NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

Phase 2 Preliminary Environmental Studies

TOWNSHIP OF HORNEPAYNE AND AREA, ONTARIO

APM-REP-07000-0202

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PHASE 2: PRELIMINARY ENVIRONMENTAL STUDIES

TOWNSHIP OF HORNEPAYNE AND AREA, ONTARIO
SUMMARY REPORT

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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 Hornepayne, 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 60% 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 Hornepayne area, and includes a summary of both 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. The APM plan includes a site selection process for identifying an informed and willing host community for a deep geological repository. The Township of Hornepayne, 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 2013; NWMO 2013) 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 Hornepayne (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 Hornepayne area and includes a summary of both Phase 1 and Phase 2 studies.

2.0 PHASE 1: DESKTOP ASSESSMENT

The Phase 1 Environment Report (Golder 2013) provides a high level description of the environment in the Township of Hornepayne and surrounding area. The Township of Hornepayne is situated in the Abitibi Uplands physiographic region, featuring the broadly rolling surfaces of Canadian Shield bedrock that occupies most of north-central Ontario. Approximately 30% of the area is covered by Quaternary deposits with the other 70% being bedrock that is either directly

[1] All figures are presented in Attachment A.

exposed or covered by a thin layer of ground moraine. Geologically, the Township of Hornepayne 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 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 631, a Canadian National (CN) rail corridor, and an electrical transmission line. There are no pipelines recorded. One provincial park (Nagamisis Provincial Park) and 21 known archaeological sites occur in the area (Golder 2013).

The Hornepayne area lies in the Boreal Forest Region. Forestry is a major industry in the area and includes a number of private timber companies currently managing forestry operations. Overlapping Forest Management Units (FMU) include: Nagagami Forest (FMU 390), and Hearst Forest (FMU 601). The region's forests provide habitat for wildlife including game, furbearing mammals and fish. Woodland caribou, moose and marten populations and concentration and nesting areas for raptors, herons and waterfowl are managed by the Ministry of Natural Resources (MNRF). The Hearst Forest area contains mostly cool water fisheries on the claybelt and cold water fisheries associated with the eskers (Golder 2013).

The Hornepayne area is located within the drainage areas of the Nagagami River tertiary watershed. Lands in the southwest Hornepayne area form part of the White River tertiary watershed of the Lake Superior drainage basin. The eastern portion of the Hornepayne area lies within the Upper Kabinakagami River tertiary watershed of the Hudson Bay drainage basin. Water wells in the Hornepayne area obtain water from the overburden or the shallow bedrock. Air, soil and surface water quality within the Hornepayne area are expected to be within the normal range for north-central Ontario (Golder 2013).

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 two 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 two areas are referred to as the Black-Pic and the Quetico blocks, respectively.

3.1 Desktop Assessments

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, 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, and 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 and 2b).

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). For a portion of the Hornepayne area being studied, 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). Although the majority of the FRI data had not been updated since between 1989 and 1996, these forest cover types are unlikely to have changed other than within areas where forest harvesting or forest fires have occurred. Boreal ELC descriptions were not available as part of older FRI data and were therefore determined based on canopy tree information. Canopy tree information and Boreal ELC associations were available in newer FRI data and were used as a baseline for determining Boreal ELC descriptors for older FRI data, in addition to referencing canopy descriptions available in Banton et al. (2015).

Based on the desktop review, 34 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 95.3% of the vegetated land area within the two areas of study. Of the remaining 4.7% vegetated land area, 3.7% is represented by open fen vegetation communities. Overall, upland and wetland communities represented 69.3% and 30.7% 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 Hornepayne. The *Significant Wildlife Habitat 3E*

[2] All tables are presented in Attachment B.

Criterion Schedule identifies 42 distinct wildlife habitats in Ecoregion 3E, which are separated into four categories: Seasonal Concentration Areas of 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 two areas of study and ELC communities described in the *Significant Wildlife Habitat 3E Criterion Schedule* for each distinct wildlife habitat type, 22 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 withdrawal areas, 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). Yellow Birch Rare Treed significant wildlife habitat type occurs in most ecosites with aspen/poplar species.

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 Hornepayne 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 Hornepayne areas of study fall within MNRF Fisheries Management Zone 7 which encompasses a long stretch of Lake Superior shoreline, important recreational and tourism-based fisheries, fisheries for sportfish species including Walleye, Northern Pike, Lake Trout and Brook Trout, stocked Brook Trout lakes, as well as 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 meeting of two 1st-order streams assigns the downstream reach an order of 2. The meeting 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.

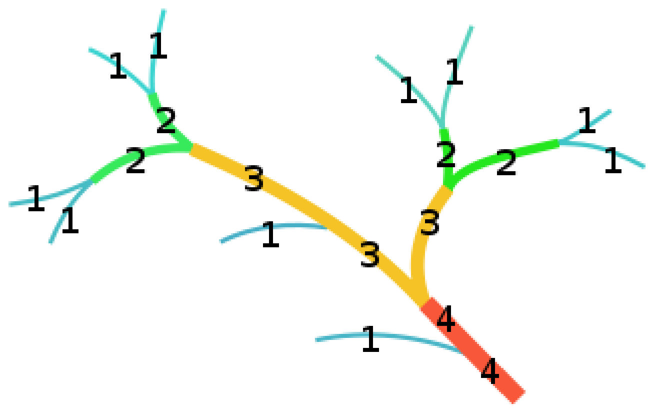

Diagram 1: Stream order based on the Strahler classification method

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 September 29 and October 1, 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 106 plant species were recorded, ranging between 98 to 100 species recorded within each of the areas 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 101 polygons (blocks) representing 15 Boreal ELC ecosite types were surveyed in the Hornepayne 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 40 of the 101 surveyed polygons, which suggests an overall rate of 60% 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. Overall, the majority of suggested revisions do not indicate meaningful errors in the desktop assessment data. Only four (4) 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.

The difference between the overall accuracies of newer and older FRI data by area of study was not notable (Table 7), suggesting that estimated data was not significantly less accurate. 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

Both candidate Rare Vegetation Community Significant Wildlife Habitat Types, 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 considered to be Rare Vegetation Communities.

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 study areas. 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 both 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 14 and 15, 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; however, the Black-Pic withdrawal area was not surveyed due to accessibility issues. 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 11 study locations were visited, and 19 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. Only two transects with different stream morphology classifications (measured using hydraulic head; a measure of stream flow). As such, these field verification results show the estimated stream permanence and flow morphology data were largely correct (89% accurate).

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 can be 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 60% 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,
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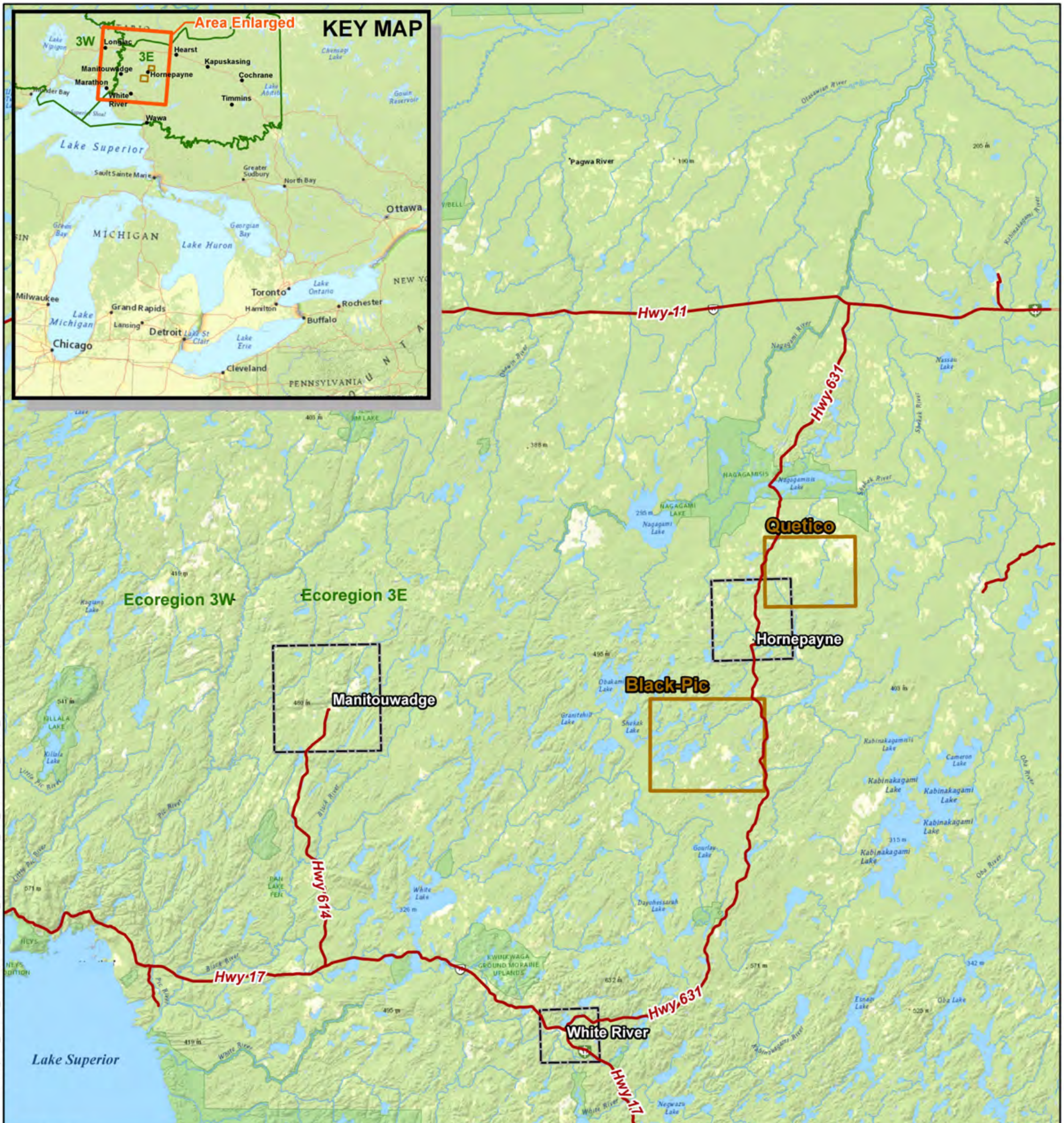
ATTACHMENT A

FIGURES



G:\Proposal_NWMO_NorthSuperior_Ontario_April2016\Initial_GIS_Work\Enviro_Reports_Oct2017\Hornepayne\MXD_Maps\Location_of_Hornepayne_WithdrawalAreas_3.mxd

LEGEND

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

0 5 10 20 30 40 50 Kilometres

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

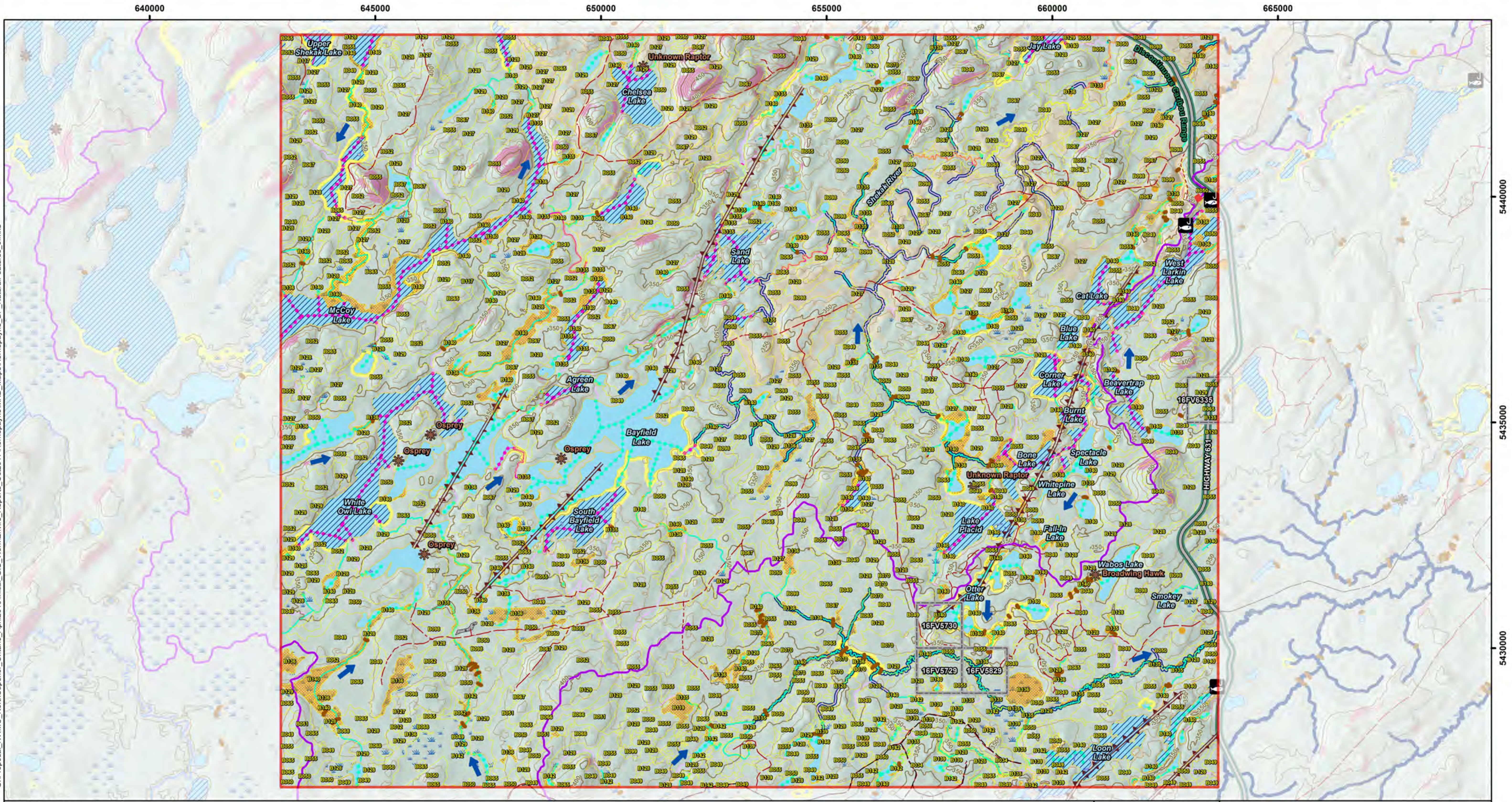
Datum: NAD83
Projection: UTM Zone 16N

NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

ADAPTIVE PHASED MANAGEMENT
PHASE 2 - TOWNSHIP OF HORNEPAYNE AND AREA

Location of Hornepayne Areas Temporarily Withdrawn from Mineral Staking Studied

PROJECT N^{o}: TB161019	FIGURE: 1
SCALE: 1:950,000	DATE: November 2017



G:\Proposal_NWMO_NorthSuperior_Ontario_April2016\Initial_GIS_Work\Enviro_Reports_Oct2017\Hornepayne\MXD_Maps\Hornepayne_BP_NaturalFeatures_3.mxd

LEGEND

- NHIC Species at Risk 1 km Square (refer to table for species information)
- Fishing Access Point
- Avian Nesting Site
- Flow Direction
- Active Aggregate Site
- Waste Management Site
- Moose Aquatic Feeding Area
- Caribou Range Boundary
- Research Plot
- Highway
- Local Road
- Resource / Recreation Road
- Forestry Road (MNRF)
- Major Contour (50 metre interval)
- Minor Contour (10 metre interval)
- Esker
- Beaver Dam
- Waterbody
- Wetland
- Wooded Area
- Watershed Boundary
- Aquatic Resource Area Information (Waterbody)
- Aquatic Resource Area Information (Watercourse)
- Ecological Land Classification (labelled with Boreal ELC code)
- 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

NHIC Species at Risk

NHIC Square ID	Species
16FV5729	Common Nighhawk, Eastern Whip-poor-will
16FV5829	Common Nighhawk, Eastern Whip-poor-will
16FV5730	Common Nighhawk, Eastern Whip-poor-will
16FV6335	Woodland Caribou

0 2.5 5 10 15 20 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.

NHIC Species at Risk sensitive data:
Source: Data provided by Ontario MNRF
Copyright: Queen's Printer for Ontario [May-June 2014 and 1990]
This derivative product of the sensitive data does not constitute endorsement by MNRF

Datum: NAD83
Projection: UTM Zone 16N

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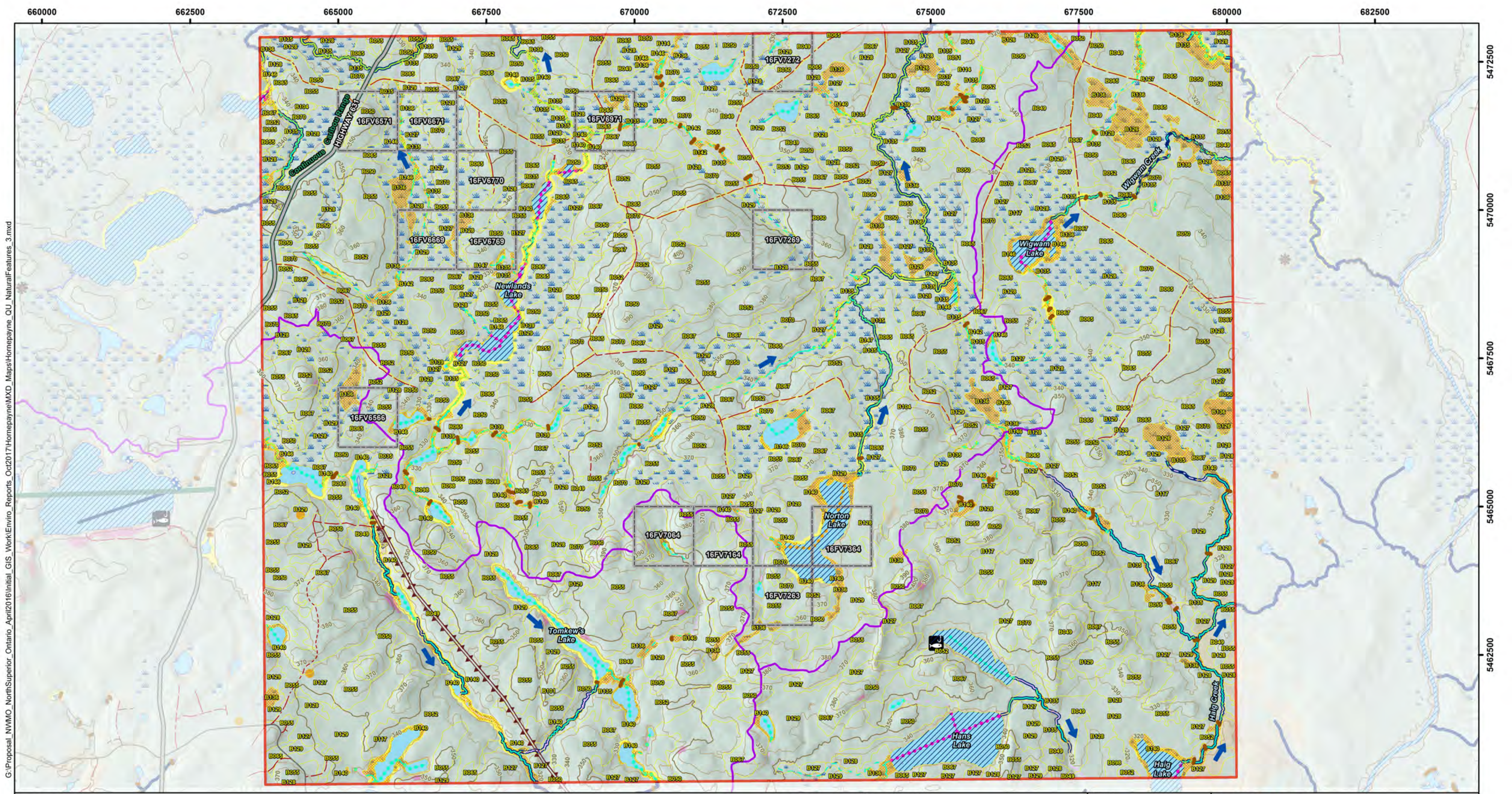
ADAPTIVE PHASED MANAGEMENT PHASE 2 - TOWNSHIP OF HORNEPAYNE AND AREA

Hornepayne Black-Pic Natural Features Map

PROJECT N°: TB161019	**FIGURE: 2a**
SCALE: 1:80,000	DATE: November 2017



LEGEND

- NHIC Species at Risk 1 km Square (refer to table for species information)
- Fishing Access Point
- Avian Nesting Site
- Water Well
- Flow Direction
- Active Aggregate Site
- Moose Aquatic Feeding Area
- Caribou Range Boundary
- Research Plot
- Highway
- Local Road
- Forestry Road (MNRF)
- Major Contour (50 metre interval)
- Minor Contour (10 metre interval)
- Esker
- Beaver Dam
- Waterbody
- Wetland
- Wooded Area
- Watershed Boundary
- Aquatic Resource Area Information (Waterbody)
- Aquatic Resource Area Information (Watercourse)
- Ecological Land Classification (labelled with Boreal ELC code)
- 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

NHIC Species at Risk

NHIC Square ID	Species
16FV6566	Woodland Caribou
16FV6669	Woodland Caribou
16FV6769	Woodland Caribou
16FV6571	Woodland Caribou
16FV6671	Woodland Caribou
16FV6770	Woodland Caribou
16FV6971	Woodland Caribou

NHIC Square ID	Species
16FV7064	Woodland Caribou
16FV7164	Woodland Caribou
16FV7263	Woodland Caribou
16FV7269	Woodland Caribou
16FV7364	Woodland Caribou
16FV7272	Woodland Caribou

0 1 2 4 6 8 10 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.

NHIC Species at Risk sensitive data:
Source: Data provided by Ontario MNRF

Datum: NAD83
Projection: UTM Zone 16N

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ADAPTIVE PHASED MANAGEMENT PHASE 2 - TOWNSHIP OF HORNEPAYNE AND AREA

Hornepayne Quetico Natural Features Map

PROJECT N°: TB161019	FIGURE: 2b
SCALE: 1:60,000	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	Hornepayne	
				Black-Pic	Quetico
B012	Very Shallow, Dry to Fresh: Pine - Black Spruce Conifer	Black Spruce, Jack Pine, Balsam Fir, Paper Birch, Northern Mountain-ash	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		✓
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	✓	✓
B051	Dry to Fresh, Coarse: Cedar (Hemlock) Conifer	Eastern White Cedar, Paper Birch, White Spruce, Balsam Fir, Black Spruce, Trembling Aspen, White Pine, Jack Pine, Red Maple, Red Pine, Balsam Poplar, Large-tooth Aspen, Northern Mountain-ash	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	✓	✓

Boreal ELC Code[1]	Description[1]	Potential Tree Species[1]	Community Type	Hornepayne	
				Black-Pic	Quetico
B065	Moist, Coarse: Black Spruce - Pine Conifer	Black Spruce, Jack Pine, Trembling Aspen, Balsam Fir, Paper Birch, American Larch	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	✓	✓
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	✓	✓
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		✓
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		✓
B114	Moist, Fine: Black Spruce - Pine Conifer	Black Spruce, Jack Pine, Trembling Aspen, Balsam Fir, Paper Birch	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	✓	
B126	Low Treed Bog	Black Spruce	Bog		✓

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Boreal ELC Code[1]	Description[1]	Potential Tree Species[1]	Community Type	Hornepayne	
				Black-Pic	Quetico
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	✓	✓
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	✓	✓
B142	Mineral Meadow Marsh	Black Spruce, American Larch	Marsh	✓	✓
B146	Open Shore Fen	--	Fen	✓	✓
B147	Shrub Shore Fen	American Larch, Black Spruce	Fen		✓
B165	Open Rock Barren	Jack Pine, Pin Cherry	Rock Barren		✓

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

Table 2: Summary of Boreal ELC Ecosites by Community Series and Area of Study

Community Series	Number of Unique Boreal ELC Ecosites	Boreal Ecosite Codes[1]	Estimated Community Series Area (ha)	
			Black-Pic	Quetico
Coniferous Forest	17	B012, B034, B035, B037, B049, B050, B051, B052, B053, B065, B067, B068, B098, B099, B101, B114, B117	13,196	8,154
Mixedwood Forest	5	B040, B055, B070, B104, B119	9,147	4,504
Coniferous Swamp	3	B127, B128, B129	6,969	6,163
Thicket Swamp	1	B135	220	142
Fen	5	B136, B139, B140, B146, B147	1,214	661
Bog	2	B126, B137	0	92
Marsh	1	B142	35	13
Total	**34**	**-**	**30,781**	**19,730**

[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]	
			Black-Pic	Quetico
Seasonal Concentration Areas for Wildlife Species	Moose Late Winter Cover	-	13,040	8,112
	Waterfowl Stopover and Staging Areas (Aquatic)	2	37 [β]	89 [β]
	Bat Maternity Colonies	-	6,540	2,457
	Turtle-Wintering Areas	-	6,915	5,771
	Reptile Hibernacula	-	6,057	5,451
	Colonially Nesting Bird Breeding Habitat (Tree/Shrub)	-	13,543	3,752
	Colonially Nesting Bird Breeding Habitat (Ground)	9	35 [β]	14 [β]
Rare Vegetation Community	Rare Treed Type: Yellow Birch	-	9,716	4,549
	Sand Dunes	h	35 [β]	13 [β]
Specialized Habitats of Wildlife	Waterfowl Nesting Area	-	15,296	6,671
	Bald Eagle and Osprey Nesting Habitat	-	23,074	15,406
	Woodland Raptor Nesting Habitat	-	29,312	18,821
	Seep or Springs	-	12,557	3,054
	Aquatic Feeding Habitat	-	13,336	3,558
	Mineral Licks	-	12,557	3,054
	Denning Sites	-	29,312	18,821
	Rendezvous Sites	q	1,214 [β]	754 [β]
	Amphibian Breeding Habitat (Wetlands)	-	5,704	5,184
	Amphibian Breeding Habitat (Woodlands)	s	10 [β]	0
	Mast Producing Areas		29,312	18,821
	Sharp-tailed Grouse Leks	u	1,211 [β]	678 [β]
Habitat for Species of Conservation Concern	Marsh Bird Breeding Habitat	v	1,468 [β]	817 [β]
Count of Potential Significant Wildlife Habitat Types			**22**	**21**

[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	B034	B035	B037	B040	B049	B050	B051	B052	B053	B055	B065	B067	B068	B070	B098	B099	B101	B104	B114	B117	B119	B126	B127	B128	B129	B135	B136	B139	B140	B142	B146	B147	B165
Seasonal Concentration Areas for Wildlife Species																																		
Moose Late Winter Cover				✓		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓													
Waterfowl Stopover and Staging Areas (Aquatic)																															✓	✓	✓	
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: Yellow Birch					✓						✓				✓	✓			✓			✓												
Sand Dunes																															✓			✓
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]																																		

Potential Significant Wildlife Habitat[1]	Boreal ELC Ecosite																																
	B012	B034	B035	B037	B040	B049	B050	B051	B052	B053	B055	B065	B067	B068	B070	B098	B099	B101	B104	B114	B117	B119	B126	B127	B128	B129	B135	B136	B139	B140	B142	B146	B147	B165
Amphibian Breeding Habitat (Wetlands)																									✓	✓	✓				✓	✓	✓	
Amphibian Breeding Habitat (Woodlands)																						✓												
Mast Producing Areas	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓								
Sharp-tailed Grouse Leks																							✓					✓	✓	✓				
Habitat for Species of Conservation Concern																																		
Marsh Bird Breeding Habitat																											✓	✓	✓	✓	✓	✓	✓	

[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]
		Black-Pic	Quetico	
TREES				
Abies balsamea	Balsam Fir	X	X	S5
Betula papyrifera	Paper Birch	X	X	S5
Larix laricina	American Larch	X	X	S5
Picea glauca	White Spruce	X	X	S5
Picea mariana	Black Spruce	X	X	S5
Pinus banksiana	Jack Pine		X	S5
Populus balsamifera	Balsam Poplar	X	X	S5
Populus tremuloides	Trembling Aspen	X	X	S5
Thuja occidentalis	Eastern White Cedar	X	X	S5
SHRUBS and WOODY VINES				
Acer spicatum	Mountain Maple	X	X	S5
Alnus incana	Speckled Alder	X	X	S5
Alnus viridis	Green Alder		X	S5
Amelanchier sp.	Serviceberry Species	X	X	-
Andromeda polifolia var. polifolia	Northern Bog Rosemary	X	X	S5
Betula pumila	Swamp Birch	X	X	S5
Chamaedaphne calyculata	Leatherleaf	X	X	S5
Cornus canadensis	Bunchberry	X	X	S5
Cornus stolonifera	Red-osier Dogwood	X	X	S5
Corylus cornuta	Beaked Hazelnut	X	X	S5
Dasiphora fruticosa	Shrubby Cinquefoil	X	X	S5
Diervilla lonicera	Northern Bush-honeysuckle	X	X	S5
Epigaea repens	Trailing Arbutus		X	S5
Gaultheria hispidula	Creeping Snowberry	X	X	S5
Gaultheria procumbens	Teaberry		X	S5
Kalmia polifolia	Pale Laurel	X	X	S5
Linnaea borealis	Twinflower	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	S5
Myrica gale	Sweet Bayberry	X	X	S5
Physocarpus opulifolius	Eastern Ninebark		X	S5
Prunus pensylvanica	Pin Cherry		X	S5
Prunus virginiana	Choke Cherry		X	S5
Rhamnus alnifolia	Alderleaf Buckthorn		X	S5
Rhododendron groenlandicum	Common Labrador Tea	X	X	S5
Ribes sp.	Currant Species	X	X	-
Ribes triste	Swamp Red Currant	X	X	S5
Rosa acicularis	Prickly Rose	X	X	S5

Scientific Name	Common Name	Presence of Plant Species		Provincial S-Rank[1]
		Black-Pic	Quetico	
Rosa sp.	Rose Species		X	-
Rubus idaeus ssp. strigosus	Wild Red Raspberry	X	X	S5
Rubus pubescens	Catherinettes Berry	X	X	S5
Salix pedicellaris	Bog Willow	X	X	S5
Salix sp.	Willow Species	X	X	-
Sambucus racemosa	Red Elderberry	X	X	S5
Sorbus decora	Northern Mountain-ash	X		S5
Spiraea alba	Narrow-leaved Meadow-sweet		X	S5
Vaccinium angustifolium	Late Lowbush Blueberry	X	X	S5
Vaccinium myrtilloides	Velvetleaf Blueberry	X	X	S5
Vaccinium oxycoccos	Small Cranberry	X	X	S5
Viburnum edule	Squashberry	X	X	S5
HERBACEOUS (Vascular and Non-Vascular)				
Actaea sp.	Baneberry Species		X	-
Anaphalis margaritacea	Pearly Everlasting	X	X	S5
Anemone quinquefolia	Wood Anemone	X		S5
Aralia nudicaulis	Wild Sarsaparilla	X	X	S5
Athyrium filix-femina var. angustum	Lady Fern		X	S5
Calamagrostis canadensis	Canada Blue-joint	X	X	S5
Caltha palustris	Marsh Marigold	X	X	S5
Carex aquatilis var. aquatilis	Water Sedge	X	X	S5
Carex diandra	Lesser Panicled Sedge	X		S5
Carex magellanica	Boreal Bog Sedge		X	S5
Carex sp.	Sedge Species	X	X	-
Carex trisperma	Three-seed Sedge	X	X	S5
Chamerion angustifolium	Fireweed	X	X	S5
Cirsium sp.	Thistle Species	X	X	-
Clintonia borealis	Blue Bead-lily	X	X	S5
Comarum palustre	Marsh Cinquefoil	X	X	S5
Coptis trifolia	Goldthread	X	X	S5
Doellingeria umbellata var. umbellata	Flat-top White Aster		X	S5
Dryopteris carthusiana	Spinulose Shield Fern	X	X	S5
Dryopteris cristata	Crested Shield Fern	X	X	S5
Equisetum palustre	Marsh Horsetail	X		S5
Equisetum sylvaticum	Woodland Horsetail	X	X	S5
Eurybia macrophylla	Large-leaf Wood-aster	X	X	S5
Eutrochium maculatum var. maculatum	Spotted Joe-pye Weed	X	X	S5
Fragaria virginiana	Virginia Strawberry		X	S5
Galium asprellum	Rough Bedstraw		X	S5
Galium sp.	Bedstraw Species	X	X	-

Scientific Name	Common Name	Presence of Plant Species		Provincial S-Rank[1]
		Black-Pic	Quetico	
Galium triflorum	Sweet-scent Bedstraw	X	X	S5
Geum macrophyllum	Large-leaved Avens		X	S5
Gymnocarpium dryopteris	Oak Fern	X	X	S5
Hieracium sp.	Hawkweed Species		X	-
Impatiens capensis	Spotted Jewel-weed		X	S5
Iris versicolor	Blueflag		X	S5
Lycopus uniflorus	Northern Bugleweed		X	S5
Maianthemum canadense	Wild-lily-of-the-valley		X	S5
Maianthemum trifolium	Three-leaf Solomon's-seal	X		S5
Menyanthes trifoliata	Bog Buckbean		X	S5
Mertensia paniculata	Tall Bluebells	X	X	S5
Mitella nuda	Naked Bishop's-cap	X	X	S5
Monotropa uniflora	Indian-pipe		X	S5
Packera aurea	Golden Ragwort		X	S5
Petasites frigidus var. palmatus	Palmate Coltsfoot	X	X	S5
Petasites frigidus var. sagittatus	Arrow-leaved Coltsfoot		X	S4?
Phegopteris connectilis	Northern Beech Fern	X		S5
Platanthera hyperborea	Tall Northern Green Orchid		X	S4S5
Polygonum sp.	Smartweed Species		X	-
Pteridium aquilinum	Bracken Fern		X	S5
Pyrola asarifolia	Pink Pyrola		X	S5
Pyrola sp.	Pyrola Species	X	X	-
Sarracenia purpurea	Northern Pitcher-plant	X	X	S5
Scirpus cyperinus	Cottongrass Bulrush		X	S5
Scirpus pendulus	Rufous Bulrush		X	S5
Solidago canadensis var. canadensis	Canada Goldenrod	X	X	S5
Solidago sp.	Goldenrod Species		X	-
Streptopus lanceolatus	Rose Twisted-stalk		X	S5
Symphyotrichum ciliolatum	Lindley's Aster		X	S5
Symphyotrichum sp.	Aster Species		X	-
Thalictrum pubescens	Tall Meadowrue		X	S5
Triadenum fraseri	Marsh St. John's-wort		X	S5
Trientalis borealis	Northern Starflower	X	X	S5
Typha latifolia	Broad-leaf Cattail		X	S5
Viola renifolia	Kidney-leaf White Violet	X	X	S5
Viola sp.	Violet Species		X	-
MOSSES and LICHENS (Including Clubmosses)				
Cladonia coccifera	A Lichen		X	S5
Cladonia mitis	A Lichen	X	X	S5
Cladonia rangiferina	A Lichen		X	S5
Cladonia stellaris	A Lichen		X	S5
Cladonia stygia	A Lichen		X	S5

Scientific Name	Common Name	Presence of Plant Species		Provincial S-Rank[1]
		Black-Pic	Quetico	
Dendrolycopodium obscurum	Flat-branched Tree-clubmoss	X	X	S4
Diphasiastrum complanatum	Northern Ground-cedar		X	S5
Hylocomium splendens	Stair-step Moss	X	X	S5
Lycopodium clavatum	Running Clubmoss	X	X	S5
Peltigera aphthosa	A Lichen		X	S5
Pleurozium schreberi	A Moss	X	X	S5
Ptilium crista-castrensis	Knight's Plume	X	X	S5
Sphagnum angustifolium	Narrowleaf Peat Moss	X	X	S5
Sphagnum sp.	Sphagnum Moss Species	X	X	-
Sphagnum squarrosum	Shaggy Peat Moss	X	X	S5
Spinulum annotinum	Stiff Clubmoss	X	X	S5
Tally of Number of Plant Species Recorded		**98**	**100**	**-**

[1] Provincial S-Rank: S4 = Apparently Secure, S5 = Secure, S? Rank Uncertain, SNR = Unranked.

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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	Accuracy of Newer FRI	Accuracy of Older FRI	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
B035	1	0	100%	-	100%	-	-	-	-	-	-	-	-	-	
B049	3	1	-	67%	67%	B055	1	6%	✓	✓				✓	
B050	6	2	75%	50%	67%	B052	1	11%		✓					
						B055*	1	8%	✓	✓				✓	
B052	8	6	50%	17%	25%	B067	5	63%				✓			
						B070*	1	12%	✓	✓		✓			
B052	8	6	100%	100%	100%	-	-	-	-	-	-	-	-	-	
B055*	25	6	60%	80%	76%	B052	1	4%	✓	✓					
						B067	2	8%	✓	✓				✓	
						B035	1	4%	✓		✓			✓	
						B065	1	4%	✓		✓				
						B129	1	4%	✓		✓	✓	✓		
B065	7	3	100%	25%	57%	B128	3	43%		✓		✓	✓		
B067	9	2	100%	33%	78%	B055*	1	11%	✓	✓				✓	
						B116	1	11%				✓			
B070*	2	1	50%	-	50%	B067	1	50%	✓	✓				✓	
B098	2	2	-	0%	0%	B055*	1	50%	✓		✓			✓	
						B128	1	50%				✓	✓		
B127	8	6	50%	17%	25%	B065	1	13%		✓		✓	✓		
						B128	2	25%							Greater understory species richness
						B129	3	37%							Greater understory species richness
B128	11	8	0%	43%	27%	B052	1	9%			✓	✓	✓	✓	
						B067	1	9%			✓	✓	✓	✓	
						B129	6	55%							Greater understory species richness
B129	12	1	-	92%	92%	B128	1	8%							Lesser understory species richness
B135	2	0	-	100%	100%	-	-	-	-	-	-	-	-	-	
B140	4	2	-	50%	50%	B142*	1	25%							Greater understory species richness
						B141	1	25%							Difference in understory – dominated by emergent graminoids
B146	2	0	100%	-	100%	-	-	-	-	-	-	-	-	-	
Total	**101**	**40**	**69%**	**57%**	**60%**	**-**	**40**	**40%**	**-**						

[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[3]	Observations
	Waypoint ID	Observation Date	UTM[1] Northing	UTM[1] Easting	Inferred Morphology	Actual Morphology		
HC-RS2-P4	HC-RS2-P4-T1	14-Oct-16	5466618	671983	Glide/Run (Int)[2]	Glide/Run (Int)[2]	N	Water present in isolated pool (recent rain accumulation), likely glide/run during periods of high flow
HC-RS2-P4	HC-RS2-P4-T2	14-Oct-16	5466624	671957	Glide/Run (Int)[2]	Glide/Run (Int)[2]	N	Boulder substrate, narrow stream
HC-RS2-P6	HC-RS2-P6-T1	14-Oct-16	5466621	673928	Pool	Pool	N	Boulder/cobble substrate with sand base
HC-RS2-P6	HC-RS2-P6-T2	14-Oct-16	5466615	673938	Pool	Pool	N	Boulder/cobble substrate with sand base, small bodied fish observed
HC-RS2-P7	HC-RS2-P7-T1	14-Oct-16	5465492	673729	Pool (Open)[3]	Pool (Open)[3]	N	Norton Lake outlet, organic woody debris substrate overlying hard base
HC-RS2-P8	HC-RS2-P8-T1	14-Oct-16	5465414	673640	Pool (Open)[3]	Pool (Open)[3]	N	Norton Lake outlet, organic woody debris substrate overlying hard base
HC-RS3-P1	HC-RS3-P1-T1	14-Oct-16	5464604	665596	Pool	Pool	N	Gravel substrate with coarse sand base, macrophytes and emergent vegetation
HC-RS3-P1	HC-RS3-P1-T2	14-Oct-16	5464617	665599	Pool	Pool	N	Gravel substrate with coarse sand base, macrophytes and emergent vegetation, shell of a Fatmucket (*Lampsilis siliquoidea*) observed
HC-RS3-P1	HC-RS3-P1-T3	14-Oct-16	5464625	665596	Pool	Pool	N	Gravel substrate with coarse sand base, macrophytes and emergent vegetation
HC-RS3-P2	HC-RS3-P2-T1	14-Oct-16	5464259	665657	Pool	Pool	N	Slightly braided channel, gravel substrate with sand base
HC-RS3-P2	HC-RS3-P2-T2	14-Oct-16	5464285	665661	Pool	Pool	N	Slightly braided channel, gravel substrate with sand base
HC-RS3-P2	HC-RS3-P2-T3	14-Oct-16	5464297	665666	Pool	Pool	N	Slightly braided channel, gravel substrate with sand base
HC-RS3-P3	HC-RS3-P3-T1	14-Oct-16	5463632	665903	Pool	Pool	N	Channel in floodplain, Juvenile Northern Pike observed
HC-RS3-P3	HC-RS3-P3-T2	14-Oct-16	5463658	665915	Pool	Pool	N	Channel in floodplain
HC-RS3-P3	HC-RS3-P3-T3	14-Oct-16	5463669	665906	Pool	Pool	N	Channel in floodplain, macrophytes throughout reach
HC-RS3-P4	HC-RS3-P4-T1	15-Oct-16	5464222	667468	Glide/Run (Int)[2]	Glide/Run (Int)[2]	N	Diffused subterranean flow U/S, small surface channel, likely glide/run during periods of higher flow
HC-RS3-P5	HC-RS3-P5-T1	15-Oct-16	5464080	667525	Glide/Run (Int)[2]	Pool	Y	Stream through beaver dam, small dam present in area
HC-RS3-P6	HC-RS3-P6-T1	15-Oct-16	5464050	667580	Glide/Run (Int)[2]	Pool	Y	Stream through beaver dam, pool with minimal gradient change
HC-RS3-P7	HC-RS3-P7-T1	15-Oct-16	5464011	667613	Pool (Open)[3]	Pool (Open)[3]	N	Flooded area at Tomkew's Lake

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

[2] (Int) – Intermittent waterbody

[3] (Open) – Open water (e.g., lake, pond)

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

ATTACHMENT C

PHOTO APPENDIX

Photo 1: ELC Community B141 – Open Extremely Rich Fen. September 29, 2016.

Photo 2: ELC Community B055 – Dry to Fresh, Coarse: Aspen – Birch Hardwood - Regenerating. September 29, 2016.

Photo 3: ELC Community B065 – Moist, Coarse: Black Spruce – Pine Conifer. September 29, 2016

Photo 4: ELC Community B050 – Dry to Fresh, Coarse: Pine – Black Spruce Conifer. September 29, 2016.

Photo 5: ELC Community B067 – Moist, Coarse: Spruce – Fir Conifer. September 30, 2016.

Photo 6: ELC Community B129 – Organic Rich Conifer Swamp. September 30, 2016.

Photo 7: ELC Community B146 – Open Shore Fen. September 28, 2016.

Photo 8: ELC Community B055 – Dry to Fresh, Coarse: Aspen – Birch Hardwood. September 30, 2016.

Photo 9: Aquatic survey station HC-RS2-P6, “Pool”, upstream. October 14, 2016.

Photo 10: Aquatic survey station HC-RS2-P7, “Pool (Open)”, Norton Lake outlet. October 14, 2016.

Photo 11: Aquatic survey station HC-RS2-P4, “Glide/Run (Int.)”. October 14, 2016.