.

Standard construction best practices will be used during the site preparation and construction phase to reduce the potential negative interactions with vegetation. For the transmission line, for example, mitigative measures during construction will include:

- No grading or stripping will occur in corridor
- Vegetated buffer zones (slope-dependent) will be left between the line and sensitive habitats (e.g., watercourses, waterbodies)
- Lower vegetation and brush will be left in place
- Disturbed soil will be stabilized to assist vegetation regrowth and to control erosion
- Hand-clearing of vegetation will be used at sensitive stream crossings and within erosion control zones to reduce soil disturbance

As outlined in the Conceptual Closure Plan (see Section 6.2.1 of this EIS Addendum [Vol 2]), progressive rehabilitation will be used to recover some of the area lost during mine operation, including the access road and transmission line, and return it to a vegetated state. Progressive reclamation will commence as early in the site development process as practicable to encourage the early re-establishment of vegetation. Following closure, stockpiled topsoil/overburden will be spread over portions of the MRSA and used to reclaim other locations (e.g. process plant, interior roads) on site, followed by seed application and/or planted with non-invasive vegetation (and native, where practicable) to meet habitat reclamation objectives.

Indirect Change or Impairment

Mitigation measures associated with dust creation during all phases include the use of suppressants/water to reduce dust creation and limiting vehicle traffic to previously disturbed and necessary areas only. See Section 6.2.1 of this EIS Addendum (Vol 2) for mitigation details with respect to fugitive dustfall.

Preventing the initial establishment of invasive plants is the most effective method for control (Clark 2003; Polster 2005). Specific mitigative measures that will be implemented include:

- implementing an invasive species awareness and control program
- isolating sensitive areas until adequate native vegetation is established through reclamation

- maintaining a healthy, non-invasive, vegetative cover wherever practicable on site
- managing areas with exposed soil to prevent the establishment of unwanted vegetation in disturbed/high traffic areas
- evaluating the quality control of reclamation seed mixes to ensure seed mixes are of high quality (i.e., avoid contamination with propagules of non-desirables)
- progressive reclamation of disturbed lands

See Section 6.2.3 of this EIS Addendum (Vol 2) for mitigation details with respect to impacts on groundwater and surface water hydrology.

Project Residual Effect

Residual effects for vegetation are summarized in Table and discussed below.

Direct Loss

Project site development and construction will result in the long-term loss of approximately 1,081 ha of forest in the SSA (Table 6.2.6-4), which consist of forest ecosites that are common and widespread in the RSA. Therefore, the loss of these forest types in the SSA is not predicted to jeopardize their long-term viability in the adjacent landscape. In comparison, 17,514 ha of forest is scheduled to be harvested in the Pic Forest FMU in 2020-2021 alone (NFMC 2019) and the area cleared for commercial forestry, and subsequently regenerated, in the Pic Forest FMU during the life of the mine will be at least two orders of magnitude larger than the footprint of the SSA.

Soil and site conditions will be permanently altered for much of the SSA. Forest communities in these affected areas of the SSA are not predicted to return to original forest conditions. Forest regrowth will occur after closure in areas where soils and topography are suitable for tree growth. For the purposes of the effects assessment on vegetation communities it is assumed that all vegetation removed during construction will be permanently lost and that vegetation that becomes established during active closure will differ from existing conditions.

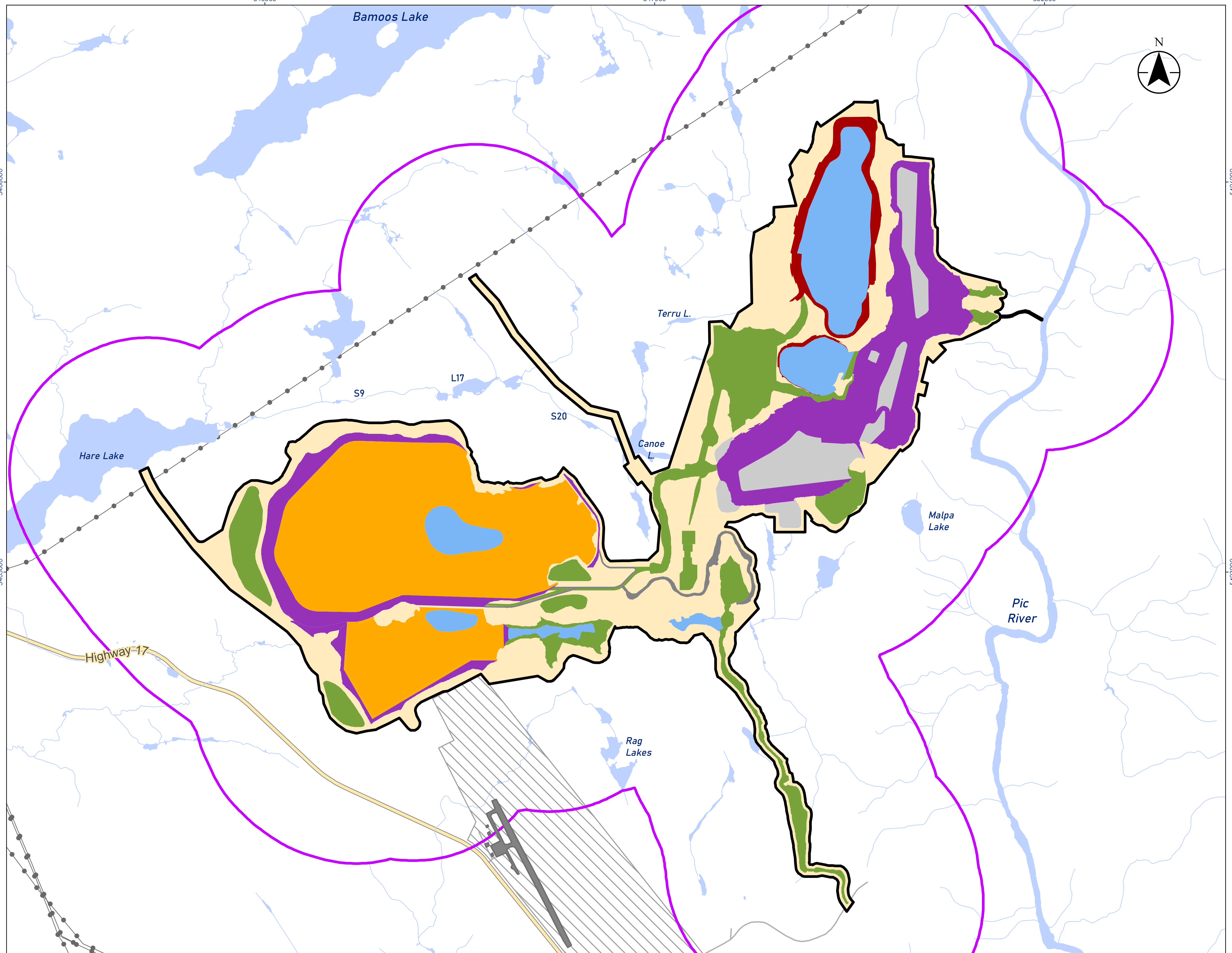
Permanent changes in the substrate from relatively deep mineral and organic soils to shallow soils and exposed rock are predicted to dominate the SSA after closure. As such, the loss of these vegetation communities in the SSA is considered irreversible. In areas that are conducive to tree growth, regrowth is predicted to occur gradually over decades following rehabilitation. Rehabilitation will include reapplication of topsoil, where feasible, and sowing graminoid and herbaceous seed-mixes. Details of the seed mixture, mulching, and fertilization requirements will be established as identified in the Conceptual Closure Plan (see Section 6.2.1 of this EIS Addendum [Vol 2]). Areas of the SSA conducive to tree and shrub growth will be left to naturally revegetate through the natural recruitment of adjacent tree and shrubs in the surrounding landscape. Rehabilitated upland communities are predicted to include early successional treed areas, open meadows, and a mosaic of mixed early successional trees and shrubs, meadow, and exposed rock. Post-closure vegetation communities are presented in Figure. Rehabilitated areas are predicted to develop into mature forest over succeeding decades; however, it is also likely that productive commercial forest will not be restored in the SSA.

Table 6.2.6-4: Summary of Ecosites in the SSA, LSA, and RSA (Pic Forest FMU FMP)

Ecosite / Habitat Type	Area (ha) in SSA	Area (ha) in LSA	Area (ha) in RSA
B007 Active Mineral Barren	0.0	6.3	479.5
B012 Very Shallow, Dry to Fresh: Pine - Black Spruce Conifer	41.8	121.6	47,115.7
B014 Very Shallow, Dry to Fresh: Conifer	110.8	264.6	2,866.8
B016 Very Shallow, Dry to Fresh: Aspen - Birch Hardwood	18.1	180.6	13,819.3
B040 Dry, Sandy: Aspen-Birch Hardwood	0.0	7.4	4,400.5
B046 Dry to Fresh, Coarse: Sparse Shrub	0.0	0.4	41.8
B047 Dry to Fresh, Coarse: Shrub	3.0	17.3	954.2
B049 Dry to Fresh, Coarse: Jack Pine - Black Spruce Dominated	3.1	8.0	120,587.3
B050 Dry to Fresh, Coarse: Pine - Black Spruce Conifer	39.7	304.8	147,336.0
B052 Dry to Fresh, Coarse: Spruce - Fir Conifer	537.1	1,334.5	35,726.3
B053 Dry to Fresh, Coarse: Conifer	0.0	5.1	750.5
B055 Dry to Fresh, Coarse: Aspen - Birch Hardwood	194.4	1,061.6	260,121.5
B062 Moist, Coarse: Sparse Shrub	0.8	8.4	24.3
B063 Moist, Coarse: Sparse Shrub	2.4	17.6	881.0
B065 Moist, Coarse: Pine - Black Spruce Conifer	26.3	91.2	63,783.8
B067 Moist, Coarse: Spruce - Fir Conifer	77.3	118.0	4,906.5
B070 Moist, Coarse Aspen - Birch Hardwood	4.7	70.9	31,076.7
B098 Fresh, Silty to Fine Loamy: Jack Pine - Black Spruce Dominated	0.0	8.0	25,593.4
B099 Fresh, Silty to Fine Loamy: Jack Pine - Black Spruce Conifer	0.8	31.3	26,953.4
B101 Fresh, Silty to Fine Loamy: Spruce - Fir Conifer	2.5	42.1	6,513.5
B104 Fresh, Silty to Fine Loamy: Aspen - Birch Hardwood	18.4	170.8	44,672.6
Other Upland Forest Ecosites			49,840.7
B128 Intermediate Swamp: Organic Soil	0.0	7.3	102,969.2
Other Conifer Swamps			40,287.0
Hardwood Swamps			718.2
B135 Organic Thicket Swamp	0.0	0.9	8,258.7
Mineral Thicket Swamp			1,060.5
Treed and Open Bogs			3,043.9
B136 Sparse Treed Fen: Tamarack-Black Spruce / Sphagnum: Organic	4.3	14.4	18,083.2
B140 Open Moderately Rich Fen	1.6	1.6	1,711.4

Table 6.2.6-4: Summary of Ecosites in the SSA, LSA, and RSA (Pic FMU FMP)

Ecosite / Habitat Type	Area (ha) in SSA	Area (ha) in LSA	Area (ha) in RSA
Other Fens			1,516.6
B142 Mineral Meadow Marsh	14.7	24.6	11,554.4
B144 Organic Meadow Marsh	0.0	1.0	150.3
B146 Shore Fen: Organic Soil	0.0	1.7	1,921.2
Rock Meadow Marsh			4.1
Other Meadow/Shrub Ecosites			829.9
B164 Sparsely Treed Rock Barren	0.0	0.9	1,766.7
B165 Open Rock Barren	0.0	0.4	68.3
Cliff & Open Cliff			258.0
B168 Open Talus	0.6	0.6	12.4
Talus or Raised Beach			36.8
Bluff, Dune, & Shoreline			391.3
Anthropogenic	0.2	65.3	7,050.8
U999 Water & Island	13.8	142.0	821.3
Other Unclassified			62,266.2
Grand Total	**1,116.4**	**4,131.4**	**1,153,225.8**



Legend

Revegetation at Closure

- G-WATER
- Mixed
- G-BNDY-RCLM-AREA
- G-BNDY-RCLM-PSMF
- G-OPEN-PIT-WALL
- G-BNDY-RCLM-MINE-ROCK-CREST
- G-BNDY-RCLM-MINE-ROCK-SLOP
- G-BNDY-NOT-RCLM
- Local Study Area
- Site Study Area
- Airport
- Waterbody (LIO)
- Watercourse (LIO)
- Hydro Line
- Railway
- Highway

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Notes

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Project Location
Marathon

Prepared by D Harvey & R. Foster on 2021-03-02

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GENERATION MINING LTD.
MARATHON PALLADIUM PROJECT

Figure No.
6.2.6-4

Title
Conceptual Revegetation at Closure

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Indirect Change or Impairment

After mitigation, negligible effects on vegetation are expected due to dustfall. Effects from dust deposition due to construction, operation and active closure activities will be localized to 30 m from the SSA. As discussed in Section 6.2.1 of this EIS Addendum (Vol 2), dust generated during construction and closure will be less than that generated during operation.

Other edge effects will likely vary with local topography, aspect, and other factors, and will be broadly comparable to those experienced in clear-cuts associated with commercial forestry in the Pic FMU or along forest access roads. Forest clearing for the Project will fragment forest communities along the boundary of the SSA. Although this fragmentation will result in a reduction in local connectivity within the LSA and SSA during the life of the Project, the fragmentation will not substantially alter the broad-scale landscape connectivity in the RSA. With respect to forest fragmentation, the 1,116 ha SSA is larger than the average clear-cut size in the Pic FMU, which is projected to be 495 ha for the 2019-2029 period (Pic FMP unpublished data). In addition, 87% of the areas disturbed by wildfire over the last 60 years in the Pic FMU were from fires greater than 1,000 ha in size (NFMC 2018). During closure, it is anticipated fragmentation will also be reduced following the re-establishment of vegetation. Given the resilience of the boreal landscape to disturbance, the relatively small changes restricted to the SSA are not predicted to threaten the function of landscape connectivity.

Invasive species already exist within the SSA and the surrounding landscape, however areas within the SSA and LSA that are not currently affected may be affected by the spread of these invasive species by new roads, construction equipment and vehicles or imported fill. Vegetation communities within 30 m of the SSA will be most susceptible to the introduction of invasive and non-native species. With mitigation, residual effects are predicted to be less than would be typically associated with cutovers and access roads associated with commercial forestry in the Pic FMU.

Effects on forests from predicted changes in groundwater and surface water hydrology are expected to manifest slowly as they are reflected in altered successional pathways of the overstory trees. Forested areas within the LSA with raised or lowered groundwater or surface water as a result of the Project may see a slow replacement in overstory tree species. For example, Ecosite 52 Dry to Fresh, Coarse: Spruce – Fir Conifer is the forested ecosite most affected by predicted changes to groundwater, with 171 ha in the LSA (outside the SSA) predicted to have a groundwater increase of at least 0.5 m. This ecosite typically has a soil moisture regime of 2 to 3. This ecosite could potentially transition over time to Ecosite 67 Moist, Coarse: Spruce – Fir Conifer with a moisture regime of 4 or 5. Overstory and understory conditions are similar in these two ecosites, with a slightly greater abundance of herbaceous plant and moss species preferring slightly moister conditions in the latter.

However, many of the predominant boreal tree species (e.g., black spruce, balsam fir) in the LSA have rather broad tolerance with respect to soil moisture regime. Understory effects are predicted to be more pronounced but may be difficult to differentiate from natural variation and ecological processes associated with succession and will be of much lower magnitude than observed with natural disturbance (e.g., wildfire, forest pest and disease outbreaks, windthrow) or forest harvesting.

Determination of Significance

As with the original EIS (2012), the residual adverse effects on forest cover are predicted to be not significant. Residual effects of the Project arise from the loss of approximately 1,081 ha of forest in the SSA and potential indirect effects on 842 ha in the adjacent LSA. With remediation at closure, at least some of this loss will be mitigated over time. These forest communities are widespread in the LSA and RSA, and therefore the distribution of vegetation communities is predicted to remain similar to baseline RSA conditions. The boreal forest is a disturbance-driven ecosystem and loss of forest due to the Project is well within natural variation, and orders of magnitude smaller than annual disturbance levels from commercial forestry in the RSA (Pic Forest FMU) that are determined to be sustainable by the MNRF.

Further, residual effects from invasive species, dustfall and other edge effects, and indirect effects from predicted changes to groundwater and surface water hydrology are not predicted to not result in the loss or permanent impairment of forest communities.

6.2.6.6.2 Change in Non-Forest Cover

Analytical Assessment Techniques

Methodology is the same as described for change in forest cover (Section 6.2.6.6.1 of this report), but the RSA for non-forest cover is Ecodistrict 3W-5 rather than the Pic Forest FMU.

Project Pathways

Project pathways are generally as described for forest cover (Section 6.255 of this report), although open wetlands are expected to be more sensitive than upland forests to changes in groundwater or surface water hydrology. As in the original EIS (2012), the main pathway is direct loss of habitat in the LSA (Figure 6.2.6-3).

Wetlands that may be affected by predicted changes in groundwater level are depicted as B136 Sparse Treed Fen. In the LSA, these typically occur on organic deposits in low-lying depressions supported by groundwater movement, often from adjacent bedrock-controlled uplands. An increase in groundwater availability may lead to an eventual shift to a more open fen condition (Ecosite 139, B140), with fewer or more stunted black spruce and tamarack than currently observed. The remaining 0.8 ha of open wetland in the area predicted to have groundwater increase are predominantly Ecosite B142 Mineral Meadow Marsh. These wetland types are the least sensitive to changes in groundwater, as the hydrology is strongly controlled by lake levels and surface water flows. It is predicted that these seasonally flooded wetlands will persist even with drawdown, because the modelled changes are predicted to be small compared to water input to these wetlands associated with lake levels and creek flows. In wetter areas, emergent marshes (Ecosite B148, B149) may replace meadow marsh as is often observed in active beaver-dominated systems. Approximately 1.0 ha of existing meadow marshes in the LSA are in areas predicted to have a groundwater drawdown of more than 0.5 m. With drier conditions, there may be a gradual shift to a mosaic of meadow marsh and thicket swamp (Ecosite B134) with increasing alder and willow.

The main pathway for impacts on non-forested upland communities is direct loss in the LSA. These communities are unlikely to be affected substantially from groundwater impacts.

Mitigation and Enhancement Measures

Mitigation and enhancement measures are generally as described for forest cover (Section 6.2.6.6.1 of this report).

Project Residual Effect

Non-Forested Wetlands

Most of the impacts to non-forested wetlands are from direct loss within the SSA, accounting for 21.4 ha of open wetlands and an additional 9.8 ha of sparsely vegetated open water habitat (see Table 6 of the Terrestrial Environment Baseline Report Update (Northern Bioscience 2020) (CIAR #722) for a breakdown of wetland types in the SSA). During closure, rehabilitation efforts will encourage native vegetation community growth, although it is unlikely that wetland communities lost due to the Project will be restored to their original state. Some wetland communities will likely be converted to upland communities resulting in a net loss of wetlands in the SSA. Although new areas of wetland communities may develop in low-lying areas, most of the reclaimed areas in the SSA are anticipated to develop into upland vegetation communities. Details on the revegetation plan at closure are provided in the Conceptual Closure Plan (see Section 6.2.1 of this EIS Addendum [Vol 2]). Relatively little non-forested wetland will be impacted by predicted changes to groundwater or surface water in the LSA outside the SSA. Only 6.0 ha would potentially have indirect effects from groundwater increase, mainly near the PMSF and approximately 1.0 ha could be affected by predicted groundwater drawdown, primarily near the pit and MRSA (Figure 6.2.6-3).

Approximately 21 ha of open wetlands (Ecosites B136, B140, and B142) will be lost within the SSA during Project development. Within the LSA this represents less than 0.2% of the 11,430 ha of these ecosites found within Ecodistrict 3W-5 based on FRI ecosite mapping. An additional eight other non-forested wetland ecosites account for an additional 9,932 ha within the RSA. This is still likely a substantial underestimate of available open wetland abundance in the RSA since there are 8,500 mapped waterbodies <10 ha in size that encompass more than 10,000 ha total in Ecodistrict 3W-5, none of which have shallow marshes or open water marshes (Ecosites B148 to B152) delineated in the FRI (Table 6.2.6-5). This does not include unmapped wetland area on larger waterbodies in Ecodistrict 3W-5.

Table 6.2.6-5: Waterbody number and area by size class within Ecodistrict 3-W5

Size Class	# Waterbodies	# Rivers	Total #	Total Waterbody Area (ha)	Total River Area (ha)	Total Area (ha)
<0.1 ha	1,272	67	1,339	38	2	41
0.1 - 1.0 ha	3,910	467	4,377	1,333	132	1,465
1.1 - 5.0 ha	2,052	114	2,166	4,988	250	5,238
5.1 - 10.0 ha	565	36	601	3,973	265	4,238
10.1 - 50.0 ha	568	29	597	11,410	763	12,172
50.1 - 100.0 ha	87	5	92	6,281	336	6,617
>100 ha	60	7	67	18,393	1,387	19,780
TOTAL	**8,514**	**725**	**9,239**	**46,416**	**3,135**	**49,551**

Non-Forested Upland Plant Communities

Approximately 6.8 ha of non-forested upland will be lost through development of the LSA, with most (6.2 ha) of this being non-treed Ecosites B047, B062 and B063. These ecosites are dominated by shrubs and stunted trees, typically over shallow, bedrock-controlled soils of various textures. This loss within the SSA represents less than 0.4% of 1,404 ha of these ecosites found within the Ecodistrict 3W-5.

The remaining non-forested uplands (<1 ha) within the LSA are talus (Ecosite B168), treed rock barren (Ecosite B164), or open rock barren (Ecosite B165). Non-forested uplands are not anticipated to be substantively affected by predicted changes to groundwater or surface water hydrology. Rehabilitation of the MRSA and adjacent areas of the SSA will create bare rock and partially vegetated communities that will likely be functionally similar to these ecosites over the long term (Table 6.2.6-4). The combined loss of <1 ha of cliff, rock barren, and talus communities in the SSA during development is much less than 1% of the 610 ha, 951 ha, and 63 ha of these ecosites respectively mapped within the RSA based on FRI.

Less than 1 ha of non-forested communities of anthropogenic origin (e.g., existing transmission line right-of-way) will be impacted during Project development and operation, which will be more than replaced after closure.

Determination of Significance

With mitigation and environmental protection measures, residual adverse effects on non-forested wetlands and non-forested upland communities from direct loss or indirect impairment are predicted to be not significant due to the small area (6.1 ha) potentially impacted.

6.2.6.6.3 Change to Regionally and Provincially Rare Plant Species

Analytical Assessment Techniques

Methodology is the same as described for change in forest cover (Section 6.2.6.6.1 of this report) but the RSA is Ecodistrict 3W-5 rather than the Pic FMU.

Provincially rare species are those that are ranked as S1-S3 by MNRF's Natural Heritage Information Centre (NHIC 2020). Regionally rare species are considered those that a known from five or fewer records in the Thunder Bay District Checklist (TBFN 2015). These species are generally secure or apparently secure elsewhere in their Ontario range (i.e., S4-S5). These lists are updated from time to time based on known occurrences, and as such, some species originally included as regionally rare species in the original EIS (2012) have been downgraded and have therefore been excluded from this update.

Direct and indirect effects on vegetation species considered to be Species at Risk, either provincially or federally, are discussed in Sections 6.2.9 of this EIS Addendum (Vol 2).

Project Pathways

The main project pathway for provincially and regionally rare plant species is direct loss of habitat in the LSA, as described for forest cover (Section 6.2.6.6.1 of this report). As for vegetation, similar indirect effects such as dustfall are anticipated depending on the location of the occurrence.

Mitigation and Enhancement Measures

General mitigation measures for direct loss of habitat and indirect effects on vegetation in the LSA and are as described for forest cover (Section 6.2.6.6.1 of this report). Additional specific mitigation measures for provincially and regionally rare plant species are discussed below.

As detailed in response to IR15.1 (CIAR # 426) and AIR9 (CIAR #654), mitigation is proposed for provincially rare alga pondweed (S2) and regionally rare Oakes' pondweed. These pondweed species are found in two small lakes within the SSA (L26 and L26a). Prior to their loss due to the development of the PSMF, reproductive structures of these species will be transferred to ecologically similar waterbodies in the LSA or adjacent landscape in the RSA. There are 8,500 mapped waterbodies <10 ha in size that encompass more than 10,000 ha total in Ecodistrict 3W-5 RSA (Table 6.2.6-5). Even within 5 km of the LSA, there are 367 waterbodies less than 10 ha in size representing a total area of 252 ha. These lakes occur on a landscape with similar bedrock and soils, similar post-glacial history, and physical environment to that of the Project site and are considered potentially suitable receptor sites for transplanting these two pondweed species. Transplantation methods similar for rare pondweeds are detailed in response to IR15.1 (CIAR # 426) and AIR9 (CIAR #654).

One occurrence of the provincially rare alpine woodsia (S2) is within the SSA and will likely be lost through Project development. Proposed mitigation includes transplanting alpine woodsia individuals from the shaded, moist rock face in which they are found to one or more other moist rock faces or cliffs in the adjacent landscape outside the SSA. There is generally little known about the population ecology of ferns

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and baseline data about establishment, recruitment, growth rates and survivorship in natural populations of different species are lacking (Aguraiuja 2011). However, closely related rusty woodsia (*W. ilvensis*) has been successfully transplanted elsewhere in its circumboreal range including England (Lusby et al. 2002; McHaffie 2007) and Estonia (Aguraiuja 2011). In Canada, individuals of blunt-lobed woodsia grown from spores have also been transplanted with relatively high survival rates (COSEWIC 2006). Transplanting of alpine woodsia from the SSA will occur in early spring prior to site development. The receiving rock face or cliff will be identified prior to the transplanting and will have similar aspect, rock type, moisture regime, shade, and associates such as slender cliff brake (*Crypotgamma stelleri*), fragrant cliff fern (*Dryopteris fragrans*), other *Woodsia* spp., liverworts (*Marchantia*), and mosses. All smooth woodsia found at the known donor location in the SSA will be gently extracted from cracks in the rock face using a flexible knife and tweezers. Plants will be placed in a small cooler with moist moss to prevent desiccation during transport. Transplants will be brought to the receiver habitat and gently inserted into small planting sites enlarged in suitable cracks/crevices prior to transplanting. As with rusty woodsia transplanting efforts, micro-climatically stable microsites will be selected, and existing vegetation removed where necessary to create planting sites big enough to accommodate the woodsia root wad (Lusby et al. 2003; McHaffie 2007). A small amount of soil/humus/moss substrate will be used as a planting medium if necessary, in the crack to help retain moisture, and the transplant will be lightly watered. Older fertile leaves will be trimmed to reduce evapotranspiration stress on the transplant, and these leaves will be inserted into additional cracks to facilitate potential spore germination. Transplanted ferns will be monitored at least twice during the summer after transplanting and watered if necessary. Survivorship monitoring will be conducted the following two years.

Transplantation of heartleaf twayblade and northern St. John's wort was originally proposed in response to AIR9 (CIAR #654); however, these two species are no longer considered regionally rare in the Thunder Bay Judicial District (additional occurrences have recently been documented) and specific mitigation is no longer required.

Provincially rare Braun's holly fern and two regionally rare plant small pondweed are in portions of the LSA that are beyond predicted hydrological changes (Figure 6.2.6-3). Braun's holly fern may be at more risk of dustfall than the other species but is still 45 m from the planned edge of the SSA and beyond most dustfall even in the absence of mitigation. Invasive species are less likely to colonize the shaded valley with vegetated talus in which the Braun's holly fern is located and pose minimal risk. The two small pondweed species are not considered at risk from the project.

Project Residual Effect

As discussed in the original EIS (2012), the PSMF will permanently remove the habitat for one occurrence of the provincially rare alga pondweed and two adjacent occurrences of the regionally rare Oakes' pondweed. This loss can be partially mitigated by transplanting individuals to receptor lakes in the adjacent landscape, with an estimated moderate to high degree of success. Alga pondweed is an inconspicuous species that grows in acidic, oligotrophic ponds, bogs, lakes, and slow-moving streams (Oldham and Brinker 2009). There has been very little botanical survey in Ecodistrict 3W-5 particularly for submergents, and it is extremely likely that there are additional undocumented occurrences of this species in at least some of the 8500 small (<10 ha) waterbodies in the RSA that collectively represent more than 10,000 ha of potentially suitable habitat.

The revised Project footprint will result in the permanent loss of one occurrence of the provincially rare alpine woodsia. Transplanting the affected cliff ferns to other suitable habitat outside the LSA is anticipated to have moderate potential for mitigating this loss. The SSA occurrence of alpine woodsia (S2/S3) is one of approximately 10 known occurrences of this inconspicuous fern[2] in the RSA (Argus and White 1982-1987; Cody and Britton 1989; iNaturalist 2020; NHIC unpublished data). In Ontario, this species is largely restricted to cool, moist crevices and cliffs along the north shore of Lake Superior (Oldham and Brinker 2009). There has been very little botanical survey work in Ecodistrict 3W-5 and there is over 600 ha of potentially suitable cliff habitat scattered across the rugged terrain of the RSA.

Nine other plant species were formerly considered regionally rare but additional known occurrences have downgraded their status in the Thunder Bay Judicial District and they are no longer included in the Vegetation or SAR VEC. Therefore, no residual effects were assessed for these species.

Determination of Significance

With mitigation and environmental protection measures, residual adverse effects on rare plants are predicted to be not significant.

6.2.6.6.4 Change to Plant Species of Interest to Indigenous Communities

Analytical Assessment Techniques

Analytical assessment techniques are generally as described for forest cover (Section 6.2.6.6.1 of this report) and non-forested communities such as wetlands and rock barrens (Section 6.2.6.6.2 of this report).

Project Pathways

Project pathways are generally as described for forest cover (Section 6.2.6.6.1 of this report) and non-forested communities such as wetlands and rock barrens (Section 6.2.6.6.2 of this report). Plant species considered to be species of interest to Indigenous communities include those identified in Table 12 of the Terrestrial Environment Baseline Report Update (Northern Bioscience 2020) (CIAR #722).

Mitigation and Enhancement Measures

Mitigation and enhancement measures are generally as described for forest cover (Section 6.2.6.6.1 of this report) and non-forested communities such as wetlands and rock barrens (Section 6.2.6.6.2 of this report).

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[2] It is easily overlooked and mistaken for the more common rusty woodsia

Project Residual Effect

The removal of habitat that supports plant and fungus species of interest to Indigenous communities from the SSA is not anticipated to affect the viability of populations of these species in the LSA and RSA. Given that these plant and fungus species of interest are relatively common in the RSA and are predicted to maintain viable populations in areas that will be accessible throughout the life of the Project, the magnitude of the residual effect is rated as low. While there is potential to incorporate plant species of interest to Indigenous peoples during rehabilitation (revegetation plantings), where use and establishment of these species is appropriate and technically feasible, the residual effect is conservatively considered irreversible. The characterization of the residual effects for change in abundance of plant species of interest is summarized in Table.

Determination of Significance

With mitigation and environmental protection measures, residual adverse effects on plants and fungi of interest to Indigenous communities are predicted to be not significant.

6.2.6.7 Prediction Confidence

Overall confidence in the residual environmental effect and significance predictions for vegetation is high. This prediction confidence is based on consideration of the following:

- The potential environmental effects and effect mechanisms for the Project are known based on similar mining operations and other large construction projects and are well understood
- The mitigation measures are well understood and align with provincial and federal standards and standard management practices
- The understanding of existing conditions is supported by high quality background information, including detailed FRI mapping, literature review, traditional knowledge / TLRU studies/information and baseline reports from multiple years of field studies
- The assessment uses conservative assumptions and methods to increase the level of confidence, specifically:
    - The SSA, while assumed to be entirely cleared and developed in the assessment, includes areas that will not be physically altered
    - Although progressive revegetation will occur during operation, the analysis assumes that revegetation activities will only commence during the closure phase. Since progressive revegetation will occur, this is a conservative case scenario
    - The Project effects on vegetation communities are quantified using GIS

6.2.6.8 Summary of Project Residual Effects

A summary of residual environmental effects on vegetation that are likely to occur as a result of the Project is provided in Table 6.2.6-6.

Table 6.2.6-6: Project Residual Effects on Vegetation

Residual Effect	Residual Effects Characterization									
	Project Phase	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Ecological/ Societal Value	Significance Determination
Change in forest cover	C, O, D	A	N	N	N/A	H	M	H	L	NS
Change in non-forest cover	C, O, D	A	N	N	N/A	H	M	H	L	NS
Change to regionally and provincially rare species	C, O, D	A	N	N	N/A	H	M	L	M	NS
Change to protected species	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NS
Change to plant species of interest to Indigenous and Métis communities	N/A	A	N	N	N/A	H	M	H	L	NS

KEY

See Section 2.5 of EIS Addendum (Vol 1) and Table 6.2.6-2 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: No 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.

6.2.6.9 References

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