12.0 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS ON UPLAND VEGETATION AND WETLANDS

Upland vegetation (e.g., non-wetland vegetation such as conifer forests, hardwood forests and mixed conifer/hardwood forests) and wetlands (e.g., swamps, marshes, bogs, shallow open water and fens) encompass the vegetated state of the natural environment and the ecosystem services they provide, and are both considered within this Chapter. Upland vegetation and wetlands are described as ecosite community types which include all vascular plants and the soil, climatic, and hydrological conditions that support them. Upland vegetation and wetlands were selected as a VC for assessment because of the intrinsic value of plants, the value of upland vegetation and wetland communities have for biodiversity and traditional use by Aboriginal communities, and the value of upland vegetation and wetlands communities have on a local and regional landscape scale. Plant species that are of interest to Aboriginal communities for traditional purposes have been identified through consultation (refer to Section 12.1.2) and are considered in the assessment of environmental effects of the Project.

The Project has the potential to affect the upland vegetation and wetlands VC in such that there may be a change in both upland vegetation and wetlands through:

- change in abundance of vegetation species of interest;
- change in abundance or condition of upland vegetation communities; and,
- change in wetland function and connectivity.

Upland vegetation and wetlands are pathways to other VCs, including:

- wildlife and wildlife habitat (Chapter 13.0) - changes in vegetation and wetlands have the potential to affect wildlife and wildlife habitat;
- land and resource use (Chapter 16.0) – changes in upland vegetation and wetlands have the potential to affect current land and resource use, through the removal or alteration of vegetation communities supporting activities related to plants and wetlands (e.g., berry picking);
- traditional land and resource use (Chapter 18.0) - changes in upland vegetation and wetlands have the potential to affect traditional land and resource use by Aboriginal communities, through the removal or alteration of vegetation communities associated with traditional harvesting for food sources or plants with cultural significance; and
- human and ecological health (Chapter 19.0): vegetation affected by dust deposition could affect organisms that ingest this vegetation.
12.1 SCOPE OF ASSESSMENT

12.1.1 Regulatory and Policy Setting

12.1.1.1 EIS Guidelines and ToR Requirements

The environmental effects assessment for upland vegetation and wetlands has been prepared in accordance with the requirements of the federal EIS Guidelines (Appendix A1) and provincial Terms of Reference (ToR, Appendix A2). Concordance tables, indicating where EIS Guidelines and Terms of Reference requirements have been addressed, are provided in Appendix B.

12.1.1.2 Federal Species at Risk Act

The federal Species at Risk Act (SARA) was created to prevent wildlife species from becoming extirpated (e.g., extinct in Canada). SARA, which became law in June 2003, protects federally listed species at risk (SAR) and their critical habitats. SARA also contains provisions to help manage species of conservation concern (SOCC) in order to prevent them from becoming endangered, extinct or extirpated. SARA is administered throughout Canada by the ECCC in conjunction with provincial agencies.

SARA includes prohibitions against killing, harming, harassing, capturing or taking SAR, which makes it illegal to destroy their critical habitats, and can impose restrictions on development and construction projects.

Species are designated “at risk” by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), an independent body of experts that assesses wildlife according to a broad range of scientific data. The committee meets annually to review status reports on species suspected of being at risk and provides assessments to government and the public. The federal Cabinet then decides whether those species should get legal protection under SARA. These decisions are made after consultation with affected stakeholders and other groups.

SARA is one part of a three-part strategy the Government of Canada has implemented to protect wildlife SAR (specifically plants for this VC) in Canada, and it applies to plant species listed in Schedule 1 of SARA and their critical habitat.

12.1.1.3 Provincial Endangered Species Act

The Ontario Endangered Species Act, 2007 (ESA) takes precedence for provincially listed SAR, and protection under the ESA extends to both public and private lands. The ESA identifies plant species considered to be at risk in Ontario and designates them as threatened, endangered, extirpated or of special concern. Provincial SAR are identified and assessed by the Committee on the Status of Species at Risk in Ontario (COSSARO), which is a committee of botanical experts and scientists, and individuals who provide Aboriginal traditional knowledge. COSSARO classifies
species according to their degree of risk based on the best available scientific information, community knowledge and Aboriginal traditional knowledge. When COSSARO classifies a SAR, the classification applies throughout Ontario, unless COSSARO indicates that the classification applies only to a specified geographic area in Ontario. The ESA is administered in the province by the MNRF.

The ESA protects SAR and their habitats by prohibiting anyone from killing, harming, harassing or possessing protected species, as well as prohibiting any damage or destruction to the habitat of species identified on the Species at Risk in Ontario (SARO) List. All species on the SARO List are provided with general habitat protection under ESA as of June 2013, which protects those areas a species depends upon to carry out its life processes. The ESA protects individuals of the species from harm or harassment and their habitats from damage or destruction. Threatened and endangered species on the SARO List receive immediate general habitat protection; general habitat is defined as areas on which the species depends, directly or indirectly, to carry out its life processes. O. Reg. 242/08 provides exemptions from the habitat provisions of the ESA for some specific activities based on the activity, the species, the date the species was listed and the date the activity commenced. For some species, general habitat is defined according to three categories (red, orange, yellow) which reflect how tolerant the species is to change in that habitat before its usefulness for the species is compromised. Regulated habitat is also defined within two (endangered) or three (threatened) years of a species being added to the SARO List. Regulated habitat is species-specific and is more precisely defined than general habitat to include specific habitat features and geographic boundaries.

12.1.1.4 Federal Policy on Wetland Conservation

Federal guidance for wetland conservation is provided by the Federal Policy on Wetland Conservation (EC 1991), which includes the principle of no net loss of wetland function. The federal policy applies to projects occurring on federal lands and waters, projects receiving federal funding, or wetlands of international importance, as determined by the Ramsar Convention (1971). Although this policy does not apply to the Project, it will be used as guidance.

12.1.1.5 Provincial Policy Statement

The wise use and management of the natural environment is recognized as a crucial component of ensuring Ontario’s long-term prosperity, environmental health and social well-being. Accordingly, the Provincial Policy Statement (PPS) (MMAH 2014) provides direction for the long-term protection, restoration and improvement of the diversity and connectivity of natural features, the ecological function and biodiversity of natural systems, and the quality and quantity of water at a watershed scale. The diversity and connectivity of the natural features in an area should be maintained and enhanced, where possible, recognizing linkages between and among natural heritage, surface water and groundwater features.
Policy 2.1 of the PPS provides direction for the protection of the natural heritage features, while guidance in this regard is provided through the Natural Heritage Reference Manual (MNR 2010) and the EcoRegion Criterion Schedules (MNRF 2015, MNR 2012) for significant wildlife habitat.

“The natural heritage features to be considered in accordance with the PPS include:

- provincially significant wetlands (PSW) and significant coastal wetlands;
- significant habitat of endangered and threatened species;
- significant woodlands;
- significant valleylands;
- significant wildlife habitat;
- significant areas of natural and scientific interest (ANSIs); and
- fish habitat.

In northern Ontario (including the Project location in Ecoregion 3W), development and site alteration shall not be permitted in provincially significant wetlands north of the Canadian Shield, significant wildlife habitat, or significant ANSIs unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions. Significant woodlands and significant valleylands are exempt from such restrictions in Northern Ontario. Development and site alteration shall not be permitted in habitat of endangered species and threatened species, or in fish habitat, except in accordance with provincial and federal requirements.

Development and site alteration shall not be permitted on adjacent lands1 to the natural heritage features unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative effects on the natural features or on their ecological functions.”

Criteria for determining significance for these features are recommended by the province, and are defined in the PPS. While some significant features (e.g., PSWs, ANSIs and some wildlife habitat types) may already be identified and inventoried by MNRF, the significance of others can only be determined after field-based evaluation. The PPS and guidance documents are used as tools for identifying important natural features.

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1 For the purposes of Policy 2.1.8 of the PPS, adjacent lands are those lands contiguous to a specific natural heritage feature or area where it is likely that development or site alteration would have a negative impact on the feature or area. The extent of the adjacent lands may be recommended by the province or based on municipal approaches which achieve the same objectives. In general, the width of adjacent lands from natural heritage features is 120 m, with the exception of Earth Science ANSIs, which is 50 m.
It should be noted that “significance” under the PPS is not associated with the term “significant” as it relates to the assessment of residual adverse environmental effects. Threshold criteria for the determination of significance are discussed in Section 12.1.6.

12.1.2 Influence of Consultation and Engagement on the Identification of Issues and the Assessment Process

Consultation has been ongoing prior to and throughout the EA process, and will continue through permitting and the life of the Project. GGM will continue to meet with agencies, Aboriginal communities, the general public and other stakeholders to provide updates, receive feedback, address concerns and maintain communication. See Chapter 3.0 for more details on the consultation process, and Appendix C for the RoC that includes comments received during the development of the Draft EIS/EA.

12.1.2.1 Timing of Comments

Comments regarding upland vegetation and wetlands were raised during consultation and engagement activities at a number of stages of the EA process, including:

- following requests for comments on EA material, including:
  - the draft and final ToR;
  - baseline reports and methodologies;
  - the alternatives assessment methodology and list of criteria and indicators;
  - the assessment of environmental effects and identification of mitigation measures (updates to follow circulation of the Draft EIS/EA); and

- during PICs for the public and Aboriginal communities to present the results of studies, EA methodologies and other Project information;

- during meetings with government agencies and Aboriginal communities related to baseline studies and the EA process; and

- from other correspondence or communications received throughout the EA process.

12.1.2.2 Comments

Comments on upland vegetation and wetlands were provided by the following agencies, Aboriginal communities or stakeholders:

- Aroland First Nation;

- ECCC.
12.1.2.3 Consideration of Key Comments

Feedback was provided as consultation activities took place, and the comments have been addressed through direct responses, updates to baseline information, and in the Draft EIS/EA, as appropriate. A summary of the key comments directly related to upland vegetation and wetlands, and how these comments were addressed is provided below:

<table>
<thead>
<tr>
<th>Key Comments</th>
<th>How Issue was Addressed in Design or Draft EIS/EA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential environmental effects on upland vegetation and wetlands.</td>
<td>Addressed through the assessment of potential environmental effects on upland vegetation and wetlands in the Draft EIS/EA.</td>
</tr>
<tr>
<td>Questions and concerns related to the baseline monitoring program methodology and results.</td>
<td>Addressed in the baseline reports and related discussion in the Draft EIS/EA.</td>
</tr>
<tr>
<td>Requests for clarification or additional information related to baseline results, existing conditions and delineation of features.</td>
<td>Addressed in the baseline reports and related discussion in the Draft EIS/EA.</td>
</tr>
<tr>
<td>Requests for additional baseline monitoring to supplement information on existing conditions.</td>
<td>Addressed through clarification on data sources used to date and the completion of additional baseline surveys in 2015, which have been included in the Draft EIS/EA.</td>
</tr>
<tr>
<td>Identification of the importance of assessing change in wetlands as it relates to wetland function and connectivity.</td>
<td>Addressed through the assessment of effects on wetland function and connectivity in the Draft EIS/EA.</td>
</tr>
</tbody>
</table>

12.1.3 Selection of Potential Environmental Effects and Measurable Parameters

Table 12-1 summarizes the potential environmental effects of the Project on upland vegetation and wetlands, the measurable parameters and the rationale for their selection. These potential environmental effects were selected based on professional judgment, recent EAs for mining projects in Ontario, and comments provided during consultation.
## Table 12-1: Potential Environmental Effects and Measurable Parameters for Vegetation and Wetlands

<table>
<thead>
<tr>
<th>Potential Environmental Effect</th>
<th>Measurable Parameters and Units of Measurement</th>
<th>Notes or Rationale for Selection of the Measurable Parameter</th>
</tr>
</thead>
</table>
| Change in abundance of vegetation species of interest | Abundance (count or areal extent (ha)) of:  
  - plant species of interest to Aboriginal communities  
  - plant SAR or SOCC specimens/communities or habitat removed | The removal or alteration of vegetation communities associated with traditional harvesting for food sources or plants with cultural significance has the potential to affect traditional land and resource use by Aboriginal communities. The implication of removal or alteration of these vegetation communities to traditional land and resource use is assessed in Chapter 18.0.  
  SAR are listed both federally and provincially and tracked or protected by statute.  
  Provincially listed plant species are tracked and ranked by COSSARO and protected under provisions of ESA.  
  SAR are defined as “species on Schedule 1 of SARA or listed as endangered, threatened or extirpated under the ESA”.  
  SOCC are defined as “species listed as special concern under the ESA or provincially rare species (e.g., listed as S1-S3 or SH by the MNRF).”  
  This parameter includes the number of individuals or populations of SAR and SOCC that have special status (federally or provincially) such that they are protected by law. |
| Change in abundance or condition of upland vegetation communities | Abundance (count or areal extent (ha)) of:  
  - upland vegetation removed  
  - rare vegetation communities/specialized habitat removed  
  - upland vegetation affected by dust deposition  
  - upland Ecosite types fragmented by vegetation removal | The direct loss of plants and vegetation communities will occur through vegetation removal to accommodate for Project development.  
  Through the loss of vegetation communities, a change in landscape diversity, distribution and abundance of plant species common to the area may be affected.  
  Vegetation communities adjacent to Project components may be affected by fugitive dust emissions thereby changing the condition of the vegetation community.  
  Vegetation communities in Ontario are tracked and ranked by the Natural Heritage Information Centre. Provincially rare community types are afforded protection as provincially significant wildlife habitat, as defined by the MNRF. |
Table 12-1: Potential Environmental Effects and Measurable Parameters for Vegetation and Wetlands

<table>
<thead>
<tr>
<th>Potential Environmental Effect</th>
<th>Measurable Parameters and Units of Measurement</th>
<th>Notes or Rationale for Selection of the Measurable Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in wetland function and connectivity</td>
<td>Areal extent (ha) of:</td>
<td>The direct loss or alteration of wetland communities will occur through vegetation removal to accommodate for Project development. Wetlands are important from hydrological, ecological and socio-economic standpoints. The area of wetland affected by the Project can be estimated to determine the extent of change within the greater landscape.</td>
</tr>
<tr>
<td></td>
<td>• wetland vegetation removed or altered/converted to other wetland types or uplands</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• wetlands that will experience a loss of wetland function as a result of groundwater drawdown</td>
<td></td>
</tr>
</tbody>
</table>

12.1.4 Boundaries

12.1.4.1 Spatial Boundaries

The assessment boundaries described in Section 6.2.4 were considered for specific application for upland vegetation and wetlands. The assessment areas applied are described below. The spatial boundaries described in this section are shown in Figure 12-1.

The Project development area (PDA) encompasses the Project footprint and is the anticipated area of direct physical disturbance associated with the construction and operation of the Project.

The Local assessment area (LAA) applied for upland vegetation and wetlands encompasses (i) the area where effects due to dust deposition may occur on vegetation communities extending 30 m from the limits of the PDA (ii) the area of groundwater drawdown in shallow overburden of 0.5 m or greater, and (iii) wetlands downstream of the PDA to their point of discharge into Kenogamisis Lake. The greatest concentration of dust deposition occurs within 10 m of the source (Spatt and Miller 1981), however dust particles can disperse beyond 20 m from the source (Farmer 1992). Based on a conservative estimate of the distance dust may disperse from Project sources, this assessment assumes effects may occur on vegetation communities up to 30 m from Project. The 0.5 m contour generally corresponds with the rooting limit of most vegetation species in mineral wetlands, and approximates the minimum depth of organic accumulation in wetlands with organic soils (Yuan and Chen 2010, Strong and La Roi 1983). Marsh and swamp communities are also generally seasonally adapted to water level fluctuations within 0.5 m as such the most pronounced effects are anticipated to occur in areas with drawdown equal to or greater than 0.5 m. LAA is approximately 2,801.7 ha in size, and includes the PDA.
The regional assessment area (RAA) was selected using natural ecological boundaries, specifically the Burrows River, Kenogamisis River and Kenogamisis Lake watersheds. The RAA contains similar ecosystem and habitat types to those found within the LAA and can provide a regional context for assessing cumulative effects on upland vegetation and wetland resources. The total area of the RAA is approximately 168,307 ha in size. The RAA includes the LAA, and is consistent with the RAA for wildlife and wildlife habitat (Chapter 13.0).

12.1.4.2 Temporal Boundaries

The temporal boundaries for the assessment of upland vegetation and wetlands are:

- construction (pre-production): Years -2 and -1;
- operation:
  - mill phase 1 - initial production: Years 1 and 2;
  - mill phase 2 - full production: Years 3 to 15; and
- closure: five plus years of active closure followed by post-closure (Years 16+).
Lake A-321
Lake A-322
Lake A-320
Kenogamisis Lake (Central Basin)
Magnet Lake
Mosher Lake
Longacre Lake
Marron Lake
Goldfield Lake
McKelvie Lake
Puppy Lake
Pussy Lake
Barton Bay (West) - SWP1
GCP1
SWP2
GFP2
GFP4
GCP3
GCP4
Barton Bay (East) - SWP3
GCP5
GCP6
Glory Hole
Kenogamisis Lake (Southwest Arm)
Magnet Creek
GCP2
GCP3
Glory Hole
Trans Canada Highway 11
WC-M
WC-L
Goldfield Creek
Hardrock Creek
WC-H
WC-A
Puppy Lake Creek
GCF2
GCP3
WC-C
WC-J1

Notes
1. Coordinate System: NAD 1983 UTM Zone 16N
   Base features produced under license with the Ontario Ministry of Natural Resources & Forestry's Printer for Ontario, 2013.

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Residual Environmental Effects Description Criteria

Table 12-2 summarizes how residual environmental effects are characterized in terms of direction, magnitude, geographic extent, frequency, duration, reversibility and in ecological/socio-economic context. Quantitative measures or definitions for qualitative categories are provided.

**Table 12-2: Characterization of Residual Environmental Effects on Upland Vegetation and Wetlands**

<table>
<thead>
<tr>
<th>Characterization</th>
<th>Description</th>
<th>Quantitative Measure or Definition of Qualitative Categories</th>
</tr>
</thead>
</table>
| **Direction**    | The long-term trend of the residual effect | **Positive**-an increase in the area of upland vegetation or wetland, or an increase in numbers of individuals or populations of species of interest.  
**Adverse**-a decrease in the area of upland vegetation or wetland, or a decrease in numbers of individuals or populations of species of interest.  
**Neutral**-no net change in the area of upland vegetation or wetland, or in numbers of individuals of populations of species of interest. |
| **Magnitude**    | The amount of change in measurable parameters or the VC relative to existing conditions | **Negligible**-no measurable change in upland vegetation or wetland, or in numbers of individuals or populations of species of interest. For hydrological function of wetlands, negligible refers to no reduction in wetland water level.  
**Low**-a measurable change in upland vegetation or wetland but the change is within the normal variability of baseline conditions and does not result in the loss of long-term viability of that vegetation community type in the RAA. For hydrological function of wetlands, Low refers to a reduction of ≤ 0.5 m in water level; drawdown under 0.5 m is not anticipated to affect wetland function.  
**Moderate**-a measurable change in upland vegetation or wetland; change is within regulatory limits and does not result in the loss of long-term viability of that vegetation community type in the RAA. For hydrological function of wetlands, Moderate refers to a reduction of ≤ 0.5 m in water level; and there is an adverse effect on wetland function.  
**High**-a measurable change in upland vegetation or wetland; change is outside of regulatory limits and does result in the loss of long-term viability of that vegetation community type in the RAA. For hydrological function of wetlands, High refers to > 0.5 m reduction in water level; wetland function is impaired. |
| **Geographic Extent** | The geographic area in which an environmental effect occurs | **PDA**-residual effects are restricted to the PDA.  
**LAA**-residual effects extend into the LAA.  
**RAA**-residual effects extend into the RAA. |
Table 12-2: Characterization of Residual Environmental Effects on Upland Vegetation and Wetlands

<table>
<thead>
<tr>
<th>Characterization</th>
<th>Description</th>
<th>Quantitative Measure or Definition of Qualitative Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Identifies when the residual effect occurs and how often during the Project or in a specific phase</td>
<td><strong>Single event</strong>-the effect occurs once during the Project or during a specific phase.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Multiple irregular event</strong> (no set schedule)-the effect occurs more than once during the Project or during specific phases and is not regularly scheduled.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Multiple regular event</strong>-the effect occurs more than once during the Project or during specific phases and is regularly scheduled.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Continuous</strong>-the residual effect occurs continuously.</td>
</tr>
<tr>
<td>Duration</td>
<td>The period of time required until the measurable parameter or the VC returns to its existing condition, or the effect can no longer be measured or otherwise perceived</td>
<td><strong>Short-term</strong>-the residual effect is restricted to construction and/or closure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Medium-term</strong>-the residual effect extends through construction, operation, and active closure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Long-term</strong>-the residual effect extends into post-closure.</td>
</tr>
<tr>
<td>Reversibility</td>
<td>Pertains to whether a measurable parameter or the VC can return to its existing condition after the Project activity ceases</td>
<td><strong>Reversible</strong>-the effect is likely to be reversed after activity completion.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Irreversible</strong>-the effect is unlikely to be reversed when the activity ceases.</td>
</tr>
<tr>
<td>Ecological and Socio-economic Context</td>
<td>Existing condition and trends in the area where environmental effects occur</td>
<td><strong>Resilient</strong>-able to assimilate to change.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Not Resilient</strong>-having little tolerance to imposed stresses and not able to assimilate to change.</td>
</tr>
</tbody>
</table>

12.1.6 Significance Thresholds for Residual Environmental Effects

Significance thresholds for residual effects on upland vegetation and wetlands considered federal and provincial regulatory requirements, standards, objectives and guidelines (as discussed in Section 12.1.1.).

A significant residual environmental effect of a change in upland vegetation is defined as one that:

- results in permanent, irreversible loss of a species listed on Schedule 1 of SARA or listed as threatened or endangered under ESA; or,
- alters or removes an upland vegetation community type resulting in the loss of long-term viability of that vegetation community type in the RAA.
A significant residual environmental effect of a change in wetland function is defined as one that:

- results in permanent, irreversible loss of a species listed on Schedule 1 of SARA or listed as threatened or endangered under ESA; or,
- alters a wetland community type such that the long-term viability of that community type is compromised in the RAA.

12.2 EXISTING CONDITIONS FOR UPLAND VEGETATION AND WETLANDS

The general Project area is located in the boreal forest, and upland vegetation and wetland ecosites are typical in this part of northern Ontario. There are no designated natural heritage or protected areas (i.e., provincial or national parks) in the PDA or LAA. However, the Project has the potential to affect some natural vegetated elements such as wetlands, sensitive vegetation communities and plant species of interest.

12.2.1 Methods

Forest Resource Inventory (FRI) data were used to classify the upland vegetation and wetland ecosites within the RAA, LAA and PDA. Wetland areas within the PDA and LAA were identified through a review of MNRF mapping. Field studies were conducted within the LAA and PDA in 2013 and 2014 to confirm and refine ecosite boundaries for upland and wetland communities based on methodology given in the Provincial Ecosite Classification System (Banton et al., 2009). Soil and vegetation plots were surveyed to confirm ecosite classification using basic soil data and dominant vegetation cover. Detailed descriptions of the methods employed during the baseline investigations are provided in Section 2.4 of the Appendix E8.2.

A three-season (e.g., spring, summer, and late summer/fall) botanical inventory was completed concurrent with ecosite mapping confirmation field studies, with priority placed on habitats likely to be affected by Project development. Ecosite, landform type, ground cover, coarse woody debris and dominant plant species were recorded. Diameter and age of dominant tree species were measured. Soil texture, moisture regime, organic layer depth and calcareousness were also recorded at each vegetation plot. A list of plant species recorded in the LAA and PDA in 2013 and 2014 was compiled (Appendix E8). Scientific names of flora species appear in the species lists provided in Appendix E8. Scientific names are excluded from this Chapter, unless the species does not appear in Appendix E8.

Provincial Status (S-Ranks) and Sensitivity

The provincial status of wildlife flora and fauna is provided by the MNRF (NHIC 2014). Provincial or Sub-national status rankings (S-Ranks) for vegetation communities and plant species are based on the number of occurrences in Ontario and have the following meanings:
HARDROCK PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT / ENVIRONMENTAL ASSESSMENT

Assessment of Potential Environmental Effects on Upland Vegetation and Wetlands
January 2016

- S1: extremely rare; usually fewer than 5 occurrences;
- S2: very rare; usually between 5-20 occurrences;
- S3: rare to uncommon; usually between 20-100 occurrences;
- S4: common; apparently secure, usually more than 100 occurrences;
- S5: very common; demonstrably secure;
- SH: historically known; not verified recently (typically not recorded in the province in the last 20 years);
- SU: unrankable; currently unrankable due to insufficient or conflicting data; and
- SNR: unranked; status not yet assessed.

Species ranked as S1 are considered critically imperiled in the province; species ranked as S2 are considered imperiled; and, species ranked as S3 are considered vulnerable in the province with relatively few populations. Species ranked S4 or S5 are considered secure. Species ranked as SH are considered possibly extirpated.

These rarity rankings are used throughout this assessment to characterize the rarity of vegetation communities and individual plant species throughout the LAA.

12.2.2 Overview

The RAA is located in the Central Plateau, along the southern boundary section of the Boreal Forest Region, in northern Ontario (Rowe 1972). Typical forest cover is a mix between deciduous and upland coniferous forest cover as well as wetland coniferous swamp; vegetation communities are predominantly coniferous with deciduous associates. White and black spruce, tamarack, balsam fir and jack pine are common throughout the RAA with frequent occurrences of deciduous vegetation communities and species, including white birch, trembling aspen and balsam poplar. Wetland vegetation community types occur throughout the RAA and are common to the Boreal Forest Region. Wetland ecosites include swamp, marsh, bog and fen communities. Many of these wetland ecosites contain a shallow open water component.

12.2.2.1 Ecosite Communities

In total, 21 terrestrial ecosite community types were recorded in LAA, of which 19 were present in the PDA (Figure 12-2). Ecosite communities within the PDA and LAA included conifer, hardwood (e.g., deciduous) and mixed forests, conifer swamps and fens. Areas of open water were also present within the LAA and PDA, and were generally located in areas along the Central Basin and Southwest Arm of Kenogamisis Lake where Project components extended into the open water. Areas of disturbance that showed early successional growth in both hardwood and mixed communities occurred frequently throughout the PDA and LAA. Ecosite communities in the PDA were approximately 40.9% conifer-dominated upland forest, 9.8%...
hardwood-dominated forest, 12.4% early successional/disturbed forest, 35.9% conifer-dominated
swamp and <1% open wetland (marsh, bog and fen) communities. The remaining <1% cover
was shallow open water. Ecosite conditions and classifications in the LAA were consistent with
the ecosites in the PDA. Ecosite descriptions, including general site characteristics, structure,
composition and distribution, are provided in Appendix E8. The distribution of ecosite community
types in the PDA and LAA is presented in Table 12-3.
Legend

- Local Assessment Area
- Project Development Area

Existing Features
- Highway
- Major Road
- Local Road
- Watercourse-Permanent
- Watercourse-Intermittent
- Waterbody

Vegetation Communities
- Upland Vegetation
- Wetland
- Disturbed

Notes
1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources & Forestry's Printer for Ontario, 2013.

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Client/Project
Greenstone Gold Mines GP Inc (GGM)
Hardrock Project

Figure No.: 12-2

Ecotone Classification
in PDA and LAA

December 2015
Modified by dharvey
Table 12-3: Upland Vegetation and Wetland Cover in PDA and LAA by Ecosite

<table>
<thead>
<tr>
<th>Ecosite Type</th>
<th>Listed as provincially rare ecosite in Ecoregion 3E*? (Yes/No)</th>
<th>Area in LAA** (ha)</th>
<th>Proportion of Ecosite in LAA (%)</th>
<th>Area in PDA (ha)</th>
<th>Proportion of Ecosite in PDA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UPLAND VEGETATION ECOSITES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B034T1Dk</td>
<td></td>
<td>155.9</td>
<td>5.6</td>
<td>149.8</td>
<td>7.7</td>
</tr>
<tr>
<td>Dry, Sandy: Jack Pine–Black Spruce Dominated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B035T1Dk</td>
<td>No</td>
<td>153.9</td>
<td>5.5</td>
<td>134.9</td>
<td>6.9</td>
</tr>
<tr>
<td>Dry, Sandy: Pine–Black Spruce Conifer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B040T1Dk</td>
<td>No</td>
<td>8.5</td>
<td>0.3</td>
<td>3.7</td>
<td>0.2</td>
</tr>
<tr>
<td>Dry, Sandy: Aspen–Birch Hardwood</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B049T1Dk/B049T1Dn/B049T1Mn/B049T1Sn</td>
<td>No</td>
<td>206.2</td>
<td>7.4</td>
<td>182.7</td>
<td>9.4</td>
</tr>
<tr>
<td>Dry to Fresh, Coarse Loamy: Jack Pine–Black Spruce Dominated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B050T1Dn/B050T1Mn/B050T1Dk/B050T1Mk</td>
<td>No</td>
<td>152.3</td>
<td>5.4</td>
<td>62.3</td>
<td>3.2</td>
</tr>
<tr>
<td>Dry to Fresh, Coarse Loamy: Jack Pine–Black Spruce Conifer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B052T1Dn</td>
<td>No</td>
<td>20.8</td>
<td>0.7</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Dry to Fresh, Coarse Loamy: Spruce-Fir Conifer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B055T1Dk/B055T1Dn/B055T1MDk/B055T1Mk/B055T1Mn/B055T1Sn</td>
<td>No</td>
<td>226.7</td>
<td>8.1</td>
<td>178.7</td>
<td>9.2</td>
</tr>
<tr>
<td>Dry to Fresh, Coarse Loamy: Aspen–Birch Hardwood</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Table 12-3: Upland Vegetation and Wetland Cover in PDA and LAA by Ecosite

<table>
<thead>
<tr>
<th>Ecosite Type</th>
<th>Listed as provincially rare ecosite in Ecoregion 3E*? (Yes/No)</th>
<th>Area in LAA** (ha)</th>
<th>Proportion of Ecosite in LAA (%)</th>
<th>Area in PDA (ha)</th>
<th>Proportion of Ecosite in PDA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B065T1Dk/B065T1Dn/B065T1Dn/B065T1Mn</td>
<td>No</td>
<td>318.3</td>
<td>11.4</td>
<td>266.0</td>
<td>13.7</td>
</tr>
<tr>
<td>Moist, Coarse Loamy: Pine–Black Spruce Conifer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B070T1Dk/B070T1Dn/B070T1Dn/B070T1Mn</td>
<td>No</td>
<td>12.9</td>
<td>0.5</td>
<td>7.2</td>
<td>0.4</td>
</tr>
<tr>
<td>Moist, Coarse Loamy: Aspen–Birch Hardwood</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B104T1Dk/B104T1Dn</td>
<td>No</td>
<td>0.8</td>
<td>&lt;0.1</td>
<td>0.2</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Fresh, Silty to Fine Loamy: Aspen–Birch Hardwood</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B110N</td>
<td>No</td>
<td>1.3</td>
<td>&lt;0.1</td>
<td>0.5</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Moist, Fine: Cultural Meadow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B119T1Dk</td>
<td>No</td>
<td>1.1</td>
<td>&lt;0.1</td>
<td>0.2</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Moist, Fine Loamy: Aspen–Birch Hardwood</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-total Upland Vegetation Ecosites</td>
<td></td>
<td>1258.5</td>
<td>44.9</td>
<td>986.3</td>
<td>50.8</td>
</tr>
<tr>
<td>B194X</td>
<td>No</td>
<td>55.8</td>
<td>2.0</td>
<td>52.6</td>
<td>2.7</td>
</tr>
<tr>
<td>(Early Successional Forest-Disturbed – Coarse Clean Fill)**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B198X</td>
<td>No</td>
<td>220.7</td>
<td>7.9</td>
<td>189.4</td>
<td>9.7</td>
</tr>
<tr>
<td>(Early Successional Forest-Disturbed – Compact Graveled Surface)***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-total Disturbed Ecosites</td>
<td></td>
<td>276.5</td>
<td>9.9</td>
<td>242.0</td>
<td>12.5</td>
</tr>
</tbody>
</table>

### WTENLAND ECOSITE TYPES

<table>
<thead>
<tr>
<th>Ecosite Type</th>
<th>Listed as provincially rare ecosite in Ecoregion 3E*? (Yes/No)</th>
<th>Area in PDA (ha)</th>
<th>Proportion of Ecosite in PDA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B127T1Dn</td>
<td>No</td>
<td>47.3</td>
<td>1.7</td>
</tr>
<tr>
<td>Poor Conifer Swamp</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B128T1Dn/B128T1Mn</td>
<td>No</td>
<td>752.5</td>
<td>26.9</td>
</tr>
<tr>
<td>Intermediate Conifer Swamp</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

*Ecoregion 3E* indicates the ecoregion in which the ecosite is listed as provincially rare. **LAA** stands for Landscape Analysis Area. ***Disturbed Ecosite types include Early Successional Forest-Disturbed and Compact Graveled Surface.
Table 12-3: Upland Vegetation and Wetland Cover in PDA and LAA by Ecosite

<table>
<thead>
<tr>
<th>Ecosite Type</th>
<th>Listed as provincially rare ecosite in Ecoregion 3E*? (Yes/No)</th>
<th>Area in LAA** (ha)</th>
<th>Proportion of Ecosite in LAA (%)</th>
<th>Area in PDA (ha)</th>
<th>Proportion of Ecosite in PDA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B129TIDn/ B129TIMn Rich Conifer Swamp</td>
<td>No</td>
<td>91.9</td>
<td>3.3</td>
<td>72.7</td>
<td>3.7</td>
</tr>
<tr>
<td>B135SDn Organic Thicket Swamp</td>
<td>No</td>
<td>81.2</td>
<td>2.9</td>
<td>58.9</td>
<td>3.0</td>
</tr>
<tr>
<td>B136TIDn/B136TtDn Sparse Treed Fen</td>
<td>No</td>
<td>55.7</td>
<td>2.0</td>
<td>9.9</td>
<td>0.5</td>
</tr>
<tr>
<td>B142NDn Mineral Meadow Marsh</td>
<td>No</td>
<td>0.1</td>
<td>&lt;0.1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>B144NDn Organic Meadow Swamp</td>
<td>No</td>
<td>136.8</td>
<td>4.9</td>
<td>38.8</td>
<td>2.0</td>
</tr>
<tr>
<td>B146NDn Open Shore Fen</td>
<td>No</td>
<td>0.5</td>
<td>&lt;0.1</td>
<td>0.2</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>B223TtDk/ B223TtDn Peaty Phase: Mineral Intermediate Conifer Swamp</td>
<td>No</td>
<td>13.5</td>
<td>0.5</td>
<td>3.8</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Sub-total Wetland Ecosites</strong></td>
<td></td>
<td>1179.4</td>
<td>41.9</td>
<td>708.7</td>
<td>36.4</td>
</tr>
<tr>
<td><strong>Water</strong>*</td>
<td>n/a</td>
<td>87.4</td>
<td>3.1</td>
<td>4.6</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Notes:
* MNRF, 2015
** The LAA includes the PDA.
*** Open Water is not a naturally-occurring terrestrial vegetation community, and is not included in the assessment of effects on either upland vegetation or wetland communities.

12.2.2.2 Upland Vegetation Ecosites

In total, eleven (11) upland vegetation ecosite types were present within the PDA and twelve (12) in the LAA. These included coniferous forests (40.9% of PDA; 36.0% of LAA) and hardwood forests (9.8% of PDA; 8.9% of LAA). Upland vegetation ecosites are illustrated in Figure 12-2.

No provincially rare or specialized habitat for upland vegetation communities were identified in the PDA or LAA.
Disturbed upland vegetation was frequent within the PDA and LAA, and consisted of two disturbed ecosite types that were generally associated with historical mining areas. Disturbed ecosite types made up 12.4% of the PDA and 9.9% of the LAA, and are illustrated in Figure 12-2.

12.2.2.3 Wetland Ecosites

In total, eight (8) wetland ecosite types were present within the PDA and nine (9) in the LAA. These included coniferous swamp (35.9% of PDA; 40.2% of LAA) and fen community (0.5% of PDA; 2% of LAA) types. Wetland ecosites are illustrated in Figure 12-2 and listed in Table 12-4. The extent of wetlands across the PDA and LAA is illustrated in Figure 12-3.

No PSWs were identified in the PDA or LAA.

No provincially rare wetland communities were identified in the PDA or LAA. One sensitive, but not provincially designated as rare, wetland community was identified immediately adjacent to the PDA, and within the LAA: Sparse Treed Fen (B136 on Figure 12-3). This community was located adjacent to the northeast limits of the proposed TMF. This fen occupies a shallow basin that covers about 40 ha and is adjacent to conifer swamp (ecosites B128 and B129) on the east and west. Vegetation cover in the fen included tree, shrub and herbaceous/moss cover. Tree cover included tamarack, black spruce and white cedar, and canopy height was generally less than 10 m. This fen supports a butterfly SOCC (taiga alpine butterfly (Erebia mancinus)) and areas of seepage from springs. Although this ecosite community type (B136) is not listed as a provincially rare vegetation type, it could be considered a sensitive feature due to its dependence on nutrient-rich springs and groundwater, and its ecological characteristics. Sparse Treed Fen occurs in several areas in the LAA, but only B136 is located near a Project component, and therefore has the potential to be affected by the Project.

12.2.2.4 Botanical Inventory

In total, 245 species of vascular plants were recorded in the LAA, of which 91% (223 species) were native species and 9% (22 species) were not native species. Of the 223 native plant species, 216 had a rank of either S5 or S4 (see Section 12.2.1). The remaining 7 native plant species were ranked as SU (unranked) as the provincial conservation status of these plant species has not yet been assessed. No species ranked S1-S3 or SH were recorded in the LAA. The following plant species of interest to Aboriginal communities were present in the LAA:

- balsam fir;
- birch;
- black spruce;
- blueberries;
- cedar;
ferns;
• high bush cranberry;
• Labrador tea;
• low bush cranberry;
• mint;
• mountain ash;
• raspberries (stemless, wild red, dwarf raspberries);
• strawberries;
• white and red willow;
• wild rice - (white grained mountain and slender mountain rice); and
• yarrow.

These species also had a rank of either S5 or S4 and are considered common and secure in Ontario. A complete list of plant species recorded during field investigations is provided in Appendix E8.

12.2.2.5 Species at Risk and Species of Conservation Concern

SAR and SOCC are protected under federal or provincial legislation, including SARA and ESA (Section 12.1.1). SAR are defined as “species on Schedule 1 of SARA or listed as endangered, threatened or extirpated under the ESA”. SOCC are defined as “species listed as special concern under the ESA or provincially rare species (e.g., listed as S1-S3 or SH by the MNRF).”

Consultation with MNRF (personal communication between Dave Barker [MNRF] and Al Harris [Northern Bioscience], July 15, 2014) identified one SAR that may occur within the LAA: butternut (Juglans cinerea). Butternut is an S3 species, and listed as endangered federally and provincially. Non-hybrid butternut specimens were not found during surveys in the PDA and LAA.

Specimens were reported on a private residential property in the MacLeod town site, within the LAA. On September 24, 2014, Northern Bioscience conducted a survey of the property. Three hybrid butternut specimens (likely J. cinerea × ailantifolia) were identified on the property, which is located approximately 700 km north of the recognized range of butternut in Ontario (Farrar 1995; Farlee et al. 2014). Hybrid specimens are not listed as SAR, and therefore are not protected under SARA or ESA.

No plant SAR or SOCC were identified in the PDA or LAA during field investigations.
12.3 PROJECT INTERACTIONS WITH UPLAND VEGETATION AND WETLANDS

Table 12-4 identifies Project physical activities that may interact with upland vegetation or wetlands. These interactions are indicated by a check mark (√) and are further discussed in Section 12.4 in the context of effects mechanisms, standard and Project-specific mitigation and residual effects. Justification for non-interactions (i.e., no check marks) is provided following Table 12-4.

Table 12-4: Potential Project Environmental Effects on Vegetation and Wetlands, Prior to Mitigation

<table>
<thead>
<tr>
<th>Project Components and Physical Activities</th>
<th>Change in abundance of vegetation species of interest</th>
<th>Change in abundance or condition of upland vegetation communities</th>
<th>Change in wetland function and connectivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTRUCTION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site Preparation (removal of existing buildings, removal of contaminated materials, vegetation clearing and earthworks)</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Watercourse Crossings and Realignments</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Mine Components (open pit, WRSAs, water management facilities, TMF)</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Site Buildings and Associated Infrastructure</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Linear Facilities (mine site roads, onsite pipelines and piping, power lines and substations, Highway 11 realignment)</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Ancillary Facilities (fuel supply, storage and distribution, aggregate requirements)</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Employment and Expenditure</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>OPERATION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Pit Mining (drilling, blasting, loading and hauling of ore and waste rock)</td>
<td>-</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Waste Rock Disposal</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ore Processing (ore crushing and conveyance, ore milling)</td>
<td>-</td>
<td>√</td>
<td>-</td>
</tr>
<tr>
<td>Water Management (mine water collection and storage, process water supply)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Table 12-4: Potential Project Environmental Effects on Vegetation and Wetlands, Prior to Mitigation

<table>
<thead>
<tr>
<th>Project Components and Physical Activities</th>
<th>Potential Environmental Effects (prior to mitigation)</th>
<th>Change in abundance of vegetation species of interest</th>
<th>Change in abundance or condition of upland vegetation communities</th>
<th>Change in wetland function and connectivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tailings Management</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Site Buildings, Linear Facilities and Associated Infrastructure (mine site roads, power plant and associated infrastructure, explosives manufacturing plant and storage, fuel supply, conversion, storage and distribution)</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Employment and Expenditure</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CLOSURE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decommissioning</td>
<td></td>
<td>-</td>
<td>√</td>
<td>-</td>
</tr>
<tr>
<td>Rehabilitation (progressive rehabilitation, active closure rehabilitation)</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Post-Closure</td>
<td></td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Employment and Expenditure</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

NOTES:
✓ = Potential interactions that might cause an effect without mitigation.
- = Interactions are not expected.

Project employment and expenditures are not anticipated to interact with upland vegetation and wetlands as these are not considered a physical work or physical activity.

12.4 ASSESSMENT OF RESIDUAL ENVIRONMENTAL EFFECTS ON UPLAND VEGETATION AND WETLANDS

12.4.1 Analytical Methods

12.4.1.1 Analytical Assessment Techniques for Upland Vegetation

The assessment of environmental effects on upland vegetation species (e.g., non-wetland vegetation) and communities of interest used a geographic information system (GIS) to overlay the PDA on ecosite mapping developed during the terrestrial baseline surveys. Ecosites included in the assessment were upland forest ecosites including coniferous, hardwood and mixed forests and early successional/disturbed ecosites. This allowed for a quantitative measurement of the
area of upland vegetation communities proposed for removal to accommodate the various Project components. It also allowed for the quantitative measurement of the area of upland vegetation communities adjacent to Project components that may be affected by fugitive dust emissions, or communities that are sensitive to “edge effects” (e.g., encouraging invasion by weedy generalist plants, exposing plants that are sensitive to light, wind or dust, changing micro-drainage patterns) as a result of fragmentation. As stated in Section 12.1.4.1 dust deposition declines with distance from the source. Unpaved roads will be a primary source of dust deposition. Although the greatest concentration of dust deposition occurs within 10 m of the source (Spatt and Miller 1981), dust particles can disperse beyond 20 m from the source (Farmer 1992). Based on a conservative estimate of the distance dust may disperse from Project sources, this assessment assumes effects may occur on vegetation communities up to 30 m from Project components, which is reflected in the delineation of the LAA (e.g., 30 m from the PDA).

This approach enabled the calculation of area for specific upland vegetation communities that may be affected by individual Project components, and the effects on both upland and other non-wetland ecosite types (e.g., disturbed ecosites) from the Project as a whole. To the extent practical, quantitative measures are used to characterize residual environmental effects. Qualitative considerations were identified and defined where quantitative measurements were not possible.

12.4.1.2 Analytical Assessment Techniques for Wetlands

The assessment of effects on wetlands also relied on a GIS overlay of the PDA on ecosite mapping. Ecosites used in the assessment were wetland communities, including marshes, bogs, fens and swamps. GIS was used to calculate the areas of wetlands that may be removed or affected by dust emissions (using the same parameters described for vegetation). This enabled the calculation of area for specific wetland communities that may be affected by individual Project components, and the direct and indirect effects on wetland ecosite types combined from the Project as a whole.

In addition, a qualitative assessment of the potential Project effects on wetland function was undertaken using a 3-D hydro-geological model to quantify a cone of influence and drawdown in groundwater levels in different parts of the PDA (Chapter 9.0). The model simulated drawdown in the overburden and shallow bedrock for the ultimate pit extents, and estimated the projected drawdowns in the overburden under the maximum dewatering conditions. The use of maximum dewatering conditions represents a conservative means of assessing potential Project effects on wetland hydrology and, therefore, on wetland function due to lowering of the water table and reduced discharge into wetlands from seeps, springs and groundwater sourced surface water features. The assessment considered an area of potential groundwater influence using a 0.5-m drawdown contour. This contour generally corresponds with the rooting limit of most vegetation species in mineral wetlands, and approximates the minimum depth of organic accumulation in wetlands with organic soils (Yuan and Chen, 2010; Strong and La Roi, 1983).
Marsh and swamp communities are also generally seasonally adapted to water level fluctuations within 0.5 m. The most pronounced effects are anticipated to occur in areas with drawdown equal to or greater than 0.5 m, and wetlands in these areas were quantified separately from the maximum dewatering area of influence.

12.4.1.3 Assumptions and the Conservative Approach

As discussed in Appendix 8E, 46 ecosite community types were recorded in local study area during baseline investigations. A total of 1,546 ecosite community polygons were identified in the local study area using remotely sensed data in 2013. Field investigations were completed to ground-truth a statistically representative sample of these communities to confirm the accuracy of the preliminary ecosite mapping. In total, 183 vegetation plots were surveyed in these community polygons throughout the local study area. A population size sample calculation program (University of Guelph 1999) used to determine statistical representation indicated that sampling of 183 vegetation plots provided a 93–94% level of confidence that sufficient ground-truthing was undertaken to accurately characterize vegetation communities throughout the LAA. The distribution of vegetation sampling plots is provided in the Appendix 8E.

Although progressive revegetation will occur following the end of construction, the analysis assumes that all revegetation activities will commence during the closure phase. This is considered to be a conservative case scenario. In addition, this approach accepts the likelihood that some areas may not be returned to their original state (e.g. permanent alteration), and that some of the cleared areas may not be completely revegetated (e.g., the preliminary targets for revegetation is 40% of the WRSA and portions of the TMF) and may return to a vegetated state through natural means over a longer period of time.

12.4.2 Assessment of Change in Abundance of Vegetation Species of Interest

12.4.2.1 Project Mechanisms for Change in Abundance of Vegetation Species of Interest

Construction

Site preparation will include vegetation removal in the PDA, which will result in direct effects on the vegetation species of interest. The removal of vegetation may result in the removal of vegetation species of interest including plant species of interest to Aboriginal communities. As discussed in Section 12.2.2.4, these species had a rank of either S5 or S4 and are considered common and secure in Ontario. These plant species are considered common to the LAA and RAA.

During construction, in the absence of any mitigation, there is the potential for indirect effects on vegetation species of interest within 30 m of Project components from dust deposition due to construction activities. Sources of fugitive dust include clearing activities, vehicle traffic on unpaved surfaces, and the initial development of the open pit. The emissions related to these
activities will be localized and temporary, lasting the duration of the construction activities and expected to be smaller in magnitude than Project operation.

Invasive and exotic (non-native) plant species can displace vegetation in some cases, in the absence of any mitigation. Vegetation communities within 30 m of Project components may be affected by the introduction of exotic or invasive species by construction equipment and vehicles.

No plant SAR or SOCC were recorded during field surveys for the Project, and the potential for encountering plant SAR within the LAA has been determined to be low based on an assessment of the vegetation communities within the LAA. No interaction with SAR or SOCC is anticipated.

**Operation**

Operation will not result in any additional vegetation clearing. As discussed in Section 4.6.2 when practical, areas that are no longer required may be rehabilitated during mining operations. However, as a conservative case scenario, this assessment assumes that rehabilitation will not occur until closure.

Although there will be no direct effect on vegetation species of interest due to removal, there will be indirect effects from dust deposition in the absence of any mitigation. As described in Section 7.4.2.1, dust emissions during operation would result from traffic of mining fleet and other equipment on unpaved roads; handling and transferring of extracted ore, waste rock and overburden; stockpiles of ore, waste rock and overburden; the open pits; and mining and milling operations (crushing, grinding, refining).

**Closure**

At closure, Project infrastructure, equipment, and ancillary facilities not required for long-term closure will be removed and the PDA will be rehabilitated. Construction activities associated with the removal of buildings and equipment from the PDA may result in a short term increase in dust generated from earth-moving equipment and dust from vehicle traffic in the absence of any mitigation. Vegetation within 30 m of Project components may be susceptible to indirect effects from dust deposition.

Vegetation communities within 30 m of Project components may be affected by the introduction of exotic or invasive species by construction equipment and vehicles in the absence of mitigation.

**12.4.2.2 Mitigation for Change in Abundance of Vegetation Species of Interest**

Project planning and design and the application of established mitigation measures will be used to avoid or limit environmental effects on vegetation species of interest. Standard practices and general environmental protection measures for mining projects will address effects of the Project
Assessment of Potential Environmental Effects on Upland Vegetation and Wetlands
January 2016

on upland vegetation and wetlands. The following mitigation measures are listed in the general sequence in which they will be applied throughout the Project.

Construction

• general site clearing activities will be restricted to the PDA;
• use of dust suppressants (e.g., water) on roadways during situations that have an increase potential to generate airborne dust; implement erosion and sedimentation control measures;
• clean, coarse fill material will be used for grading to reduce the risk of introducing or spreading exotic or invasive plant species.

Operation

• removal of construction-related buildings and revegetation of laydown areas and access roads used during construction or no longer required during operation;
• stabilization and revegetation of WRSAs A through to C;
• rehabilitation of the north cell of the TMF upon completion of deposition (anticipated after Year 7);
• use of dust collection /control systems to reduce potential dust emissions during ore crushing and grinding activities;
• enclosure of dust sources such as the mill feed storage area;
• installation of truck wheel washing stations;
• application of water sprays, chemical suppression, and application, to control fugitive dust emission from road ways; and
• implement an ambient monitoring program to monitor dust levels at selected offsite locations during the operation;

Closure

• use of dust suppressants (e.g., water) on roadways used during closure;
• implement revegetation program following the removal of infrastructure, equipment and materials mine components not required during closure;
• development of a vegetative cover over the top surface of the over the south cell of the TMF;
• stabilization and revegetation of WRSA D;
• implement erosion protection measures until vegetative cover is established;
clean, coarse fill material will be used for grading to reduce the risk of introducing or spreading exotic or invasive plant species; and

- incorporate plant species of interest to Aboriginal communities into rehabilitation plans where appropriate and technically feasible.

Because no interactions with SAR or SOCC are predicted as a result of the Project, mitigation measures specific to SAR or SOCC are not identified.

A Vegetation Management Plan will be prepared, which will outline plans and commitments for mitigating adverse effects on vegetation and wetlands during construction and operation, and for facilitating the timely restoration of affected vegetation communities. The Vegetation Management Plan will also serve as a guide for the rehabilitation of vegetation and wetlands into the closure phase through integration with the Mine Closure Plan.

The Vegetation Management Plan will outline mitigation approaches for reducing effects on vegetation, identifies and prioritizes areas containing sensitive natural features (e.g., fens). The Vegetation Management Plan will outline a strategy to protect these features; through:

- protecting sensitive features identified in the Draft EIS/EA;
- outlining mitigation measures during vegetation clearing and removal;
- protocols for managing invasive species (which may include inspections and targeted removal); and
- integrating with rehabilitation and closure activities covered under the Closure Plan (see Section 4.6.4 – Closure Phase)

12.4.2.3 Characterization of Residual Environmental Effect for Change in Abundance of Vegetation Species of Interest

Clearing of vegetation during construction may result in the removal of plant species of interest to Aboriginal communities. However, these plant species are not limited to the habitat in the LAA and are common species throughout the RAA. The removal of plant species of interest to Aboriginal communities that are located within the PDA are not anticipated to affect the viability of these species occurring in the RAA. As such, the magnitude of the residual effect on plant species of interest to Aboriginal communities is rated as low due to the prevalence of the species throughout the RAA. The removal of these plants occurs in a single event, during construction, and, with the incorporation of plant species of interest to Aboriginal communities where appropriate and technically feasible during rehabilitation, the residual effect is reversible.

The emissions related to construction and closure activities will be localized and temporary, lasting the duration of the construction activities and expected to be smaller in magnitude than Project operation. Dust generated during construction and closure will be less than that
generated during operation and is considered negligible within 30 m of the PDA and rated not significant.

No interaction with SAR or SOCC is anticipated as a result of the Project.

12.4.3 Assessment of Change in Abundance or Condition of Upland Vegetation Communities

12.4.3.1 Project Mechanisms for Change in Abundance or Condition of Upland Vegetation Communities

Construction

Site preparation will include vegetation removal in the PDA, which will result in direct effects on upland vegetation. As discussed in Section 12.2.2.2, no provincially rare vegetation communities were identified in the PDA or LAA and therefore no potential adverse effects are anticipated.

There is the potential for indirect effects on vegetation within 30 m of Project components from dust deposition due to construction activities in the absence of any mitigation. Sources of fugitive dust include clearing activities, vehicle traffic on unpaved surfaces, and the initial development of the open pit. The emissions related to these activities will be localized and temporary, lasting the duration of the construction activities and expected to be smaller in magnitude than Project operations.

Fragmentation could occur when communities are severed by a Project component (e.g., a forest polygon that is bisected by an access road, or partially removed to accommodate a WRSA) and new edges are created. Upland vegetation communities adjacent to Project components may be sensitive to “edge effects” (e.g., allowing invasion by weedy generalist plants, exposing plants that are sensitive to light, wind or dust, changing micro-drainage patterns) as a result of fragmentation.

Invasive and exotic (non-native) plant species can displace communities of concern in some cases and some invasive species are restricted according to provincial regulations. Vegetation communities within 30 m of Project components may be affected by the introduction of exotic or invasive species by construction equipment and vehicles, in the absence of any mitigation.

Operation

No additional upland vegetation clearing will occur during operation and closure beyond that previously cleared during construction. If some time elapses between site preparation and construction and installation of facilities, some early successional, regenerated vegetation may be removed, but this has been accounted for during the construction phase. Upland vegetation regeneration will not occur in areas that were either previously disturbed, or will be constantly being disturbed, such as open pit mining, ore processing, mine waste and water management.
areas, and along roads used for transportation of personnel and goods to the site. Operation of linear facilities will include vegetation management (e.g., removal of overhanging tree limbs and trimming of shrubs that may impede reliable operation of transmission lines, or to a lesser extent, removal of vegetation that may encroach on or interfere with lines of sight on the site access roads). This will not result in additional loss of vegetation as these activities will occur in areas that have been previously cleared.

Vegetation communities within 30 m of Project components may be affected from dust deposition from operation activities in the absence of any mitigation (see Section 12.4.1.1). Sources of fugitive dust during operation include, vehicle traffic, the open pit, ore crushing and grinding activities, TMF and WRSAs.

Similar to construction, effects during operation on vegetation communities within 30 m of Project components may also be affected by the introduction of exotic or invasive species by vehicles, imported fill or wastewater discharge in the absence of any mitigation.

**Closure**

At closure, Project infrastructure, equipment, and ancillary facilities not required for long-term closure will be removed and the PDA will be rehabilitated. Construction activities associated with the removal of buildings and equipment from the PDA may result in a short term increase in dust generated from earth-moving equipment and dust from vehicle traffic. Vegetation within 30 m of Project components may be susceptible to indirect effects from dust deposition in the absence of any mitigation. Also, vegetation communities within 30 m of Project components may be affected by the introduction of exotic or invasive species by construction equipment and vehicles in the absence of any mitigation.

**12.4.3.2 Mitigation for Change in Abundance or Condition of Upland Vegetation Communities**

No potential adverse effects on rare vegetation communities are predicted as a result of the Project. No mitigation measures are identified beyond those described in Section 12.4.2.2.

**Construction**

Mitigation measures during construction will include:

- general site clearing activities will be restricted to the PDA;
- use of dust suppressants (e.g., water) during situations that have an increased potential to generate airborne dust;
- implement erosion and sedimentation control measures; and
- clean, coarse fill material will be used for grading to reduce the risk of introducing or spreading exotic or invasive plant species.
Operation

As the Project advances from the construction phase to the operation phase, progressive rehabilitation activities can commence where opportunities present themselves. Progressive rehabilitation opportunities for the Project during the operation phase will include:

- removal of construction-related buildings and revegetation of laydown areas and access roads used during construction or no longer required during operation;
- stabilization and revegetation of WRSAs A through to C; and
- rehabilitation of the north cell of the TMF upon completion of deposition (anticipated after Year 7).

Implementation of these measures will reduce the amount of time that vegetation communities are vulnerable to edge effects, and will accelerate natural revegetation in the affected areas. In addition, these progressive rehabilitation/revegetation activities will contribute to the rehabilitation efforts that would otherwise be carried out during closure when mining operations have ceased. A more detailed discussion on progressive rehabilitation is provided in Appendix I. As noted previously in Section 12.4.1.3, as a conservative case scenario, the assessment assumes that all revegetation will occur during closure.

Standard dust control measures discussed in Chapter 7.0 (atmospheric environment) will also be implemented to limit potential effects on vegetation from potential dust emissions during operation. These include:

- use of dust collection /control systems to reduce potential dust emissions during ore crushing and grinding activities;
- enclosure of dust sources such as the mill feed storage area;
- installation of truck wheel washing stations;
- application of water sprays, chemical suppression, and application, to control fugitive dust emission from road ways;
- implement an ambient monitoring program to monitor dust (PM and PM2.5) levels at selected offsite locations during the operation.

Refer to Section 7.4.4.2 for additional details regarding mitigation measures to reduce Project-related effects on the atmospheric environment.

Closure

Listed below are mitigation measures specific to Project closure phase as well as measures previously identified under the Project construction phase:

- use of dust suppressants (e.g., water) on roadways used during closure;
implementation of revegetation program following the removal of infrastructure, equipment and materials mine components not required during closure;

- development of a vegetative cover over the top surface of the over the south cell of the TMF;
- stabilization and revegetation of WRSA D;
- clean, coarse fill material will be used for grading to reduce the risk of introducing or spreading exotic or invasive plant species; and

- implement erosion protection measures until vegetative cover is established.

As discussed in Section 12.4.2.2, a Vegetation Management Plan will be prepared and will specify mitigation measures to reduce or eliminate potential effects on species composition or abundance. The Plan will include specific protocols for managing invasive species (e.g., inspections and targeted removal).

Water will be treated in accordance with ECA criteria prior to release to the environment.

12.4.3.3 Characterization of Residual Environmental Effect for Change in Abundance or Condition of Upland Vegetation Communities

Construction

During the construction phase of the Project approximately 1,229.6 ha of upland vegetation community will be removed or altered from the PDA. The vegetation communities to be removed consist of disturbed (e.g., a result of industry and anthropogenic disturbance) and naturally occurring upland vegetation. Approximately 987.5 ha of naturally occurring upland vegetation from nine naturally-occurring ecosite types will be affected by the Project, either through direct removal of vegetation or alteration of vegetation communities (e.g., the conversion of one ecosite type to another). An additional 242.1 ha of disturbed upland vegetation will also be affected during construction of the Project. The extent of this loss or alteration will be limited to the PDA. Table 12-5 summarizes the loss of area of upland vegetation and disturbed upland vegetation by duration (as defined in Table 12-2). The areas of upland vegetation and disturbed vegetation that will be affected by the Project are shown in Figure 12-4.

No provincially rare vegetation communities were identified in the PDA or LAA and therefore no potential adverse effects are anticipated. However, one sensitive vegetation community (undesignated) was identified directly adjacent to the PDA: Sparse Treed Fen (B136). However, the mitigation measures discussed in Section 12.4.3.2 are expected to reduce potential adverse effects on sensitive habitat located in the LAA. No residual adverse effects on rare or specialized habitat for vegetation communities are predicted as a result of the Project as they are not present in the PDA.
Short-Term Loss

During construction of the Goldfield Creek diversion channel approximately 0.8 ha of naturally occurring vegetation will be removed. Upland vegetation communities along the banks of the existing channel are anticipated to experience change in water flow to accommodate additional water, but are anticipated to return to a pre-existing vegetated naturalized habitat after the single occurrence of water diversion except in the channel of the creek realignment.

Long-Term Loss

The long-term removal of upland vegetation will affect approximately 1222.8 ha of upland vegetation of which 1081.1 ha is likely to return to a vegetated naturalized habitat. This long-term removal of disturbed and naturally occurring upland vegetation (see Table 12-5) will extend from construction to beyond closure (assuming linear facilities such as haul roads and the electrical system remain intact for an indeterminate time once mining operations cease). When and where possible, affected areas will be progressively restored throughout the operation phase to reduce the length of time that vegetation is absent. Ongoing vegetation management of affected communities in these locations will re-establish naturalized vegetation communities along these linear facilities, with characteristics and composition similar to baseline conditions. Rehabilitation activities will be undertaken to revegetate the TMF and WRSAs to the extent possible and will be refined through closure planning (see Section 4.6.4 – Closure Phase). Communities converted into collection ponds or creek alignments will also be affected because the terrestrial character of the community will be affected as part of the conversion. However, it is anticipated that naturalized riparian communities will form over time along the edges of the storm ponds and realigned stream channel.

Approximately 147.7 ha of upland vegetation (forest), of which 90.3 ha is considered disturbed, are unlikely to return to a vegetated naturalized habitat. These areas are associated with the open pit, realignment of the Highway 11 corridor and creek realignment.

Table 12-5: Duration and Area of Upland Vegetation Community Loss

<table>
<thead>
<tr>
<th>Duration</th>
<th>Disturbed¹</th>
<th>Naturally Occurring</th>
<th>Total</th>
<th>Likely to return to a vegetated naturalized habitat</th>
<th>Project Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term loss</td>
<td>0</td>
<td>0.8</td>
<td>0.8</td>
<td>Yes</td>
<td>Creek realignment – existing channel</td>
</tr>
<tr>
<td>Medium-term loss</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>NA</td>
<td>none</td>
</tr>
<tr>
<td>Long-term loss</td>
<td>151.8</td>
<td>929.3</td>
<td>1081.1</td>
<td>Yes</td>
<td>Mine site roads, site buildings and associated infrastructure, ore</td>
</tr>
</tbody>
</table>
Table 12-5: Duration and Area of Upland Vegetation Community Loss

<table>
<thead>
<tr>
<th>Duration</th>
<th>Upland Vegetation Community Loss (ha)</th>
<th>Project Components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Disturbed(^1)</td>
<td>Naturally Occurring</td>
</tr>
<tr>
<td>Permanent loss</td>
<td>90.3</td>
<td>57.4</td>
</tr>
<tr>
<td>Total</td>
<td>242.1</td>
<td>987.5</td>
</tr>
</tbody>
</table>
Closure

Revegetation during closure will improve the quality of habitat for vegetation within the PDA, which will have a positive effect on affected upland vegetation, as well as areas that were previously disturbed. The establishment of either actively-managed or naturally revegetated areas, and the quality of habitat resulting from these activities will be monitored during and after closure.
Trans-Canada Highway 11
OldArena Road
Goldfield Road
WC- C
WC- A
WC- H
Lake A321
Lake A-323
Magnet Lake
Kenogamisis Lake (Southwest Arm)
Kenogamisis Lake (Central Basin)
Barton Bay (East)
Barton Bay (West)
Mosher Lake
Longacre Lake
Marron Lake
Goldfield Lake
McKelvie Lake
Puppy Lake
Pussy Lake
Barton Bay (West)
Barton Bay (East)
Lake 4-223

Legend
Local Assessment Area
Project Development Area
Areas of Vegetation Removal
Disturbed Communities to be Removed
Forest Communities to be Removed
Wetland Communities to be Removed
Dust Deposition
30m from PDA
Affected Wetlands
Downstream
Upstream
Drawdown
Existing Features
Highway
Major Road
Local Road
Watercourse - Permanent
Watercourse - Intermittent
Waterbody

Notes
1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

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12.4.4 Assessment of Change in Wetland Function and Connectivity

12.4.4.1 Project Mechanisms for Change in Wetland Function and Connectivity

Construction

Site preparation will include pre-construction activities that will result in removal of wetland and wetland vegetation in the PDA. The 'loss' of wetlands will occur as a result of the removal of wetland vegetation, wetland soils and overburden material, and the infilling of wetlands. Loss of wetlands is defined as the direct physical removal of wetland vegetation and or the alteration of wetland vegetation communities (e.g., the conversion of one ecosite type to another) that results in a change in wetland function and connectivity. The Project will result in an alteration (e.g., loss of existing wetland function) through the removal of peat during construction. The removal of peat will result in the conversion of peatlands (e.g., conifer swamps and fens) to marshes, alder thickets or upland communities. Potentially affected wetland communities include coniferous swamps, thicket swamps, meadow swamps and treed and open fens. Alteration of ecosite communities in the PDA relative to the ecosite distribution in the LAA is described in Table 12-3. In addition to the removal of wetlands, the Project has the potential to affect wetland function due to the installation of onsite pipelines, piping and power lines in wetlands and wetland buffers.

Operation

No additional wetland vegetation clearing will occur during operation beyond that previously cleared during construction. If some time elapses between site preparation and construction and installation of facilities, some early successional, regenerated vegetation may be removed in wetlands previously disturbed during the construction phase. Regeneration is not anticipated in areas that are constantly being disturbed, including open pit mining, ore processing, mine waste and water management, and along roads used for transportation of personnel and goods to the site. Operation of onsite pipelines, piping and power lines will include vegetation maintenance (e.g., removal of trees and shrubs that obstruct site access or operation of transmission lines), which will have a minor interaction with wetlands because the work will be conducted in previously cleared areas.

During operation there is the potential for effects on wetlands as a result of groundwater drawdown from dewatering the open pit. Effects may include changes in surface water flow, downstream flow and riparian wetlands. The changes in wetlands resulting from a lower water table could include the following:

- reduction in the amount of standing water;
- reduction or alteration of flow in associated watercourses;
- reduction in shallow groundwater flow and input;
• transition from hydrophytic vegetation communities to upland communities;
• change in the accumulation of organic material; and
• shifts in wetland community type.

Closure

Similar to the operation phase, no additional wetland clearing will occur during closure beyond that previously cleared during construction. During mine closure, dewatering activities will cease, and water drawdown in surrounding wetlands should no longer occur.

The wetlands in the PDA and LAA with the potential to be affected by groundwater drawdown are shown on Figure 12-5.

12.4.4.2 Mitigation for Change in Wetland Function and Connectivity

As the Project advances from the construction phase to the operational phase, progressive rehabilitation activities can commence where opportunities present themselves. Progressive rehabilitation during operation followed by revegetation following the removal of infrastructure, equipment and materials mine components not required during closure. These rehabilitation and revegetation activities and the implementation of mitigation measures discussed in Section 12.4.2.2 will reduce or potential avoid effects on wetlands and wetland function. In addition to those mitigation measures discussed in Section 12.4.2.2, the following mitigation measures will be implemented:

• natural buffers will be maintained around wetlands and riparian zones, where possible;
• construction activities will be limited in wetland areas to reduce potential environmental effects of disturbance (erosion and sedimentation, introduction or spread of exotic or invasive vascular plant species); and
• drainage courses will be left undisturbed or with low disturbance where possible to limit effects down-gradient.

12.4.4.3 Characterization of Residual Environmental Effect for Change in Wetland Function and Connectivity

Construction

Approximately 708.8 ha of wetland communities from eight naturally-occurring ecosite types will be removed or altered as a result of the Project. The extent of this loss or alteration will be limited to the PDA and adjacent areas that are indirectly affected by Project activities (in the LAA) (Table 12-7). The installation of onsite pipelines, piping and power lines will avoid wetlands and wetland buffers to the extent practical. Any forested wetlands within the corridors will be cleared, but will revegetate naturally following construction. Changes in wetland function are
predicted to be minimal as a result of the installation of these facilities with the implementation of avoidance and mitigation measures around most wetlands.

All wetland communities in the PDA, including the affected communities, are typical of the Boreal Forest Region. The ecosites that will be removed are common and widespread in the boreal forest. Conifer swamp and non-forested wetland comprise 30% and 11% of the Kenogami Forest Management Unit (Riley and Michaud 1989; Terrace Bay Pulp 2011). Removal of these communities for the Project will not substantially alter the distribution or composition of wetland communities across the RAA, although their removal will result in a change in distribution and composition of the wetland communities within the PDA and LAA.

Short-term Loss

Short-term removal of wetland will affect approximately 14.5 ha, and will occur during construction for the Goldfield Creek diversion. Wetland communities along the banks of the existing channel are anticipated to experience change in water flow to accommodate additional water, but is anticipated to return to its existing vegetated naturalized habitat after the single occurrence of water diversion.

Long-term Loss

The Project will result in an alteration of 694.3 ha of wetlands from eight ecosite types through the removal of peat during construction. The removal of peat will result in the conversion of peatlands (conifer swamps and fens) to marshes, alder thickets or upland communities. Affected wetland communities include coniferous swamps, thicket swamps, meadow swamps and treed and open fens. The extent of this loss in wetland function as a result of alteration will be limited to the PDA and adjacent areas which may be indirectly affected by Project activities.

The majority of wetland area that will be altered (approximately 640.0 ha) is likely to return to a naturalized habitat. However, approximately 54.3 ha of wetland will unlikely return to a vegetated naturalized habitat. These areas are associated with permanent linear facilities (Highway 11 corridor) or habitat conversion (creek realignment) and Project components, including the open pit.

It is unlikely that wetland communities removed for the Project in the long-term will be reclaimed to their original state. However, during closure, these sites may be reclaimed as upland communities, which will result in a net loss of wetland cover in the LAA.

When possible, affected areas will be progressively restored throughout the operation phase. Ongoing wetland and vegetation management will establish naturalized vegetation communities with characteristics, composition and functionality that are either similar to baseline conditions or are restored or reclaimed to an upland vegetated naturalized habitat.
Table 12-6: Duration and Area of Wetland Loss

<table>
<thead>
<tr>
<th>Duration of Loss</th>
<th>Area of Loss (ha)</th>
<th>Likely to return to a naturalized habitat</th>
<th>Project Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term loss</td>
<td>14.5</td>
<td>Yes</td>
<td>Creek realignment – existing channel</td>
</tr>
<tr>
<td>Medium-term loss</td>
<td>0</td>
<td>NA</td>
<td>none</td>
</tr>
<tr>
<td>Long-term loss</td>
<td>640.0</td>
<td>Yes</td>
<td>Mine site roads, site buildings and associated infrastructure, ore processing, water management facilities, TMF, WRSAs and ancillary facilities.</td>
</tr>
<tr>
<td>Permanent loss</td>
<td>54.3</td>
<td>No</td>
<td>Open Pit, Goldfield Creek diversion, Highway 11 realignment</td>
</tr>
<tr>
<td>Total</td>
<td>708.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Note: mine components may not consume the entire PDA. As a result, this figure may not equal the total area of wetlands in the PDA. However, it is assumed that all wetland vegetation within the PDA will be cleared to accommodate areas peripheral to most major mine components (e.g., open pit, waste rock dumps).

The areas of wetland loss as a result of the Project are shown in Figure 12-4.

As discussed in Section 12.2.2.1, the B136 – Sparse Treed Fen community is located adjacent to the northeast limits of TMF. The preliminary design of the TMF was revised in order to maintain the community intact; no removal of this sensitive community will be required for the Project.

**Operation**

Dewatering of the open pit will also result in a loss of wetland function in 142.0 ha of wetlands as a result of groundwater drawdown in excess of 0.5 m. Moderate and high magnitude effects are expected to occur in wetland communities where groundwater drawdown is equal to or greater than 0.5 m, at which point adverse effects on wetland vegetation, soils and function may occur (see Section 12.4.1.2).

**Closure**

Rehabilitation activities will be undertaken to revegetate portions of the TMF and WRSAs. Removal of peatlands (fens and conifer swamps) may be a permanent loss or alteration unless the hydrological conditions are maintained or restored, and naturalized vegetation returns (Graf 2009). Sensitive features such as fens are particularly susceptible if they are dependent on groundwater inputs. Based on successional ecological trends in the PDA and LAA, wetland communities such as bog, fen and swamp are likely to be replaced by marsh and alder thicket
communities, which are also native naturalized habitats and provide wetland function similar to that of the communities being replaced.

During mine closure, dewatering activities will cease and the open pit will refill with water. Once the open pit fills with water, normal groundwater flow will resume and drawdown effects to wetlands will no longer occur.
Legend

- Local Assessment Area
- Project Development Area
- Groundwater Overburden Drawdown
  - 0.3m Shallow Drawdown Contour
- Wetland (Eco-Site Based)

Existing Features

- Highway
- Major Road
- Local Road
- Watercourse - Permanent
- Watercourse - Intermittent
- Waterbody

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen’s Printer for Ontario, 2013.

December 2015

Client/Project

Wetlands Affected by Drawdown

Greenstone Gold Mines GP Inc (GGM)

Hardrock Project

Figure No.

12-5

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen’s Printer for Ontario, 2013.
12.4.5 Summary of Residual Environmental Effects on Upland Vegetation and Wetlands

A summary of residual environmental effects that are likely to occur as a result of the Project are summarized in Table 12-7. Negligible effects are not characterized in the table below.

Residual adverse effects are carried forward to the cumulative effects assessment (Chapter 23.0). A preliminary follow-up and monitoring program is presented in Chapter 24.0. The objective of follow-up monitoring is to determine the effectiveness of mitigation measures and to verify the changes to the environment as a result of the Project are as predicted (see Table 12-7).
### Table 12-7: Summary of Residual Adverse Environmental Effects on Upland Vegetation and Wetlands

<table>
<thead>
<tr>
<th>Residual Effect</th>
<th>Activity</th>
<th>Residual Environmental Effects Characterization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### CHANGE IN ABUNDANCE OF VEGETATION SPECIES OF INTEREST

<table>
<thead>
<tr>
<th>Activity</th>
<th>Residual Environmental Effects Characterization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in abundance of vegetation species of interest to Aboriginal communities.</td>
<td>Adverse Magnitude: Low Geographic Extent: PDA Duration: Long-term Frequency: Single event Reversibility: Reversible Socio-economic Context: Resilient</td>
</tr>
</tbody>
</table>

Clearing of vegetation during construction may result in the removal of plant species of interest to Aboriginal communities. However, these plant species are not limited to the habitat in the LAA and are common species throughout the RAA. The removal of plant species of interest to Aboriginal communities that are located within the PDA are not anticipated to affect the viability of these species occurring in the RAA. As such, the magnitude of the residual effect on plant species of interest to Aboriginal communities is rated as low due to the prevalence of the species throughout the RAA. The removal of these plants occurs in a single event, during construction, and, with the incorporation of plant species of interest to Aboriginal communities where appropriate and technically feasible during rehabilitation, the residual effect is reversible.

#### CHANGE IN ABUNDANCE OR CONDITION OF UPLAND VEGETATION COMMUNITIES

<table>
<thead>
<tr>
<th>Activity</th>
<th>Residual Environmental Effects Characterization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in abundance or condition of upland vegetation communities</td>
<td>Adverse Magnitude: Low Geographic Extent: PDA Duration: Short-term Frequency: Single event Reversibility: Reversible Socio-economic Context: Resilient</td>
</tr>
</tbody>
</table>

The Project will result in the short-term removal of upland vegetation will affect approximately 0.8 ha of naturally occurring vegetation. The short-term removal of upland vegetation will occur during the construction of the creek realignment within the existing southwest arm tributary channel to accommodate the Goldfield Creek diversion. Upland vegetation communities along the banks of the existing channel are anticipated to experience change in water flow to accommodate additional water, but are anticipated to return to a pre-existing vegetated naturalized habitat except in the channel of the creek realignment. This short-term removal of vegetation is within the normal variability.
Table 12-7: Summary of Residual Adverse Environmental Effects on Upland Vegetation and Wetlands

<table>
<thead>
<tr>
<th>Residual Effect</th>
<th>Activity</th>
<th>Residual Environmental Effects Characterization</th>
<th>Direction</th>
<th>Magnitude</th>
<th>Geographic Extent</th>
<th>Duration</th>
<th>Frequency</th>
<th>Reversibility</th>
<th>Ecological and Socio-economic Context</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Construction</td>
<td>Operation</td>
<td>Closure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removal of approximately 147.7 ha of upland vegetation communities unlikely to return to a vegetated naturalized habitat.</td>
<td>✔</td>
<td>Adverse</td>
<td>Moderate</td>
<td>LAA</td>
<td>Long-term</td>
<td>Single event</td>
<td>Irreversible</td>
<td>Not Resilient</td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
<td>During the construction phase approximately 147.7 ha of upland vegetation communities within the PDA will be removed. Approximately 90.3 ha of the 147.7 ha is considered disturbed. The vegetation to be removed is associated with the open pit, realignment of the Highway 11 corridor and in the channel of the creek realignment. This adverse effect is restricted to the PDA, and will result in the long-term removal of upland vegetation communities that are unlikely to return to a vegetated naturalized habitat. This long-term removal of vegetation is not anticipated to result in the loss of long-term viability of that vegetation community type in the RAA.</td>
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<td></td>
</tr>
<tr>
<td>Removal of approximately 1,081.1 ha of upland vegetation communities likely to return to a vegetated naturalized habitat.</td>
<td>✔</td>
<td>Adverse</td>
<td>Moderate</td>
<td>LAA</td>
<td>Long-term</td>
<td>Single event</td>
<td>Reversible</td>
<td>Resilient</td>
<td></td>
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<tr>
<td></td>
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<tr>
<td>During construction approximately 1081.1 ha of upland vegetation communities will be removed from the PDA. This removal will typically extend from construction to beyond closure. However, progressive rehabilitation activities initiated immediately following the end of construction will reduce the length of time that vegetation is absent. This removal of vegetation is not anticipated to result in the loss of long-term viability of that vegetation community type in the RAA. It is predicted that following active rehabilitation that the majority of these areas are likely to return to a vegetated naturalized habitat post closure.</td>
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<td></td>
</tr>
</tbody>
</table>
### Table 12-7: Summary of Residual Adverse Environmental Effects on Upland Vegetation and Wetlands

<table>
<thead>
<tr>
<th>Residual Effect</th>
<th>Activity</th>
<th>Residual Environmental Effects Characterization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Direction</strong></td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>Operation</td>
</tr>
<tr>
<td>Fragmentation of 11 upland vegetation ecosite types.</td>
<td>✓</td>
<td>Adverse</td>
</tr>
</tbody>
</table>

The Project will affect 11 naturally-occurring ecosite types through fragmentation during the construction phase. Upland vegetation communities adjacent to Project components may be sensitive to “edge effects” (e.g., encouraging invasion by weedy generalist plants, exposing plants that are sensitive to light, wind or dust, changing micro-drainage patterns.) as a result of fragmentation.

### CHANGE IN WETLAND FUNCTION AND CONNECTIVITY

<table>
<thead>
<tr>
<th>Activity</th>
<th>Residual Environmental Effects Characterization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Direction</strong></td>
</tr>
<tr>
<td>Short-term removal of 14.5 ha of wetland area.</td>
<td>✓</td>
</tr>
</tbody>
</table>

Short-term removal of wetland will affect approximately 14.5 ha of wetland, will occur during construction for the creek realignment within the existing southwest arm tributary channel to accommodate the Goldfield Creek diversion. Wetland communities along the banks of the existing channel are anticipated to experience change in water flow to accommodate additional water, but is anticipated to return to its existing vegetated naturalized habitat after the single occurrence of water diversion.
### Table 12-7: Summary of Residual Adverse Environmental Effects on Upland Vegetation and Wetlands

<table>
<thead>
<tr>
<th>Residual Effect</th>
<th>Activity</th>
<th>Residual Environmental Effects Characterization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of 54.3 ha of wetland area not likely to return to a naturalized habitat.</td>
<td>✓</td>
<td>Adverse, Moderate, PDA, Long-term, Single event, Irreversible, Not Resilient</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Approximately 54.3 ha of wetland removed during construction is unlikely to return to a vegetated naturalized habitat. These areas are associated with permanent linear facilities (Highway 11 corridor) or habitat conversion (creek realignment) and Project components, including the open pit.</td>
</tr>
<tr>
<td>Loss of 640.0 ha of wetland area likely to return to a naturalized habitat.</td>
<td>✓</td>
<td>Adverse, Moderate, LAA, Medium-term, Single event, Reversible, Resilient</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The Project will result in an alteration (e.g., loss of existing wetland function) of 640.0 ha of wetlands from eight ecosite types through the removal of peat during construction. The removal of peat will result in the conversion of peatlands (e.g., conifer swamps and fens) to marshes, alder thickets or upland communities. The extent of this loss in wetland function as a result of this conversion will be limited to the PDA and adjacent areas which may be indirectly affected by Project activities (e.g., the LAA).</td>
</tr>
<tr>
<td>Loss of wetland function in 142.0 ha of wetlands as a result of groundwater drawdown in excess of 0.5 m.</td>
<td>✓</td>
<td>Adverse, High, LAA, Long-term, Continuous, Reversible, Resilient</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dewatering of the open pit will also result in a loss of wetland function in 142.0 ha of wetlands as a result of groundwater drawdown in excess of 0.5 m. Moderate and high magnitude effects are expected to occur in 142.0 ha of wetland communities where groundwater drawdown is equal to or greater than 0.5 m, at which point adverse effects on wetland vegetation, soils and function may occur.</td>
</tr>
</tbody>
</table>

NOTES: See Table 12-2 for detailed definitions.
12.5 DETERMINATION OF SIGNIFICANCE

Upland Vegetation

Residual environmental effects on upland vegetation will result from vegetation removal in upland habitats throughout the PDA. A conservative approach assumes vegetation clearing will be required throughout the full extent of the PDA. This adverse effect is restricted to the PDA, and will result in the long-term removal of upland vegetation communities through Project construction and operation. Vegetation removal in the PDA will occur primarily as a single event as clearing activities during construction. The effect is generally moderate in magnitude because upland vegetation communities will be re-established during operation and closure, and removal of upland vegetation communities to accommodate the Project is considered reversible.

Based on the significance thresholds identified in Section 12.1.6, the residual environmental effects of the Project on upland vegetation are predicted to be not significant, because:

- the Project will not result in permanent, irreversible loss of a species listed on Schedule 1 of SARA or listed as threatened or endangered under ESA; and,
- the Project will not alter or remove an upland vegetation community type resulting in the loss of long-term viability of that vegetation community type in the RAA.

Wetlands

Residual environmental effects on wetlands will result from removal of wetland habitats throughout the PDA. A conservative approach assumes wetland clearing will be required throughout the full extent of the PDA. This adverse effect is restricted to the PDA, and will result in the long-term removal of wetland communities through the construction and operation of the Project. Removal of the wetland communities in the PDA has the potential to affect downstream wetland communities in the LAA if they are hydrologically connected. Wetland removal in the PDA will occur as a single event as clearing activities during construction. The effect is generally moderate in magnitude, as it is assumed most wetland removal can be mitigated through ongoing rehabilitation and closure activities. Wetlands that cannot be reclaimed to their original state (e.g., peatlands, including conifer swamps and fens) may return as marsh, alder thickets or upland communities, resulting in a minor net loss of wetland cover in the LAA.

Based on the significance thresholds identified in Section 12.1.6, the residual environmental effects of the Project on wetlands are predicted to be not significant, because:

- the Project will not result in permanent, irreversible loss of a species listed on Schedule 1 of SARA or listed as threatened or endangered under ESA; and,
- the Project will not alter a wetland community type such that the long-term viability of that community type is compromised in the RAA.
12.6 PREDICTION CONFIDENCE

Specific vegetation community types, including wetlands, occur within the LAA. Area calculations for all ecosites in the PDA and LAA are provided in Table 12-3. Further descriptions of these ecosites are provided in the Appendix E8. These vegetation communities were based on FRI data and confirmed through ground-truthing and botanical field investigations. In total, 183 vegetation plots were surveyed in ecosite communities throughout the LAA, which provided a 93–94% level of confidence that sufficient ground-truthing was undertaken to accurately characterize vegetation communities throughout the LAA.

The level of confidence in the assessment of residual environmental effects on upland vegetation and wetlands is high. The predicted effects are common to mining operations and are well-understood. The application of standard mitigation measures (as described in Sections 12.4.2.2., 12.4.3.2 and 12.4.4.2) are expected to mitigate environmental effects on upland vegetation and wetlands. Standard mitigation measures will work in concert with Project-specific vegetation management and monitoring measures prescribed in the Vegetation Management Plan (Section 12.4.2.2). Potential effects on wetlands (as a result of groundwater drawdown or changes in hydrology) were determined using standard hydrogeological and hydrological modelling, which is a reliable means of quantifying potential effects.

12.7 REFERENCES

12.7.1 Literature and Internet Sites


Assessment of Potential Environmental Effects on Upland Vegetation and Wetlands
January 2016


Natural Heritage Information Centre (NHIC) database. 2014. Natural Areas and Species records search.


Ontario Ministry of Natural Resources (MNR). 2012. Draft Significant Wildlife Habitat EcoRegion 3E Criterion schedule (online).


12.7.2 Personal Communications

Barker, Dave. MNRF. [personal comm. Dave Barker (MNRF) and Al Harris (NBS), July 15, 2014]. Presence of Butternut – Hardrock Project.