APPENDIX 5-A

Terrain, Permafrost, and Soils Baseline Report

June 2016
Report No. 1541520

May 2016

AGNICO EAGLE MINES: MEADOWBANK DIVISION - WHALE TAIL PIT PROJECT

Terrain, Permafrost, and Soils Baseline Report

Submitted to:
Agnico Eagle Mines Limited
Ryan Vanengen
Environment Superintendent

REPORT

Report Number: Doc 038-1524321.1100 Ver 0

Distribution:

1 copy: Agnico Eagle Mines Limited
1 copy: Golder Associates Ltd.

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1.0 INTRODUCTION

Agnico Eagle Mines Limited: Meadowbank Division (Agnico Eagle) is proposing to develop Whale Tail Pit, a satellite deposit on the Amaruq property, in continuation of mine operations and milling of the Meadowbank Mine. The Amaruq Exploration property is a 408 square kilometre (km^2) site located on Inuit Owned Land approximately 150 kilometres (km) north of the hamlet of Baker Lake and approximately 50 km northwest of the Meadowbank Mine in the Kivalliq region of Nunavut (Figure 1-1). The property was acquired by Agnico Eagle in April 2013 subject to a mineral exploration agreement with Nunavut Tunngavik Incorporated.

The Meadowbank Mine is an approved mining operation and Agnico Eagle is looking to extend the life of the mine by constructing and operating Whale Tail Pit (referred to in this document as the Project), which is located on the Amaruq Exploration property. As an amendment to the existing operations at the Meadowbank mine, it is subject to an environmental review established by Article 12, Part 5 of the *Nunavut Land Claims Agreement* (NLCA). Baseline data have been collected in support of the Environmental Review to document existing conditions and to provide the foundation for a qualitative and quantitative assessment of project operations and the extension of the mine development, to be evaluated in the Environmental Impact Statement (EIS) for the Project.

This report presents the results of the terrain, permafrost, and soil baseline conditions for the Project.

1.1 Study Area

1.1.1 Terrain, Permafrost, and Soils Study Area

The Terrain, Permafrost, and Soils study area covers an area of approximately 10,904.2 ha and is divided into the Whale Tail Pit (7,722.4 ha, 71% of the Project study area) and the Whale Tail Pit Haul Road (3,181.8 ha, 29% of the Project study area). The study area is based on a 1.5 km buffer around the proposed Whale Tail Pit operations, and the Haul Road study area is based on a 500 m wide corridor centered on the Haul Road footprint (Figure 1-2). The Haul Road starts at the Vault Pit and travels approximately 63 km north and northwest to the satellite deposit.

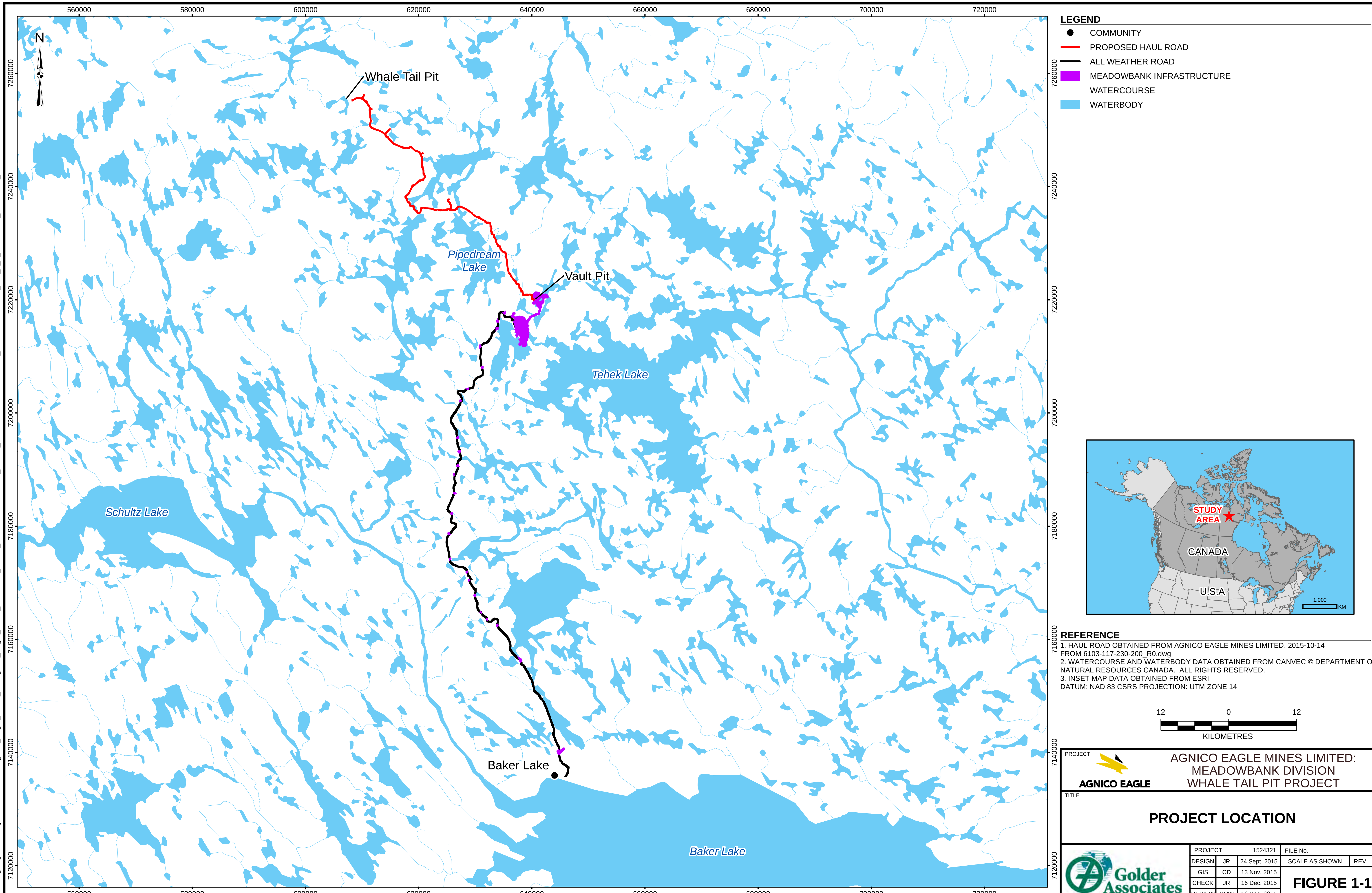
1.1.2 General Setting

The Project is found within two ecoregions (Figure 1-3):

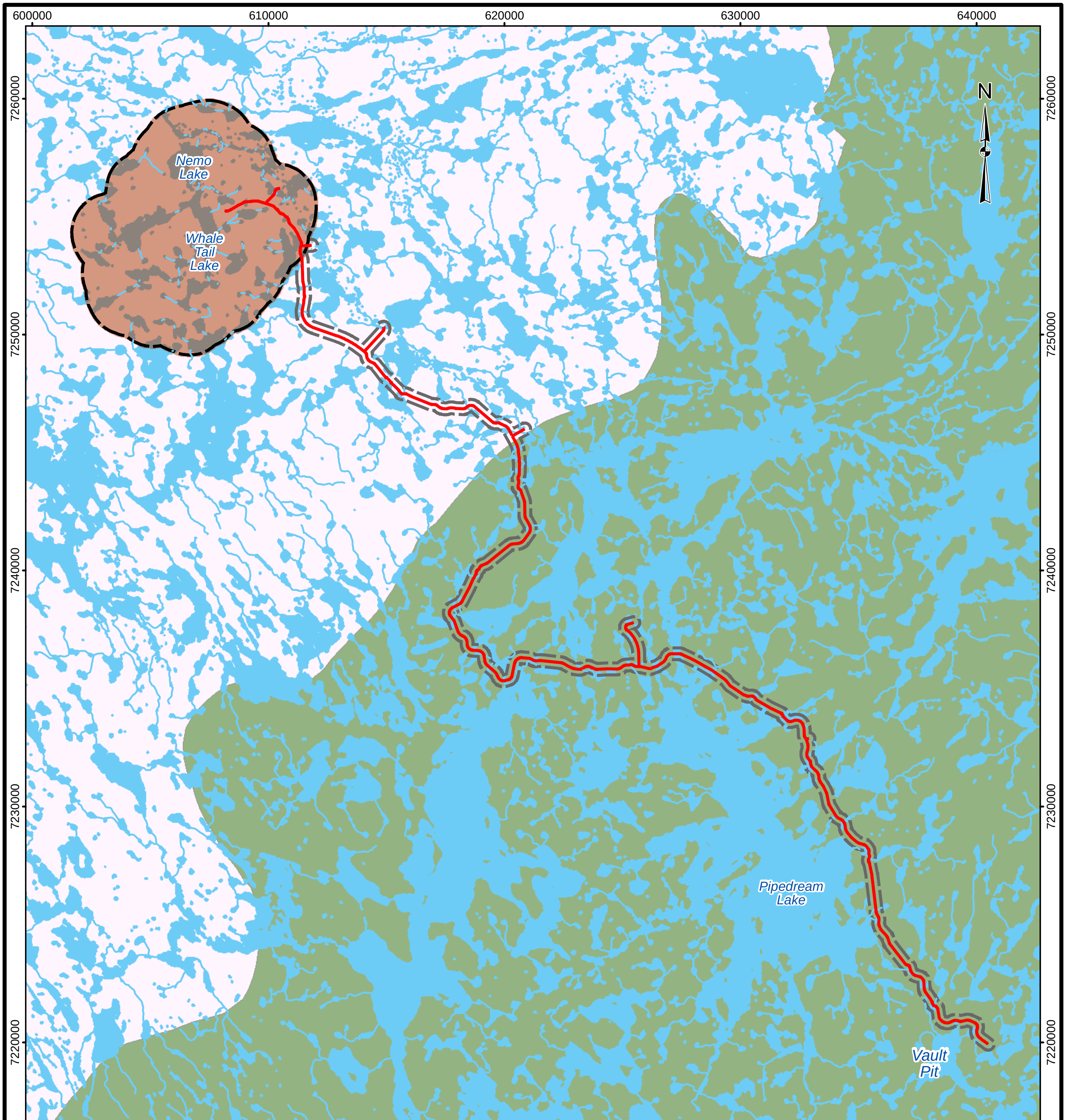
- Wager Bay Plateau (KP 0 to 42+250 on the Haul Road); and
- Garry Lake Lowland (KP 42+250 to 63+750 on the Haul Road and the satellite deposit).

The Wager Bay Plateau is an area composed of massive Archean rocks of the Canadian Shield that form broad, sloping uplands, plains, and valleys (Ecological Stratification Working Group [ESWG] 1995). It rises gradually westward from Chesterfield Inlet to approximately 600 metres (m) in elevation where it is deeply dissected (ESWG 1995). The Garry Lake Lowland lies west of the Wager Bay Plateau and is a vast area of massive granitic Archean rocks that have formed a broad, level to gently sloping plain that reaches approximately 300 metres above sea level (masl) (ESWG 1995). Elevations within the study area vary from approximately 139 to 205 m within the study area near the satellite deposit and approximately 116 to 192 m along the Haul Road.

Turbic and Static Cryosols that have developed on discontinuous, thin, sandy moraine (till) and alluvial (fluvial) deposits are the dominant soils in both ecoregions (ESWG 1995).



N
Whale Tail Pit
Pipedream Lake
Vault Pit
Tehek Lake
Schultz Lake
Baker Lake
Baker Lake
560000
580000
600000
620000
640000
660000
680000
700000
720000
7260000
7240000
7220000
7200000
7180000
7160000
7140000
7120000
LEGEND
COMMUNITY
PROPOSED HAUL ROAD
ALL WEATHER ROAD
MEADOWBANK INFRASTRUCTURE
WATERCOURSE
WATERBODY
STUDY AREA
CANADA
U.S.A
1,000
KM
REFERENCE
1. HAUL ROAD OBTAINED FROM AGNICO EAGLE MINES LIMITED. 2015-10-14 FROM 6103-117-230-200_R0.dwg
2. WATERCOURSE AND WATERBODY DATA OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
3. INSET MAP DATA OBTAINED FROM ESRI
DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14
12 0 12
KILOMETRES
PROJECT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT
TITLE
PROJECT LOCATION
Golder Associates
PROJECT 1524321
FILE No.
DESIGN JR 24 Sept. 2015
SCALE AS SHOWN
REV. A
GIS CD 13 Nov. 2015
CHECK JR 16 Dec. 2015
REVIEW DRW 16 Dec. 2015
FIGURE 1-1
\\golder.gds\gal\burnaby\CAD-GIS\Client\Agnico_Eagle_Mines_Ltd\Agnico_Eagle_Mines_Ltd\Whale_Tail\99_PROJECTS\1524321_EIS\02_PRODUCTION\BASELINE_REPORT\1524321_FIG_1_1_GENERAL_PROJECT_LOCATION.mxd



0 4 8

KILOMETRES

LEGEND

- WHALE TAIL PIT STUDY AREA
- HAUL ROAD STUDY AREA
- SATELLITE DEPOSIT STUDY AREA
- PROPOSED HAUL ROAD
- WATERCOURSE
- WATERBODY

ECOREGION

- GARRY LAKE LOWLAND
- WAGER BAY PLATEAU

REFERENCES

1. BASE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED (AGNICO EAGLE).
2. WATERCOURSE, WATERBODY DATA OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
3. ECOREGIONS FROM AGRICULTURE AND AGRI-FOOD CANADA.

DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED: MEADOWBANK DIVISION WHALE TAIL PIT PROJECT

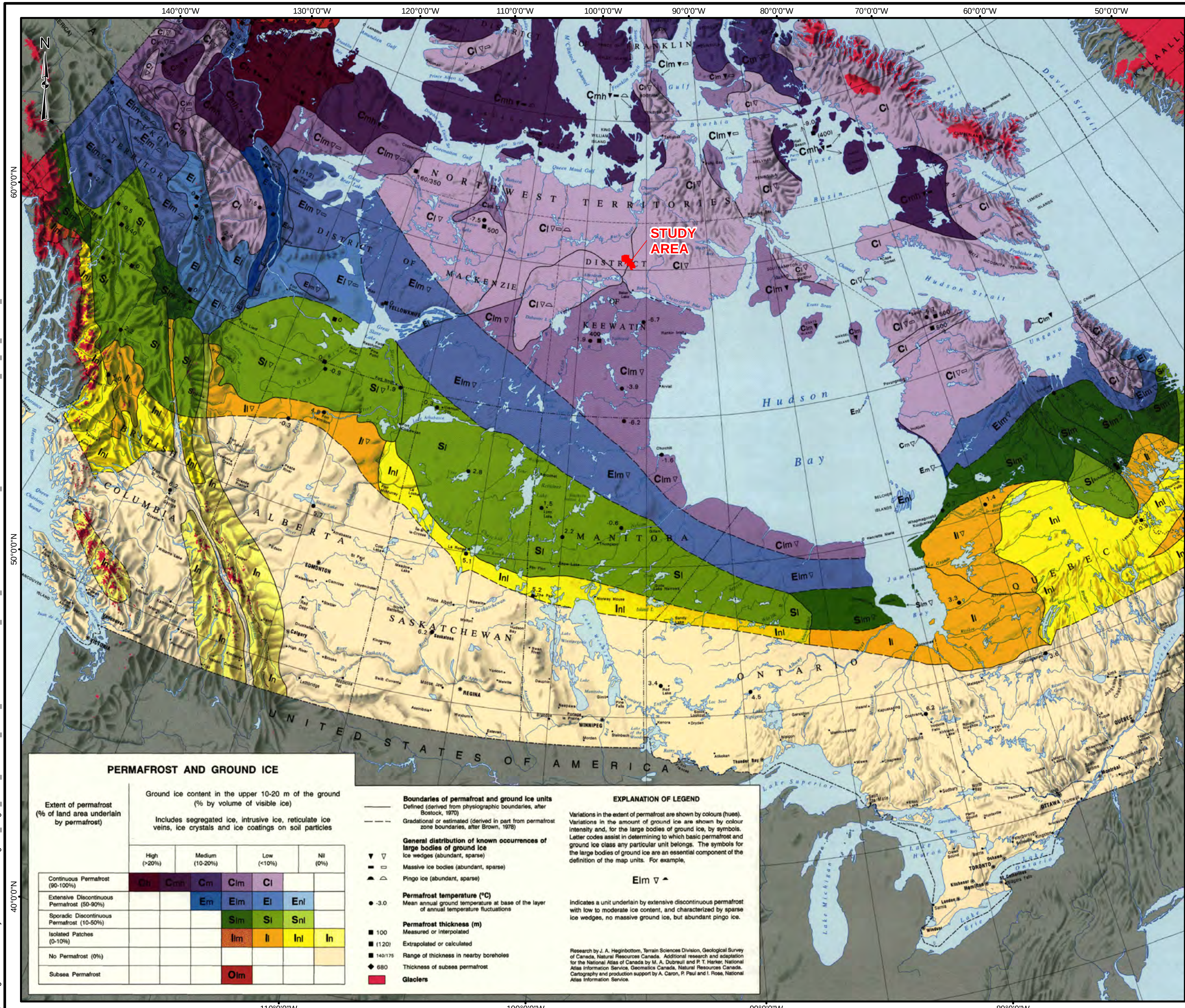
TITLE

TERRAIN, PERMAFROST AND SOILS STUDY AREA

Golder Associates

PROJECT NO.		1524321	FILE No.	
DESIGN	DO	27 OCT. 2015	SCALE AS SHOWN	REV. 0
GIS	JG	27 OCT. 2015		
CHECK	AS	02 MAY. 2016	FIGURE 1-2	
REVIEW	DO	02 MAY. 2016		

\\golder.gds\gal\burnaby\CAD-GIS\Client\Agnico_Eagle_Mines_Ltd\Agnico_Eagle_Mines_Ltd\Whale_Tail\99_PROJECTS\1524321_EIS\02_PRODUCTION\BASELINE_REPORT\TERRAIN\1524321_FIG_1-2_ECOREGIONS.mxd



LEGEND

STUDY AREA

REFERENCE

PROPOSED HAUL ROAD FROM AGNICO EAGLE MINES LIMITED (AGNICO EAGLE).
PERMAFROST MAP OF CANADA PRODUCED BY THE NATIONAL ATLAS INFORMATION SERVICE, CANADA CENTRE FOR MAPPING, GEOMATICS CANADA, AND THE TERRAIN SCIENCES DIVISION, GEOLOGICAL SURVEY OF CANADA, NATURAL RESOURCES CANADA. PRINTED 1995 (MCR 4177).
DATUM: NAD 83 CSRS PROJECTION: CANADA ATLAS LAMBERT

280 0 280
KILOMETRES

PROJECT: AGNICO EAGLE

AGNICO EAGLE MINES LIMITED: MEADOWBANK DIVISION WHALE TAIL PIT PROJECT

TITLE

PERMAFROST MAP OF CANADA

Golder Associates

PROJECT		1524321	FILE No.
DESIGN	DO	28 OCT. 2015	SCALE AS SHOWN REV. 0
GIS	CDB	28 OCT. 2015	
CHECK	AS	28 OCT. 2015	FIGURE 1-3
REVIEW	DO	28 OCT. 2015	

\\golder.gds\GAL\Burnaby\CAD-GIS\Client\Agnico_Eagle_Mines_Ltd\Whale_Tail\99_PROJECTS\1524321_EIS\02_PRODUCTION\BASELINE_REPORT\TERRAIN\1524321_FIG_1-3_CANADA_PERMAFROST.mxd

Permafrost is continuous in this area with low ice content (Figure 1-3; Heginbottom et al. 1995). This means that permafrost is found underlying 90 to 100% of the landscape, and that there is less than 10% ground ice content in the upper 10 to 20 m of the ground (based on percentage by volume of visible ice). Ice wedges tend to be sparse (Heginbottom et al. 1995).

2.0 METHODS

The following tasks were completed to properly classify the terrain and permafrost conditions found within the Project study area;

- review of publically available data, including maps and reports;
- detailed mapping at a scale of 1:5,000; and
- a field survey.

2.1.1 Review of Background Data

Literature relevant to the bedrock geology, terrain, surficial geology, Quaternary history, permafrost, and soils of the study area was reviewed and summarised in the following sections. Bedrock geology information consists of 1:250,000 scale mapping by Tella (1984) and 1:50,000 scale mapping by Zaleski (2005). More recent studies in the Meadowbank area have been completed by Sherlock et al. (2001) and Cumberland (2005 a, b). Surficial geology data consists of mapping by Dyke et al. (1979) and Thomas (1981) at scales of 1:125,000 and 1:250,000, respectively. Previous work for the Phase-1 Meliadine All-weather Access Road (Golder 2010) was also reviewed.

2.1.2 Bedrock Geology

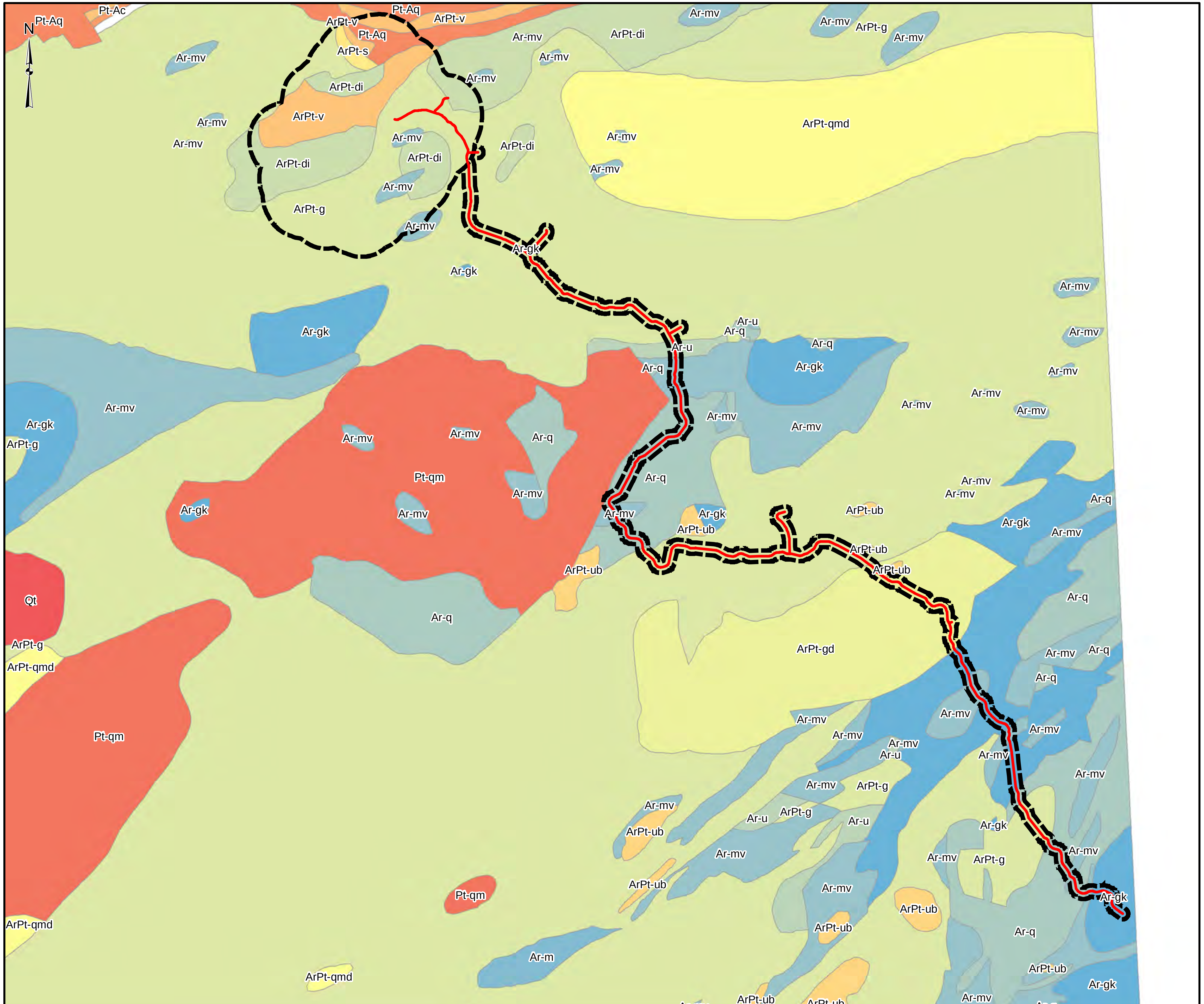
The bedrock geology in this region consists of Archean and Proterozoic supercrustal sequences and plutonic rocks (Figure 2-1). In the study area the Woodburn Lake Group (Archean supercrustal sequence) was intruded by orogenic granites, which in turn were unconformably overlain by a Proterozoic basin deposit known as the Amer Group (Sherlock et al. 2001; Zaleski 2005).

The Woodburn Lake Group is a sequence of Archean supercrustal rocks which are thought to have been deposited in a continental rift setting (Zaleski 2005). The group is composed of:

- a variety of ultramafic to felsic volcanic and volcaniclastic rocks, iron-formation, and related sedimentary rocks;
- quartz arenite, conglomerate, and related sedimentary rocks; and
- arkosic wacke and mudstone that are interlayered with iron formation (NRCAN 2015).

Although the Woodburn Lake Group is Archean, several phases of deformation have affected the stratigraphy, with four events recognised regionally (Sherlock et al. 2001).

The Amer Group was formed during the Early Proterozoic and is a succession of terrestrial and marine sedimentary rocks which outcrop in the north part of the study area near the satellite deposit (Figure 2-1). This group is composed of quartzarenite, carbonate rock, carbonaceous shale, siltstone, mudstone and sandstone, and tectonized mafic volcanic rock. It overlies the Neoarchean granite and lesser supercrustal rocks of the Woodburn Lake Group (NRCAN 2015).



LEGEND

TERRAIN_LSA_MINESITE_ACCESSROAD_COMBINED

- STUDY AREA
- PROPOSED HAUL ROAD

BEDROCK GEOLOGY

MAP UNIT CODE AND DESCRIPTION

- Ar-gk | Greywacke, chlorite schist, banded iron formation
- Ar-m | Migmatite, layered and/or banded gneiss
- Ar-mv | Metavolcanic rock (Archean)
- Ar-q | Orthoquartzite (Archean)
- Ar-u | Ultramafic rocks (Archean)
- ArPt-di | Undifferentiated foliated granitoid rocks
- ArPt-g | Granite
- ArPt-gd | Granodiorite
- ArPt-qmd | (K-feldspar) augen gneiss
- ArPt-s | Biotite schist, paragneiss
- ArPt-ub | Mafic to ultramafic rocks (Archean and/or Early Proterozoic)
- ArPt-v | Metavolcanic rock (Archean and/or Early Proterozoic)
- Pt-Ac | Carbonate
- Pt-Aq | Orthoquartzite (Proterozoic)
- Pt-qm | Quartz monzonite to granite
- Qt | Quaternary

REFERENCE

PROPOSED HAUL ROAD FROM AGNICO EAGLE MINES LIMITED (AGNICO EAGLE).
BEDROCK GEOLOGY:GEOLOGY, AMER LAKE (66H), DEEP ROSE LAKE (66G) AND PARTS OF PELLY LAKE (66F); TELLA, S. GEOLOGICAL SURVEY OF CANADA, OPEN FILE 2969, 1994, ; 1 SHEET, CANADA. PRINTED 1995 (MCR 4177).
DATUM: NAD 83 CSRS PROJECTION: CANADA ATLAS LAMBERT

3 0 3

KILOMETRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

BEDROCK GEOLOGY OF THE PROJECT AREA

Golder Associates

PROJECT		1524321	FILE No.
DESIGN	AS	28 OCT. 2015	SCALE AS SHOWN REV. 0
GIS	JG	28 OCT. 2015	
CHECK	AS	28 OCT. 2015	FIGURE 2-1
REVIEW	DO	28 OCT. 2015	

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2.1.3 Quaternary History

The terrain and surficial deposits within the study area are the result of the glacial history of the region. Although there are several events predating the last glaciation, due to a lack of stratigraphic sections a region-wide correlation is not possible (Dyke and Dredge 1989). As a result, the majority of surficial deposits in the Project area were deposited by the Laurentide Ice Sheet, which existed in the Late Wisconsin period 24,000 to approximately 8,000 years before present (BP). The Laurentide Ice Sheet was at or near its maximum extent by 18 ka, and by 11 ka retreat of the ice sheet was well underway (Dyke and Prest 1987a). The Project lies close to what is known as the Keewatin Ice Divide. An ice divide is a topographic ridge on an ice mass that induces a divergence of flow lines from a linear axis (Dyke et al. 1989). There has been some debate as to how long the Keewatin Ice Divide existed and whether the Laurentide Ice Sheet was single- or multi-domed (Tyrrell 1913; Flint 1943; Lee et al. 1957). Drift prospecting south of Baker Lake led Shilts et al. (1979) to define the Keewatin Ice Divide as a long-lived feature of the multi-domed Laurentide Ice Sheet.

A compilation of surficial geology maps and ground observations led Aylsworth and Shilts (1989) to produce a map showing the glacial features around the Keewatin Ice Divide. They refined the position of the ice divide based on interpreted zones or suites of glacial landforms that radiated outwards from the Keewatin Ice Divide. The study area lies within Zone 2 but is close to the boundary of Zone 3 (Figure 2-2). Zone 2 is an area characterised by well developed, linear trains of ribbed (rogen) moraine, which radiate from the Keewatin Ice Divide and extend along former flow lines. This zone also contains radiating esker-outwash systems and linear drumlin fields. Zone 3 is characterised by a dendritic pattern of eskers and drift cover (till) (Aylsworth and Shilts 1989; Aylsworth et al. 2012). More recent research by Utting and McMartin (2004) measuring small scale ice-flow indicators (e.g., striations, roches moutonnées) in the Meadowbank Mine area suggests that initial ice movement north of the Keewatin Ice Divide was to the north and then the ice turned towards the north-northwest. These small-scale features reflect the flow direction inferred by large scale features such as eskers in this area and presented by Aylsworth and Shilts (1989) and Aylsworth et al. (2012). The change in flow direction is due to the retreat of ice during deglaciation as the underlying topography started to have more control on the direction of ice flow. By about 8,000 years BP the Keewatin Ice had retreated beyond the study area and had entirely melted from the Keewatin area by approximately 7.8 ka BP (Dyke and Prest 1987a,b).

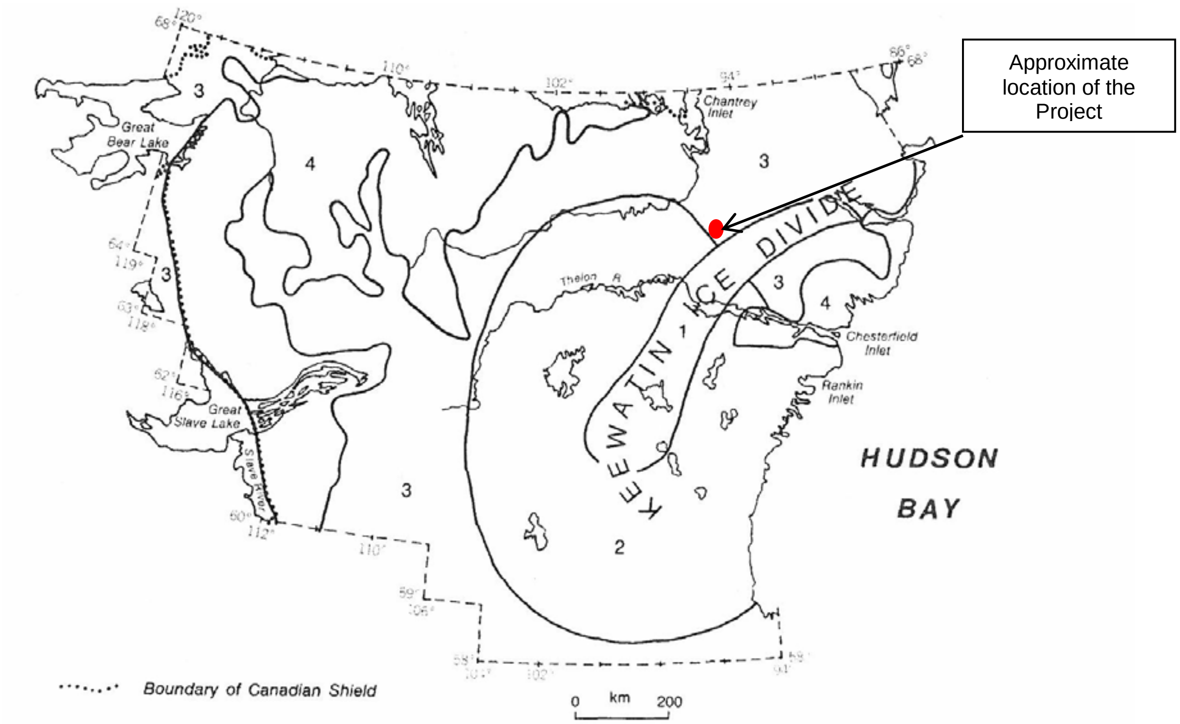


Figure 2-2: The Glacial Landform Assemblage Zones that are Concentric about the Keewatin Ice Divide (after Aylsworth and Shilts 1989)

2.1.4 Surficial Geology

The surficial geology in the region is influenced by the bedrock geology, glacial history, and on-going geological processes (e.g., periglacial processes). Surficial geology data consists of mapping by Dyke et al. (1979) and Thomas (1981) at scales of 1:125,000 and 1:250,000, respectively. This previously completed mapping suggests that the study area is comprised of shallow till overlying undulating bedrock with scattered bedrock outcrops and eskers; thin lacustrine materials overlying till have been identified in the proposed Whale Tail Pit and at the north end of the Haul Road. The till is characterised as a massive matrix supported diamicton composed of pebbly silty sand with locally derived boulders (Dyke et al. 1979; Thomas 1981). Boulders up to 2 m long are common on the surface (Thomas 1981). The glaciofluvial sediments are composed of coarsely stratified to finely laminated medium to coarse sand and gravel (Dyke et al. 1979) up to 30 m thick (Thomas 1981) and the lacustrine sediments are composed of poorly stratified silty sand (Dyke et al. 1979). More recent terrain mapping was completed for the Meadowbank Mine (Cumberland 2005a, b); the Meadowbank Mine area is approximately 50 km to the southeast of the proposed Whale Tail Pit to the south. The Meadowbank Mine area is dominated by hummocky boulder glacial till plains and scattered boulder till moraines with frequent bedrock outcropping in isolated exposures, elevated plateaus and elongate ridges. Glaciofluvial kames and eskers are rare.

2.1.5 Permafrost and Periglacial Processes

Permafrost is defined as ground (soil or rock and includes ice or organic material) that remains at or below 0 degrees Celsius (°C) for at least two consecutive years (Everdingen 1998). Near the ground surface, temperatures rise above 0°C for part of the year and this seasonally thawed layer above the permafrost is called the active layer (Everdingen 1998). The depth of the active layer can vary based on material type and water content, presence or absence of vegetation, proximity to water, and general topographic aspect (the direction the slope faces, either north, south, east, or west), but is relatively consistent over regional areas. The active layer is deeper in poorly drained low lying areas, and shallower in well drained areas such as ridge lines.

Permafrost is sometimes referred to as ‘warm’ or ‘cold’. The actual temperature ranges associated with such naming varies depending on source; however, Hammer et al. (1985) suggest that ‘warm’ permafrost has a temperature range of 0 to -4^{o}C, and ‘cold’ permafrost has a temperature range colder than -4^{o}C. The construction of surface infrastructure, such as roadways, in ‘warm’ permafrost is considerably more difficult than construction in ‘cold’ permafrost. This is because the balance between the frozen and thawed state for ‘warm’ permafrost is delicate, and minimal energy, such as ground disturbance during road construction, is required to change the state from a frozen to a thawed state.

Ground surface features, such as palsas, peat plateaus, thermokarst lakes, patterned ground (mudboils, polygons, and stripes), solifluction lobes, rock heave features, and block fields are indicative of underlying frozen ground conditions. The role of frost action is particularly evident on frost shattered bedrock and in areas of thick, fine grained sediments. In bedrock areas the presence of permafrost is indicated by the occurrence of ice in rock pores, and of lenses and veinlets of ice in fissures (Dyke et al. 1989).

The presence of permafrost and associated ground ice strongly influence the properties and performance of earth materials, landscape processes and surface and subsurface hydrology. Shilts (1978) suggests that mudboils occur widely in the Kivalliq region – natural moisture contents are near the liquid limits, so that muds liquefy and flow readily in response to slight changes in moisture content or external stresses.

Permafrost and periglacial processes were described by Dyke et al. (1979) in their extended legend for north-central Kivalliq. They suggested that in areas of till the frost depth is at depths between 40 and 70 centimetres (cm) and that although the ground ice in the area has less than 5% ice content, layers of almost pure ice can be found just below the frost table in low lying areas. From a patterned ground perspective they suggest that circles (mudboils), polygons and stripes are common within till areas. In glaciofluvial areas they suggest that the frost table is commonly 60 to 90 cm but may be up to 1.5 m deep in unvegetated areas, and non-sorted polygons occur on almost every type of glaciofluvial deposit. Lacustrine sediments commonly have an active layer of about 50 cm, and circles, polygons and stripes develop on these finer grained deposits (Dyke et al. 1979).

Permafrost in the Meadowbank Mine area is considered to be ‘cold’ based on the definition by Hammer et al. (1985) and is estimated to extend to 450 to 550 m deep depending on the proximity of lakes (Cumberland 2005b). The depth of the active layer ranges from 1.3 m in areas with shallow overburden to about 4 m adjacent to lakes. A talik (zone of permanently unfrozen ground) was identified below Second Portage Lake and within the Meadowbank Mine area; taliks will likely exist where water depth is greater than 2 to 2.5 m (Cumberland 2005b).

2.1.6 Soil

Existing information on soil types, characteristics, and distribution in the region is limited. A high level discussion of soil development and soil classification for the Meadowbank Mine is discussed in Section 4.0 (Terrain and Soils) of the Meadowbank Gold Project Baseline Terrestrial Ecosystem Report (Cumberland 2005a).

As described in the Baseline Terrestrial Ecosystem Report (Cumberland 2005a), the development of soil in this region, including the Project study area, is strongly influenced by the Arctic climate. Mean annual temperatures of -11°C combined with low annual precipitation (ESWG 1995) resulting from the cold, dry Arctic air influence soil development by slowing weathering rates (i.e., the breakdown of bedrock into mineral fractions) and keeping the ground frozen throughout much of the year. Soil chemical, physical, or biological processes involved in soil development can be impeded or prevented in low soil temperatures while the presence of water is essential to these processes due to its influence on movement of soil components throughout the soil horizons. As a result, soils in the region are generally nutrient poor resulting from the reduction in chemical, physical, and biological processes.

The Project is located within the continuous permafrost zone. The presence of permafrost in soil is considered the main factor in the fluctuations between freeze and thaw conditions fundamental in periglacial processes and the main driver for cryoturbation in soil. Cryoturbation is frost heave due to the increase in volume from water to ice causing churning and considerable structural modification of the soils (Tarnocai and Bockheim 2011). The soil becomes churned, resulting in mixed, broken, displaced, and disrupted horizons (SCWG 1998) (Photo 1, Appendix A).

The presence of continuous permafrost at the Project suggests that soils in the region are predominantly of the Cryosolic Order. Soils of the Cryosolic order are considered the dominant soils in the Arctic regions of Canada (Tarnocai and Bockheim 2011). These soils are formed in either mineral or organic materials that have permafrost either within 1 m of the surface or within 2 m, if the active layer of the soil has been strongly cryoturbated (SCWG 1998). Cumberland (2005a) state that two great groups of the Cryosolic Order, Turbic Cryosols and Static Cryosols, are predominantly found within the Meadowbank Mine area. Turbic Cryosols are described in Cumberland (2005a) as mineral soils with marked cryoturbation with a permafrost layer within two metres of the mineral surface. Static Cryosols are described as soils that have permafrost within 1 m of the surface and show little to no evidence of cryoturbation. Cumberland (2005a) asserts that Turbic Cryosols and Static Cryosols are found in areas where the mean annual soil temperature is less than or equal to 0°C and are most commonly found in coarse textured glaciofluvial, fluvial, and some glacial till parent materials (Cumberland 2005a) suggesting Turbic Cryosols and Static Cryosols are also the predominant soil types in the Project study area.

2.2 Detailed Mapping

2.2.1 Terrain

Preliminary detailed terrain mapping was completed for the Project study area at a scale of 1:7,500 using 1:60,000 black and white aerial photographs acquired on September 1, 1979 and August 3 and 4, 1982. These aerial photographs were obtained from the National Airphoto Library in Ottawa and subsequently rectified for use in Golder Associates Ltd.'s (Golder) softcopy mapping system (PurVIEW and ArcGIS). These photos are considered to be of poor quality as they were quite hazy (typical for many aerial photographs flown by the Federal Government in Nunavut and Northwest Territories). Final terrain mapping was completed at a scale of 1:5,000 using 50 cm WorldView-2 digital stereo satellite imagery acquired on August 28, 2015 and used with Golder's softcopy mapping system. Where there was no satellite imagery coverage, the 1:60,000 black and white imagery was used.

The purpose of the terrain mapping was to develop a baseline terrain map. Relatively homogenous terrain units were delineated within the Project study area on the basis of:

- surficial material (e.g., till, bedrock, organic, etc.);

- surface expression (e.g., undulating, rolling, etc.);
- depth to bedrock (e.g., at surface, <1 m, 1 to 3 m and >3 m);
- slope class (e.g., 0 to 2%, 2 to 5%, 6 to 9%, etc.);
- drainage class (rapid, well, moderate, imperfect, poor, and very poor); and
- geological modifying processes (e.g., general periglacial processes, solifluction, etc.).

In the softcopy system, mapping was possible at a scale of 1:3,000 to 1:5000 using the digital satellite imagery. All mapping was completed in adherence to the standards and definitions presented in the Terrain Classification for British Columbia (Howes and Kenk 1997). This classification system has been used previously for other work across Canada. A series of 11" x 17" map sheets have been produced, with each terrain polygon having a label as follows:

$$\frac{\text{Mv[Ru]} - \text{Cr}}{\text{m - i}}$$

Where:

M	=	dominant parent material type;
v	=	surface expression or depth to bedrock;
R	=	underlying parent material;
u	=	surface expression of underlying material;
C	=	geological modifying process;
r	=	geological modifying process subclass;
m, i	=	drainage class.

The terrain label above suggests that the unit would be comprised of moderately well to imperfectly drained (m-i) morainal (M) veneers (v) that are less than 1 m in thickness overlying undulating (u) bedrock (R). The materials are influenced by cryoturbation (C) resulting in patterned ground features (r) such as polygons and/or mudboils.

Preliminary mapping occurred prior to the field survey program, while final mapping was completed following the field program in August 2015 (see Section 2.3). The purpose of the final mapping was to modify any of the preliminary line work and to incorporate the site-specific data from the field program.

2.2.2 Soils

Soil development and subsequent mapping of soil extent and distribution involves an understanding of terrain morphology (i.e., shape and relief), surficial geology (i.e., material type and stratification), and the local and regional drainage patterns. To assess the extent and distribution of soils in the Project study area, a dominant soil type was identified and associated with each mapped terrain unit based on the parent material type, surface expression, depth to bedrock, and the results of the field survey. According to *A Soil Mapping System for Canada: Revised* (Agriculture Canada 1981), at least 65% of the map unit must be comprised of the dominant soil type. The remaining proportion of the map unit will include different soil types as minor components of the map unit (up to 35%) and/or inclusions in the map unit (less than 15%) (Agriculture Canada 1981). Minor soil types (up to 35% of the map unit) are similar and non-limiting components of the map unit. Similar components refer to soils that may be different from the dominant soil in some properties yet have the same interpretations (i.e., sensitivity ratings) and non-limiting components of a map unit do not affect the management of the unit in a significantly different way from the dominant soils. Soil inclusions in the map units (less than 15%) are likely to be dissimilar and limiting but only take up a small proportion of the map unit and thus were not identified or rated.

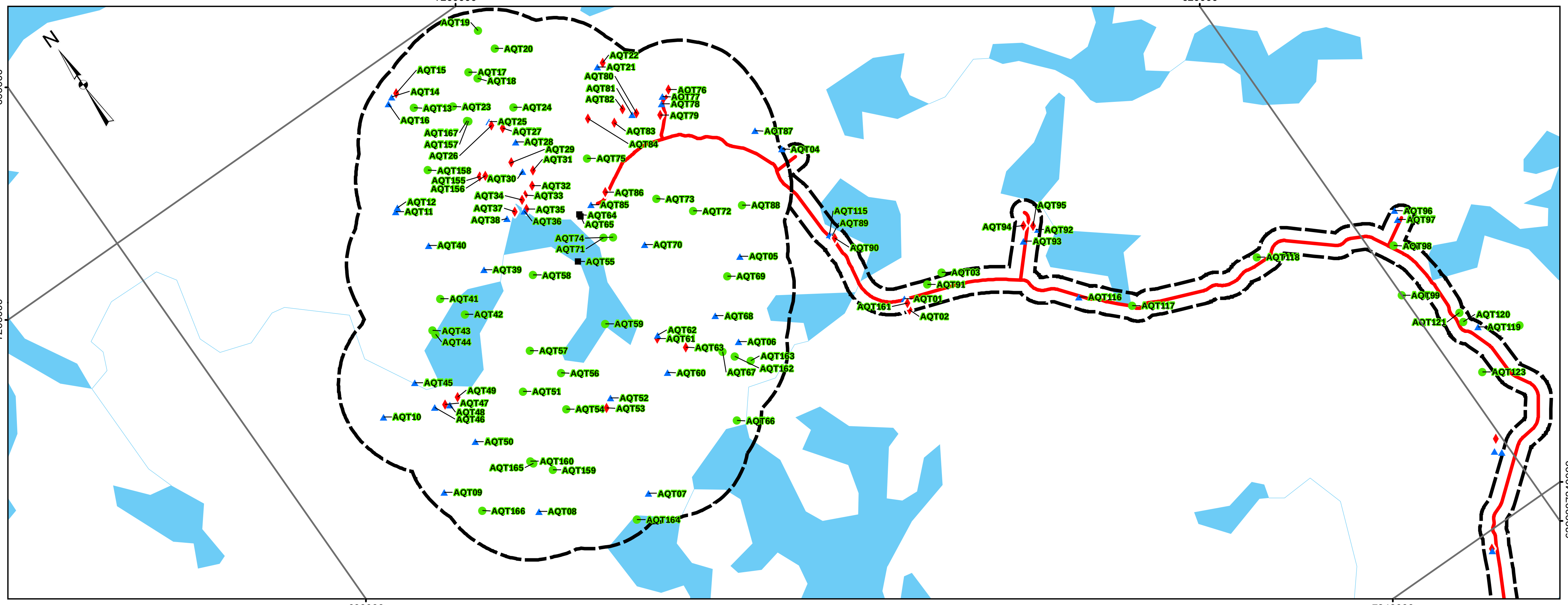
Terrain units were separated into five parent material types; till, glaciofluvial, fluvial, lacustrine, and organic. Thickness, surface expression and depth to bedrock were used to sub-divide parent material types further. Till units were divided into deep units with surface material greater than 1 m thick, (e.g., Mb unit), moderate units with surface material less than 1 m but greater than 20 cm thick (e.g., Mvb unit), and shallow units with surface material less than 20 cm thick (e.g., Mvx unit). Glaciofluvial units were separated into deep (e.g., FGr, FGb units) and shallow surface material (e.g., FGvb) based on the same thickness range (as identified for till materials). Fluvial, lacustrine, and organic units were not subdivided due to their infrequent occurrence.

In cases where the terrain units are stratified, dominant soils were associated with each terrain type and the proportions of each were taken into account when calculating the distribution of the dominant soil types. For example, if a unit is 24 hectares (ha) in size and 80% of the unit is dominated by Orthic Dystric Turbic Cryosol and 20% of the unit is dominated by Orthic Dystric Brunisols then 19.2 ha is comprised of Turbic Cryosols and 4.8 ha of the unit consists of Brunisolic soils.

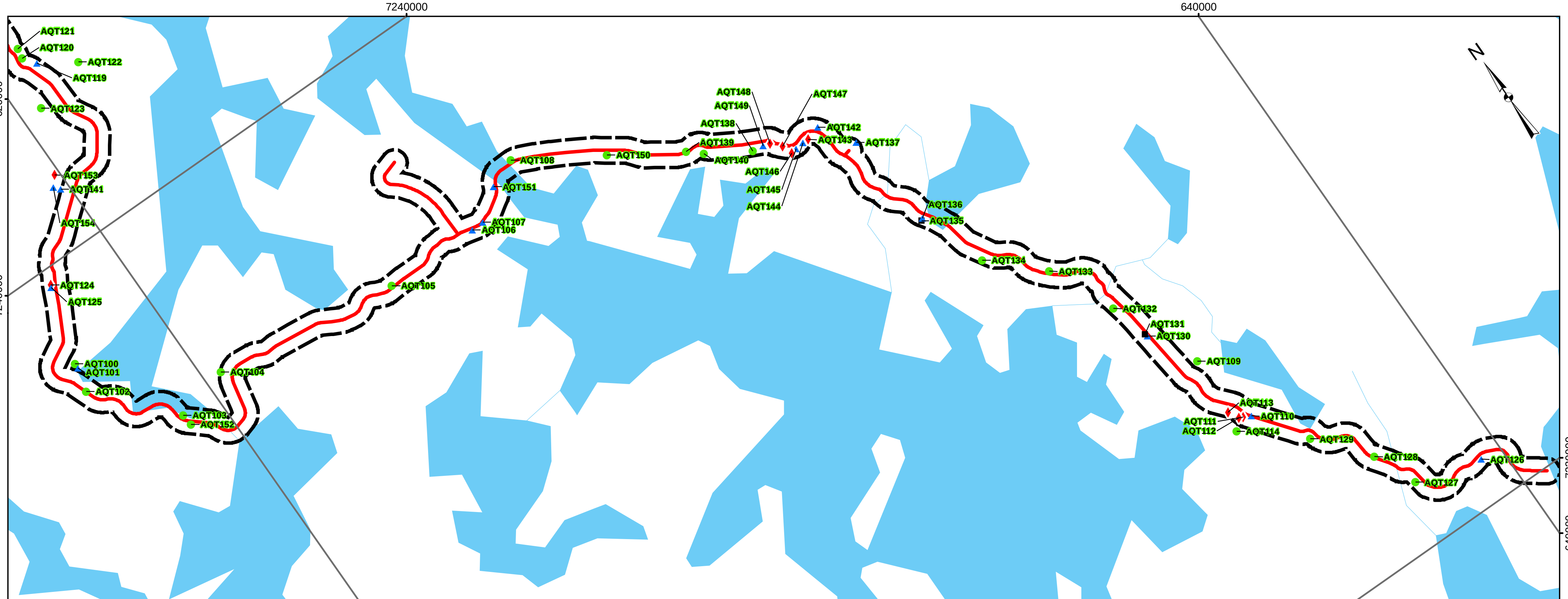
2.3 Field Surveys

A terrain and soils field program was completed August 13 to 19, 2015. The purpose of the field survey was to ground truth the preliminary mapping and to collect detailed field data on the parent materials, surface expression, depth to bedrock, slopes, drainage, and geomorphic processes (e.g., periglacial features) to support the final mapping and environment impact assessment of the Project.

Field sites were selected prior to the fieldwork (from the preliminary mapping) to adequately sample all materials and landscapes. Six days of fieldwork were completed by a crew consisting of a terrain scientist and a soil scientist; Agnico Eagle also provided a wildlife monitor to accompany the crew. Observation pits were dug by hand using a shovel and Dutch auger up to a maximum depth of 1 m, or to “auger refusal” if ground ice or gravelly or stony contacts were encountered. Organic soils were examined using a Dutch auger to the depth of peat plus 0.2 m into the underlying mineral. Terrain data was collected from a total of 168 sites (Figure 2-3), of which 63 are considered detailed, 40 ground observations, and 65 air calls. Soil surveys were completed at 66 sites (Figure 2-3).



37+250 TO 63+750
WHALE TAIL PIT



0+000 TO 37+250
VAULT PIT

LEGEND

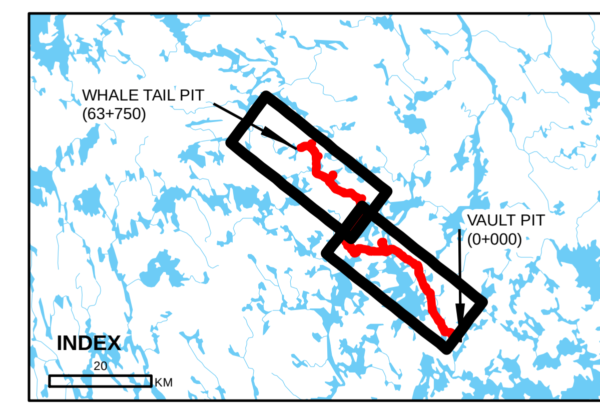
- STUDY AREA
- PROPOSED HAUL ROAD

FIELD SITE LOCATION (2015)

- TERRAIN AND SOIL (GROUND - DETAILED)
- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)
- TERRAIN (GROUND - QUICK)

BASEMAP FEATURE

- WATERCOURSE
- WATERBODY



REFERENCE

1. HAUL ROAD OBTAINED FROM AGNICO EAGLE MINES LIMITED. 2015-10-14 FROM 6103-117-230-200_R0.dwg
2. WATERCOURSE AND WATERBODY DATA OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
3. INSET MAP DATA OBTAINED FROM ESRI

DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

2 0 2
KILOMETRES

PROJECT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE
LOCATION OF
TERRAIN AND SOIL FIELD SITES

Golder Associates

PROJECT		1524321	FILE No.
DESIGN	AS	24 Sept. 2015	SCALE AS SHOWN REV. A
GIS	JG	20 Oct. 2015	
CHECK	AS	20 Oct. 2015	FIGURE 2-3
REVIEW	DO	20 Oct. 2015	

\\golder.gds\GAL\Burnaby\CAD-GIS\Client\Agnico_Eagle_Mines_Ltd\Whale_Tail\99_PROJECTS\1524321_EIS\02_PRODUCTION\BASELINE_REPORT\TERRAIN\1524321_FIG_2_3_TERRAIN_AND_SOIL_FIELD_SITES.mxd

2.3.1 Terrain

At each detailed ground inspection site an observation pit was dug and the following information was recorded (Appendix B):

- GPS co-ordinates;
- elevation (masl);
- slope and aspect (where applicable);
- parent material type (e.g., till, glaciofluvial, etc.);
- surface expression (e.g., undulating, steep etc.);
- depth to bedrock (veneer, blanket);
- clast content, size, and angularity (coarse fragment content);
- sorting and structure of sediment (e.g., matrix or clast supported);
- matrix texture (e.g., gravelly sandy silt);
- drainage (e.g., well, poor, etc.);
- geoprocesses (e.g., periglacial processes); and
- notes and supporting documentation.

Digital images were taken of the pit and the surrounding landscape and sketch diagrams of landscape features were drawn. Quick ground observations and air call observations from the helicopter were recorded to provide additional information to be included in the final mapping. For example, areas of exposed bedrock, gullies or streams, change in slope, or geoprocesses. At these sites, GPS coordinates were recorded along with a note of the observation made. In addition, supplementary information was provided from digital photos taken with a camera.

2.3.2 Soil

The following soil information was recorded for each soil survey site:

- soil subgroup and parent material type;
- surface expression, slope class, slope position, slope length, aspect, and drainage;
- horizons, horizon thickness, colour, texture, structure, consistence, carbonates, coarse fragment content, surface stoniness and mottling, if present;
- fine and coarse roots; and
- depth to bedrock and water table if encountered;

Soils were identified, described and classified according to the Canadian System of Soil Classification (SCWG 1998).

Soil samples of representative soil types identified in the study area were collected from five sites during the terrain and soils field program and analyzed to determine baseline soil quality. Samples were collected from each horizon unless soil horizons were less than 5 cm thick, had excessive stones or boulders, or were frozen, as it was impractical to obtain an adequate quantity of soil sample in these circumstances. Once collected, soil samples were placed in labelled, re-sealable plastic bags and kept cool until submission to ALS Laboratory Group in Winnipeg, Manitoba. Soil samples were analyzed for the following chemical parameters:

- potential of hydrogen (pH) and electrical conductivity (EC);
- plant available chloride (Cl), calcium (Ca), potassium (K), magnesium (Mg), and sodium (Na);
- sodium adsorption ratio (SAR);
- percent saturation;
- nitrate (NO_3) and nitrite (NO_2); and
- particle size (for mineral soils).

2.4 Quality Assurance and Quality Control

Quality control and quality assurance were completed by a senior terrain scientist during the preliminary mapping and final mapping and classification. Preliminary terrain mapping (including both linework and classification) was reviewed by a senior terrain scientist early in the mapping process. Any discrepancies in linework and classification were discussed with the individual mappers and revisions made prior to the field program. Final mapping and classification were reviewed by a senior terrain scientist to confirm that the linework and classification properly reflected the nature of the terrain in the Project study area.

Field datasheets were checked in the field to confirm that all data fields were completed. Data entry was evaluated for errors or omissions by reviewing all the datasheets to confirm that the electronic database accurately reflected field observations. All results tables for chemical analyses were checked for transcription errors.

3.0 RESULTS

3.1 Terrain

The surficial geology of the Project study area shows strong evidence of glacial activity and confirms much of the previously completed high level mapping by Dyke et al. (1979) and Thomas (1981) for the Project area. The area is dominated by veneers and blankets of till overlying undulating bedrock. Bedrock frequently outcrops in isolated exposures, elevated plateaus and elongated ridges. The southern part of the Haul Road is controlled more by the underlying bedrock than the satellite deposit where thicker till deposits are common. A large glaciofluvial esker and terrace complex is found in the northeast part of the satellite deposit and extends towards the southeast intersecting at or close to the Haul Road in several areas. Lakes and ponds are abundant throughout the study area, occupying approximately 16% of the area.

Table 3-1 provides summaries of surficial materials found within the Whale Tail Pit, the Haul Road and Project study area and crossed by the Haul Road from Vault Pit to the proposed Whale Tail Pit, respectively. The properties of each surficial material are described in detail below. Photographs are provided in Appendix A. Appendix C is a mapbook showing the distribution of primary surficial deposits in the study area; field site locations are also shown. The polygon labels provide information on primary and any secondary surficial deposits within each polygon, any geoprocesses and drainage. A legend describing the sediment and explaining the terrain codes is also included in Appendix C.

Table 3-1: Summary of Surficial Materials in the Project Study Area

Surficial Material	Whale Tail Pit		Haul Road		Project Study Area	
	Area (ha)	Percent (%)	Area (ha)	Percent (%)	Area (ha)	Percent (%)
Anthropogenic	0.0	0.0	25.0	0.8	25.0	0.2
Bedrock	232.2	3.0	115.1	3.6	347.3	3.2
Colluvium	13.5	0.2	1.8	0.1	15.2	0.1
Fluvial	2.9	<0.1	0.0	0.0	2.9	<0.1
Glaciofluvial	486.7	6.3	112.7	3.5	599.3	5.5
Lacustrine	0.0	0.0	4.7	0.1	4.7	<0.1
Organic	0.4	<0.1	4.7	0.2	5.1	<0.1
Till	5,457.3	70.7	2,703.9	85.0	8,161.2	74.8
Waterbody	1,529.5	19.8	214.0	6.7	1,743.5	16.0
Total	**7,722.4**	**100.0**	**3,181.8**	**100.0**	**10,904.2**	**100.0**

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

Table 3-2: Summary of Surficial Materials Crossed by the Haul Road from Vault Pit to the Proposed Whale Tail Pit

Surficial Material	Haul Road	
	Length (m)	Percent (%)
Anthropogenic	107.7	0.2
Bedrock	1,846.0	2.6
Colluvium	14.5	<0.1
Fluvial	0.0	0.0
Glaciofluvial	2,032.4	2.9
Lacustrine	153.6	0.2
Organic	108.6	0.2
Till	65,027.5	93.2
Waterbody	444.7	0.6
Total	**69,735.1**	**100.0**

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
m = metre

A discussion of the individual material types is found below; the discussion is based upon data from published reports as well as the field data collected to support this assessment.

3.1.1 Till

Till is deposited directly by glacial ice and is found at the surface in 70.7% of the satellite deposit and 85.0% of the Haul Road areas (Table 3-1). It is the dominant material throughout the Project study area (74.8%) and 93.2% (Table 3-2) of the Haul Road crosses till materials of variable thickness. The till varies in thickness throughout the Project study area with thicker deposits (more than 3 m thick) are found in areas throughout the satellite deposit (especially near lakes A15, A16, A20, the north side of A65 and the east side of A17 [Appendix

C]) and the north end of the Haul Road. Overburden thickness data provided by Agnico Eagle (Frenette 2015, pers. comm.) indicates that in the Whale Tail Lake area the overburden can be up to 10 m thick overlying bedrock. Thinner blankets (1 to 3 m thick), veneers (<1 m thick) and thin veneers (< 20 cm thick) of till are found in the northern part of the satellite deposit and for much of the Haul Road south of Esker #3. Due to the abundance of stones within the till it was often difficult to hand-dig pits with the average depth of pit being 52 cm. As a result, exposures of bedrock were noted during field.

The till throughout the study area consists of a silty sand matrix with a clast content varying from 5 to 60%. The clasts vary in size from granule gravel to boulders and they are angular to subangular (Photo 2, Appendix A). Areas where the till has a higher clast content tend to have a greater percentage of stones on the surface (Photo 3, Appendix A), and those areas with a lower clast content have less surface stones (Photo 4, Appendix A).

Drainage in till materials varies from well to poor depending on the location within the landscape. In areas of gently undulating topography the till is moderately well drained. Till with a lower clast content tends to be moderately well to imperfectly drained. Well drained boulder fields (Photo 5, Appendix A) were noted throughout the study area and are found in two topographic positions. Those found on gentle slopes are thought to be areas of washed till, with all the fine grained material removed mainly during deglaciation as meltwater washed over the material. Drainage in these areas is well to moderately well. Boulder fields were also noted adjacent to, or occurring in draws between many of the lakes within the study area (Photo 6, Appendix A). These areas are washed of all fine material as the lake levels drop (on average 60 cm, see Hydrology Baseline report [Golder 2015b]) throughout the summer months. In some areas the lake beds (boulder fields) are completely dry by the end of the summer. Drainage in these areas is poor during spring melt and well drained once the water levels have dropped.

Perched boulders (Photo 7, Appendix A) were also noted especially on bedrock ridges. These were let down by ice melt or ablation during deglaciation.

3.1.2 Glaciofluvial

Glaciofluvial deposits are found primarily in the northeast part of the Project study area (Appendix C) but they extend outside of the study area towards the southeast paralleling and intersecting the Haul Road. Approximately 6.3% of the satellite deposit study area and 3.5% of the Haul Road study area are characterised as having glaciofluvial deposits (Table 3-1; Appendix C); only 2.9% of the Haul Road crosses these sediments (Table 3-2). These deposits were transported and deposited by glacial meltwater rivers either directly in front of or in contact with glacial ice. As the ice melted, the large esker and outwash terrace complexes were revealed (Photo 8, Appendix A).

The eskers are commonly found adjacent to exposed bedrock suggesting that they formed at the base of the ice and the bedrock was washed clean of other material. These esker ridges are sharp to flat topped with side slopes of 35% (were measured in the field). The eskers are composed of well-sorted fine- to coarse-grained sand with minor amounts of silt and varying amounts (0 to 95%) of subangular to subrounded granule, pebble and cobble gravel (Photo 9, Appendix A). These sediments are generally well to rapidly drained. In some areas large subangular to angular cobbles and boulders mantle the surface of the eskers. It is thought that these were let down on top of the eskers as the ice containing the stones slowly melted *in situ*.

Glaciofluvial outwash terraces with eroded channels and kettles (depressions in surficial materials resulting from the melting of buried or partially buried glacial ice) are commonly found adjacent to the eskers (e.g., AQT16, Photo 10, Appendix A). The terraces are also found around basins that currently occupy lakes (e.g., AQT26, Photo 11, Appendix A). These flat topped features are several meters thick and commonly are mantled with a cobbled pavement (Photo 12, Appendix A) suggesting that any fine-grained material was washed away. Aylsworth and Shilts (1989) suggest that the terraces were formed when the ice was thin (< 25 m) and was left behind in depressions as the ice front retreated. They suggest that the terraces are remnants of outwash that was deposited on inactive esker ridges or against valley sides by meltwater flowing across the stagnant ice. Where eskers protruded above the surface of the stagnant ice they were planed off or terraced by fluvial erosion or deposition to the level of the terrace or ice floor, leaving flat-topped esker segments. Once the ice completely melted, lakes formed in the depressions between the terraces.

3.1.3 Colluvium

Colluvial materials are formed by the downslope movement of material due to gravity. They are characterised by angular fragments of frost shattered or frost wedged bedrock lying at the base of steep bedrock exposures (Photo 13, Appendix A). Only 0.2% (13.5 ha) of the satellite deposit study area and 0.1% (1.8 ha) of the Haul Road study area is covered by colluvial deposits (Table 3-1). The Haul Road crosses less than 0.1% (Table 3-2) material identified as colluvial.

3.1.4 Fluvial

Fluvial deposits are mapped in one area just south of the proposed satellite deposit (<0.1% of the satellite deposit study area, Table 3-1; Appendix C). Although there is water movement between lakes throughout the Project study area, the water is flowing generally between boulders and there is little or no sediment or clast movement or deposition due to flowing water (e.g., AQT148, Photo 14, Appendix A). As a result these areas have been mapped as washed till with poor drainage. The fluvial sediments near the satellite deposit are composed of approximately 10 to 20 cm of sand overlying till; this area is poorly drained and there is some organic accumulation (Photo 15, Appendix A).

3.1.5 Organic

Only two areas of organic material were noted in the field making; organics account for only 5.1% of the entire study area. The first is adjacent to Esker #3 (AQT97, Appendix C) where 50 cm of organic material was found overlying sandy pebbly glaciofluvial material. The other was found east of lake C46 (AQT27, Appendix C) where 45 cm of organic material was found overlying a silty clay till with 30% clast content. In both areas drainage is very poor to poor. There will likely be other areas within the LSA, especially in depressions, where there are veneers of organic material overlying other sediments. Without additional field verification it is not possible to determine the thickness and extent of organic material in depressional areas within the study area and therefore where there is potential for the accumulation of organic material, these areas have been mapped as poorly drained. Approximately 0.2% of the Haul Road crosses organic material.

During the fieldwork the wildlife monitor mentioned some of the traditional methods used either by himself or his family. At one site there was some organic humic material which the wildlife monitor said was used in the past on the bottom of his father’s dog sled to allow it to slide easily over the snow.

3.1.6 Bedrock

Exposed bedrock accounts for 3.0% of the satellite deposit study area and 3.6% of the Haul Road study area (Table 3-1). Approximately 2.6% of the Haul Road crosses bedrock (Table 3-2). Regolith, a layer of unconsolidated rocky debris of any thickness overlying bedrock (Parker 1994) has also been mapped as bedrock within the Project study area. Several areas were identified in the field as being composed of rocky debris that appears to have had been plucked or quarried from the adjacent or underlying bedrock, picked up by the ice and let down almost immediately. The quarrying of fragments from bedrock is the result of stress concentrations below the ice enlarging and connecting weaknesses (joints) in the rock, eventually leading to the detachment of a fragment or fragments (Benn and Evans 1998). One such area is located at AQT61 and AQT63 (Photos 16 and 17, Appendix A). There is a small esker in this area indicating that there was a subglacial meltwater channel in the area depositing material in the esker and removing any surficial material from the surrounding bedrock. The washed bedrock would then be subject to plucking and the plucking process was likely enhanced by the freezing of meltwater in joints and cracks within the bedrock. Other areas where plucking of bedrock is noticeable is on the north or northwest side of bedrock ridges (e.g., AQT28, Photo 18, Appendix A). Ice flow in the area was towards the north and north-northwest (Utting and McMartin 2004) and small cavities would develop under the ice sheet on the lee (north) side of the ridges. Lower than normal pressures in these lee side areas promotes cracking and fracturing of bedrock just upstream of the cavity resulting in plucking of bedrock.

3.1.7 Lacustrine

Lacustrine deposits were previously mapped by Dyke et al. (1979) and Thomas (1981) in parts of the satellite deposit study area and the north end of the Haul Road. No sediments were mapped as lacustrine in the satellite deposit study area and only 0.1% of the Haul Road study area has been identified as lacustrine. The lacustrine sediments are located south of Esker #4 and composed of silty sand with granule gravel (Appendix C). Lacustrine sediments identified by Dyke et al. (1979) and Thomas (1981) are likely areas of washed till adjacent to lakes. It is possible that fine-grained lacustrine sediments are found elsewhere within the study area but the exposed areas around the lakes tend to be coarse grained boulder fields.

3.2 Permafrost and Periglacial Processes

3.2.1 Permafrost

The Project study area is found within the zone of continuous permafrost meaning that permafrost is found underlying 90 to 100% of the landscape. Heginbottom et al. (1995) suggest that the permafrost in the Canadian Shield extends to depths of more than 500 m in the northern Ungava Peninsula, Somerset Island, and Bathurst Inlet and decreases in thickness to about 60 m in the Churchill, Manitoba area, which lies near the southern limit of continuous permafrost.

The depth of the permafrost in the Project study area is estimated to be between 450 and 550 m depending on proximity to lakes, similar to that estimated for the Meadowbank Mine (Cumberland 2005b). The permafrost and talik conditions below Whale Tail Lake have been characterised by Knight Piésold Consulting (2015). Thermistors were installed in six drill holes around the periphery of the proposed open pit and Whale Tail Lake to collect data on the ground thermal regime. Knight Piésold concluded the following:

- Permafrost is expected below the land and the shallowest parts of Whale Tail Lake.

- The depth of the permafrost in the Project study area is estimated to be approximately 425 m
- A talik is expected below the central portions of Whale Tail Lake
- The talik is likely underlain by permafrost in the shallower and narrower parts of Whale Tail Lake
- The talik is thought to connect vertically with the sub-permafrost aquifer in the deeper and wider parts of the lake.

3.2.2 Periglacial Processes

Periglacial processes are most evident in areas where till materials are found. The ground features and patterns observed in the field and on the satellite imagery are typical of areas underlain by continuous permafrost. The meaning and definition of the various geomorphic features and processes identified follows the standard definitions given in Everdingen (1998).

The periglacial features present in the area fall into three main process types as follows:

- physical weathering of in situ materials;
- freezing induced displacement of soils; and
- thaw induced displacement of soils.

Physical Weathering

Frost shattering and wedging occur on exposed bedrock and in coarse grained boulder fields. The frost shattered bedrock accumulates at the base of steeper slopes as colluvium (Photo 19, Appendix A). Photo 20 (Appendix A) shows an example of a frost shattered stone.

Freezing Induced Displacement of Soils

Evidence for cryoturbation of till and glaciofluvial sediments occurs in the form of patterned ground, small low hummocks, mudboils, and cracks. These terrain features indicate that periglacial processes such as frost sorting, frost heave, and frost creep are acting on the surficial materials within the study area.

Patterned ground is evident throughout the Project study area and is mapped (Appendix C) where field data is available (to support its mapping). The dominant mechanism for the formation of patterned ground is the recurrent freezing and thawing of moist soil (Ballantyne 2013). Sorted patterned ground develops on unvegetated or sparsely vegetated terrain where abundant clasts overlie or are within fine grained material. The till within the study area has a high clast content and the matrix is a silty sand; ideal for the development of sorted patterns. On level or gently undulating ground the sorted patterns consist of polygons or cells of mainly fine sediment surrounded by stony borders (Photo 21, Appendix A). Most researchers envisage the development of sorted patterns occur in terms of a circulatory model involving the upward and/or outward movement of sediment in cells. Sorting occurs when the sediment moving out towards the margins at or near the surface is coarser than the sediment moving inwards towards the center of the cell at depth (Ballantyne 2013). Non-sorted polygons (bound by vegetation rather than clasts) are also evident within the landscape (Photo 22, Appendix A). With an increase in slope both sorted and non-sorted polygons can become elongated forming stripes.

The fine sediment within the center of sorted or non-sorted polygons is commonly referred to as a mudboil (Photo 23, Appendix A). These are bare soil patches that have a semi-rigid surface layer approximately 10 to 15 cm thick underlain by a thawed substrate approximately 15 to 20 cm thick. The thawed substrate is super-saturated due to the underlying permafrost table restricting the free drainage of water (Shilts 1978). As a result, this super-saturated layer can liquefy and in many of the hand dug pits, slowly flowed back into the excavated hole (Photo 24, Appendix A).

Ice wedge polygons are also evident within the study area and are associated with thick glaciofluvial deposits (Photo 25, Appendix A). Ice wedges form by the infilling of thermal contraction cracks in frozen ground with meltwater and sediment. Repeated contraction cracking of the ice in the wedge, followed by freezing of the water in the crack gradually increases the width and depth of the wedge (Everdingen 1998). The surface expression of ice wedges is generally a network of polygonal troughs at the ground surface (Photo 25, Appendix A).

Thaw induced Displacement of Soils

Solifluction is the slow downslope movement of saturated unfrozen sediment over impermeable frozen ground. The rate of movement varies in response to changing soil properties, vegetation, drainage, snow cover, and topography. The slow movement results in the formation of distinct step-like landforms called solifluction lobes (Photo 26, Appendix A). Solifluction was noted in several areas throughout the study area on gentle slopes.

3.3 Soils

3.3.1 Soil Classification

Soil orders identified during the baseline field program included Cryosolic, Brunisolic, Gleysolic, and Regosolic soils (Table 3-3). Regosolic and Orthic Dystric Cryosols, as well as Brunisolic, and Regosolic soils were generally found at moderately well to rapidly drained upland landscape positions. Gleysols and Gleysolic Cryosolic soils were found in moderately well to imperfectly drained transition areas between upland and depressional landscape positions (i.e., drainage channels). Organic Cryosolic soils were found in areas of poor to very poor drainage (i.e., wetlands).

Similar to the main Meadowbank mine site (Section 4.0 [Terrain and Soils] of the Meadowbank Gold Project Baseline Terrestrial Ecosystem Report, Cumberland 2005a), which is approximately 50 km to the southeast of the satellite deposit study area, the Whale Tail project area is also dominated by Cryosolic soils, in particular Turbic Cryosols (Table 3-3 and Table 3-4). Further, saturated soil layers overlying frozen layers, described for the Meadowbank Mine (Cumberland 2005a), were readily observed in Turbic and Static Cryosols classified during the 2015 field survey. Mottling and gleyed coloring, both evidence of soil saturation were observed in this layer. It was noted during the field survey that Cryosolic soils with saturated layers were more common at the satellite deposit as opposed to the Haul Road. A thicker active layer due to thicker parent material deposits observed at the satellite deposit may explain this observation, as landscapes in this area tend to be more subdued and have smaller slope gradients. This would result in a reduction of water movement by horizontal drainage and surface runoff, leading to an accumulation of soil water above the frozen soil layer and subsequently saturating the overlying soil.

Table 3-3: Summary of Soils Classified within the Study Area

Soil Order	Soil Subgroup	Number of Field Sites
Cryosolic	Orthic Dystric Turbic Cryosol	26
	Orthic Dystric Static Cryosol	1
	Regosolic Turbic Cryosol	16
	Regosolic Static Cryosol	3
	Gleysolic Turbic Cryosol	5
	Gleysolic Static Cryosol	1
	Terric Fibric Organic Cryosol	2
Brunisolic	Orthic Dystric Brunisol	6
Regosolic	Orthic Regosol	1
Gleysolic	Rego Gleysol	4
	Orthic Gleysol	1
Total		**66**

Table 3-4: Dominant Soil Subgroups within the Project Study Area

Soil Order	Dominant Soil Subgroup	Whale Tail Pit		Haul Road		Project Study Area	
		Area [ha]	Proportion [%]	Area [ha]	Proportion [%]	Area [ha]	Proportion [%]
Cryosolic	Orthic Dystric Turbic Cryosol	5,336.5	69	2,394.1	75	7,730.6	71
	Regosolic Turbic Cryosol	176.3	2	360.9	11	537.2	5
	Terric Fibric Organic Cryosol	0.4	<1	4.7	<1	5.1	<1
Brunisolic	Orthic Dystric Brunisol	431.2	6	91.3	3	522.5	5
Gleysolic	Rego Gleysol	2.9	<1	n/a	n/a	2.9	<1
Bedrock/ Colluvium	n/a	245.7	3	116.9	4	362.5	3
Water	n/a	1,529.5	20	214.0	7	1,743.5	16
Total		**7,722.4**	**100**	**3,181.8**	**100**	**10,904.2**	**100**

Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.
ha = hectare; % = percent; n/a = not applicable.

3.3.2 Soil Mapping

As discussed in Section 2.2, a dominant soil type was associated with each terrain map unit to assess the spatial extent and distribution of the soils in the Project study area. The dominant soil types identified in Table 3-3 comprise at least 65% of the terrain map units (Agriculture Canada 1981).

Soil field survey results are presented in Table 3-4. Based on these results:

- Orthic Dystric Turbic Cryosols (7,730.6 ha [71%]) were the dominant soil identified in the moderate and deep till terrain units, and the lacustrine unit;

- Orthic Dystric Brunisols (522.5 ha [5%]) were the dominant soil in the deep glaciofluvial terrain units;
- Regosolic Turbic Cryosols(537.2 ha [5%)]) were the dominant soil in both the shallow glaciofluvial and shallow till terrain units;
- Rego Gleysols (2.9 ha [<1%]) are the dominant soil in fluvial units; and
- Terric Fibric Organic Cryosols (5.1 ha [<1%]) were the dominant soil in organic units.

The distribution and extent of the dominant soil types within the Project study area are illustrated in Appendix D and provided in Table 3-4.

3.3.3 Soil Sensitivity and Capability Ratings

Soil sensitivity and capability ratings were based soil physical and chemical characteristics of the dominant soil subgroups identified in the field survey. Physical characteristics of the 66 soil inspection sites and chemical characteristics for the five representative samples collected during the field survey are presented in Appendix E (Table E-1 and Table E-2). Sensitivity and capability ratings for the soils observed for the Project are presented in Table 3-5. Methods used to generate the sensitivity and capability ratings are discussed below.

Table 3-5: Soil Sensitivity and Capability Ratings

Soil Order	Dominant Soil Subgroup	Parent Material	Wind Erosion Rating[(a)]	Water Erosion Rating[(b)]	Sensitivity to Acidification Rating[(c)]	Compaction Sensitivity Rating[(d)]
Cryosolic	Orthic Dystric Turbic Cryosol	Till and lacustrine[(f)]	Medium	Medium	Medium to high	Low
	Regosolic Turbic Cryosol	Till and glaciofluvial[(g)]	Medium to high	Medium	Medium to high	Low
	Terric Fibric Organic Cryosol	Organic	Low	Low	Medium	High
Brunisolic	Orthic Dystric Brunisol	Glaciofluvial	High	Low	High	Low
Gleysolic	Rego Gleysol	Till	Low	Low	Medium	High

[(a)] TAC (2005).
[(b)] Adapted from Coote and Pettapiece (1989).
[(c)] Adapted from Holowaychuk and Fessenden (1987).
[(d)] Adapted from Lewis et al. (1989).
[(e)] Alberta Agriculture (1987).
[(f)] Observed as dominant soil in both till and lacustrine material.
[(g)] Observed on shallow deposits of till and glaciofluvial material.

3.3.3.1 Erosion Sensitivities

Soil erosion risk is one of the primary concerns for disturbed soils because the sparse vegetation cover exposes soil materials to the elements (e.g., wind and water). Vegetative cover is limited to low lying vascular and nonvascular plants on the tundra landscape (Dougan and Associates 2015) and the lack of extensive root systems does not offer significant soil stabilization. With continuous exposure to wind or rain, the uppermost portions of the soil profile may be eroded, washed, or blown away, depending on soil and terrain characteristics, resulting in loss of topsoil and subsequent soil quality.

Wind Erosion

Wind erosion ratings were assigned to the soil subgroups identified in map units in the Project study area. Mineral soil sensitivity to wind was based on the uppermost mineral soil horizon texture and a dimensionless index described by Coote and Pettapiece (1989).

Wind erosion ratings assigned to dominant soil subgroups classified during the field program are presented in Table 3-5. Wind erosion ratings for the Brunisolic soils and Regosolic Turbic Cryosols associated with glaciofluvial parent material (i.e., eskers) were considered High based on the sandy and gravelly sand textured upper soil horizons present. Soils with Low to Medium wind erosion ratings potential were associated with medium textured (sandy loam) upper horizon material of the till deposits, and/or are sheltered from the wind in depressional areas of the landscape associated with till, fluvial, lacustrine, and organic deposits.

Water Erosion

Determining soil erosion potential by water is based on methods described by the Transportation Association of Canada (TAC 2005). Water erosion ratings and potentials were assigned to dominant soil subgroups within the Project study area based on characteristics of soils and terrain (i.e., topsoil texture, slope length, and gradient) recorded during the field survey. Water erosion potentials were then assigned to each soil subgroup. Water erosion potentials are based on soils that have been disturbed and have not had mitigation applied.

In the Project study area, Turbic Cryosols, dominant in the till, fluvial, and lacustrine parent material, have Medium sensitivity to water erosion due to the sandy loam textured upper soil material. The coarse sandy Brunisolic soils associated with eskers' (i.e., glaciofluvial parent material) have Low sensitivity to water erosion. The erosion potential increases to Medium on locations along the eskers' steep side slopes. Gleysolic soils occurring at transition and depressional landscape positions in till-dominated landscapes have Low sensitivity to water erosion. Regardless of soil type, if slope percentage or slope length increases, the water erosion potential for soils will also increase.

3.3.3.2 Sensitivity to Acidification

The sensitivity of a soil to acid inputs is a measure of the decrease in soil pH that a soil would likely experience from a given addition of acid. Soils can have High, Medium, or Low sensitivity ratings. The ratings are based on the sensitivity to loss of basic cations (primarily calcium, magnesium, and potassium), sensitivity to acidification, and sensitivity to solubilization of aluminum.

Ratings were determined by comparing cation exchange capacity (CEC), estimated from soil texture (sands = 1 to 5, sandy loams = 5 to 10) (Subramanian 2002), and sampled soil pH values to the chemical criteria published by Holowaychuk and Fessenden (1987). In general, neutral to alkaline soils (pH values greater than 6.0) have a lower sensitivity to acidification because of an increased buffering capacity (Holowaychuk and Fessenden 1987).

Sensitivity to acidification for the dominant soil subgroups in the Project study area is generally Medium to High based on the acidic pH from samples obtained from the upper horizons of mineral soil.

3.3.3.3 Compaction Sensitivity

Compaction ratings for the dominant soil types in the Project study area were determined using the criteria outlined in Lewis et al. 1989, using textures observed during the field program and prevailing moisture conditions. Soils were rated using moist conditions. Soils occurring at toe slopes and in depressions (wetlands) were assigned compaction ratings based on soil texture under wet (saturated) soil conditions. An organic layer overlying soils and bedrock were not assigned. Compaction ratings based on the upper mineral soil horizon; however, the presence and depth of surface organic material can affect the rating because it can cushion the surface mineral horizon, as is the case with the Gleysolic and Organic Cryosolic soils.

Sandy and sandy loam textured Turbic Cryosols and Brunisols associated with till, fluvial, lacustrine, and glaciofluvial (i.e., eskers) materials, have a Low sensitivity to compaction under moist soil conditions. Imperfect to poorly drained Gleysolic soils developed on till parent material generally had sandy loam textures in the upper and lower mineral soil horizons, indicating Moderate to High sensitivity to compaction under wet soil conditions. Poor to very poorly drained Organic Cryosolic soils associated with wetlands (i.e., Organic parent material) generally had silt loam and sandy textured mineral soil horizons, indicating Moderate to Very High sensitivity to compaction under wet soil conditions. However, the organic layer present on these soils is sometimes fibric, which can reduce the compaction sensitivity by one class by dampening pressure on the surface mineral horizon.

4.0 SUMMARY

4.1 Terrain and Permafrost

This report presents a review and interpretation of information obtained from previously published literature and from field data collected during the 2015 field survey. The survey was conducted to determine the existing terrain, surficial deposits, and permafrost conditions within the Project study area.

Glacial deposits in the region are dominated by till, which has a silty sand matrix and clasts that range from granule gravel to large boulders in size. Clast content within the till ranges from 5 to 60%. The till varies in thickness from less than 20 cm overlying bedrock to approximately 10 m; the thicker deposits are found within the satellite deposit study area. The till along the Haul Road tends to be thinner (< 3 m) and the topography is bedrock controlled. In many areas the till is washed (either during deglaciation or by current spring melt events) creating well drained boulder fields.

Glaciofluvial deposits in the form of eskers and terraces are found in the northeast section of the satellite deposit study area and they continue in a southeast direction intersecting the Haul Road study area in several locations. The deposits are composed of well sorted fine- to coarse-grained sand and varying amounts (0 to 95%) of granule, pebble, and cobble gravel. These deposits tend to be thick but are often found adjacent to exposures of bedrock.

Organic and fluvial deposits are rare but where they do exist they are thin (< 1 m) and overlie till. Frost-shattered bedrock forms colluvium at the base of steep bedrock faces. Areas of regolith are also found adjacent to exposed bedrock. The regolith in this area is a jumbled mass of rocky debris formed as glacial ice picked up fragments of bedrock that became detached due to fracturing within the bedrock.

The Project study area is within the zone of continuous permafrost. Permafrost and hydrogeological characterization work by Knight Piesold Consulting (2015) around Whale Tail Lake suggests that the permafrost is estimated to be approximately 425 m deep. A talik is expected in the central section of Whale Tail Lake.. Periglacial processes are evident throughout the landscape in the form of frost shattering, sorted and non-sorted polygons, mudboils, ice wedge polygons, and solifluction.

4.2 Soils

This report presents a review and interpretation of qualitative and quantitative information from the literature and from data collected during the 2015 field survey. The key objective of this report is to describe existing soil resources, associated soil quality and sensitivities within the Project study area.

Cryosolic soils, specifically Turbic Cryosolic soils were identified as the dominant soil type in the Project study area which is in agreement with the dominant soil types identified for the Meadowbank Mine (Cumberland 2005a).

Soils identified included:

- Cryosolic (containing permafrost);
- Brunisolic (having brownish-coloured B-horizons);
- Gleysolic (affected by periodic or sustained saturation); and
- Regosolic (poorly developed) soils.

Brunisolic, Gleysolic, and Regosolic soils lack clear evidence of permafrost. Turbic Cryosols (characterized by lateral mixing of soil horizons in the active layer) were most common in glacial till-dominated landscapes (76% of the Project study area), while Brunisolic soils (5% of the Project study area) were most prevalent in glaciofluvial-dominated landscapes (e.g., eskers). Gleysolic soils (<1% of the Project study area) were found on till-dominated landscapes at transition areas between upland and depressional landscape positions (i.e., local drainages). Organic Cryosolic soils (<1% of the Project study area) were found in wetlands.

Cryosolic soils, specifically Turbic Cryosolic soils were identified as the dominant soil type in the Project study area which is in agreement with the dominant soil types identified for the Meadowbank Mine. (Cumberland 2005a).

Wind erosion ratings for soils in the Project study area range from Low to Medium based on sandy loam upper soil horizons and/or their presence in low or depressional areas that are sheltered from the wind. Soils most sensitive to wind erosion are Brunisolic soils with either sandy or gravelly sand upper soil horizons associated with glaciofluvial material.

Water erosion potential for the dominant soil types in the Project study area range from Low to Medium, based on the dominantly sandy and sandy loam textures associated with upper soil horizons and low percent slope. Regardless of soil type, if slope percentage or slope length increases, the water erosion potential for soils will also increase.

Dominant soil types are categorized as having High and Medium sensitivity ratings to acid deposition. The sensitivity of soils to acid deposition was evaluated using the chemical criteria published by Holowaychuk and Fessenden (1987). In the Project study area Brunisolic soils have a High sensitivity to acidification, Turbic Cryosolic soils have a Medium to High sensitivity to acidification while Gleysolic and Organic Cryosolic soils have Medium sensitivity to acidification.

In the Project study area, sandy and sandy loam textured Turbic Cryosols and Brunisols developed on till, glaciofluvial, fluvial, and lacustrine material, have a Low sensitivity to compaction under moist soil conditions.

Gleysolic soils developed on sandy loam textured till material have a Moderate to High sensitivity to compaction under wet soil conditions. Poorly to very poorly drained Organic Cryosolic soils associated with wetlands with silt loam and sandy textured underlying mineral soil horizons have a Moderate to Very High sensitivity to compaction under wet soil conditions. If present, an organic layer on the soil surface can reduce the compaction sensitivity by one class by cushioning the surface mineral horizon.

Report Signature Page

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https://capws.golder.com/sites/p1524321amaruqwhaletailbaselineandeis/baseline/p1100 terrain and permafrost/report/doc 038-1524321 whale tail baseline terrain_soil report ver a.docx

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APPENDIX A

Photographs

Photo 1: Soil cryoturbation exposed in a section at AQT04

Photo 2: Silty sand till with numerous clasts

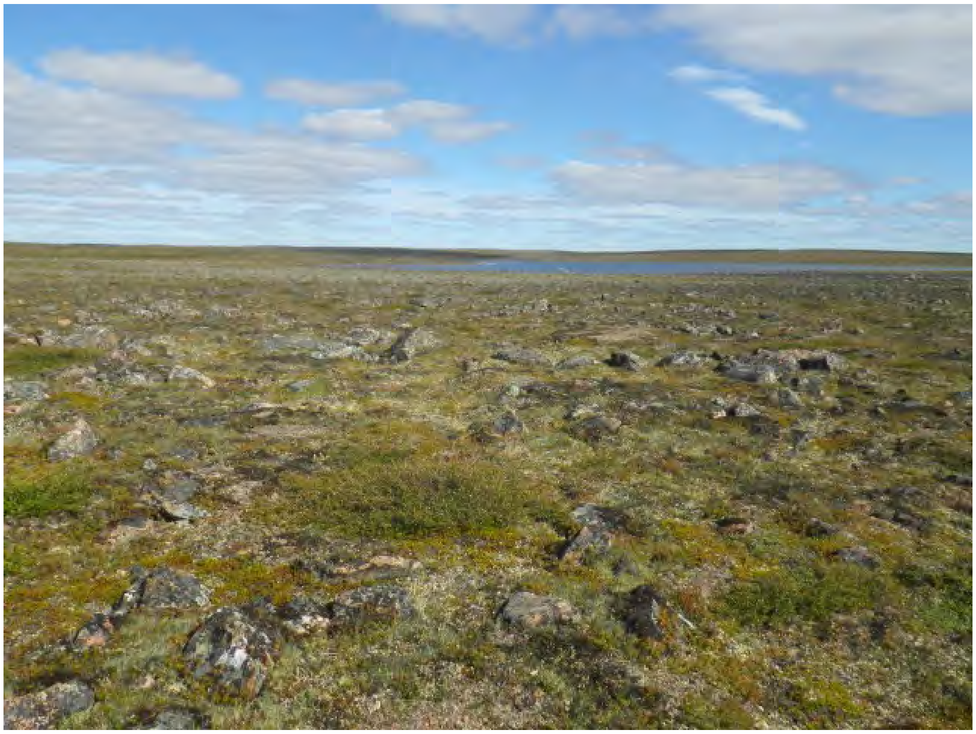

Photo 3: Example of till with high percentage of surface stones

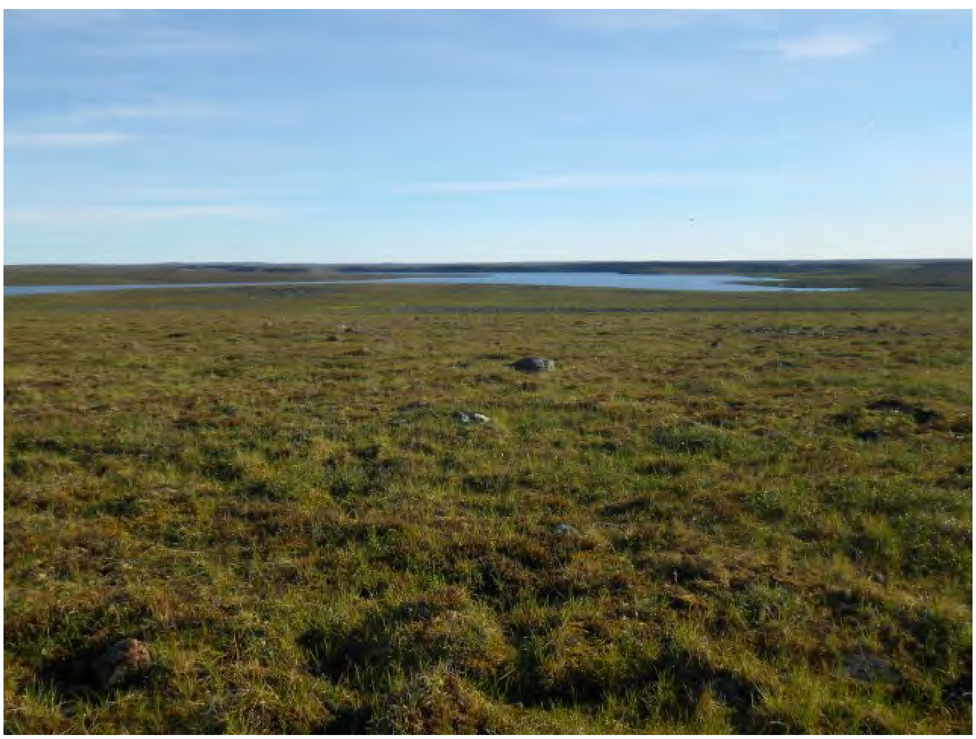

Photo 4: Example of till with low percentage of surface stones

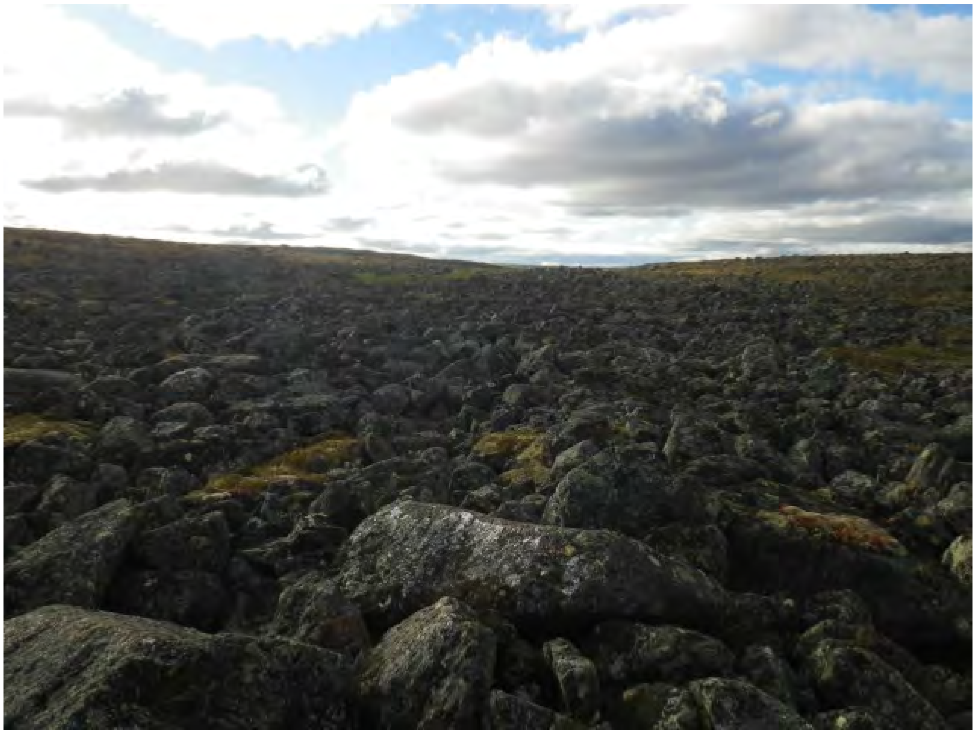

Photo 5: Well drained boulder field on a gentle slope

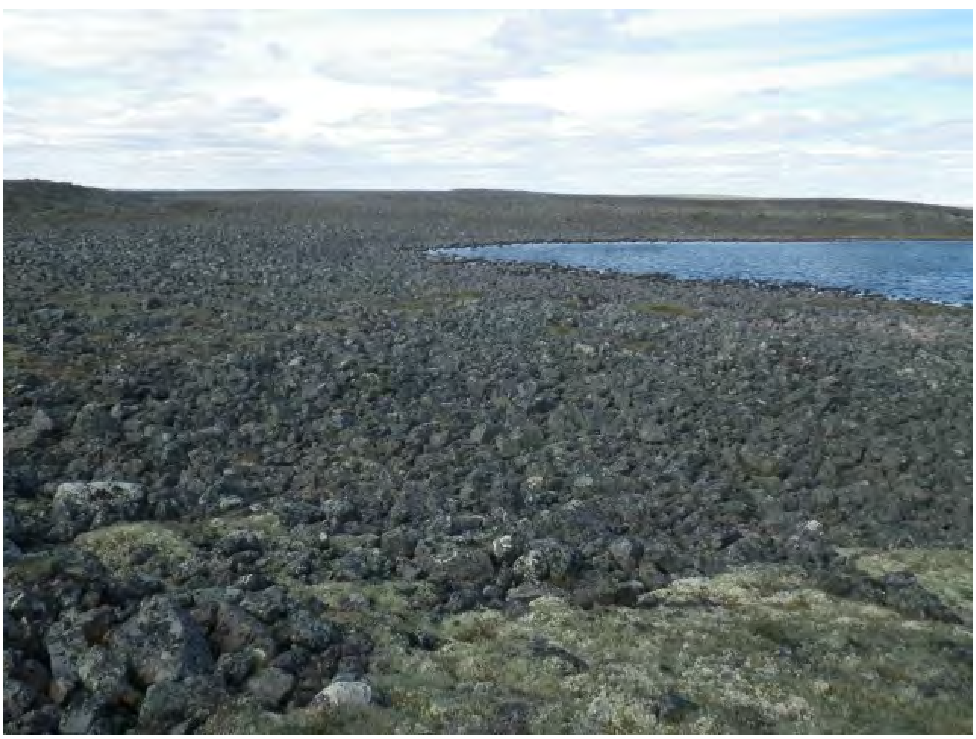

Photo 6: Boulder field adjacent to lake. Any fine-grained sediment has been washed away during spring melt

Photo 7: Perched boulder

Photo 8: Part of the large esker and outwash terrace complex at Esker #3

Photo 9: Glaciofluvial sediments

Photo 10: Channelled surface of glaciofluvial terrace at AQT16

Photo 11: Glaciofluvial terrace adjacent to lake at AQT25

Photo 12: Glaciofluvial terrace with cobbled surface

Photo 13: Frost-shattered colluvium lying at base of slope

Photo 14: Boulder stream - fine grained material has been washed away by flowing water

Photo 15: Fluvial sediments near the Whale Tail Pit Exploration Camp

Photo 16: Bedrock and regolith at AQT61

Photo 17: Bedrock and regolith at AQT63

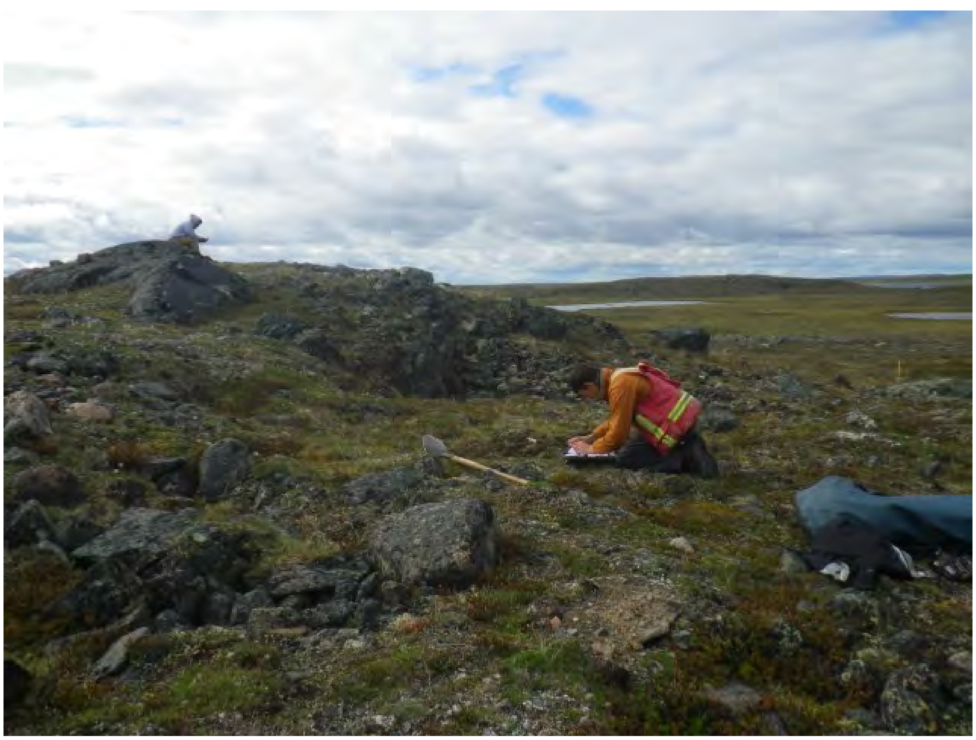

Photo 18: Bedrock with plucked lee side at AQT28

Photo 19: Frost-shattered bedrock

Photo 20: Frost-shattered stone

Photo 21: An example of sorted polygons

Photo 22: An example of non-sorted polygons

Photo 23: An example of a mudboil

Photo 24: Super-saturated layer starting to slowly flow back into the hand dug pit

Photo 25: Ice wedge polygons in glaciofluvial sediments at Esker #5

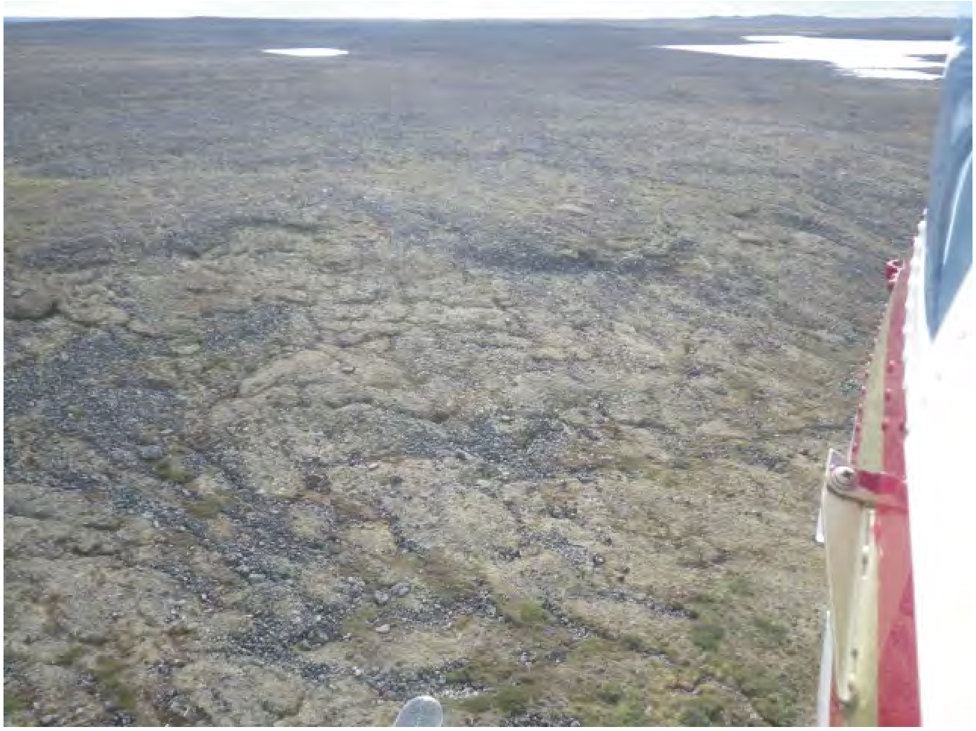

Photo 26: An example of solifluction at AQT160

APPENDIX B

Field Data

Table B-1: Summary of Field Data

Site_ID	Easting	Northing	Air or Ground	Terrain Call	Drainage	Geomorphic Process 1	Geomorphic Process 2	Slope	Aspect	Clast Content	Angularity	Clast Size	Matrix	Surface Boulders	Notes
AQT01	611994	7250284	Ground	dzsMv	i-p	C	L	6	20	20	A-SA	pg-c (12)	c-s	15-50%	Pit depth 68cm. Matrix coming out in chunks (frozen). Sediment slumping slowly into pit. In area mapped as L. Washed till.
AQT02	611950	7250049	Ground-Quick	dzsMb		C	L			30					Pit depth 60cm. Similar to AQT01. Mudboils and blockfields close by.
AQT03	612889	7250287	Air	Mb		C									Washed till. Stone polygons
AQT04	611707	7254055	Ground	psFGu	w	C		15	0	10	SA	pg-c (12)	fs-cs	>50%	Pit depth 117cm. Up to 40cm there is some cryoturbation. Large boulders on surface likely let down from ice during meltout. Esker area. Cryoturbated seds in section next to lake.
AQT05	609835	7252808	Ground	dzsMvb	i	C	L	2	286	25-30	A-SA	gg-c	c-s	>50%	Blockfields surrounding site. At edge of mudboil. Seepage at 15-20cm. Super-sat sediment flowing into pit. R exposed on slope behind.
AQT06	608855	7251461	Ground	psMvb	i	C	L	2		5-10	SA	gg-pg		15-50%	Pit depth 80cm. Frozen 28-80cm. Less clasts than previous site. Super-sat. sediment 0-28cm. Some stone sorting in area. Photos 68-69 failure west of site?
AQT07	605713	7250038	Ground	cdsMb	mw	C				40	A-SR, SA	pg-cg	c-s	>50%	Pit depth 37cm. Large stones on surface. Sandy matrix.
AQT08	603753	7250978	Ground	psMb	mw					25-30	A-SA, SA	gg-pg	z-s	>50%	Pit depth 38cm. Frozen layer at surface, thawed below. Many boulders on surface. Mudboills. See card for sketch.
AQT09	602454	7252347	Ground	pzcMb	p	C		4		15	A-SA, SA	gg-cg	c-fs		Pit depth 65cm. Very different to other sites. In small draw down to bldr field. Perhaps LG but clasts throughout. Some stone stripes. R exposed nearby. See card for sketch.
AQT10	602324	7254237	Ground	zdsMb	mw	C				40-45	VA-SR, SA	gg-cg	c-s	>50%	Pit depth 42cm. On small flat ridge. Small areas of clast-supported in pit, pockets water washed. Low-lying area to south, bldr field - ephemeral pond, almost gone at site visit.
AQT100	618110	7238161	Air	Mvb[R]											R exposed in section next to lake.
AQT101	618110	7238053	Ground	cdsMb	mw-i	C		5	44	45	SA	gg-bg	c-s	15-50%	Large stone in pit. Fewer boulders on surface exposed. Crossed large boulder field to get to this site. C has evidence of cryoturbation throughout area.
AQT102	617980	7237593	Air	Mb											Mudboils. R not evident.
AQT103	619266	7236120	Air	Mu?											Mu? Depression area -> wetter.
AQT104	620355	7236394	Air												Solifluction.
AQT105	624064	7235854	Air	Mx[R]											R exposed.
AQT106	625980	7235847	Ground	zdsMb or Mu	mw	C		gently undulating		30-35	A-SR, SA	gg-cg	z-s	>50%	Large number of stones on surface, very similar to other pits. Esker nearby. Cryoturbation evident on landscape.
AQT107	626232	7235854	Ground	sFGur	w	C		ridge top		5	A-SR, SA	gg	fs-cs		Back end of esker. 7-25cm cryoturbation, some organic within unit, f-ms, odd gg, 25-64cm f-ms, 64-90cm ms-cs.
AQT108	627374	7236530	Air	F											River crossing
AQT109	636124	7225610	Air	R											Frost shattered R and movement downslope. R exposed on crest of hill.
AQT11	604821	7257387	Ground	dsMb	mw	C				40	VA-SA, A	gg-cg (11.5)	z-s	>50%	Pit depth 35cm. Boulders on surface.
AQT110	636374	7224127	Ground	zdsMv[Ru]	mw	C		gently undulating		35-40	A-SR, SA	pg-cg	z-s	>50%	Pit depth 44cm. Crest of hill, R exposed nearby. Large blocks in piles. A-VA boulders on surface - have not travelled far. Minor amounts of super-sat sediment. Pockets of coarser material (50% clast content)
AQT111	636231	7224199	Ground - Quick	Mv.Cv[R]	mw-i			25							On slope. Solifluction lobes? VA-A boulders plucked. Mudboils, frost shattered rocks. Roches moutonnees? Mountain sorrel site.
AQT112	636151	7224235	Ground - Quick	Mb	p								cs-sc		Some boulders on surface, some organic accumulation. Small depression. Collects finer deposits. Some running water.
AQT113	636044	7224445	Ground - Quick	Mv[R]											Same as AQT110. R exposed nearby.
AQT114	635968	7224045	Air	R											R channel. Frost shattered rock -> C (talus)
AQT115	611513	7252153	Ground	zdsMb[Ru]	mw	C		gently undulating		35	A-SR, SA	gg-cg	z-s	>50%	Pit depth 42cm. No R exposed. Very similar to previous pits. Mudboils. Super-sat layer in B horizon on one side of pit.
AQT116	614805	7248355	Ground	zdsMb or Lv[M]	mw-i	C		gently undulating		10-15, 30	SA	gg-pg	z-s	15-50%	Pit depth 48cm. Not as many boulders on surface. 0-25cm - 10-15% clasts, gg, zs matrix, super-sat. 25-48cm zds, 30% clasts. Possibly L as lack of pg or cg in upper horizon.
AQT117	615563	7247618	Air	Mvb											Polygons, R exposed
AQT118	618105	7246998	Air	Mb											Polygons
AQT119	620867	7243398	Ground	zdsMb	mw-i	C		6	12	30	A-SR, SA	gg-pg	z-s	>50%	Pit depth 43cm., Some super-sat layer. Solifluction lobes, mudboil staircase. R exposed to north. Bldrs on surface. See card for sketch.
AQT12	604893	7257425	Ground	Mb	w-r					100	A-SR, SA	cg-bg	-		Boulder field. In slight depression. At edge there is some frost sorting and polygon development.

Table B-1: Summary of Field Data

Site_ID	Easting	Northing	Air or Ground	Terrain Call	Drainage	Geomorphic Process 1	Geomorphic Process 2	Slope	Aspect	Clast Content	Angularity	Clast Size	Matrix	Surface Boulders	Notes
AQT120	620690	7243643	Air	R											R exposed. Frost shattered.
AQT121	620725	7243837	Air	R											R exposed.
AQT122	621550	7242957	Air	R											Frost shattered R. Poor drainage.
AQT123	620433	7242630	Air												Solifluction
AQT124	618605	7239693	Ground - Quick	Mb											Boulder field.
AQT125	618583	7239649	Ground	zdsMb	mw	C		2	5	35	A-SA, SA	gg-cg	z-s	>50%	Pit depth 62cm. Cryoturbation in B horizon. Rr SE of pit.
AQT126	639572	7220854	Ground	zdsMu	mw	C		9	250	55	VA-SA, A	gg-cg (13cm)		>50%	Pit depth 40cm. Same texture as other pits but finer sand. Pockets of class supported. X on ridges, vb in depressions? Layer of clast at top of pit -> frost heave. Bldrs on surface but clasts in pit are pg-cg. Site next to Rr. From here to camp Rr. Areas where there is drainge the till is washed -> bldr fields.
AQT127	638259	7221226	Air	M											Drainage channel in till. Stripes.
AQT128	637890	7222093	Air	Mxv[Rr]											Wetter areas in depressions.
AQT129	637063	7223097	Air	R											R channel, frost shattered C
AQT13	606275	7258841	Air	Fgu											R exposed nearby.
AQT130	635606	7226573	Ground	cdsMb	mw	C		2		30	A-SA, SA	gg-cg (10cm)	c-s	15-50%	Pit depth 56cm. Cryoturbation in B not C. In area previously mapped as stripped. Not as many bldrs on surface. Dwarf birch. See card for sketch.
AQT131	635582	7226626	Ground	Mb or FGv[M]	i	C		5				gg	c-s	0.1-3%	Pit depth 110cm. Odd pit. Cryoturbated, super-sat layer, gg but nothing larger. Some stones/bldrs on surface but not many. Further upslope more boulders on surface and sorted. Augered this new site, bldrs and pg on surface, zsc with some gg and pg below. See card for sketch.
AQT132	635369	7227395	Air	Rr											
AQT133	634757	7228710	Air	Mbv											
AQT134	633811	7229640	Air	Rr											Rr with Mx. Possibly thicker in depressions.
AQT135	633277	7230950	Ground	cdsMb	mw	C		5	310	30	VA-SA, SA	gg-cg (19cm)	c-s	15-50%	Not many boulders on surface, dwarf birch. Pockets of matrix with less clay. See card for sketch. Rr at top of slope, lake at toe.
AQT136	633323	7230983	Ground	zdsMb	mw-i	C				30	A-SR, SA	gg-cg (15cm)	c-s	3-15%	LFH 18cm, pit depth 90cm. Similar to previous pit.
AQT137	633113	7232938	Ground	sgFGru	r-w					90-95	A-SR, SA	gg-pg	ms-vcs	>50%	Pit depth 56cm. Top 20cm more pg, matrix ms. Below 20cm gg and cs-vcs. Ice wedges in area (Photo 522?), Solifluction? (photo 523-525), esker and area (526-532). R exposed nearby.
AQT138	631356	7233958	Air	Mxv[Ru]											Wetter areas in depressions
AQT139	630278	7234703	Air	Mv[Ru]											
AQT14	606048	7259266	Ground	zdsMvx	mw	C				45-50	VA-A	pg-cg	z-s	>50%	30cm to bedrock. Mapped as slump but appears to be bedrock terraces. Roches moutonnee? Some stone sorting and mudboils. Frozen layer at 5cm for about 5cm.
AQT140	630541	7234472	Air	Rh											Rh with frost shattered C
AQT141	619837	7241119	Ground	zdsMv[Rj]	mw	C		15	towards lake	40	SA-SR, SA	gg-cg (23cm)	z-s	>50%	R at or near surface, large boulders on surface, solifluction lobes. Roches moutonnees?
AQT142	632660	7233617	Ground	sgFGur	r-w					80	SA-SR, SR	gg-pg	fs-vcs	>50%	Kettled area. Bed of f-ms with no clasts 14-22cm depth. Some beds of coarse frags as well. See soil sheet.
AQT143	632374	7233522	Ground - Quick	Mv[Ruj]											Mudboils and sorting. Roches moutonnees
AQT144	632253	7233530	Ground	cdsMv[Rj]	mw	C		12	280	40	A-SA, SA	pg-cg (21cm)	c-s		Pit depth 40cm. Crossed boulder field between points. Not many boulders on surface. Mudboils, solifluction. Roches moutonnees? R near surface.
AQT145	632078	7233509	Ground	cdsMb	mw	C		8	210		VA-SR, SA	gg-cg (15cm)	c-s	15-50%	Pit depth 73cm. Dwarf birch and moss. Likely wetter in spring. See card for sketch.
AQT146	631956	7233486	Ground - Quick	Mvx[Rr]											Boulders on surface. Solifluction. Siksik
AQT147	631885	7233702	Ground - Quick	Ru											Ru with some Mx. Tent ring in area, Caribou.
AQT148	631714	7233881	Ground - Quick	Fv											Fv with large boulders.
AQT149	631580	7233932	Ground	zdsMb	mw-w	C		5	188	40	A-SA, SA	gg-cg (20 cm)	z-s	15-50%	Not many boulders on surface. Mudboils, some solifluction likely. Pit depth 40cm.
AQT15	606157	7259272	Ground - Quick	Rs-Rb	r										Exposed rock, rockfall, frost shattering
AQT150	628974	7235538	Air	Mbv											Polygon sorting
AQT151	626800	7236301	Ground	zdsMb	mw-w	C				40	A-SR, SA	gg-cg 917cm)	z-s	>50%	Pit depth 35cm. Boulders on surface. Is there FGr around lake to west? Very similar to other pits.
AQT152	619293	7235886	Air	Mx[Ru]											R exposed. With distance from lake thicker Mv
AQT153	619896	7241411	Ground - Quick	M								cg-bg			Coarse till. Boulders likely from slope above. Rapidly drained. Some sorting

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Site_ID	Easting	Northing	Air or Ground	Terrain Call	Drainage	Geomorphic Process 1	Geomorphic Process 2	Slope	Aspect	Clast Content	Angularity	Clast Size	Matrix	Surface Boulders	Notes
AQT154	619734	7241224	Ground	dscMbv	p					20			c-s	3-15	Augered site. Water sitting at surface. Adjacent to boulder field. Augered to 90 cm but elsewhere stones at depth of 20 cm. R exposed on slope behind. Drainage channel - water getting held up in area (stones, bedrock, frozen?)
AQT155	606558	7257009	Ground - Quick	FGr											Cobbles on surface, f-ms, rapidly drained. See card for sketch.
AQT156	606660	7256950	Ground - Quick	Mvx[Ruh]											Photo 586 - lake in spring. Purple flower.
AQT157	606995	7258017	Air	Mxv[Ruj]											R exposed. Some solifluction. Esker nearby
AQT158	605800	7257687	Air	Mv[Ru											
AQT159	604438	7251488	Air	Mv[Rr]											
AQT16	605909	7259191	Ground	sgFGu	w-r					70	A-SR, SR	gg-cg	fs-cs	>50%	Pockets of smaller stones but not obvious bedding in pit. No evidence of cryoturbation.
AQT160	604179	7251881	Air												Solifluction
AQT17	607547	7258804	Air												R at surface. Water at surface, some F. Fresh rockfall.
AQT18	607624	7258605	Air	R											Fresh rockfall
AQT19	608165	7259360	Air												Mudboils, solifluction
AQT20	608238	7258886	Air												Dried out lake, rockfall nearby
AQT21	609676	7257439	Ground	sgFGu	w-r	C				0,40,70	SR	gg-pg	fs-cs	>50%	Pit depth 60cm. Top 25cm cryoturbated. Site at toe of slope. 0-25cm f-ms with odd stone (backwater deposit), 25-60cm f-cs 40-70% clasts increasing with depth. Beach ridge?
AQT22	609804	7257453	Ground - Quick	Lv[Mb]	p										Ephemeral lake. Boulders. No obvious water source. Some fine grained sediments. Is previous site on beach ridge? R at surface nearby.
AQT23	606913	7258426	Air	R/Ca											Exposed rock with colluvium.
AQT24	607878	7257738	Air												Dried lake with beaches?
AQT25	607325	7257779	Ground	zsdMbv	i-p					60	A-SR, SA	gg-bg (30cm)	z-s	15-50%	Dark colour like organic but stones throughout. Bedrock exposed nearby.
AQT26	607319	7257688	Ground - Quick	FGu	w										Cobble river bars with channels. Cobble pavement appears to be similar elevation as beach(?) to the east. Till on either side with larger boulders on surface.
AQT27	607469	7257525	Ground - Quick	Ov[zcL]	vp										Frozen at 45cm. Close to small lake. Small fluvial channel running through organic. See card for sketch. Gravel ridge surrounding wetland and lake.
AQT28	607522	7257157	Ground	dzsMvx[Rr]	mw-w	C		5	0	30	A-SA, SA	gg-cg	z-s		Evidence of soil saturation on one side of pit at 10cm depth. Pit 31cm. R exposed nearby. As came up from last site moved into Mb and then Mvx here. Perched boulders and frost shattered bedrock.
AQT29	607197	7256878	Ground - Quick	Mb or Lv	p-i					30				15-50%	In flat/basin area with several lakes. Boulders on surface but matrix is sc. Till that is occasionally inundated? Grass veg, bog cotton.
AQT30	607307	7256607	Ground	FGvb or Fv	p					0			c-fs	<0.1%	Frozen at 60cm. Augered site. No coarse frags, zsc. Few stones on surface in area. Frost mounds/hummocks in area.
AQT31	607478	7256508	Ground - Quick	Mxv[Ru]											R exposed, frost shattered rock. Perched boulders.
AQT32	607296	7256270	Ground - Quick	Mb	i-p										Likely till. Till that is poorly drained (grasses, bog cotton, some surface water). In depression towards lake. Augered to 35cm. Stones heard while augering. Some boulders on surface.
AQT33	607075	7256193	Ground-Quick												Stone sorting, ice wedges, solifluction?
AQT34	606980	7256155	Ground - Quick	Fv[M]											
AQT35	606944	7255957	Ground - Quick	FGr	w										cs-gg-cg. Photo 221 - ice wedge? adjacent to esker on way to AQT36.
AQT36	606886	7255950	Ground	FGu	w	C		2-3		0			fs-cs	0.1-3%	Adjacent to esker. R exposed behind site away from lake. Frozen at 29-46cm (currently defrosted) and at 120cm. 0-29cm cryoturbated.
AQT37	606725	7256045	Ground-Quick	Ru//Mx	r										Ru with Mx boulders
AQT38	606526	7256021	Ground	Mbv[Ru]	mw-i	C					A-SA, SA	gg-pg	z-fs	0.1-3%	Layer of angular pg just below LFH. Frost heaved to surface. Veg is dwarf birch. Heaved mounds? Super-sat soil 17-40cm. Auger refusal at 72cm.
AQT39	605583	7255466	Ground	zdsMvb	mw	C		gently undulating		40	VA-A, A	gg-cg	z-s	15-50%	Pit depth 43cm. Saturated sandy layer with frost heaved stones above. Less stones in sat layer. Boulders on surface. Coarse polygons adjacent to pit, mudboils. Striations on exposed bedrock 340_o
AQT40	604968	7256477	Ground	zdsMb	mw	C		gently undulating		25	A-SA, SA	gg-pg	z-s	>50%	Pit depth 55cm. Super-sat layer in top 20cm. Area of polygons, large stone polygons with finer in center. Smaller stnes in this pit compared to last site. Polygons further away at last pit. Large erratic in area (taller than me). Small slide near site - solifluction?
AQT41	604559	7255490	Air												Lake in spring
AQT42	604776	7254967	Air	Mvb											

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Site_ID	Easting	Northing	Air or Ground	Terrain Call	Drainage	Geomorphic Process 1	Geomorphic Process 2	Slope	Aspect	Clast Content	Angularity	Clast Size	Matrix	Surface Boulders	Notes
AQT43	604074	7255070	Air	Mb											
AQT44	604085	7254978	Air	Mb											Washed till
AQT45	603208	7254433	Ground	zdsMb	mw-w	C		4	80	50-55	A-SA, SA	gg-cg	z-s	>50%	Pit depth 50cm. No obvious cryoturbation, no super-sat layer. Cryoturbation evident in landscape. Small hummock near water could be R cored but possibly Mh. Hydro photo indicating water depth.
AQT46	603252	7253814	Ground	zdsMbv	mw	C		gently undulating		25	A-SA, SA	gg-pg	z-s	15-50%	Pit depth 56cm. Not as many boulders on surface as previous sites. Small Rr about 100m north of site. Minimal evidence of cryoturbation but landscape evidence.
AQT47	603451	7253743	Ground - Quick	F											Running water
AQT48	603520	7253687	Ground	Mh											Mh? Large boulders on surface. Between here and AQ137(pre-field site) small lake which will be larger in spring.
AQT49	603734	7253722	Ground - Quick	Mvb[Rr]											possibly washed a little
AQT50	603519	7252808	Ground	zdsMb	mw	C		slight ridge		40	A-SR, SA	gg-cg	z-s	>50%	Pit depth 42cm. Very similar to previous pit. Cryoturbated structure - massive, layer of frozen sand, massive. Low-lying ground around site washed till, no fines. Mudboils.
AQT51	604846	7253080	Air	Mb											Mb and washed till
AQT52	606173	7251994	Ground	Fvb[Mb]	p			2					c-s	0.1-3%	Where augered no stones, but clasts elsewhere. See card for sketch. Started getting ice crystals at about 40cm. In muddy channel. Texture sc.
AQT53	605998	7251874	Ground - Quick	Mvb[Rr]											
AQT54	605337	7252309	Air	Mb											Mb and washed Mb. Stone polygons.
AQT55	607180	7254547	Ground	sgFGr	w-r					75-90	A-SR, SA	gg-cg	s-cs	>50%	On top of flat-topped esker. Till is adjcent on far side of lake. Coarse bedding. 0-35cm 75-80% clasts, pg-cg, 35-45cm 95% clasts, pg little sand. Ice pushed ridge next to lake.
AQT56	605657	7252948	Air	Mb											Polygons
AQT57	605408	7253654	Air	Mb											
AQT58	606311	7254829	Air	M											Stone stripes. Small F channels in till.
AQT59	606922	7253237	Air	F											F in spring melt. R exposed in face.
AQT60	607375	7251756	Ground	zdsMb[Ru]	mw	C		gently undulating		40		gg-pg	z-s	15-50%	Pit depth 40cm. One side is super-sat -> cryoturabated and close to mudboil, other side no super-sat and further from mudboil. Approx 100m WNW from site R exposed and blockfield.
AQT61	607587	7252422	Ground-Quick	R											R exposed. Appears to be chunks of R plucked but not moved far.
AQT62	607634	7252467	Ground	FGr	r-w			ridge, 25%		75-80	SA-SR, SR	gg-bg (28cm)	cs	>50%	Pit depth 44cm. Feature is armoured with cobbles (let down from ice?). Apperas to get finer with depth, smaller clasts. Matrix is cs. Exposed R in area.
AQT63	607942	7251957	Ground - Quick	Ruh	r-w										R exposed with rockfall. Area mapped as FG but appears to be undulating to hummocky till(?) with odd area of FG. Ice picks up rock and doesn't move it very far. Currently frost shattering and rockfall. Very coarse till (boulders moved by ice)
AQT64	607726	7255273	Ground	sFv[zdsMb]	p	L		3-4	towards Whale Tail	30	SA	pg-cg	z-s	0.1-3%	Pit depth 80cm. In center of drainage area between 2 lakes. Small channels in area. Till starts at 35cm. Organic material 20cm or so on surface. Originally mapped areas as stripes - more likely drainage areas. See card for sketch. See soil notes.
AQT65	607728	7255238	Ground	Mb or Mu	mw	C		3	towards lake	20	A-SA, SA	pg-cg	z-s	3-15%	Pit depth 67cm. LFH 20cm. Cryoturbated. Large cobble (22cm) under LFH and then pg clasts below this. Smaller stones in till.
AQT66	607939	7250213	Air	R											R exposed, frost shatter. Small creeks.
AQT67	608488	7251475	Air	Fv[Mb]											
AQT68	608772	7252134	Ground	Mb or Mu	mw	C				30	A-SA, SA	gg-cg	z-s	15-50%	Pit depth 90cm. Not that many stones on surface. Where there are, they are in groups. Gentle slope down to lake. Super-sat layer on one side of pit. Increase in clay content at base of pit (80-90 cm).
AQT69	609407	7252633	Air	M											Solifluction, mudboils
AQT70	608438	7254068	Ground	zdsMb	mw	C		5	towards lake	30	SA	pg	z-s	15-50%	Pit depth 62cm. Very similar to previous pit.
AQT71	607858	7254632	Air	FGr											small esker
AQT72	609595	7254059	Air	Fv[Mb]											
AQT73	609138	7254665	Air	M											R controlled. Mudboils.
AQT74	608016	7254539	Air	F											
AQT75	608487	7256090	Air	M											Washed till.

Table B-1: Summary of Field Data

Site_ID	Easting	Northing	Air or Ground	Terrain Call	Drainage	Geomorphic Process 1	Geomorphic Process 2	Slope	Aspect	Clast Content	Angularity	Clast Size	Matrix	Surface Boulders	Notes
AQT76	610556	7256281	Ground - Quick	FGu											FG u with R exposed nearby. Cobbled surface.
AQT77	610380	7256235	Ground	dsMb[Rr]	mw	C		gently undulating ridge top		40	VA-SA, SA	gg-cg	z-s	>50%	Pit depth 38cm. Mudboils. Many boulders on surface like pavement. Clast content increases with depth. Evidence of cryoturabtion in landscape, not as much in pit.
AQT78	610290	7256130	Ground	sgFGu	w-r			gently undulating		70	SA-SR, SR	gg-cg (9cm)	fs-cs	3-15%	Pit depth 52cm. No obvious bedding. Some boulders on surface likely let down from ice. Till nearby on upper slope.
AQT79	610143	7255961	Ground - Quick												Edge of FG. Bewteen this and previous site polygons.
AQT80	609773	7256258	Ground - Quick	M											Poorly drained till. Some water sitting on surface. Some organic accumulation.
AQT81	609695	7256282	Ground	zdsMb[Ru]	mw	C		crest of slope		35	A-SA, SA	gg-cg (10cm)	z-s		Pit depth 55cm. Very similar to previous till pits. Photo 353 looking back to poorly drained till
AQT82	609601	7256482	Ground - Quick	Mb	p								zcs		Poorly drained till. Slight depression. Augered. Tried 3 times but hit stone. 4th time augered to 75cm.
AQT83	609313	7256352	Ground - Quick	Mb[Rr]											Ridge is till. Walking upslope from previous site, mudboils like steps -> solifluction. R exposed at end of ridge nearest AQT82.
AQT84	608942	7256723	Ground - Quick	M											Boulder field
AQT85	608027	7255307	Ground	zdsMu or Mb	mw-w	C		gently undulating		40	S-SA	gg-cg (19.5cm)	z-s	3-15%	Pit depth 35cm. Gently undulating, no evidence of stripes. Stripes likely drainage channels. No R exposed nearby -> Mu? No significant mudboils in area.
AQT86	608396	7255343	Ground - Quick	Mr											Mr or Mbv[Rr] Slightly armoured. Large boulders on surface. Channelled till. Several parallel ridges. R found nearby - R cored ridges.
AQT87	611484	7254647	Ground	sFGr	r-w	K	C			5	SR	pg	fs-cs	>50%	Pit depth 78cm. Could dig further but falling in due to dryness. A few stones. Some cryoturbation in the upper horizon. At 58cm it becomes coarser: fs-ms -> ms-cs-gg.
AQT88	610440	7253605	Air	Mb											Lakes with some F inbetween
AQT89	611538	7252101	Ground	cdsMb or Mu	mw	C		gently undulating		35	A-SA, SA	gg-cg	c-ms	>50%	Mudboils, some stone sorting, Cryoturbation in B not in C.
AQT90	611554	7252039	Ground - Quick	M											Area of sorted stones. Coarse on outside, finer inside. Horsetail, dwarf birch suggesting wetter conditions. A drainage channel in spring.
AQT91	612522	7250257	Air	Mb or Mu											Mudboils, polygons.
AQT92	614868	7249923	Ground	sdMb	mw	C		5		60	VA-SR, A	gg-cg (22cm)	fs-ms	>50%	Pit depth 40cm. Many boulders on surface. Stone polygons at base of slope - forming due to increased water in area -> increased heave?
AQT93	614548	7249873	Ground	FGr	w-r			small ridge		70-80	SA-SR	gg-cg	ms-vcs	>50%	Pit depth 46cm. Esker with boulders on surface let down from ice. Till on either side of small ridge. Angular frags on top cg with ms matrix. Below 20cm pg and SR. With depth matrix becomes coarser but clasts are smaller.
AQT94	614719	7250118	Ground - Quick	FGr											On top of esker ridge. Large boulders let down on top from ice. Ridge slope 35%
AQT95	614869	7250008	Ground - Quick												Ephemeral lake. R adjacent to it.
AQT96	620835	7246197	Ground	sFGr	r-w	C		22	137	5	SR		fs-cs	15-50%	A few clasts in top 20cm. Matrix f-ms -> m-cs with depth. R exposed nearby. Small stream in channel. Gullied. Large polygons on surface. Dwarf birch. Wolf pack.
AQT97	620784	7246020	Ground	Ov[FGb]	vp			gently undulating							0-50cm organic, FG is cs with pg and frozen. Wolf pack. See card for sketch.
AQT98	620426	7245645	Air	Mb											
AQT99	620002	7244758	Air	F											River
FROSTMND?	607224	7256881	Ground - Quick												Frost mound?
AQT161	611993	7250182	Ground - Quick												Stone sorting, mudboils.
AQT162	608626	7251266	Air												Solifluction, boulder field, R exposed
AQT163	608837	7251016	Air	R											R exposed
AQT164	605234	7249748	Air												Rock bluff with rockfall, shattered rock. Washed till next to lake.
AQT165	604201	7251811	Air												Solifluction - see also AQT160
AQT166	602852	7251627	Air												R exposed, frost shattering. Polygons.
AQT167	606982	7258038	Air												Possible solifluction

APPENDIX C

Terrain Figures

Terrain Symbol Legend

Surficial Material

A	Anthropogenic
C	Colluvium
F	Fluvial
FG	Glaciofluvial Material
L	Lacustrine Material
M	Morainal/Till
O	Organic
R	Bedrock

Drainage Code Separator

,	no intermediate classes
-	all intermediate classes
/	first drainage dominant
//	first drainage significantly dominant

Drainage	
r	rapid
w	well
m	moderate
i	imperfect
p	poor
v	very poor

TERRAIN LABEL:

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass

^{8}Mbv[Ru]^{2}Ovb[Mb]-Cr
m // v

drainage
drainage separator

Surface Expression	
a	Moderate Slope (27-49%)
b	Blanket (1-3 m thick)
h	Hummock(s)
j	Gentle Slope (6-26 %)
k	Moderately Steep Slope (50-70%)
p	Plain
r	Ridge(s)
t	Terrace(s)
u	Undulating
v	Veneer (<1 m thick)
x	Thin Veneer (< 20 cm)

Geomorphological Process	
C	Cryoturbation
W	Washing
S	Solifluction
Z	General Periglacial Processes
E	Channeled by Meltwater
H	Kettled
U	Inundation

Geomorphological Process Subclasses

Mass Movement Processes	
r	Patterned Ground
s	Frost shattered

PROJECT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE
TERRAIN LEGEND

Golder Associates

PROJECT NO.		1524321	FILE No.	
DESIGN	DO	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	**FIGURE C-1**	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- ANTHROPOGENIC (A)
- MORAINAL / TILL (M)
- WATER (N)

PROPOSED HAUL ROAD

- SECTION 1

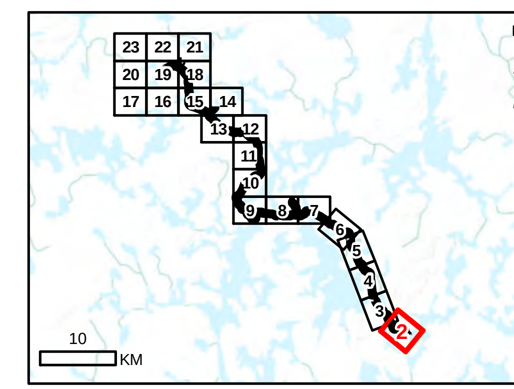
BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY

TERRAIN LABEL:

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass

8Mbv[Ru]2Ovb[Mb]-Cr
m // v
drainage
drainage separator



NOTE

1. FOR DETAILED TERRAIN MAPPING AND LABEL DEFINITIONS PLEASE REFER TO LEGEND FIGURE C-1.
2. TERRAIN POLYGONS ARE COLOUR CODED BASED ON THE DOMINANT SURFICIAL MATERIAL. SECONDARY DEPOSITS MAY EXIST IN LESSER AMOUNTS AND ARE IDENTIFIED IN THE TERRAIN LABEL.

REFERENCE

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300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

TERRAIN MAPPING

Golder Associates

PROJECT		1524321	FILE No.
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN REV. 0
GIS	MM	02 May. 2016	FIGURE C - 2
CHECK	AS	02 May. 2016	
REVIEW	DO	02 May. 2016	

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LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)
- TERRAIN (GROUND - QUICK)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- MORAINAL / TILL (M)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 1

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY

TERRAIN LABEL:

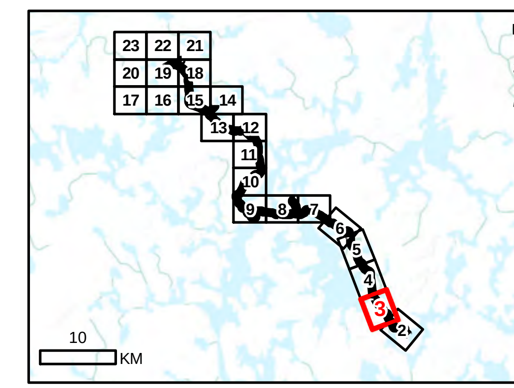
decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass

^{8}Mbv[Ru]^{2}Ovb[Mb]-Cr

m // v

drainage

drainage separator



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300 0 300

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TITLE

TERRAIN MAPPING

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DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	FIGURE C - 3	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN AND SOIL (GROUND - DETAILED)
- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- MORAINAL / TILL (M)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 1

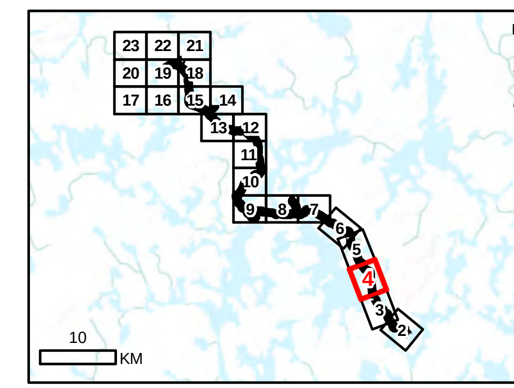
BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY

TERRAIN LABEL:

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass

^{8}Mbv[Ru]^{2}Ovb[Mb]-Cr
m // v
drainage
drainage separator



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PROJECT
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TITLE

TERRAIN MAPPING

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DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	FIGURE C - 4	
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LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN AND SOIL (GROUND - DETAILED)
- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- GLACIOFLUVIAL (FG)
- MORAINAL / TILL (M)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 1
- SECTION 2

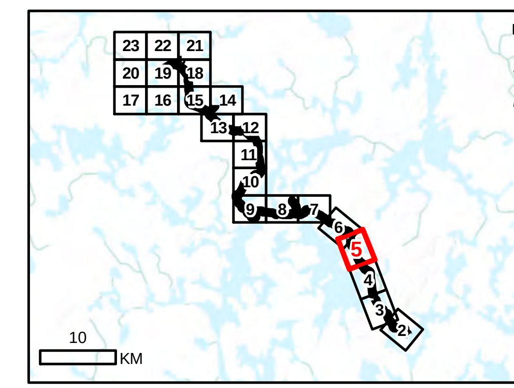
BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER

TERRAIN LABEL:

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass

8Mbv[Ru]2Ovb[Mb]-Cr
m // v
drainage
drainage separator



NOTE

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MEADOWBANK DIVISION
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TITLE

TERRAIN MAPPING

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REVIEW	DO	02 May. 2016		

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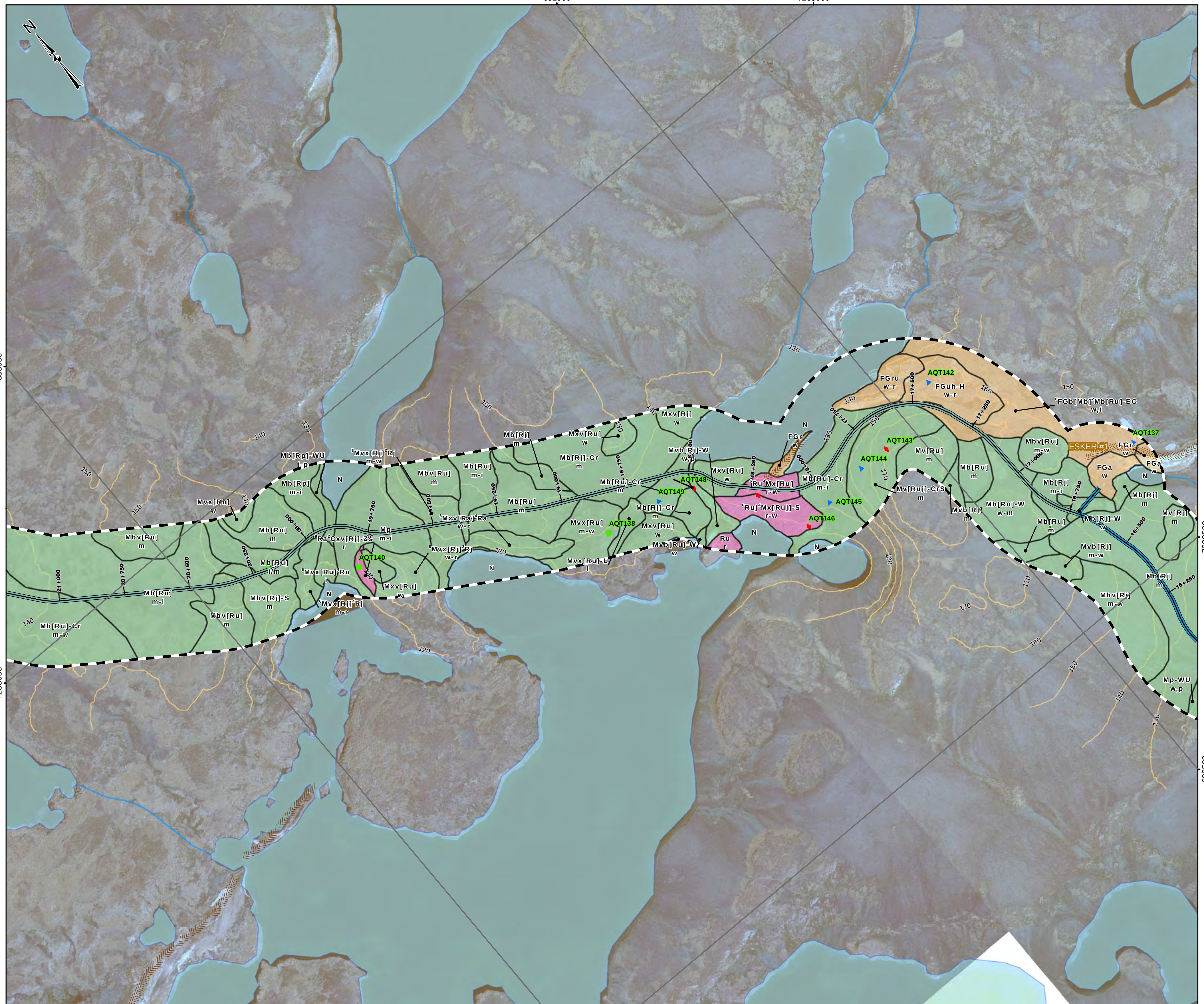


LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)
- TERRAIN (GROUND - QUICK)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- GLACIOFLUVIAL (FG)
- MORAINAL / TILL (M)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 1
- SECTION 2

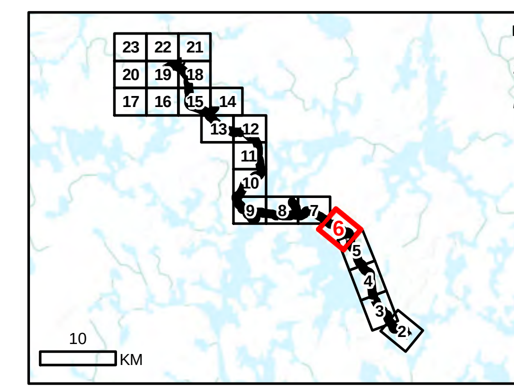
BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER

TERRAIN LABEL:

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass

8Mbv[Ru]2Ovb[Mb]-Cr
m // v
drainage
drainage separator



NOTE

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SCALE 1:15,000 METRES

PROJECT
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MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

TERRAIN MAPPING

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DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016		
CHECK	AS	02 May. 2016	FIGURE C - 6	
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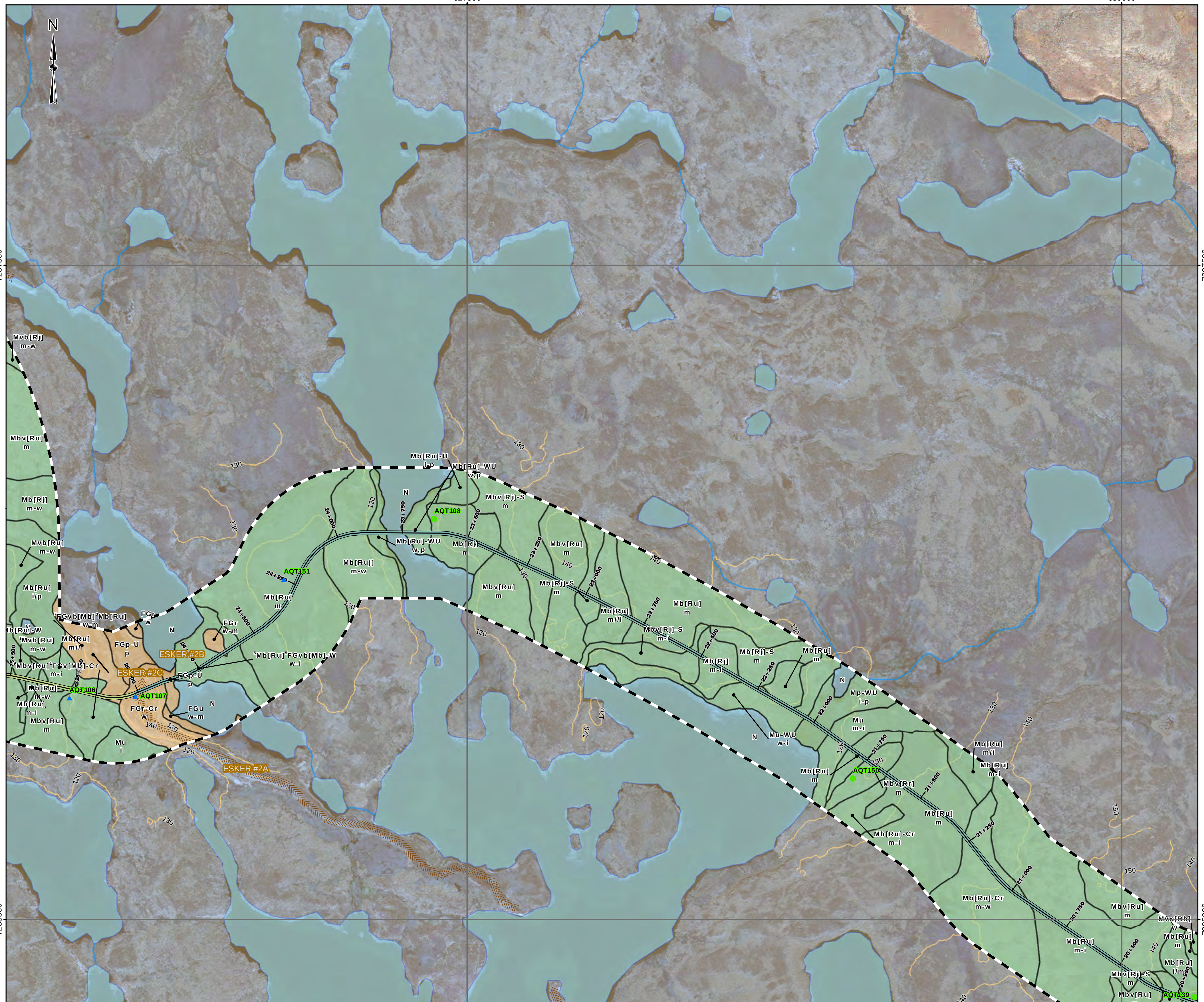


LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- GLACIOFLUVIAL (FG)
- MORAINAL / TILL (M)
- WATER (N)

PROPOSED HAUL ROAD

- SECTION 2
- SECTION 3

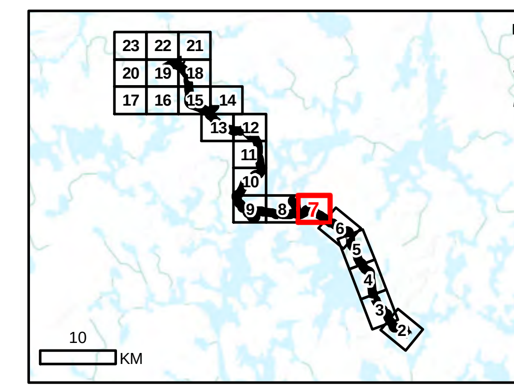
BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER

TERRAIN LABEL:

^{8}Mbv[Ru]^{2}Ovb[Mb]-Cr
m // v

- decile
- surficial material
- surface expression(s)
- underlying material
- underlying surface expression
- geomorphological process and subclass
- drainage
- drainage separator



NOTE

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PROJECT
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MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

TERRAIN MAPPING

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PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	FIGURE C - 7	
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REVIEW	DO	02 May. 2016		

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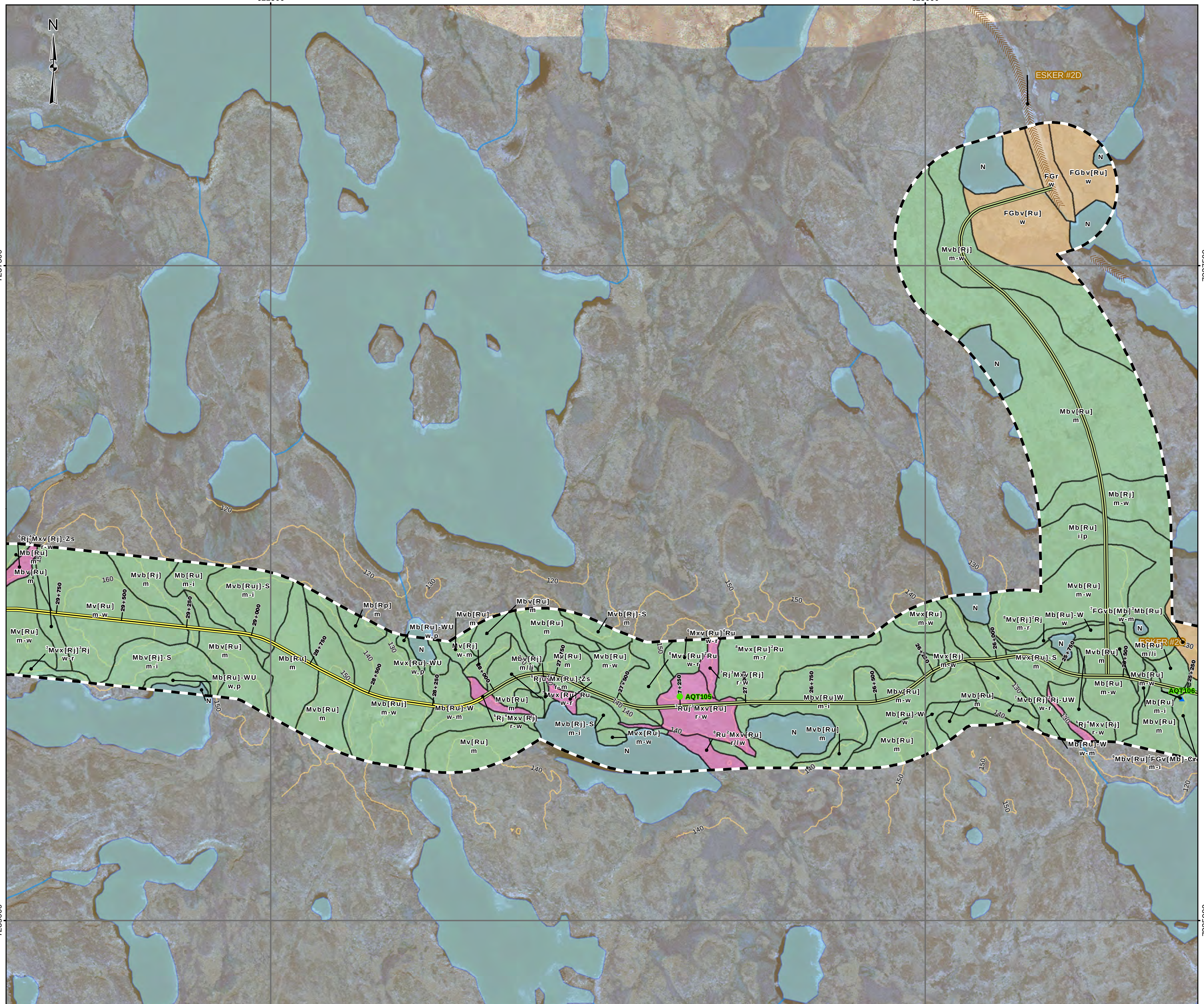


LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- GLACIOFLUVIAL (FG)
- MORAINAL / TILL (M)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 3
- SECTION 4

BASEMAP FEATURES

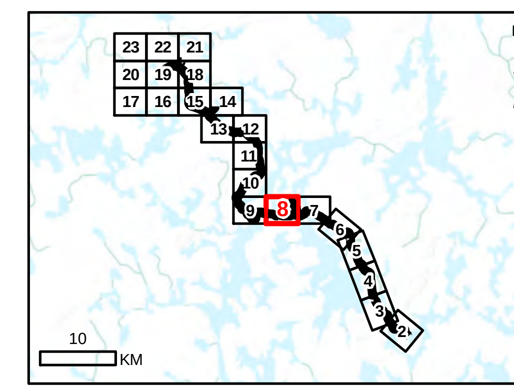
- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER

TERRAIN LABEL:

^{8}Mbv[Ru]^{2}Ovb[Mb]-Cr

m // v

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass
drainage
drainage separator



NOTE

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PROJECT

AGNICO EAGLE

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MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

TERRAIN MAPPING

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016		
CHECK	AS	02 May. 2016	FIGURE C - 8	
REVIEW	DO	02 May. 2016		

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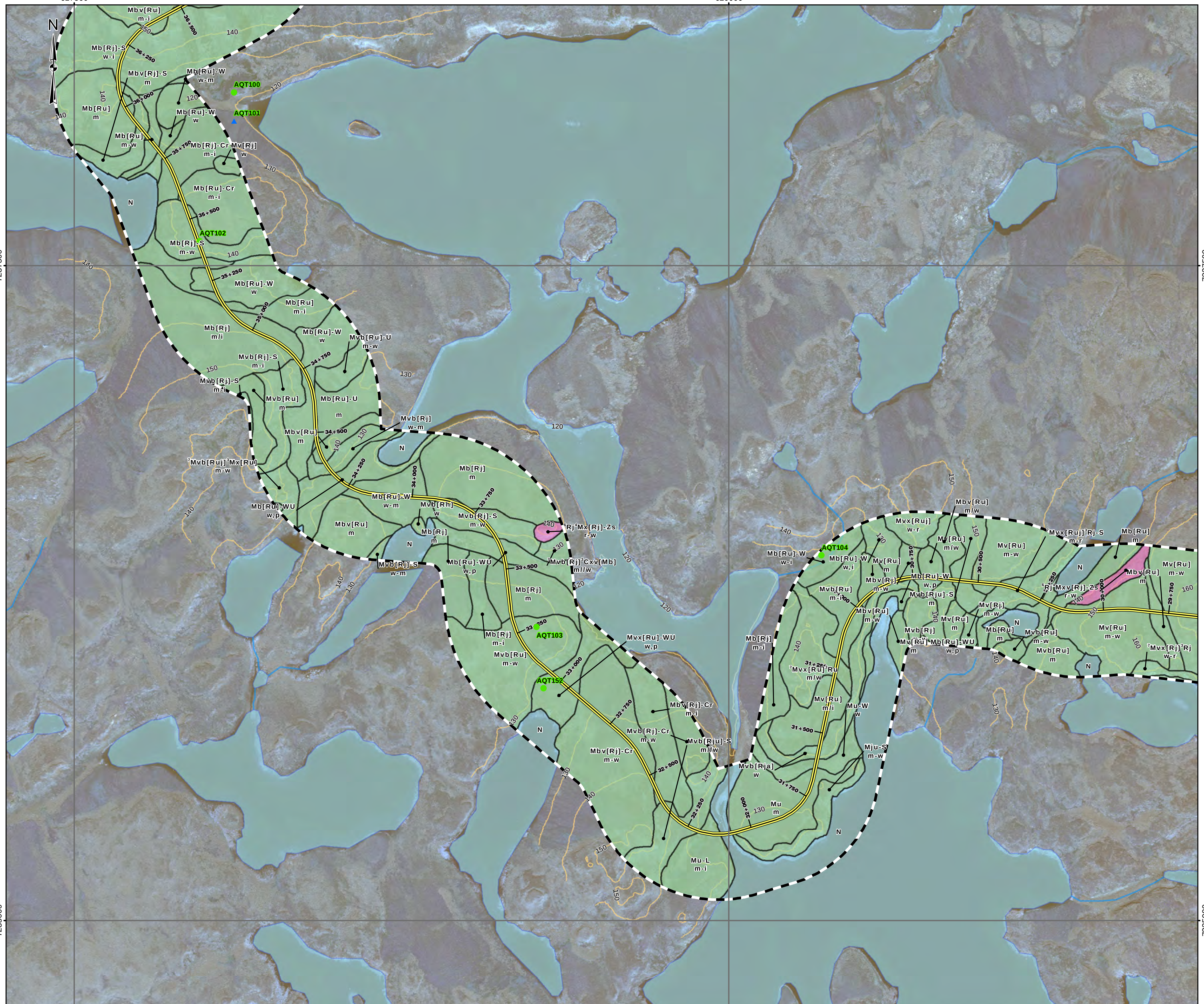


LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- MORAINAL / TILL (M)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 4

BASEMAP FEATURES

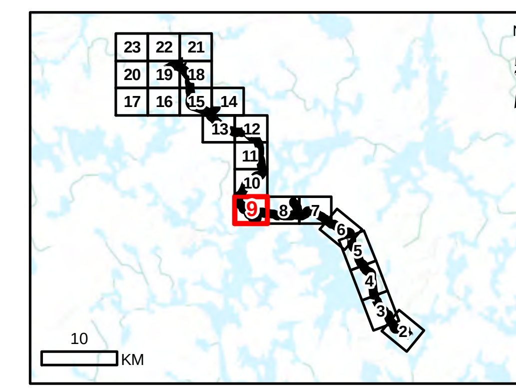
- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY

TERRAIN LABEL:

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass

8Mbv[Ru]2Ovb[Mb]-Cr
m // v

drainage
drainage separator



NOTE

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300 0 300
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PROJECT

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MEADOWBANK DIVISION
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TITLE

TERRAIN MAPPING

Golder Associates

PROJECT		1524321	FILE No.
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN REV. 0
GIS	MM	02 May. 2016	
CHECK	AS	02 May. 2016	**FIGURE C - 9**
REVIEW	DO	02 May. 2016	

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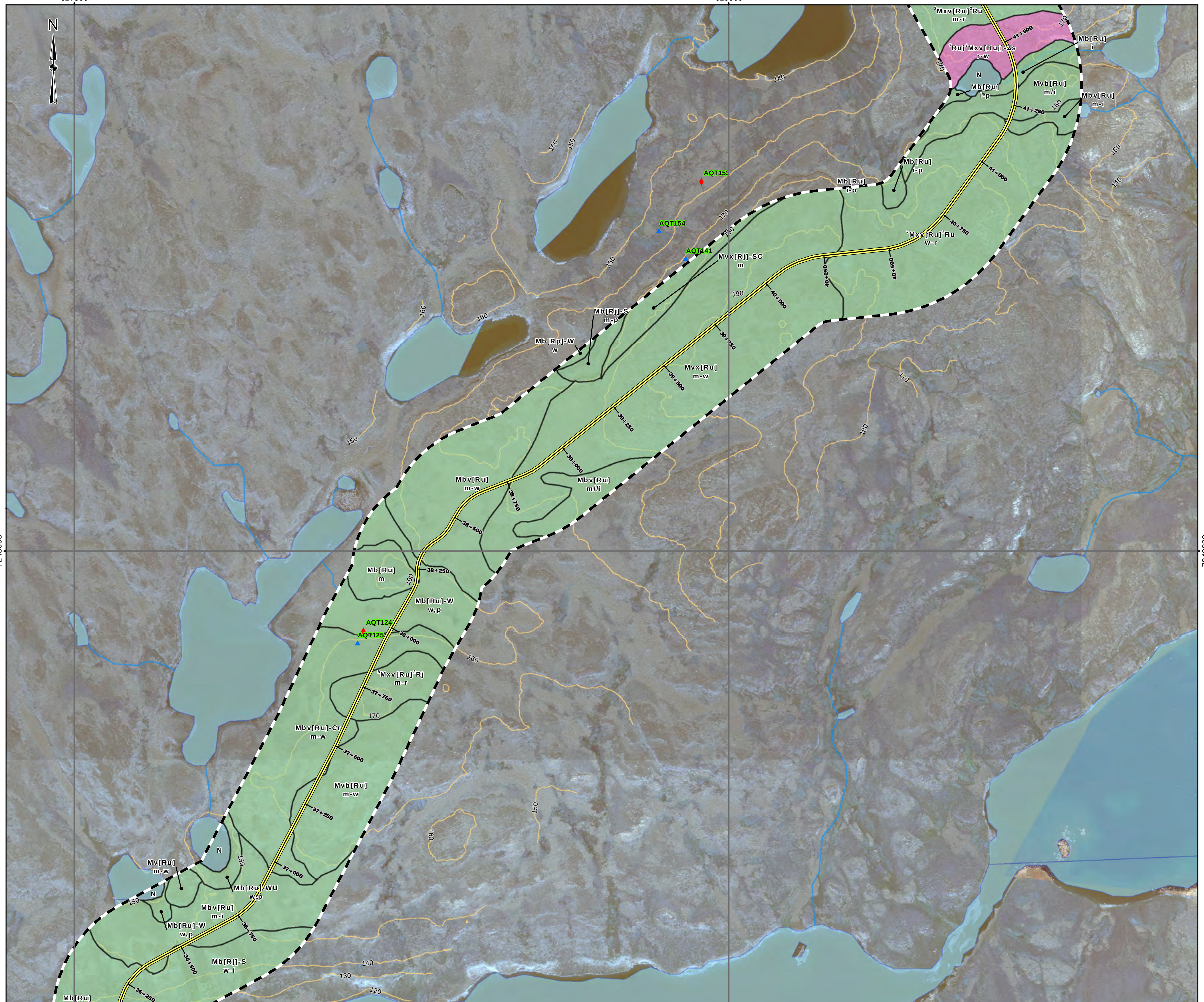


LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (GROUND - DETAILED)
- TERRAIN (GROUND - QUICK)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- MORAINAL / TILL (M)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 4

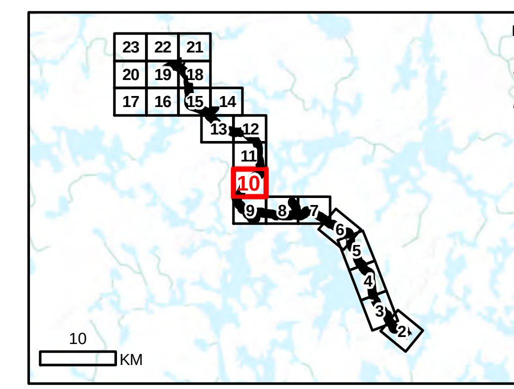
BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY

TERRAIN LABEL:

^{8}Mbv[Ru]^{2}Ovb[Mb]-Cr
m // v

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass
drainage
drainage separator



NOTE

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300 0 300
SCALE 1:15,000 METRES

PROJECT
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MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

TERRAIN MAPPING

Golder Associates

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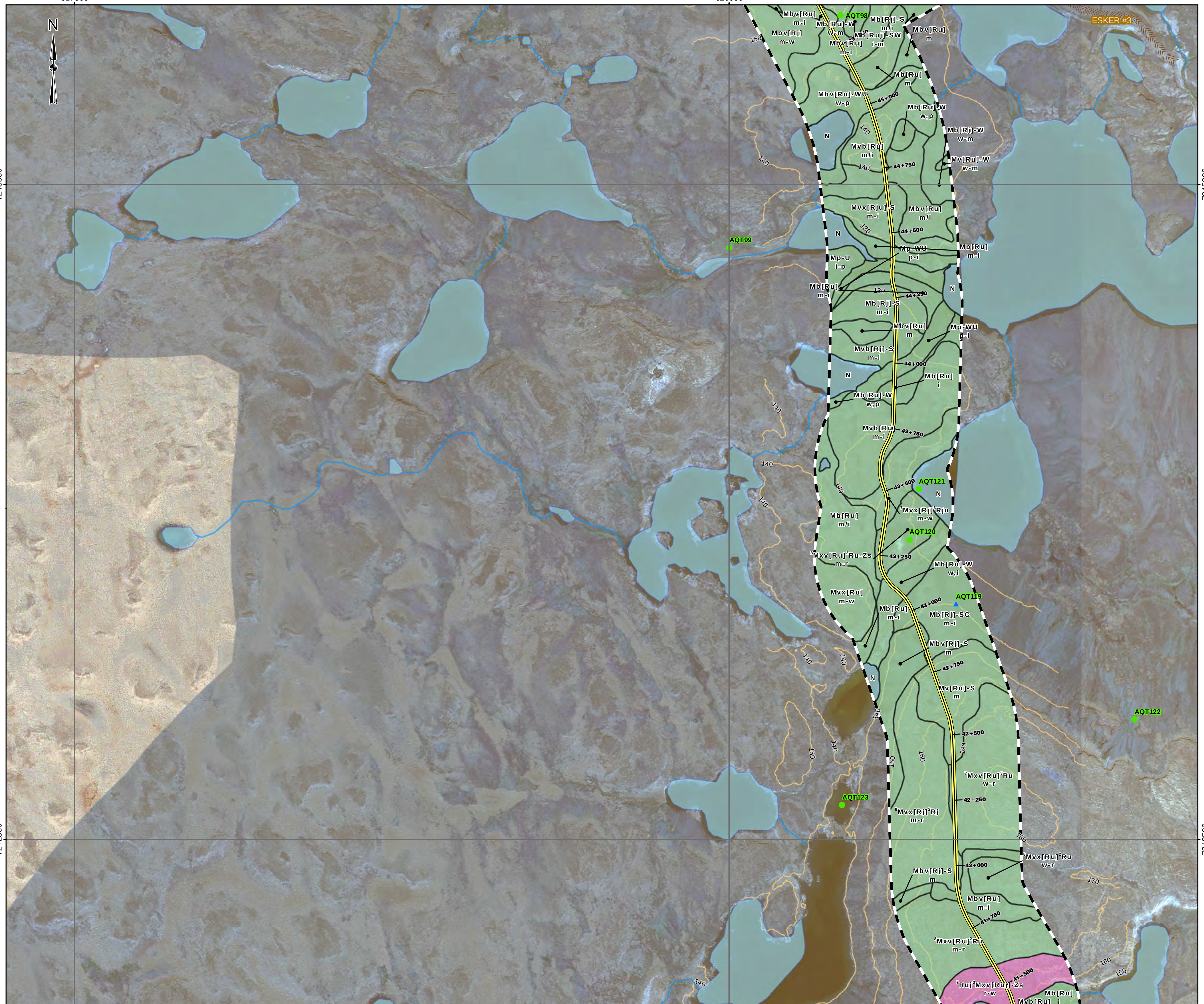
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016		
CHECK	AS	02 May. 2016	FIGURE C - 10	
REVIEW	DO	02 May. 2016		



LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- MORAINAL / TILL (M)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 4

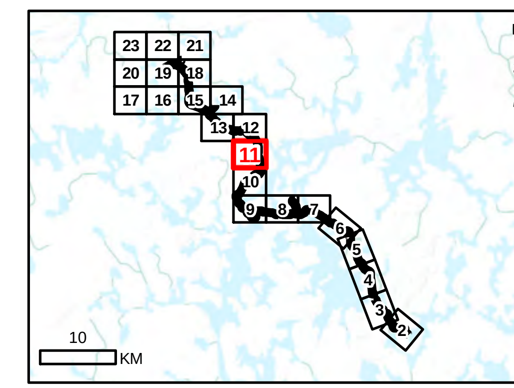
BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER

TERRAIN LABEL:

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass

8Mbv[Ru]2Ovb[Mb]-Cr
m // v
drainage
drainage separator



NOTE

1. FOR DETAILED TERRAIN MAPPING AND LABEL DEFINITIONS PLEASE REFER TO LEGEND FIGURE C-1.
2. TERRAIN POLYGONS ARE COLOUR CODED BASED ON THE DOMINANT SURFICIAL MATERIAL. SECONDARY DEPOSITS MAY EXIST IN LESSER AMOUNTS AND ARE IDENTIFIED IN THE TERRAIN LABEL.

REFERENCE

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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300
SCALE 1:15,000 METRES

PROJECT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

TERRAIN MAPPING

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016		
CHECK	AS	02 May. 2016	FIGURE C - 11	
REVIEW	DO	02 May. 2016		

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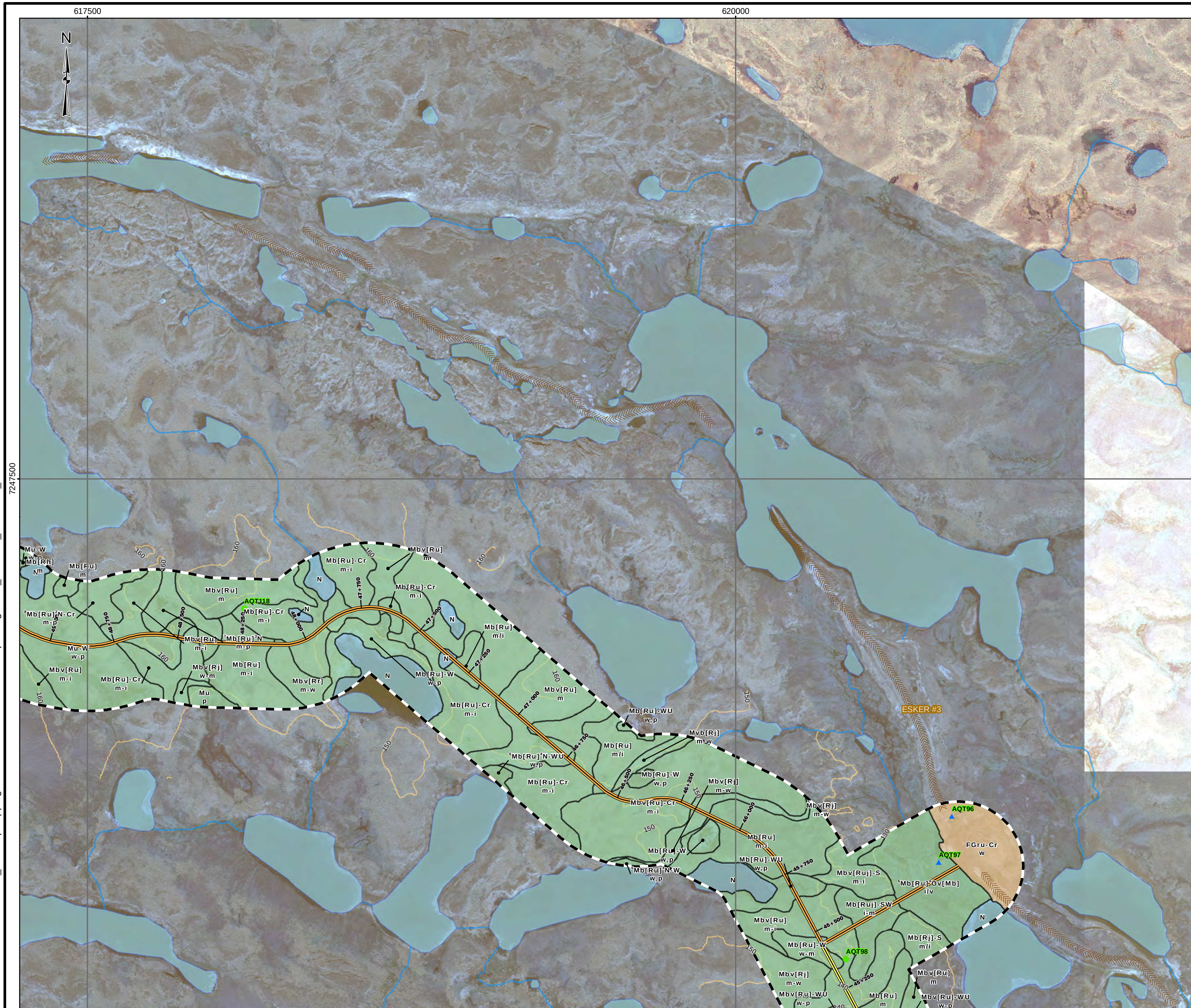


LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- GLACIOFLUVIAL (FG)
- MORAINAL / TILL (M)
- WATER (N)

PROPOSED HAUL ROAD

- SECTION 4
- SECTION 5

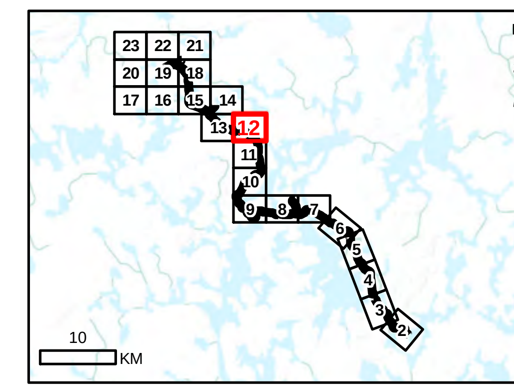
BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER

TERRAIN LABEL:

[8]Mbv[Ru][2]Ovb[Mb]-Cr
m // v

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass
drainage
drainage separator



NOTE

1. FOR DETAILED TERRAIN MAPPING AND LABEL DEFINITIONS PLEASE REFER TO LEGEND FIGURE C-1.
2. TERRAIN POLYGONS ARE COLOUR CODED BASED ON THE DOMINANT SURFICIAL MATERIAL. SECONDARY DEPOSITS MAY EXIST IN LESSER AMOUNTS AND ARE IDENTIFIED IN THE TERRAIN LABEL.

REFERENCE

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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300
SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

TERRAIN MAPPING

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	FIGURE C - 12	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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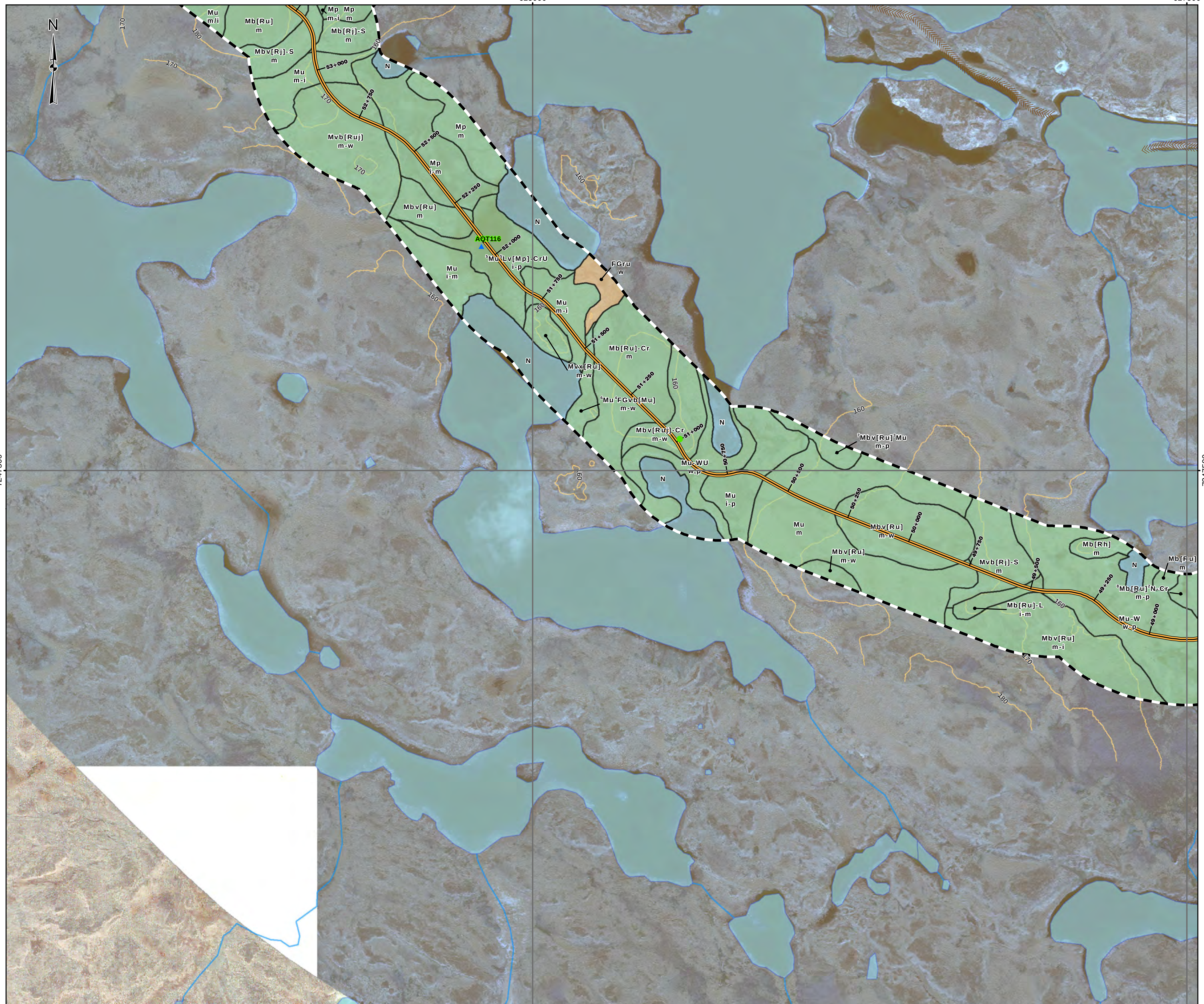


LEGEND

- STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- GLACIOFLUVIAL (FG)
- MORAINAL / TILL (M)
- WATER (N)

PROPOSED HAUL ROAD

- SECTION 5

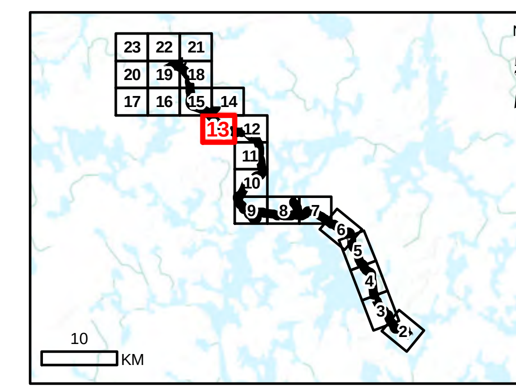
BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER

TERRAIN LABEL:

^{8}Mbv[Ru]^{2}Ovb[Mb]-Cr
m // v

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass
drainage
drainage separator



NOTE

1. FOR DETAILED TERRAIN MAPPING AND LABEL DEFINITIONS PLEASE REFER TO LEGEND FIGURE C-1.
2. TERRAIN POLYGONS ARE COLOUR CODED BASED ON THE DOMINANT SURFICIAL MATERIAL. SECONDARY DEPOSITS MAY EXIST IN LESSER AMOUNTS AND ARE IDENTIFIED IN THE TERRAIN LABEL.

REFERENCE

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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

TERRAIN MAPPING

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	FIGURE C - 13	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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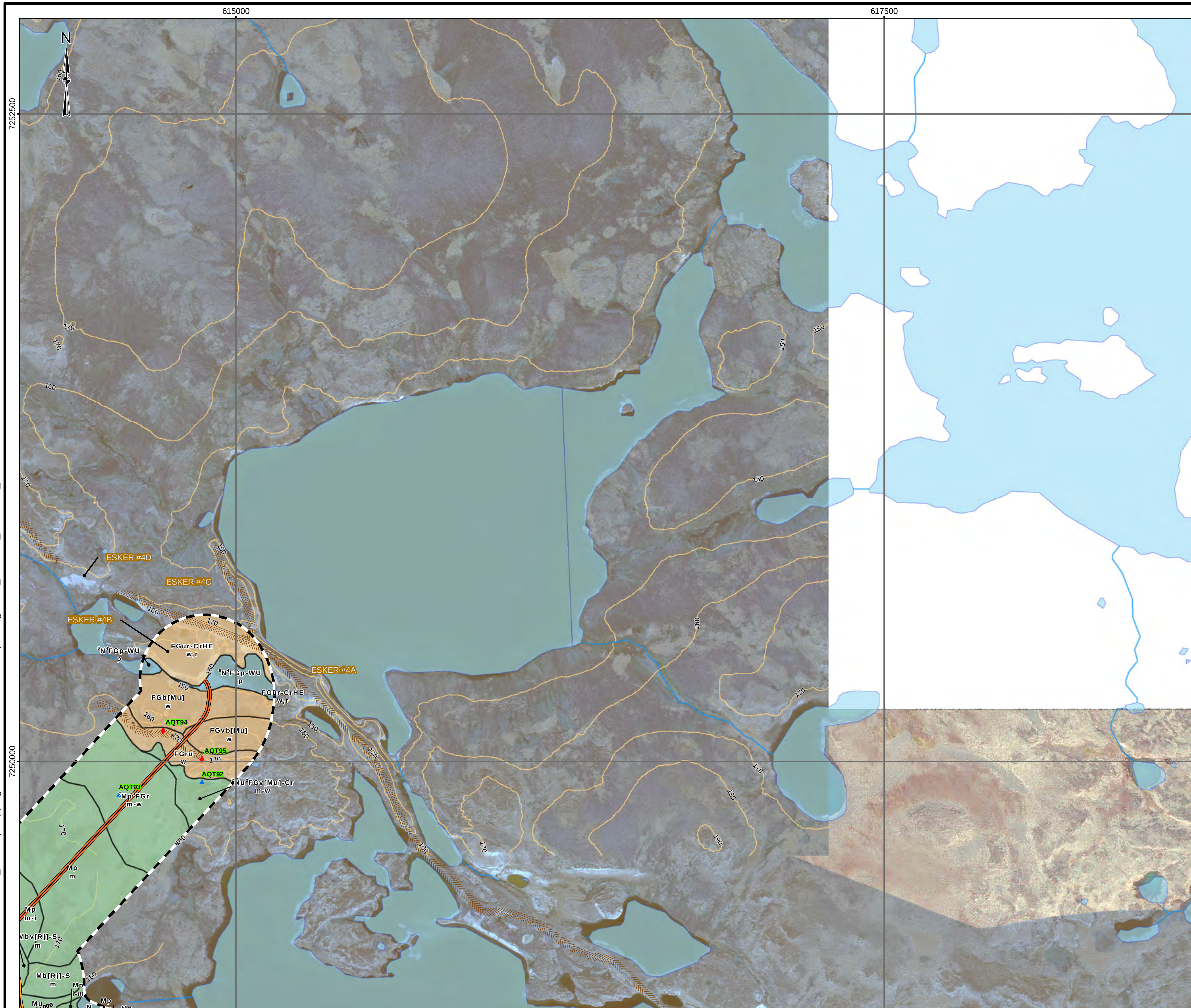


LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (GROUND - DETAILED)
- TERRAIN (GROUND - QUICK)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- GLACIOFLUVIAL (FG)
- MORAINAL / TILL (M)
- WATER (N)

PROPOSED HAUL ROAD

- SECTION 5
- SECTION 6

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER

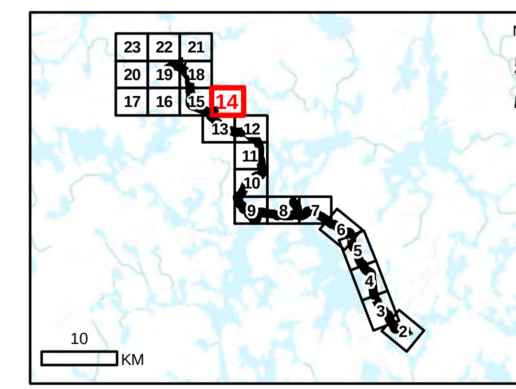
TERRAIN LABEL:

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass

^{8}Mbv[Ru]^{2}Ovb[Mb]-Cr

m // v

drainage
drainage separator



NOTE

1. FOR DETAILED TERRAIN MAPPING AND LABEL DEFINITIONS PLEASE REFER TO LEGEND FIGURE C-1.
2. TERRAIN POLYGONS ARE COLOUR CODED BASED ON THE DOMINANT SURFICIAL MATERIAL. SECONDARY DEPOSITS MAY EXIST IN LESSER AMOUNTS AND ARE IDENTIFIED IN THE TERRAIN LABEL.

REFERENCE

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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

TERRAIN MAPPING

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	FIGURE C - 14	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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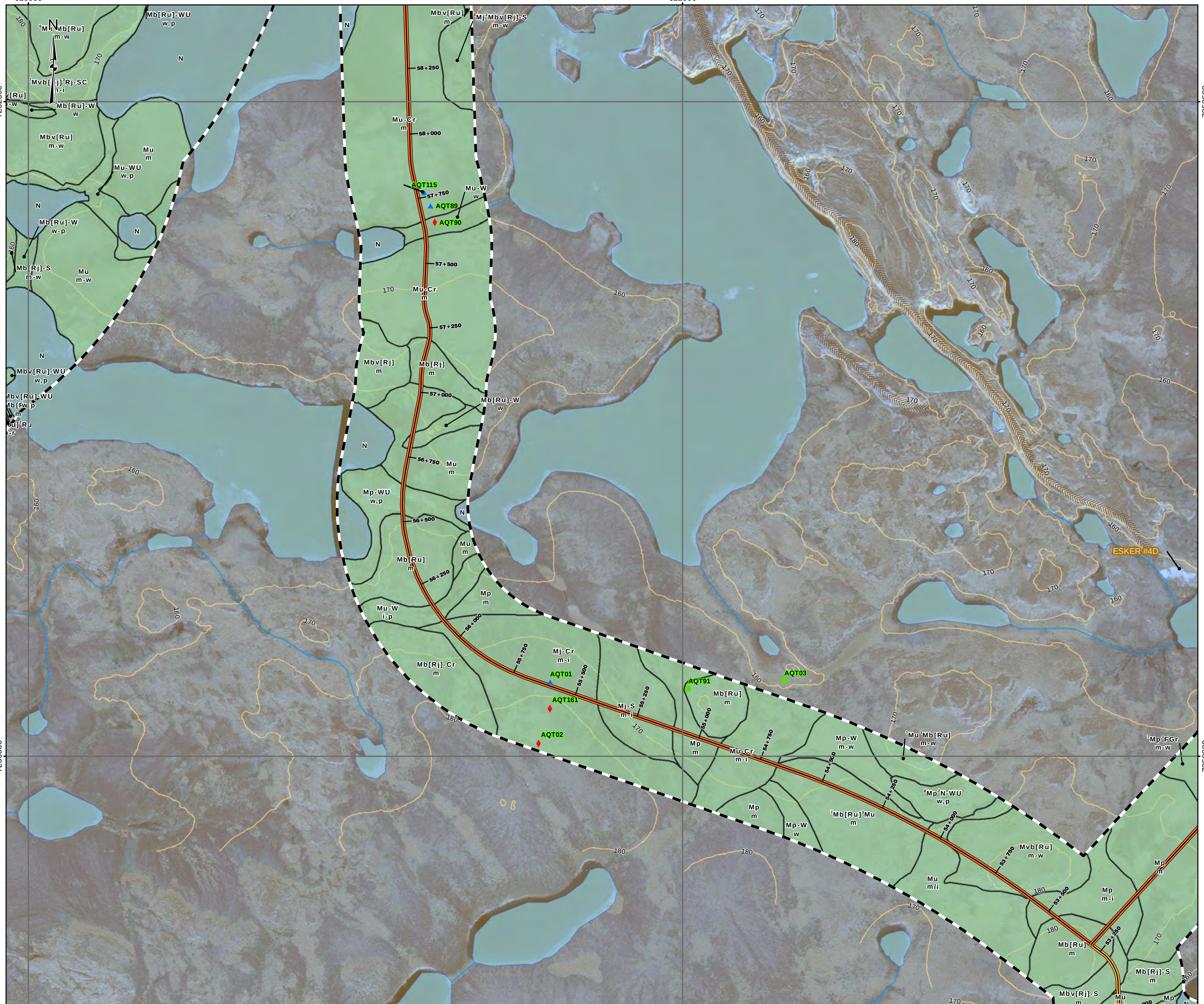

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LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)
- TERRAIN (GROUND - QUICK)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- MORAINAL / TILL (M)
- WATER (N)

PROPOSED HAUL ROAD

- SECTION 5
- SECTION 6

BASEMAP FEATURES

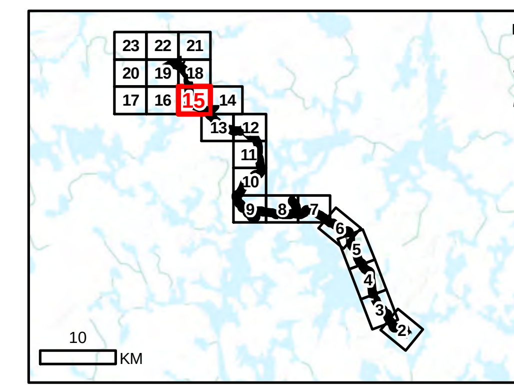
- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER

TERRAIN LABEL:

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass

^{8}Mbv[Ru]^{2}Ovb[Mb]-Cr
m // v

drainage
drainage separator



NOTE

1. FOR DETAILED TERRAIN MAPPING AND LABEL DEFINITIONS PLEASE REFER TO LEGEND FIGURE C-1.
2. TERRAIN POLYGONS ARE COLOUR CODED BASED ON THE DOMINANT SURFICIAL MATERIAL. SECONDARY DEPOSITS MAY EXIST IN LESSER AMOUNTS AND ARE IDENTIFIED IN THE TERRAIN LABEL.

REFERENCE

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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300
SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

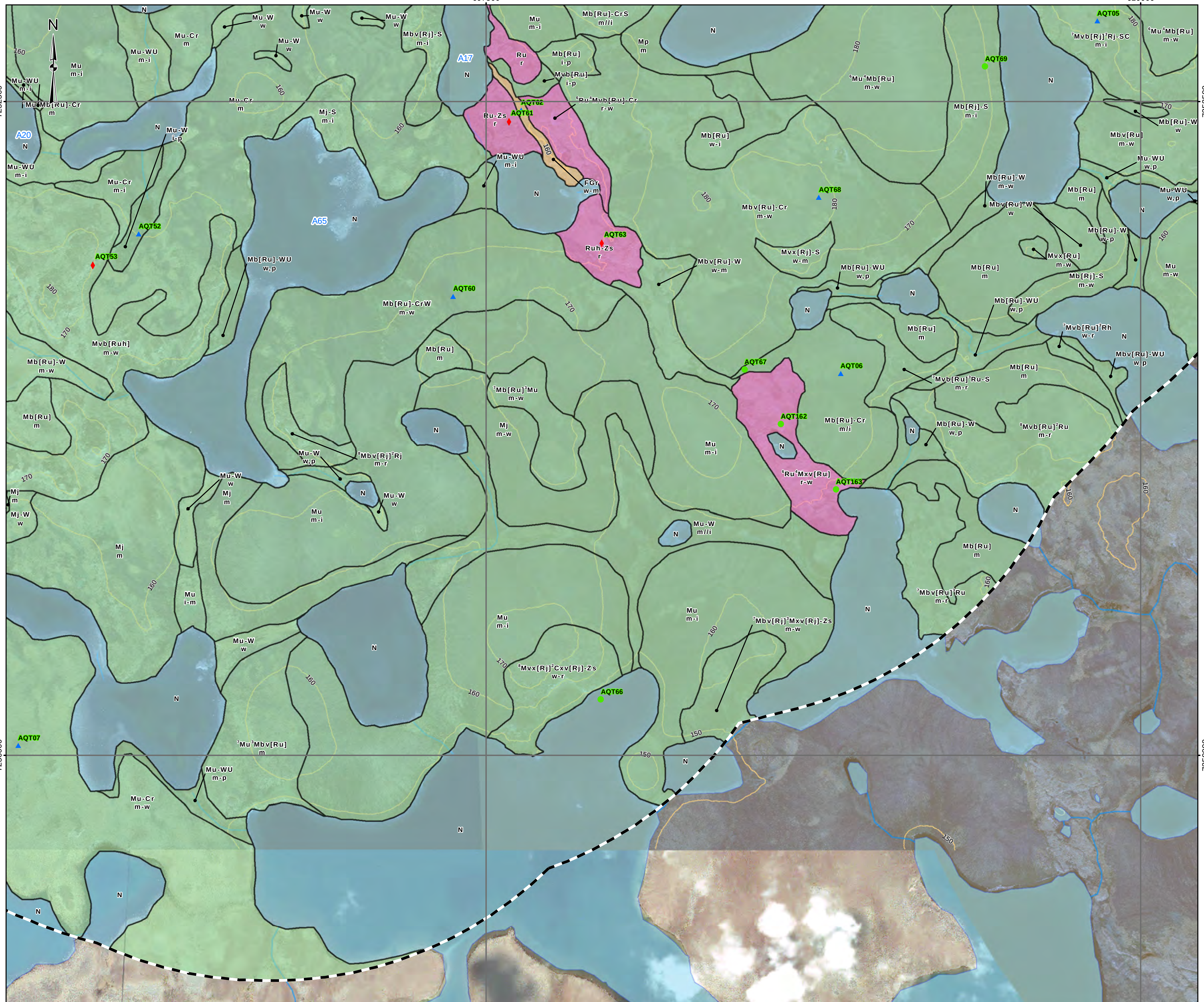
TITLE

TERRAIN MAPPING

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016		
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

FIGURE C - 15



LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)
- TERRAIN (GROUND - QUICK)

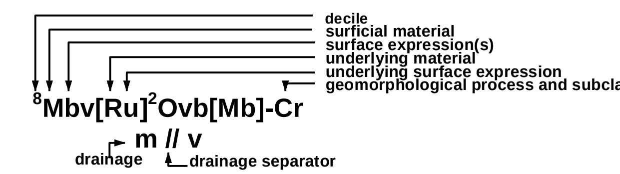
DOMINANT SURFICIAL MATERIAL

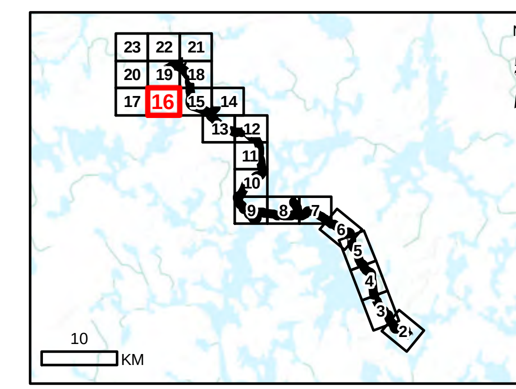
- TERRAIN UNIT (APPROXIMATE)
- GLACIOFLUVIAL (FG)
- MORAINAL / TILL (M)
- WATER (N)
- BEDROCK (R)

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY

TERRAIN LABEL:





NOTE

1. FOR DETAILED TERRAIN MAPPING AND LABEL DEFINITIONS PLEASE REFER TO LEGEND FIGURE C-1.
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REFERENCE

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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300
SCALE 1:15,000 METRES

PROJECT
AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

TERRAIN MAPPING

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016		
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

FIGURE C - 16

LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- MORAINAL / TILL (M)
- WATER (N)
- BEDROCK (R)

BASEMAP FEATURES

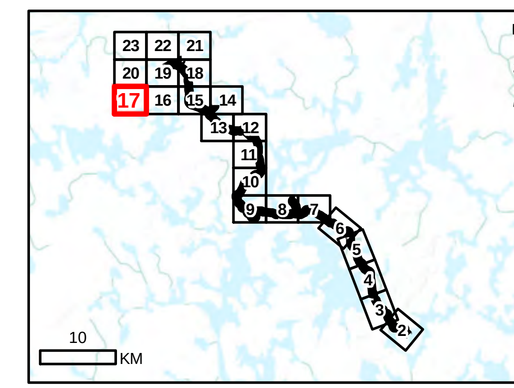
- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY

TERRAIN LABEL:

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass

^{8}Mbv[Ru]^{2}Ovb[Mb]-Cr
m // v

drainage
drainage separator



NOTE

1. FOR DETAILED TERRAIN MAPPING AND LABEL DEFINITIONS PLEASE REFER TO LEGEND FIGURE C-1.
2. TERRAIN POLYGONS ARE COLOUR CODED BASED ON THE DOMINANT SURFICIAL MATERIAL. SECONDARY DEPOSITS MAY EXIST IN LESSER AMOUNTS AND ARE IDENTIFIED IN THE TERRAIN LABEL.

REFERENCE

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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300
SCALE 1:15,000 METRES

PROJECT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

TERRAIN MAPPING

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	FIGURE C - 17	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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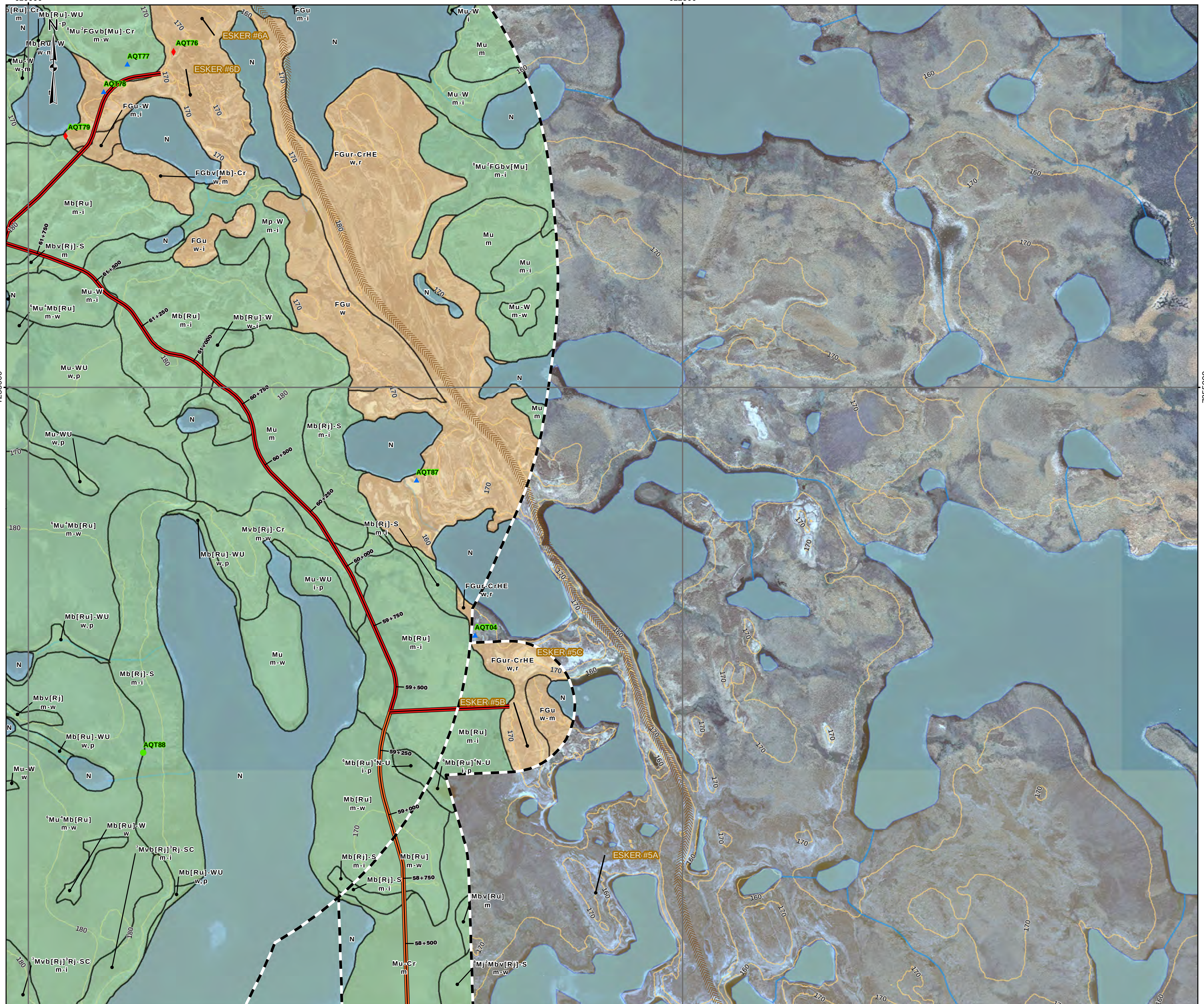


LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)
- TERRAIN (GROUND - QUICK)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- GLACIOFLUVIAL (FG)
- MORAINAL / TILL (M)
- WATER (N)

PROPOSED HAUL ROAD

- SECTION 6
- SECTION 7

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER

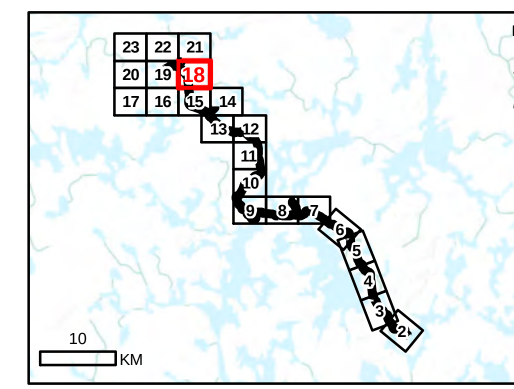
TERRAIN LABEL:

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass

^{8}Mbv[Ru]^{2}Ovb[Mb]-Cr

m // v

drainage
drainage separator



NOTE

1. FOR DETAILED TERRAIN MAPPING AND LABEL DEFINITIONS PLEASE REFER TO LEGEND FIGURE C-1.
2. TERRAIN POLYGONS ARE COLOUR CODED BASED ON THE DOMINANT SURFICIAL MATERIAL. SECONDARY DEPOSITS MAY EXIST IN LESSER AMOUNTS AND ARE IDENTIFIED IN THE TERRAIN LABEL.

REFERENCE

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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

TERRAIN MAPPING

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	FIGURE C - 18	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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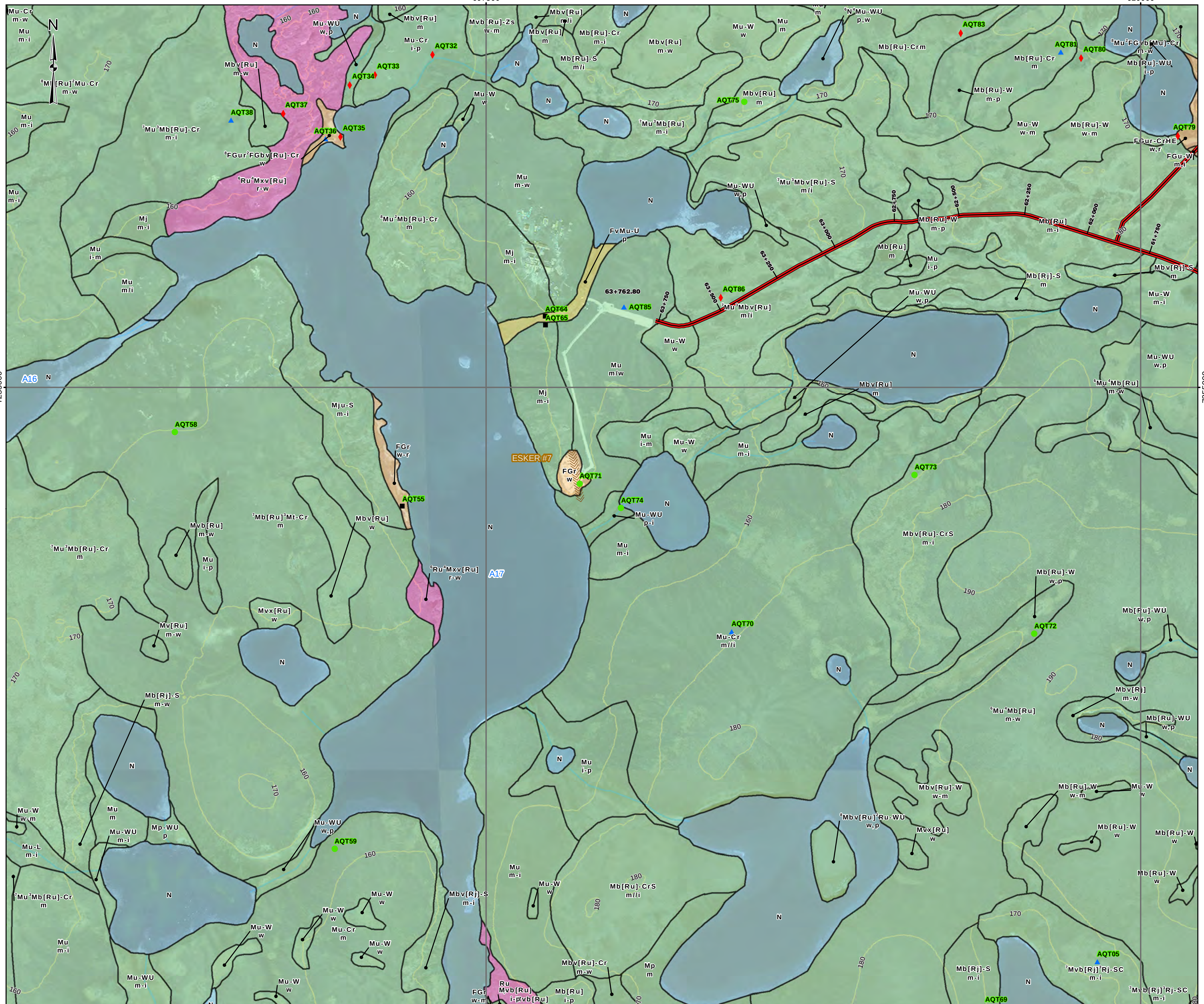


LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN AND SOIL (GROUND - DETAILED)
- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)
- TERRAIN (GROUND - QUICK)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- FLUVIAL (F)
- GLACIOFLUVIAL (FG)
- MORAINAL / TILL (M)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 7

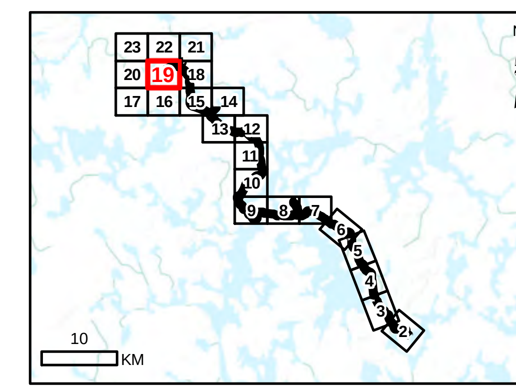
BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- ESKER

TERRAIN LABEL:

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass

8Mbv[Ru]2Ovb[Mb]-Cr
m // v
drainage
drainage separator



NOTE

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2. TERRAIN POLYGONS ARE COLOUR CODED BASED ON THE DOMINANT SURFICIAL MATERIAL. SECONDARY DEPOSITS MAY EXIST IN LESSER AMOUNTS AND ARE IDENTIFIED IN THE TERRAIN LABEL.

REFERENCE

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300 0 300
SCALE 1:15,000 METRES

PROJECT
AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

TERRAIN MAPPING

PROJECT		1524321	FILE No.		
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV.	0
GIS	MM	02 May. 2016			
CHECK	AS	02 May. 2016	FIGURE C - 19		
REVIEW	DO	02 May. 2016			

Golder Associates

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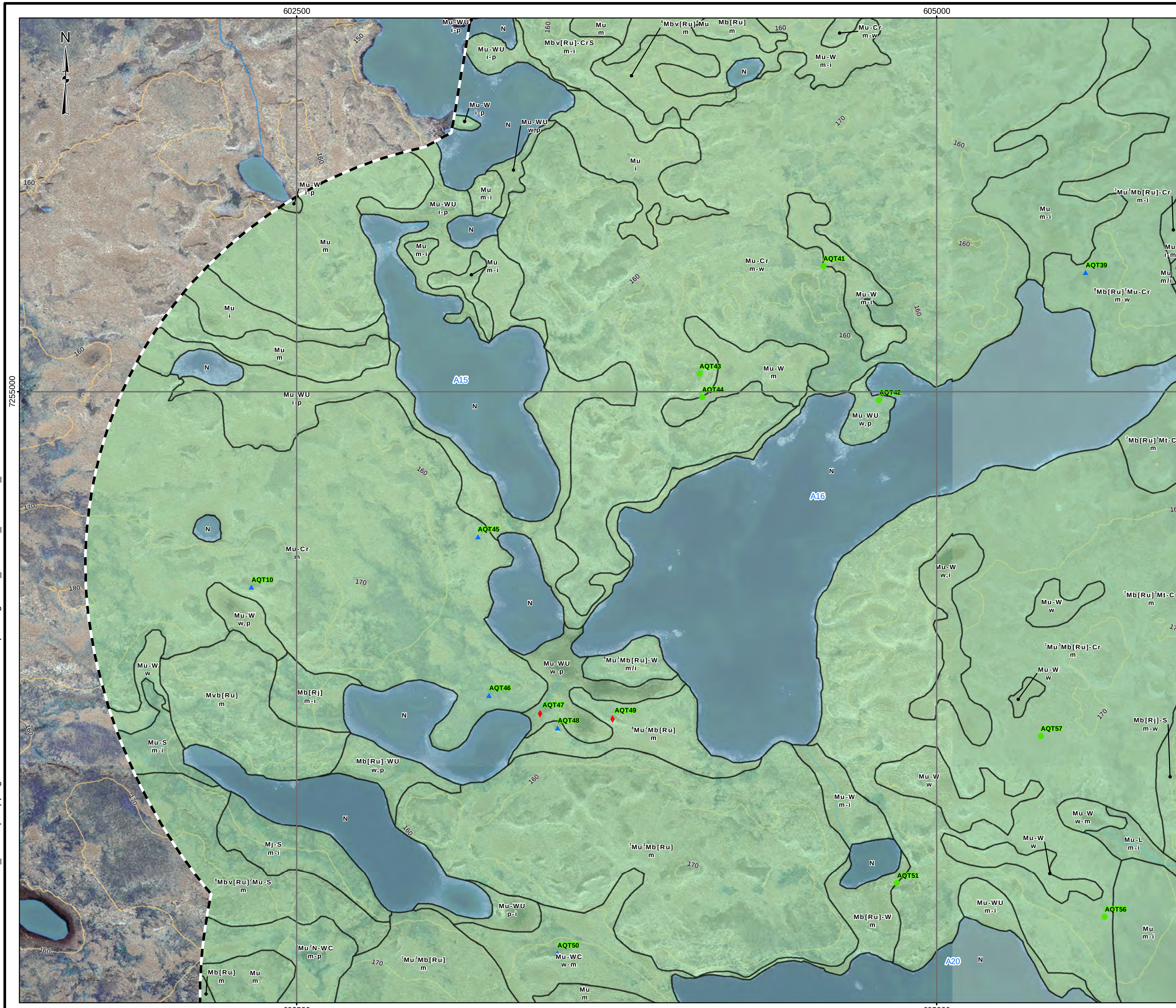


LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)
- TERRAIN (GROUND - QUICK)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- MORAINAL / TILL (M)
- WATER (N)

BASEMAP FEATURES

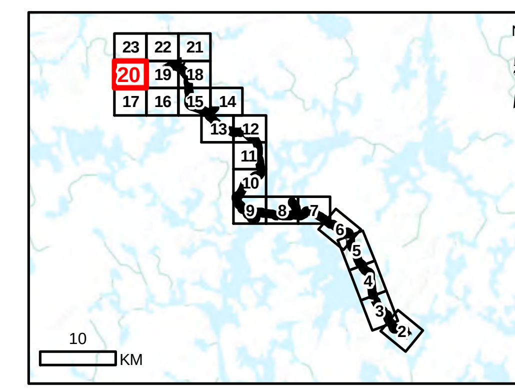
- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY

TERRAIN LABEL:

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass

8Mbv[Ru]2Ovb[Mb]-Cr
m // v

drainage
drainage separator



NOTE

1. FOR DETAILED TERRAIN MAPPING AND LABEL DEFINITIONS PLEASE REFER TO LEGEND FIGURE C-1.
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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

TERRAIN MAPPING

Golder Associates

PROJECT		1524321	FILE No.
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN REV. 0
GIS	MM	02 May. 2016	
CHECK	AS	02 May. 2016	FIGURE C - 20
REVIEW	DO	02 May. 2016	

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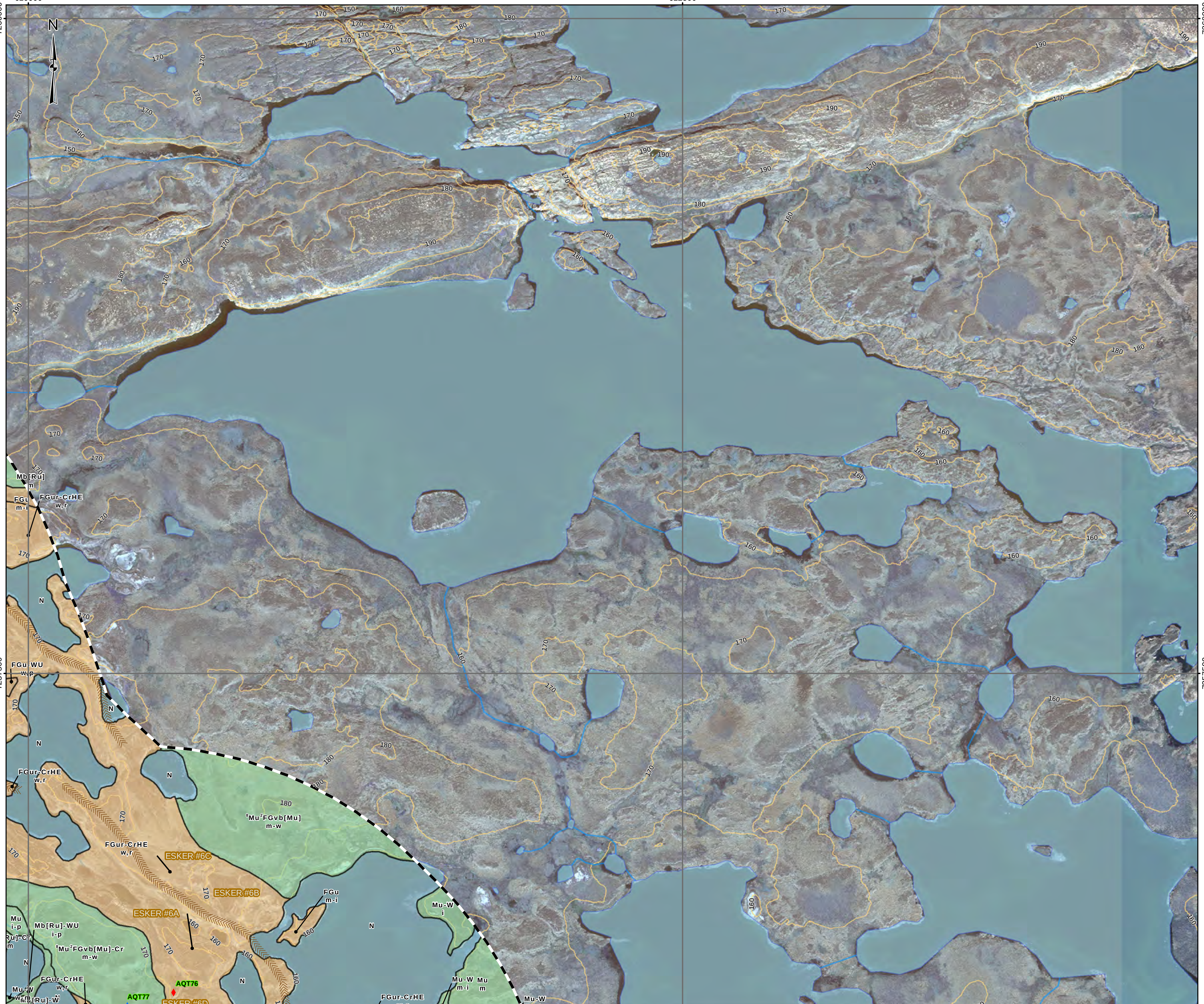


LEGEND

- STUDY AREA

FIELD SITE LOCATION

- TERRAIN (GROUND - DETAILED)
- TERRAIN (GROUND - QUICK)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- GLACIOFLUVIAL (FG)
- MORAINAL / TILL (M)
- WATER (N)

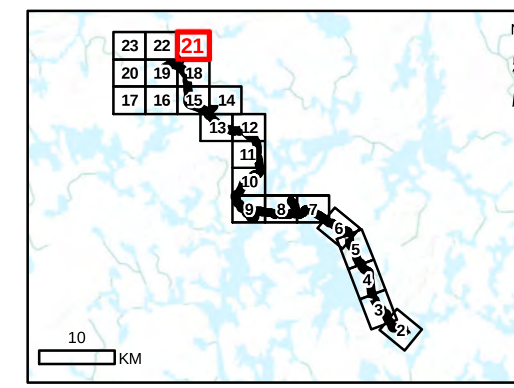
BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER

TERRAIN LABEL:

^{8}Mbv[Ru]^{2}Ovb[Mb]-Cr
m // v

decile; surficial material; surface expression(s); underlying material; underlying surface expression; geomorphological process and subclass; drainage; drainage separator



NOTE

1. FOR DETAILED TERRAIN MAPPING AND LABEL DEFINITIONS PLEASE REFER TO LEGEND FIGURE C-1.
2. TERRAIN POLYGONS ARE COLOUR CODED BASED ON THE DOMINANT SURFICIAL MATERIAL. SECONDARY DEPOSITS MAY EXIST IN LESSER AMOUNTS AND ARE IDENTIFIED IN THE TERRAIN LABEL.

REFERENCE

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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300
SCALE 1:15,000 METRES

PROJECT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE
TERRAIN MAPPING

Golder Associates

PROJECT		1524321	FILE No.
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN — REV. 0
GIS	MM	02 May. 2016	
CHECK	AS	02 May. 2016	FIGURE C - 21
REVIEW	DO	02 May. 2016	

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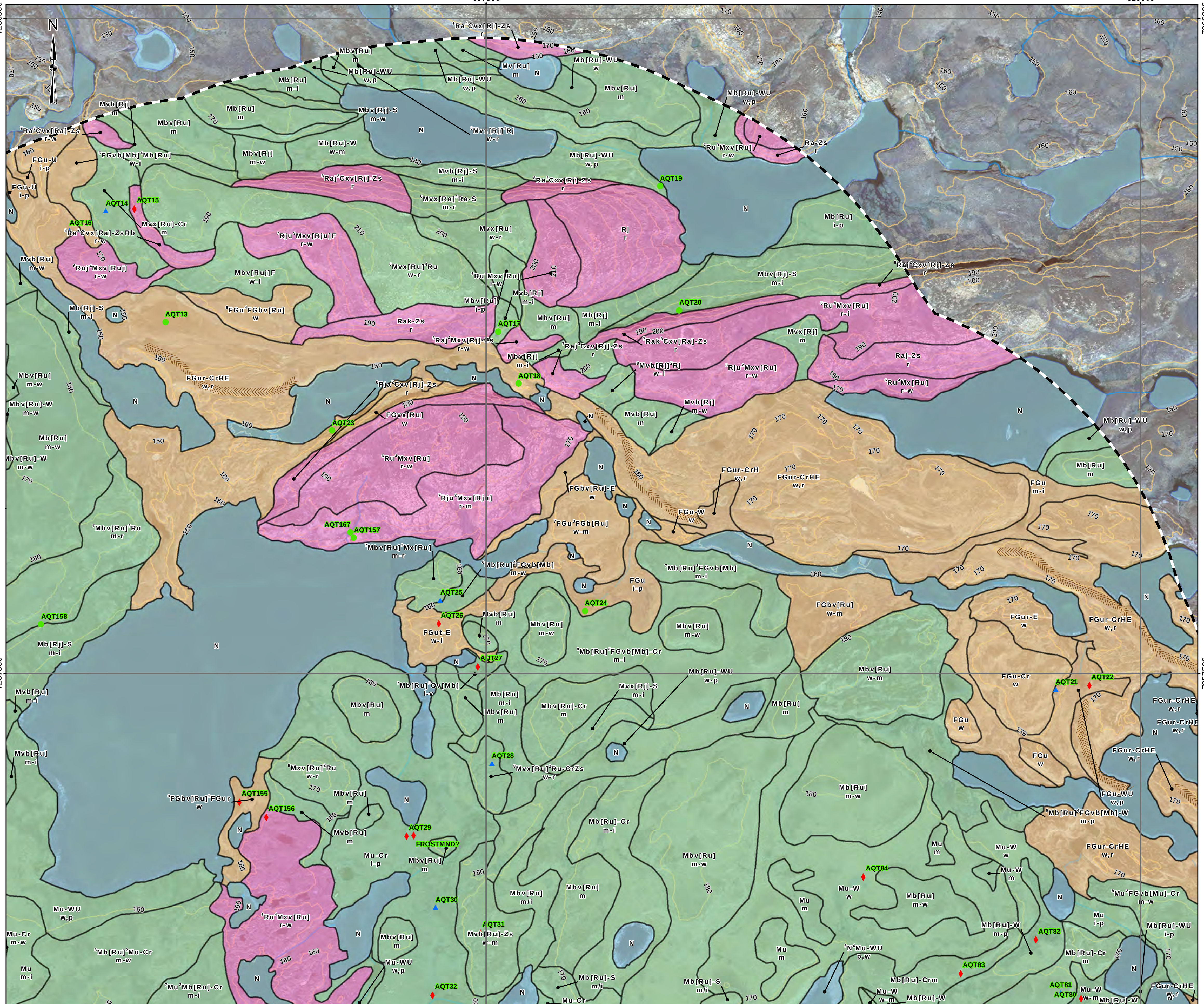


LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)
- TERRAIN (GROUND - QUICK)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- GLACIOFLUVIAL (FG)
- MORAINAL / TILL (M)
- WATER (N)
- BEDROCK (R)

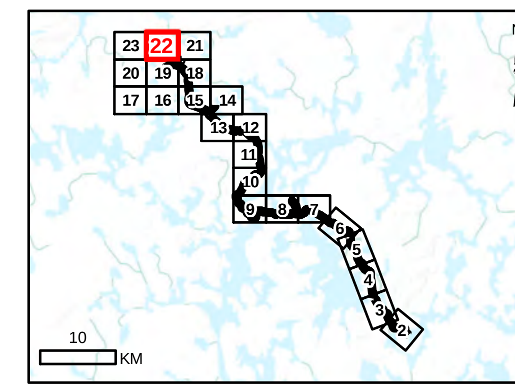
BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER

TERRAIN LABEL:

8Mbv[Ru]2Ovb[Mb]-Cr
m // v

- decile
- surficial material
- surface expression(s)
- underlying material
- underlying surface expression
- geomorphological process and subclass
- drainage
- drainage separator



NOTE

1. FOR DETAILED TERRAIN MAPPING AND LABEL DEFINITIONS PLEASE REFER TO LEGEND FIGURE C-1.
2. TERRAIN POLYGONS ARE COLOUR CODED BASED ON THE DOMINANT SURFICIAL MATERIAL. SECONDARY DEPOSITS MAY EXIST IN LESSER AMOUNTS AND ARE IDENTIFIED IN THE TERRAIN LABEL.

REFERENCE

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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300
SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

TERRAIN MAPPING

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	FIGURE C - 22	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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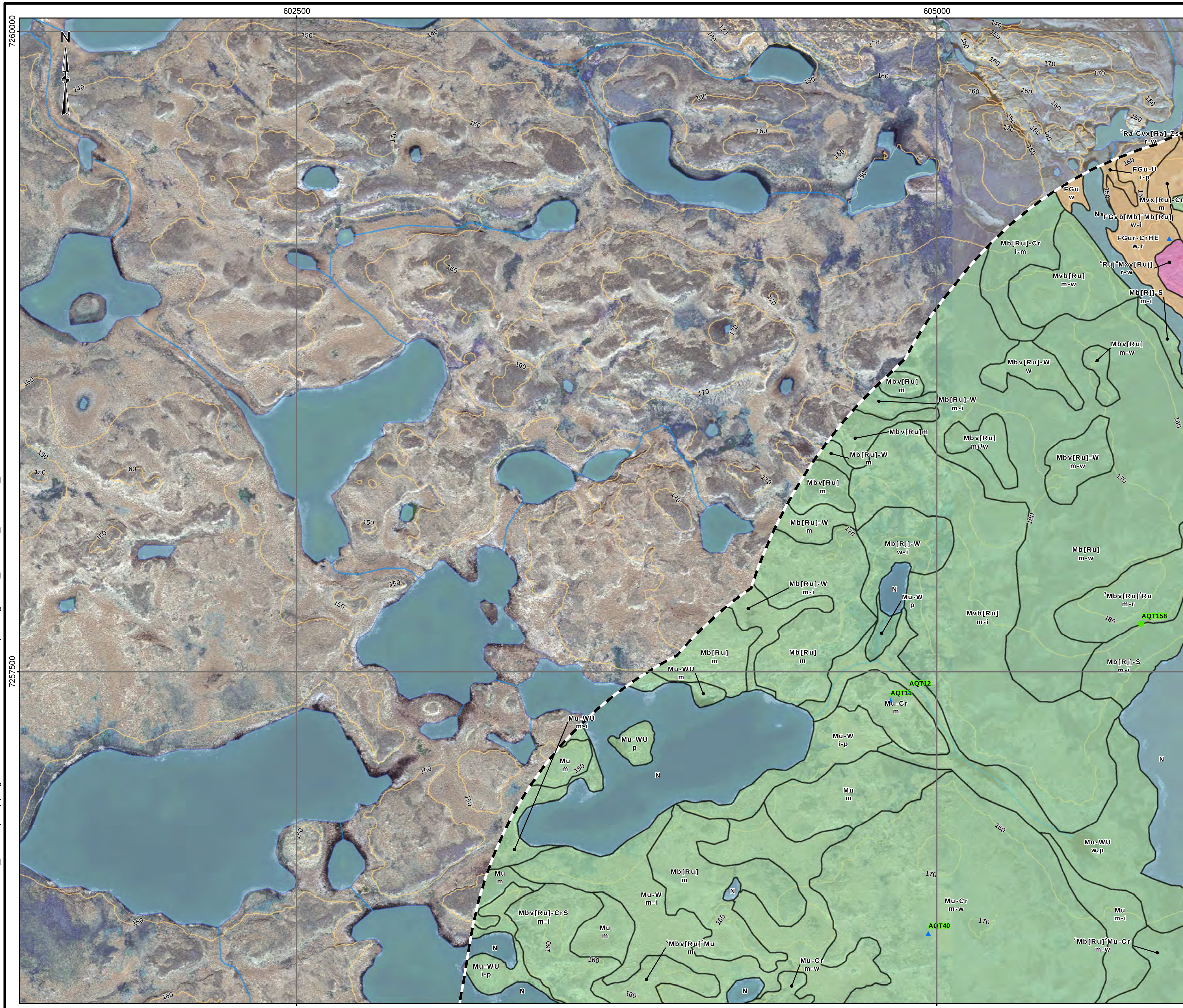


LEGEND

STUDY AREA

FIELD SITE LOCATION

- TERRAIN (AIR)
- TERRAIN (GROUND - DETAILED)

DOMINANT SURFICIAL MATERIAL

- TERRAIN UNIT (APPROXIMATE)
- GLACIOFLUVIAL (FG)
- MORAINAL / TILL (M)
- WATER (N)
- BEDROCK (R)

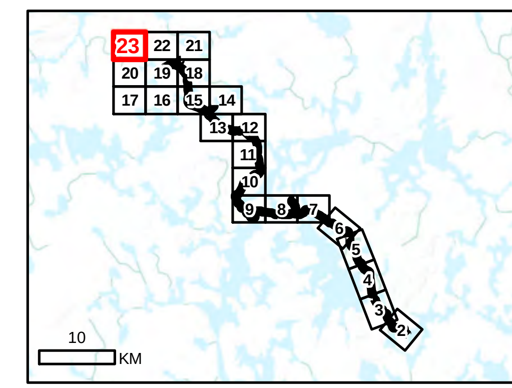
BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY

TERRAIN LABEL:

decile
surficial material
surface expression(s)
underlying material
underlying surface expression
geomorphological process and subclass

^{8}Mbv[Ru]^{2}Ovb[Mb]-Cr
m // v
drainage
drainage separator



NOTE

1. FOR DETAILED TERRAIN MAPPING AND LABEL DEFINITIONS PLEASE REFER TO LEGEND FIGURE C-1.
2. TERRAIN POLYGONS ARE COLOUR CODED BASED ON THE DOMINANT SURFICIAL MATERIAL. SECONDARY DEPOSITS MAY EXIST IN LESSER AMOUNTS AND ARE IDENTIFIED IN THE TERRAIN LABEL.

REFERENCE

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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300
SCALE 1:15,000 METRES

PROJECT
AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

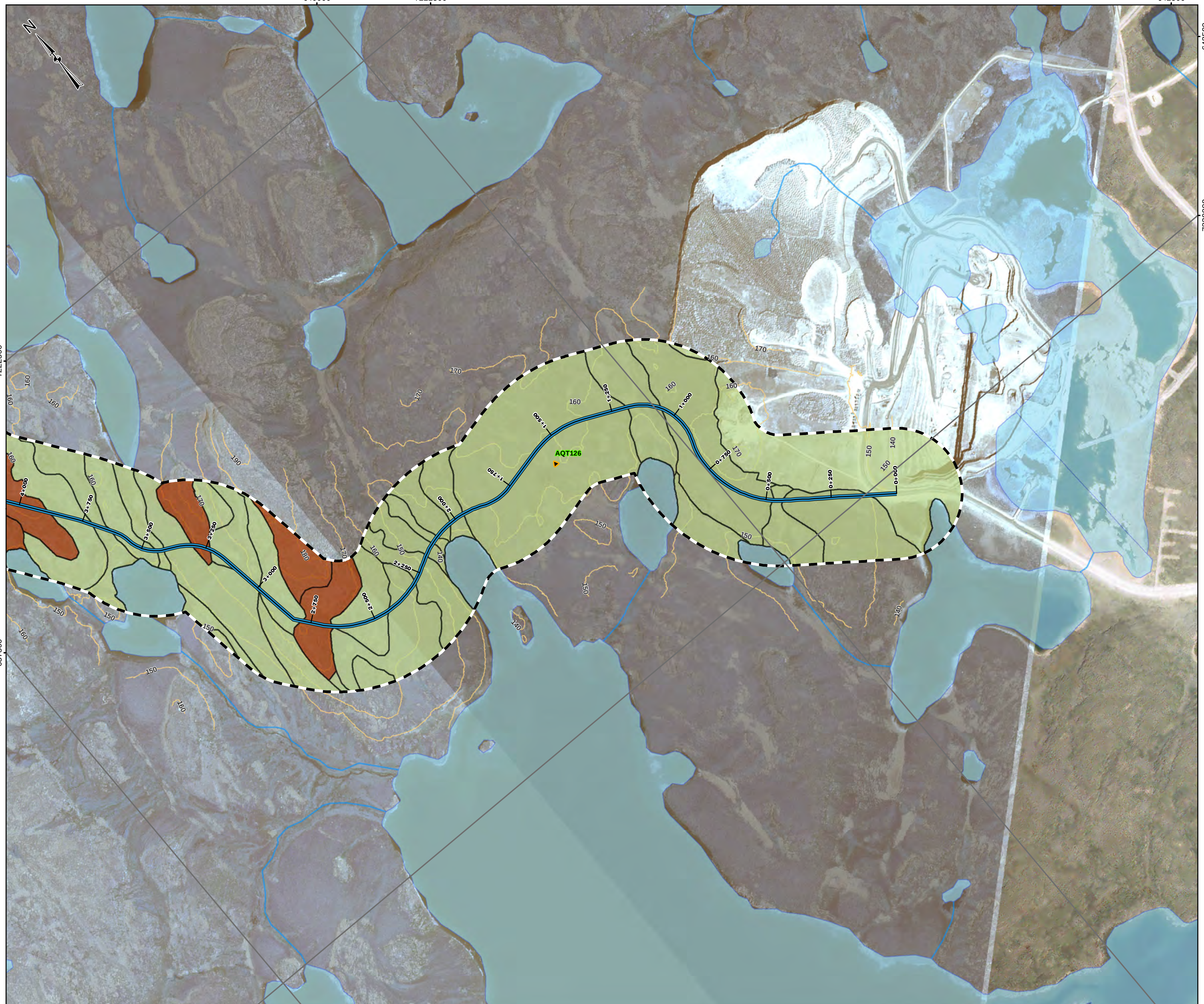
TERRAIN MAPPING

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	FIGURE C - 23	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

APPENDIX D

Soils Figures



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LEGEND

STUDY AREA

FIELD SITE LOCATION

SURVEYED SOIL SITE

SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

SOIL UNIT (APPROXIMATE)

ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)

REGOSOLIC TURBIC CRYOSOL (R.TC)

WATER (N)

PROPOSED HAUL ROAD

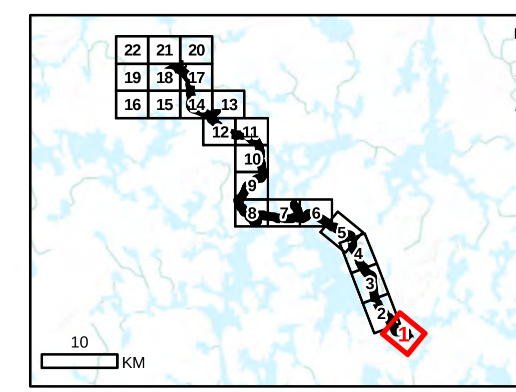
SECTION 1

BASEMAP FEATURES

CONTOUR (10m INTERVAL)

WATERCOURSE

WATERBODY



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300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
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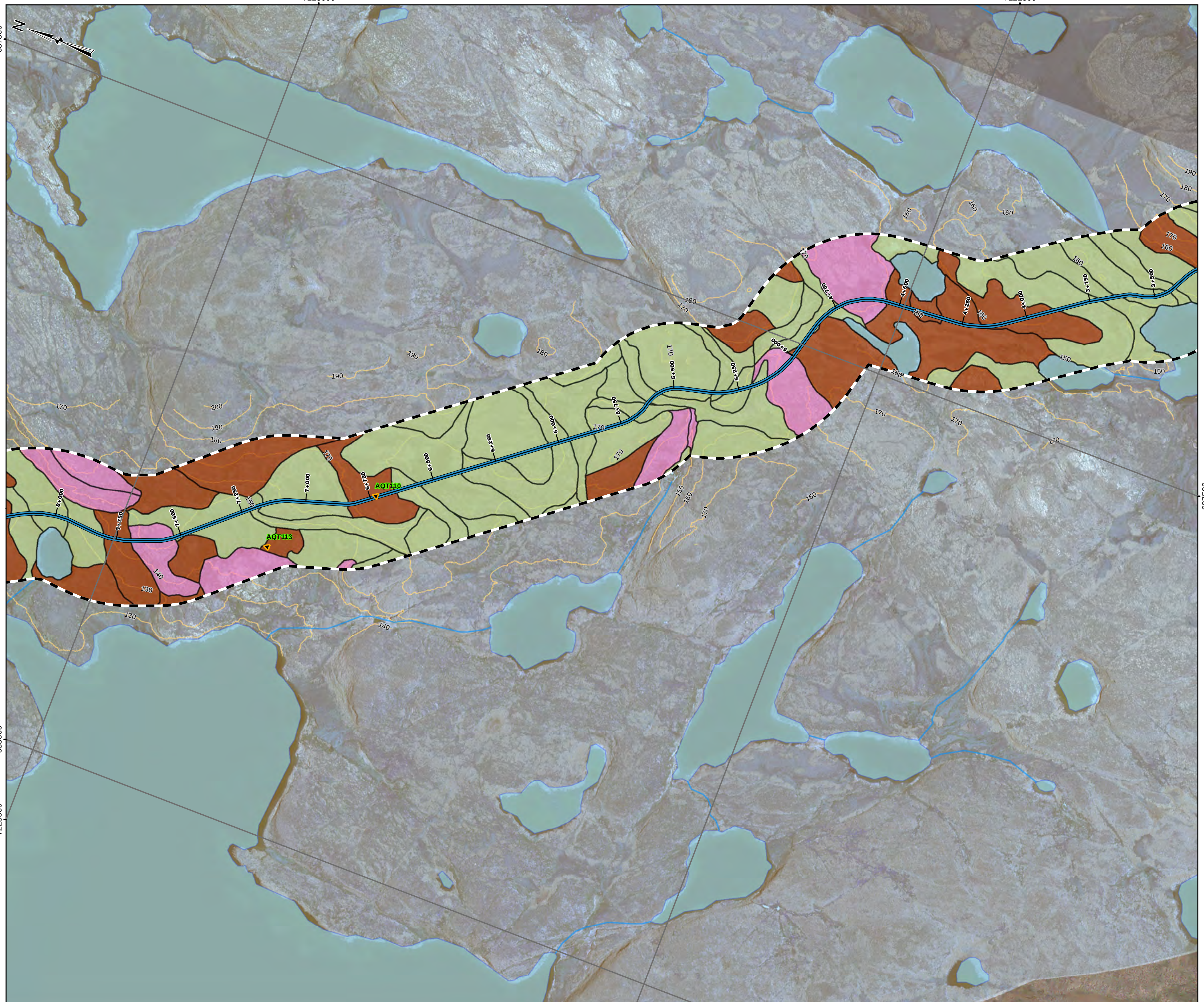
CHECK	AS	02 May. 2016	**FIGURE D - 1**	
REVIEW	DO	02 May. 2016		



LEGEND

STUDY AREA

FIELD SITE LOCATION

SURVEYED SOIL SITE

SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

SOIL UNIT (APPROXIMATE)

ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)

REGOSOLIC TURBIC CRYOSOL (R.TC)

WATER (N)

BEDROCK (R)

PROPOSED HAUL ROAD

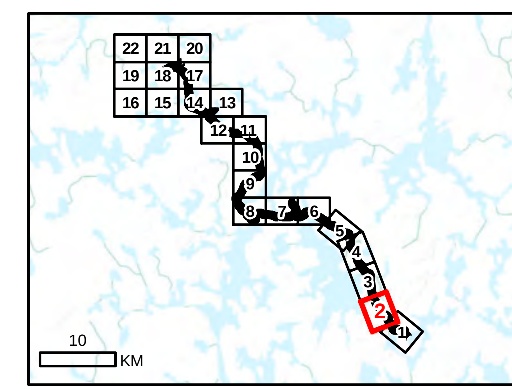
SECTION 1

BASEMAP FEATURES

CONTOUR (10m INTERVAL)

WATERCOURSE

WATERBODY



REFERENCE

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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT
OF DOMINANT SOIL SUBGROUPS
WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	FIGURE D - 2	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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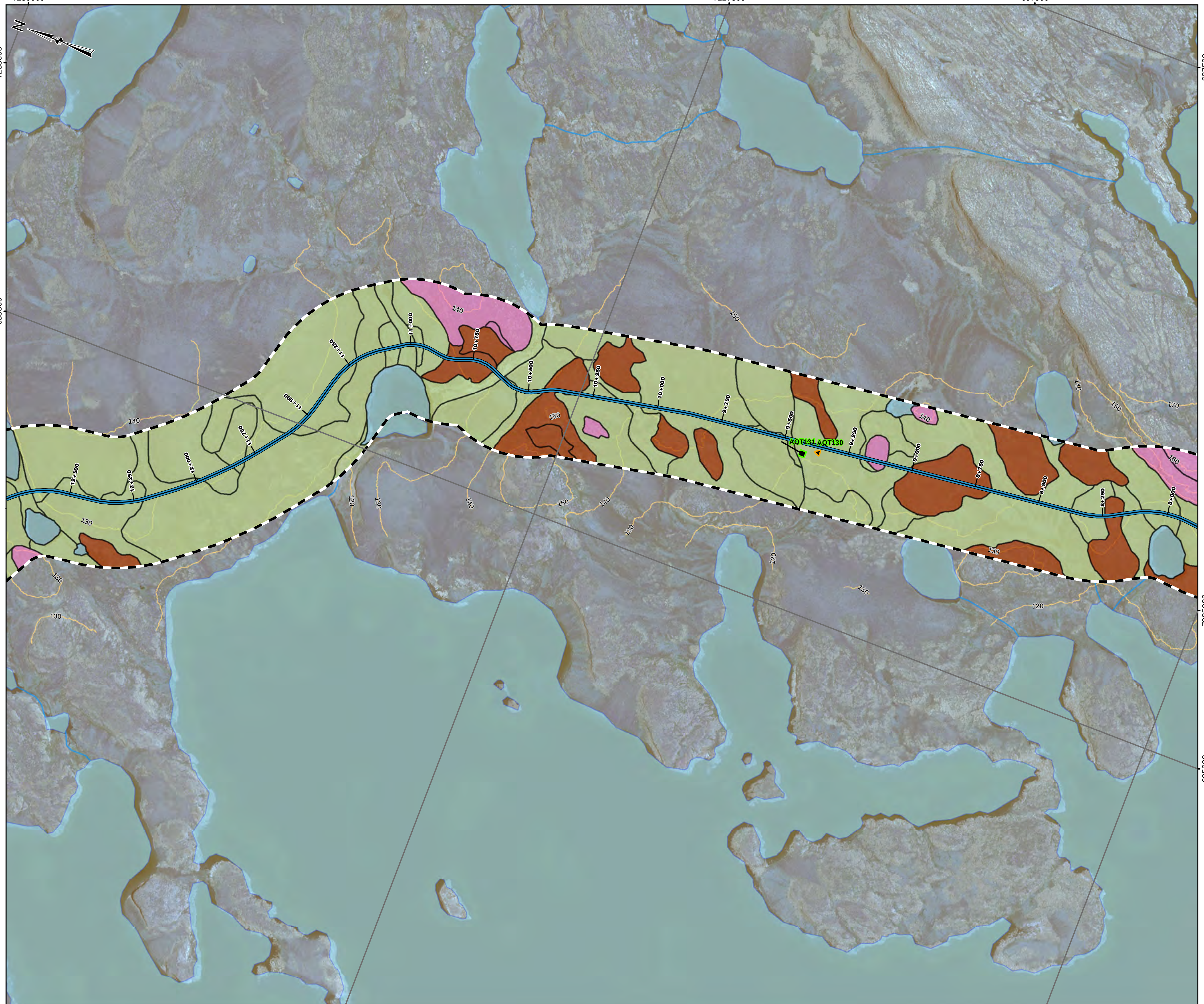


LEGEND

STUDY AREA

FIELD SITE LOCATION

- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

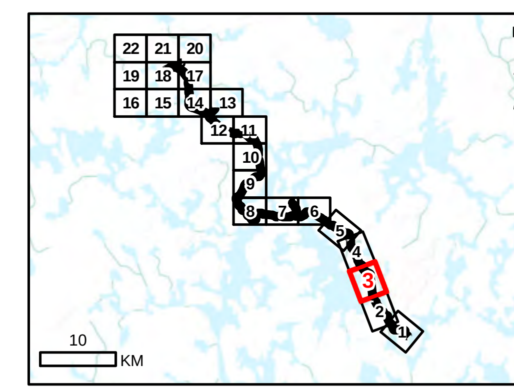
- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- REGOSOLIC TURBIC CRYOSOL (R.TC)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 1

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY



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300 0 300
SCALE 1:15,000 METRES

PROJECT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED: MEADOWBANK DIVISION WHALE TAIL PIT PROJECT

TITLE
DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
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CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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LEGEND

- STUDY AREA

FIELD SITE LOCATION

- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

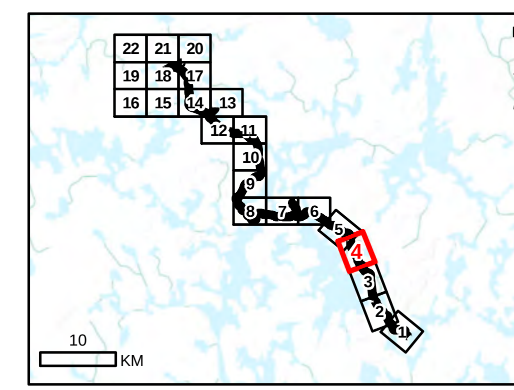
- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC BRUNISOL (O.DYB)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- REGOSOLIC TURBIC CRYOSOL (R.TC)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 1
- SECTION 2

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER



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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	FIGURE D - 4	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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LEGEND

- STUDY AREA

FIELD SITE LOCATION

- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

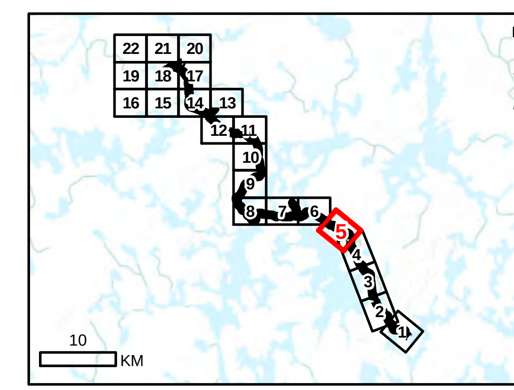
- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC BRUNISOL (O.DYB)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- REGOSOLIC TURBIC CRYOSOL (R.TC)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 1
- SECTION 2

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER



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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	**FIGURE D - 5**	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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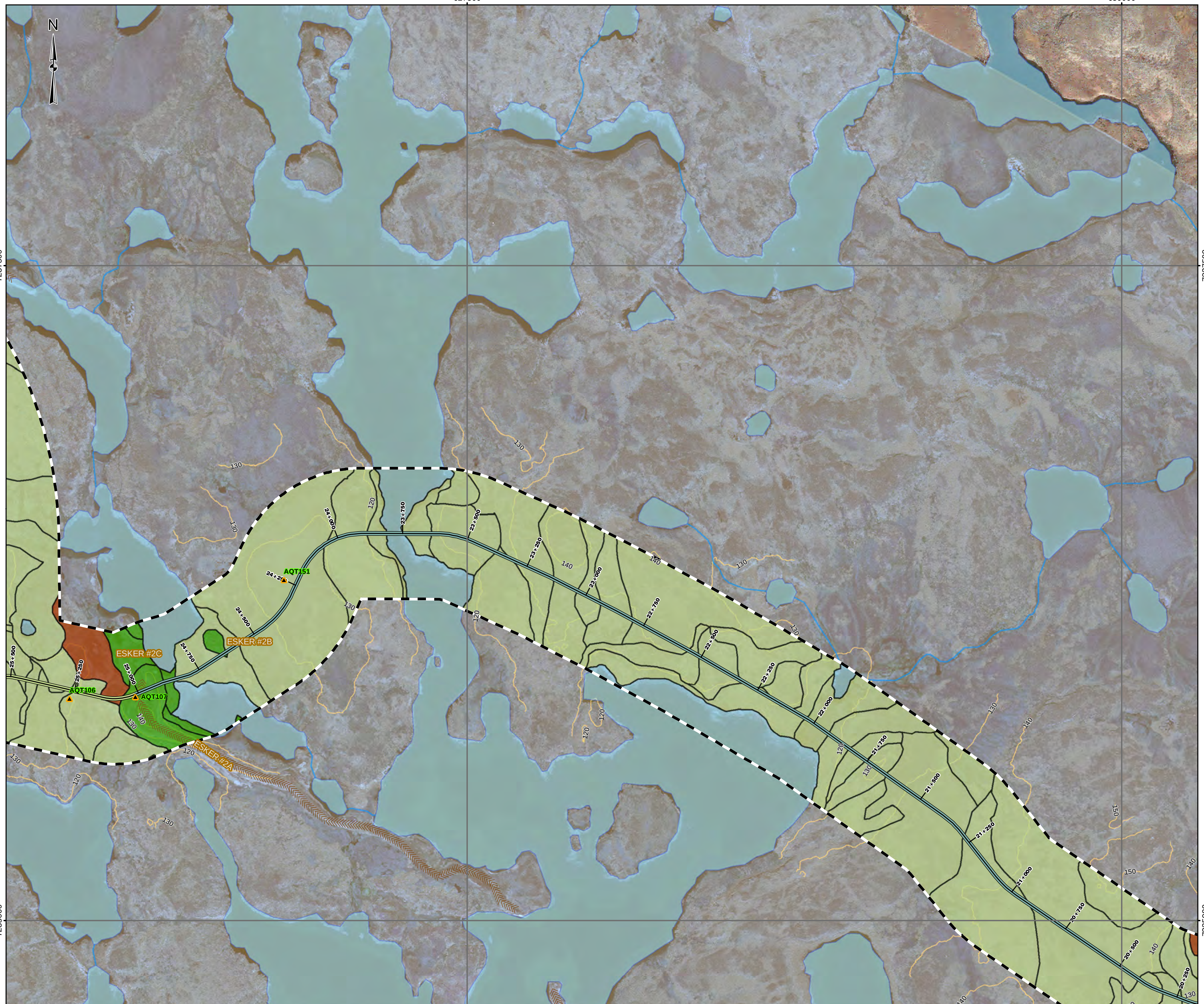


LEGEND

- STUDY AREA

FIELD SITE LOCATION

- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

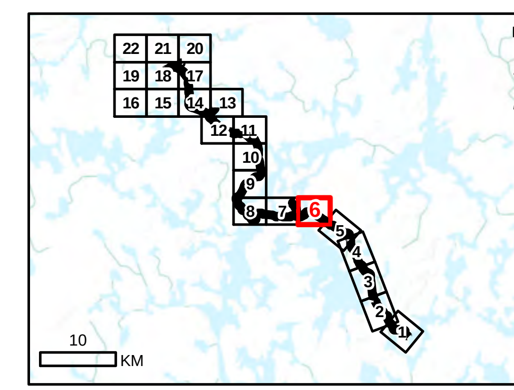
- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC BRUNISOL (O.DYB)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- REGOSOLIC TURBIC CRYOSOL (R.TC)
- WATER (N)

PROPOSED HAUL ROAD

- SECTION 2
- SECTION 3

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER



REFERENCE

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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300
SCALE 1:15,000 METRES

PROJECT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE
DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	**FIGURE D - 6**	
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REVIEW	DO	02 May. 2016		

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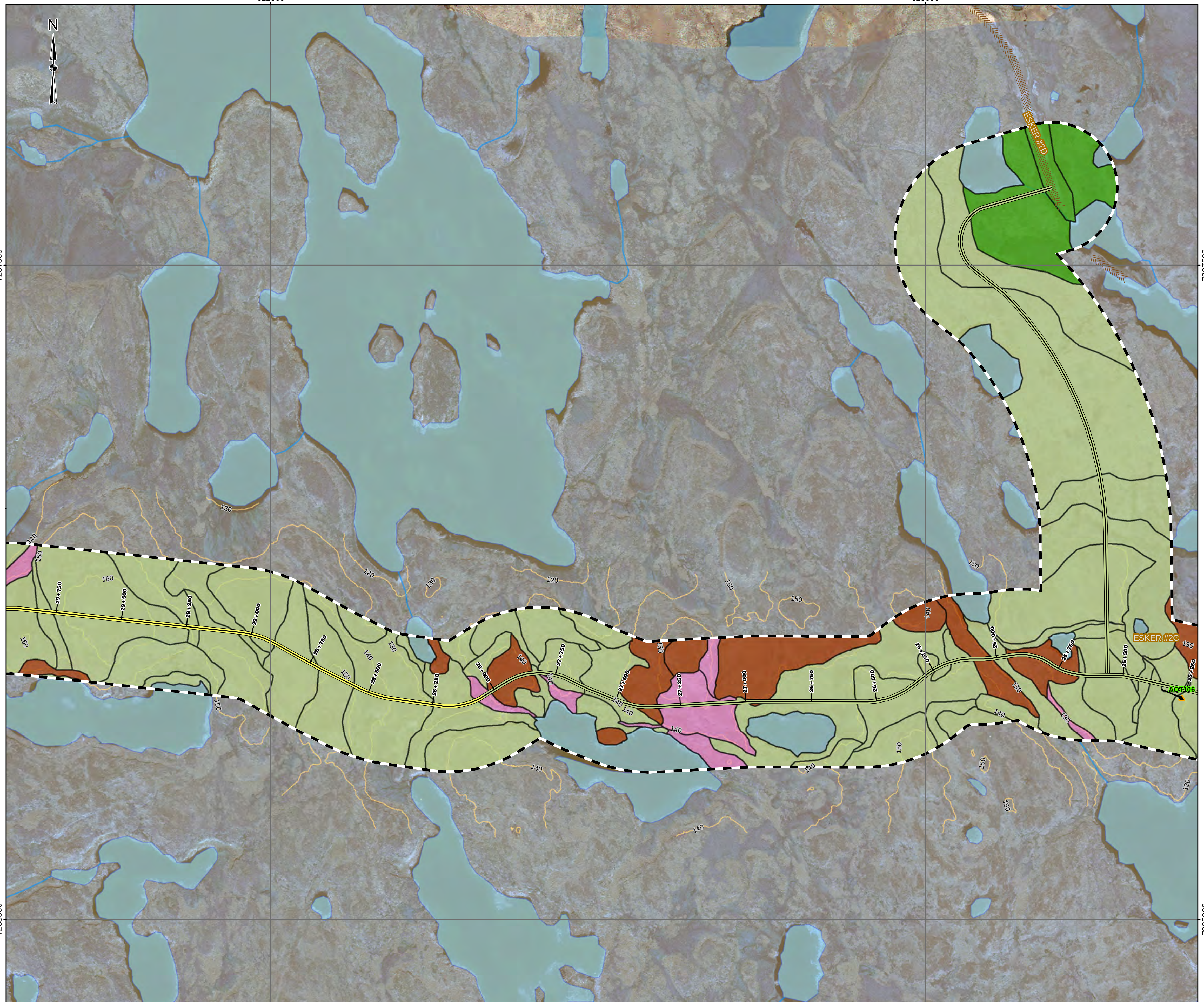


LEGEND

- STUDY AREA

FIELD SITE LOCATION

- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

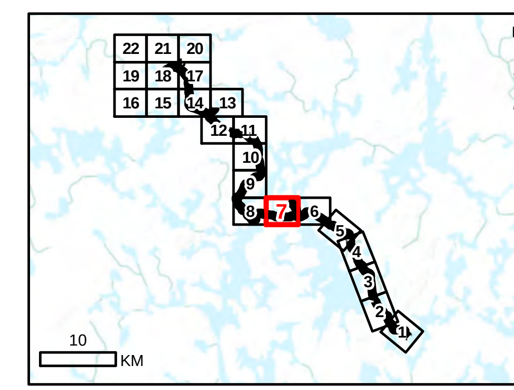
- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC BRUNISOL (O.DYB)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- REGOSOLIC TURBIC CRYOSOL (R.TC)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 3
- SECTION 4

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER



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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016		
CHECK	AS	02 May. 2016	FIGURE D - 7	
REVIEW	DO	02 May. 2016		

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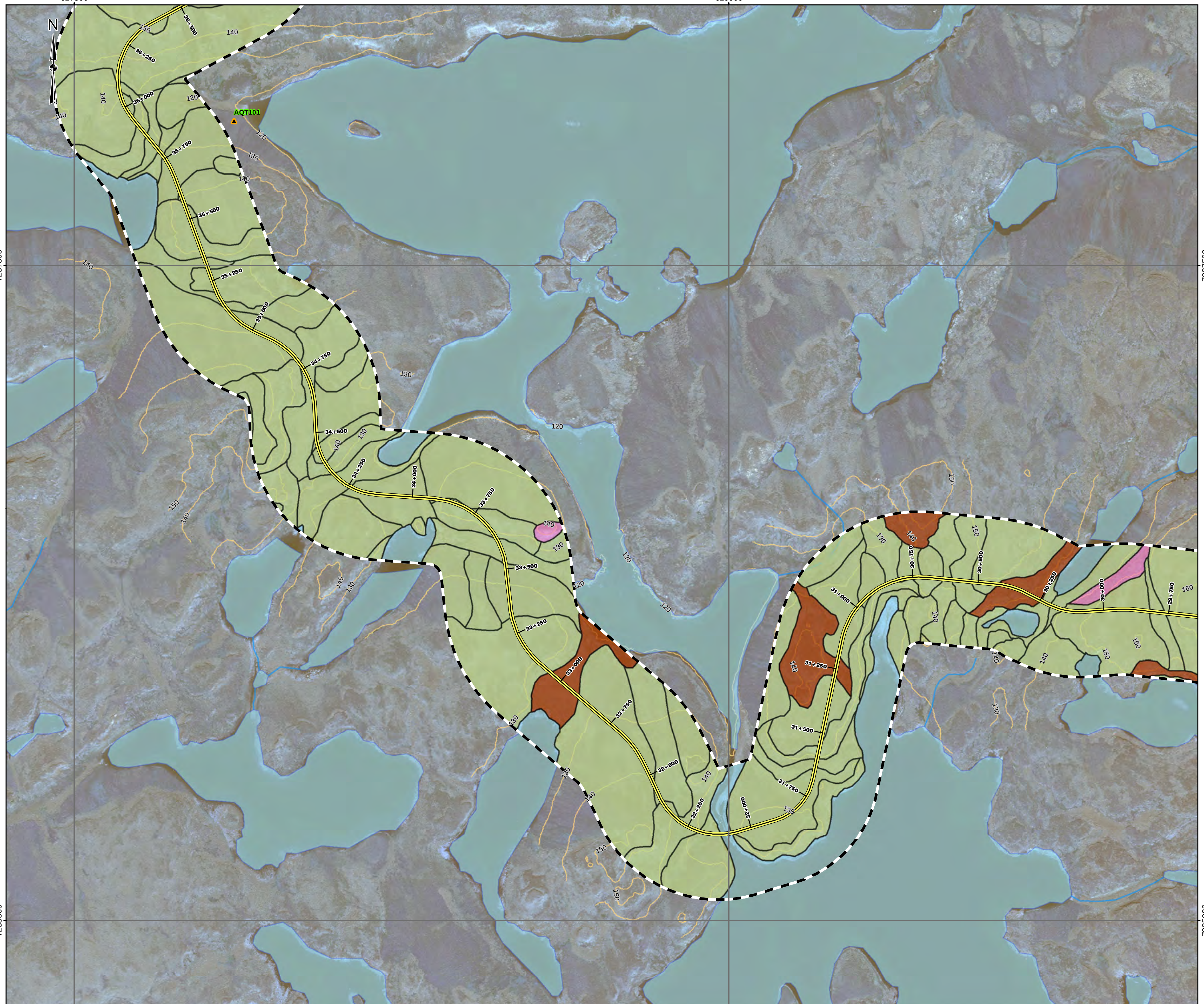


LEGEND

STUDY AREA

FIELD SITE LOCATION

- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

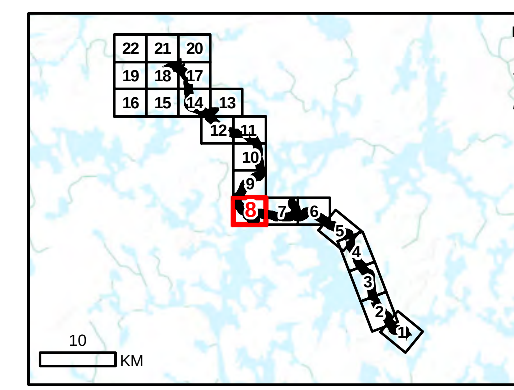
- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- REGOSOLIC TURBIC CRYOSOL (R.TC)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 4

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY



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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

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SCALE 1:15,000 METRES

PROJECT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE
DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

PROJECT		1524321	FILE No.
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN REV. 0
GIS	MM	02 May. 2016	FIGURE D - 8
CHECK	AS	02 May. 2016	
REVIEW	DO	02 May. 2016	

Golder Associates

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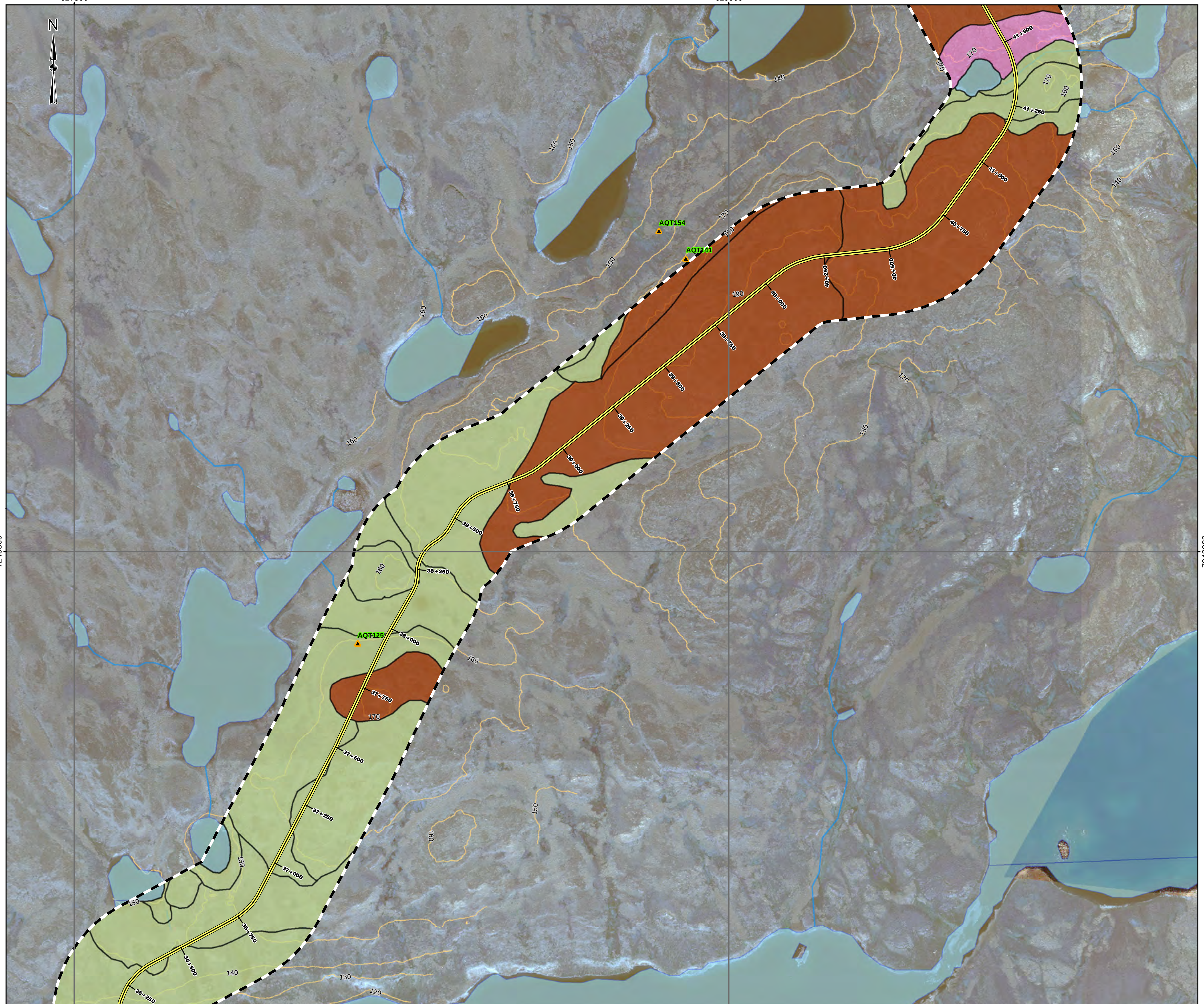


LEGEND

STUDY AREA

FIELD SITE LOCATION

- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

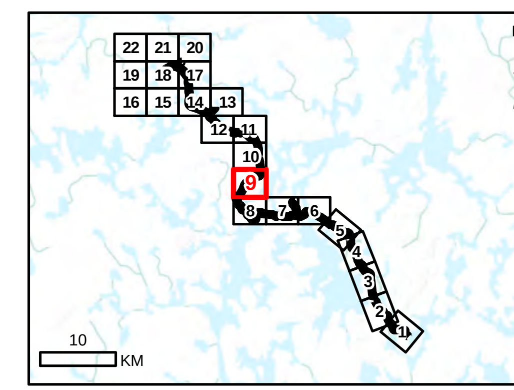
- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- REGOSOLIC TURBIC CRYOSOL (R.TC)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 4

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY



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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300
SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN REV. 0
GIS	MM	02 May. 2016	**FIGURE D - 9**
CHECK	AS	02 May. 2016	
REVIEW	DO	02 May. 2016	

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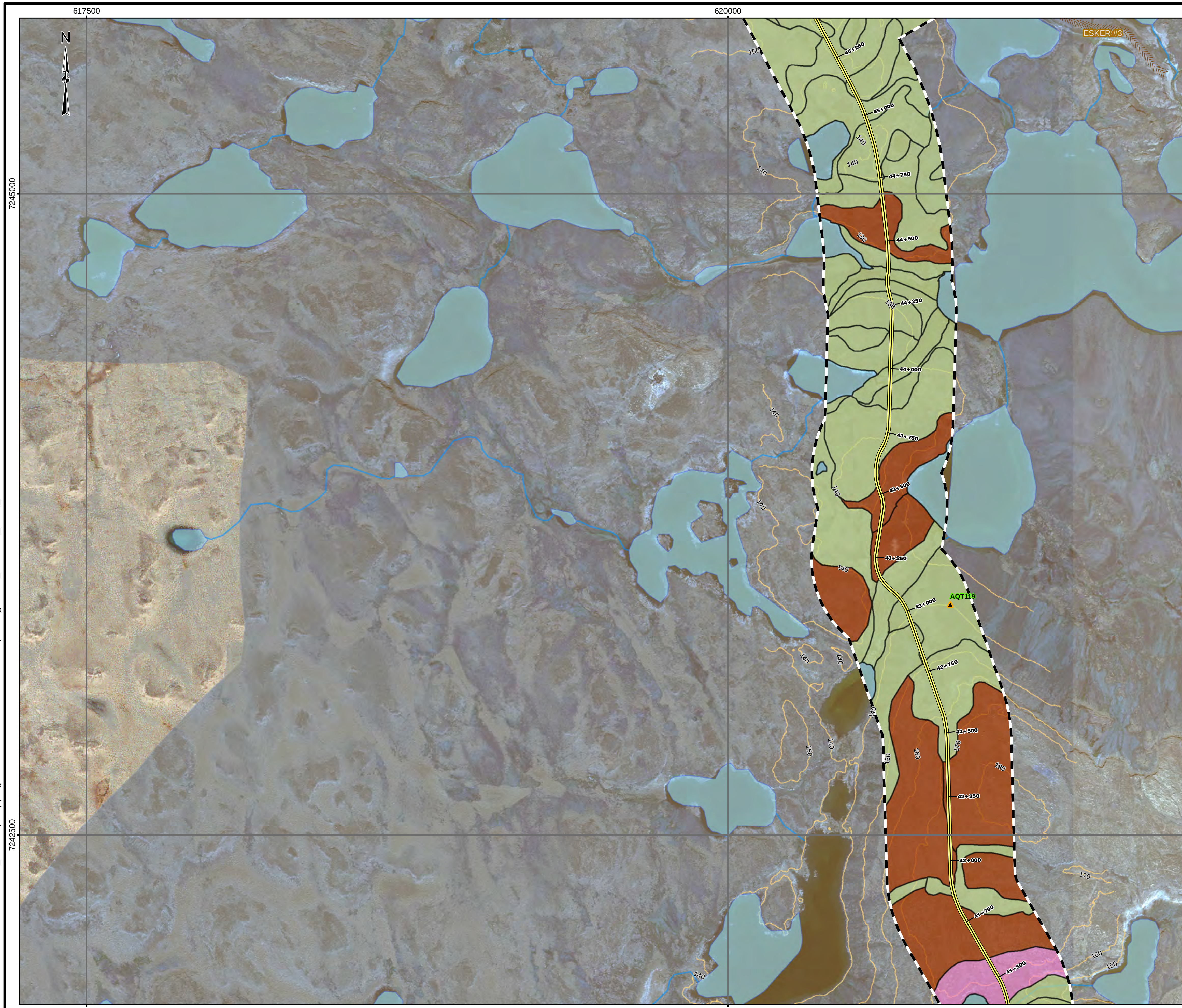


LEGEND

STUDY AREA

FIELD SITE LOCATION

SURVEYED SOIL SITE

SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

SOIL UNIT (APPROXIMATE)

ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)

REGOSOLIC TURBIC CRYOSOL (R.TC)

WATER (N)

BEDROCK (R)

PROPOSED HAUL ROAD

SECTION 4

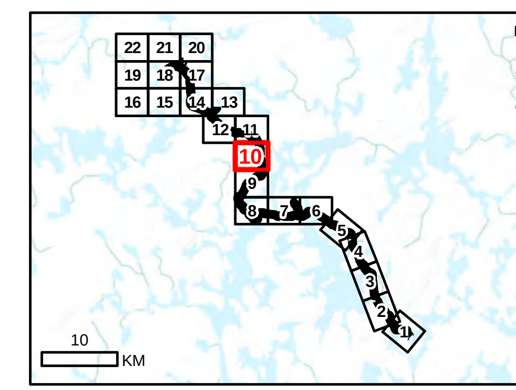
BASEMAP FEATURES

CONTOUR (10m INTERVAL)

WATERCOURSE

WATERBODY

ESKER



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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	**FIGURE D - 10**	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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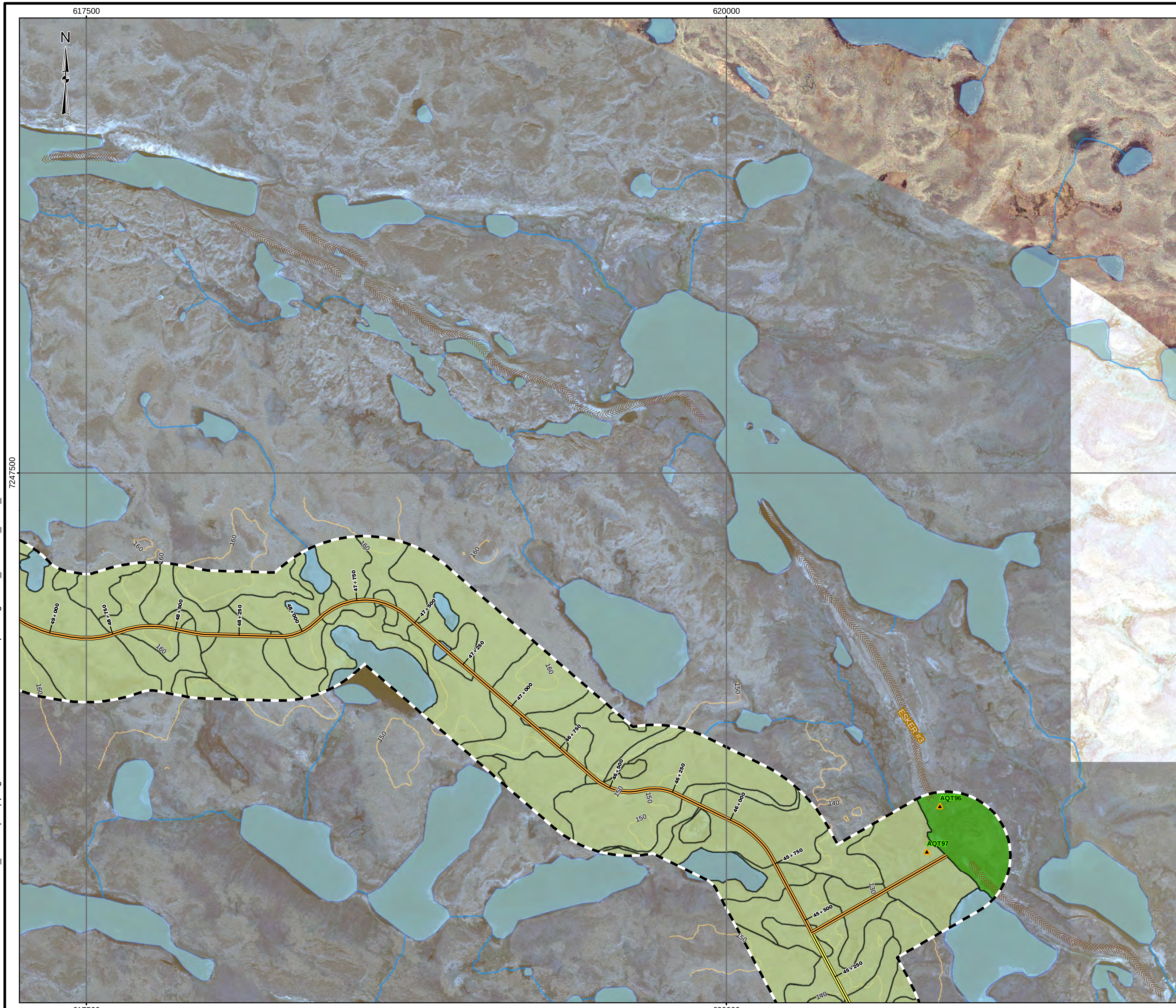


LEGEND

STUDY AREA

FIELD SITE LOCATION

- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

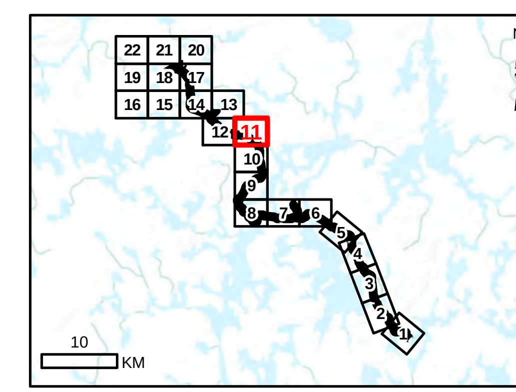
- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC BRUNISOL (O.DYB)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- WATER (N)

PROPOSED HAUL ROAD

- SECTION 4
- SECTION 5

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER



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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016		
CHECK	AS	02 May. 2016	**FIGURE D - 11**	
REVIEW	DO	02 May. 2016		

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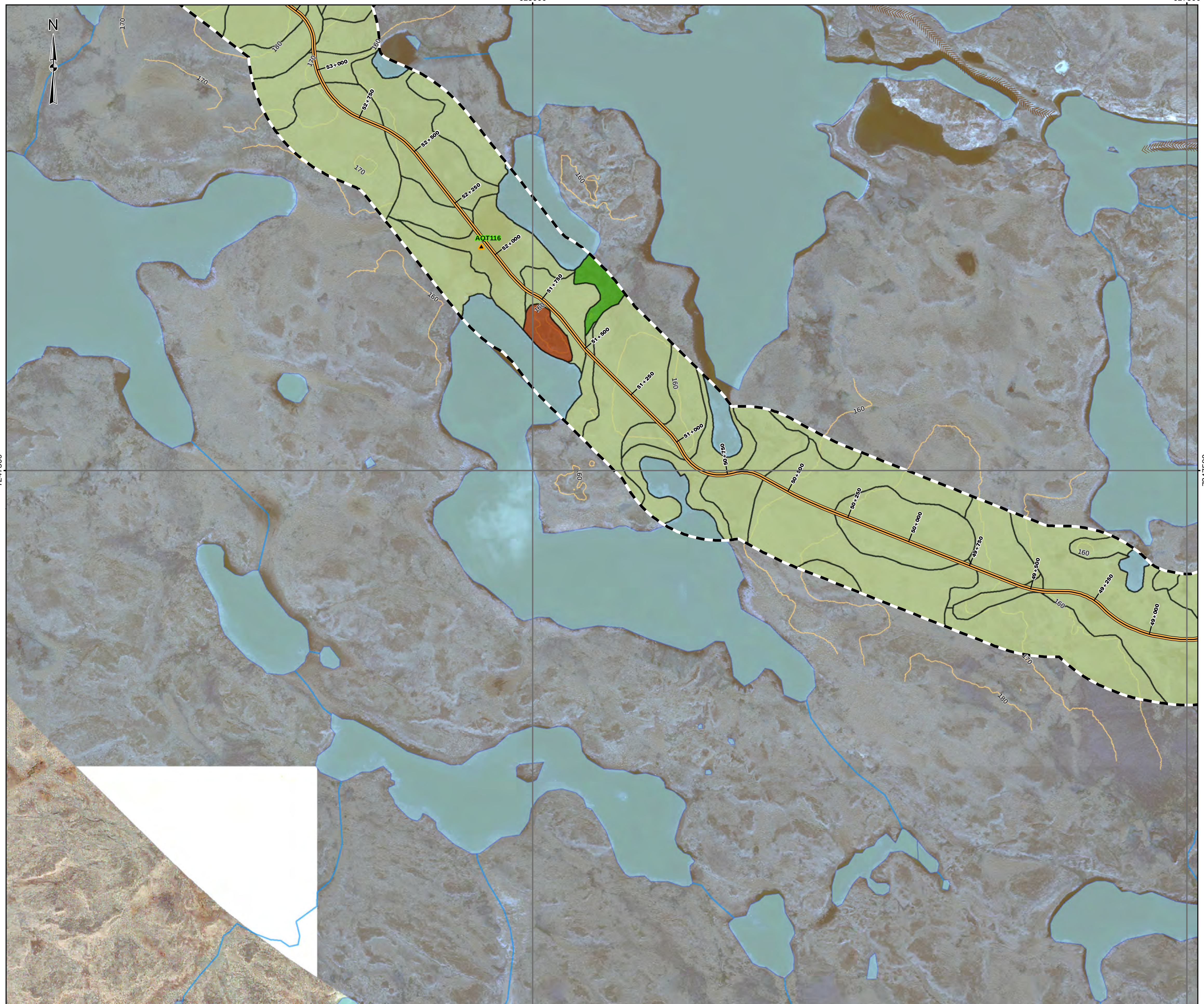


LEGEND

STUDY AREA

FIELD SITE LOCATION

- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

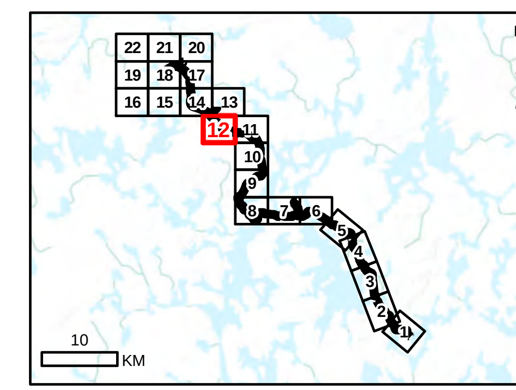
- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC BRUNISOL (O.DYB)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- REGOSOLIC TURBIC CRYOSOL (R.TC)
- WATER (N)

PROPOSED HAUL ROAD

- SECTION 5

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER



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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

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SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	FIGURE D - 12	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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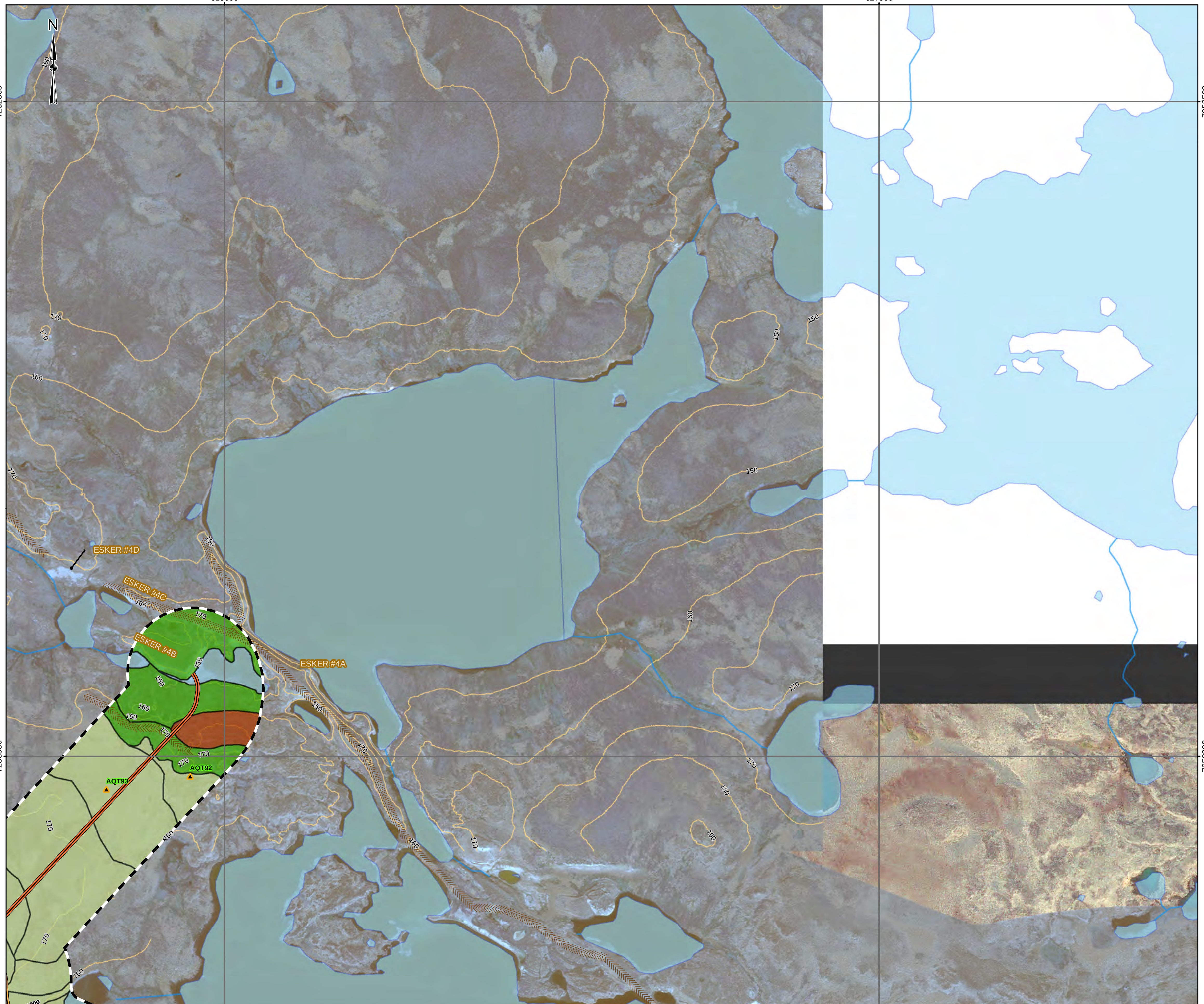


LEGEND

STUDY AREA

FIELD SITE LOCATION

- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

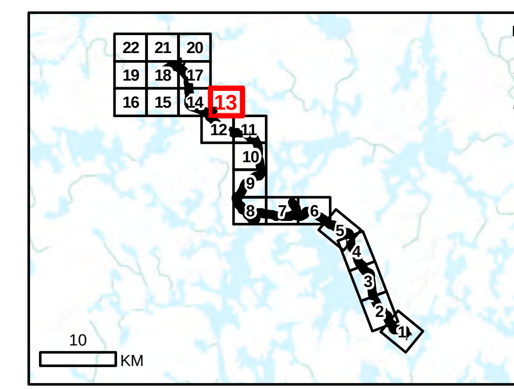
- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC BRUNISOL (O.DYB)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- REGOSOLIC TURBIC CRYOSOL (R.TC)
- WATER (N)

PROPOSED HAUL ROAD

- SECTION 5
- SECTION 6

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER



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300 0 300
SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN REV. 0
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CHECK	AS	02 May. 2016	FIGURE D - 13
REVIEW	DO	02 May. 2016	

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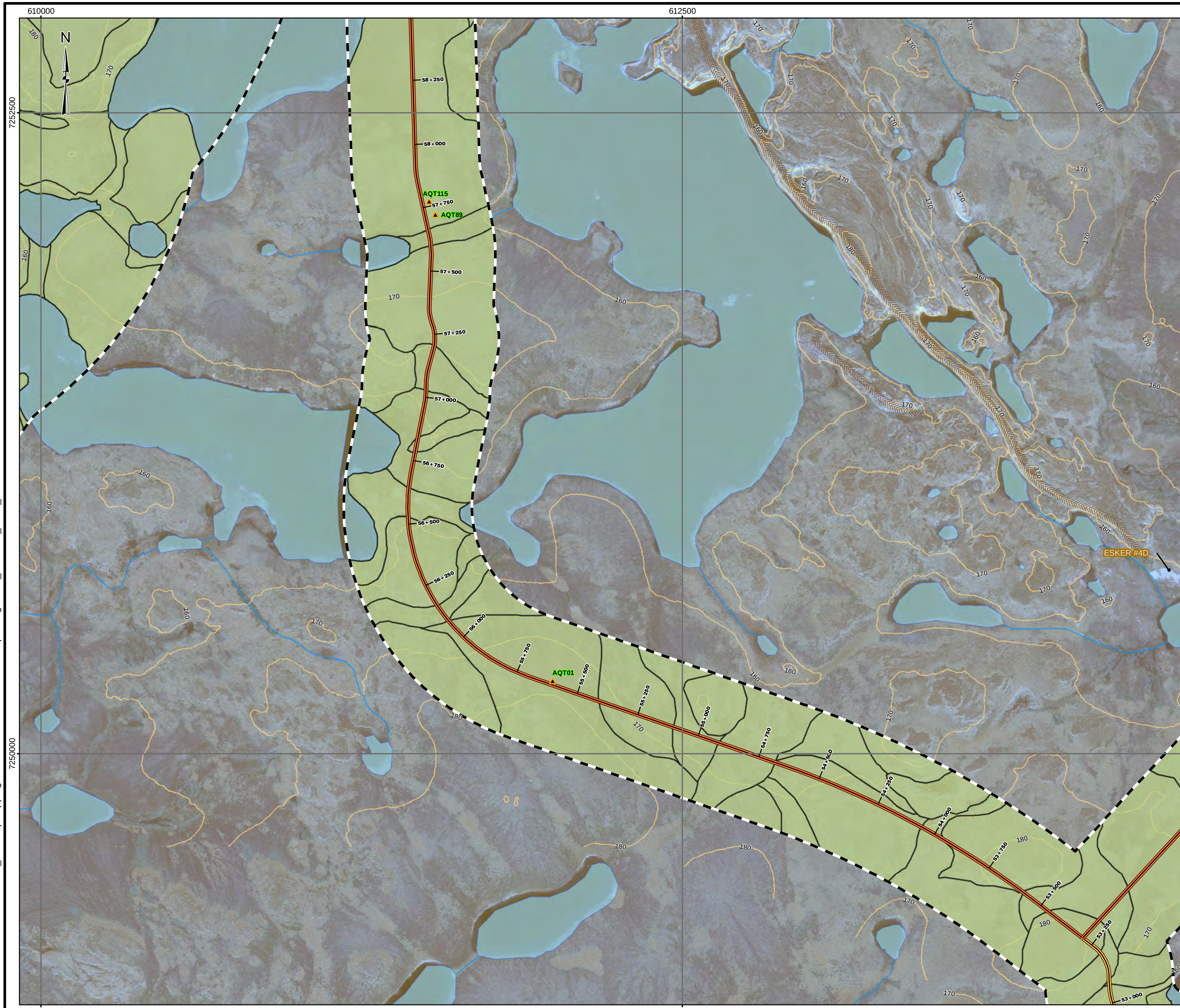


LEGEND

STUDY AREA

FIELD SITE LOCATION

- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

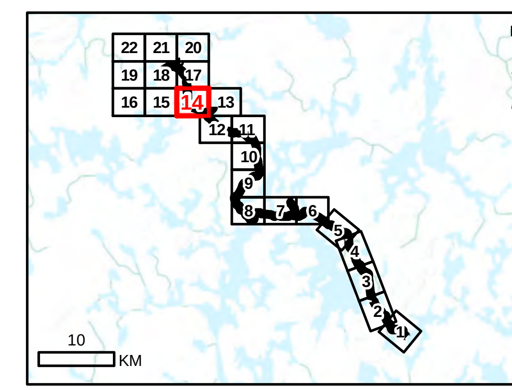
- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- WATER (N)

PROPOSED HAUL ROAD

- SECTION 5
- SECTION 6

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER



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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

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SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
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CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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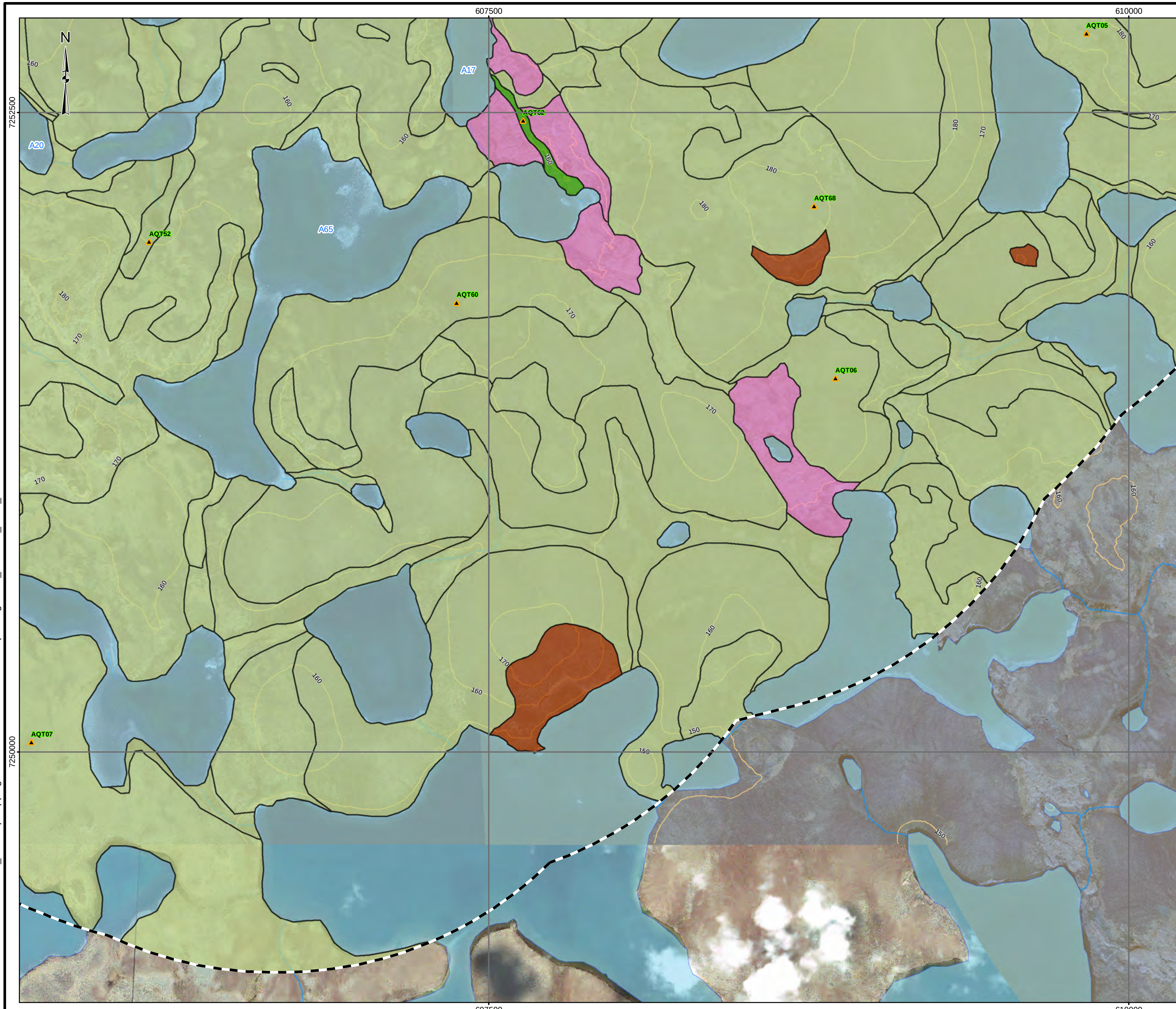


LEGEND

STUDY AREA

FIELD SITE LOCATION

SURVEYED SOIL SITE

SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

SOIL UNIT (APPROXIMATE)

ORTHIC DYSTRIC BRUNISOL (O.DYB)

ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)

REGOSOLIC TURBIC CRYOSOL (R.TC)

WATER (N)

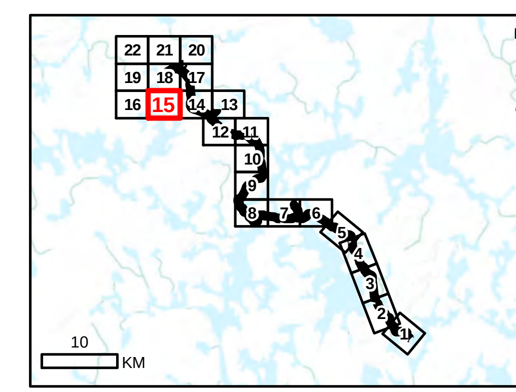
BEDROCK (R)

BASEMAP FEATURES

CONTOUR (10m INTERVAL)

WATERCOURSE

WATERBODY



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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.
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CHECK	AS	02 May. 2016	**FIGURE D - 15**
REVIEW	DO	02 May. 2016	

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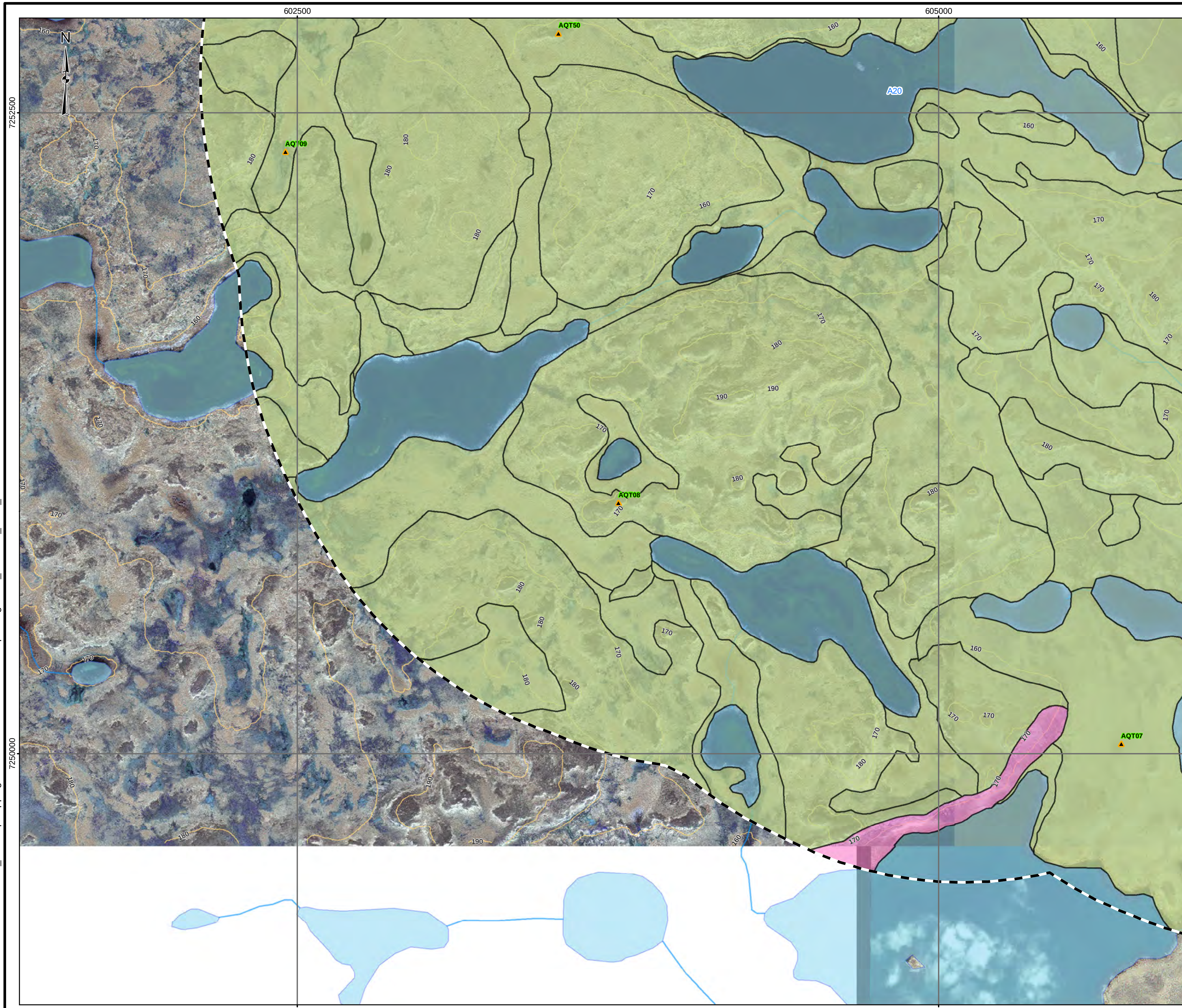


LEGEND

STUDY AREA

FIELD SITE LOCATION

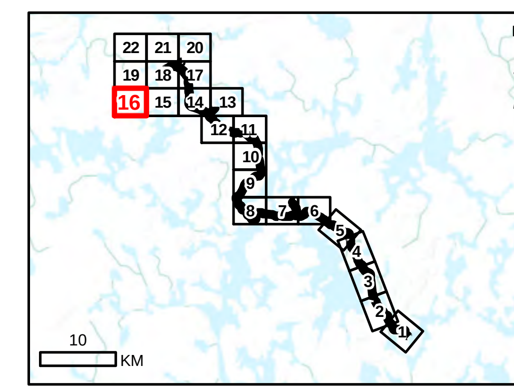
- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- WATER (N)
- BEDROCK (R)

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY



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300 0 300
SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016		
CHECK	AS	02 May. 2016	**FIGURE D - 16**	
REVIEW	DO	02 May. 2016		

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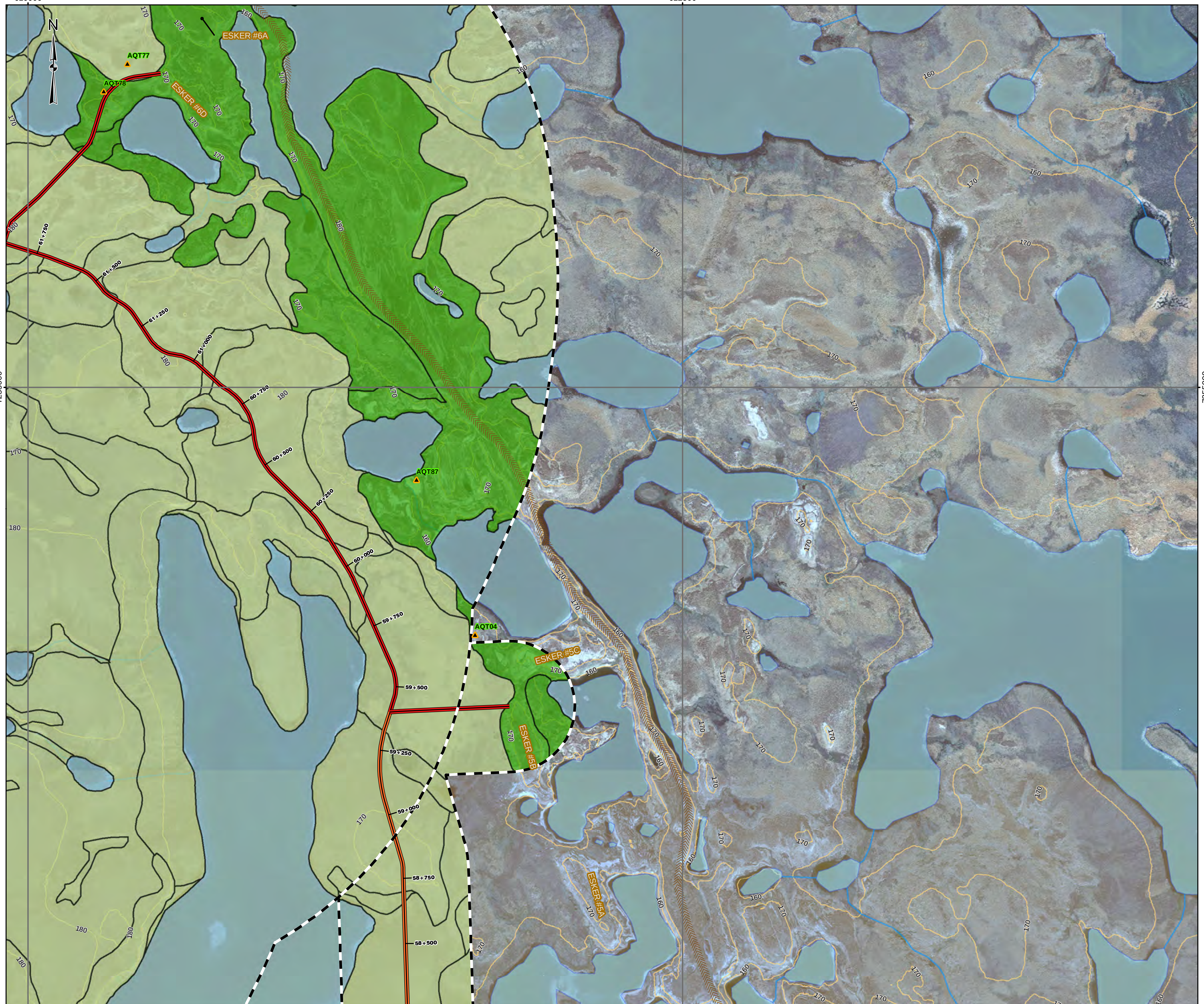

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LEGEND

STUDY AREA

FIELD SITE LOCATION

- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

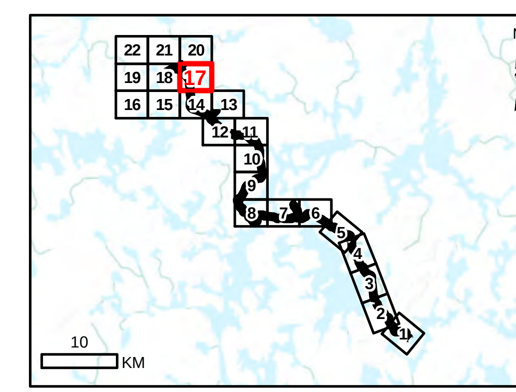
- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC BRUNISOL (O.DYB)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- WATER (N)

PROPOSED HAUL ROAD

- SECTION 6
- SECTION 7

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER



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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
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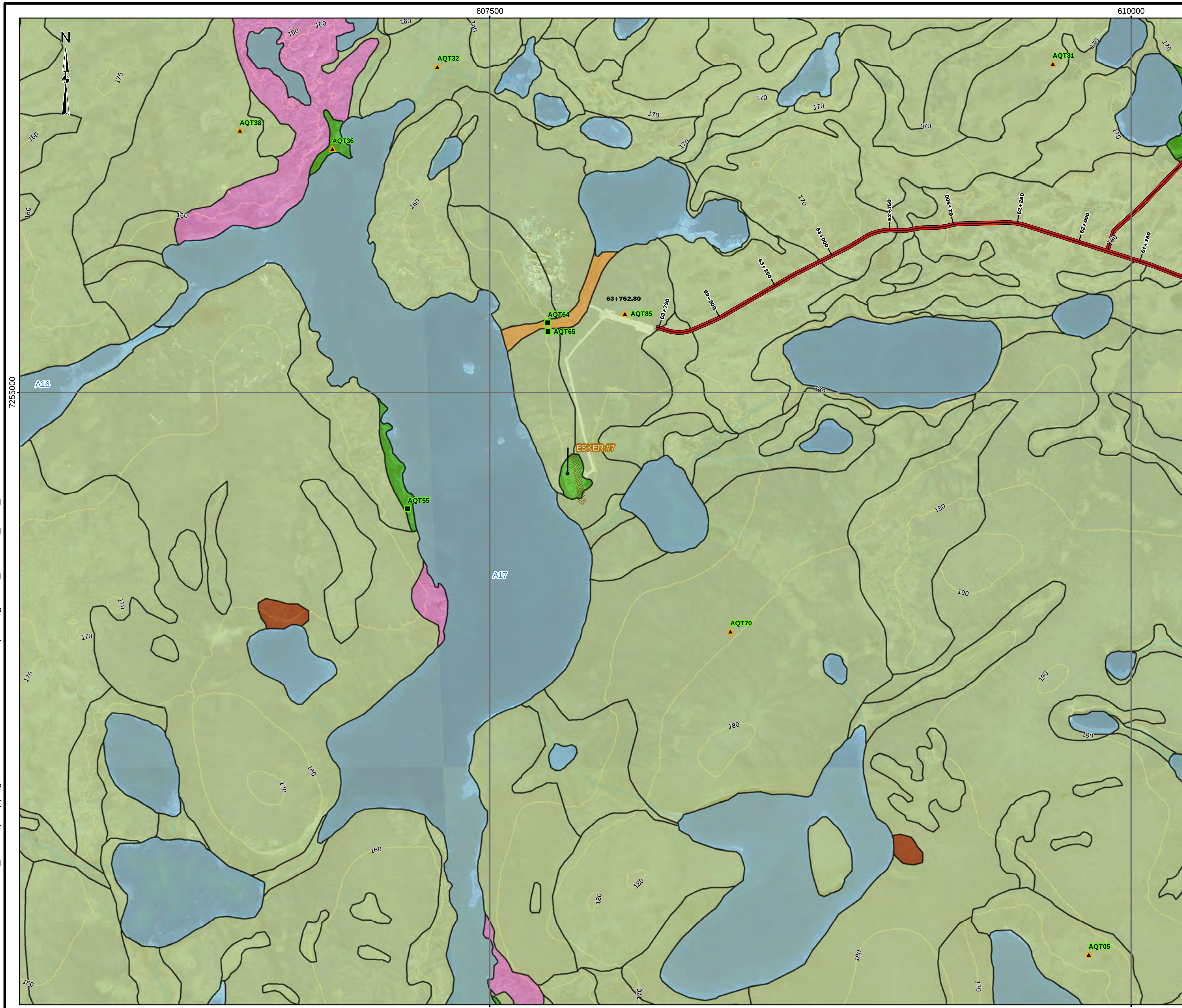
REVIEW	DO	02 May. 2016		



LEGEND

STUDY AREA

FIELD SITE LOCATION

- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

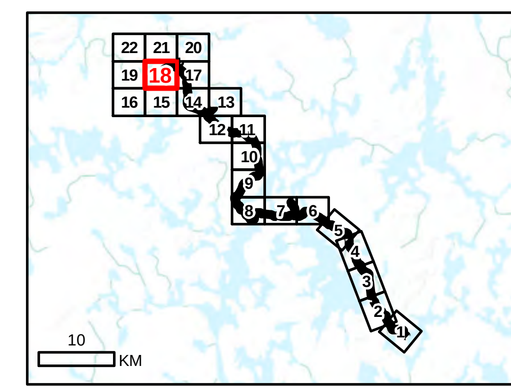
- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC BRUNISOL (O.DYB)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- REGO GLEYSOL (R.G)
- REGOSOLIC TURBIC CRYOSOL (R.TC)
- WATER (N)
- BEDROCK (R)

PROPOSED HAUL ROAD

- SECTION 7

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- ESKER



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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT	1524321		FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016		
CHECK	AS	02 May. 2016	**FIGURE D - 18**	
REVIEW	DO	02 May. 2016		

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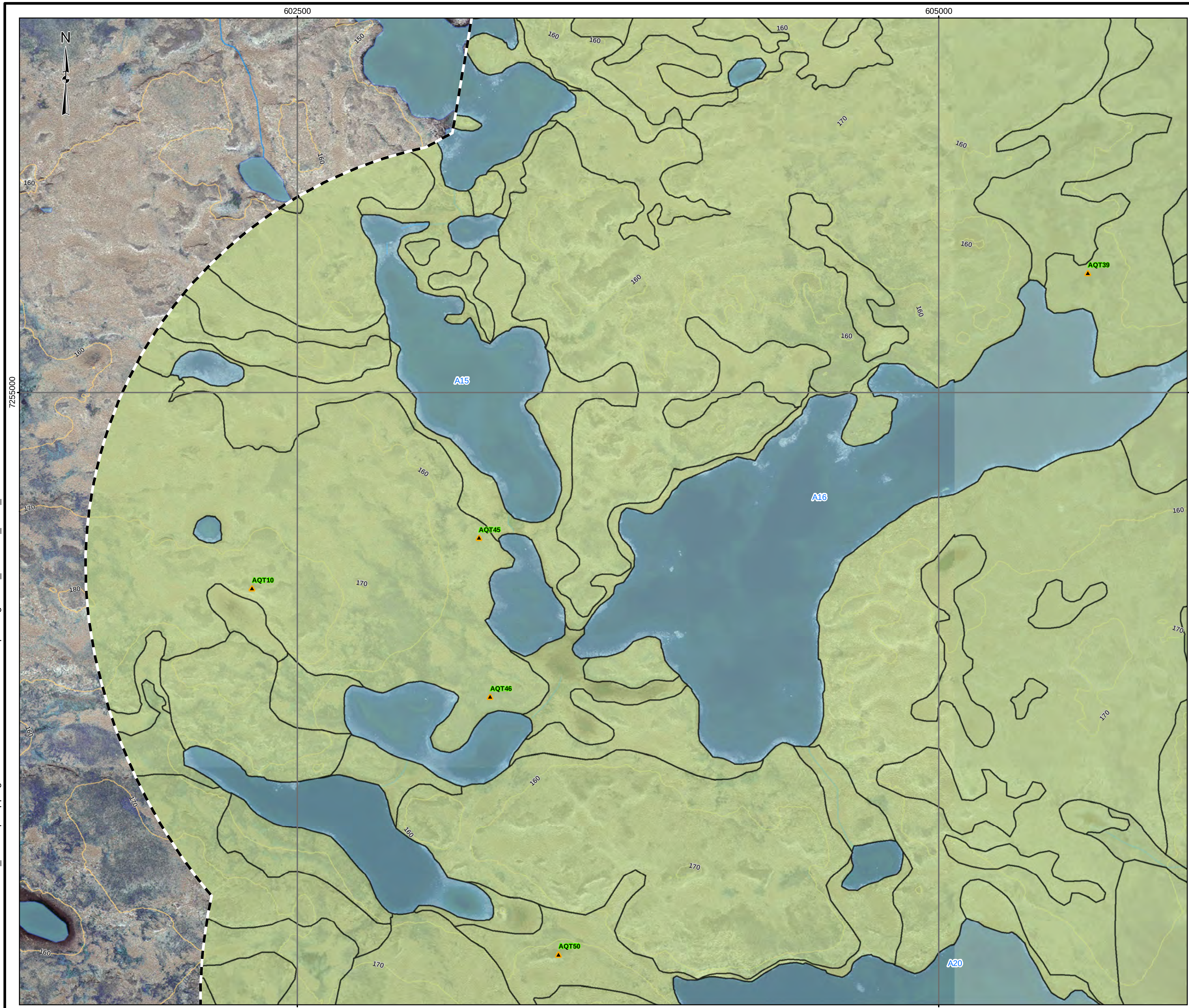


LEGEND

STUDY AREA

FIELD SITE LOCATION

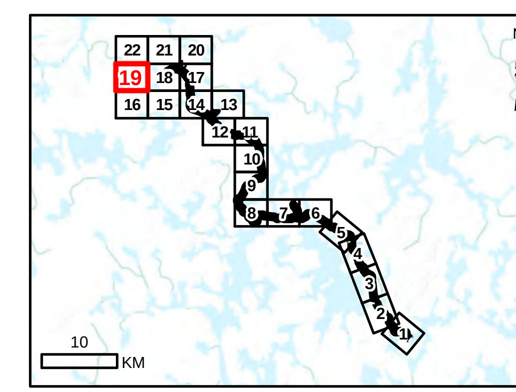
- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- WATER (N)

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY



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300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	**FIGURE D - 19**	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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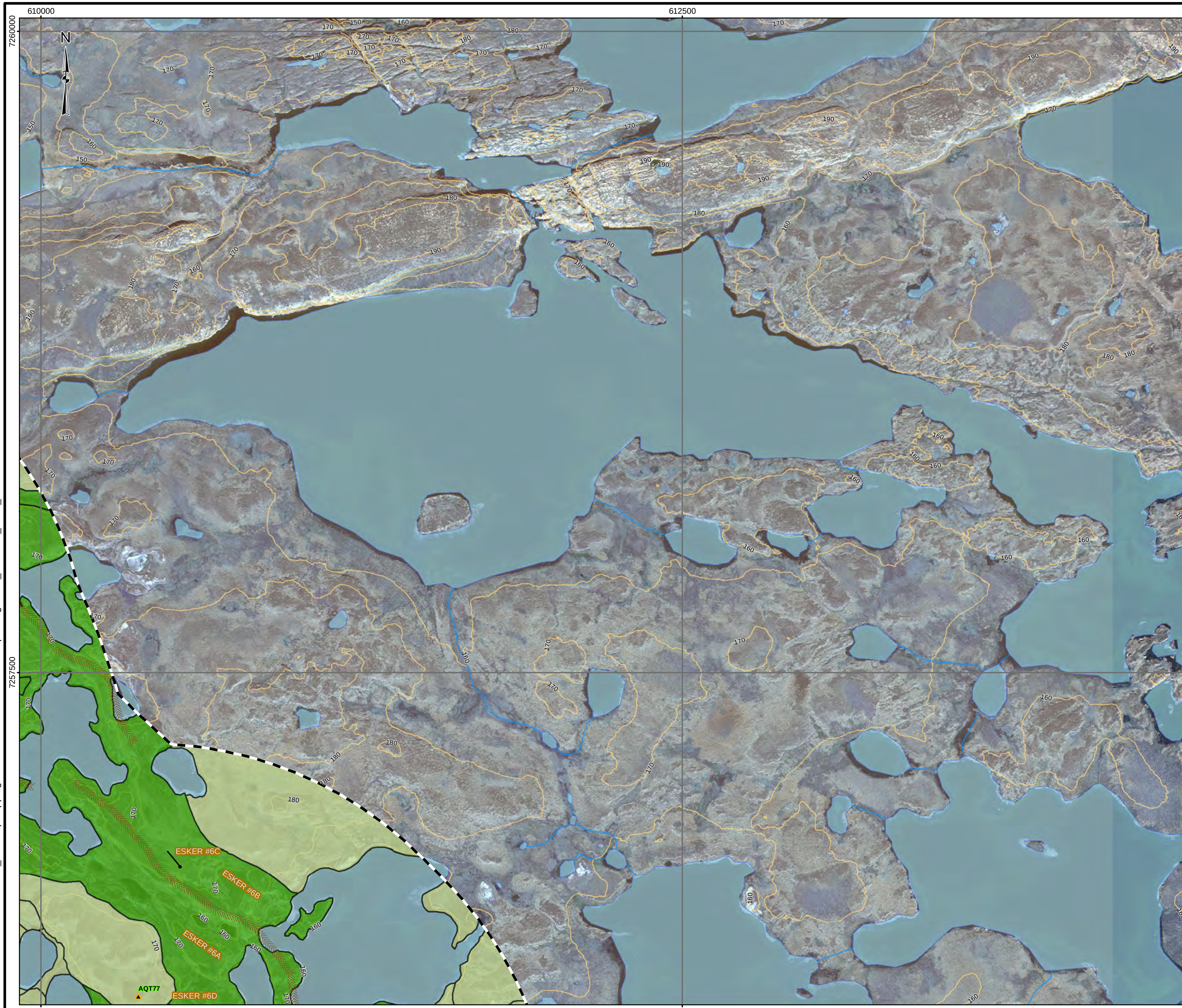


LEGEND

STUDY AREA

FIELD SITE LOCATION

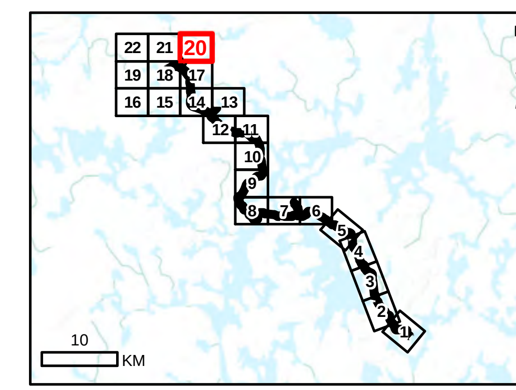
- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC BRUNISOL (O.DYB)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- WATER (N)

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER



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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED: MEADOWBANK DIVISION WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016		
CHECK	AS	02 May. 2016	**FIGURE D - 20**	
REVIEW	DO	02 May. 2016		

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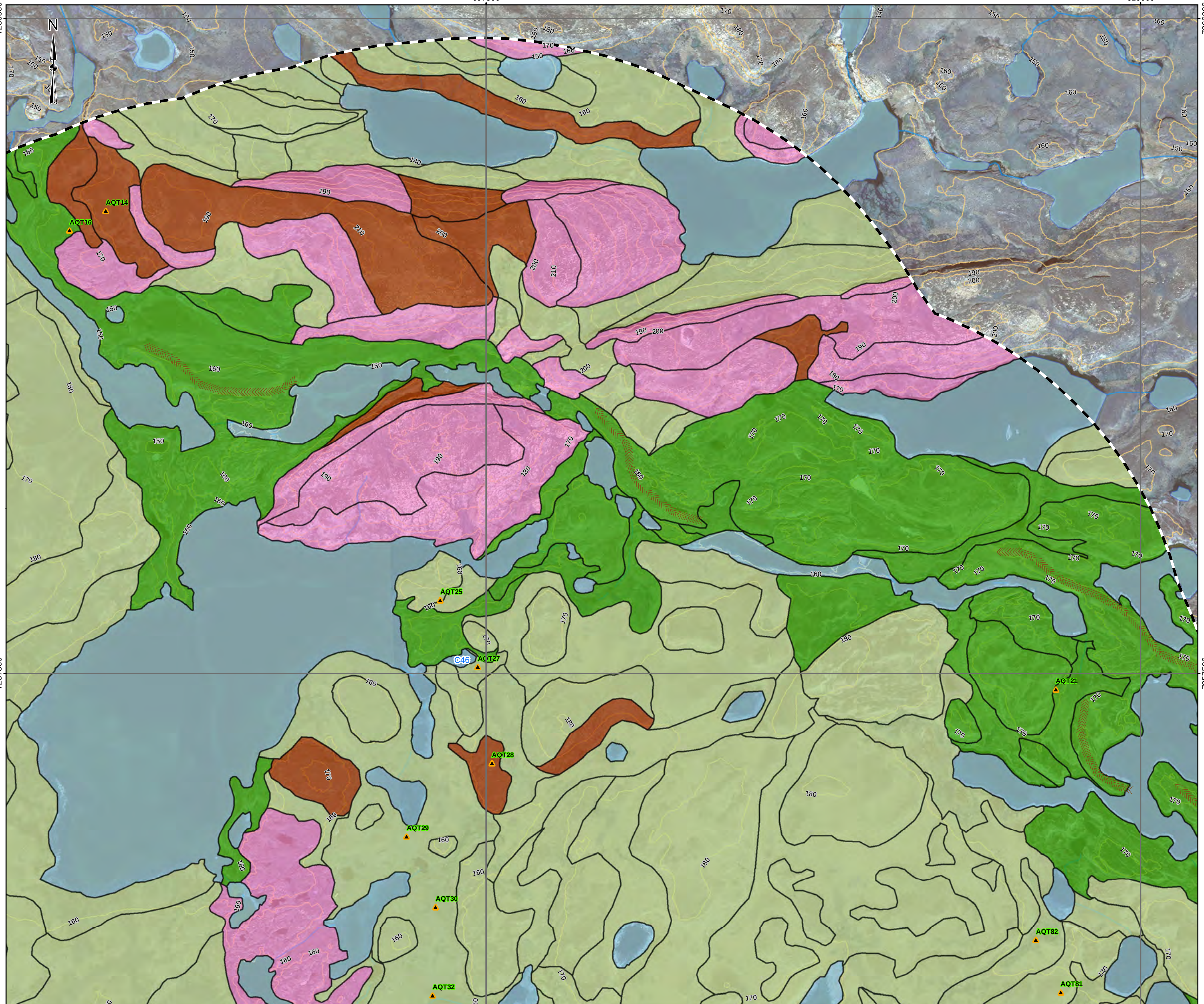


LEGEND

STUDY AREA

FIELD SITE LOCATION

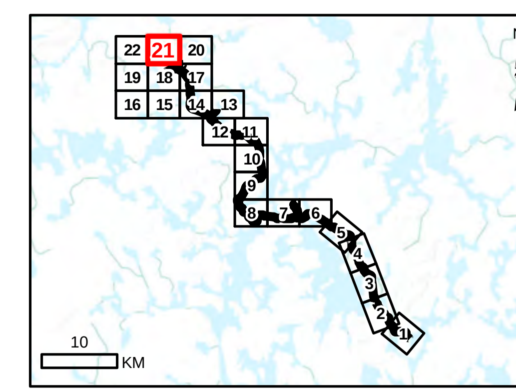
- SURVEYED SOIL SITE
- SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

- SOIL UNIT (APPROXIMATE)
- ORTHIC DYSTRIC BRUNISOL (O.DYB)
- ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)
- REGOSOLIC TURBIC CRYOSOL (R.TC)
- WATER (N)
- BEDROCK (R)

BASEMAP FEATURES

- CONTOUR (10m INTERVAL)
- WATERCOURSE
- WATERBODY
- ESKER



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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT		1524321	FILE No.	
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN	REV. 0
GIS	MM	02 May. 2016	**FIGURE D - 21**	
CHECK	AS	02 May. 2016		
REVIEW	DO	02 May. 2016		

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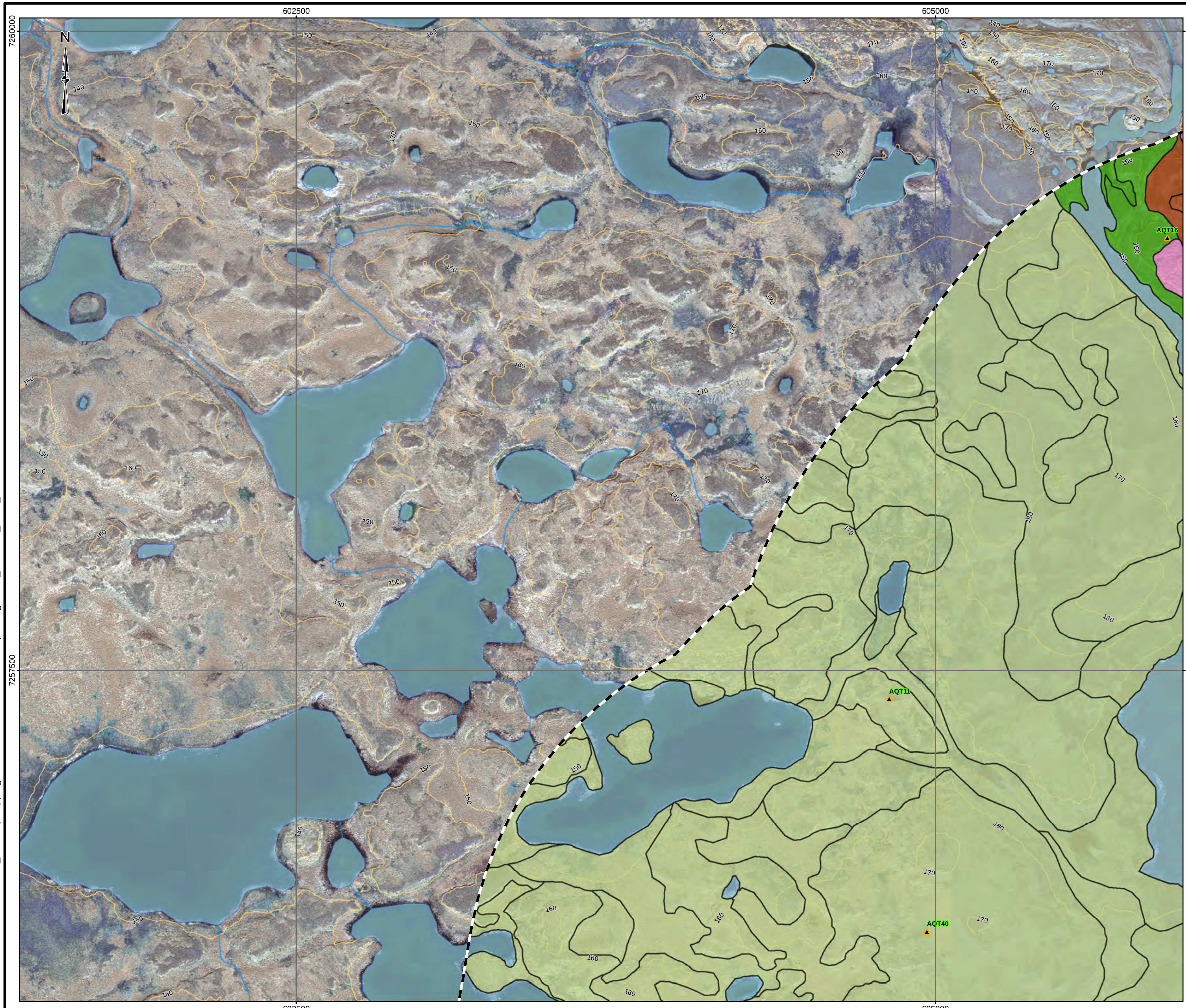


LEGEND

STUDY AREA

FIELD SITE LOCATION

SURVEYED SOIL SITE

SAMPLE SOIL SITE

DOMINANT SOIL SUBGROUP

SOIL UNIT (APPROXIMATE)

ORTHIC DYSTRIC BRUNISOL (O.DYB)

ORTHIC DYSTRIC TURBIC CRYOSOL (OD.TC)

REGOSOLIC TURBIC CRYOSOL (R.TC)

WATER (N)

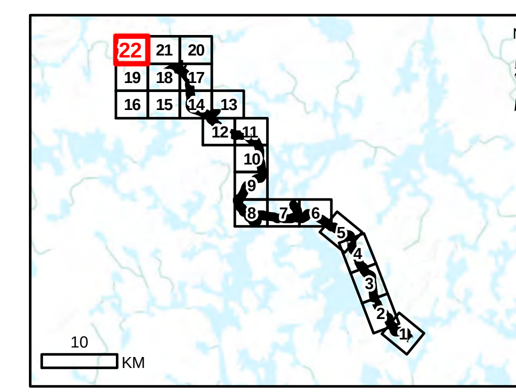
BEDROCK (R)

BASEMAP FEATURES

CONTOUR (10m INTERVAL)

WATERCOURSE

WATERBODY



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DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

SCALE 1:15,000 METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

TITLE

DISTRIBUTION AND EXTENT OF DOMINANT SOIL SUBGROUPS WITHIN THE STUDY AREA

Golder Associates

PROJECT	1524321		FILE No.
DESIGN	AS	27 Oct. 2015	SCALE AS SHOWN REV. 0
GIS	MM	02 May. 2016	
CHECK	AS	02 May. 2016	FIGURE D - 22
REVIEW	DO	02 May. 2016	

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APPENDIX E

Soil Chemistry Data

Table E-1: Summary of Soil Data Collected, 2015

Site Name	GPS Location		Surface Expression	Slope Position	Percent Slope	Slope Length (m)	Peat/LFH Depth (cm)	Soil Texture[a]	Drainage	Parent Material	Subgroup Code[b]	Surface Stoniness (% of ground surface covered)	Sampled
	Easting	Northing											
AQT01	611994	7250284	Undulating	Mid	>5-10	>70	0	Sandy Loam	Imperfect	Till	O.G	Exceedingly (15 to 50)	No
AQT04	611707	7254055	Undulating	Mid	>10-15	<70	0	Sandy Loam	Well	Glaciofluvial	OD.TC	Excessively (>50)	No
AQT05	609835	7252808	Undulating	Mid	>0.5-2	N/A	0	Sandy Loam	Imperfect	Till	OD.TC	Excessively (>50)	No
AQT06	608855	7251461	Undulating	Mid	>5-10	>70	0	Sandy loam	Imperfect	Till	GL.TC	Exceedingly (15 to 50)	No
AQT07	605713	7250038	Undulating	Mid	>0.5-2	>70	0	Sandy loam	Moderately Well	Till	OD.TC	Excessively (>50)	No
AQT08	603753	7256978	Ridged	Upper	>2-5	<70	0	Sandy loam	Moderately Well	Till	R.SC	Excessively (>50)	No
AQT09	602454	7252347	Level	Depression	0-0.5	N/A	15	Silty Clay	Poor	Till	GL.TC	Moderately (0.1 to 3)	No
AQT10	602324	7254237	Undulating	Upper	>5-10	>70	0	Sandy loam	Moderately Well	Till	R.TC	Excessively (>50)	No
AQT11	604821	7257387	Undulating	Mid	>2-5	<70	0	Sandy loam	Moderately Well	Till	R.TC	Excessively (>50)	No
AQT14	606047	7259266	Undulating	Lower	>2-5	<70	0	Sandy loam	Moderately Well	Till	R.TC	Excessively (>50)	No
AQT16	605909	7259191	Undulating	Level	>0.5-2	N/A	0	Sandy Loam	Well	Glaciofluvial	O.DYB	Excessively (>50)	No
AQT21	609676	7257439	Undulating	Mid	>2-5	N/A	0	Sand	Well	Glaciofluvial	OD.TC	Excessively (>50)	No
AQT25	607325	7257779	Undulating	Lower	>5-10	<70	25	Sand	Imperfect	Till	R.TC	Exceedingly (15 to 50)	No
AQT27	607469	7257525	Undulating	Toe	>5-10	>70	45	Fibric/Silty Clay	Very Poor	Organic/ Lacustrine	TFI.OC	Non (<0.01)	No
AQT28	607522	7257157	Hummocky	Upper	>10-15	<70	0	Sandy loam	Moderately Well	Till	R.TC	Excessively (>50)	No
AQT29	607197	7256878	Hummocky	Level	>0.5-2	N/A	0	Sand	Imperfect	Till	R.G	Exceedingly (15 to 50)	No
AQT30	607307	7256607	Undulating	Level	>0.5-2	N/A	5	Sandy Clay Loam	Poor	Glaciofluvial	R.SC	Non (<0.01)	No
AQT32	607296	7256270	Undulating	to	>2-5	>70	0	Sandy loam	Imperfect	Till	R.G	Very (3 to 15)	No
AQT36	606886	7255950	Undulating	Mid	>2-5	>70	0	Sand	Well	Glaciofluvial	OD.SC	Moderately (0.1 to 3)	No
AQT38	606724	7256045	Undulating	Level	>0.5-2	N/A	0	Sand	Imperfect	Till	GL.TC	Moderately (0.1 to 3)	No
AQT39	605583	7255466	Undulating	to	>2-5	>70	0	Sandy loam	Moderately Well	Till	R.TC	Exceedingly (15 to 50)	No
AQT40	604968	7256477	Undulating	Mid	>0.5-2	>70	0	Sandy loam	Moderately Well	Till	R.TC	Excessively (>50)	No
AQT45	603209	7254433	Undulating	Mid	>2-5	>70	0	Sandy loam	Moderately Well	Till	OD.TC	Excessively (>50)	No
AQT46	603252	7253814	Undulating	Toe	>0.5-2	>70	0	Sandy loam	Moderately Well	Till	R.TC	Exceedingly (15 to 50)	No
AQT50	603519	7252808	Undulating	Upper	>2-5	<70	0	Sandy loam	Moderately Well	Till	OD.TC	Excessively (>50)	No

Table E-1: Summary of Soil Data Collected, 2015

Site Name	GPS Location		Surface Expression	Slope Position	Percent Slope	Slope Length (m)	Peat/LFH Depth (cm)	Soil Texture[a]	Drainage	Parent Material	Subgroup Code[b]	Surface Stoniness (% of ground surface covered)	Sampled
	Easting	Northing											
AQT52	606174	7251994	Undulating	Depression	>0.5-2	>70	20	Sandy Clay	Poor	Fluvial	R.SC	Moderately (0.1 to 3)	No
AQT55	607180	7254547	Ridged	Upper	>0.5-2	<70	0	Sand	Rapid	Glaciofluvial	O.DYB	Excessively (>50)	Yes
AQT60	607375	7251756	Undulating	Mid	>5-10	>70	0	Sandy loam	Moderately Well	Till	R.TC	Exceedingly (15 to 50)	No
AQT62	607634	7252467	Ridged	Crest	>15-30	<70	0	Loamy Sand	Rapid	Glaciofluvial	O.DYB	Excessively (>50)	No
AQT64	607727	7255273	Undulating	Depression	>2-5	>70	0	Sandy Loam	Poor	Fluvial	R.G	Moderately (0.1 to 3)	Yes
AQT65	607727	7255238	Undulating	Mid	>2-5	>70	0	Sandy loam	Moderately Well	Till	OD.TC	Very (3 to 15)	Yes
AQT68	608772	7252134	Undulating	Mid	>2-5	>70	0	Sandy loam	Moderately Well	Till	OD.TC	Exceedingly (15 to 50)	No
AQT70	608438	7254068	Undulating	Mid	>2-5	>70	0	Sandy loam	Moderately Well	Till	OD.TC	Exceedingly (15 to 50)	No
AQT77	610379	7256235	Ridged	Crest	>0.5-2	>70	0	Sandy loam	Moderately Well	Till	R.TC	Excessively (>50)	No
AQT78	610289	7256130	Ridged	Depression	>2-5	N/A	0	Loamy Sand	Well	Glaciofluvial	O.DYB	Very (3 to 15)	No
AQT81	609695	7256281	Undulating	Mid	>2-5	>70	0	Sandy loam	Moderately Well	Till	OD.TC	Exceedingly (15 to 50)	No
AQT82	609601	7256481	Undulating	Depression	>2-5	>70	0	Sandy loam	Imperfect	Till	R.G	Moderately (0.1 to 3)	No
AQT85	608027	7255307	Undulating	Mid	>0.5-2	>70	0	Sandy loam	Well	Till	OD.TC	Very (3 to 15)	No
AQT87	611483	7254647	Ridged	Upper	>15-30	<70	0	Sand	Rapid	Glaciofluvial	OD.TC	Excessively (>50)	No
AQT89	611537	7252101	Undulating	Mid	>2-5	>70	0	Sandy Loam	Moderately Well	Till	OD.TC	Excessively (>50)	No
AQT92	614868	7249923	Undulating	Lower	>5-10	>70	0	Sand	Well	Till	OD.TC	Excessively (>50)	No
AQT93	614548	7249873	Ridged	Crest	>15-30	<70	0	Sand	Rapid	Till/Glaciofluvial	O.R	Excessively (>50)	No
AQT96	620834	7246197	Ridged	Mid	>15-30	<70	0	Sand	Rapid	Glaciofluvial	OD.TC	Exceedingly (15 to 50)	No
AQT97	620784	7246019	Level	Level	>0.5-2	N/A	50	Fibric/Sand	Poor	Organic/ Glaciofluvial	TFI.OC	Non (<0.01)	No
AQT101	618110	7238053	Undulating	Lower	>5-10	>70	22	Sandy loam	Moderately Well	Till	R.TC	Exceedingly (15 to 50)	No
AQT106	625980	7235847	Undulating	Mid	>2-5	>70	0	Sandy loam	Moderately Well	Till	R.TC	Excessively (>50)	No
AQT107	626231	7235853	Ridged	Lower	>2-5	>70	0	Loamy Sand	Well	Glaciofluvial	OD.TC	Slightly (0.01 to 0.1)	No
AQT110	636374	7224127	Undulating	Lower	>2-5	<70	0	Sandy loam	Moderately Well	Till	OD.TC	Excessively (>50)	No
AQT113	636044	7224444	Undulating	Lower	>2-5	<70	0	Sandy loam	Moderately Well	Till	OD.TC	Excessively (>50)	No
AQT115	611513	7252152	Undulating	Mid	>2-5	>70	0	Sandy loam	Moderately Well	Till	OD.TC	Excessively (>50)	No

Table E-1: Summary of Soil Data Collected, 2015

Site Name	GPS Location		Surface Expression	Slope Position	Percent Slope	Slope Length (m)	Peat/LFH Depth (cm)	Soil Texture[a]	Drainage	Parent Material	Subgroup Code[b]	Surface Stoniness (% of ground surface covered)	Sampled
	Easting	Northing											
AQT116	614805	7248355	Undulating	Level	>0.5-2	N/A	0	Sandy loam	Moderately Well	Till	OD.TC	Exceedingly (15 to 50)	No
AQT119	620867	7243399	Undulating	Mid	>5-10	>70	0	Sandy loam	Moderately Well	Till	OD.TC	Excessively (>50)	No
AQT125	618583	7239649	Undulating	Mid	>5-10	>70	0	Sandy loam	Moderately Well	Till	OD.TC	Excessively (>50)	No
AQT126	639572	7220853	Undulating	Mid	>5-10	<70	0	Sandy loam	Moderately Well	Till	R.TC	Excessively (>50)	No
AQT130	635605	7226573	Undulating	Mid	>2-5	>70	0	Sandy loam	Well	Till	OD.TC	Exceedingly (15 to 50)	No
AQT131	635581	7226625	Undulating	Depression	>2-5	>70	6	Loam - Sandy loam	Imperfect	Till	GL.TC	Moderately (0.1 to 3)	Yes
AQT135	633276	7230950	Undulating	Mid	>2-5	>70	0	Sandy Loam	Moderately Well	Till	OD.TC	Exceedingly (15 to 50)	Yes
AQT136	633322	7230982	Undulating	Depression	>2-5	>70	18	Sandy Loam	Imperfect	Till	GL.TC	Very (3 to 15)	No
AQT137	633113	7232937	Ridged	Upper	>2-5	<70	0	Sand	Well	Glaciofluvial	O.DYB	Excessively (>50)	No
AQT141	619836	7241118	Undulating	Mid	>15-30	>70	0	Sandy Loam	Moderately Well	Till	OD.TC	Excessively (>50)	No
AQT142	632660	7233617	Undulating	Crest	>10-15	<70	0	Sand	Rapid	Glaciofluvial	O.DYB	Excessively (>50)	No
AQT144	632253	7233530	Undulating	Mid	>10-15	>70	0	Sandy loam	Moderately Well	Till	R.TC	Excessively (>50)	No
AQT145	632078	7233509	Undulating	Lower	>5-10	>70	0	Sandy loam	Moderately Well	Till	R.TC	Exceedingly (15 to 50)	No
AQT149	631579	7233931	Undulating	Mid	>2-5	>70	0	Sandy loam	Moderately Well	Till	R.TC	Exceedingly (15 to 50)	No
AQT151	626799	7236300	Undulating	Mid	>2-5	>70	0	Sandy loam	Moderately Well	Till	OD.TC	Excessively (>50)	No
AQT154	619734	7241223	Undulating	Toe	>5-10	>70	20	Sandy Clay Loam	Poor	Till	GL.SC	Very (3 to 15)	No

Note: GPS locations in NAD 83 Zone 14W.

a) Texture from upper surface horizon.

b) See Table A-2a for Soil Subgroup code descriptions.

GPS = global positioning system; NAD = North American Datum; LFH = leaf folic humic; m = metre; cm = centimetre; > = greater than; < = less than; N/A = not applicable.

Table E-2a: Soil Subgroup Code Descriptions

Order	Subgroup Code	Full Subgroup Name
Cryosolic	OD.TC	Orthic Dystric Turbic Cryosol
	R.TC	Regosolic Turbic Cryosol
	GL.TC	Gleysolic Turbic Cryosol
	OD.SC	Orthic Dystric Static Cryosol
	R.SC	Regosolic Static Cryosol
	GL.SC	Gleyed Static Cryosol
	TFI.OC	Terric Fibric Organic Cryosol
Brunisolic	O.DYB	Orthic Dystric Brunisol
Gleysolic	O.G	Orthic Gleysol
	R.G	Rego Gleysol

Table E-2b: Soil Horizon Symbol Definitions

Symbol	Definition
Major Mineral Horizon Symbol[a]	
A	This mineral horizon forms at or near the surface in the zone of leaching or eluviation of materials in solution or suspension, or of maximum in situ accumulation of organic matter or both.
B	This mineral horizon is characterized by enrichment in organic matter, sesquioxides, or clay; or, by the development of soil structure; or, by a change of colour denoting hydrolysis, reduction, or oxidation.
C	This mineral horizon is comparatively unaffected by the pedogenic processes operating in A and B horizons.
Lowercase Mineral Horizon Suffix	
g	A horizon characterized by gray colours, or prominent mottling, or both, indicating permanent or periodic intense reduction.
m	A horizon slightly altered by hydrolysis, oxidation, or solution, or all three to give a change in colour or structure, or both.
y	A horizon affected by cryoturbation as shown by disrupted and broken horizons, incorporation of materials from other horizons, and mechanical sorting in at least half of the cross section of the pedon.
z	A frozen layer.
Major Organic Horizon Symbol[b]	
O	Organic horizon developed mainly from mosses, rushes, and woody materials, and divided into the following subhorizons.
Organic Subhorizon Code[c]	
Of	This O horizon consists largely of fibric materials that are readily identifiable as to botanical origin. A fibric horizon has 40% or more of rubbed fiber by volume and a pyrophosphate index of 5 or more. Fibric material usually is classified on the von Post scale of decomposition as class 1 to class 4.
Om	This O horizon consists of mesic material, which is at a stage of decomposition intermediate between fibric and humic materials. The material is partly altered both physically and biochemically. It has a rubbed fiber content ranging from 10% to less than 40%, and has a pyrophosphate index of >3 and <5. Mesic material usually is classified on the von Post scale of decomposition as class 5 or 6.

Source: SCWG (1998).

[a] Mineral horizons contain 17% or less organic carbon (about 30% organic matter) by weight.

[b] Organic horizons occur in organic soils and commonly at the surface of mineral soils. They may occur at any depth beneath the surface in buried soils or overlying geologic deposits. They contain more than 17% organic carbon (about 30% or more organic matter) by weight. Two groups of these horizons are recognized, the O horizons (peat materials) and the L, F, and H horizons (folic materials).

[c] Ofm denotes a combination of fibric and mesic organic material

% = percent; < = less than; > = greater than.

Table E-3: Results of Soil Chemistry of Sampled Soils within the Whale Tail Pit Study Area

Parameter	Unit	Detection Limit	AQT55 (O.DYB)		AQT64 (R.G)		AQT65 (OD.TC)			AQT131 (GL.TC)		AQT135 (OD.TC)		
			Bm	C	Ofm	Cg	LF	Bmy	Cz	Ofm	Cgy	LF	Bmy	C
			0 - 20 cm	20 - 50 cm	35 - 0 cm	0 - 80 cm	20 - 0 cm	0 - 24 cm	24 - 56 cm	6 - 0 cm	0 - 110 cm	7 - 0 cm	0 - 24 cm	24 - 100 cm
pH	pH units	0.10	5.4	5.66	5.17	5.2	5.14	5.32	6.24	6.87	6.49	5.8	6.43	6.96
Chloride (Cl)	mg/kg	1.5 - 70	<1.6	<1.7	<27	<1.9	23	<2.2	1.9	134	<2.0	44	<1.7	2.9
Sulphur (as SO_4)	mg/kg	1.6 - 70	1.7	<1.7	69	4.2	71	3.2	3.3	190	5.4	94	2.8	7
Calcium(Ca)	mg/kg	0.63 - 28	0.97	<0.67	17	1.71	29.4	2.37	2.46	535	2.94	115	2.06	4.24
Potassium (K)	mg/kg	0.31 - 14	0.88	<0.33	22.2	1.85	28.4	0.9	1.07	301	0.9	64.6	0.83	1.49
Magnesium (Mg)	mg/kg	0.63 - 28	<0.63	<0.67	<11	0.79	18.1	1.53	1.88	130	1.48	46.5	1.14	2.68
Sodium (Na)	mg/kg	1.2 - 56	<1.3	<1.3	<22	2.7	19	1.8	1.8	<56	1.7	<18	<1.4	2.9
Salinity (electrical conductivity)	dS/m	0.10	<0.1	<0.1	<0.1	0.11	0.11	<0.1	<0.1	0.38	<0.1	0.26	<0.1	0.17
Sodium adsorption ratio (SAR)[(a)]	SAR	0.1 - 4.0	<0.6	Incalculable	<0.6	0.7	0.33	0.35	0.36	<0.2	0.32	<0.2	<0.3	0.49
Percent saturation	%	1.0	31.4	33.3	543	37.8	425	43.1	34.5	1400	40.2	444	34.1	29.9
Available nitrate (NO_3)	mg/kg	1.0 - 22	<1.0	<1.0	<10	<1.0	<6.0	<1.0	<1.0	<22	<1.0	<8	<1.0	<1.0
Available nitrite (NO_2)	mg/kg	0.4 - 4.4	<0.4	<0.4	<2.0	<0.4	<1.2	<0.4	<0.4	<4.4	<0.4	<1.6	<0.4	<0.4
Texture	-	N/A	Sand	Sand	N/A	Sandy Loam	N/A	Sandy Loam	Loam	N/A	Loam/ Sandy Loam	N/A	Sandy Loam	Loam

Note: See Table D-2a for Soil Subgroup Code Descriptions and Table D-2b for Soil Horizon Symbol Definitions.

[(a)] Sodium adsorption ratio is incalculable where sodium (Na) concentrations are below detection limits.

pH = potential of hydrogen, provides measure of the acidity or alkalinity of a solution on a scale of 0 to 14; cm = centimetre; mg/kg = milligrams per kilogram; dS/m = decisiemens per metre; % = percent; < = below detection limit of; N/A = not applicable; - = no unit.

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