THOR LAKE RARE EARTH METALS BASELINE PROJECT

Environmental Baseline Report: Volume 5 – Vegetation Resources

FINAL INTERIM REPORT

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EXECUTIVE SUMMARY

In 2009 baseline vegetation studies were completed on behalf of Avalon Rare Metals Inc. for the Thor Lake Project, Nechalacho Deposit. These studies were planned based on recommendations contained in a "gap analysis" completed in 2007 by Jacques Whitford AXYS (now Stantec) for the same area. The 2007 gap analysis recommended that terrestrial ecosystem mapping be completed for the area around the proposed Project. In addition, the gap analysis indicated that a rare plant survey be completed as part of the baseline studies.

Vegetation field surveys were undertaken in June 2009 to gather data in support of terrestrial ecosystem mapping (TEM) of the Thor Lake area. An early-summer rare plant field survey was also completed in June 2009.

Two separate study areas were defined for the purposes of this baseline reporting: the local study area (LSA) and the regional study area (RSA). The LSA is almost 1800 hectares and the RSA is 44,030 hectares. Following field work, ecosystem mapping was completed for the LSA or approximately 1797 ha surrounding the proposed Project footprint. A total of twenty-one (21) vegetated ecosystem units and nine non-vegetated units (such as rock and open water) were mapped in the study area. Vegetation classification mapping was completed for the larger RSA area to support general vegetation assessment as well as in support of wildlife habitat capability and suitability assessment.

Ecosystem maps were then analyzed to determine the abundance and distribution of ecosystems in the study areas at Baseline (2009).

This Technical Data Report is to be considered interim.

ABBREVIATIONS AND ACRONYMS

ATV ..... All Terrain Vehicle
BC ..... British Columbia
cm ..... centimetre
COSEWIC ..... Committee on the Status of Endangered Wildlife in Canada
DBH ..... diameter at breast height
ENR ..... Northwest Territories Environment and Natural Resources Department
ETM+ ..... Enhanced Thematic Mapper Plus
GIS ..... Geographic Information systems
GPS ..... Global Positioning System
ha ..... hectares
HD-MAPP ..... High Definition Mapping and Applications
HHERA ..... Human Health and Ecological Risk Assessment
JWA ..... Jacques Whitford AXYS Ltd.
km ..... kilometre
LA ..... lake
LSA ..... Local Study Area
m ..... metre
MVRMA ..... *Mackenzie Valley Resource Management Act*
NDVI ..... Normalized Difference Vegetation Index
NIR ..... near infrared
NWT ..... Northwest Territories
PFS ..... Prefeasibility Study
RIC ..... British Columbia Resource Inventory Committee Standards
RSA ..... Regional Study Area
SIL ..... survey intensity level
SLC ..... Scan Line Corrector
SW ..... Southwest
TDR ..... Technical Data Report
TEM ..... Terrestrial Ecosystem Mapping
UTM ..... Universal Transverse Mercator
VENUS ..... Vegetation and Environmental Data Nexus

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Appendix I ..... Moisture Regimes and Ecosystems found within the LSA
Appendix J ..... Interim Rare Plant Survey Coordinates
Appendix K ..... Interim Preliminary Species List

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1 INTRODUCTION

Avalon Rare Metals Inc (Avalon) is currently undertaking a Prefeasibility Study (PFS) for the development of the Thor Lake Project, Nechalacho Deposit, located on mineral leases it holds at Thor Lake in the Northwest Territories. The Nechalacho deposit is located approximately 100 km southeast of Yellowknife and 4 km north of the Hearne Channel of Great Slave Lake.

The Thor Lake Project site is located within the Akaitcho Territory, an area currently under negotiation of a comprehensive land claim between the federal government and the Akaitcho First Nations, representing First Nations in Lutselk"e, Fort Resolution, Ndilo and Dettah. Thor Lake lies within the Mackenzie Valley region of the NWT and is, therefore, subject to the provisions of the *Mackenzie Valley Resource Management Act* (MVRMA) in addition to other federal and territorial legislation of general application.

The Thor Lake site has been subject to mineral exploration since the 1970s. Previous exploration focused on beryllium resources in the T-zone and included drilling and bulk sampling. Since acquiring the property in 2006, Avalon has focused on delineating the rare earth resource within the Nechalacho Deposit. Preliminary development concepts being considered for the Nechalacho Deposit during the PFS include development of an underground mine, mineral concentration, tailings disposal, waste rock disposal, fuel and concentrate storage, power generation and transportation infrastructure (airstrip, upgraded site roads, wharf on Great Slave Lake). Concentrate would be shipped off-site seasonally for refinement into a marketable rare earth product.

Stantec (formerly Jacques Whitford AXYS Ltd.) initiated environmental baseline studies at the Thor Lake project, Nechalacho Deposit in the fall of 2008. Aquatic monitoring of drilling was undertaken during fall 2007 and winter 2008. This Technical Data Report (TDR) presents and analyzes data collected for the vegetation discipline as of fall 2009.

This interim report for 2009 presents background information, methods, and results for baseline vegetation studies conducted for Avalon related to this Project. A data gap analysis was completed in the same study area during 2007 by Jacques Whitford AXYS Ltd. (JWA) (now Stantec).

This gap analysis recommended that terrestrial ecosystem mapping (TEM) be conducted at a scale of 1:20,000 following BC Resource Inventory Committee (RIC) Standards. Also, the gap analysis recommended that the regional mapping be expanded to cover about 40,000 hectares. In addition the JWA analysis recommended that a rare plant survey be conducted in areas with high potential for rare plants such as wetlands, riparian areas, areas of shallow water, and rock outcrops – particularly those with warm exposures.

The 2009 baseline program was designed to address these identified gaps. Field programs were undertaken to inventory the vegetation resources as well as conduct terrain and soils studies. A modified TEM was completed to describe the distribution and abundance of ecosystems and a separate summer rare plant survey was completed.

Vegetation is a critical component in the diversity and function of natural ecosystems. Vegetation provides habitat and food for wildlife, performs important roles in environmental processes such as the water, air, and soil nutrient cycling, and provides a scenic backdrop for recreation. Changes in vegetation community or species diversity may alter ecosystem function and can have negative implications for wildlife, human recreation and physical environmental cycles.

There are two main sections in this Technical Report: the ecosystem mapping and the rare plant survey.

The detailed description and spatial mapping of ecosystems allow for the identification of sensitive or ecologically important ecosystems, culturally important plants, rare plants and rare ecosystems, and unusual forest types. Analyzing ecosystem distribution also serves as the basis for wildlife habitat suitability mapping and many other interpretations.

Rare plants are species that exist in small numbers or have a limited global or territorial distribution (Lancaster 2000). In the Northwest Territories, the Environment and Natural Resources (ENR) Department of the NWT Government is in the process of listing and ranking the status of plant species found in the territory and has begun monitoring their populations. The lists of these species with their corresponding ranks are presented in this document (See Section 4, Table 9).

In summary, the objectives of the entire vegetation baseline program are to:

- Develop ecosystem maps for local and regional study areas around the Thor Lake Project Nechalacho Deposit
- Survey the area for rare plants
- Collect lichen and other forage species samples for contaminants analysis
- Complete a general survey for the presence of invasive plants in the study area
- Provide a report describing baseline conditions of the proposed mine site area, which will in turn to support the permitting processes.

In 2009, the vegetation team completed one field trip. This interim Technical Data Report presents the background information, methods, and results of field work done in 2009.

Refer to the following appendices for supporting details and maps:

Appendix A	Interim RSA Vegetation Classification
Appendix B	Ecosystem Mapping Field Survey 2009 Locations (RSA &LSA)
Appendix C	Interim LSA Ecosystem Map (on Orthophoto)
Appendix D	Interim Regional Mapping Unit Descriptions
Appendix E	Interim LSA Ecosystem Descriptions
Appendix F	Interim Ecosystem Mapping Legend and Mapped Hectares
Appendix G	Edatopic Grid of Mapped Ecosystems within the LSA
Appendix H	Landscape Profile of Mapped Ecosystems within the LSA
Appendix I	Moisture Regimes and Ecosystems found within the LSA
Appendix J	Interim Rare Plant Survey Coordinates
Appendix K	Interim Preliminary Species List

2 STUDY AREA BOUNDARIES

Two separate study areas have been defined for the purposes of this baseline reporting: the interim local study area (LSA) and the regional study area (RSA). These study areas are defined based on the proposed development as known in 2009 and by landscape features. (See Figure 1, Thor Lake Project Area indicating the Local and Regional Study Areas.)

N

Buckham Lake

Mystery Lake

François River

Grace Lake

Blachford Lake

Whiteman Lake

Caribou Lake

Mad Lake

Elbow Lake

Hearne Channel

Blanchet Island

0 1 2 3 4
Kilometers

Legend

Thor Lake

RSA

LSA

2009 Baseline Studies for Avalon Ventures Ltd.
Proposed Thor Lake Rare Earth Metals Project

Thor Lake Project Area Indicating the Local and Regional Study Areas

AVALON RARE METALS INC.

PREPARED BY Stantec

DRAFT DATE 16/10/2009			SCALE 1:116,000
REVISION DATE 15/12/2009			PROJECT 1036222 / FIGURE NO. 1
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2.1 Interim Local Study Area

The interim 2009 Local Study Area (LSA) currently occupies an area of 1,797.2 ha and contains an anticipated direct projected footprint area (yet to be defined) while providing suitable data for both vegetation and wildlife assessments and interpretation over time. In order to support the Project assessment, the vegetation field work and the detailed ecosystem mapping was focused on the LSA.

2.2 Regional Study Area

The RSA occupies an area of 44,030.0 ha and is defined as a 15 kilometer radius around the anticipated project footprint. This broader study area is representative of the area affected by the project and is used to provide a regional context for the assessment of environmental affects – especially in support of regional wildlife habitat assessments.

Figure 2: General Overview Image Indicating the RSA (red boundary)

3 ECOSYSTEM MAPPING METHODS

Vegetation resources have been described through a combination of field inventory and 1:20,000 scale ecosystem mapping. The methods used to characterize vegetation resources in the study areas are described in this section.

3.1 Review of Existing Information & Literature Review

Background information on the ecology of the Project area was compiled from broader regional studies done in the NWT. These reports include the following:

- *Ecological Regions of the Northwest Territories – Taiga Shield* (Government of the Northwest Territories 2008).
- *Species at risk in the Northwest Territories, a guide to NWT species legally listed under the federal Species at Risk Act and those under consideration for listing, 2008 edition* (Government of the Northwest Territories 2008).
- *Northwest Territories biodiversity action plan – report two: gap and overlap analysis and recommendations for future actions* (NWT Biodiversity Team 2006).
- *Phase 1 ecological and renewable resources assessment, Caribou Point candidate protected area, Northwest Territories* (EBA Engineering Consultants Ltd. 2006).
- *Ecological Assessment of the Edéhzhíe candidate protected area* (EBA Engineering Consultants Ltd. 2005).
- *Characteristics of tree line plant communities in Alaska* (Viereck 1979).
- *Vegetation classification for the west Kitikmeot/Slave study region* (Matthews, *et al*. 2001).
- *An environmental survey of the Thor Lake area (Golder Associates Ltd. 1998. Saskatoon, Saskatchewan)*
- *Thor Lake Area (NWT) Environmental Baseline Survey (Melville, G., B. Godwin, D. Russell and J. Polson. 1989. Saskatchewan Research Council Publication E-901-1-E-89).*

3.2 Climate Information – (Relevant to Vegetation)

The closest Environment Canada weather station is located in Yellowknife (205.7 m elevation), which is approximately 100 km to the northwest. Data collected between 1971 and 2000 reports average annual precipitation of 280.7 mm, and an average annual snowfall of 151.8 cm (Environment Canada 2000). Temperature information indicates July to be the warmest month with an average temperature of 16.8 C, and January the coldest with -26.8 C, for a yearly average of -4.6 C.

3.3 Background/Available Ecosystem Information

As shown above, a number of regional reports and ecological information was reviewed prior to the implementation of the ecosystem mapping program for this pre-feasibility assessment. Although general vegetation communities were described and discussed in previous reports, no site specific ecosystem mapping information was available for the project area. The mapping program followed the British Columbia Terrestrial Ecosystem Mapping protocols, however the ecosystem types and mapping approach was built upon both the historical biophysical mapping completed in the

Northwest Territories in various projects, and the ecoregional structure developed by the Government of the Northwest Territories.

The ecoregional classification system is described here within:

> *In 2008, the Government of the Northwest Territories and the Ecosystem Classification Group published the Ecological Regions of the Northwest Territories: Taiga Shield. The hierarchy of ecoregion classification places the Thor Lake site within the Level I Taiga Ecoregion. This is the broadest classification level that provides the backdrop to the ecological mosaic of the continent, and provides context at a global or intercontinental scale. The Level II Taiga Shield Ecoregion designation for the study area is useful for national and sub-continental overviews of physiography, wildlife and land use (Commission for Environmental Cooperation 1997). The Level II Taiga Shield Ecoregion is characterized by Precambrian bedrock outcrops with many lakes and wetlands in glacially carved depressions.*
>
> *The third level of ecoregion classification is defined by regional climatic differences within Level II Ecoregions (Ecosystem Classification Group 2008). The Thor Lake Project area Level III Ecoregion classification is Taiga Shield High Boreal which is characterized by exposed bedrock plains with thin boulder till veneers. Jack pine or black spruce stands occupy large areas depending on fire frequency and white spruce/aspen forests are common in low elevation areas to the west where nutrient and water supplies are adequate. Peat plateaus and floating fens are scattered throughout. (Ecosystem Classification Group 2008).*
>
> *Level IV Ecoregions which are characterized by distinctive regional ecological factors. These factors include climate, physiography, vegetation, soil, water and fauna (Marshall, et al. 1996). The Level IV Ecoregion that encompasses this Project is the Great Slave Upland High Boreal Ecoregion. The main characteristics are a nearly level bedrock plain with thin discontinuous till veneers, scattered outwash and lacustrine deposits, and a mosaic of black spruce woodlands and jack pine and paper birch regeneration on burned areas (Ecosystem Classification Group 2008).*

3.4 Pre-Field Bioterrain Mapping for LSA

Initial bioterrain mapping for the local study area (LSA) was completed using 1996, 1:20,000 scale black and white aerial photographs, and viewed in stereo using a HD-MAPP system for the LSA mapping. Following delineation of the polygons the bioterrain line work was transferred into digital format and merged into a seamless map for the LSA. These bioterrain polygons provide a strong foundation for the mapping of vegetation and ecosystems. A detailed description of the bioterrain mapping process and results is provided in the Surficial Geology, Terrain, and Soils Baseline Interim Report.

3.5 Terrestrial Ecosystem Mapping (TEM)

TEM is a hierarchical framework that integrates the topographic, terrain, soils, and vegetative features of a landscape to produce a product that can be used for quantifying the distribution and

abundance of ecosystems in a landscape. The mapping product(s) form the basis for various interpretations such as wildlife habitat, tree species and age, and soil modeling.

The methodology used for the LSA ecosystem mapping followed the *Standards for Terrestrial Ecosystem Mapping in BC* (RIC 1998), however only applicable sections were used as it relates to the NWT. Since, there is no established site specific ecosystem classification system for the NWT, the British Columbia TEM mapping approach was relevant and useful for developing a classification system in the Project area. The following information was reviewed and used as a starting point for the detailed ecosystem classification and mapping for the Thor Lake Project:

- *Thor Lake area (NWT) environmental baseline survey* (Melville, et. al. 1989)
- *An environmental survey of the Thor Lake Area* (Golder Associates Ltd. 1998)
- *Environmental data review and requirements, Thor Lake Project* (Highwood Resources 2000).
- *Ecological Regions of the Northwest Territories – Taiga Shield* (Government of the Northwest Territories 2008).

3.6 Regional Ecosystem Mapping

As per the project objectives, a general vegetation classification was created for the RSA using available satellite imagery and National Topographic Data. Remote sensing was used in the RSA as this is the most effective and efficient tool for classifying vegetation over such a large area (44,030 ha). See Appendix A for vegetation classification for the RSA. Remote sensing is the science, technology and art of obtaining information about objects or phenomena from a distance (i.e., without being in physical contact with them) (Natural Resources Canada 2009).

The following section details the methods used to create a vegetation classification for the Thor Lake Regional Study Area (RSA).

LandSat 7, Enhanced Thematic Mapper Plus (ETM+) imagery was used for this classification.

3.6.1 Satellite Dataset

The satellite imagery was acquired from LandSat 7 ETM+ on July 6, 2008. The LandSat 7 ETM+ imagery is composed of eight spectral bands (Table 1). For purposes of the vegetation classification the bands one through four were used. The spatial resolution is 30 m.

Table 1: LandSat 7 ETM+ Characteristics

Band Number	Wavelength Interval (µm)	Spectral Response	Resolution (m)
1	0.45–0.515	Blue-Green	30
2	0.525–0.605	Green	30
3	0.63–0.69	Red	30
4	0.75–0.90	Near-IR	30
5	1.55–1.75	Mid-IR	30

Band Number	Wavelength Interval (µm)	Spectral Response	Resolution (m)
6	10.40–12.50	Thermal-IR	60
7	2.09–2.35	Mid-IR	30
Pan	0.52–0.90		15

NOTE:
The LandSat 7 satellite was launched on April 15, 1999 and is still in operation despite a Scan Line Corrector (SLC) failure May 31, 2003 (NASA, 2009). The LandSat 7 ETM+ currently acquires image data in the "SLC-off" mode. In this project the „SLC-off" effects about one percent of the RSA vegetation classification results and mapping. The problem is most pronounced along the edge of the image and gradually diminishes toward the centre of the image. For the purposes of this study, we have some remnants of the SLC-off, where lines appear on the North-west portion of the RSA classification. However, for the purposes of the work conducted this problem is considered minor and has little impact on the overall mapping product created.

3.6.2 Methods of Analysis

PCI Geomatica software (version 10.1) was used to perform image processing and classification. The original LandSat 7 ETM+ image was clipped to the Regional Study Area (RSA) and all processing was limited to the RSA.

For this study, there were two classifications performed – unsupervised and supervised. The unsupervised classification was performed first, prior to the collection of field data. Unsupervised classification is a useful tool for organizing image information into discrete classes of similar pixel values and it does not require any prior knowledge of the data or image. This classification identified 16 unique classes in the Thor Lake RSA. These classes were then used to guide where to collect data in the field.

Following the collection of field data, a supervised classification was performed on the image. The supervised classification requires input from the user to „train" the dataset. The following sequence of steps outlines the supervised classification process:

1. Create Normalized Difference Vegetation Index (NDVI)

   NDVI was calculated to capture the vegetation characteristics of the study area and improve modeling results. Vegetation is highly reflective in the near infrared (NIR) and highly absorptive in the visible red; as a result, NDVI correlates with the photosynthetic activity of vegetation. NDVI was included as a data source in the supervised classification, along with bands 1 through 4. NDVI is defined as:

   $$NDVI = (NIR – Red) / (NIR + Red)$$

2. Perform Tassel Cap Transformation

   The Tassel Cap Transformation captures the greatest amount of data variability in the fewest number of linearly combined output bands and enhances the interpretability of data sets with respect to the actual image characteristics (Jensen, 2007). In the LandSat 7 ETM+ data, the image characteristics can be captured in 3-dimensions – Brightness, Greenness and

Wetness (Crist and Kauth, 1986). The Brightness, Greenness and Wetness were included as a data source in the supervised classification.

3. Create Training Sites

   Training sites were created from the field data. Similar vegetation types were grouped and assigned a class and the classes were used to generate spectral signatures for the area of interest. The creation of training sites is a critical step as the data collected at the training sites are used to define the statistical limits of the classes that are being defined. These statistics are then used to assign unknown pixels to the appropriate classes.

4. Perform a Supervised Classification using a Maximum Likelihood Method

   Once the classes have been defined, each pixel was assigned to a class using the Maximum Likelihood classifier (an equi-probability classifier) in a supervised classification.

5. Perform an Internal Accuracy Assessment

   A preliminary internal accuracy assessment was conducted for the vegetation classification of the RSA using a portion of the field data. This initial classification followed Story and Congalton (1986), which provides a means for evaluating the reliability of the classification. Producer‟s accuracy represents how well a specific area of reclaimed land can be mapped. It is derived by calculating the percentage of reference areas of a particular land cover type were correctly classified and therefore represents the probability that a reference sample will be correctly classified.

   There are also errors of commission, when land cover types are misclassified. User‟s accuracy is concerned with how well the maps represent what is actually on the ground. If a user travels to a site indicated on the map as a particular land cover type, the user‟s accuracy estimate provides an estimate of the probability that the particular land cover type is actually present at that site.

   These internal accuracy values provide the mapper with an initial estimate of omission error. The final accuracy assessment is to be performed upon the completion of final mapping.

6. Create a Thematic Map

   The classification was exported to ArcGIS v9.2 for thematic map production. Refer to Appendix A for the Regional Vegetation Classification map.

4 FIELD PROGRAMS

Two field programs were conducted in 2009 to determine baseline conditions for vegetation resources in the Thor Lake study areas. These programs involved the following:

- 1:20,000 ecosystem mapping in the LSA, and 1:50,000 regional ecosystem mapping in the RSA
- Rare plant field survey.

4.1 LSA Ecosystem Mapping Field Program

A modified ecosystem sampling plan was developed for the Thor Lake Nechalacho Deposit study areas following the methods developed per the *Standard for Terrestrial Ecosystem Mapping in BC* (RIC 1998). Preliminary delineation of bio-terrain polygons was completed for the LSA prior to the initiation of field work. These polygons were used to pre-select candidate field inspection sites. Field maps were prepared that displayed the bio-terrain polygons and potential inspection sites overlain onto an ortho-photograph. The geo-spatial coordinates of the pre-selected sampling points were loaded into GPS units. Sampling points were selected to capture the range of ecosystem units present within the LSA.

Field work took place from June 22 through June 29, 2009. A field crew consisting of a Senior Vegetation Specialist and rare plant specialist/vegetation ecologist – which carried out field inspections within the LSA and RSA on foot, ATV and also using a helicopter (See appendix B Ecosystem Mapping Field 2009 Survey Locations (RSA & LSA)).

Two types of inspections were completed: ground inspections and visual inspections. The majority of the plots were on-site ground inspections. Visual inspections were done when in transit or from the air, and were done to make notes on ecosystem types that were readily identified from distance. The locations of the ground inspection sites were selectively chosen. (See Figure 3, Thor Lake LSA TEM Map Plot Locations). An effort was made to ensure that the sample site locations were representative of the general ecosystem type with respect to site, soil and vegetation characteristics. The Terrestrial Ecosystem Mapping Ground Inspection Form was used for recording ground inspection data. The Field Manual for Describing Terrestrial Ecosystems (Ministry of Forests and BC Environment 1998) provided a detailed method for data collection at ground inspections locations.

The following information was collected at the each of the ground inspection sites:

- UTM coordinates
- Topographic position (e.g. crest position, lower slope, depression etc)
- Aspect
- Slope
- Drainage
- Soil nutrient regime
- Soil moisture regime
- Plant list
- Dominant trees
- Percent cover by species
- Wildlife notes.

In addition to the above, photographs were taken at the majority of sampling sites, and tree mensuration data (height, diameter, and age) were collected at selected sites.

N

Elbow Lake

Legend

- Thor Lake
- TEM Plot Locations
- LSA

TEM Mapping: Dominant Ecosystem Unit

- BF - black spruce-feathermoss-crowberry upland forest
- BG - black spruce-cloudberry-sphagnum moss bog forest
- BT - black spruce-tamarack-water sedge fen
- LA - lake
- LL - labrador tea-reindeer lichen-black spruce bog
- LW - lichen-bearberry woodland
- MI - mine
- OW - shallow open water
- PA - paper birch-aspen-willow forest
- PD - pond
- RL - bedrock-lichen-juniper-saxifrage
- RO - bedrock
- RW - rural/camp
- RZ - road surface
- SP - spruce-paper birch-toadflax forest
- SS - scrub birch-sweet gale-bog rosemary fen
- WA - white spruce-green alder-prickly rose forest
- WB - water sedge-buckbean-arrow grass fen
- WH - white spruce-horsetail-glow moss forest

Thor Lake LSA
Terrestrial Ecosystem Map 2009

Area of Detail

0 0.2 0.4 0.6 0.8
Kilometers

AVALON RARE METALS INC.

PREPARED BY Stantec

DRAFT DATE 16/10/2009			SCALE 1:23,000	
REVISION DATE 18/12/2009			PROJECT 1036222	FIGURE NO. 3
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4.2 RSA Ecosystem Mapping Field Program

In 2009, an initial reconnaissance level survey of the RSA was also conducted at the same time as the field work for the LSA. All of the work conducted in the RSA was completed by helicopter. Eighty-five (85) air calls were completed (see Table 4) following applicable British Columbia field data collection standards and TEM mapping protocols (See Appendix C, LSA Ecosystem Map on Orthophoto). The ecosystems were described following the same protocols and mapping legend as the TEM. See Appendix D for the list of the Thor Lake regional mapping unit definitions.

5 RESULTS

The following section describes the results of the field program and subsequent final ecosystem mapping for the both the LSA and RSA.

5.1 Field Work Results

At total of 163 field inspections were completed within the Project area to support the ecosystem mapping. For the LSA, 79 ecosystem field plots were completed (59 visual inspections and 20 ground inspection plots). In the RSA 85 field inspections were carried out. Refer to Table 2 (below) for a breakdown of TEM field plots by inspection type and ecosystem unit.

Table 2: Summary of 2009 Thor Lake Vegetation Sampling Effort by Plot Inspection Type and Ecosystem Unit

Ecosystem Unit Mapcode[1]	Ground	Visual	Aircall	Total
BF	1	7	17	**25**
BG	1	1	6	**8**
BT	3	5	3	**11**
JH		1	1	**2**
LA		1	2	**3**
LL			3	**3**
LW		8	12	**20**
PA			4	**4**
PD		3		**3**
RL	2	7	9	**18**
RO		1	2	**3**
SH			1	**1**
SP	2	6	8	**16**
SS	4	5	8	**17**
SW	1			**1**

Ecosystem Unit Mapcode[1]	Ground	Visual	Aircall	Total
WA	3	6	2	**11**
WB	2	5	6	**13**
WH	1	3		**4**
Grand Total	**20**	**59**	**85**	**163**

NOTE:
[1] Map codes are described in the ecosystem mapping legend located in Appendix E

The interim results show that the combined RSA (including the LSA portion of the regional classification) is composed of 11,200.0 ha of coniferous forest ecosystems and 4,527 ha of treed fens ecosystems. Wetlands occupy approximately 8761.0 ha and deciduous dominated or mixed forest types cover about 5,693.0 ha. Also, within the RSA there are approximately 8,420.2 ha of the bedrock or bedrock/lichen vegetation type.

Mapping survey intensity level (SIL) is a measure of sampling density and has implications for map accuracy as well as the confidence in the interpretations that are made from the map data. SIL is based on the variables of polygon number, number of plots, and study area size (RIC 1998).

In this project, 79 polygons out of the 329 polygons in the LSA were sampled (24%). By area, there is one ground sampling point for every 23 ha (see Table 3), providing a SIL level of 3 (on a scale of 1 – 5). This level of inspection (SIL 3) is deemed appropriate for insuring the accuracy and confidence in interpretations that are made from the map data (such as ecosystem summaries and wildlife habitat modeling (RIC 1998).

Table 3: Mapping Survey Intensity Levels

Study Area	Area (ha)	Number of Polygons	Number of Polygons with Inspections	Survey Intensity Level	
				% of Inspected Polygons	Hectares per Inspection
LSA	1,797.2	329	79	25.0	22.0

5.2 Interim Final Ecosystem Mapping

Following the completion of the field program all field data was entered into an MS ACCESS database using VENUS (VTEM) software. Using this data the pre-field bioterrain mapping was revised, and final ecosystem maps were produced using methods described in the *Standard for Terrestrial Ecosystem Mapping in BC* (RIC 1998). In the RSA a mapping scale of 1:50,000 was used for vegetation classification using satellite imagery, while a map scale of 1:20,000 was used in the LSA using higher resolution digital aerial photographs. A description of the ecosystem mapping process is provided in the following sections.

5.2.1 Polygon Attribution

Using the field data, plot photos, terrain data and other information, the project ecologists proceeded to assign attributes to map polygons in a GIS environment (ESRI ArcMap).

Polygon attributes including surficial material, texture, surface expression, geomorphological process, and soil drainage were revised in the mapping geodatabase (ArcMap). Ecosystem unit labels were created by the project ecologists. Ecosystem unit labels include an ecosystem unit, site modifier(s) (used to describe physical site characteristics) and a structural stage. Aerial photographs were examined to determine the labels for each polygon. Ecosystem labels may consist of simple units (one ecosystem unit) or be complex and consist of up to three ecosystem units.

Ecosystem unit and bioterrain labels were entered into the map geodatabase. Mapping standards provide a list of the core polygon attribute data that are required. Some of the core data found in the ecosystem database for each polygon include ecosystem labels [decile, site series, modifier(s), and structural stage, recorded up to three times per polygon] and stand composition. Terrain attributes were also entered in the database. Ecosystem labels and attributes are explained below.

Ecosystem maps were created in geodatabase format by combining the polygon digital files and the ecosystem databases. An example of a polygon ecosystem label composed of two components is as follows:

6FCw6C – 4BLw3a

Component 1	**Component 2**
6 = Decile 1	4 = Decile 2
FC = Map code 1	BL = Map code 2
w = Site modifier 1	w = site modifier 2
6 = Structural stage 1	3 = Structural stage 2
C = Stand composition 1	a = Structural stage modifier 2

Each polygon was attributed with a minimum of one to a maximum of three ecosystem units. The ecosystems are ordered in the data based on their relative proportion within the polygons; component deciles indicate the percentage of the polygon occupied by the each ecosystem unit. Hence, in the example shown above the first ecosystem occupies 60% of the polygon area while the second occupies 40%. The deciles total 100% for each polygon.

5.2.2 Site Modifiers

Site modifiers, where used, further denote specific conditions that are associated with individual ecosystem units within map polygons (Table 4). These modifiers describe features such as slope, aspect of terrain features. A slope of 15% was used rather than the standard 25% for an aspect modifier due to the importance of aspect on ecosystem and plant development in the Thor Lake area. The following site modifiers (Table 4) have been used in the Project mapping:

Table 4: Site Modifier Definitions

Symbol	Criteria
a	active floodplain
g	gullying occurring with the ecosystem
h	hummocky terrain
k	cool, northerly or easterly aspect (285-135 degrees, slopes >15%)
n	fan or cone
p	peaty material on surface
r	ridge top
t	terrace
w	warm, southerly or westerly aspect (135-285 degrees, slopes >15%)*

5.2.3 Structural Stage

Structural stage describes the existing dominant stand appearance or physiognomy of the ecosystem unit (Table 5). One of six structural stage categories describing the current development stage is assigned to each ecosystem unit.

Table 5: Structural Stage Definitions

Symbol	Structural Stage	Age Criteria and Descriptions
1	Sparse/ Bryoid	Initial stages of primary and secondary succession; total shrub and herb cover is less than 20%
1a	Sparse	Less than 10% vegetation cover (less than 20 years)
1b	Bryoid	Bryophyte and lichen-dominated communities; >1/2 total vegetation cover (less than 20 years)
2	Herb	Early successional stages, and disclimax or climax sites, dominated by herbaceous vegetation (tree cover <10%, shrub cover <= 20%, herb cover >20% or >= 33% of total cover) (less than 20 years for normal forest succession)
2a	Forb-dominated	Herbaceous communities dominated (>1/2 of total herb cover) by non-graminoid herbs, including ferns
2b	Graminoid-dominated	Herbaceous communities dominated (>1/2 of total herb cover by graminoids [grasses, sedges, reeds, and rushes])
2d	Dwarf woody shrub dominated	Herbaceous communities dominated (>1/2 of total herb cover by dwarf woody species [mountain-heathers, mountain avens, dwarf willows])
3	Shrub/Herb	Early successional stages, and communities dominated by shrub vegetation < 5m in height (tree cover <10%, shrub cover >20% or > = 33% of total cover). Used for communities that will be forested at climax (less than 20 years for normal forest succession)

Symbol	Structural Stage	Age Criteria and Descriptions
3a	Low Shrub	Disclimax or climax communities dominated by shrub cover <2 m in height
3b	Tall Shrub	Disclimax or climax communities dominated by shrub cover 2–5 m in height
4a	Normal Pole/Sapling Succession	Trees greater than 5 m tall with <15cm diameter at breast height (DBH). Densely stocked (up to 80% crown closure) but may still be competing with shrub and herb layers. Self thinning and vertical structure are not yet evident in the canopy. Time since disturbance is usually between 50 and 100 years.
4i	Stagnant Stands	Stands growing on very wet sites (i.e., forested bogs) where moisture conditions and the development of discontinuous permafrost have delayed the successional process creating stagnant stands of stunted trees. Tree heights range from 5-7 m with <10cm DBH. Generally sparse to moderately open stands (occasionally densely stocked stands) that may still be competing with shrub and herb layers. Typical stands are usually greater than 70 years old and occasionally more than 120 years of age.
5	Young Forest	Trees heights range from 10 – 15 m, 10-60% crown closure, DBH <20cm. Self-thinning is usually evident and the forest canopy has begun differentiation into distinct layers. Tree ages are typically range from 80 – 120 years. Also includes older stagnant stands similar to stage 4i described above.
6	Mature Forest	Tree heights generally less than 20 m tall, 10 – 50% crown closure, DBH up to 30 cm. Trees established after the last disturbance have matured and a second cycle of shade tolerant trees may have established. Tree ages range from 100 – 140 years for coniferous stands.
7	Old Forest	Tree heights ranging from 18 – 25 m, DBH >30 cm and 10 – 35% canopy cover. Presence of snags and coarse woody debris, canopy gaps, and often structurally complex stands. Generally >140 years old and coniferous stands.

To summarize the area of each ecosystem unit in the Project study areas, it was necessary to "decompose" complex ecosystem units. For instance, a 10 ha polygon in the forested zone comprised of 50% BT and 50% WA would be broken into 5 ha of each ecosystem type in summary tables. The limitation of this approach is that it is not possible to be spatially explicit about where the component ecosystem types are located within a given polygon. In describing and summarizing Baseline conditions, it was necessary to reduce the ecosystem areas based on the disturbances present at Baseline. These disturbances include the features such as existing roads, exploration trails, seismic lines, drill pads, and trenches. For the purposes of the spatial analyses completed in support of the effects assessment, it is assumed that ecosystem types within a complex TEM polygon are distributed evenly. However, as ecosystem types are typically disproportionately distributed in nature, this assumption may overestimate or underestimate ecosystem Baseline availability in any one area.

5.3 Interim Results of LSA Ecosystem Mapping

Twenty different ecosystem units were mapped in the LSA, including four non-vegetated units: lake, pond, shallow open water, and bedrock (See Appendix E LSA Ecosystem Descriptions). There are 197 ha of lake and 142 ha of pond in the LSA. Two anthropogenic units were also mapped:

rural/camp (1 ha), and mine (6 ha). Fourteen (14) vegetated ecosystems were mapped. The most common unit was LW: lichen - bearberry woodland which occurs on crests and upper slope positions (291 ha).

The second most common unit, with 255 ha, was SP: spruce – paper birch – toadflax forest. Some of the less common ecosystem types were WB: water sedge – buckbean – arrowgrass fen (12 ha); PA: paper birch – aspen – willow forest (1 ha); and WH: white spruce – horsetail – glow moss forest (1 ha) (See Appendix F Ecosystem Mapping Legend and Mapped Hectares). An edatopic grid was developed for ecosites within the LSA and is presented in Appendix G. Also, a landscape profile was created for ecosites with the LSA and is presented in Appendix H. Furthermore, a diagram showing the moisture regimes and ecosites within the LSA is presented in Appendix I.

5.4 Interim Results of RSA Mapping

Eleven broad ecosystem types make up the preliminary vegetation map within the RSA. This preliminary RSA vegetation map and interim results show that the RSA is predominately made up of „Bedrock-Lichen", „Deep Open Water", „Spruce Upland", and „Mixed Upland forest. Refer to Appendix A for an overview map of the current RSA vegetation classification results. Once complete, the final vegetation classification product will be used to support wildlife habitat analysis and assessment.

Table 6: Interim RSA Vegetation Classification Results

Regional Mapping Unit	Hectares	%
Bedrock	1,110	2%
Bedrock Lichen	7,310	16%
Broadleaf Upland	4	0%
Mixed Upland	5,689	12%
Deep Open Water	6,720	15%
Sedge Fen	1,380	3%
Shallow Water	3,709	8%
Shrub Fen	3,671	8%
Spruce Upland	6,770	15%
Spruce Wet	4,429	10%
Treed Fen	4,527	10%
No data	506	1%
Sum within the RSA	**45,827**	**100%**

6 RARE PLANT STUDY

6.1 Methods

The rare plant study was partially completed in 2009, and completed for the LSA only.

6.1.1 Review of Existing Literature

Prior to embarking on the rare plant field survey, a literature review of NWT Government publications and previous reports for the Thor Lake area was conducted. These documents included:

- *Thor Lake Environmental Baseline Survey* (Melville, *et al*. 1989)
- *An Environmental Survey of the Thor Lake Area* (Golder Associates Ltd. 1998)
- *NWT 2006-2010 – General Status Ranks of Wild Species in the Northwest Territories* (Working Group on General Status of NWT Species 2006) [The Department of Environment and Natural Resources (ENR) of the NWT Government is in the process of listing and ranking the status of all species found in the territory, including plants, and has also begun monitoring populations. These listed species with their corresponding ranks are presented in this document].

In the report by Melville, *et al*. (1989), commissioned by the Saskatchewan Research Council, three plants of restricted range are reported to have been found near Thor Lake: *Prunus pennsylvanica, Campanula rotundifolia* and *Chamaerhodos erecta*. By cross-referencing with the current ranking of species mentioned in NWT 2006–2010, an update of the status ranks of these species indicates that of the three species, only the status of *Chamaerhodos erecta* is uncertain, which is ranked as “May be at Risk”. The report by Golder (1998) focused on aquatic and wildlife resources and therefore had no information on rare plant availability.

Rare species are ranked according to their population size, distribution, frequency, threats to existing populations and population trends as well as the amount of information available for them. The NWT 2006 – 2010 list of rare species with their associated rank was consulted prior to embarking on the summer 2009 rare plant survey. The complete list was edited to include only those species ranked as At Risk, May Be At Risk, Sensitive, Undetermined and Presence Expected. The definitions of the species rank categories are presented in Table 7.

Table 7: Definitions of Species Rank Categories

Rank	Definition
At Risk	Species for which a detailed assessment has already been completed (e.g., by COSEWIC or jurisdictional status reports) that determined the species to be at risk of extirpation or extinction. This is a special category that may be used only for species that have been assessed as "Endangered" or "Threatened" according to COSEWIC, or according to a similar future committee in the NWT
May Be At Risk	Species that may be at risk of extinction or extirpation, and are therefore candidates for detailed risk assessment. This is the highest rank that can be given to a species using the General Status Ranking system independent of a more detailed assessment as noted in the At Risk category
Sensitive	Species that are not at risk of extinction or extirpation but may require special attention or protection to prevent them from becoming at risk. These species are ranked with a medium priority for a detailed assessment
Secure	Species which are not at risk or sensitive. These species have the lowest priority for a detailed assessment
Undetermined	Species for which insufficient information, knowledge, or data is available to reliably evaluate their general status
Presence Expected	Species not yet recorded in the NWT, but are expected to be present. These species are expected in the NWT due to their presence in adjacent jurisdiction(s), the presence of appropriate habitat in the NWT, and other evidence. The status rank forms a "Look For" species list

The NWT 2006-2010 plant list was further distilled to include plants found only in the Taiga Shield, and for which suitable habitat was thought to be available in the Project area, and the results are presented below in Table 8.

Table 8: Potential Rare Plants of the Taiga Shield, NWT

Scientific Name	Common Name	Family	NWT Status Rank
Acorus americanus (Acorus calamus)	Several vein sweetflag	*Acoraceae*	May Be At Risk
Atriplex dioica (Atriplex patula)	Thick-leaved orache	*Chenopodiaceae*	May Be At Risk
Callitriche heterophylla (Callitriche anceps)	Large water starwort	*Callitrichaceae*	Undetermined
Cardamine parviflora	Small-flower bitter cress	*Brassicaceae*	May Be At Risk
Carex arcta	Northern clustered sedge	*Cyperaceae*	May Be At Risk
Carex trisperma	Three-seed sedge	*Cyperaceae*	May Be At Risk
Cirsium foliosum	Leafy thistle	*Asteraceae*	May Be At Risk
Cornus suecica	Swedish dwarf dogwood	*Cornaceae*	May Be At Risk
Crassula aquatica	Water pigmy-weed	*Crassulaceae*	May Be At Risk
Cypridedium acaule	Pink lady's-slipper	*Orchidaceae*	Undetermined

Scientific Name	Common Name	Family	NWT Status Rank
Elatine triandra	Long-stemmed waterwort	*Elatinaceae*	Undetermined
Lobelia dortmanna	Water lobelia	*Campanulaceae*	May Be At Risk
Lycopus uniflorus	Northern bugleweed	*Lamiaceae*	Undetermined
Malaxis monophyllos (Malaxis brachypoda)	White adder's mouth	*Orchidaceae*	May Be At Risk
Moehringia macrophylla (Arenaria macrophylla)	Large-leaved sandwort	*Caryophyllaceae*	Sensitive
Nymphaea tetragona	Pygmy white waterlily	*Nymphaeaceae*	Sensitive
Orthocarpus luteus	Yellow owl's clover	*Scrophulariaceae*	May Be At Risk
Polydodium virginianum	Rock polypody	*Polypodiaceae*	Undetermined
Salix pyrifolia	Balsam willow	*Salicaceae*	Secure
Scirpus atrocinctus	Blackgirdled bulrush	*Cyperaceae*	Presence Expected
Senecio eremophilus	Desert groundsel	*Asteraceae*	Sensitive
Sibbaldiopsis tridentata (Potentilla tridentata)	Three-toothed cinquefoil	*Rosaceae*	Sensitive
Silene drummondii (Melandrium drummondii)	Drummond's campion	*Caryophyllaceae*	Undetermined
Trientalis borealis	Northern starflower	*Primulaceae*	Undetermined
Vaccinium myrtilloides	Velvetleaf blueberry	*Ericaceae*	May Be At Risk

6.2 Rare Plant Field Program

Prior to embarking on the field survey, digital orthophotos were examined for unique features such as rock outcrops and microhabitats such as wetlands and drainages that might have rare plant potential. Candidate sampling locations were selected and marked. Sites were also chosen within representative areas of some of the common ecosystem types within the LSA.

The 2009 early summer rare plant surveys were conducted within the LSA by vegetation ecologists from June 22 through June 29, 2009. During field work, rare plant surveys were done at the targeted locations which were deemed to have rare plant potential. At each plot, vegetation ecologists followed the procedure set out by the Alberta Native Plant Council (Lancaster 2000) which consists of conducting a “random meander” within a plant community and compiling a species list until no new species are found. Specimens requiring further examination or species confirmation were collected, with the exception of plants where seed heads or flowers required for identification to species level were unavailable or where plant populations were small (i.e., fewer than 20) (Lancaster 2000).

6.3 Results

Fifty six plots were assessed for rare plants, eight of which were solely rare plant survey plots and 48 were done in conjunction with the TEM survey plots. Plot coordinates and site descriptions are provided in Appendix J (Interim: Rare Plant Survey Coordinates and Site Details), and a visual depiction of survey plot locations is provided in Figure 4 (Thor Lake 2009 Rare Plant Survey Locations).

A preliminary list of 147 plant species (including mosses and lichens) were documented during the survey and are listed in Appendix K, Interim: Thor Lake preliminary species list. One rare plant, rock polypody, *Polypodium virginianum* (Figure 5), was discovered approximately 100-150 meters from the eastern shore of Long Lake on a north facing granite outcrop (Rare Plant Plot Number *RPE-015* with UTM coordinates: 417939 E, 6885702 N). The population size of the specimen was deemed sufficient to allow a voucher specimen to be collected (presently housed in the herbarium at the Stantec Sidney office).

Polypodium virginianum (L.) is an evergreen fern which grows to 20 cm tall, with fronds arising singly along a scaly rhizome. In the NWT, *P. virginianum* is occasionally found on mossy ledges and cliffs in wooded parts of the Precambrian Shield area, north to Great Bear Lake; and in the Mackenzie Mountains known only from Mount Coty, opposite Fort Liard. Its general distribution is circumpolar, ranging from Labrador to BC and SW Mackenzie (Porsild and Cody 1980). This species is currently ranked as “undetermined”, therefore it is not necessarily rare in the NWT, but not enough is known about its frequency or abundance.

Thor Lake Rare Plant Survey Locations 2009

Legend

- Rare Plant Survey Location
- LSA
- Watercourse
- Waterbody

Ecosystem Map Unit

- BF - black spruce-feathermoss-crowberry upland forest
- BG - black spruce-cloudberry-sphagnum moss bog forest
- BT - black spruce-tamarack-water sedge fen
- LA - lake
- LL - labrador tea-reindeer lichen-black spruce bog
- LW - lichen-bearberry woodland
- MI - mine
- OW - shallow open water
- PA - paper birch-aspen-willow forest
- PD - pond
- RL - bedrock-lichen-juniper-saxifrage
- RO - bedrock
- RW - rural/camp
- RZ - road surface
- SP - spruce-paper birch-toadflax forest
- SS - scrub birch-sweet gale-bog rosemary fen
- WA - white spruce-green alder-prickly rose forest
- WB - water sedge-buckbean-arrow grass fen
- WH - white spruce-horsetail-glow moss forest

Structural Modifier

e.g. 6WA4m

a = low shrub
b = tall shrub
i = irregular canopy
m = multistoried canopy
s = single canopy
t = two storied canopy

N

0 0.5 1 1.5

Kilometres

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Figure 5: *Polypodium virginianum* on a granite outcrop at the east end of Long Lake within the Thor Lake Local Study Area

6.4 Summary

In June of 2009, a rare plant survey was conducted in the Thor Lake Project area. Of 147 species identified during the survey, one species, rock polypody (*Polypodium virginianum*), a plant of "undetermined status rank", was found at one of the 56 surveyed sites. With regard to rare ecosystems, the Northwest Territories do not currently maintain a listing of rare ecosystems.

7 CLOSURE

Stantec has prepared this report for the sole benefit of Avalon Rare Metals Inc. for the purposes of documenting baseline conditions in anticipation of an environmental assessment under the Federal *Environmental Assessment Act*. The report may not be relied upon by any other person or entity, other than for its intended purposes, without the express written consent of Avalon Rare Metals Inc. and Stantec. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties.

The information provided in this report was compiled from existing documents and data provided by Avalon Rare Metals Inc., field data compiled by Stantec (formerly Jacques Whitford AXYS Ltd.), and by applying currently accepted industry and governmental standards. This report represents the best professional judgment of our personnel available at the time of its preparation. Stantec reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

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APPENDIX A

Interim RSA Vegetation Classification

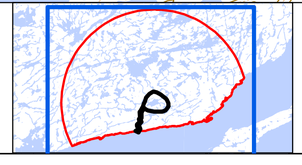
Legend

- Regional Study Area (15km buffer)
- LSA Boundary
- Contour - Intermediate
- Contour - Index (50 Feet)

Class

- Open Water
- Shallow Water
- Spruce Wet
- Sedge Fen
- Shrub Fen
- Treed Fen
- Broadleaf Upland
- Mixed Upland
- Spruce Upland
- Bedrock Lichen
- Bedrock
- No Data

Vegetation Classification for the RSA 2009



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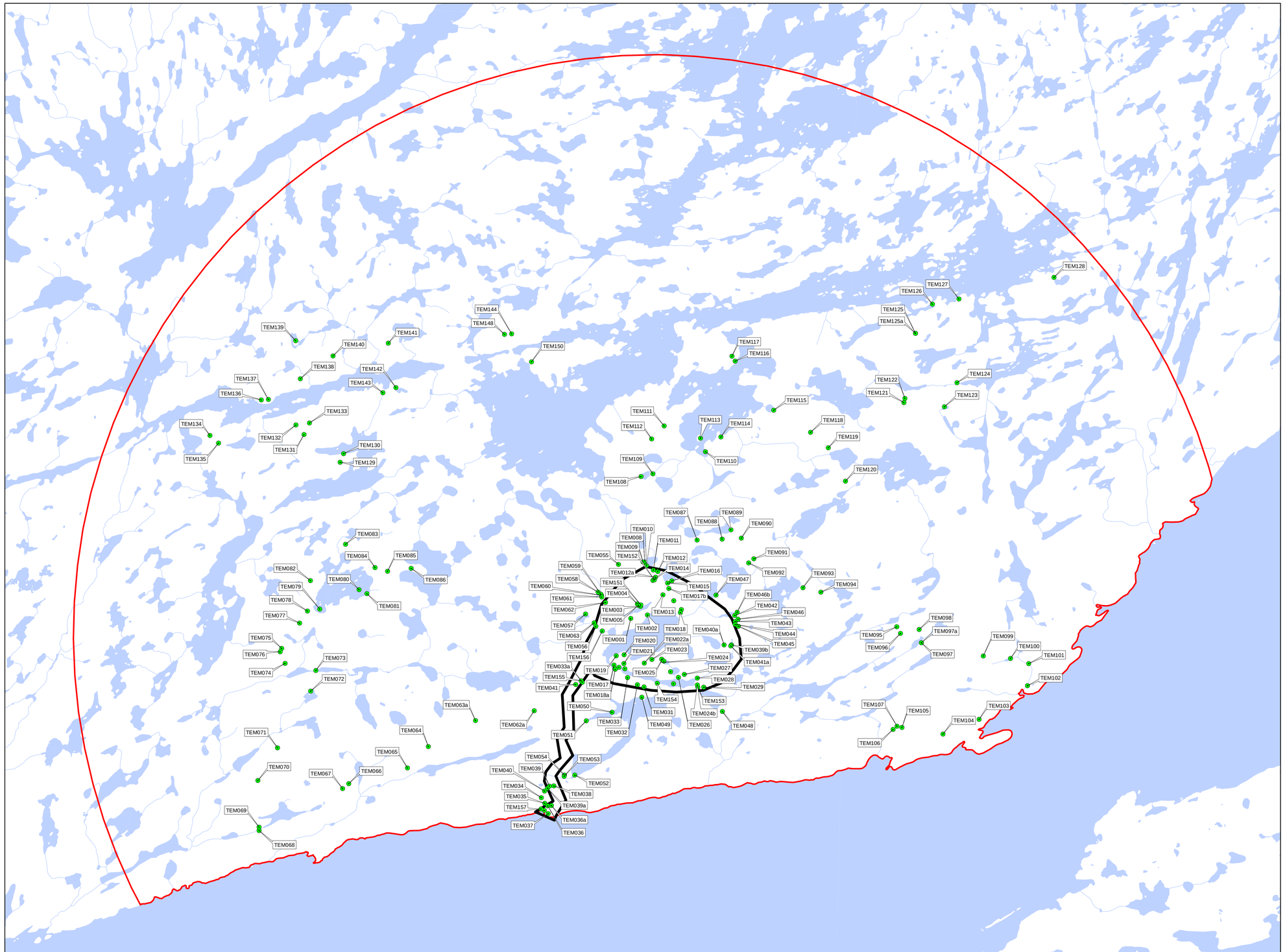
APPENDIX B

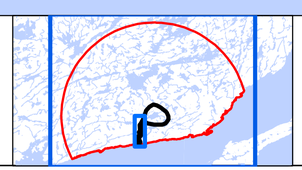
Ecosystem Mapping Field Survey 2009 Locations (RSA &LSA)



Legend

- Field Survey Locations 2009
- LSA
- Regional Study Area (15km buffer)

THOR LAKE
Ecosystem Mapping
Field Survey Locations 2009
(RSA and LSA)



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0 2.5 5 Kilometers

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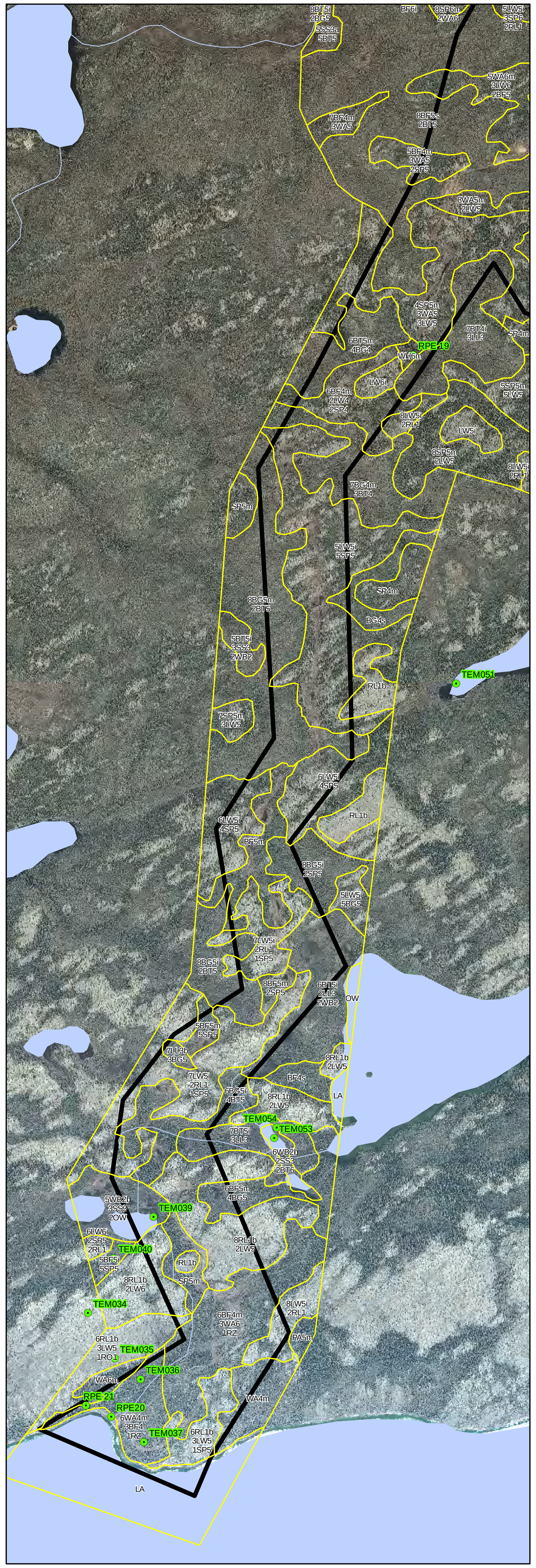
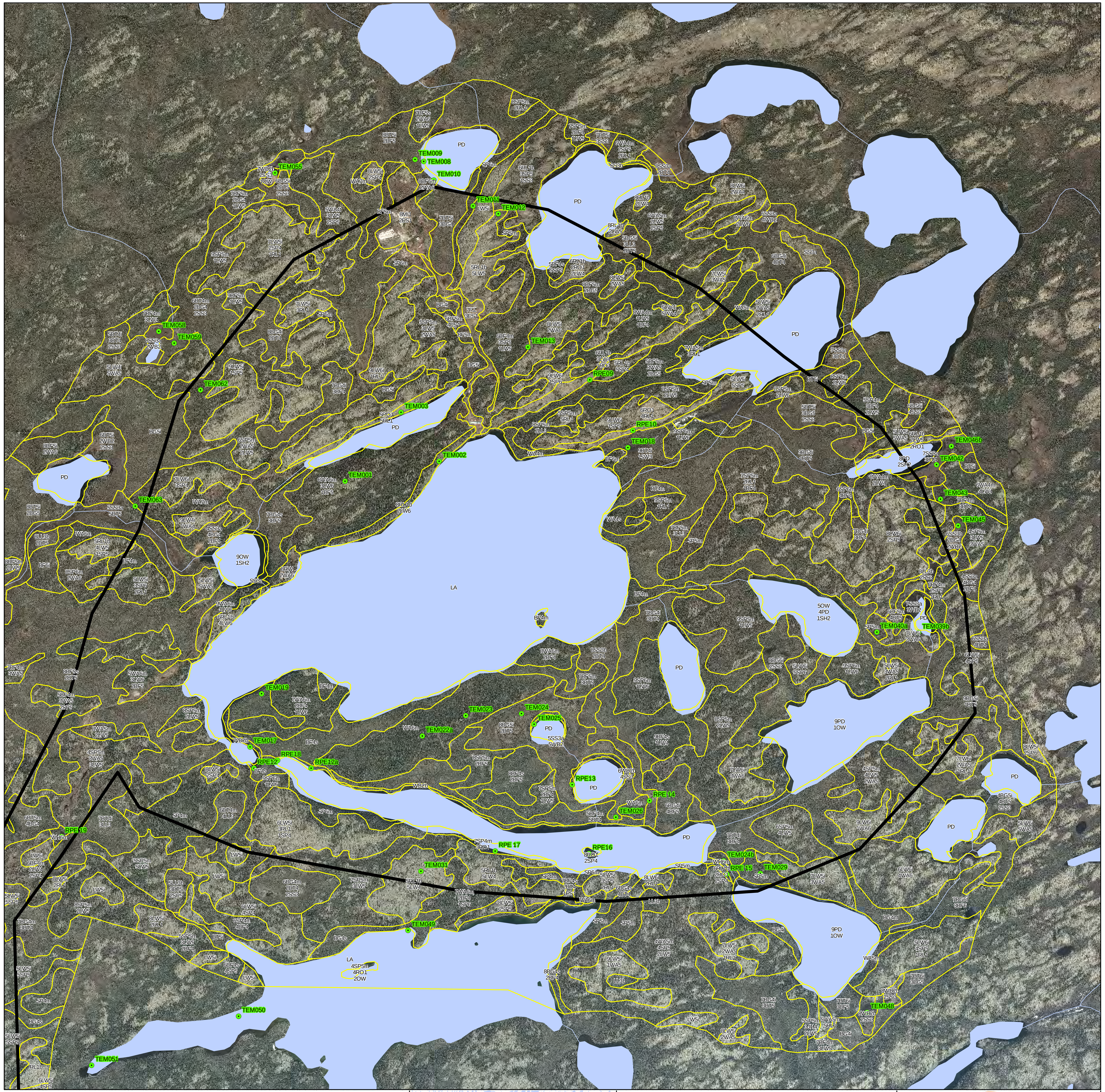
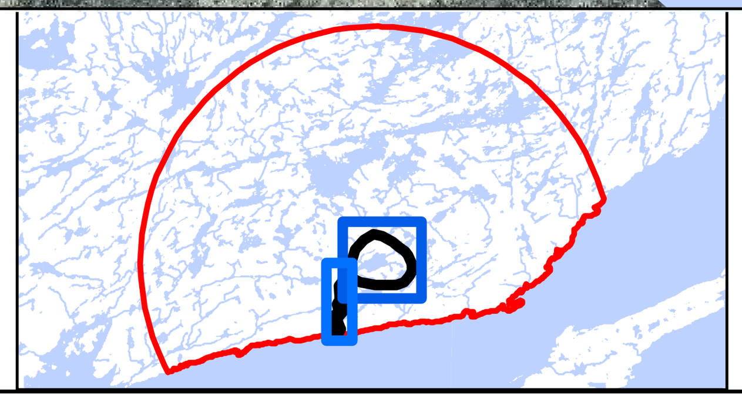
APPENDIX C

Interim LSA Ecosystem Map (on Orthophoto)







Legend

- Survey Locations
- Ecosystem Polygons
- LSA
- RSA (15km buffer)

Structural Modifier

e.g. 6WA4m

a = low shrub
b = tall shrub
i = irregular canopy
m = multistoried canopy
s = single storied canopy
t = two storied canopy

THOR LAKE
Terrestrial Ecosystem Map on Orthophoto

N

0 100 200 300
Meters

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APPENDIX D

Interim Regional Mapping Unit Descriptions

Bedrock-Lichen: Crest or upper slope position with rapid to very rapid drainage and tree cover from 0-30%. Shallow soils (5-30cm) with >30% exposed rock or sparsely vegetated rock (crust lichens).

Upland Pine: Upper slope position with rapid to well drained shallow soils (<50cm to bedrock) supporting pine forests.

Spruce Upland: Upper slope to crest position with well to moderately well drained soils. Shallow soils (<50cm to bedrock) with poor to medium nutrient regimes that support both white and black spruce.

Spruce Wet: Imperfect to poorly drained sites that support spruce stands. Isolated pockets of permanent seepage may be present.

Mixed Upland: Mid to lower slope position with moderately well drained shallow soils supporting a mixture of coniferous and deciduous species.

Broadleaf Upland: Mid to upper slope position with well drained shallow soils that support deciduous forests.

Shrub Upland: Imperfect to well drained sites, sparsely vegetated (fire regeneration) with open low shrubs.

Shrub Riparian: Imperfect to poorly drained sites along streams, lakes and wetlands that support shrubs and sparse tree cover.

Treed fen: Poorly drained moderately rich sites that support black spruce and tamarack. Open shrubby forests, often found adjacent to riparian areas.

Shrub Wet: Poorly drained open shrub communities with sparse and stunted black spruce; sometimes associated with thick organics over rock on lower slopes or very wet depressions.

Shrub Fen: Very poorly drained shrub communities found on thick organics with sparse, stunted black spruce and tamarack.

Sedge Fen: Very poorly drained sedge communities found on thick organics with a high water table.

Marsh/Shallow Water: Level and depressional areas around the shorelines of water bodies and riparian zones dominated by emergent sedges and rushes.

Exposed Soil/Barren Land: land devoid of vegetation due to extreme climatic or edaphic conditions. It includes areas of recent disturbance, such as mud slides, debris torrents, avalanches, and human disturbances.

Gravel Bar: An elongated landform generated by waves and currents, usually running parallel to the shore. It is composed of unconsolidated small rounded cobbles, pebbles, stones and sand.

Lake: A naturally occurring static body of water, greater than 2m deep in some portion. The boundary of the lake is the natural high water mark.

Pond: A small body of water greater than 2m deep but not large enough to be classified as a lake.

River: A watercourse formed when water flows between continuous, definable banks. The flow may be intermittent or perennial.

Bedrock: A gentle to steep, bedrock escarpment or outcropping, with little soil development and sparse vegetative cover.

Settlement: An area in which residences and other human developments form an almost continuous covering of the landscape. These areas include cities and towns, subdivisions, commercial and industrial parks, and similar developments both inside and outside city limits.

APPENDIX E

Interim LSA Ecosystem Descriptions

REGIONAL MAPPING CATEGORIES AND ECOSITE DESCRIPTIONS

The following are descriptions of the regional mapping categories and ecosites which outline the main vegetation and site characteristics found in the Great Slave Upland High Boreal Ecoregion that includes the Thor Lake Project area. These descriptions are based on field data collected during the summer of 2009. However, in general, the main characteristics of this ecoregion are a nearly level bedrock plain with thin discontinuous till veneers, scattered outwash and lacustrine deposits, and a mosaic of black spruce woodlands with jack pine and paper birch regeneration on burnt areas (Ecosystem Classification Group 2008).

Regional Mapping Category: Bedrock – Lichen

This vegetation community is typically found on a crest or upper slope position with rapid to very rapid drainage and tree cover from 0-30%. Shallow soils (5-30cm) with >30% exposed rock or sparsely vegetated rock (crust lichens).

Ecosite RL: Bedrock – Lichen – Juniper – Saxifrage

The moisture regime for this ecosite is xeric to very xeric with a poor to very poor nutrient regime. This ecosite typically has very rapid drainage and water storage capacity is essentially nil due to fragmental or shallow soils. These ecosites are often associated with a crest position and more than 30% exposed rock or sparsely vegetated rock (crust lichens).

Tree cover is usually less than 10% and may include jack pine, white spruce or deciduous species. Trees are usually stunted and of poor form due to the extremely dry conditions and poor to very poor nutrient regime. Characteristic shrub species are common juniper (*Juniperus communis*), creeping juniper (*Juniperus horizontalis*) and common bearberry (*Arctostaphylos uva-ursi*). The forb layer includes species such as three-toothed saxifrage (*Saxifraga tricuspidata*), rusty woodsia (*Woodsia* ilvensis) and parsley fern (*Crytogramma crispa*). A nearly continuous cover of crust lichens and reindeer lichens can be found on these sites.

Photo 1: Representative RL Ecosite: Bedrock – Lichen – Juniper – Saxifrage (Example TEM Field Site Number 34)

Ecosite LW: Lichen – Bearberry – Woodland

Ecosite LW is found in subxeric and xeric conditions with a poor to very poor nutrient regime. This ecosite is well or rapidly drained with shallow soils ranging from 5 – 30 cm. Slope positions range from upper to crest with variable aspects.

Tree cover is sparse (10 – 30%) with jack pine and/or white spruce being the dominant species. Shrubs species include common bearberry (*Arctostaphylos uva-ursi*), common juniper (*Juniperus communis*), creeping juniper (*Juniperus horizontalis*), Canada buffaloberry (*Sheperdia canadensis*) and crowberry (*Empetrum nigrum*). The forb layer includes species such as three-toothed saxifrage (*Saxifraga tricuspidata*), rusty woodsia (*Woodsia* ilvensis), plains wormwood (*Artemisia* campestris) and parsley fern (*Crytogramma crispa*). A discontinuous cover of crust and reindeer lichens can be found on these sites.

Photo 2: Representative LW Ecosite: Lichen – Bearberry – Woodland (Example TEM field site number 13)

REGIONAL MAPPING CATEGORY: PINE UPLAND

This vegetation community is typically found on upper slope positions with rapid to well-drained shallow soils (<50 cm to bedrock) that support pine forests.

Ecosite JH: Jack Pine – Heath – Lichen – Upland Forest

Ecosite JH is found in upper slope positions (> 10% slope) with a submesic to subxeric moisture regime. The soil nutrient regime is typically poor with shallow soils over bedrock (< 50 cm).

Jack pine is the dominant tree species, regenerating after forest fires and representing an intermediate seral stage. Crown closure ranges between 10 and 40% in old stands but can be as high as 70% in younger stands. The shrub layer is represented by lingonberry (Vaccinium vitis-idaea). The forb layer will typically have American milk vetch (Astragalus americanus). Ground cover includes various lichens/mosses and rock (EBA Engineering Consultants Ltd. 2005).

No field plots were established in the LSA (very little of this ecosystem occurs in the LSA), however the ecosite was seen in the RSA, and the photo below was taken in the RSA from a helicopter

Photo 3: Representative JH Ecosite: Jack Pine – Heath – Lichen – Upland Forest (Example RSA air call number 117)

REGIONAL MAPPING CATEGORY: SPRUCE UPLAND

This vegetation community is typically found on lower slope to crest positions with well to moderately well drained and somewhat coarse textured soils. Shallow soils (<50cm to bedrock) with poor to medium soil nutrient regimes that support both white and black spruce.

Ecosite BF: Black Spruce – Feathermoss – Crowberry – Upland Forest

Ecosite BF is found in subhygric to submesic moisture regimes with typically poor soil nutrient regime. Topographically, this ecosite is usually found on the lower or mid-slope position with variable aspects.

Black spruce is the dominant tree species but white spruce may also occur. Tree height is usually less than 10m with crown closure ranging from 10-40%. Characteristic shrub species include green alder (*Alnus crispa*), Labrador tea (*Ledum groenlandicum*), crowberry (*Empetrum nigrum*), and alpine bearberry (*Arctostaphylos rubra*). The forb layer includes species such as dwarf scouring rush (*Equisetum scripoides*) and three-toothed cinquefoil (*Potentilla tridentata*). The ground cover includes a variety of lichens and feathermosses.

Photo 4: Representative BF Ecosite: Black Spruce – Feathermoss – Crowberry – Upland Forest (Example TEM field site number 40)

Ecosite WA: White Spruce – Green Alder – Prickly Rose – Upland Forest

Ecosite WA is found on mesic to submesic moisture regimes with poor to medium nutrient regimes. This ecosite is typically found in the upper slope to crest position (5 – 15% slope) with well drained sandy loam soils but may also occur on the mid or lower slope positions. The depth to bedrock is shallow (<50 cm) and there is often <70% coarse fragments.

Forests on these sites are moderately productive and dominated by white spruce. Tree heights of mature (older) stands are in the 20 m range with diameters up to 30 cm. Green alder (*Alnus crispa*), low bush-cranberry (*Viburnum edule*) and prickly rose (*Rosa acicularis*) are characteristic species in the shrub layer. Northern bastard toadflax (*Geocaulon lividum*) and fairyslipper (*Calypso bulbosa*) are often found in the forb layer. Red stemmed feathermoss (*Pleurozium schreberi*) and stair-step moss (*Hylocomium splendens*) are common ground cover species.

Photo 5: Representative WA Ecosite: White Spruce – Green Alder – Prickly Rose – Upland Forest (Example TEM field site number 22a)

REGIONAL MAPPING CATEGORY: MIXED UPLAND

This vegetation community is typically found on mid to lower slope positions with moderately well-drained shallow soils supporting a mixture of coniferous and deciduous species.

Ecosite SP: Spruce – Paper Birch – Toadflax – Forest

Ecosite SP is found in subhygric to submesic moisture regimes with a poor to medium nutrient regime and silty soils. This ecosite occupies both the mid to lower slope position (5-10% slope) and also occurs in moderately shallow soils over bedrock where pockets of soil has developed in association with the RL and LW ecosites.

The forest canopy is predominately a mixture of white spruce and paper birch but black spruce may also be present. These moderately productive sites have a well developed shrub layer with green alder (*Alnus crispa*), Labrador tea (*Ledum groenlandicum*) and lingonberry (*Vaccinium vitis-idaea)* being common. The forb layer often contains Northern bastard toadflax (*Geocaulon lividum*), fairyslipper (*Calypso bulbosa*) and alpine bearberry (*Arctostaphylos rubra*). Red stemmed feathermoss (*Pleurozium schreberi*), stair-step moss (*Hylocomium splendens*) and reindeer lichens are common ground cover species.

Photo 6: Representative SP Ecosite: Spruce – Paper Birch – Toadflax – Forest (Example TEM field site number 40a)

REGIONAL MAPPING CATEGORY: BROADLEAF UPLAND

This vegetation community is typically found on mid to upper slope positions with well-drained shallow soils that support a continuous canopy of deciduous forests.

Ecosite PA: Paper Birch – Aspen – Willow – Forest

Ecosite PA has a submesic moisture regime with a medium nutrient regime. The slope position ranges from mid to upper with well drained moderately deep loamy soils.

Paper birch or aspen dominates the tree canopy layer and white spruce may be a minor component. Crown closure can range from 50-80% with tree heights generally less than 15m. Willow (*Salix* spp.), common juniper (*Juniperus communis*) and northern black currant (*Ribes hudsonianum*) are typically found in the shrub layer. The forb and ground cover species have not been documented for this ecosite.

Photo 7: Representative PA Ecosite: Paper Birch – Aspen – Willow – Forest (Example TEM field site number 141)

REGIONAL MAPPING CATEGORY: SHRUB UPLAND

This vegetation community is typically found on imperfect to well drained sites, sparsely vegetated (fire regeneration) with open low shrubs.

Ecosite SL: Scrub Birch – Willow – Alder – Open Shrub

Ecosite SL is found on subhygric to submesic sites with a medium nutrient regime. This sparsely vegetated ecosite occurs as a result of fire and is dominated by open low shrubs. The forb and ground cover species have not been documented for this ecosite. This ecosystem type was mapped in the RSA but not currently mapped in the LSA.

No photos taken.

REGIONAL MAPPING CATEGORY: SHRUB RIPARIAN

Ecosite SW: Scrub Birch – Willow – Water Sedge – Riparian Shrub

Ecosite SW is found on subhygric to hygric soil moisture regimes with a medium to rich nutrient regime. This ecosite is found in riparian areas adjacent to small streams where there is sparse tree cover but dense shrub cover usually less than 5m tall.

Typical shrub species include scrub birch (*Betula glandulosa*) and willow (*Salix* spp). The forb and ground cover species include water sedge (*Carex aquatilis*) and buckbean (*Menyanthes trifolium*).

Photo 8: Representative SW Ecosite: Scrub Birch – Willow – Water Sedge – Riparian Shrub

REGIONAL MAPPING CATEGORY: SPRUCE WET

This vegetation community is typically found on imperfect to poorly drained sites that support both white spruce and black spruce stands. Isolated pockets of permanent seepage may be present.

Ecosite WH: White Spruce – Horsetail – Glow Moss – Forest

Ecosite WH is typically a small, localized site found on subhygric to hygric moisture regimes with a medium to rich nutrient regime. Small isolated pockets of permanent seepage maybe present. The slope position is typically depressional or level.

White spruce is the dominant tree species but very minor amounts of black spruce and paper birch may also be present.. The shrub layer is not well developed with Labrador tea (*Ledum groenlandicum*) and lingonberry (*Vaccinium vitis-idaea*) usually present. Forb species include a high cover of common horsetail (*Equisetum arvense*) and a variety of sedge species. Ground cover species include stair-step moss (*Hylocomium splendens*) and glow moss (*Aulacomnium palustre*).

Photo 9: Representative WH Ecosite: White Spruce – Horsetail – Glow Moss – Forest (Example TEM field site number 155)

Ecosite BG: Black Spruce – Cloudberry – Sphagnum Moss – Bog – Forest

Ecosite BG occurs on subhygric to hygric moisture regimes that also have a poor soil nutrient regime. It is found on lower or depressional slope positions as well as toe and level positions.

These low productivity sites support sparse and stunted stands of black spruce typically ranging from 5 – 8 m in height. These sites usually occur on thin organic soils over bedrock, but may also form on lacustrine deposits. The well-developed shrub layer has a high cover of lingonberry (*Vaccinium vitis-idaea*), Labrador tea (*Ledum groenlandicum*) and or northern Labrador tea (*Ledum decumbens*). Typical species in the forb layer include cloudberry (*Rubus chamaemorus*) and red baneberry (*Actaea rubra*). Sphagnum moss, reindeer lichens, and glow moss (*Aulacomnium palustre*) are common ground cover species.

Photo 10: Representative BG Ecosite: Black Spruce – Cloudberry – Sphagnum Moss – Bog – Forest (Example TEM field site number 24)

REGIONAL MAPPING CATEGORY: TREED FEN

This vegetation community is typically found on poorly drained sites that support black spruce and tamarack. Open shrubby forests, often found adjacent to riparian areas.

Ecosite BT: Black Spruce – Tamarack – Water Sedge – Fen

Ecosite BT is found on hygric to subhydric moisture regimes with a poor to medium nutrient regime. Slope position can vary from level, depressional, lower or toe. These sites are often present around water bodies or are transitional to riparian areas.

Black spruce and tamarack are the dominant tree species but tree cover is sparse. These ecosites are located on organic soils that form open shrubby forests ranging from 5 to 10 m in height. The typical shrub species include willow (*Salix* spp.), Labrador tea (*Ledum groenlandicum*) and scrub birch (*Betula glandulosa*). The forb layer consists of various sedge species, common horsetail (*Equisetum arvense*) and cloudberry (*Rubus chamaemorus*). Glow moss (*Aulacomnium palustre*) is the dominant ground cover.

Photo 11: Representative BT Ecosite: Black Spruce – Tamarack – Water Sedge – Fen (Example TEM field site number 46b)

REGIONAL MAPPING CATEGORY: SHRUB WET

This vegetation community is typically found on poorly drained open shrub communities with sparse and stunted black spruce; sometimes associated with thick organics over rock on lower slopes or very wet depressions.

Ecosite LL: Labrador Tea – Reindeer Lichen – Black Spruce – Bog

Ecosite LL is found on hygric and subhydric moisture regimes with a poor nutrient regime. This ecosite may have a thick organic layer over sloping rock on lower slopes, and also occur at times in very wet depressions.

Generally, the vegetation consists of very open shrub communities with sparse & stunted black spruce (<5m tall), tamarack is usually absent. Shrub species include scrub birch (*Betula glandulosa*) and dwarf bog-rosemary (*Andromeda polifolia*). The characteristic species in the forb layer is water sedge (*Carex aquatilis*). Reindeer lichen species are the dominant ground cover.

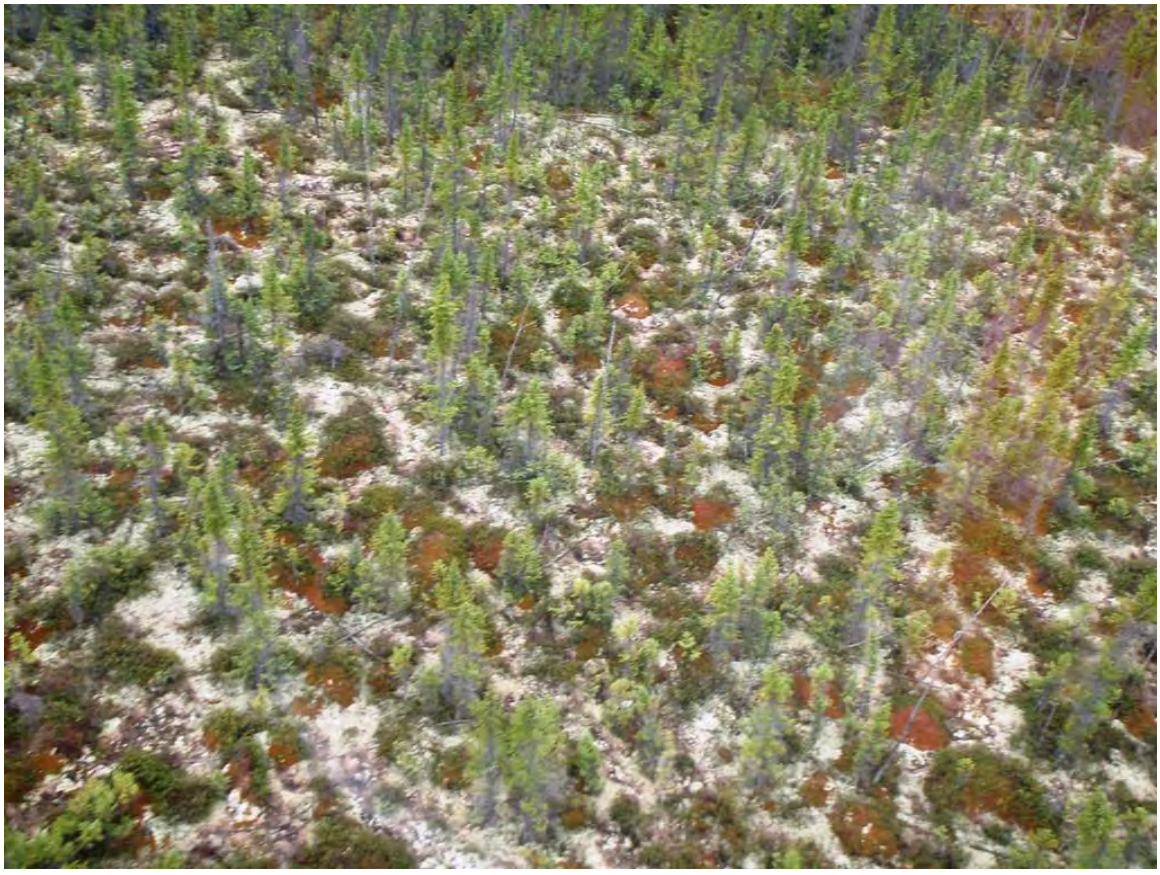


Photo 12 Representative LL Ecosite: Labrador Tea – Reindeer Lichen – Black Spruce – Bog (Example TEM field site number 121)

REGIONAL MAPPING CATEGORY: SHRUB FEN

This vegetation community is typically found on very poorly drained shrub communities found on thick organics with sparse, stunted black spruce and tamarack.

Ecosite WS: Willow – Scrub Birch – Alder – Tall Shrub – Fen

Ecosite WS is found on hygric and subhydric moisture regimes with a medium nutrient regime on organic soils. The slope position is depressional or level.

The tree canopy is a sparse cover of stagnated black spruce and tamarack. Willow (*Salix* spp.), scrub birch (*Betula glandulosa*) and alder (*Alnus* spp.) are the characteristic shrub species. The forb and ground cover species have not been documented for this ecosite.

No photos taken.

Ecosite SS: Scrub Birch – Sweet Gale – Bog Rosemary – Fen

Ecosite SS is found on subhydric to hygric moisture regimes with a medium to rich nutrient regime on organic soils. The slope position is depressional or level and the ecosite is usually forming a transitional band between the sedge fen (and ponds and lakes) and the treed fen or wet spruce forests.

Stunted black spruce and tamarack can be found scattered throughout this dominantly shrub community. The dominant shrub species are scrub birch (*Betula glandulosa*), willow (*Salix* spp.) sweet gale (*Myrica gale*), and dwarf bog rosemary (*Andromeda polifolia*), and generally form a discontinuous cover less than two meters in height. Water sedge (*Carex aquatilis*), dwarf raspberry (*Rubus arcticus*) and tufted bulrush (*Scirpus caespitosus*) are commonly found in the forb/graminoid layer.

Photo 13: Representative SS Ecosite: Scrub Birch – Sweet Gale – Bog Rosemary – Fen (Example TEM field site number 42)

REGIONAL MAPPING CATEGORY: SEDGE FEN

This vegetation community is typically found on very poorly drained sedge communities found on thick organics with a high water table.

Ecosite WB: Water Sedge – Buckbean – Arrow Grass – Fen

Ecosite WB is found on subhydric to hydric moisture regimes with a rich to very rich nutrient regime. Standing water is often present as these sites are either found immediately adjacent to lakes and ponds or within localized depressions across the landscape.

The tree canopy is absent and the shrub layer usually contains minor amounts of scrub birch (*Betula glandulosa*), sweet gale (*Myrica gale*), dwarf bog rosemary (*Andromeda polifolia*) and willow (*Salix* spp.). The herbaceous layer forms the dominant cover and includes buck bean (*Menyanthes trifoliata*), arrow-grass (*Triglochin maritima*) and water sedge (*Carex aquatilis*).

Photo 14: Representative WB Ecosite: Water sedge - Buckbean - Arrow Grass Fen (Example TEM field site number 25)

REGIONAL MAPPING CATEGORY: MARSH/SHALLOW WATER

This vegetation community is typically found on level and depressional areas around the shorelines of water bodies and riparian zones dominated by emergent sedges and rushes.

Ecosite SH: Swamp Horsetail – Marsh

Ecosite SH is found on hydric sites with a rich to very rich nutrient regime. Tree and shrub canopies are absent and swamp horsetail (*Equisetum fluviatile*) is the dominant forb species.

Photo 15: Representative SH Ecosite: Swamp Horsetail – Marsh (Example TEM field site number 110)

Ecosite GB: Great Bulrush – Marsh

Ecosite GB is found on hydric sites with a very rich nutrient regime. Tree and shrub canopies are absent and great bulrush (*Scirpus lacustris*) is the dominant forb species.

No photos taken.

APPENDIX F

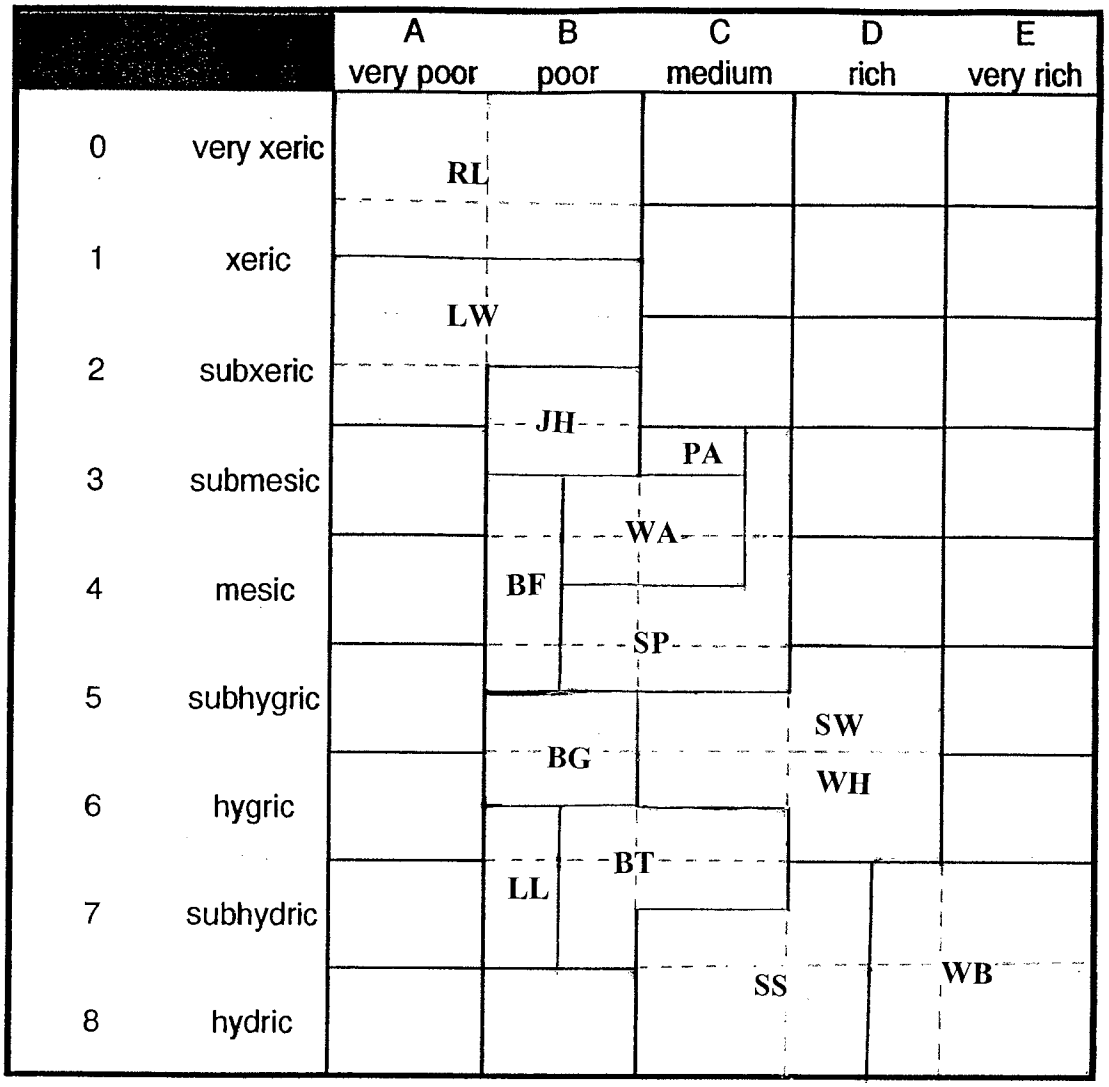
Interim Ecosystem Mapping Legend and Mapped Hectares

Map Code	Final Name	Mapped Area (ha)	Description	Soil Drainage
BF	black spruce – feathermoss – crowberry upland forest	187	moist to moderately dry upland poor forest	moderate (well)
BG	black spruce – cloudberry – sphagnum moss bog forest	243	very moist to wet black spruce forest, poor low productive sparse forest, usually thin soils over bedrock	imperfect-poor
BT	black spruce – tamarack – water sedge fen	128	wet to very wet black spruce tamarack moderately rich open shrubby forest, often along riparian areas and wetlands	poor
JH	jack pine – heath – lichen forest	not mapped	upper slope, >10% slope, shallow to bedrock (<50 cm), >70% crown closure	rapid - well
LA	lake	197	naturally occurring static body of water, greater than 2 m deep in some portion. The boundary for the lake is the natural high water mark.	n/a
LL	labrador tea – reindeer lichen – black spruce bog	6	very open non-treed shrubby community with sparse and short black spruce, sometimes thick organics over sloping rock on lower slopes, and sometimes very wet depressions	poor
LW	lichen – bearberry woodland	291	jack pine and/or white spruce open woodland, crest and upper slope position, sparsely 10 – 30% treed, very dry and rapidly drained, generally 5 – 30 cm soil development	rapid – well
MI	mine	6	unvegetated area used for the extraction of mineral ore and other materials.	n/a
OW	shallow open water	14	wetland composed of permanent shallow open water and lacking extensive emergent plant cover. The water is less than 2 m deep. (If vegetated, these units should developed into site series groups for interpretation.)	n/a
PA	paper birch – aspen – willow forest	1	mid to upper slope on significant aspect, well drained deciduous forest on shallow soils	well
PD	pond	142	small body of water greater than 2 m deep, but not large enough to be classified as a lake (e.g., less than 50 ha).	n/a
RL	bedrock – lichen – juniper – saxifrage	81	crest position, >30% exposed rock or sparsely vegetated rock (crust lichens), <10% trees, very dry and very rapidly drained	very rapid
RO	bedrock	5	A gentle to steep, bedrock escarpment or outcropping, with little soil development and sparse vegetative cover.	n/a

Map Code	Final Name	Mapped Area (ha)	Description	Soil Drainage
RW	rural/camp	1	residences such as farms and other human developments such as work or recreational camps spread out over the landscape.	n/a
RZ	road surface	4	area cleared and compacted for the purpose of transporting goods and services by vehicles.	n/a
SL	scrub birch – willow – alder open shrub	not mapped	sparsely vegetated (fire regeneration) open low shrub	imperfect-well
SP	spruce – paper birch – toadflax forest	255	mid to lower slope, 5 – 10% slope, moderately shallow silty loam soils over rock, mod productive spruce or jack pine and paper birch community	moderate (well)
SS	scrub birch – sweet gale – bog rosemary fen	38	shrub dominated fen dominated by scrub birch, sweet gale, and bog rosemary	very poor
SW	scrub birch – willow – water sedge riparian shrub	184	riparian shrub community along streams, mineral soil, sparse tree species less than 5 m tall	imperfect - poor
WA	white spruce – green alder – prickly rose forest	184	upper slope to crest position, well drained sandy loam soils, shallow to bedrock (<50 cm), 5 – 15% slope, <70% coarse fragments, productive forest	well
WB	water sedge – buckbean – arrow grass fen	12	wetland fen dominated by sedges, buckbean and arrow-grass	very poor
WH	white spruce – horsetail – glow moss forest	1	wet to very wet white spruce forest, isolated pockets of permanent seepage	imperfect-poor

APPENDIX G

Edatopic Grid of Mapped Ecosystems within the LSA


A
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B
poor
C
medium
D
rich
E
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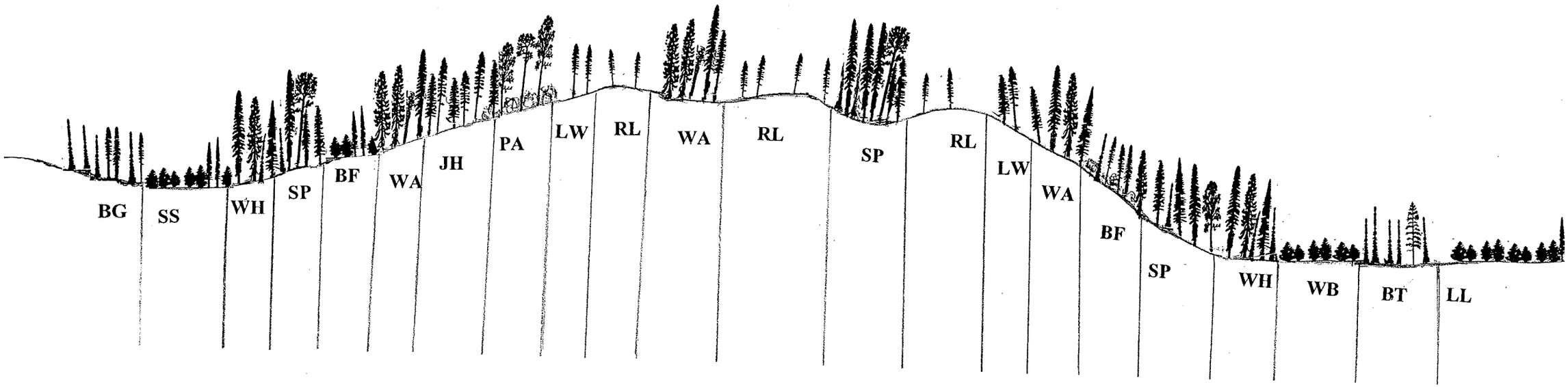
0
very xeric
1
xeric
2
subxeric
3
submesic
4
mesic
5
subhygric
6
hygric
7
subhydric
8
hydric
RL
LW
JH
PA
WA
BF
SP
SW
BG
WH
BT
LL
SS
WB

APPENDIX H

Landscape Profile of Mapped Ecosystems within the LSA

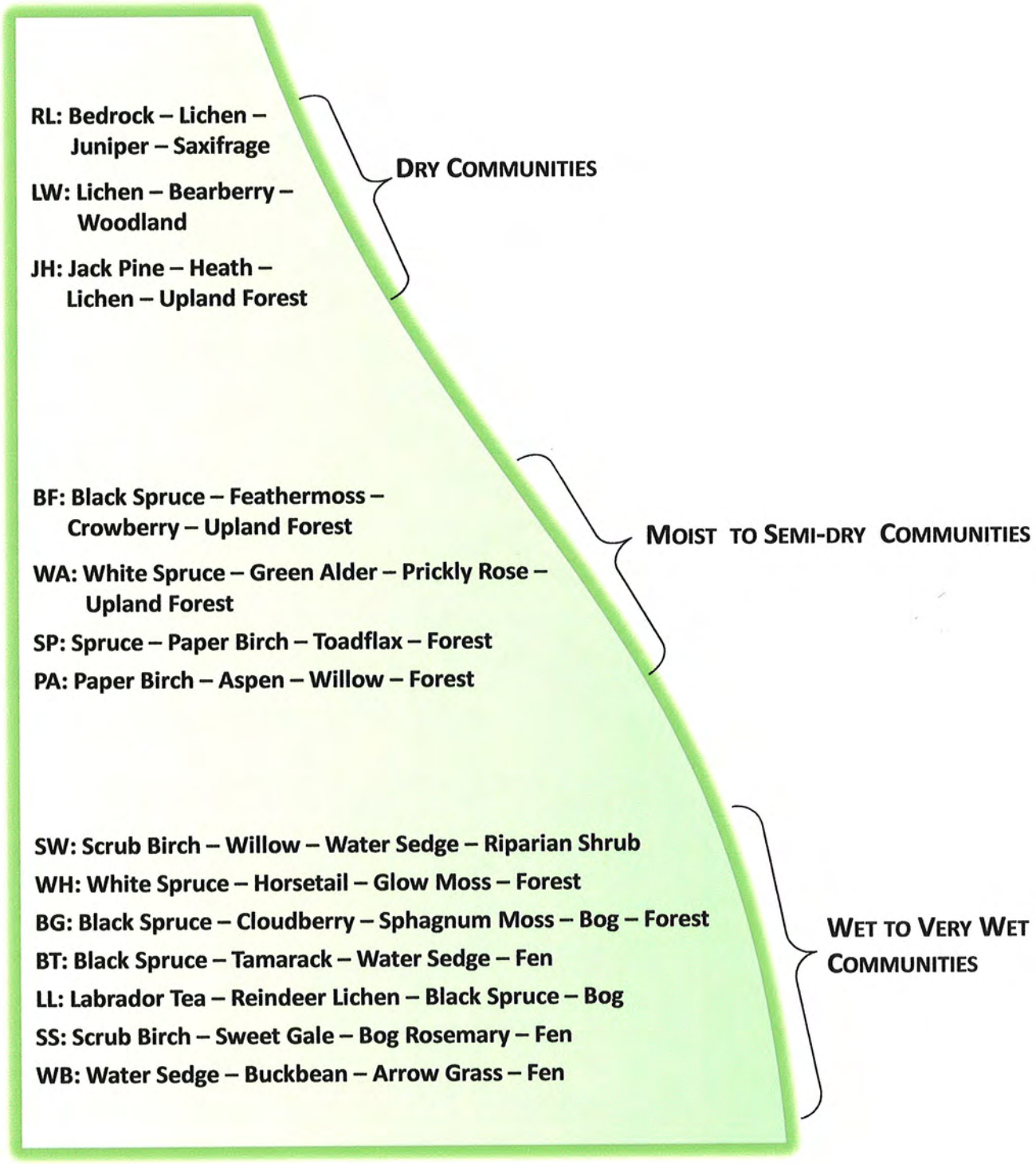
Appendix H: Landscape Profile of Ecosites within the Local Study Area



APPENDIX I

Moisture Regimes and Ecosystems found within the LSA

Appendix I Moisture Regimes and Ecosites Found within the Local Study Area



APPENDIX J

Interim Rare Plant Survey Coordinates

Plot Name and #	Northing	Easting	Date	Elevation (m)	Aspect (degrees)
RPE 09	6887944	417317	24-Jun-09	258	180
RPE 10	6887714	417513	24-Jun-09	250	180
RPE 12	6886169	415807	25-Jun-09	231	N/A
RPE 12a	6886183	416054	25-Jun-09	244	no data
RPE 13	6886108	417237	25-Jun-09	240	no data
RPE 16	6885795	417313	25-Jun-09	237	no data
RPE 18	6886218	415901	25-Jun-09	246	no data
RPE 20	6882519	413969	26-Jun-09	160	239
TEM01	6887485	416207	23-Jun-09	253	320
TEM02	6887575	416634	23-Jun-09	no data	180
TEM03	6887797	416461	23-Jun-09	252	N/A
TEM08	6888935	416564	24-Jun-09	no data	N/A
TEM09	6888994	416525	24-Jun-09	233	N/A
TEM10	6888850	416609	24-Jun-09	no data	no data
TEM11	6888773	416788	24-Jun-09	250	295
TEM12	6888697	416902	24-Jun-09	267	N/A
TEM13	6888093	417036	24-Jun-09	259	330
TEM 27 (RPE 14)	6886036	417588	25-Jun-09	245	no data
TEM153 (RPE 15)	6885702	417939	25-Jun-09	243	55
TEM17	6886289	415777	25-Jun-09	235	N/A
TEM18	6887637	417490	24-Jun-09	238	N/A
TEM19	6886521	415829	25-Jun-09	238	360
TEM22a	6886329	416577	25-Jun-09	253	45
TEM23	6886422	416754	25-Jun-09	246	130
TEM24	6886431	417007	25-Jun-09	244	N/A
TEM24b	6885763	417924	25-Jun-09	237	no data
TEM25	6886382	417065	25-Jun-09	241	N/A
TEM26	6885960	417435	25-Jun-09	242	190
TEM29	6885705	418090	25-Jun-09	243	205
TEM31	6885715	416551	25-Jun-09	260	N/A
TEM34	6882846	413930	25-Jun-09	227	168
TEM35	6882702	413950	26-Jun-09	194	158
TEM36	6882637	414062	26-Jun-09	172	220
TEM37	6882438	414072	26-Jun-09	165	no data

Plot Name and #	Northing	Easting	Date	Elevation (m)	Aspect (degrees)
TEM39	6883150	414100	26-Jun-09	no data	N/A
TEM39b	6886798	418808	27-Jun-09	254	N/A
TEM40	6883019	413976	26-Jun-09	231	N/A
TEM40a	6886800	418619	27-Jun-09	250	240
TEM42	6887559	418889	27-Jun-09	250	N/A
TEM43	6887403	418957	27-Jun-09	254	10
TEM45	6887282	418957	27-Jun-09	253	N/A
TEM46b	6887643	418956	27-Jun-09	251	N/A
TEM48	6885075	415574	27-Jun-09	no data	N/A
TEM49	6885447	416493	27-Jun-09	no data	N/A
TEM50	6885057	415724	27-Jun-09	no data	N/A
TEM51	6884835	415058	27-Jun-09	no data	N/A
TEM53	6883398	414483	27-Jun-09	239	N/A
TEM54	6883432	414491	27-Jun-09	243	N/A
TEM55	6888883	415890	27-Jun-09	no data	N/A
TEM58	6888164	415362	27-Jun-09	243	N/A
TEM59	6888110	415433	27-Jun-09	242	N/A
TEM62	6887898	415552	27-Jun-09	245	N/A
TEM63	6887372	415257	27-Jun-09	234	255
TEM154 (RPE 17)	6885807	416888	25-Jun-09	249	21
TEM155 (RPE 19)	6885873	414932	26-Jun-09	255	N/A
TEM157 (RPE 21)	6882554	413889	26-Jun-09	167	160

APPENDIX K

Interim Preliminary Species List

Trees and Shrubs	
Alnus viridis ssp. crispa	green alder
Amelanchier alnifolia	saskatoon
Arctostaphylos alpina var. rubra	alpine bearberry
Arctostaphylos uva-ursi	kinnikinnick
Betula nana	scrub birch
Betula papyrifera	paper birch
Chamaedaphne calyculata	leatherleaf
Dryas integrifolia	entire-leaved mountain-avens
Empetrum nigrum	crowberry
Juniperus communis	common juniper
Juniperus horizontalis	creeping juniper
Larix laricina	tamarack
Ledum groenlandicum	Labrador tea
Ledum palustre ssp. *decumbens*	northern Labrador tea
Oxycoccus oxycoccos	bog cranberry
Myrica gale	sweet gale
Pentaphylloides floribunda	shrubby cinquefoil
Picea glauca	white spruce
Picea mariana	black spruce
Pinus banksiana	jack pine
Populus balsamifera	balsam poplar
Populus tremuloides	trembling aspen
Prunus pensylvanica	pin cherry
Rhododendron lapponicum	Lapland rhododendron
Ribes hudsonianum	northern blackcurrant
Ribes oxyacanthoides	northern gooseberry
Rosa acicularis	prickly rose
Rubus idaeus	red raspberry
Rubus idaeus ssp. strigosus	red raspberry
Salix arbusculoides	northern bush willow
Salix athabascensis	Athabasca willow
Salix bebbiana	Bebb's willow
Salix candida	sage willow
Salix myrtillifolia	bilberry willow

Salix pedicellaris	bog willow
Salix planifolia	plane-leaved willow
Shepherdia canadensis	soopolallie
Vaccinium caespitosum	dwarf blueberry
Vaccinium uliginosum	bog blueberry
Vaccinium vitis-idaea	lingonberry
Viburnum edule	highbush-cranberry
Herbaceous Plants	
Achillea millefolium	yarrow
Achillea sibirica	Siberian yarrow
Agropyron trachycaulon	wheatgrass
Allium schoenoprasum	wild chives
Amerorchis rotundifolia	round-leaved orchis
Androsace septentrionalis	northern fairy-candelabra
Anemone multifida	cut-leaved anemone
Anemone parviflora	northern anemone
Anemone patens	prairie crocus
Antennaria rosea	rosy pussytoes
Aquilegia brevistyla	blue columbine
Arabis holboellii var. pinetorum	Holboell's rockcress
Arnica chamissonis	meadow arnica
Artemisia campestris	northern wormwood
Aster sp.	
Astragalus canadensis	Canadian milk-vetch
Calamagrostis canadensis	bluejoint reedgrass
Calamagrostis purpurascens	purple reedgrass
Calypso bulbosa	fairy-slipper
Carex aquatilis	water sedge
Carex capillaris	hairlike sedge
Carex scirpoidea	single-spike sedge
Carex vaginata	sheathed sedge
Cerastium arvense	field chickweed
Comarum palustre	marsh cinquefoil
Corallorhiza trifida	yellow coralroot
Corydalis sempervirens	pink corydalis

Herbaceous Plants, cont'd	
Eleocharis acicularis	needle spike-rush
Epilobium angustifolium	fireweed
Eriophorum scheuchzeri	Scheuchzer's cotton-grass
Eriophorum vaginatum	sheathed cotton-grass
Eriophorum vaginatum ssp. vaginatum	sheathed cotton-grass
Eriophorum viridicarinatum	green-keeled cotton-grass
Festuca sp.	fescue
Fragaria virginiana	wild strawberry
Galium boreale	northern bedstraw
Geocaulon lividum	false toad-flax
Geranium bicknellii	Bicknell's geranium
Geum sp.	
Juncus sp.	rush
Luzula sp.	wood-rush
Maianthemum stellatum	star-flowered false Solomon's-seal
Menyanthes trifoliata	buckbean
Minuartia obtusiloba	alpine sandwort
Minuartia rubella	boreal sandwort
Nuphar sp.	
Orthilia secunda	one-sided wintergreen
Oxytropis sp.	
Pedicularis labradorica	Labrador lousewort
Petasites sagittatus	arrow-leaved coltsfoot
Plantago major	common plantain
Platanthera obtusata	one-leaved rein orchid
Potamogeton sp.	pondweed
Potentilla nivea	snow cinquefoil
Potentilla norvegica	Norwegian cinquefoil
Pyrola asarifolia	pink wintergreen
Ranunculus lapponicus	Lapland buttercup
Rubus arcticus	nagoonberry
Rubus chamaemorus	cloudberry
Rubus pubescens	dwarf red raspberry
Salix arctica	arctic willow

Herbaceous Plants, cont'd	
Saxifraga nivalis	alpine saxifrage
Saxifraga tricuspidata	three-toothed saxifrage
Senecio streptanthifolius	Rocky Mountain butterweed
Stellaria longipes	long-stalked starwort
Taraxacum officinale	common dandelion
Tofieldia sp.	
Trichophorum cespitosum	tufted clubrush
Triglochin maritima	seaside arrow-grass
Triglochin palustris	marsh arrrow-grass
Typha latifolia	common cattail
Ferns and Fern Allies	
Cryptogramma crisp	
Cystopteris fragilis	fragile fern
Equisetum arvense	common horsetail
Equisetum fluviatile	swamp horsetail
Equisetum scirpoides	dwarf scouring-rush
Equisetum sylvaticum	wood horsetail
Polypodium virginianum	rock polypody
Woodsia ilvensis	rusty cliff fern
Mosses and Lichens	
Arctoparmelia centrifuga	rippled rockfrog
Arctoparmelia sp.	rockfrog lichens
Aulacomnium palustre	glow moss
Cladina mitis	lesser green reindeer
Cladina rangiferina	grey reindeer
Cladina stellaris	star-tipped reindeer
Cladonia borealis	boreal pixie-cup
Cladonia chlorophaea	mealy pixie-cup
Cladonia cornuta	
Dicranum polysetum	wavy-leaved moss
Dicranum sp.	heron's-bill moss
Flavocetraria sp.	
Hylocomium splendens	step moss

Mosses and Lichens, cont'd	
Marchantia polymorpha	green-tongue liverwort
Peltigera aphthosa	freckle pelt
Peltigera sp.	pelt lichens
Pleurozium schreberi	red-stemmed feathermoss
Polytrichum sp.	haircap moss
Sphagnum angustifolium	poor-fen peat-moss
Sphagnum capillifolium	common red peat-moss
Sphagnum fuscum	common brown peat-moss
Sphagnum squarrosum	shaggy peat
Stereocaulon sp.	foam lichens
Tomentypnum nitens	golden fuzzy fen moss
Usnea sp.	beard lichens