Inuvik to Tuktoyaktuk Highway - Baseline Data Acquisition Program: Vegetation Mapping and Rare Plant Surveys

FINAL REPORT

August 31, 2012

Prepared for:
Government of the Northwest Territories – Department of Transportation
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Project Number: 123510689

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Abbreviations

DOT ..... Department of Transportation
EIRB ..... Environmental Impact Review Board
EIS ..... Environmental Impact Statement
ENR ..... Environment and Natural Resources GNWT
EOSD ..... Earth Observation for Sustainable Development of Forests
IOL ..... Imperial Oil Limited
GIS ..... Geographic Information System
GNWT ..... Government of the Northwest Territories
MGP ..... Mackenzie Gas Project

1 INTRODUCTION

1.1 PROJECT BACKGROUND

The Government of the Northwest Territories (GNWT), Department of Transportation (DOT), the Town of Inuvik and the Hamlet of Tuktoyaktuk are proposing to construct a 140 km all-season highway to connect the Town of Inuvik with the Hamlet of Tuktoyaktuk (the Project). The Project is wholly within the Inuvialuit Settlement Region, with portions of the highway crossing Inuvialuit 7(1)(a), 7(1)(b) and Crown lands. The Project is currently undergoing a substituted Panel review by the Environmental Impact Review Board. An Environmental Impact Statement (EIS) was submitted in May 2011. Following conformity review of the EIS by the EIRB and reviewers, a vegetation baseline study program was proposed to address specific deficiencies in the EIS. One of the goals of the supplemental vegetation study is to present additional information related to the identification of vegetation types located within a 1 km corridor centered on the Project's Preferred Alignment and Alternate #1 as filed in the EIS and supplementary documents and at borrow sources. The other goal is to conduct rare plant surveys in high potential locations along the alignment and at borrow sources.

1.2 STUDY OBJECTIVES

The scope of the vegetation study includes the following tasks:

- Confirm the appropriateness of the vegetation classification system previously used in a portion of the study area for the Mackenzie Gas Project
- Visually assign vegetation cover classifications to polygons mapped as part of terrain study
- Summarize the vegetation cover distribution along the highway alignment
- Conduct field verification of vegetation mapping
- Conduct rare plant surveys

The study has been completed in two parts:

1. Preliminary vegetation cover classification and mapping based on desktop review (completed, and filed as *Inuvik to Tuktoyaktuk Highway: Preliminary Vegetation Mapping – Preliminary Draft Report* and associated .shp file; April 2012)
2. Final vegetation cover classification and mapping based on desktop review and field verification and completion of rare plant surveys

The present report summarizes the results of (2). The preliminary vegetation mapping as presented in the Preliminary Draft Report and .shp file has been edited based on field data. Rare plant surveys were conducted concurrently with mapping verification.

2 METHODOLOGY

The following section describes the methodology used to complete preliminary vegetation cover mapping.

2.1 REVIEW OF EXISTING VEGETATION COVER INFORMATION

The proposed alignment for the Inuvik to Tuktoyaktuk Highway crosses four Level IV Ecoregions (Ecosystem Classification Group. 2007, revised 2009): Mackenzie Delta High Subarctic, Sitidgi Plain High Subarctic, Caribou Hills Low Arctic, and Tuktoyaktuk Coastal Plain Low Arctic (Kiggiak-EBA. 2011). Specific classification and identification of vegetation communities or cover types in these areas has been produced as a satellite image classification product (Earth Observation for Sustainable Development of Forests (EOSD) initiative of the Canadian Forest Service (Wulder et al. 2004) and for Environmental Impact Statement for the Mackenzie Gas Project (IOL et al. 2004)); and as a field data and air photo interpretation based vegetation classification (Environmental Impact Statement (EIS) for the Mackenzie Gas Project (MGP) (IOL et al. 2004).

2.2 MAPPING METHODOLOGY

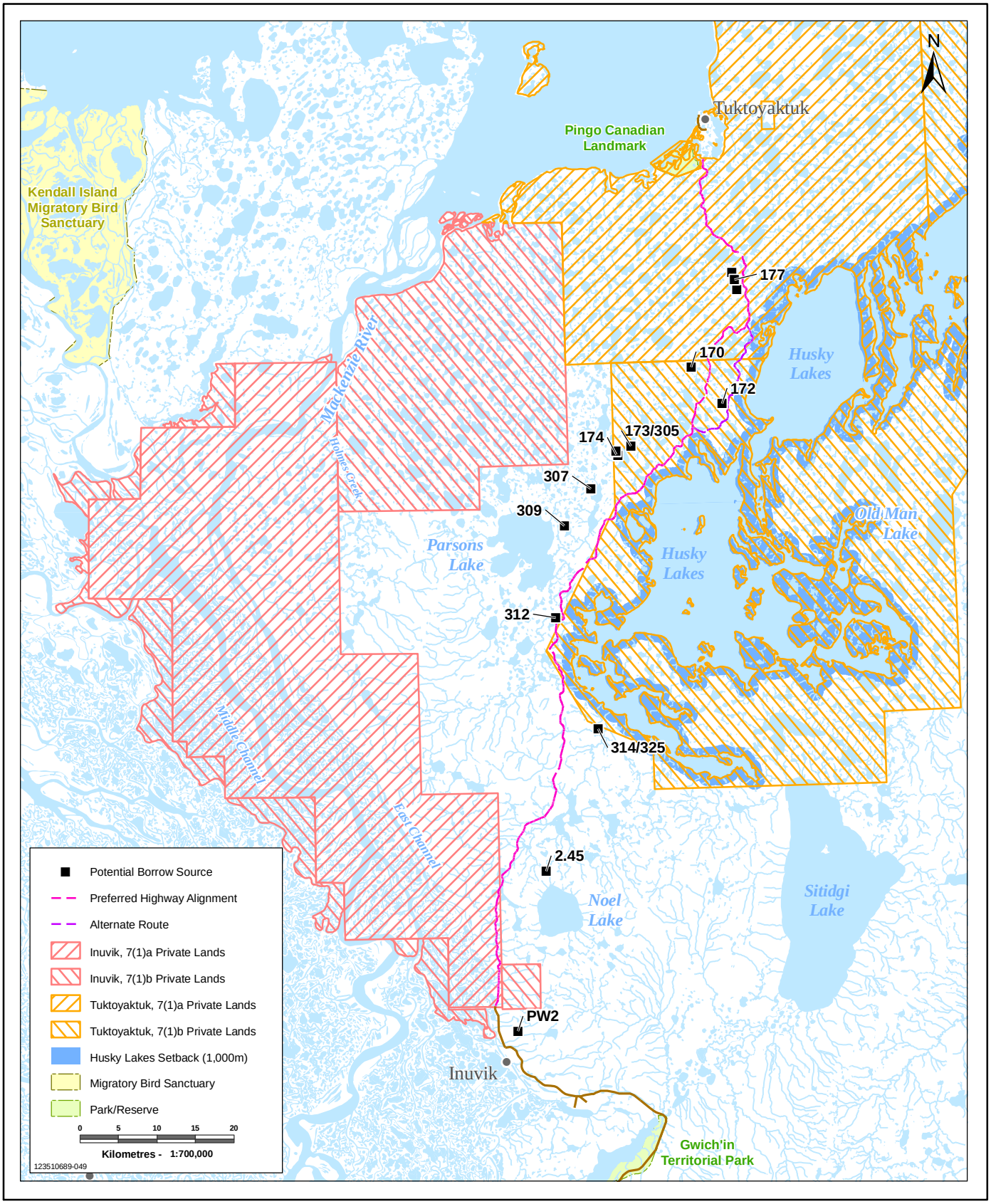
2.2.1 Review of Vegetation Classification

The largest, recent, small scale vegetation cover mapping product near or in the Project area was completed for the Mackenzie Gas Project (MGP) Environmental Impact Statement (EIS) in 2004 (IOL et. al. 2004). Vegetation classification used for the MGP has been used as the classification system for this Project, for the following reasons:

- MGP mapping overlaps three of the four Level IV Ecoregions of the Project study area
- MGP vegetation classification and mapping was conducted using stereo air photo interpretation of 1:20,000 scale photos, a similar scale and type of imagery as is available for this study
- MGP mapping and composition of the vegetation types was confirmed with a detailed field program

There are many similarities in landscape and climate characteristics across the MGP Project area and the Project study area. Nine unique vegetation types from the MGP classification were identified though visual interpretation as appropriate to be used to map vegetation types within the present Project study area based on the experience of KAVIK-STANTEC staff that completed the air photo mapping and much of the field work for the tundra section of the MGP. Three MGP vegetation cover types are excluded as they are associated with the active Mackenzie River delta and not part of the Project study area.

The Project study area is shown in Figure 2-1.



Inuvik - Tuktoyaktuk Highway

Project Study Area Overview

Data Provided By: Base data provided by Government of Canada; Private Land data provided by the Joint Secretariat

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KAVIK-STANTEC

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Northwest Territories Transportation

FIGURE NO.
2-1

Last Modified: August 31, 2012 By: jpetho

2.2.2 Vegetation Mapping

Preliminary vegetation mapping was completed by reviewing terrain mapping as provided in the Terrain Report and map atlas for this Project (KAVIK-STANTEC 2012a) and the imagery in stereo view (detailed below). Vegetation type was assigned to each polygon based on the dominant vegetation type observable in each polygon. The terrain polygons often contain more than one vegetation type, and as a result, during the preliminary mapping, one type was chosen as the most characteristic of the polygon. One exception was made for common upland vegetation, where the two most common vegetation types could be assigned to one polygon to represent areas where those two types were occurring as co-dominant in those polygons.

Terrain mapping was completed to delineate and classify surficial geology, potentially ice-rich terrain features such as polygonal peat plateaus and terrain-related constraints (e.g. steep slopes, thaw slumps and seepage areas). Surface material, surface expression, drainage, slopes and geomorphic processes were mapped as small as 1 ha using digital 1:30,000 scale color photographs acquired in August of 2004 and 2005 as part of the Mackenzie Valley Airphoto Project (GNWT 2011). Terrain mapping and vegetation mapping were completed using GIS applications, specifically softcopy stereo (3D) vision systems. Elevation information used comes from the national and provincial digital elevation model (DEM) as well as from 1:50,000 scale digital base data available on the web portal of the Earth Sciences Sector (ESS) of Natural Resources Canada (NRCan).

Mapping was completed along the entire length of the Primary and Alternate highway alignments. A 1 km corridor was placed on the alignments to define a mapping corridor (resulting in a 500 m buffer on either side of the alignment).

2.2.3 Field Surveys

A field program was completed July 17, 19, 21 and 22, 2012. The program was designed to collect vegetation cover data used to confirm and or further refine the vegetation cover types as assigned during preliminary mapping, as well as conduct a rare plant survey.

2.2.4 Final Vegetation Cover Mapping

Final vegetation cover mapping is presented in a 1:10,000 scale atlas (see Appendix A). Rare plant locations are included. Updated vegetation mapping, based on field verification has been used to update wildlife habitat suitability models used to assess wildlife habitat potential as presented in KAVIK-STANTEC 2012b.

2.3 Rare Plant Survey Methods

Prior to the survey, information on potential rare plants was collected to inform the survey botanist and focus the survey targets. Sources included information presented in the Project EIS (Kiggiak-EBA 2011),

information presented in the MGP EIS (IOL et al. 2004), review of the GNWT Species Infobase and supplemented with references from several floras as required.

This preliminary review indicated that the greatest potential for rare plants within the Project study area was the exposed substrate of MGP Tundra Type 1. Tundra Type 1 was also identified in the MGP EIS as a vegetation type of concern due to its limited distribution on the landscape.

3 VEGETATION CLASSIFICATION RESULTS

3.1 Vegetation Classification

In the Project region, topography is level to rolling, and elevation varies from close to sea level near Inuvik, Tuktoyaktuk and Husky Lakes, to 150 m near Parsons Lake. Vegetation grows on a veneer of unfrozen organic or granular substrate overlying permafrost. In wetter areas, sedges, cotton-grasses and sphagnum moss dominate high-centred and low-centred polygons. Drier areas support ericaceous shrubs. Riparian communities include wet sedge communities and taller shrubs. Larger creeks support outliers of black spruce (IOL et al. 2004).

The unique vegetation types from the MGP classification identified within the Project area, as described in the MGP EIS, are in the following section. Three of the MGP tundra vegetation cover types are excluded as they are associated with the active Mackenzie River delta and no part of the Highway alignment as associated with the Mackenzie delta. Two of the transition forest vegetation types as described in the MGP EIS are also included. These were added subsequent to the preliminary mapping as a result of observations made during field surveys.

3.1.1 Vegetation Type 1 – Dry Saxifrage Tundra

The dry saxifrage tundra vegetation type is found on dry, upland areas on the tundra of the Tuktoyaktuk Peninsula. It is often found on sparsely vegetated sites containing granular materials, where bare ground comprises a median percent cover of 20.8%. The surface cover includes ground birch, locoweed species, red bearberry, black crowberry, bog bilberry, mountain cranberry and willow species. The indicator species for this vegetation type are alpine holy grass and prickly saxifrage. Hair-cap moss is the most common bryophyte, and *Cetraria*, *Alectoria* and *Cladina* are frequent lichens. Other plants frequently found, but with low cover values are Yukon stitchwort – a rare species, blunt sedge, prostrate willow, and *Cladonia*, *Thamnolia* and *Stereocaulon* lichens. The dry saxifrage tundra vegetation type is characteristic of dry, warm soils in this ecological zone. It is common on crests and upper slopes with well-drained shallow soils with scarce organic material. These sites are associated with gravely deposits such as the hummocky glaciofluvial outwash, kames or eskers, or with weathered surfaces of poorly lithified sedimentary rocks. The nutrient regime in these sites is estimated to be poor to very poor with a moisture regime ranging from xeric to subxeric. The active layer depth is greater than 30 cm.

3.1.2 Vegetation Type 2 – Dwarf Shrub Heath

Dwarf shrub heath is the most common tundra vegetation type on the Tuktoyaktuk Peninsula. It is widespread throughout flat and rolling terrain, in thin organic soils on crests to mid-slope positions where water does not accumulate. Dwarf shrubs make up most of the shrub and ground cover layers. These include ground birch, mountain cranberry, northern Labrador tea, green alder, black crowberry, red bearberry, and bog bilberry. Cloudberry and sweet coltsfoot are also present. Arrow-leaved coltsfoot is an

indicator species for this vegetation type. Common lichens are reindeer lichens and *Cetraria*, and peat moss is the most common bryophyte. *Peltigera* species are often associated with low cover values.

The dwarf shrub heath vegetation type is located on a variety of parent materials including glaciofluvial, morainal and colluvial. A veneer of peat is often present over mineral deposits, but is usually thinner than 50 cm. Sites are usually located in crest, upper to mid-slope positions but less commonly in depressions. Permafrost features such as thermokarst subsidence or frost boils are often present. Nutrient regime in these sites is estimated to be poor and the moisture regime ranges from mesic to hygric. The active layer depth ranges from 18 to 200 cm.

3.1.3 Vegetation Type 3 – Upland Shrub

Slopes on upland areas are frequently vegetated with an upland shrub vegetation type. The taller shrubs form a scattered to open canopy of ground birch, blue-green willow and green alder ranging from 0.5 to 1.5 m. Dwarf shrubs such as mountain cranberry, red bearberry and black crowberry comprise the ground cover layer. Additional species present in the ground cover layer include sweet coltsfoot and *Spiraea beauverdiana*, with bog bilberry found in lesser amounts. Indicator species of this vegetation type are Herriot's sagewort, arrow-leaved coltsfoot and bistort. Large-flowered lousewort is also an indicator for this vegetation type. Common lichens include reindeer lichens, *Cetraria* and club lichens.

The upland shrub vegetation type in the tundra occurs on morainal or lacustrine landforms with fine silty clay and loamy texture. Most sites have a hygric to subhydric moisture regime with moderate to poor drainage and fairly level to gently rolling topography. The upland shrub vegetation type also grows on coarse glaciofluvial sediments with coarse loamy sand to sandy loam parent material texture. There, this vegetation type is more common on the mid- to lower landscape positions where drainage is restricted by permafrost. Sites can have thermokarst subsidence or occasional but poorly developed ice-wedge polygons. A veneer of peat is often present over mineral deposits, but is usually thinner than 40 cm.

These sites have poor nutrients and a subhygric to hygric moisture regime. The active layer depth ranges from 25 to 67 cm.

3.1.4 Vegetation Type 4 – Cotton-Grass Tussock

The cotton-grass tussock vegetation type is found on lower slopes and lowlands where blanket flow of water at the permafrost surface creates hygric-subhydric soil moisture. Sheathed cotton-grass is the dominant species in this vegetation type. It forms dense tussocks along with two sedges, *Carex lugens* and *Carex consimilis*. In between the tussocks, sphagnum species thrive, whereas shrub species are less prominent because of the high moisture levels. Ground birch, mountain cranberry, northern Labrador tea, black crowberry and flat-leaved willow occur in the lower shrub layer. *Cladonia* and *Cetraria* lichen species are sometimes present. Cloudberry is also found in the ground cover layer. Other plants frequently found with low cover values are bog bilberry and *Dactylina* species. Leatherleaf (*Chamaedaphne calyculata*) is an indicator plant of this vegetation type.

The cotton-grass tussock vegetation type is located mostly within fine-textured morainal and lacustrine landscapes. Sites can be subject to inundation or permafrost, and demonstrate features such as thermokarst subsidence and frost heave. Micro-topography is often hummocky; with regional slopes less than 10%.The nutrient regime in this vegetation type is typically considered to be poor with a moisture regime ranging from hygric to subhydric. The active layer depth ranges from 11 to 75 cm.

3.1.5 Vegetation Type 5 – High-centred Polygons

High-centred polygons are found localized in depression areas and flats on the Tuktoyaktuk Peninsula. They have large net-like patterns with high centres surrounded by water-filled troughs with ice bottoms. The centre of each polygon develops a dome of peat and is vegetated with upland species similar to the dwarf shrub heath vegetation type including northern Labrador tea, ground birch, mountain cranberry and black crowberry. Cloudberry and red bearberry are also common. Reindeer lichens are prominent and *Cetraria* and club lichens also occur on most sites. Species frequently found with low cover values in the wetter troughs and cracks are cotton-grasses, water sedge, *Carex consimilis*, *Carex rariflora* and *Carex lugens*.

In many high-centred polygons, a thick layer of strongly cryoturbated, mixed organic and mineral soil underlies surface peat deposits. The polygons are usually located in poorly drained areas that occupy low landscape positions such as depressions associated with thermokarst lakes or ponds, pingos, hollows or channel-like features. These sites occur in ice-rich, fine-grained soils with a silty clay loam to clay loam texture on the morainal landforms and small lacustrine basins. The nutrient regime in these sites is poor, and the moisture regime ranges from subhygric to hydric. The active layer depth ranges from 29 to 40 cm.

3.1.6 Vegetation Type 6 – Low-Centred Polygons

This vegetation type is localized in depression areas and drained lake basins on the Tuktoyaktuk Peninsula, typically adjacent to areas of standing water. Low-Centred Polygons often occur adjacent to high-centred polygons and are usually similar in pattern size. However, the centre of the polygons are depressed, often containing pond water and are covered with wetland vegetation such as sheathed cotton-grass, *Carex consimilis*, *Carex rotundata*, *Carex lugens* and *Carex rariflora*. Peat moss is the dominant moss in the wet centres. Leatherleaf is an indicative plant of this vegetation type; however, it has a low percent cover value and is not represented. The drier ridges are dominated by dwarf shrub heath vegetation, including ground birch, bog bilberry, northern Labrador tea, mountain cranberry, cloudberry and black crowberry. Flat-leaved willow and green alder are also present, along with bog rosemary and red bearberry at lower cover values. Common lichen species include reindeer lichens and *Cetraria*.

The middles of low-centred polygons are wet and are surrounded by soil ridges pushed up adjacent to ice wedges. The polygons are usually located in poorly-drained areas that occupy low landscape positions such as depressions associated with thermokarst lakes or ponds, pingos, hollows or channel-like features, and are often mixed with or near high-centred polygons. These sites occur in ice-rich, fine-grained soils with a silty clay loam to clay loam texture on the morainal landforms and small lacustrine

basins. This vegetation type is nutrient poor and has a moisture regime ranging from subhygric to hydric. The active layer depth ranges from 11 to 50 cm.

3.1.7 Vegetation Type 7 – Riparian Shrub

The riparian shrub vegetation type is found along streams and drainage basins in the Tuktoyaktuk Peninsula. Taller shrubs form a closed canopy of flat-leaved willow, ground birch and green alder. Common ground cover species include mountain cranberry, northern Labrador tea, black crowberry and cloudberry, with sweet coltsfoot with lower cover values. Water sedge and marsh cinquefoil are common in areas with open water. The most common bryophyte is peat moss.

The riparian shrub vegetation type is most common on silty sand fluvial deposits associated with the small and beaded streams. Topography is subdued and concave, with slopes up to 5%. Soils are usually moderately well to poorly drained, with a shallow permafrost and water table near the surface. These sites have a poor to medium nutrient regime and the moisture regime ranges from hygric to hydric. The active layer depth ranges from 18 to 90 cm.

3.1.8 Vegetation Type 8 – Riparian Sedge – Cotton-Grass

The riparian sedge – cotton-grass vegetation type occurs on the perimeters of small lakes and ponds, and less commonly along small streams, in the Tuktoyaktuk Peninsula. The dominant vegetation is water sedge. Indicator species for this vegetation type include water horsetail and buck-bean. Peat moss is the most prominent nonvascular component.

The riparian sedge – cotton-grass vegetation type is most common on silty sand deposits associated with the small lakes and ponds. Topography is subdued with slopes up to 5%. Soils are usually imperfectly to very poorly drained, with a shallow active layer. These sites have a poor nutrient regime and the moisture regime ranges from subhydric to hydric. The active layer depth ranges from 15 to 45 cm.

3.1.9 Vegetation Type 13 – Riparian Black Spruce/Shrub

This vegetation type is the only forested tundra vegetation type, and is the northern limit of black spruce in the area. The average tree height on the survey plots is 9.1 m tall. The shrub layer is dominated by black spruce, flat-leaved willow and blue-green willow, and ground birch with lower cover values. The ground cover includes black crowberry, prickly rose, northern Labrador tea, mountain cranberry, and sweet coltsfoot. Dwarf scouring-rush and bog bilberry are also often present, but at lower cover values. Black spruce in the tree layer, and prickly rose in the ground cover layer are indicator species of this vegetation type.

This vegetation type is found exclusively along the floodplain and terraces of larger streams. Poorly developed soils on sandy to silty fluvial sediments show loamy sand to sandy texture with occasional gravely loamy sand sites. Sites are moderately well drained, transitioning to poor or very poor closer to the stream. The moisture regime is mesic and the soil nutrient regime range is poor. The active layer depth exceeds 100 cm.

3.1.10 Vegetation Type Td5 – Upland Alaska Birch – Spruce

The Td5 vegetation type is found scattered throughout upland terrain, often on ridges, knolls and upper slope positions and less frequently, in lowland areas. It occurs up to and including along the tree line. Alaska birch is dominant in the tree canopy along with smaller quantities of black spruce and white spruce. Average tree heights range between 8.0 and 11.0 m for the three canopy species. Blue-green willow, Alaska birch, mountain cranberry and soapberry occur in the understorey.

This vegetation type is primarily found on level to gently sloping moraine with silty clay to loamy texture. Organic deposits can occur as a veneer over depressional morainal deposits. Drainage varies from imperfect to poor depending on topographic position. Blanket slope drainage can also be present, where sheet flow occurs at the surface of the permafrost table. Moisture regime ranges from submesic to mesic and nutrient regime is poor.

3.1.11 Vegetation Type Th3 – Black Spruce/Ground Birch

The Th3 vegetation type occurs abundantly on mid to lower slope positions, and on lowlands on glaciolacustrine material. This vegetation type frequently intergrades with the Tundra upland shrub vegetation type. The dominant component of this vegetation type is the taller shrub canopy, composed primarily of ground birch and willows. Black spruce forms a scattered tree canopy and also appears in lower layers. The average tree height is 5.8 m in the tree canopy. Lower shrubs, including northern Labrador tea, bog bilberry, mountain cranberry and black crowberry are common. Mosses are a prominent component and include peat moss species, Schreber's moss and golden moss. Terrestrial lichens, including reindeer lichens, club lichens and *Peltigera*, have low cover values. The Th3 vegetation type occurs primarily on flat to gently sloping morainal landforms that frequently have a peat veneer. Thick morainal deposits overlying fairly level bedrock are also associated with this vegetation type. Drainage ranges from imperfect to very poor and can be further characterized by the presence of linked hollows, closed basins, or blanket slopes. The moisture regime ranges from subhygric to subhydric and the nutrient regime from poor to very poor. The active layer depth ranges from 30 to 55 cm.

3.2 Field Verification and Final Vegetation Mapping

Twenty-five (25) ground-based point surveys were completed to verify classification of vegetation cover. Visual verification of the preliminary mapping was also conducted from the air by correcting vegetation types on the field map on the way to and in between survey sites. Portions of borrow sources were surveyed for rare species by traversing the sites on foot. Notes on vegetation classifications were also completed at this time.

As a result of field observations, edits were made to the vegetation classification. Some additional line work was completed to separating Type 2 and Type 3 vegetation types in certain areas and the line work around Type 1 polygons was refined as it has been identified as high potential rare plant habitat. Type 1 vegetation polygons occur on exposed substrates, however there are only very few, small occurrences of exposed substrates within the Project study area. The Type 1 polygons do include some Type 2 and 3

vegetation types interspersed with these very small patches. Isolated Type 1 small exposures have not been mapped in detail as they are not discernible at the scale of the current mapping.

Additional line work was also completed on small Type 8 patches as they were identified as preferred Horned Grebe habitat (KAVIK-STANTEC 2012b). Type 7 patches were also reviewed and corrected as necessary, as they were identified as higher potential habitat for Rusty Blackbird. The maps identify small areas of “disturbed” land cover, which represent previous borrow source extraction areas.

The final vegetation cover areas by type has been summarized by Project study area, the 28 m footprint and within borrow source areas (see Table 3-1). The dominant vegetation types are vegetation Type 2 – dwarf shrub heath and vegetation Type 3 – upland shrub. These two types occur on very similar landscape types and in complexes with each other. The results from the mapping show that dwarf shrub heath and upland shrub are intermixed in many of the polygons and as a result, these are summarized as one vegetation type.

Traditional knowledge and land use information obtained for the Project study area (KAVIK-STANTEC 2012c) indicates that a number of plants found within the area are harvested for food and medicinal use. Berries are identified as important and commonly harvested. There are a number of berry producing plants common in the region including blueberries, crowberries, cranberries, cloudberries and red currants. The tundra vegetation Types 2 and 3 have crowberries, blueberries and cranberries as main components of the species composition as well as Labrador tea, which is used to make tea. Cloudberries or yellow berries are found within lower wet areas so are more associated with high and low centered polygon vegetation Types 5 and 6 but may also be found in vegetation Type 4. Red currant is species with a more southern range relative to the study area and is more associated with the black spruce vegetation Types 13 and Td5. Other species identified as food sources including wild rhubarb and aquatic plants with edible roots are not generally identified as main components of the vegetation types so distribution is not well represented by the mapping, however their potential locations can be associated with low wet areas, wetlands and shorelines.

Table 3-1 Distribution of Vegetation Classes within Study Area and at Borrow Sources

Vegetation Class	Project Study Area (ha)	28m Footprint (ha)	Borrow Source 170 (ha)	Borrow Source 174 (ha)	Borrow Source 177 (ha)	Borrow Source 309 (ha)	Borrow Source 314/325 (ha)	Borrow Source PW2 (ha)	Project Study Area (%)
01 Dry Saxifrage Tundra	454.4	0.2	35.3	113.7	4.6	49.7	0.0	0.0	2.0
02 Dwarf Shrub Heath	6136.2	149.0	1.0	50.8	19.5	53.6	0.0	0.0	26.7
03 Dwarf Shrub Heath/Upland Shrub	7792.7	147.0	3.5	301.7	90.4	102.9	0.6	173.7	33.8
04 Cotton-Grass Tussock	482.8	4.9	1.6	20.0	10.2	0.0	153.6	0.0	2.1
05 High-Centred Polygons	2065.2	41.4	1.6	33.5	0.1	7.1	1.0	0.0	9.0
06 Low-Centred Polygons	156.3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.7
07 Riparian Shrub	740.2	15.4	0.4	1.6	5.8	0.0	1.0	0.9	3.2
08 Riparian Sedge - Cotton-Grass	309.9	3.4	0.0	0.9	1.2	0.0	0.0	0.0	1.4
13 Riparian Black Spruce/Shrub	36.1	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.2
d5 Upland Alaska Birch - Spruce	731.4	14.6	0.0	0.0	0.0	0.0	0.0	61.9	3.2
h3 Black Spruce/Ground Birch	242.9	2.8	0.0	0.0	0.0	0.0	0.0	18.2	1.1
Dist Disturbed	13.6	0.0	0.0	0.0	6.0	3.8	0.0	2.4	0.0
00 Water	3910.8	0.0	0.0	108.1	12.7	92.7	0.0	0.0	16.9
Total	**23072.6**	**379.8**	**43.3**	**630.2**	**150.5**	**309.7**	**156.1**	**257.0**	**100.0**

4 RARE PLANT SURVEY RESULTS

Twenty-five (25) point surveys were completed to characterize the vegetation cover and survey for rare plants. Additionally, portions of borrow sources were surveyed for rare species by traversing the sites on foot.

One rare plant species, Yukon stitchwort (*Minuartia yukonensis*) was identified at three different locations at one borrow source, 173/305 (see Figure 4-1). Yukon stitchwort (Photos 4-1 and 4-2) is listed as Sensitive in the NWT using the General Status Ranking system. This ranking indicates that the species is of limited distribution but at present is not considered at risk. It was found to the west of the alignment during surveys for the MGP Project.

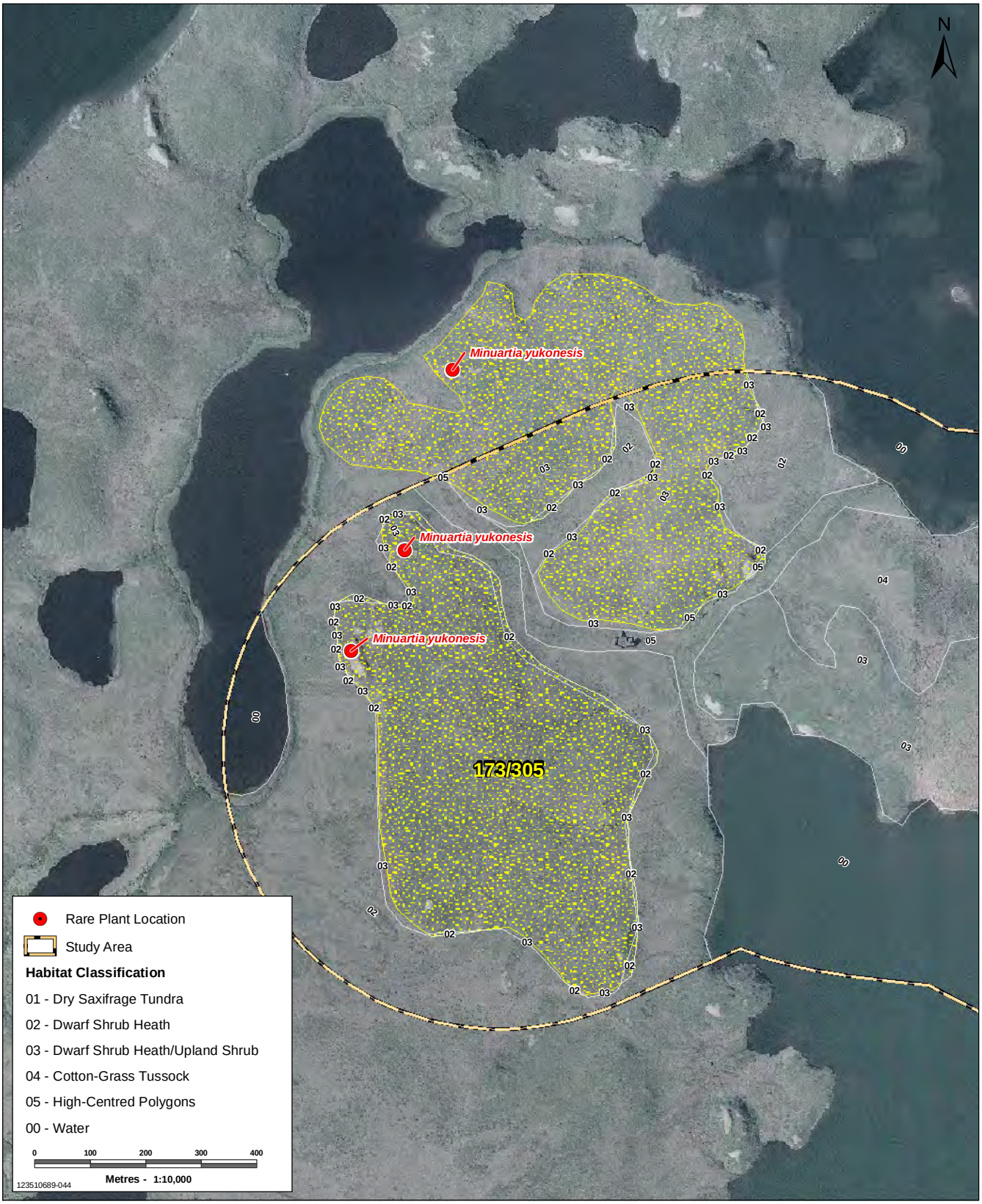
The rare plant surveys for this Project targeted almost all exposed substrates within borrow sources 170, 172, 173/305, 307, 312, 314/325 and 2.45. It was noted that Yukon stitchwort was found on south and south west facing slopes with a slope of 20% or greater (Photos 4-3 and 4-4). As the slope decreased and leveled out at the crest, the density of the stitchwort decreased. The density of the plants on the slope faces ranged from 1 per meter squared to 1 per 4 meters squared.

Many exposed slopes surveyed were also limited discharge areas, facing other directions, not as steep or had a low percentage of actual exposed mineral substrate. It appears that the plant has very specific habitat criteria. However these criteria were not as apparent on locations surveyed for MGP. The primary commonality is exposed substrate at elevated slope positions resulting in dry conditions.

Rare plant surveys were not conducted at borrow sources PW2, 309, 174 and 177, however results from rare plant surveys conducted in support of the MGP confirm occurrence of Yukon stichwort at borrow source 309 (see Figure 4-2)(IOL et al. 2004). Exposed tundra substrates occur within borrow sources 177 and 174 indicating potential for the occurrence of Yukon Stitchwort at these specific locations as well.

Mitigation options are limited for this species. Its habitat is very limited across the landscape and apparently very specific. Transplantation or seed collection are not proven techniques especially for species where there is no evidence that it would work. The locations it was found at the borrow source are very near the edge of the proposed extent of disturbance. A slight alteration to the proposed extent may serve to avoid the populations that were found.

Bryophyte and lichen samples were collected during the 25 point surveys. These samples require identification by a bryologist and a lichenologist. When results area available, they will be provided as supplemental information to this report.



Inuvik - Tuktoyaktuk Highway

Rare Plant Species at Borrow Source 173/305

Base Data provided by Government of Canada; Private Land data provided by the Joint Secretariat

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Northwest Territories Transportation

FIGURE NO.

4-1

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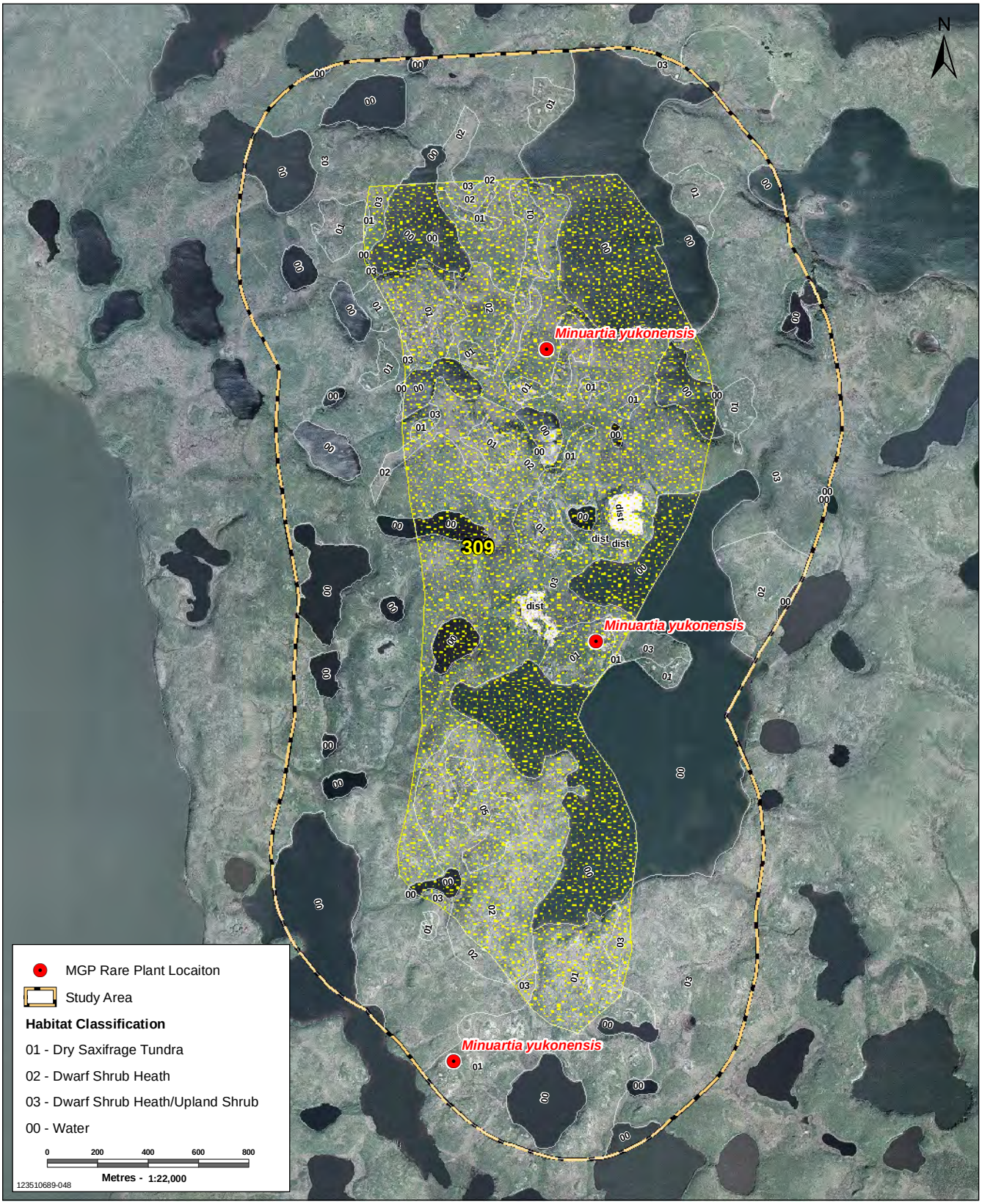

Inuvik - Tuktoyaktuk Highway

Rare Plant Species at Borrow Source 309

Base Data provided by Government of Canada; Private Land data provided by the Joint Secretariat

PREPARED BY

PREPARED FOR

Northwest Territories Transportation

FIGURE NO.

4-2

Last Modified: August 31, 2012 By: jpetho

Photo 4-1 Yukon stitchwort (Minuartia yukonensis)

Photo 4-2 Yukon stitchwort *(Minuartia yukonensis)*

Photo 4-3 Yukon stitchwort *(Minuartia yukonensis)* Habitat

Photo 4-4 Yukon stitchwort *(Minuartia yukonensis)* Habitat

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APPENDIX A

Vegetation Map Atlas