NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

Phase 2 Preliminary Environmental Studies

TOWNSHIP OF MANITOUWADGE AND AREA, ONTARIO

APM-REP-07000-0203

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PHASE 2: PRELIMINARY ENVIRONMENTAL STUDIES

TOWNSHIP OF MANITOUWADGE AND AREA, ONTARIO
SUMMARY REPORT

Submitted to:

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EXECUTIVE SUMMARY

The Nuclear Waste Management Organization (NWMO) is implementing Adaptive Phased Management (APM) to plan for the long-term care of used nuclear fuel. The APM plan includes a site selection process for identifying an informed and willing host for a deep geological repository. The Township of Manitouwadge, located in north-central Ontario, expressed interest in participating in the site selection process.

The Phase 1 preliminary assessment provided high level descriptions of the biological and physical environment within the community and surrounding area which, along with geoscientific information, was used to evaluate the potential for a facility to be safely constructed and operated in the vicinity.

Phase 2 preliminary environmental desktop assessments advanced information and updated the environmental data compiled for the potentially suitable areas based on new information and enhanced desktop studies. The intent of the desktop assessments was to identify and map known or potential ecological features, including ecological land classification (ELC) ecosites, candidate significant wildlife habitat, stream reach classification, and species at risk. This environmental information is useful in evaluating the overall potential to safely construct and operate the APM project in the area. The information is used as an input to the integrated assessment of the suitability of the areas of study for the project and to identify possible environmental risks associated with siting activities to avoid, mitigate, and/or monitor potential effects.

Field verification studies were undertaken as part of Phase 2 in order to determine the accuracy of data collected through the described desktop assessment. Results suggest an overall rate of 69% accuracy of ELC data collected through desktop assessments, and the majority of revisions to the desktop assessment data based on the field verification data are attributable to minor differences in forest canopy or soil type. Stream reach classification was verified through field studies focusing on waterbody permanence (permanent or temporary) and stream morphology (shape, size, stream flow, etc.).

This report serves as documentation of environmental investigations undertaken to date in the Manitouwadge area, and includes a summary of Phase 1 and Phase 2 studies.

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1.0 INTRODUCTION

The Nuclear Waste Management Organization (NWMO) is implementing Adaptive Phased Management (APM) for the long-term care of used nuclear fuel. This includes a site selection process for identifying an informed and willing host for a deep geological repository. The Township of Manitouwadge, located in north-central Ontario, expressed interest in participating in the process.

The site selection process consists of a number of steps, with each step requiring increasingly detailed evaluations of the potential suitability of the area to host the APM Project. The Phase 1 preliminary assessment report (Golder 2014; NWMO 2014) provided high level descriptions of the biological and physical environment within the community and surrounding area which, along with geoscientific information, was used to evaluate the potential for a facility to be safely constructed and operated in the vicinity.

Several geographically large areas (areas temporarily withdrawn from mineral staking) within the vicinity of the Township of Manitouwadge (Figure 1[1]) were identified as potentially suitable for the long-term management of used nuclear fuel. Two of these identified areas were the subject of investigations undertaken by Amec Foster Wheeler Environment and Infrastructure Ltd. (Amec Foster Wheeler) as part of Phase 2 preliminary environmental studies as aerial geophysical data is available for those areas. The purpose of these studies was to update the description of the environmental features and conditions within these areas, where necessary (Amec Foster Wheeler 2017).

Data pertaining to known or potential ecological features was assessed, including ecological land classification (ELC) ecosites (a scientific method to organize, classify and evaluate ecosystems for the purposes of land resource management), candidate significant wildlife habitat, stream reach classification (a method of identifying stream hierarchy to infer stream size), and potential habitat availability and use by species at risk. This environmental information is useful in evaluating the overall potential to safely construct and operate the APM project in the area. The information is used as an input to the integrated assessment of the suitability of the areas of study for the project and to identify possible environmental risks associated with siting activities (e.g., borehole drilling) to avoid, mitigate, and/or monitor potential effects.

This report serves as documentation of environmental investigations undertaken to date in the Manitouwadge area and includes a summary of Phase 1 and Phase 2 studies.

2.0 PHASE 1: DESKTOP ASSESSMENT

The Phase 1 Environment Report (Golder 2014) provides a high level description of the environment in the Township of Manitouwadge and surrounding area (shown on Figure 1 of the Phase 1 Environment Report; Golder 2014), using readily available information compiled from existing data sources. The Township of Manitouwadge is situated in the Abitibi Uplands

[1] All figures are presented in Attachment A.

physiographic region of northwestern Ontario, featuring abundant bedrock outcrop with shallow drift cover and a rugged topography. Geologically, the Manitouwadge area straddles the boundary between the Quetico subprovince to the north and the Wawa Subprovince to the south, which are part of the western region of the Superior Province of the Canadian Shield. The Quetico area is underlain primarily by metasedimentary and migmatitic rocks and the Wawa Subprovince is underlain predominantly by gneissic tonalite of the Black-Pic batholith. Both subprovinces also include subordinate granitoid intrusions and slivers of greenstone belt rocks.

Infrastructure in the area includes Highway 614, a Canadian National (CN) rail corridor, one 115 kilovolt (kV) electrical transmission line, and one 44 kV transmission line. There are no gas pipelines. There are no provincial parks but two conservation reserves partially occur within the area (Isko Dewabo Lake Complex Conservation Reserve and North Thornhen Lake Moraine Conservation Reserve). Additionally, there are two known archaeological sites (Golder 2014).

The Manitouwadge area lies in the Boreal Forest Region. Overlapping Forest Management Units (FMU) include: Big Pic Forest (FMU 067), Pic River Forest (FMU 965), White River Forest (FMU 060), and Nagagami Forest (FMU 390). Trapping of fur bearing species occurs in the area. Woodland caribou, moose, marten and pileated woodpecker along with other sensitive wildlife populations are managed by the Ministry of Natural Resources and Forestry (MNRF). Fish that are commonly harvested include Walleye, Northern Pike, Lake Trout, Brook Trout, Smallmouth Bass and Yellow Perch (Golder 2014).

The Manitouwadge area lies mainly within the Pic River tertiary watershed of the Lake Superior drainage basin. Along the eastern edge of the Manitouwadge area are the Upper Kenogami and the Nagagami tertiary watersheds of the Hudson Bay drainage basin. Water wells in the area obtain water from the overburden or the shallow bedrock. Air, soil and surface water quality within the Manitouwadge area are expected to be within the normal range for north-central Ontario (Golder 2014).

3.0 PHASE 2: PRELIMINARY ENVIRONMENTAL STUDIES

Phase 2 preliminary environmental desktop assessments advanced information presented in the Phase 1 reports and updated the environmental data compiled for the potentially suitable areas based on new information and enhanced desktop studies. Studies focused on four geographically large areas that were determined to be potentially suitable following Phase 1 integrated studies and for which aerial geophysics data was collected during Phase 2 geoscientific studies. For this report, these four areas are referred to as the Quetico, the Fourbay, the Black-Pic West and the Black-Pic East blocks, respectively.

3.1 Desktop Assessments

The intent of the desktop assessments was to identify and map known or potential ecological features, including ELC ecosites (a scientific method to organize, classify and evaluate ecosystems for the purposes of land resource management), candidate significant wildlife habitat, potential species at risk habitat suitability and use, and stream reach classification (a method of

identifying stream hierarchy to infer stream size). The methodology of desktop studies includes the interpretation of existing and new information, mapping of polygonal (block), point and linear features of potential ecological relevance, and identification of areas with species/habitat associations (e.g. significant wildlife habitat). Prepared natural features maps use additional information available from provincial and federal agencies and other existing information sources. The natural feature maps illustrate Boreal ELC ecosites, infrequent candidate significant wildlife habitat polygons (those covering less than 10% of the areas of study), waterbodies and stream reach classifications, steep slopes (≥ 15%) based on topographical data, and the road network (Figures 2a through 2d).

3.1.1 Ecological Land Classification

Ecological land classification (ELC) is a scientific method used to organize, classify and evaluate ecosystems (and complexes of ecosystems) for the purposes of land resource management. This method uses ELC codes to represent “ecosites”, which are landscape areas consisting of typical and recurring associations of vegetation, soil, and moisture regimes. These ecosites are used to understand resources availability (vegetation community) as well as potential wildlife habitat suitability and use.

Ecosite polygons (blocks) are primarily derived using existing Forest Resource Inventory (FRI) vegetation species composition and primary ecosite data, with interpretation using high resolution four-band digital aerial ortho-photos (where available). Species composition and ecosite information for the FRI forest stand polygon data available data from the MNRF were last updated between 2007 and 2010, and included vegetation classification information in the form of Boreal ELC codes as described by Banton et al. (2015).

Based on the desktop review, 55 distinct ecosite types were identified (Tables 1 and 2[2]). Upland coniferous forests were the most commonly distributed vegetation community, followed by upland mixedwood forest communities and coniferous swamp communities. These three vegetation community types represent 94.6% of the vegetated land area within the four areas of study. Of the remaining 5.4% vegetated land area, 4.6% is represented by open fen, open marsh, and thicket swamp vegetation communities. Overall, upland and wetland communities represented 76.1% and 24.9% of the vegetated land area, respectively. The estimated area of each vegetation community and associated ELC ecosite(s) is presented in Table 2.

3.1.2 Candidate Significant Wildlife Habitat

The *Significant Wildlife Habitat Ecoregion 3E Criterion Schedule* (MNRF 2015) and *Significant Wildlife Habitat Technical Guide* (MNR 2000) provide criteria for identifying significant wildlife habitat within the area of the Township of Manitouwadge. Although the Quetico and Fourbay blocks partially occur within Ecoregion 3W, an approved criterion schedule for this Ecoregion does not exist, and it is accepted practice that criteria listed for Ecoregion 3E is applied. The *Significant Wildlife Habitat 3E Criterion Schedule* identifies 42 distinct wildlife habitats in Ecoregion 3E, which are separated into four categories: Seasonal Concentration Areas of

[2] All tables are presented in Attachment B.

Animals, Rare Vegetation Communities and Specialized Habitat for Wildlife, Habitat for Species of Conservation Concern, and Animal Movement Corridors. Based on cross-referencing Boreal ELC codes (Banton et al. 2015) within the four areas of study and ELC communities described in the *Significant Wildlife Habitat 3E Criterion Schedule* for each distinct wildlife habitat type, 32 potential or candidate significant wildlife habitat types were identified. It should be noted that *Significant Wildlife Habitat 3E Criterion Schedule* help to identify which significant wildlife habitat types are possible, based on typical habitat associations of ELC ecosites; however, field surveys are required to ascertain that specific micro- or macro-habitat conditions actually exist and/or that select wildlife species are present. Such surveys were not undertaken during this phase of study. Potential significant wildlife habitat occurring within the areas of study, including their estimated area, is provided in Table 3. A summary of Boreal ELC ecosites and their potential significant wildlife habitat associations is provided in Table 4.

Some potential significant wildlife habitat types are commonly distributed throughout the areas of study, such as mast producing areas, woodland raptor nesting habitat, denning sites, and Bald Eagle and Osprey nesting habitat; although, this is a result of their potential to occur across a broad range of Boreal ELC ecosite associations (Table 4). Except for the Yellow Birch Rare Treed significant wildlife habitat type, which occurs in most ecosites with aspen/poplar species, Rare Vegetation Communities Significant Wildlife Habitat Types were scarce to absent throughout much of the areas of study, with the majority of the rare vegetation communities occurring in Black-Pic West.

3.1.3 Species at Risk and Regionally Rare Species

Species at risk information was obtained through MNRF's Natural Heritage Information Centre (NHIC database; used to track species at risk occurrences, rare species and habitats, as well as other natural heritage information), as provided by the NWMO. Species occurrence information was obtained to generate specific data for the Township of Manitouwadge and area. Additional sightings for bird species were obtained through the online Ontario Breeding Bird Atlas (OBBA; Bird Studies Canada 2017). As species occurrence data for northern Ontario is typically scarce, other secondary sources of information, including bird, herptile, mammal and aquatic species atlases for Ontario (Bird Studies Canada 2017; Ontario Nature 2017; Dobbyn 1994, DFO 2017; respectively) and federal and provincial species at risk lists and range maps (Government of Canada 2017; MNRF 2017, respectively) were also reviewed to generate an inclusive list.

According to the review of secondary sources, the following species at risk have the potential to occur within the study areas:

- Eight (8) bird species: Bank Swallow, Barn Swallow, Eastern Whip-poor-will, Bald Eagle, Canada Warbler, Common Nighthawk, Olive-sided Flycatcher, and Rusty Blackbird;
- Three (3) mammal species: Woodland Caribou, Little Brown Myotis, and Northern Myotis;
- One (1) herptile species: Snapping Turtle;
- One (1) butterfly species: Monarch; and

- One (1) aquatic species: Lake Sturgeon (Great Lakes – Upper St. Lawrence population).

No species at risk plants were identified. As this information is based primarily from species range maps, targeted field studies would need to be undertaken to confirm habitat suitability and/or species presence. Such studies were not undertaken during this phase of study.

3.1.4 Fisheries Management

Historically, MNRF district-wide fisheries management plans were developed to manage the commercial and recreational fisheries, and to establish and regulate sustainable harvest levels. One such example is the Wawa District Fisheries Management Plan 1988-2000, published as a draft in 1989. These district fisheries management plans typically used a lake-by-lake management strategy which has largely been replaced by the landscape approach management strategies developed for the more recently mapped MNRF Fisheries Management Zones as part of the Broadscale Scientific Monitoring Program in 2008 (MNRF 2016). The fisheries management zone planning and management process includes advisory councils that consult with angling groups, scientists and researchers, conservation groups and interested community members. Consultation allows the advisory councils to share stakeholder ideas and expertise with the MNRF and to help develop and implement management strategies.

The Manitouwadge areas of study fall within MNRF Fisheries Management Zone 7 which encompasses important recreational and tourism-based fisheries, fisheries for sportfish species including Walleye, Northern Pike, Lake Trout and Brook Trout, stocked Brook Trout lakes, nearby to Pukaskwa Provincial Park and the Chapleau Crown Game Preserve (MNRF 2014). No advisory council has been established for Fisheries Management Zone 7, and recent communication with MNRF indicate no action with regard to development of a Fisheries Management Zone 7 MP or advisory council is planned. As such, the MNRF Land Information Ontario data, fish species occurrence records and habitat information were used for the desktop studies.

3.1.5 Stream Reach Classification

3.1.5.1 Stream Reach Order

Stream order classifies stream hierarchy from its source (headwaters) downstream and was determined through digital elevations models (from Land Information Ontario) and the application of the Strahler stream order classification. Stream order provides a measure of the relative size of streams, which relates to the amount of water moving off the watershed into the stream channel. Water volume as well as velocity influence water quality and, therefore, health of living organisms and habitats associated with the stream (USEPA 2012). The Strahler method for classification assigns each headwater perennial stream an order of 1 (Strahler 1952; Strahler 1954; Strahler 1957). The joining of two 1st-order streams assigns the downstream reach an order of 2. The joining of two 2nd-order streams results in a downstream reach of order 3, and so on (Diagram 1). Generally, a lower stream order represents a smaller stream (i.e. a stream order of 1 is smaller than a stream order of 6). Within the areas being studied, a maximum of a 6th order stream was classified.

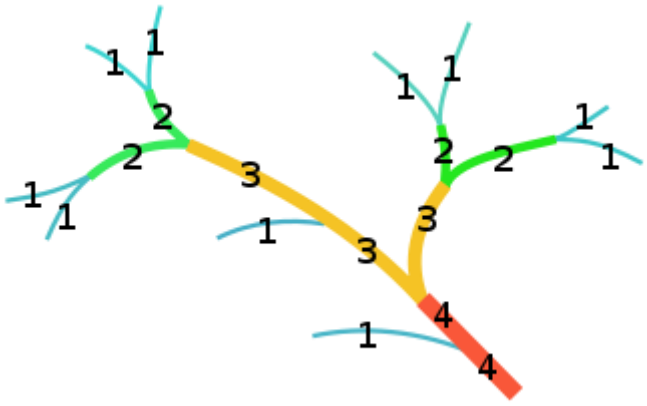

Diagram 1: Stream order based on the Strahler classification method

A general summary of stream orders with attributes commonly associated with the ranges of order classifications used in the desktop analysis is provided in Table 5 (Appendix B).

3.1.5.2 Thermal Regime

Thermal regime directly influences the aquatic environment including potential fish species present (which have specific thermal tolerances) as well as other biological elements. In this way, thermal regime can be used to provide a high-level screening of candidate areas with species of interest such as sportfish (e.g., Brook Trout, Walleye, Northern Pike). Where fish species information was available but thermal regime data was missing, the thermal regime was inferred based on Minns (2010), which describes the thermal preference of Ontario stream fish groups. Where neither fish species nor thermal regime data was available, thermal regime was inferred based on Strahler stream order, as described above. Low order streams (1st to 3rd) are typically headwaters within watersheds characterized by generally cooler, faster flowing conditions. As such, the 1st to 3rd order stream reaches that did not have associated thermal regime data were classified as cold-water environments. Stream reaches identified as 4th to 6th order streams were classified as cool-water environments in the absence of thermal regime data.

3.1.5.3 Stream Morphology

Stream morphology (form) is the shape of a river channel and how it changes in shape and direction over time. Stream morphology is a factor in stream classification systems, with initial classifications using basin characteristics such as slope (Rosgen 1996). Other morphological factors include the shape of the channel, channel patterns, entrenchment (vertical containment of a stream and the degree to which it is cut into the surrounding land), and channel material. Most of this information is typically acquired through the interpretation of high-resolution aerial imagery and field data, with the exception of slope. As such, slope was used in the desktop screening to estimate stream morphology. Digital elevation models were used to approximate the average percent slope for each watercourse segment, and the Rosgen Stream Classification (Rosgen 1996) framework was applied to guide probable stream morphology as follows: a slope of ≤1% was classified as ‘pool’, >1-5% as ‘glide/run’, 5-12% as ‘riffle’, and >12% as ‘cascade/waterfall’.

It is understood that additional morphological data may change initial classifications; however, the use of slope provides a useful screening tool that can then be verified in the field using the Ontario Stream Assessment Protocol (OSAP; Stanfield 2013).

3.2 Field Verification Studies

Field verification studies were undertaken in order to establish the accuracy of data collected through the described desktop assessment. The field verification study areas were determined through a visual assessment of the area using ArcGIS and were chosen for:

- Optimum road accessibility;
- A diverse topography;
- The presence of a rare vegetation community;
- Diverse stream reach categories and fish communities; and/or
- Potential species at risk habit.

3.2.1 Ecological Land Classification

Terrestrial field surveys were undertaken between October 2 and 5, 2016. Verification of ELC information consisted of walking the land in order to check the accuracy and classification of ecosite polygons (blocks). Ecosite communities are based on dominant plant species and soil characteristics (Banton et al. 2015). As such, plant species lists were compiled for each separate ecosite type. Determination of soil characteristics was completed through visual inspection and an estimation of organic soil (comprised mainly of plant material) versus mineral soil (derived of minerals/rocks). As environmental field studies in the area are at a preliminary stage, surveys focused efforts in representative communities (based on pre-mapped ELC polygons), to the extent possible, through predetermined field survey routes. Such survey methodology is a widely used and accepted sampling protocol in ecological studies, especially when one of the main objectives is to maximize the coverage of the area of interest. Predetermined field routes were followed to the extent possible; however, minor deviations and rarely major deviations were necessary due to health and safety considerations related to accessibility and wildlife encounters. Natural features were field verified and mapped concurrently with vegetation community surveys.

A total of 142 plant species were recorded, ranging between 91 to 123 species recorded within each area of study (Table 6). Common species occurring in upland coniferous forests include Black Spruce, Jack Pine, Balsam Fir, and White Spruce, with Bunchberry, Labrador-tea, and blueberry species in the ground layer. Mixedwood forest communities included Trembling Aspen and White Birch, with Mountain Maple, Bush Honeysuckle, Blue-bead Lily, Twinflower, and Goldthread in the ground layer. Coniferous swamp communities consisted of Black Spruce, Tamarack, and White Cedar, with Leatherleaf and sedge species. Other species recorded in thicket swamp, fen and marsh wetland communities include Speckled Alder, Sweet Gale, and Blue-flag Iris. All of these species are provincially ranked as S5 (Secure) or S4 (Apparently Secure); no rare or species at risk plant species were recorded.

A total of 190 polygons (blocks) representing 22 Boreal ELC ecosite types were surveyed in the Manitouwadge area. Plant species lists and field notes were collected for each polygon and used to determine the accuracy of the predetermined ELC information derived from desktop assessments. Where predetermined ELC codes were not deemed accurate, a new ELC code was suggested/assigned. Large polygons, to a certain extent, are commonly composed of a mosaic of community types due to some variances in topography or hydrology. In these cases, a single "best fit" ELC code was assigned to the polygon. More accurate ELC codes were suggested for 58 of the 191 surveyed polygons, which suggests an overall rate of 69% accuracy of ELC data collected through desktop assessments.

An assessment of polygon accuracy based on Boreal ELC ecosite is presented in Table 7. Rationale for a revised ELC code was most often attributed to a change in proportion of the same canopy tree species, or due to a difference in soil type, with no difference in canopy description. Most suggested revisions for coniferous swamp community types were due to a higher understory species richness, which resulted in no change to the community type. Wetland communities can sometimes be underestimated on the landscape and, based on the results of the assessment, 8 upland polygons would be more appropriated named as wetlands. Overall, the majority of suggested revisions do not indicate meaningful errors in the desktop assessment data. Only two (2) suggested revisions were attributed to both a difference in canopy composition and a difference in soil/moisture regime (wetland vs. upland), which could not be explained by logging activities.

Ecosite boundaries were determined to be fairly accurate for the majority of those polygons surveyed. Most boundary discrepancies were only up 15 m, which can be explained by ecotones (a transition zone between ecosites) which typically occur between community types. In some cases, discrepancies of up to 100 m were recorded; however, these were rather uncommon and could sometimes be attributed to logging activities.

3.2.2 Candidate Significant Wildlife Habitat

Three (3) of nine (9) potential Rare Vegetation Community Significant Wildlife Habitat Types (Red and White Pine Rare Treed Type, Yellow Birch Rare Treed Type and Sand Dunes) were visited during field surveys (see Table 7 for a list of ELC ecosites visited). These vegetation communities may contain rare species, particularly plants and small invertebrates. However, upon field inspection, none of those communities visited contained the plant species required to confirm its definition as a significant wildlife habitat. As such, the surveyed polygons were not Rare Vegetation Communities. Black Ash, Elm, and Oak Rare Treed Types as well as Rock Barren and Hardwood Swamp potential Rare Vegetation Community Significant Wildlife Habitat Types were not visited.

Confirmation of potential significant wildlife habitat was not possible for those significant wildlife habitat types where criteria is based on the presence/absence of certain indicator wildlife species (MNRF 2015). The scope of field verification studies undertaken at this preliminary assessment stage did not include species-specific surveys.

Incidental wildlife observations were recorded broadly across all areas of study. Evidence of mammals was mainly confirmed by the presence of scat and/or tracks. Mammal species documented include Black Bear, Moose, Red Squirrel, Snowshoe Hare, and Beaver. These species were observed in all study blocks. No species at risk wildlife were recorded.

3.2.3 Stream Reach Classification

Stream reach classification field assessments were guided by the Ontario Stream Assessment Protocol (OSAP; Stanfield 2013), the Ministry of Transportation / Ministry of Natural Resources Fisheries Protocol, and the Ontario Stream Fishes Habitat Assessment Models as published by the Department of Fisheries and Oceans (Minns 2010). The study objective was to verify the presence of fish habitat, as defined by the *Fisheries Act*, as well as other characteristics that were used in the desktop studies to define individual stream reaches and their corresponding habitat type. At the stream reaches selected for field verification, physical and habitat characteristics were recorded within a randomly selected site of 100 m length or ten times the channel width, as determined by in-field conditions.

Aquatic field studies were undertaken on October 16 and 17, 2016. Predetermined waypoints representing a variety of stream morphology (forms) and waterbody permanence (permanent or temporary) within the areas of study were visited for verification. The aquatic field verification studies included non-invasive observations, producing a snapshot of the existing conditions documented by field notes and photographs (i.e., no aquatic biota sampling was undertaken). The field notes included general habitat observations, stream morphology measurements and measurements of water quality (temperature, dissolved oxygen, pH, and conductivity) with an objective to verify waterbody permanence and stream morphology (shape, size, stream flow, etc.). Confirmation of other aspects such as fish community and thermal regime would require more detailed assessments such as sampling (trapping/fishing effort) and long-term temperature monitoring.

A minimum of one study transect (survey line across the stream) was completed at each waypoint to describe and verify the above-noted characteristics. Additional transects were positioned upstream and/or downstream of the initial waypoint, to further assess natural variability and verify classifications. A total of 16 study locations were visited, and 31 transects were completed to support the field verifications, with the summary of these locations and findings in Table 8. The stream morphology and permanence estimated through desktop assessments did not differ greatly from the actual conditions observed in the field. There were three (3) transects with different stream morphology classifications (measured using hydraulic head; a measure of stream flow). These field verification results show the estimated stream permanence and flow morphology data were largely correct.

4.0 SUMMARY

The intent of the desktop assessments was to identify and map known or potential ecological features, including ecological land classification (ELC) ecosites (a scientific method to organize, classify and evaluate ecosystems for the purposes of land resource management), candidate significant wildlife habitat, stream reach classification (a method of identifying stream hierarchy to infer stream size), and potential habitat availability and use by species at risk. This environmental information is useful in evaluating the overall potential to safely construct and operate the APM project in the area. The information is used as an input to the integrated assessment of the suitability of the areas of study for the project and to identify possible environmental risks associated with siting activities (e.g., borehole drilling) to avoid, mitigate, and/or monitor potential effects.

Field verification studies were undertaken in order to determine the accuracy of data collected through the described desktop assessment. Results suggest an overall rate of 69% accuracy of ELC data collected through desktop assessments, and the majority of revisions to the desktop assessment data based on the field verification data are attributable to minor differences in forest canopy or soil type.. Stream reach classification was verified through field studies focusing on waterbody permanence (permanent or temporary) and stream morphology (shape, size, stream flow, etc.).

5.0 CLOSURE

Should you require further information relative to specific field survey details, please do not hesitate to contact the undersigned.

Yours truly,

Amec Foster Wheeler Environment & Infrastructure
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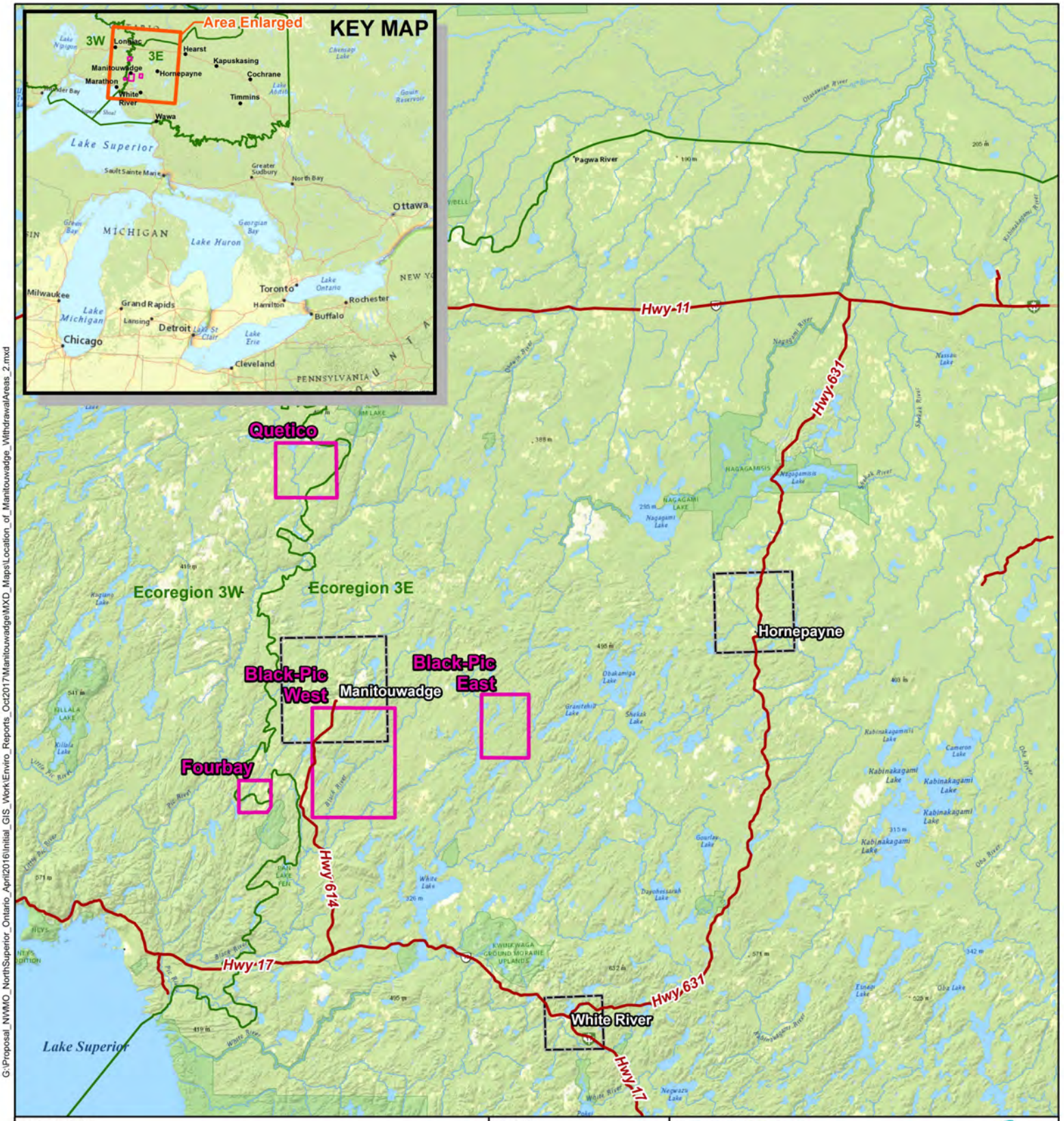
ATTACHMENT A

FIGURES



G:\Proposal_NWMO_NorthSuperior_Ontario_April2016\Initial_GIS_Work\Enviro_Reports_Oct2017\Manitouwadge\MXD_Maps\Location_of_Manitouwadge_WithdrawalAreas_2.mxd

LEGEND

- Manitouwadge areas withdrawn from mineral staking subject to Phase 2 Preliminary Environmental Studies (labelled with name)
- Regional Highways
- Municipal Boundaries
- Ontario Ecoregion Boundary (labelled with ID)

NOTES:
- Highways and municipal boundaries and Ecoregions extracted from Land Information Ontario (MNRF) Queen's printer for Ontario, 2015-2016
- Backgroup topographic map information extracted from ESRI Base Map Services

0 5 10 20 30 40 50 Kilometres

Datum: NAD83
Projection: UTM Zone 16N

N W E S

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ADAPTIVE PHASED MANAGEMENT
PHASE 2 - TOWNSHIP OF MANITOUWADGE AND AREA

Location of Manitouwadge Areas Temporarily Withdrawn from Mineral Staking Studied

PROJECT N°: TB161019 | **FIGURE: 1**

SCALE: 1:950,000 | DATE: November 2017

575000 577500 580000 582500 585000

5492500 5490000 5487500 5485000 5482500 5480000 5477500

Continuous Caribou Range
Discontinuous Caribou Range
Great Blue Heron
Lauri Lake
Big Twin Lake
Little Twin Lake
Lauri Creek
MacDonnell Lake
Great Blue Heron
Bishop Lake

LEGEND

- Avian Nesting Site
- Water Well
- Flow Direction
- Waterbody
- Wetland
- Wooded Area
- Watershed Boundary
- Major Contour (50 metre interval)
- Minor Contour (10 metre interval)
- Moose Aquatic Feeding Area
- Caribou Range Boundary
- Research Plot
- Railway
- Local Road
- Resource / Recreation Road
- Forestry Road (MNRF)
- Aquatic Resource Area Information (Waterbody)
- Aquatic Resource Area Information (Watercourse)
- Esker
- Beaver Dam
- Ecological Land Classification (labelled with ELC code) — B055
- Infrequent Candidate Significant Wildlife Habitat
- Steep Slope Area (>= 15% slope)

Watercourse Reach Classification Morphology and Regime

- Cascade / Waterfall, Cold
- Glide / Run, Cold
- Glide / Run, Cool
- Pool, Cold
- Pool, Cool
- Pool, Warm
- Riffle, Cold
- Riffle, Cool

Watercourse Class

- Intermittent Watercourse
- Permanent Watercourse
- Open Water

NOTES:
- Base data and aquatics resource area information on this map was extracted form Land Information Ontario (MNRF), Queen's Printer for Ontario, 2015 - 2016.
- Quaternary geology features from Ontario Geological Survey, MNDM.
- Water well locations from MOE.

0 0.5 1 2 3 4 5 Kilometres

Datum: NAD83
Projection: UTM Zone 16N

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ADAPTIVE PHASED MANAGEMENT
PHASE 2 - TOWNSHIP OF MANITOUWADGE AND AREA

Manitouwadge Quetico Natural Features Map

PROJECT N°: TB161019 | **FIGURE: 2a**

SCALE: 1:48,000 | DATE: November 2017

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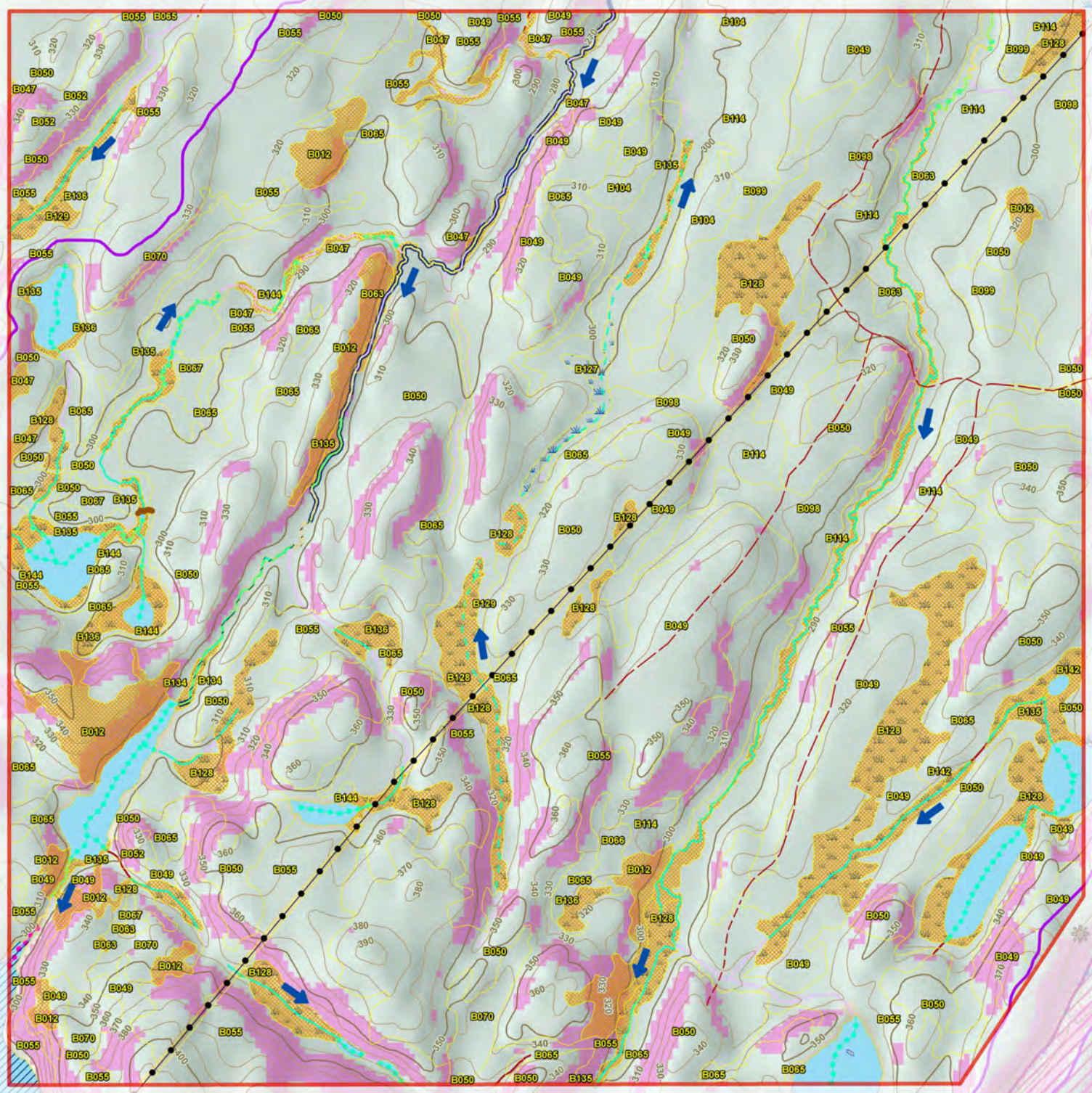
566000 568000 570000 572000

5428000 5426000 5424000 5422000 5420000



LEGEND

- Avian Nesting Site
- Flow Direction
- Conservation Reserve
- Major Contour (50 metre interval)
- Minor Contour (10 metre interval)
- Wooded Area
- Watershed Boundary
- Steep Slope Area (>= 15% slope)
- Forestry Road (MNRF)
- Utility Line
- Beaver Dam
- Waterbody
- Wetland
- Ecological Land Classification (labelled with ELC code)
- Infrequent Candidate Significant Wildlife Habitat
- Aquatic Resource Area Information (Waterbody)
- Aquatic Resource Area Information (Watercourse)

Watercourse Reach Classification Morphology and Regime

- Cascade / Waterfall, Cold
- Glide / Run, Cold
- Glide / Run, Cool
- Pool, Cold
- Pool, Cool
- Pool, Warm
- Riffle, Cold
- Riffle, Cool

Watercourse Class

- Intermittent Watercourse
- Permanent Watercourse
- Open Water

0 0.5 1 2 3 Kilometres

NOTES:
- Base data and aquatics resource area information on this map was extracted form Land Information Ontario (MNRF), Queen's Printer for Ontario, 2015 - 2016.
- Quaternary geology features from Ontario Geological Survey, MNDM.
- Entire area is within the discontinuous Caribou Range.

Datum: NAD83
Projection: UTM Zone 16N

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ADAPTIVE PHASED MANAGEMENT
PHASE 2 - TOWNSHIP OF MANITOUWADGE AND AREA

Manitouwadge Fourbay Natural Features Map

PROJECT N°: TB161019	**FIGURE: 2b**
SCALE: 1:30,000	DATE: November 2017

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580000 585000 590000 595000

5440000 5435000 5430000 5425000 5420000

Great Blue Heron
Chicken Farm Lake
Unknown Raptor
Munro Lake
Common Raven
HIGHWAY 614
Black River
Kaginu Lake
Morley Lake
Russell Lake
Northern Goshawk
Red Tailed Hawk
American Crow
Unidentified Hawk/Owl
Barehead Creek
Billet Lake
Agonzon Lake
Macuteagon Creek
16EV8829
Mickey Lake
Mobert Creek
Unidentified Hawk/Owl
Red Tailed Hawk
Unknown Raptor
Unidentified Hawk/Owl

G:\Proposal_NWMO_NorthSuperior_Ontario_April2016\Initial_GIS_Work\Enviro_Reports_Oct2017\Manitouwadge\MXD_Maps\Manitouwadge_BPW_NaturalFeatures_2.mxd

LEGEND

- NHIC Species at Risk 1 km Square 16EV8829: Woodland Caribou
- Fishing Access Point
- Avian Nesting Site
- Water Well
- Flow Direction
- Dam
- Airport
- Beaver Dam
- Communication Tower
- Active Aggregate Site
- Moose Aquatic Feeding Area
- Research Plot
- Utility Line
- Highway
- Local Road
- Watershed Boundary
- Forestry Road (MNRF)
- Drumlin
- Esker
- Major Contour (50 metre interval)
- Minor Contour (10 metre interval)
- Ecological Land Classification (labelled with ELC code)
- Infrequent Candidate Significant Wildlife Habitat
- Steep Slope Area (>= 15% slope)
- Aquatic Resource Area Information (Waterbody)
- Aquatic Resource Area Information (Watercourse)
- Wooded Area
- Waterbody
- Wetland

Watercourse Reach Classification Morphology and Regime

- Cascade / Waterfall, Cold
- Glide / Run, Cold
- Glide / Run, Cool
- Pool, Cold
- Pool, Cool
- Pool, Warm
- Riffle, Cold
- Riffle, Cool

Watercourse Class

- Intermittent Watercourse
- Permanent Watercourse
- Open Water

0 0.5 1 2 3 4 5 Kilometres

N W E S

NOTES:
- Base data on this map was extracted form Land Information Ontario (MNRF), Queen's Printer for Ontario, 2015 - 2016.
- Quaternary geology features from Ontario Geological Survey, MNDM.
- Water well locations from MOE.
- Entire area is within the discontinuous Caribou Range.

NHIC Species at Risk sensitive data: Source: Data provided by Ontario MNRF Copyright: Queen's Printer for Ontario [Oct. 13, 2004]
This derivative product of the sensitive data does not constitute endorsement by MNRF

Datum: NAD83
Projection: UTM Zone 16N

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ADAPTIVE PHASED MANAGEMENT
PHASE 2 - TOWNSHIP OF MANITOUWADGE AND AREA

Manitouwadge Black-Pic West Natural Features Map

PROJECT N°: TB161019	**FIGURE: 2c**
SCALE: 1:62,000	DATE: November 2017

612500 615000 617500 620000

5442500 5440000 5437500 5435000 5432500

Macutagon Lake
Unidentified Hawk/Owl
Unidentified Hawk/Owl
Unknown Raptor
Osprey
Osprey
Longnega Lake
Upper Foch Lake
Garnham Lake
Jembi Lake
Gum River

G:\Proposal_NWMO_NorthSuperior_Ontario_April2016\Initial_GIS_Work\Enviro_Reports_Oct2017\Manitouwadge\MXD_Maps\Manitouwadge_BPE_NaturalFeatures_2.mxd

LEGEND

- Fishing Access Point
- Avian Nesting Site
- Flow Direction
- Waterbody
- Wetland
- Wooded Area
- Watershed Boundary
- Moose Aquatic Feeding Area
- Research Plot
- Steep Slope Area (>= 15% slope)
- Forestry Road (MNRF)
- Major Contour (50 metre interval)
- Minor Contour (10 metre interval)
- Esker
- B055 Ecological Land Classification (labelled with ELC code)
- Beaver Dam
- Infrequent Candidate Significant Wildlife Habitat
- Aquatic Resource Area Information (Waterbody)
- Aquatic Resource Area Information (Watercourse)

Watercourse Reach Classification Morphology and Regime

- Cascade / Waterfall, Cold
- Glide / Run, Cold
- Glide / Run, Cool
- Pool, Cold
- Pool, Cool
- Pool, Warm
- Riffle, Cold
- Riffle, Cool

Watercourse Class

- Intermittent Watercourse
- Permanent Watercourse
- Open Water

NOTES:
- Base data and aquatic resource areas on this map were extracted form Land Information Ontario (MNRF), Queen's Printer for Ontario, 2015 - 2016.
- Quaternary geology features from Ontario Geological Survey, MNDM
- Entire area is within the discontinuous Caribou Range.

Datum: NAD83
Projection: UTM Zone 16N

0 0.5 1 2 3 4 5 Kilometres

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ADAPTIVE PHASED MANAGEMENT
PHASE 2 - TOWNSHIP OF MANITOUWADGE AND AREA

Manitouwadge Black-Pic East Natural Features Map

PROJECT N°: TB161019	FIGURE: 2d
SCALE: 1:34,500	DATE: November 2017

ATTACHMENT B

TABLES

Table 1: Summary of Boreal Ecosites Based on Desktop Assessment

Boreal ELC Code[1]	Description[1]	Potential Tree Species[1]	Community Type	Manitouwadge			
				Quetico	Fourbay	Black-Pic West	Black-Pic East
B012	Very Shallow, Dry to Fresh: Pine - Black Spruce Conifer	Black Spruce, Jack Pine, Balsam Fir, Paper Birch, Northern Mountain-ash	Coniferous Forest	✓	✓	✓	✓
B016	Very Shallow, Dry to Fresh: Aspen - Birch Hardwood	Paper Birch, Black Spruce, White Spruce, Trembling Aspen, Balsam Fir	Mixedwood Forest	✓		✓	
B024	Very Shallow, Humid: Black Spruce - Pine Conifer	Black Spruce, Jack Pine, Balsam Fir, Eastern White Cedar, American Larch, Trembling Aspen, Paper Birch	Coniferous Forest	✓			
B034	Dry, Sandy: Jack Pine – Black Spruce Dominated	Jack Pine, Black Spruce, Paper Birch	Coniferous Forest			✓	✓
B035	Dry, Sandy: Pine - Black Spruce Conifer	Jack Pine, Black Spruce, Trembling Aspen, Paper Birch, Balsam Fir, White Spruce	Coniferous Forest			✓	✓
B037	Dry, Sandy: Spruce - Fir Conifer	Balsam Fir, White Spruce, Paper Birch, Trembling Aspen, Black Spruce, Jack Pine, Northern Mountain-ash	Coniferous Forest			✓	
B040	Dry, Sandy: Aspen – Birch Hardwood	Trembling Aspen, Paper Birch, Jack Pine, Black Spruce, Balsam Fir, White Spruce	Mixedwood Forest	✓		✓	✓
B046	Dry to Fresh, Coarse: Sparse Shrub	Balsam Poplar, Trembling Aspen	Shrub			✓	
B047	Dry to Fresh, Coarse: Shrub	Balsam Poplar, Paper Birch	Shrub		✓		
B048	Dry to Fresh, Coarse: Red Pine - White Pine Conifer	Red Pine, White Pine, Paper Birch, Balsam Fir, Trembling Aspen, Black Spruce, Jack Pine, White Spruce	Coniferous Forest	✓		✓	
B049	Dry to Fresh, Coarse: Jack Pine - Black Spruce Dominated	Jack Pine, Black Spruce, Paper Birch	Coniferous Forest	✓	✓	✓	✓
B050	Dry to Fresh, Coarse: Pine - Black Spruce Conifer	Black Spruce, Jack Pine, Trembling Aspen, Paper Birch, Balsam Fir, White Spruce, Eastern White Cedar	Coniferous Forest	✓	✓	✓	✓
B052	Dry to Fresh, Coarse: Spruce - Fir Conifer	Balsam Fir, White Spruce, Paper Birch, Trembling Aspen, Black Spruce, Jack Pine, Northern Mountain-ash	Coniferous Forest	✓	✓	✓	✓
B053	Dry to Fresh, Coarse: Conifer	Black Spruce, Balsam Fir, Eastern White Cedar, White Spruce, Paper Birch, Trembling Aspen, Jack Pine, Northern Mountain-ash, American Larch	Coniferous Forest			✓	
B055	Dry to Fresh, Coarse: Aspen - Birch Hardwood	Trembling Aspen, Paper Birch, Balsam Fir, Black Spruce, White Spruce, Jack Pine, Northern Mountain-ash	Mixedwood Forest	✓	✓	✓	✓
B063	Moist, Coarse: Shrub	Balsam Poplar, White Spruce	Shrub		✓	✓	
B065	Moist, Coarse: Black Spruce - Pine Conifer	Black Spruce, Jack Pine, Trembling Aspen, Balsam Fir, Paper Birch, American Larch	Coniferous Forest	✓	✓	✓	✓
B066	Moist, Coarse: Cedar (Hemlock) Conifer	Eastern White Cedar, Paper Birch, White Spruce, Balsam Fir, Black Spruce, Balsam Poplar, Trembling Aspen, Black Ash, White Pine, Yellow Birch, Northern Mountain-ash	Coniferous Forest	✓	✓	✓	
B067	Moist, Coarse: Spruce - Fir Conifer	Balsam Fir, Black Spruce, White Spruce, Trembling Aspen, Paper Birch, Jack Pine, Balsam Poplar, Northern Mountain-ash	Coniferous Forest		✓	✓	

Boreal ELC Code[1]	Description[1]	Potential Tree Species[1]	Community Type	Manitouwadge			
				Quetico	Fourbay	Black-Pic West	Black-Pic East
B068	Moist, Coarse: Conifer	American Larch, Eastern White Cedar, White Spruce, Black Spruce, Balsam Fir, Paper Birch, Northern Mountain-ash, Trembling Aspen, Balsam Poplar	Coniferous Forest			✓	
B070	Moist, Coarse: Aspen - Birch Hardwood	Trembling Aspen, Paper Birch, Balsam Fir, White Spruce, Black Spruce, Jack Pine, Balsam Poplar	Mixedwood Forest	✓	✓	✓	
B075	Moist, Coarse: Maple Hardwood	Sugar Maple, Red Maple, Balsam Fir, Yellow Birch, White Birch, Balsam Poplar, White Spruce, Northern Mountain-ash	Hardwood Forest			✓	
B098	Fresh, Silty to Fine Loamy: Black Spruce - Jack Pine Dominated	Black Spruce, Jack Pine, Paper Birch	Coniferous Forest	✓	✓	✓	
B099	Fresh, Silty to Fine Loamy: Black Spruce - Pine Conifer	Black Spruce, Jack Pine, Trembling Aspen, Balsam Fir, Paper Birch, White Spruce, Balsam Poplar	Coniferous Forest		✓	✓	
B101	Fresh, Silty to Fine Loamy: Spruce - Fir Conifer	Balsam Fir, White Spruce, Black Spruce, Paper Birch, Trembling Aspen, Jack Pine, Northern Mountain-ash, Eastern White Cedar	Coniferous Forest			✓	
B102	Fresh, Silty to Fine Loamy: Conifer	American Larch, Black Spruce, Balsam Fir, Paper Birch, Trembling Aspen, White Spruce, Eastern White Cedar, Jack Pine, Black Ash, Yellow Birch, Red Maple, Balsam Poplar	Coniferous Forest	✓			
B104	Fresh, Silty to Fine Loamy: Aspen - Birch Hardwood	Trembling Aspen, Paper Birch, Balsam Fir, White Spruce, Black Spruce, Jack Pine, Red Maple	Mixedwood Forest	✓	✓	✓	✓
B108	Fresh, Silty to Fine Loamy: Mixedwood	Paper Birch, Trembling Aspen, Eastern White Cedar, White Pine, White Spruce, Balsam Fir, Black Spruce, Yellow Birch, Red Maple, Jack Pine, American Elm, American Basswood, Red Oak	Mixedwood Forest			✓	
B112	Moist, Fine: Shrub	Balsam Poplar, White Spruce, Trembling Aspen	Shrub			✓	
B114	Moist, Fine: Black Spruce - Pine Conifer	Black Spruce, Jack Pine, Trembling Aspen, Balsam Fir, Paper Birch	Coniferous Forest	✓	✓	✓	
B116	Moist, Fine: Spruce - Fir Conifer	Balsam Fir, White Spruce, Trembling Aspen, Black Spruce, Paper Birch, Balsam Poplar, Northern Mountain-ash	Coniferous Forest			✓	
B117	Moist, Fine: Conifer	Black Spruce, Eastern White Cedar, White Spruce, Balsam Fir, Paper Birch, Balsam Poplar, Jack Pine	Coniferous Forest			✓	
B119	Moist, Fine: Aspen - Birch Hardwood	Trembling Aspen, Balsam Poplar, Balsam Fir, Black Spruce, Paper Birch, White Spruce, Jack Pine, Red Maple	Mixedwood Forest	✓		✓	✓
B125	Moist, Fine: Mixedwood	Paper Birch, Trembling Aspen, Eastern White Cedar, White Pine, White Spruce, Balsam Fir, Black Spruce, Yellow Birch, Red Maple, Jack Pine, American Elm, American Basswood, Red Oak	Mixedwood Forest			✓	
B126	Low Treed Bog	Black Spruce	Bog	✓		✓	
B127	Organic Poor Conifer Swamp	Black Spruce, Jack Pine, American Larch	Coniferous Swamp	✓	✓	✓	✓
B128	Organic Intermediate Conifer Swamp	Black Spruce, American Larch, Balsam Fir	Coniferous Swamp	✓	✓	✓	✓
B129	Organic Rich Conifer Swamp	Black Spruce, American Larch, Eastern White Cedar, Balsam Fir, Paper Birch	Coniferous Swamp	✓	✓	✓	✓

Boreal ELC Code[1]	Description[1]	Potential Tree Species[1]	Community Type	Manitouwadge			
				Quetico	Fourbay	Black-Pic West	Black-Pic East
B130	Intolerant Hardwood Swamp	Trembling Aspen, Balsam Fir, Paper Birch, Black Spruce, White Spruce, Balsam Poplar, Black Ash, Jack Pine	Hardwood Swamp	✓			
B134	Mineral Thicket Swamp	White Spruce, Paper Birch, Black Spruce, American Larch, Balsam Poplar	Thicket Swamp	✓	✓	✓	
B135	Organic Thicket Swamp	Black Spruce, Eastern White Cedar, American Larch	Thicket Swamp	✓	✓	✓	✓
B136	Sparse Treed Fen	Black Spruce, American Larch	Fen	✓	✓	✓	✓
B137	Sparse Treed Bog	Black Spruce, American Larch, Balsam Fir	Bog			✓	✓
B139	Poor Fen	Black Spruce, American Larch	Fen	✓			✓
B140	Open Moderately Rich Fen	Black Spruce, American Larch	Fen	✓		✓	✓
B141	Open Extremely Rich Fen	Black Spruce, Eastern White Cedar, American Larch	Fen	✓			
B142	Mineral Meadow Marsh	Black Spruce, American Larch	Marsh	✓	✓	✓	✓
B144	Organic Meadow Marsh	Eastern White Cedar, Black Spruce, American Larch	Marsh		✓	✓	
B145	Floating Marsh	--	Marsh	✓			
B146	Open Shore Fen	--	Fen	✓		✓	✓
B147	Shrub Shore Fen	American Larch, Black Spruce	Fen	✓			
B162	Open Bedrock Shoreline	Eastern White Cedar, Pin Cherry	Open Bedrock			✓	
B164	Rock Barren	Jack Pine, Paper Birch, Black Spruce, Pin Cherry	Rock Barren	✓		✓	
B165	Open Rock Barren	Jack Pine, Pin Cherry	Rock Barren			✓	
B223	Mineral Intermediate Conifer Swamp	Black Spruce, Jack Pine, Balsam Fir, Paper Birch, Trembling Aspen, American Larch	Coniferous Swamp	✓			

Table 2: Summary of Boreal ELC Ecosites by Community Series

Community Series	Number of Unique Boreal ELC Ecosites	Boreal Ecosite Codes[1]	Estimated Community Series Area (ha)				Total Area (ha)	Total Area (%)
			Quetico	Fourbay	Black-Pic West	Black-Pic East		
Coniferous Forest	21	B012, B024, B034, B035, B037, B048, B049, B050, B052, B053, B065, B066, B067, B068, B098, B099, B101, B102, B114, B116, B117	4,450	2,427	16,573	4,903	28,353	54.0
Mixedwood Forest	8	B016, B040, B055, B070, B104, B108, B119, B125	2,229	566	7,017	1691	11,503	21.9
Hardwood Forest	1	B075	0	0	5	0	5	<0.1
Coniferous Swamp	4	B127, B128, B129, B223	3,485	185	3,882	2,293	9,845	18.7
Hardwood Swamp	1	B130	2	0	0	0	2	<0.1
Thicket Swamp	2	B134, B135	61	18	473	54	606	1.2
Bog	2	B126, B137	19	0	164	4	187	0.4
Fen	6	B136, B139, B140, B141, B146, B147	497	18	421	161	1,097	2.1
Marsh	3	B142, B144, B145	87	22	378	206	693	1.3
Shrub	4	B046, B047, B063, B112	0	44	133	0	177	0.3
Open Bedrock	1	B162	0	0	<0.1	0	<0.1	<0.1
Rock Barren	2	B164, B165	6	0	76	0	82	0.2
Total	**55**	**--**	**10,835**	**3,281**	**29,123**	**9,312**	**52,551**	**100**

[1] Based on Boreal ELC codes as described in Banton et al. 2015.

Table 3: Summary of Candidate Significant Wildlife Habitats

Group[1]	Potential Significant Wildlife Habitat[1]	Mapping Code[2]	Estimated Area of Candidate Significant Wildlife Habitat (ha)[3]			
			Quetico	Fourbay	Black-Pic West	Black-Pic East
Sasonal Concentration Areas for Wildlife Species	Moose Late Winter Cover	-	4,246	2,345	14,401	4,391
	Waterfowl Stopover and Staging Areas (Aquatic)	2	109[β]	22[β]	384[β]	211[β]
	Shorebird Migratory Stopover Area	3	0	0	0.01[β]	0
	Bat Hibernacula	4	6[β]	0	76[β]	0
	Bat Maternity Colonies	5	436[β]	447	1,780[β]	1,592
	Turtle-Wintering Areas	6	3,639	219[β]	4,885	2592
	Reptile Hibernacula	7	3,732	295[β]	6,408	2,671
	Colonially Nesting Bird Breeding Habitat (Tree/Shrub)	-	3,709	644	6,670	3,289
	Colonially Nesting Bird Breeding Habitat (Ground)	9	91[β]	22[β]	456[β]	206[β]
Rare Vegetation Community	Rare Treed Type: Red and White Pine	a	4[β]	0	53[β]	0
	Rare Treed Type: Black Ash	b	0	0	20[β]	0
	Rare Treed Type: Elm	c	0	0	40[β]	0
	Rare Treed Type: Oak	d	0	0	40[β]	0
	Rare Treed Type: Red and Sugar Maple	e	0	0	46[β]	0
	Rare Treed Type: Yellow Birch	-	2,283	697	8,575	1,691
	Rock Barren	g	6[β]	0	76[β]	0
	Sand Dunes	h	85[β]	5[β]	375[β]	206[β]
	Hardwood Swamps	i	2[β]	0	0	0
Specialized Habitats of Wildlife	Waterfowl Nesting Area	-	2,918	636	8,910	3,180
	Bald Eagle and Osprey Nesting Habitat	-	9,684	2,064	23,891	7,478
	Woodland Raptor Nesting Habitat	-	10,166	3,178	27,478	8,887
	Seep or Springs	-	2,681	943	7802	2,225
	Aquatic Feeding Habitat	-	3,614	655	6961	3,461
	Mineral Licks	-	2,681	943	7802	2,225
	Denning Sites	-	10,166	3,178	27,478	8,887
	Rendezvous Sites	q	522[β]	63[β]	794[β]	165[β]
	Amphibian Breeding Habitat (Wetlands)	r	3,185	217[β]	4,465	2,432
	Amphibian Breeding Habitat (Woodlands)	s	33[β]	0	286[β]	5[β]
	Mast Producing Areas	-	10,166	3,222	27,611	8,887
	Sharp-tailed Grouse Leks	u	494[β]	18[β]	581[β]	160[β]
Habitat for Species of Conservation Concern	Marsh Bird Breeding Habitat	v	645[β]	59[β]	1280[β]	425[β]
	Shrub/Early Successional Bird Breeding Habitat	w	0	0	119[β]	0
Count of Potential Significant Wildlife Habitat Types			**26**	**21**	**31**	**22**

[1] Based on the Significant Wildlife Habitat (SWH) Ecoregion 3E Criterion Schedule (MNRF, 2015)
[2] Only "infrequent" SWH types were mapped; those which cover less than 10% of the area of study. [β] Denotes within which study area the SWH type is considered to be "infrequent".
[3] As many ecosites support multiple candidate significant wildlife habitats, the sum of the hectarage is greater than the total study area.

Table 4: Boreal ELC Ecosite and Candidate Significant Wildlife Habitats Associations

Potential Significant Wildlife Habitat[1]	Boreal ELC Ecosite																																																					
	B012	B016	B024	B034	B035	B037	B040	B046	B047	B048	B049	B050	B052	B053	B055	B063	B065	B066	B067	B068	B070	B075	B098	B099	B101	B102	B104	B108	B112	B114	B116	B117	B119	B125	B126	B127	B128	B129	B130	B134	B135	B136	B137	B139	B140	B141	B142	B144	B145	B146	B147	B162	B164	B165	B223
Seasonal Concentration Areas for Wildlife Species																																																							
Moose Late Winter Cover						✓					✓	✓	✓	✓			✓	✓	✓	✓			✓	✓	✓	✓				✓	✓	✓																							
Waterfowl Stopover and Staging Areas (Aquatic)																																															✓	✓	✓	✓	✓				
Shorebird Migratory Stopover Area																																																				✓			
Bat Hibernacula																																																					✓	✓	
Bat Maternity Colonies[2]		✓	✓				✓								✓						✓	✓					✓	✓					✓	✓																					
Turtle-Wintering Areas																																					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓				
Reptile Hibernacula	✓	✓	✓																																																		✓	✓	
Colonially Nesting Bird Breeding Habitat (Tree/Shrub)[3]								✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓																✓			
Colonially Nesting Bird Breeding Habitat (Ground)								✓																																							✓	✓				✓	✓	✓	
Rare Vegetation Community																																																							
Rare Treed Type: Red and White Pine										✓																																													
Rare Treed Type: Black Ash																												✓																											
Rare Treed Type: Elm																												✓						✓																					
Rare Treed Type: Oak																												✓						✓																					
Rare Treed Type: Red and Sugar Maple																						✓						✓						✓																					
Rare Treed Type: Yellow Birch							✓								✓						✓		✓				✓	✓					✓	✓																					
Rock Barren																																																							
Sand Dunes																																															✓						✓	✓	
Hardwood Swamps																																							✓																
Specialized Habitats of Wildlife																																																							
Waterfowl Nesting Area[4]																																																							
Bald Eagle and Osprey Nesting Habitat[5]																																																							
Woodland Raptor Nesting Habitat	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓																✓
Seep or Springs[6]	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓																✓
Aquatic Feeding Habitat[7]																																																							
Mineral Licks[8]	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓																✓
Denning Sites	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓																✓
Rendezvous Sites[9]																																																							
Amphibian Breeding Habitat (Wetlands)																																					✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓				✓
Amphibian Breeding Habitat (Woodlands)																																	✓	✓																					
Mast Producing Areas	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓																
Sharp-tailed Grouse Leks								✓																											✓							✓	✓	✓	✓	✓									

Potential Significant Wildlife Habitat[1]	Boreal ELC Ecosite																																																					
	B012	B016	B024	B034	B035	B037	B040	B046	B047	B048	B049	B050	B052	B053	B055	B063	B065	B066	B067	B068	B070	B075	B098	B099	B101	B102	B104	B108	B112	B114	B116	B117	B119	B125	B126	B127	B128	B129	B130	B134	B135	B136	B137	B139	B140	B141	B142	B144	B145	B146	B147	B162	B164	B165	B223
Habitat for Species of Conservation Concern																																																						
Marsh Bird Breeding Habitat																																								✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
Shrub/Early Successional Bird Breeding Habitat[10]									✓	✓						✓													✓											✓	✓														

[1] Based on the Significant Wildlife Habitat (SWH) Ecoregion 3E Criterion Schedule (MNRF, 2015)
[2] Trees must be >80 years old
[3] Based on close proximity to water
[4] When adjacent to a waterbody
[5] When adjacent to riparian areas
[6] Must be within headwater areas of a stream
[7] When adjacent to a waterbody
[8] Associated with upwelling, and seeps and springs
[9] Isolated open areas
[10] Polygons must be >30 ha

Table 5: Summary of Stream Orders with Attributes Commonly Associated with the Ranges of Order Classifications

Stream Order Attributes[1]	**Upper Reaches (Headwaters) 1st to 3rd Order**	**Middle Reaches 3rd to 6th Order**	**Lower Reaches 6th Order and above**
Substrate	Coarse (Boulder)	Sand/Gravel	Fines
Current	Fast ← →		Slow
Dissolved Oxygen	Saturated ← →		Periodic Deficits
Sunlight Exposure	Low	High	Low
Water Temperature	Fairly constant	Highly variable	Variable
Particulate Matter	Coarse ← →		Fine
Nutrient Concentrations	Low	High	Low
Dominant Invertebrate Groups	Shredders/Collectors	Grazers (Scrapers)/Collectors	Collectors
Fish Habitat and Food Preferences	Cold-cool, invertebrates	Cool-warm, fish and invertebrates	Cool-warm, fish and invertebrates
Biological Diversity	Low	High	Low

[1] Modified from Ward 1992

Table 6: Summary of Plant Species Recorded During Field Studies

Scientific Name	Common Name	Presence of Plant Species				Provincial S-Rank[1]
		Quetico	Fourbay	Black-Pic West	Black-Pic East	
TREES						
Abies balsamea	Balsam Fir	X	X	X	X	S5
Betula papyrifera	Paper Birch	X	X	X	X	S5
Larix laricina	American Larch	X	X	X	X	S5
Picea glauca	White Spruce	X	X	X	X	S5
Picea mariana	Black Spruce	X	X	X	X	S5
Pinus banksiana	Jack Pine	X	X	X	X	S5
Populus balsamifera	Balsam Poplar		X		X	S5
Populus tremuloides	Trembling Aspen	X	X	X	X	S5
Thuja occidentalis	Eastern White Cedar		X	X	X	S5
SHRUBS and WOODY VINES						
Acer spicatum	Mountain Maple			X		S5
Alnus incana	Speckled Alder	X	X	X	X	S5
Alnus viridis	Green Alder	X	X	X	X	S5
Amelanchier sp.	Serviceberry Species	X	X		X	-
Andromeda polifolia var. polifolia	Northern Bog Rosemary	X		X	X	S5
Arctostaphylos uva-ursi	Common Bearberry				X	S5
Betula pumila	Swamp Birch	X	X	X	X	S5
Chamaedaphne calyculata	Leatherleaf	X		X	X	S5
Cornus canadensis	Bunchberry	X	X	X	X	S5
Cornus stolonifera	Red-osier Dogwood	X	X	X	X	S5
Corylus cornuta	Beaked Hazelnut		X	X	X	S5
Dasiphora fruticosa	Shrubby Cinquefoil	X		X	X	S5
Diervilla lonicera	Northern Bush-honeysuckle	X		X	X	S5
Epigaea repens	Trailing Arbutus	X	X	X	X	S5
Gaultheria hispidula	Creeping Snowberry	X	X	X	X	S5
Juniperus communis	Ground Juniper			X		S5
Kalmia angustifolia	Sheep-laurel		X			S5
Kalmia polifolia	Pale Laurel	X	X		X	S5
Linnaea borealis	Twinflower	X	X	X	X	S5
Lonicera canadensis	American Fly-honeysuckle	X	X			S5
Lonicera involucrata	Bracted Honeysuckle			X	X	S5
Lonicera villosa	Mountain Fly Honeysuckle	X	X	X	X	S5
Myrica gale	Sweet Bayberry	X		X	X	S5
Physocarpus opulifolius	Eastern Ninebark	X				S5
Prunus pensylvanica	Pin Cherry	X	X		X	S5

Scientific Name	Common Name	Presence of Plant Species				Provincial S-Rank[1]
		Quetico	Fourbay	Black-Pic West	Black-Pic East	
Rhamnus alnifolia	Alderleaf Buckthorn	X	X	X	X	S5
Rhododendron groenlandicum	Common Labrador Tea	X	X	X	X	S5
Ribes glandulosum	Skunk Currant	X				S5
Ribes hirtellum	Smooth Gooseberry	X	X			S5
Ribes lacustre	Bristly Black Currant			X		S5
Ribes sp.	Currant Species	X	X	X		-
Ribes triste	Swamp Red Currant	X	X		X	S5
Rosa acicularis	Prickly Rose	X	X	X	X	S5
Rosa sp.	Rose Species				X	-
Rubus idaeus ssp. strigosus	Wild Red Raspberry	X	X	X	X	S5
Rubus pubescens	Catherinettes Berry	X	X	X	X	S5
Salix sp.	Willow Species	X	X	X	X	-
Sambucus racemosa	Red Elderberry	X	X	X		S5
Sorbus decora	Northern Mountain-ash	X	X	X	X	S5
Spiraea alba	Narrow-leaved Meadow-sweet		X			S5
Taxus canadensis	Canadian Yew		X			S4
Vaccinium angustifolium	Late Lowbush Blueberry	X	X	X	X	S5
Vaccinium myrtilloides	Velvetleaf Blueberry	X	X	X	X	S5
Vaccinium oxycoccos	Small Cranberry	X	X	X	X	S5
Viburnum edule	Squashberry	X	X	X	X	S5
HERBACEOUS (Vascular and Non-Vascular)						
Achillea millefolium	Common Yarrow	X	X			SNA
Anaphalis margaritacea	Pearly Everlasting	X	X	X	X	S5
Anemone quinquefolia	Wood Anemone	X	X	X		S5
Aquilegia canadensis	Wild Columbine			X		S5
Aralia nudicaulis	Wild Sarsaparilla	X	X	X	X	S5
Athyrium filix-femina var. angustum	Lady Fern	X		X	X	S5
Botrychium sp.	Grape-fern Species	X	X			-
Calamagrostis canadensis	Canada Blue-joint	X	X	X	X	S5
Caltha palustris	Marsh Marigold	X			X	S5
Carex aquatilis var. aquatilis	Water Sedge	X	X		X	S5
Carex crinita	Fringed Sedge			X		S5
Carex flava	Yellow Sedge			X		S5
Carex sp.	Sedge Species	X	X	X	X	-
Carex trisperma	Three-seed Sedge			X	X	S5
Chamerion angustifolium	Fireweed	X	X			S5
Cirsium sp.	Thistle Species	X	X	X	X	-
Clintonia borealis	Blue Bead-lily	X	X	X	X	S5

Scientific Name	Common Name	Presence of Plant Species				Provincial S-Rank[1]
		Quetico	Fourbay	Black-Pic West	Black-Pic East	
Comarum palustre	Marsh Cinquefoil	X			X	S5
Coptis trifolia	Goldthread	X	X	X	X	S5
Cypripedium acaule	Pink Lady's-slipper		X		X	S5
Dryopteris carthusiana	Spinulose Shield Fern	X	X	X		S5
Dryopteris cristata	Crested Shield Fern	X	X		X	S5
Equisetum fluviatile	Water Horsetail	X				S5
Equisetum palustre	Marsh Horsetail			X		S5
Equisetum sylvaticum	Woodland Horsetail	X	X	X	X	S5
Eurybia macrophylla	Large-leaf Wood-aster	X	X	X	X	S5
Eutrochium maculatum var. maculatum	Spotted Joe-pye Weed		X	X	X	S5
Fragaria virginiana	Virginia Strawberry	X	X	X	X	S5
Galium boreale	Northern Bedstraw	X				S5
Galium sp.	Bedstraw Species	X	X	X		-
Galium triflorum	Sweet-scent Bedstraw		X	X		S5
Gentiana andrewsii	Fringe-top Bottle Gentian		X	X		S4
Geum macrophyllum	Large-leaved Avens		X		X	S5
Glyceria sp.	Manna Grass Species		X			-
Gymnocarpium dryopteris	Oak Fern		X		X	S5
Hieracium sp.	Hawkweed Species	X	X			-
Iris versicolor	Blueflag	X	X			S5
Juncus sp.	Rush Species	X				-
Juncus tenuis	Path Rush	X				S5
Lycopus uniflorus	Northern Bugleweed		X	X		S5
Maianthemum canadense	Wild-lily-of-the-valley	X		X		S5
Maianthemum trifolium	Three-leaf Solomon's-seal	X		X	X	S5
Mentha arvensis	Corn Mint		X			S5
Mertensia paniculata	Tall Bluebells	X	X	X	X	S5
Mitella nuda	Naked Bishop's-cap	X	X	X	X	S5
Monotropa uniflora	Indian-pipe	X			X	S5
Onoclea sensibilis	Sensitive Fern			X		S5
Osmunda claytoniana	Interrupted Fern		X			S5
Packera aurea	Golden Ragwort	X	X	X	X	S5
Petasites frigidus var. palmatus	Palmate Coltsfoot	X	X	X	X	S5
Phegopteris connectilis	Northern Beech Fern		X			S5
Platanthera orbiculata	Large Round-leaved Orchid				X	S4S5
Pteridium aquilinum	Bracken Fern		X	X	X	S5
Pyrola asarifolia	Pink Pyrola			X		S5
Scirpus atrovirens	Dark-green Bulrush				X	S5

Scientific Name	Common Name	Presence of Plant Species				Provincial S-Rank[1]
		Quetico	Fourbay	Black-Pic West	Black-Pic East	
Scirpus cyperinus	Cottongrass Bulrush			X		S5
Scirpus sp.	Bulrush Species		X			-
Solidago canadensis var. canadensis	Canada Goldenrod	X	X	X	X	S5
Solidago sp.	Goldenrod Species	X	X			-
Solidago uliginosa	Bog Goldenrod	X		X	X	S5
Streptopus lanceolatus	Rose Twisted-stalk			X		S5
Symphyotrichum ciliolatum	Lindley's Aster		X	X		S5
Symphyotrichum lanceolatum ssp. lanceolatum	Panicled Aster				X	S5
Symphyotrichum puniceum	Swamp Aster		X		X	S5
Symphyotrichum sp.	Aster Species	X		X		-
Thalictrum pubescens	Tall Meadowrue	X	X			S5
Triadenum fraseri	Marsh St. John's-wort				X	S5
Trientalis borealis	Northern Starflower	X	X	X		S5
Trifolium sp.	Clover Species	X				-
Typha latifolia	Broad-leaf Cattail	X	X			S5
Vicia cracca	Tufted Vetch	X	X			SNA
Viola renifolia	Kidney-leaf White Violet	X	X	X		S5
Viola sp.	Violet Species	X	X	X	X	-
MOSSES and LICHEN (including Clubmosses)						
Cladonia coccifera	A Lichen		X		X	S5
Cladonia mitis	A Lichen		X	X	X	S5
Cladonia rangiferina	A Lichen	X	X			S5
Cladonia stellaris	A Lichen	X	X		X	S5
Dendrolycopodium obscurum	Flat-branched Tree-clubmoss	X	X	X	X	S4
Diphasiastrum complanatum	Northern Ground-cedar				X	S5
Hylocomium splendens	Stair-step Moss	X	X	X	X	S5
Lycopodium clavatum	Running Clubmoss	X	X	X	X	S5
Pleurozium schreberi	A Moss	X	X	X	X	S5
Ptilium crista-castrensis	Knight's Plume	X	X	X	X	S5
Sphagnum angustifolium	Narrowleaf Peat Moss	X	X	X	X	S5
Sphagnum sp.	Sphagnum Moss Species	X	X	X	X	-
Sphagnum squarrosum	Shaggy Peat Moss			X		S5
Spinulum annotinum	Stiff Clubmoss	X	X	X	X	S5
Tally of Number of Plant Species Recorded		**91**	**90**	**83**	**123**	**-**

[1] Provincial S-RANK: S1 = Critically Imperiled, S2 = Imperiled, S3 = Vulnerable, S4 = Apparently Secure, S5 = Secure, S? = Not Yet Ranked: if follow a rank, Rank Uncertain, SNR = Unranked, SNA = Not Applicable.

Table 7: Summary of Boreal ELC Ecosite Accuracy Based on Field Verification Surveys

Boreal ELC Code[1]	Number of Polygons Surveyed	Number of Inaccurate Polygons	Overall Accuracy	Suggested ELC			Rationale						
				ELC Code	Number Revised	Percent of Inaccuracy	Change in Coniferous vs. Mixedwood	Different Proportions of Similar Canopy Species	Different Canopy Species	Difference in Soil Type / Moisture	Change in Upland vs. Wetland	Affected by Recent Logging	Other
B012	6	0	100%	-	-	-	-						
B016	1	0	100%	-	-	-	-						
B048*	3	3	0%	B049	1	33%			✓				
				B099	2	67%			✓				
B049	28	8	71%	B050	5	18%		✓				✓	
				B055*	2	7%	✓	✓				✓	
				B012	1	4%				✓			
B050	19	6	68%	B052	2	10%		✓					
				B055*	1	6%	✓	✓				✓	
				B104*	2	10%	✓	✓					
				B012	1	6%				✓			
B055*	28	1	96%	B052	1	4%	✓	✓					
B063	2	1	50%	B135	1	50%		✓		✓	✓		
B065	22	9	59%	B127	6	27%		✓		✓	✓		
				B055*	1	4.5%	✓		✓			✓	
				B067	1	4.5%		✓					
				B129	1	4.5%		✓		✓	✓		
B070*	3	2	33%	B119*	1	33%		✓		✓			
				B129	1	33%	✓		✓	✓	✓		
B098*	4	1	75%	B104*	1	25%	✓		✓			✓	
B099	4	0	100%	-	-	-	-						
B104*	2	1	50%	B119*	1	50%				✓		✓	
B114	9	1	89%	B049	1	11%				✓			
B119*	1	0	100%	-	-	-	-						
B126	1	1	0%	B127	1	100%		✓					Greater canopy closure
B127	3	3	0%	B128	3	100%							Greater understory species richness
B128	35	19	46%	B117	1	3%			✓	✓	✓		
				B129	17	49%							Greater understory species richness
				B135	1	3%			✓				Forest vs. thicket
B129	2	0	100%	-	-	-	-						
B135	3	0	100%	-	-	-	-						
B136	6	0	100%	-	-	-	-						
B139	1	0	100%	-	-	-	-						

Boreal ELC Code[1]	Number of Polygons Surveyed	Number of Inaccurate Polygons	Overall Accuracy	Suggested ELC			Rationale						
				ELC Code	Number Revised	Percent of Inaccuracy	Change in Coniferous vs. Mixedwood	Different Proportions of Similar Canopy Species	Different Canopy Species	Difference in Soil Type / Moisture	Change in Upland vs. Wetland	Affected by Recent Logging	Other
B142*	7	2	71%	B135	2	29%							Difference in understory – dominated by tall shrub
Total	**190**	**58**	**69%**	**-**	**58**	**31%**	**-**						

[1] Based on Boreal ELC codes as described in Banton et al. 2015.

* Denotes ELC communities which are Potential Rare Vegetation Community SWH

Table 8: Summary of Aquatic Field Verification Study Locations

Candidate Aquatic Study Waypoint ID	Aquatic Study Field Verification Waypoints						Difference Inferred:Actual Morphology[4]	Observations
	Waypoint ID	Observation Date	UTM[1] Northing	UTM[1] Easting	Inferred Morphology	Actual Morphology		
Quetico								
MA-RS1-P1	MA-RS1-P1-T1	16-Oct-16	5485038	574150	Pool	Pool	N	U/S of crossing, Stickleback sp. observed, coarse sand base
MA-RS1-P1	MA-RS1-P1-T2	16-Oct-16	5485041	574162	Pool	Pool	N	D/S of crossing, YOY White Sucker observed, coarse sand base with some woody debris
MA-RS1-P2	MA-RS1-P2-T1	16-Oct-16	5484872	574252	Pool	Pool	N	D/S of culvert, narrow stream through grass riparian meadow
MA-RS1-P2	MA-RS1-P2-T2	16-Oct-16	5484893	574200	Pool	Pool	N	U/S of culvert, boulder substrate with coarse woody debris
MA-RS1-P4a	MA-RS1-P4a-T1	16-Oct-16	5483808	574255	Glide/Run	Glide/Run	N	D/S of culvert, gravel/coarse sand substrate, small bodied fish observed
MA-RS1-P4b	MA-RS1-P4b-T1	16-Oct-16	5483733	574324	Glide/Run	Glide/Run	N	U/S of culvert, narrow stream with coarse woody debris and boulder substrate
MA-RS1-P4b	MA-RS1-P4b-T2	16-Oct-16	5483767	574328	Glide/Run	Glide/Run	N	D/S of culvert, narrow stream with coarse sand base and boulder substrate
Fourbay								
MB-RS1-P1	MB-RS1-P1-T1	17-Oct-16	5423818	571201	Pool	Pool	N	Meandering channel with dense riparian grasses
MB-RS1-P1	MB-RS1-P1-T2	17-Oct-16	5423784	571207	Pool	Pool	N	Meandering channel with dense riparian grasses
MB-RS1-P1	MB-RS1-P1-T3	17-Oct-16	5423765	571180	Pool	Pool	N	Meandering channel with dense riparian grasses
MB-RS1-P2	MB-RS1-P2-T1	17-Oct-16	5423040	570871	Pool	Pool	N	Meandering channel with abundant macrophytes and undercut banks
MB-RS1-P2	MB-RS1-P2-T2	17-Oct-16	5423011	570851	Pool	Pool	N	Meandering channel with abundant macrophytes and undercut banks
MB-RS1-P2	MB-RS1-P2-T3	17-Oct-16	5422991	570855	Pool	Pool	N	Meandering channel with abundant macrophytes and undercut banks
MB-RS1-P3 (NEW)	MB-RS1-P3-T1	17-Oct-16	5421818	570586	Glide/Run	Glide/Run	N	Station outside of study area for additional verification purposes
MB-RS1-P3 (NEW)	MB-RS1-P3-T2	17-Oct-16	5421811	570613	Glide/Run	Glide/Run	N	Station outside of study area for additional verification purposes
MB-RS1-P3 (NEW)	MB-RS1-P3-T3	17-Oct-16	5421805	570622	Glide/Run	Glide/Run	N	Station outside of study area for additional verification purposes
MB-RS1-P4 (NEW)	MB-RS1-P4-T1	17-Oct-16	5422096	571071	Pool	Pool	N	Station outside of study area for additional verification purposes
Black-Pic West								
MC-RS1-P1	MC-RS1-P1-T1	16-Oct-16	5436946	591993	Glide/Run	Glide/Run (Int) [2]	N	No defined channel or obvious flow, slight gradient change, likely glide/run during periods of high flow
MC-RS1-P2	MC-RS1-P2-T1	16-Oct-16	5435489	591648	Pool	Pool	N	Channel through swampy area, floodplain
MC-RS1-P2	MC-RS1-P2-T2	16-Oct-16	5435501	591673	Pool	Pool	N	Channel through swampy area, floodplain
MC-RS1-P2	MC-RS1-P2-T3	16-Oct-16	5435520	591680	Pool	Pool	N	Channel through swampy area, floodplain
MC-RS1-P3	MC-RS1-P3-T1	16-Oct-16	5434885	591344	Pool	Glide/Run	Y	Well defined channel, cobble/bedrock substrate with undercut banks
MC-RS1-P3	MC-RS1-P3-T2	16-Oct-16	5434925	591360	Pool	Glide/Run	Y	Well defined channel, cobble/bedrock substrate with undercut banks
MC-RS1-P4	MC-RS1-P4-T1	16-Oct-16	5434749	591244	Glide/Run	Glide/Run	N	Stream channel with undercut banks, cobble substrate and coarse woody debris
MC-RS1-P4	MC-RS1-P4-T2	16-Oct-16	5434803	591258	Glide/Run	Glide/Run	N	Stream channel with undercut banks, cobble substrate and coarse woody debris
MC-RS1-P4	MC-RS1-P4-T3	16-Oct-16	5434831	591274	Glide/Run	Glide/Run	N	Stream channel with undercut banks, cobble substrate and coarse woody debris
Black-Pic East								
MD-RS1-P1	MD-RS1-P1-T1	17-Oct-16	5442509	615366	Pool	Pool	N	Stream through alder thicket, woody organic substrate
MD-RS1-P2	MD-RS1-P2-T1	17-Oct-16	5442553	615441	Pool	Pool	N	Stream through beaver meadow, woody organic substrate
MD-RS1-P2	MD-RS1-P2-T2	17-Oct-16	5442544	615431	Pool	Pool	N	Stream through beaver meadow, woody organic substrate

Candidate Aquatic Study Waypoint ID	Aquatic Study Field Verification Waypoints						Difference Inferred:Actual Morphology[4]	Observations
	Waypoint ID	Observation Date	UTM[1] Northing	UTM[1] Easting	Inferred Morphology	Actual Morphology		
MD-RS1-P3	MD-RS1-P3-T1	17-Oct-16	5441389	615118	Pool	Pool (Int) [2]	N	D/S of culvert, no apparent flow, some ponded water adjacent to road but no visible stream channel
MD-RS1-P4	MD-RS1-P4-T1	17-Oct-16	5441227	614884	Glide/Run	Pool (Int) [2]	Y	No defined channel, wet area with subsurface seepage

[1] UTM – Universal Transverse Mercator, North American Datum 1983, Zone 16 U

[2] (Int) – Intermittent waterbody

[3] Shaded cells indicate a difference between the inferred and actual morphological stream classification

[4] Difference between inferred and actual morphological classification observed likely due to seasonal conditions, periods of high flow would likely increase hydraulic head thereby changing the morphological classification

ATTACHMENT C:

PHOTO APPENDIX

Photo 1: ELC Community B055 – Dry to Fresh, Coarse: Aspen – Birch Hardwood. October 2, 2016.

Photo 2: ELC Community B099 – Fresh, Silty to Fine Loamy: Black Spruce – Pine Conifer. October 2, 2016.

Photo 3: ELC Community B055 – Dry to Fresh, Coarse: Aspen – Birch Hardwood. October 2, 2016.

Photo 4: ELC Community B098 – Fresh, Silty to Fine Loamy: Black Spruce – Jack Pine Dominated. October 2, 2016.

Photo 5: ELC Community B128 – Organic Intermediate Conifer Swamp. October 3, 2016.

Photo 6: ELC Community B139 – Poor Fen. October 3, 2016.

Photo 7: ELC Community B065 – Moist, Coarse: Black Spruce – Pine Conifer. October 3, 2016.

Photo 8: ELC Community B136 – Sparse Treed Fen. October 3, 2016.

Photo 9: ELC Community B012. Very Shallow, Dry to Fresh: Pine – Black Spruce Conifer. October 4, 2016.

Photo 10: ELC Community B142 – Mineral Meadow Marsh. October 4, 2016.

Photo 11: Aquatic survey station MA-RS1-P1, “Pool”. October 16, 2016.

Photo 12: Aquatic survey station MA-RS1-P2, “Pool”, upstream of culvert. October 16, 2016.

Photo 13: Aquatic survey station MD-RS1-P3, “Pool (Int.)”. October 17, 2016.

Photo 14: Aquatic survey station MD-RS1-P1, “Pool”, upstream. October 17, 2016.