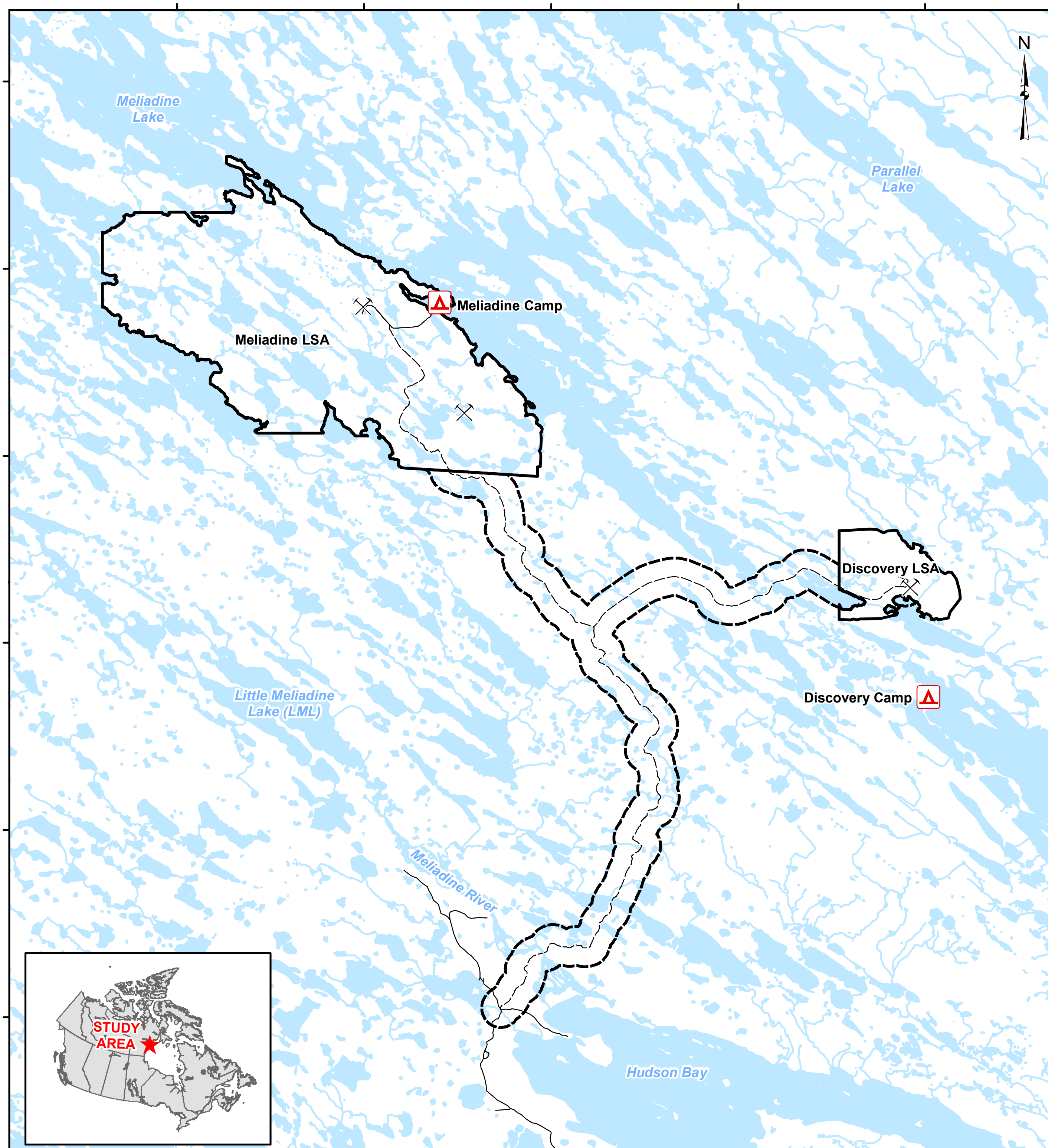

LEGEND

- Camp
- Proposed Mine Site
- Road - Existing
- Proposed Road
- Watercourse
- Local Study Area - Mine
- Local Study Area - Road
- Waterbody

3 0 3

SCALE 1:150,000 METRES

DRAFT

REFERENCE

Base data obtained from Comaplex Minerals Corporation
Projection: UTM Zone 15 Datum: NAD 83

PROJECT

COMAPLEX MINERALS CORP

COMAPLEX MINERALS CORPORATION
MELIADINE GOLD PROJECT
NUNAVUT

TITLE

LOCAL STUDY AREA USED FOR THE BASELINE VEGETATION STUDIES

Golder Associates
Edmonton, Alberta

PROJECT NO. 09-1373-0010			PHASE No. 1000	
DESIGN	LV	29 Oct. 2009	SCALE AS SHOWN	REV. 0
GIS	CDB	29 Oct. 2009	FIGURE 3-2	
CHECK	LV	22 Nov. 2009		
REVIEW	CO	22 Nov. 2009		

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4.0 VEGETATION BASELINE

4.1 Methods

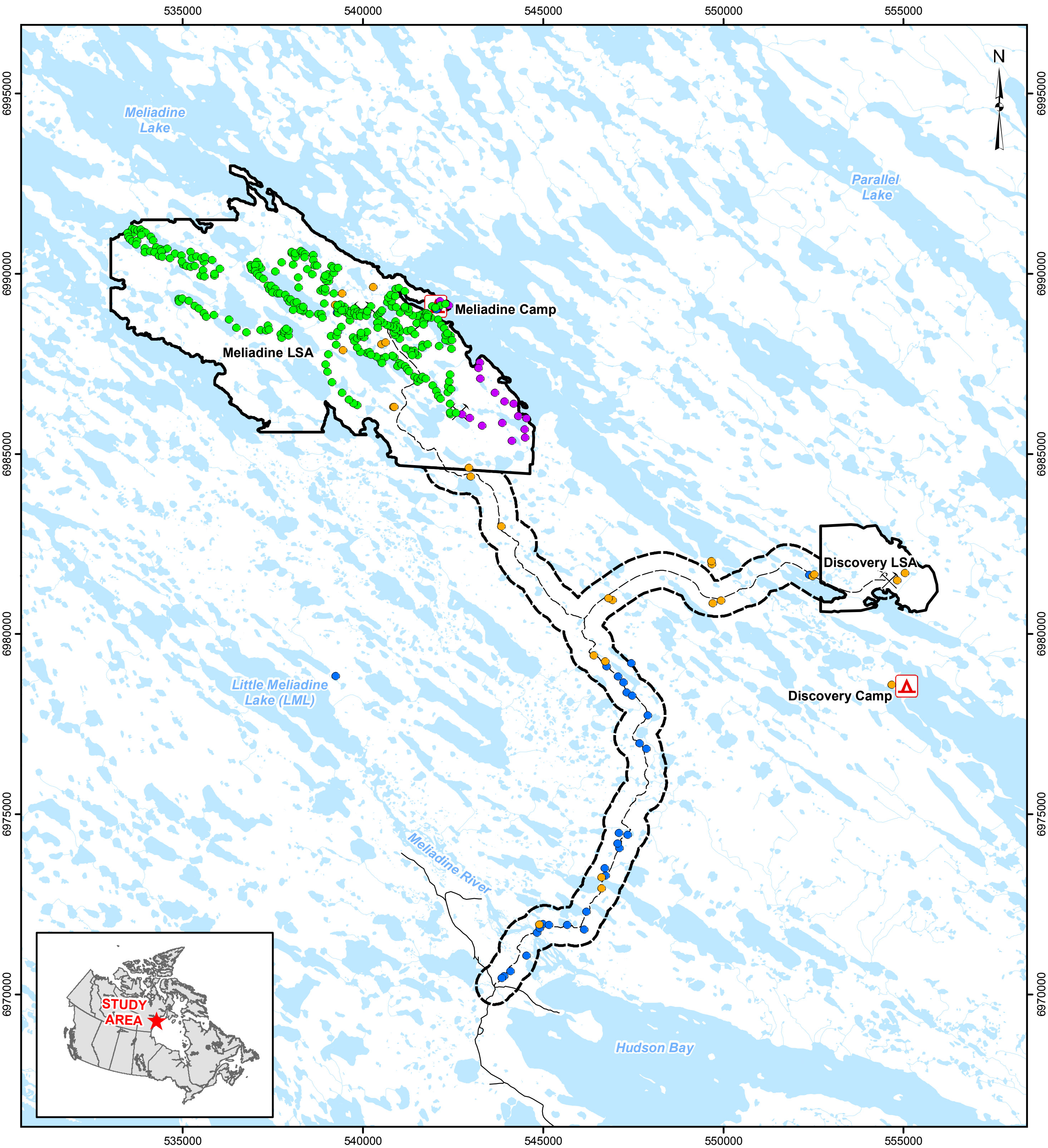
4.1.1 Baseline Field Surveys

Prior to undertaking the field surveys, a review of relevant vegetation studies completed in and around Rankin Inlet and the Arctic in general was completed to provide a perspective of available information.

Baseline vegetation surveys were carried out in the summer of 1998 over 3 survey periods (9 to 11 June, 9 to 11 July, and 16 to 23 August) to collect baseline vegetation data for the Meliadine West Gold Project area. In the summer of 2008 (29 to 31 July and 1 to 6 September) and 2009 (27 to 30 August), additional vegetation surveys were completed in the F Zone pit area, and along the proposed all-weather road from the project site to Rankin Inlet and to the Discovery Zone pit. Total, 416 plots were established, including 337 plots in 1998, 59 plots in 2008, and 20 plots in 2009 (Figure 4-1). All vegetation surveys were completed by a field botanist and a local assistant. To ensure consistent and reliable data collection, an initial training session reviewing applicable data collection protocols and common plant species was implemented prior to commencing the field surveys.

Field survey methods followed previously established protocols that were developed for the Diavik Project (Burt 1997) and other projects, including the Meadowbank Gold Project and the Baffinland Iron Mines Mary River Project (unpublished data). Prior to undertaking the vegetation surveys, preliminary plot locations were identified through a review of 1:50 000 topographical and 1:10 000 airphotos. Vegetation plots were established in a representative location within a given plant association type and care was taken to avoid transitional areas. A 5x5 m plot size was used to collect vegetation data, including plant species and percent cover information, and a Global Positioning System (GPS) coordinate was taken at the centre of each plot. Information collected at each plot included the following variables:

- plant community association;
- plant species composition and percent cover;
- slope and aspect;
- terrain and microtopography;
- percent surface substrate;
- moisture and nutrient regime;
- incidental wildlife observations (e.g., sightings, signs, habitat use);
- archaeological features;
- site photos (landscape and close-up); and
- other comments.



LEGEND

- Tissue Sampling Plot
- Vegetation Plot 1998
- Vegetation Plot 2008
- Vegetation Plot 2009
- Camp
- Proposed Mine Site
- Road - Existing
- Proposed Road
- Watercourse
- Local Study Area - Mine
- Local Study Area - Road
- Waterbody

3 0 3

SCALE 1:150,000 KILOMETRES

REFERENCE

Base data obtained from Comaplex Minerals Corporation. Vegetation data obtained from field survey.
Projection: UTM Zone 15 Datum: NAD 83

DRAFT

PROJECT

COMAPLEX MINERALS CORP

COMAPLEX MINERALS CORPORATION
MELIADINE GOLD PROJECT
NUNAVUT

TITLE

DISTRIBUTION OF VEGETATION SAMPLE PLOTS IN THE LOCAL STUDY AREA

Golder Associates
Edmonton, Alberta

PROJECT NO. 09-1373-0010			PHASE No. 1000	
DESIGN	LV	29 Oct. 2009	SCALE AS SHOWN	REV. 0
GIS	CDB	29 Oct. 2009	**FIGURE 4-1**	
CHECK	LV	22 Nov. 2009		
REVIEW	CO	22 Nov. 2009		

N:\Bur-Graphics\Projects\2007\1373\07-1373-0055\Mapping\MXD\2009\Vegetation\figure-04-01_sample-plots-vegetation.mxd

Wherever possible, vascular plants were identified to the species level in the field; however, reference specimens were collected from the field for some species and later verified using Porsild and Cody (1980) or other references (Vitt et al. 1998; Burt 1991; Aiken et. al. 2007). Lichens were collected and identified using Mosses, Lichens, and Ferns of Northwest North America (Vitt et al. 1998) and On the Lichens of North America (Brodo et al. 2001). All willows, grasses, and sedges were collected for subsequent identification by taxonomic plant specialists (Table 4-1).

Table 4-1: Vascular Plant Specialists

Year	Name	Affiliation and Speciality
1998	Dr. John Thieret	University of Northern Kentucky – specialist on grasses and other graminoids
1998	Dr. Rob Naczi	University of Delaware - specialist on sedges (*Carex* and *Eriophorum*) and rushes (*Juncus* and *Luzula*).
1998 and 2008	Dr. George Argus	Retired from the National Museum of Canada, member of the COSEWIC team – specialist on willows (*Salix*)
2008	Dr. Laurie Consaul	Canadian Museum of Nature - grass taxonomist involved in the development of the "Flora of the Canadian Arctic Archipelago"
2008	Dr. Jeff Saarela	Canadian Museum of Nature - specialist on sedges and cotton-grasses (*Cyperaceae*) and rushes (*Juncaceae*)

A complete list of all vascular plant species encountered in the local study area, as well as those that potentially occur in the area based on collection records for the Rankin Inlet area, is presented in Appendix A1. A preliminary species list of the non-vascular plants of Rankin Inlet is presented in Appendix A2 (lichens), Appendix A3 (mosses and liverworts), and Appendix A4 (fungi species–from literature for this area). A sample of the 2008 data sheet used to collect vegetation data is included in Appendix A5. Scientific nomenclature and common names followed naming conventions consistent with the NatureServe on-line database (NatureServe 2009).

4.1.2 Ecological Land Classification and Mapping

4.1.2.1 Regional Ecological Land Cover Classification Methods

A regional land cover classification map was developed using satellite imagery, remote sensing software, and a geographic information system (GIS) to provide information on the relative abundance and distribution of vegetation types within the RSA. Image classification is a method of automatically categorizing all pixels in an image. The image classification for the RSA satellite imagery is at a coarser scale than completed for the local study area (LSA), which uses fine scale data, resulting in a more broadly defined vegetation classification. However, classification of satellite imagery at the RSA level is a generally accepted standard practice for regional vegetation resource mapping and can be integrated with the LSA classification for a seamless product. The RSA vegetation classification for this report used current satellite imagery and classification methods as follows:

- LANDSAT 5 satellite spectral imagery with a 30 × 30 m pixel size;
- cloud-free coverage; and

- imagery captured on 23 July 2005.

The resolution of the imagery (i.e., pixel size) was appropriate for a regional-level vegetation classification, as it balances computer processing time and resolution. Quality control measures were implemented to ensure the imagery was correctly geo-referenced within the RSA. The imagery was translated by remote sensing software (Definiens®) for the classification process.

Land cover classes easily identifiable from the satellite imagery in the Project area were used in selecting classification "training sites." The training sites were selected to capture the range of variation in the reflectance values or "spectral signature" of the vegetation land cover classes. Field verified observation points were collected at selected training sites throughout the RSA and assigned to the appropriate land cover class. A sufficient number of observation points were collected for overall quality control.

Based on the signatures of the training sites, the remote sensing software assigned a best-fit classification to all pixels in the image. The process of selecting "training sites" and image classification was an iterative process that balanced the objectives of having as many meaningful vegetation classes as possible with a reasonable level of accuracy (i.e., pixels being accurately classified at least 70% of the time). Once the classification was complete, polygons other than those used as "training sites" were compared against the classification for validation purposes. The overall accuracy of the ELC classification was determined to be 74.2%, which represents an acceptable level of accuracy based on the current level of knowledge in the remote sensing community. A summary of the RSA classification error matrix is provided in Appendix A6.

The classification resulted in a total of 8 land cover classes within the RSA (Table 4-2). These classes fell within one of the following 3 broad groups:

- heath vegetation;
- wetlands or riparian vegetation; and
- miscellaneous cover types.

Table 4-2: Regional Land Cover Classes

General Land Category	Regional Land Cover Class
Heath	Heath boulder
Heath	Heath lichen - hair lichen
Heath	Heath lichen - *Cetraria*
Heath	Heath tundra
Wetlands	Low shrub
Wetlands	Tussock – hummock
Miscellaneous cover type	Bare ground (rock outcrop)
Miscellaneous cover type	Water

Heath vegetation in this area is defined as land where the soils are not saturated for extended periods of the year. Heath refers to the presence of low growing evergreen shrubs, such as Labrador tea, bearberry, and black crowberry, that are typical of these areas. Heath vegetation in the RSA consists of heath tundra or heath boulder and bedrock associations.

Wetlands or riparian vegetation in the RSA are defined as areas that are saturated for most, or all of the growing season. Wetlands or riparian vegetation in the RSA consists of wet sedge meadows or tussock-hummock areas and low shrubby riparian vegetation along the margins of lakes and rivers.

Miscellaneous land cover types include un-vegetated areas, such as bare ground and water. Disturbances were not mapped due to issues with scale, as there are very few anthropogenic disturbances visible at the RSA level.

4.1.2.2 Plant Community Classification and Mapping Methods

In 1998, a preliminary vegetation classification system was developed and mapped for the Project area in the vicinity of the Meliadine mine site. In 2008 and 2009, vegetation mapping was expanded to include the all-weather road and Discovery access road, Discovery Mine area, and F Zone. To reduce confusion, the classification system developed in 1998 was used for subsequent vegetation mapping in 2008/2009, though modifications were made to account for inclusions of any new community types or associations.

Like the regional ecological land cover classification, the vegetation classification at the LSA level is represented by several broad land cover groups including the following:

- terrestrial vegetation;
- wetlands;
- un-vegetated types (e.g., sand and water); and
- disturbances.

Within the broader land cover groups, 10 specific plant community types and associations have been identified that correspond to observable features on the landscape (Table 4-3). Plant community types represent mappable units at a scale of 1:10 000 and correspond to major vegetation units that are often associated with distinct terrain features. Within each plant community type, a series of subgroups, or plant associations, have been described that are based on field level observations. These units are not mappable, but have been described to provide additional information on the natural level of variability associated with each plant community type. Plant association names and terminology were developed to provide meaningful associations for other disciplines, such as wildlife, and followed to some extent existing vegetation classification systems developed for other projects (e.g., Rowe et al. 1977; Thompson 1980; BHP/Diamet 1996; Burt 1997).

Table 4-3: Meliadine Plant Community Classification System

Land Cover Class	Plant Community Type	Map Unit	Map Unit #	Plant Community Associations (not mapped)	Landscape Unit Classification*
Vegetated Units					
Wetlands	Sedge	SC	1	Sedge association -	Wet drainage areas, pond margins; sedge

Table 4-3: Meliadine Plant Community Classification System (continued)

Land Cover Class	Plant Community Type	Map Unit	Map Unit #	Plant Community Associations (not mapped)	Landscape Unit Classification*
	Community			emergent (Se)	meadows
				Non-tussock sedge (Snt)	
				Tussock sedge (St)	
				Sedge association - frost scars (Sfs)	n/a
Wetlands	Birch Seep	BS	2	n/a	n/a
Wetlands	Riparian Willow	RW	3	n/a	n/a
Terrestrial Vegetation	Heath Tundra	HT	4	Heath tundra - uplands (HTu)	Smooth slopes w/mixed lichens & heaths
				Heath tundra - solifluction slopes (HTsolif)	Rough slopes with *Dryas sp.* & heaths
				Heath tundra - frost scars (HTfs)	Frost mounds on ridges/upper slopes, mixed lichen-heath
				Heath tundra - boulders (HTb/LRb)	Turf-rimmed mud circles with *Dryas sp.*
					Frost fissures with moss, peat
					Frost fissures with *Eriophorum* & *Carex*
				Ridge or esker slope (RCsl)	n/a
Terrestrial Vegetation	Lichen-Heath - Cetraria	LHc	5	Ridge or esker crest (RCc)	Slopes with *Cetraria sp., Luzula sp., Empetrum sp.*
Terrestrial Vegetation	Lichen-Heath - Hair Lichen	LHh	6	Ridge or esker crest (RCc)	Bouldery/sandy ridge crests with mixed lichen-heath
Terrestrial Vegetation	Lichen Rock	LR	7	Boulder fields/streams, felsenmeer, heath tundra - boulders(LRb/HTb)	Bouldery crests of ridges with mixed lichens, heaths
				Cobbles/gravel on ridges (LRb/RCc)	Broad crests/flats, hair lichens, *Empetrum sp.,* and heaths; Bouldery crests of ridges with mixed lichens & heaths
				Rounded/polished bedrock outcrops (LRpol)	n/a
				Fractured bedrock outcrops and shattered bedrock (LRrf)	Rock outcrops with *Racomitrium sp./ Dryopteris sp.*
				Cliff faces (LRrcf)	n/a
<u>Un-vegetated Units</u>					
Un-Vegetated	Un-vegetated (e.g. Sand)	U	8	n/a	n/a
Disturbance	Disturbances	DS	9	Den sites (DSd)	n/a
				Caribou trails	n/a
				Avian nesting areas (DSng/DSnr)	n/a
				Faces of solifluction lobes (Dssolif)	n/a

Table 4-3: Meliadine Plant Community Classification System (continued)

Land Cover Class	Plant Community Type	Map Unit	Map Unit #	Plant Community Associations (not mapped)	Landscape Unit Classification*
				Hillside slumps (DSls)	n/a
				Drill sites (Dsdrill)	n/a
				Roads or ATV trails (DSr)	n/a
				Camps (DSc)	n/a
				Greywater outflows (Dsgrey)	Wet drainage areas, pond margins; sedge meadows
Un-vegetated	Water	W	10	n/a	n/a
Non-Mappable Units					
n/a	n/a	n/a	n/a	Transitions - Hummocks (Th)	Hummock nets on wet seepages with *Dryas sp.* and sedges
n/a	n/a	n/a	n/a	Transitions - Hummocks with frost scars (Th+fs)	Stony earth mounds with *Dryas* spp and heaths
n/a	n/a	n/a	n/a	Transitions - Gradual intergradation on slopes (Tsl)	Sedge meadows to heath tundra
n/a	n/a	n/a	n/a	Transitions - Solifluction ridges (Tsolif)	Turf ridges & “strings”; wet sedge “paddies”
n/a	n/a	n/a	n/a	Moss community (MS)	n/a
n/a	n/a	n/a	n/a	Snowbank community (SB)	Snowpatch lower slopes with *Cassiope sp.*

*Adapted from: Rowe et al. (1977).
n/a = not applicable

4.1.3 Baseline Plant Tissue and Soils Metals Analysis

4.1.3.1 Background

Some metals in trace amounts (i.e., boron, chlorine, copper, iron, manganese, molybdenum, and zinc) provide essential sources of nutrients to many organisms, including plants and animals (Pais and Jones 1997). However, a large number of metal elements are known to have adverse or toxic effects on plant or animal tissue at high concentrations depending on the nature of the metal, environmental conditions, and the species affected (Pais and Jones 1997; Kabata-Pendias 2001). In some cases, certain plant species may accumulate toxic elements or compounds, but the rate and effectiveness by which plants uptake nutrients and trace elements, including metals, is quite variable (Greger 2004).

Generally, the uptake of metals in plants occurs from the soil matrix via the roots or from the atmosphere through direct absorption through the leaf cuticle (Kabata-Pendias 2001). Absorption of metals from the soil matrix requires that metals be present in solution for them to be taken up by plants (Greger 2004). The availability of metals is governed by soil properties like moisture, pH, and organic matter content. The result is that soils containing higher amounts of organic matter, clay content, and pH levels will typically bind metals to the soil matrix making them unavailable for uptake by plants (Greger 2004). Plant uptake of metals through the leaves can occur through deposition of dry materials (i.e., dust or airborne particles containing metal elements) or wet materials (i.e., precipitation containing metal ions in solution) (Greger 2004).

Some plants, known as hyperaccumulators, have the ability to accumulate toxins to concentrations far greater than in the immediate surrounding environment, though these species are uncommon (Greger 2004). In most cases, uptake of toxins in plant tissues is proportional to availability in the surrounding environment (Greger 2004).

To effectively assess the potential effects of dust borne contaminants containing metals originating from a proposed road sites and gold mine at Meliadine, it is critical to have a good understanding of the baseline concentration of metals. Establishing a baseline sampling program for estimating background concentrations of metals in soils and plant tissues provides a basis for evaluating potential effects and for implementing a monitoring program to assess changes to metal concentrations in plant tissue and soils over the duration of the project.

4.1.3.2 Data Collection Methods

Establishing baseline metal concentrations in plant tissue and soil in the LSA was undertaken in the fall of 2008 and completed in the fall of 2009. Sample sites were selected to represent the range of vegetation types in the vicinity of the proposed mine site and road. Seventeen permanent sampling sites were established in the vicinity of the proposed mine site and along the proposed all-weather road, and an additional 12 sites were established along the road to the Discovery mine site (Figure 4-1). All sites were permanently marked with a metal stake and a tag denoting the site name, as well as a painted rock, and GPS waypoints were obtained. These sites were established as permanent plots that can be re-visited as part of a project monitoring program.

Tissue samples from at least 2 different plant species and a soil sample were collected from each site. Two equal sub-samples of soil were taken from the rooting zone and combined into one composite sample of approximately 200 g. Plant species for tissue analysis were selected based on their relative abundance in the area and their relative importance to human or wildlife consumption. The species selected for tissue analysis are summarized in Table 4-4.

Table 4-4: Plant Species Selected for Metal Concentration Baseline and Monitoring in 2008 and 2009

Scientific Name	Common Name
Shrubs	
Arctostaphylos alpina	Alpine manzanita
Betula nana	Swamp birch
Empetrum nigrum	Black crowberry
Ledum palustre sp. *decumbens*	Marsh Labrador tea
Salix planifolia	Tealeaf willow
Salix lanata sp. *richardsonii*	Lanate willow
Vaccinium uliginosum	Alpine blueberry
Vaccinium vitis-idaea	Mountain cranberry
Forbs	
Oxytropis arctica var. *bellii*	Bell's Point-vetch
Grasses and Sedges	
Carex aquatilis	Water sedge
Carex misandra	Shortleaf sedge

Table 4-4: Plant Species Selected for Metal Concentration Baseline and Monitoring in 2008 and 2009 (continued)

Scientific Name	Common Name
Poa sp.	Bluegrass
Non-vasculars	
Aulacomnium sp.	n/a
Flavocetraria nivalis(formerly *Cetraria nivalis*)	Crinkled snow lichen

n/a = not applicable

Only healthy plants were collected; plant specimens with obvious signs of disease, such as yellowing leaves, holes in leaves, or lack of foliage were not collected. Leaves and new growth were obtained from all woody plants by taking cuttings from the tips of the plants and placing samples in a Ziploc bag, while all above ground tissues of forbs and grasses were collected and placed in Ziploc bags. Non-vascular plants were collected from the ground surface and placed in a Ziploc bag. Composite tissue samples for each species were taken from collected plant materials.

All plant tissue and soil samples were frozen in the field and later transported to ALS Laboratories for subsequent metals analysis. Plant tissue samples collected in 2008 were analyzed using ICPMS for 28 metals (Table 4-5), and the Metals-Canadian Council of Ministers of Environment (CCME) package was used to assess for 19 metals in the soil samples (Table 4-5). In 2009, plant tissues and soil samples were analyzed for metals using the ICPOES and ICPMS packages (Table 4-5).

Table 4-5: Selected Metals Assessed in Plant Tissue and Soil Samples in 2008 and 2009

2008 Plant Tissue (mg/kg)	2008 Soil Matrix (mg/kg)	2009 Plant Tissue (mg/kg) and Soil Matrix (mg/kg)
Aluminum (Al)	Antimony (Sb)	Aluminum (Al)
Antimony (Sb)	Arsenic (As)	Antimony (Sb)
Arsenic (As)	Barium (Ba)	Arsenic (As)
Barium (Ba)	Beryllium (Be)	Barium (Ba)
Beryllium (Be)	Cadmium (Cd)	Beryllium (Be)
Cadmium (Cd)	Chromium (Cr)	Bismuth (Bi)
Calcium (Ca)	Cobalt (Co)	Cadmium (Cd)
Chromium (Cr)	Copper (Cu)	Calcium (Ca)
Cobalt (Co)	Lead (Pb)	Chromium (Cr)
Copper (Cu)	Mercury (Hg)	Cobalt (Co)
Iron (Fe)	Molybdenum (Mo)	Copper (Cu)
Lead (Pb)	Nickel (Ni)	Iron (Fe)
Magnesium (Mg)	Selenium (Se)	Lead (Pb)
Manganese (Mn)	Silver (Ag)	Lithium (Li)
Mercury (Hg)	Thallium (Tl)	Magnesium (Mg)
Molybdenum (Mo)	Tin (Sn)	Manganese (Mn)
Nickel (Ni)	Uranium (U)	Mercury (Hg)
Phosphorus (P)	Vanadium (V)	Molybdenum (Mo)
Potassium (K)	Zinc (Zn)	Nickel (Ni)
Selenium (Se)		Phosphorus (P)
Silver (Ag)		Potassium (K)

Table 4-5: Selected Metals Assessed in Plant Tissue and Soil Samples in 2008 and 2009 (continued)

2008 Plant Tissue (mg/kg)	2008 Soil Matrix (mg/kg)	2009 Plant Tissue (mg/kg) and Soil Matrix (mg/kg)
Sodium (Na)		Selenium (Se)
Strontium (Sr)		Sodium (Na)
Thallium (Tl)		Strontium (Sr)
Tin (Sn)		Thallium (Tl)
Titanium (Ti)		Tin (Sn)
Vanadium (V)		Titanium (Ti)
Zinc (Zn)		Uranium (U)
		Vanadium (V)
		Zinc (Zn)

4.2 Regional Study Area Results

4.2.1 Overview

The regional ELC classification identifies 8 land cover classes (Table 4-6). Figure 4-2 depicts the distribution of land cover classes across the RSA. This regional coverage includes 4 heath classes, 2 wetlands and riparian classes, and 2 miscellaneous land cover classes, which together covers an area of 849 484 ha. Heath vegetation encompasses 445 926 ha (52%) of the RSA, while wetlands and riparian areas are distributed over 122 575 ha (14%) of the RSA (Table 4-6). The remaining 280 983 ha (33%) of the RSA are classified as water, predominantly lakes and the tidal basin of Hudson's Bay, and a small percentage of bare ground and rock outcrops.

Descriptions of land cover types mapped within the RSA are provided in the following subsections. Common names are generally provided in the vegetation descriptions below. In cases where there are no common names or the common name can be confused with two or more species, a scientific name is given.

Table 4-6: Total Area and Percent Cover of Land Cover Classes within the Regional Study Area

Regional Land Cover Class	Regional Study Area	
	Area of RSA (ha)	Percent of RSA
Heath		
Heath boulder	141 484	17%
Heath lichen - hair lichen	18 339	2%
Heath lichen - *Cetraria*	12 414	1%
Heath tundra	273 690	32%
Heath vegetation subtotal	*445 926*	*52%*
Wetlands/Riparian		
Low shrub	12 662	1%
Tussock-hummock	109 913	13%
Wetlands /riparian subtotal	*122 575*	*14%*
Miscellaneous		

Table 4-6: Total Area and Percent Cover of Land Cover Classes within the Regional Study Area (continued)

Bare ground (rock outcrop)	19 273	2%
Water	261 710	31%
Miscellaneous subtotal	*280 983*	*33%*
Total	**849 484**	**100%**

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values. ha= heactares