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REPORT ON

AIR PHOTO INTERPRETATION, SITE RECONNAISSANCE, MAPPING, AND SAMPLING: TEHEK LAKE ACCESS ROAD, MEADOWBANK GOLD PROJECT NUNAVUT

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EXECUTIVE SUMMARY

An air photo assessment of geomorphic processes and surficial geology along the proposed Tehek Lake all season access road for the Meadowbank Gold Project was carried out as part of Cumberland Resources Ltd.'s development plans at Meadowbank, Nunavut. Occurrences of geomorphic and periglacial processes and surficial materials along the access road route were mapped to identify site conditions, natural hazards, and possible aggregate sources to be considered during engineering design and construction. The scope of work was limited to an office-based assessment of the approximately 115-km long route, including up to 1000 m on either side of the proposed route. The results of the office-based assessment have been field verified by eight walking traverses along selected sections of the route, observations at eleven locations associated with potential bedrock quarry sites and, terrain observations along the road route from a helicopter. In addition, bedrock sampling for geochemical analysis was carried out at a series of possible rock quarry sites. Selected soil samples were collected for geochemical and geotechnical characterisation.

The area has low relief, and is generally gently- to moderately- sloping with short, steep slopes occurring locally on some bedrock surfaces. The terrain is dominated by undulating and irregular bedrock surfaces, veneers and blankets of till and/or weathered (frost-shattered) bedrock (felsenmeer), and discontinuous organic veneers. Occasional marine (beach) deposits and very small glaciofluvial deposits are present locally. Periglacial processes present in the area are typical of areas underlain by continuous permafrost, although their surface expression is subdued due to the relatively thin cover of overburden and locally well-drained site conditions. Terrain features and geomorphic processes associated with excess ground ice are limited. Previous field studies in the Baker Lake area and the Meadowbank Project site, which included the installation of thermistor cables, indicated that the depth of annual thaw is on the order of 1.5 m to 2 m. No thermistors have been installed along the proposed access route. Shallow, hand-dug soil pits excavated in late July 2005 indicate thaw to depths of 1 m or less on imperfectly- to poorly-drained upland till surfaces at this time of year.

Physical weathering (frost wedging and frost shattering) will occur on exposed bedrock surfaces and in areas of rubbly, weathered bedrock. Freezing induced displacement of soil (frost creep, frost heave, frost jacking, and frost sorting) is expected to occur along the road alignment, although the displacements are likely restricted to poorly-drained surficial materials such as fine-grained glacial tills. Evidence of cryoturbation of the morainal materials (till), weathered bedrock, and organic veneers occurs locally in the form of weakly patterned ground. Thaw induced displacement of soils (possible solifluction and thaw consolidation/settlement) are expected to occur locally, but are expected to be restricted to the finer, grained soils and to steeper slopes. Thaw settlement

and consolidation of finer, grained tills following road construction or surface disturbance should be expected to occur along portions of the road underlain by native till materials.

Areas underlain by granular marine (beach) deposits appear to be suitable for at-grade support of road embankments, if the thickness of the road fill is greater than the annual thaw depth, and adequate site drainage is provided. However, such deposits typically occur only in the Baker Lake area. Glaciofluvial materials deposit, identified along the access road, are in insufficient quantities to form a viable source of road construction materials.

A geophysical Ground Penetration Radar (GPR) survey has recently been completed along the proposed route by Golder Associates, to evaluate areas of potential drifting, snow pack, and to refine the proposed route alignment based on actual site conditions. In addition to the GPR survey, Electromagnetic Terrain Conductivity (EM31) surveys were carried out at specific locations, in particular at potential bridge abutments, to evaluate the potential for massive ice formation. The results of these surveys will be reported to Cumberland Resources Ltd. separately.

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1.0 INTRODUCTION

Cumberland Resources Ltd. is evaluating the feasibility of developing a mine at the Meadowbank Gold Project (see Figure 1). As part of the project development, an all-weather access road is proposed to extend from Baker Lake, Nunavut, to the Meadowbank project site, some 115 km north.

A preliminary air photo interpretation was carried out along the route for the proposed Tehek Lake access road. The air photo interpretation was undertaken prior to a field mapping and sampling investigation along the proposed route. The field mapping and sampling program was undertaken to verify the results of the air photo interpretation, to obtain samples of soils and bedrock materials that may be encountered during construction of the road access, and to identify possible natural aggregate resources for the road construction. Air photo coverage is shown on Figure 2.

Terrain types and periglacial processes were mapped along the proposed road corridor for distances of approximately 0.5 km to 1 km either side of the proposed centerline. The selection of a 0.5 km, to 1 km, buffer on each side of the proposed route was based on estimates of what economic hauling distances for granular material might be.

2.0 OBJECTIVES AND SCOPE OF WORK

The objectives of the preliminary air photo interpretation were to:

1. Review current data including existing reports and topographic mapping of the proposed road route from Baker Lake to the Meadowbank project site;
2. Map terrain and geomorphic processes along an approximately 115-km route at an approximate 1: 60,000 scale (1 inch ≅ 1 mile) using available black and white air photos, supplemented with larger scale colour photography where available;
3. Prepare terrain hazard maps showing terrain susceptibility to periglacial processes; and
4. Provide preliminary geotechnical engineering comments relating to the susceptibility of the various mapped terrains to periglacial processes.

The objectives of the route reconnaissance and sampling program was:

1. To assess the continuity and lateral extent of areas of potentially suitable materials for road construction, and to assess general soil conditions along the route;
2. To make notes on permafrost depths;
3. To verify the results of previous air photo interpretation work and geophysical investigations; and
4. To identify, locate, and sample potential aggregate and bedrock resources.

2.1 Methodology

The following tasks were carried out as part of the assessment methodology:

- A review was completed of existing and available terrain data and maps;
- The terrain polygon data from the air photo mapping was assembled into an assessment matrix linking geomorphology and soils to potential road construction-related issues in permafrost terrain to assist preliminary engineering and hazard interpretations for the various terrain types mapped along the proposed route (see Appendix I);
- Mapping of the surficial materials and soils followed the methods described for terrain mapping in British Columbia (Resources Inventory Committee, 1996). The classification of terrain types, surficial geology, soils, and geomorphic processes follows the classification system developed in British Columbia by Howes and Kenk (1997). The Howes and Kenk classification system encompasses the mapping of the surficial material, the genesis of that surficial material, the morphology of the underlying bedrock surface, and the prevailing geomorphic processes. The terminology used to describe permafrost and ground ice features is consistent with the

glossary of terms prepared by Everdingen (1998). Terrain codes were developed and are presented in Appendix II;
- Terrain lines were located by hand on 1:60,000, 1;20,000 and 1:10,000 scale air photos and then the air photos were combined to form a 1:15,000 scale air photo mosaic map showing surficial material types and terrain conditions (see Appendix III); and
- A map was prepared to define potential terrain susceptibility to freeze/thaw processes (see Appendix IV).

A field program of ground confirmation of the mapped surficial materials, periglacial processes, and soils along significant portions of the route was completed in July 2005. In addition to the ground confirmation of the air photo mapping exercise, sites for potential borrow and quarry material for road construction were visited, and samples taken. The following tasks were carried out as part of the assessment methodology:

- Regional bedrock geology was reviewed (see Appendix V);
- A series of traverses which included soil and rock sampling was undertaken (see Appendix VI);
- Soil sampling locations were described in field notes, which included photographs and descriptions (Appendix VII);
- Potential rock quarry locations were described in field notes (see Appendix VIII);
- Soil samples were submitted for engineering materials classifications, including particle size distribution, moisture content, and Atterberg limits where applicable. The results of the laboratory testing program are contained in Appendix IX; and
- Photographs of representative terrain types identified as part of the air photo interpretation were taken (see Appendix X).

A CD containing all the traverse and sampling site photographs has been appended (Appendix XI).

3.0 DATA REVIEWED

The following is a list of data reviewed as part of the assessment:

- Portions of: Aylsworth, J.M., Cunningham, C.M., and Shilts, W.W. 1985. Surficial Geology, Baker Lake, District of Keewatin, Northwest Territories; Geological Survey of Canada, Map 3-1985, Scale 1:125 000.
- Government of Canada. 1998. Black and white air photos, 1:60,000 scale, Photo numbers: A15699 – 43 to 47 and A16770-18 to 23. *These air photos do not provide full stereo coverage for the map area.*
- Cumberland Resources Ltd. 1998, Colour air photos, 1:10,000 scale, Photo numbers: 2-9 to 2-11, 3-1 to 3-3, 4-1 to 4-3, 5-1 to 5-2, 6-1 to 6-3, 7-14 to 7-16, 8-3, 9-14, and 10-14 to 10-16.
- Cumberland Resources Ltd. 1998, Colour air photos, 1:20,000 scale, Photo numbers: 2-4, 3-2 to 3-3, 4-1 to 4-11, and 5-4.
- Golder Associates Ltd. 2005. Site photographs from field investigations at Baker Lake.
- Golder Associates Ltd. 2004. Geomorphology and Soils, Meadowbank Project, Nunavut. Report prepared for Cumberland Resources Ltd.

4.0 GEOMORPHOLOGY AND SOILS

The air photo assessment of geomorphology and soils, terrain features, surficial geology, and geomorphic processes for the southern third of the route used 1:20,000 scale colour air photos, and the middle third of the route used 1:60,000 scale black and white air photos.

The northern one quarter of the route used 1:10,000 colour air photos. A gap in the air photo coverage, and terrain mapping, of the access road route occurs between the colour and black and white photos. This gap extends from approximately kilometer 82 to kilometer 91 (see Figure 2).

Appendix I lists the different terrain types along with geomorphologic process and soils details for each. The terrain codes are contained in Appendix II. The attached air photo terrain maps (Appendix III) present the mapped surficial materials and soil features in relation to the proposed road location. Each map polygon is labelled with a number. These numbers correspond to distinct terrain types. Table 4.1 summarises the surficial geology interpreted from the air photos.

Table 4.1: Summary of Surficial Geology Units

Map Unit Type[1]	Soil Cover	Ground Ice	Suitability for Road Construction
Organic (O)	Veneers (Ov), humic Blankets (Ob), humic	Likely present	Poor
Marine (W)	Rubbly, gravely beach ridges and veneers (gWrv)	Likely limited. Material easily excavatable.	Good
Morainal (M)	Veneers (Mx, Mv), rubbly clasts in a fine grained matrix	Generally limited	Poor to Moderate
	Mantles (Mb), rubbly clasts in a fine grained matrix	Possible excess ice (ice detected in test pits)	Poor to Moderate
		Generally wet sites	Poor to Moderate
Glaciofluvial (F^G)	Sand or sand and gravel deposits (F^G)	Likely limited. Material easily excavatable.	Good
Frost shattered bedrock (rD) (Felsenmeer)	Rubbly mantles (Db)	Generally limited	Moderate, depending on grain size.
	Rubbly veneers (Dx, Dv) with veneers (Ov, Mv)	Generally limited	Moderate, depending on grain size.
Bedrock ®	None	Generally limited	Good if quarried and crushed.
	Blankets (Db, Mb)	Possible excess ice	Poor to Moderate
	Veneers (Ov, Dv, Mv)	Generally limited	Poor to Moderate

1. Map unit type based on most abundant surficial material interpreted from the air photos. Letter codes correspond to Howes and Kenk (1997).

4.1 Field Verification and Sampling Program

Field verification of the air photo interpretation comprised a series of eight walking traverses along selected sections of the route and eleven additional observation sites associated with rock sampling at potential rock quarry locations. To ensure that any obvious effects of bedrock lithology on terrain morphology were identified, and that bedrock was sampled, the traverse locations were selected to cross as many bedrock types as possible. Access to the traverse locations was by helicopter, and anecdotal observations were made from the air.

The traverses represent about 80 km, or 73%, of the total road route. Weather during the field program varied from sunny days with light winds, to cloudy days with strong winds and occasional rain. Visibility was generally excellent, with the exception of one day when rain and low clouds obscured more distant terrain.

Ground traverse routes, rock and soil sampling locations, and photo locations are shown on Figures 2 and 3. Initial evaluation of bedrock geology was based on available regional bedrock geology data (see Appendix V). Traverse and sampling locations for soils and rock are shown in Appendix VI. The field notes from the ground assessments are presented in Appendix VII. Notes relating to potential rock quarry sites are contained in Appendix VIII.

4.1.1 Summary of Test Pitting and Soil Sampling

To assess ground conditions and permafrost depths, 44 hand-dug soil pits were excavated along the proposed route and locations are shown on Figure 2, and in Appendix VI. Samples of overburden material were collected from all 44 test pits. A selected number of samples were submitted for additional laboratory testing. The results of the laboratory testing are contained in Appendix IX. Additional notes relating the soil conditions encountered in the test pits are contained in Appendix VII. The following table describes the samples collected, and the conditions observed in the field.

Table 4.2: Soil Sample Characteristics

Site	Depth (m)	Soil Type	Comments
Soil-1	0-0.4	Brown silt, some clay, gravel and sand	Wet
Soil-2	0-0.3	Light brown silty Sand and Gravel	Dry
Soil-3		Sand, some gravel	No sample
Soil-4		Till	No sample
Soil-5	0-0.3	Grey brown Silt, some clay, fine gravel and sand	No GPS point
Soil-6	0-0.3	Till	
Soil-7	0-0.3	Light brown Silt, some sand, clay and gravel	
Soil-8	0.4-0.6	Grey sandy Silt with gravel	No GPS point
Soil-9	0-0.3	Till	Very stiff and hard to dig
Soil-10	0-0.3	Till	Small holes showing trace of melted ice, soil around the hole is swelling, not able to dig deeper
Soil-11		Till	Dry, no sample
Soil-12		Till	Dry, no sample
Soil-13		Till	Dry, no sample
Soil-14	0-0.5	Light brown sandy Silt, some clay and gravel	Softer in the bottom than Soil-8
Soil-15		Plastic Till	Wet, no sample
Soil-16		Till	Wet, no sample
Soil-17	0-0.35	Till	Drier than others places, no trace of permafrost
Soil-18	0-0.3	Brown silty Sand mixed with weathered rock	Very difficult to dig deeper, to much rocks
Soil-19	0-0.4	Till	Very stiff at the bottom, no trace of permafrost
Soil-20		Dark brown clayey Silt, some sand and gravel	
Soil-21		Till	Permafrost at 0.6-0.7 m

Table 4.2: Soil Sample Characteristics (cont'd)

Site	Depth (m)	Soil Type	Comments
Soil-22	0-0.5	Dark brown clayey Silt, some sand and gravel	Soft at the base of pit, sandier at the surface
Soil-23	0-0.3	Brown Silt, some gravel, trace of sand and clay	No sample, rock at 0.3 m
Soil-24	0-0.7	Wet till	
Soil-25		Sand and Gravel	No sample
Soil-26	0-0.05	Weathered reddish rock	
Soil-27	0.4-0.5	Silty gravel	
Soil-28	0-0.4	Silty sandy Gravel	
Soil-29	0-0.5	Sand and Gravel	
Soil-30	0-0.6	Sand and Gravel	
Soil-31		Sand and Gravel	No sample
Soil-32	0-0.05	Till	Poorly-drained (type 4)
Soil-33	0-0.45	Ablation till	Sand and Gravel, well drained (type 2)
Soil-34	0-0.5	Grey clayey Silt, some sand and gravel	Permafrost at 0.5m
Soil-35	0-0.5	Grey brown Silt, some gravel, clay and sand	
Soil-36	0-0.5	Till	Poorly-drained
Soil-37		Dark brown clayey Silt, some sand and gravel	
Soil-38	0-0.3	Sand, some gravel	Nbn (permafrost classification), below 0.3 cm
Soil-39		Peat	Soft and wet peat over frozen peat, Vx (permafrost), no sample
Soil-40		Sandy till	Seems to have lost the sample
Soil-41		Sand	
Soil-42		Grey clayey Silt, some sand and gravel	
Soil-43	0-0.3	Grey sandy Silt, some gravel	Permafrost at 0.7 m, visible ice, inclusion of ice
Soil-44	0-0.5	Sand and Gravel	Collapsing hole, could not excavate deeper than 0.7 m deep

The topography of the area ranges from smooth to irregular, and consists of gentle to moderate slopes and ridges of generally low relief with elevations ranging from zero to 100 m above the shoreline of the larger lakes and streams. Steeply sloping areas are present locally, but the road location generally avoids these areas. Local joints and faults appear to control the location and pattern of steeper slopes and surface drainage networks.

The surficial geology of the area comprises low-lying, generally gently to moderately sloping bedrock outcrops, veneers and blankets of till, and frost-shattered bedrock overlying undulating to gently-sloping bedrock surfaces. Shallow veneers of organic material are present locally on some bedrock surfaces, along some streams, and locally mantle deposits of till and frost shattered bedrock in poorly-drained areas. There can be very limited areas of fluvial sands and gravels along some stream margins. Gravely glacio-marine and glacio-fluvial deposits occur locally.

There are a few, very small, isolated deposits of glacio-fluvial sands and gravels. Three of the more notable of these deposits are located southwest and southeast of stream crossing R08 (i.e., in the vicinity of kilometer 32 to kilometer 34, see Figure 2). These deposits range from 1 to 3 or 4 m depths and are of restricted lateral extent so do not represent significant aggregate sources. Unless they can be exploited when the ground is frozen, they are likely too far from the road location to represent viable aggregate sources. The particle size analyses of two soil samples (Soil-29 and Soil-30) from a very small, silty gravel deposit near quarry site Pit-8 at kilometer 36, and a third sample (Soil- 33) collected a short distance south of crossing R07 at rock quarry site Pit-7 that may also be of glacio-fluvial origin, are presented in Appendix IX.

Approximate locations of these small granular deposits are shown on Figure 2 as soil locations named Soil-3, Soil-29, Soil-30 and Soil-31. Table 4.3 includes approximate deposit dimensions and characteristic components.

Table 4.3: Glaciofluvial Deposits

Soil location #	Component	Estimated Dimensions	Estimate of Volume
Soil-3	Sand and some gravel	20m X 20m X 6m	2400 m^3
Soil-29	Sand and gravel	30m X 15m X 4m	1800 m^3
Soil-30	Sand and gravel	100m X 20m X 1.5m	3000 m^3
Soil-31	Sand and gravel	40m X 10m X 4m	1600 m^3

Gently-sloping, well-drained, generally uniform blankets and low ridges of marine gravels and sands (beach deposits) are present along the shore of Baker Lake, and are visible on the air photos as a series of sub-parallel lines or ridges that step up the slope

above the lake. There are occasional occurrences of similar beach ridges on the sides and tops of two or three low, gently- to moderately-sloping rocky ridges along the southern section of the proposed road location, a few kilometers north of Baker Lake. These deposits are of limited extent and are too shallow to exploit as aggregate sources, but should provide good subgrade support in those few locations where the road may traverse these deposits as most of these deposits are too small and indistinct to identify on air photos they are not shown on the terrain map. Particle size analyses for two soil samples (samples Soil-41 and Soil-44) from deposits along the southern section of the road, that may be relict beach deposits, were composed predominantly of gravel and sand-sized material, with fines content (silt plus clay) ranging from 1.2% (Soil-44) to 5.4% (Soil-41).

Till and weathered bedrock are the dominant surficial materials in the area. The tills along the road location has similar characteristics to the till encountered at Baker Lake and at the Meadowbank Project sit and are dominated by clayey silty textures. A number of till samples were collected during the walking traverses and selected samples were analysed to further characterise the physical properties of these materials.

The tills in the Baker Lake area are generally imperfectly- to poorly-drained although well-drained zones may also be present. Grain size analyses have been completed on till samples in the project area and result are presented in Appendix IX. The tills are relatively consistent gradationally. The coarse fragment portion of the samples ranged from 20% to 50%, dominated by pebble- and cobble-sized material with occasional boulder sized fragments. The fine fraction of these samples (silts and clays) ranged from 10% to 40% and the remainder was sand-size material.

The percentage of fines in five samples (Soil-9, -17, -21, -24 and -36) analysed to determine clay and silt percentages show a range of 8% to 17% clay, and 27% to 43% silt. Combined silt and clay percentages in these five samples ranged from 3% to 56%. For another six of the till samples (Soil-6, -10, -19, -27, -37 and -38) total fines (clay + silt) ranged from 19% to 58%, with only one of these samples having less than 30% fines (Soil-38). Three of the samples (Soil-17, -24 and -27) where tested for liquid and plastic limits; all were classified as CL-ML under the Unified Soil Classification System.

The depth of frost shattered bedrock (felsenmeer) in the Baker Lake area ranged from 0.4 m to about 1 m. The matrix textures ranged from sandy silts to silty sands. The coarse fraction was quite angular (cobble- and pebble-sized material but few boulders). The frost shattered bedrock was generally well-drained, but imperfectly drained areas are likely present locally. Fresh to slightly frost shattered bedrock was encountered at the base of the test pits excavated in frost shattered bedrock at Baker Lake. Similar conditions may be encountered along the proposed access road route as the terrain is

similar to that around Baker Lake. Actual bedrock conditions will likely vary as bedrock lithology and competence vary. Soil pits excavated in small, shallow pockets of till in areas of frost shattered bedrock along the road route typically encountered bedrock or large pieces of frost shattered rock at depths of 0.2 m to 0.4 m.

The test pit investigations generally confirmed the air photo interpretation and the two dominant soil conditions present can be described as:

- Extensive areas of mineral soils comprising imperfectly- to poorly-drained, likely frost-susceptible till overlying bedrock, and containing occasional, minor areas of frost-shattered bedrock. Shallow, discontinuous, organic veneers (peat layers) are found on the more poorly-drained sites, often in areas were small, shallow areas of standing water were present, or had recently been present, at the time of the field work in mid-July. These wetter areas are typically dominated by various species of grass; and
- Extensive areas of fresh to slightly frost-shattered bedrock outcrops and associated frost shattered bedrock fragments (felsenmeer), generally with a minor component of discontinuous till veneers. These till veneers are rarely deeper than half a metre and or more typically on the order of 0.3-m to 0.4-m deep. These sites are typically well drained.

4.2 Summary of Rock Sampling

Sources of granular aggregate are relatively small in spatial extent, and are scarce along the proposed road alignment. It is expected that rock quarries will be developed along the road to provide a source of material for processed aggregates.

The local bedrock consists of rocks of igneous, metamorphic, volcanic, and sedimentary origin. Individual bedrock types tend to extend over large distances along the road route (Appendix V). Samples were collected from 20 potential quarry sites located along the proposed route. The criteria for selecting potential rock quarry sites were:

1. Areas of exposed bedrock ideally 200-m x 200-m in extent;
2. Moderate relief (i.e. 5 m to 10 m or more from bottom to top of outcrop);
3. Sites located away from surface waters;
4. Avoidance of areas that are heavily mineralised;
5. Avoidance of outcrops with deep, extensive, and open fractures/joints;
6. Avoidance, if possible, of areas with deeper overburden (>0.5 m);
7. Avoidance of lee slopes (S, SSE, and SE) when possible; and
8. Well-spaced sites (5-km to 10-km apart), supplementary and closer site if only small outcrops are available.

Only a limited number of the sites met the 200-m x 200-m size criteria noted above, and some have relatively limited relief. The sample site numbers and the rock types sampled are shown in the following table. The locations are shown on Figure 3 and in Appendix VI.

Table 4.4: Potential Rock Quarry Sites

Rock Quarry #	Rock Type	Rock Quarry#	Rock Type
2	Granite	15	Metawacke
3	Granite	16	Metawacke
4	Granite-granodiorite	17	Metawacke/ granite gneiss
5	Granite	18	Mafic volcanics
7	Granite	19	Granite
8	Quartzite	20	Granite
10	Quartzite or Granite gneiss	21	Granite
11	Felsite – intermediate volcanics	22	Granite
11b	Volcanics – andesite	23a	Quartzite/ volcanic
13	Metawacke	23b	Quartzite

Three composite rock samples, weighing 3 kg to 5 kg each, were collected at each potential quarry site for geochemical testing to determine the potential for acid rock drainage. Each composite sample represents eight to ten individual rock samples taken at roughly equal intervals along a 20- to 30-m long sampling line. These sampling lines were spaced at approximately equal distances across each outcrop, so there is a reasonable expectation that the variability within the outcrop was sampled. In a very few cases a fourth composite sample was taken where a significantly different, but subordinate, rock type was present in the outcrop.

Results of the geochemical analyses will be issued in a separate report.

4.3 Stream Crossings

The terrain conditions at the stream crossing locations, as best as can be determined from the air photo interpretation and through field verification, are listed below in Table 4.5. Initially 23 stream crossings were estimated, but this number was increased to 25 during the air photo interpretation. However, on further inspection of the air photos, the route

alignment was adjusted slightly to reduce the number of stream crossings required to approximately 19.

Table 4.5: Terrain Conditions at Stream Crossings

Stream Crossing Number	Terrain Conditions	Notes	km
R01	Unconsolidated materials form both sides of the crossing. Bedrock is exposed a short distance south and north of the crossing. Road construction on the approaches could provide ample rock for crossing construction. Organic veneers and poorly-drained tills are present along the stream edge. The crossing may move closer to the lake if road location to south changes.	Crossing conditions are better closer to the lake as some bedrock is exposed on the north side of the crossing.	3.5
R02/B01	No air photo coverage. Ground photos indicate blocky-rubbly frost shattered bedrock at the crossing.	Bedrock near surface; check grades.	10
R03	Crossing appears to be on poorly-drained till. There is a possibility that the crossing could be located on bedrock a short distance to the west, or this rock could be exploited for crossing materials.	Field verify conditions.	12
R04	Crossing appears to be on poorly-drained till. There is a possibility of locating the crossing on bedrock a short distance to the west. Ground photos indicate organic soils at the crossing location.	Field verify bedrock.	13
R05	There are two possible crossings at this location (east and west of a small lake). Both crossings are on till or weathered bedrock. The east crossing appears better drained, there is a very slight chance there is exposed bedrock on the north side of the east crossing. Rounded/sub-rounded boulders visible in the stream channel in the ground photos suggest that till may underlie the stream/crossing. Poorly-drained tills are present on the approaches to the crossing.	Original (west) crossing location okay – broad and low flows after freshet; no change.	17 19
R06/B02	The stream on the eastern side of this crossing location is narrower but the western side appears to have exposed bedrock on both sides of the stream. Frost shattered bedrock is present at the east end of the stream so bedrock may be near surface. Ground photos indicate areas of blocky, rubbly frost shattered bedrock, and possibly gently dipping bedrock locally in the stream channel.	Current location is near west end of stream.	24
R07A	There is bedrock exposed along most of the north side of this crossing but the south side is dominated by till or weathered bedrock. Moving the crossing location west may provide some bedrock for the south approach as well as a narrower crossing.	Check alternative route.	27.5
R07	This is the alternative route location described above.		28
R08	Till or weathered bedrock. The south side of the crossing appears better drained than the north side. Exposed bedrock is available to the south of the crossing. There may areas of frost shattered bedrock on the south side of the crossing that may provide reasonable foundation opportunities.	Not part of the current road route, which uses an alternate high ground alignment to the west of R08.	34
R09	There appear to be bedrock outcrops at this location on the stream that may provide favourable foundation conditions.		54
R10/B03	Primarily unconsolidated materials (till) – poorly-drained till likely dominates. Could exploit exposed bedrock by moving towards west or on green route or to the east.	Crossing excluded from revised route alignment.	63.5
R11	Bedrock is present on the south side of crossing. Mainly unconsolidated materials (till) on north side but may be bedrock locally.	Crossing excluded from revised route alignment.	64
R12	Unconsolidated materials (till) dominate this crossing.	Crossing excluded from revised route alignment.	66
R13	Unconsolidated materials (till) dominate this crossing.		68

Table 4.5: Terrain Conditions at Stream Crossings (cont'd)

Stream Crossing Number	Terrain Conditions	Notes	km
R14	Poorly- to imperfectly-drained tills dominate the approaches to this crossing. Rubbly, frost-shattered bedrock is present along the stream.		74
R15/B04	Bedrock and frost shattered bedrock dominate on both sides of this crossing.	Check rock at abutments.	75
R16	Unconsolidated materials (till) dominate both sides of this crossing. Some exposed bedrock may be present a short distance west.	Shift route slightly west.	80
R17	Unknown conditions, no air photo coverage. Ground photo suggests there may be exposed bedrock or frost shattered bedrock to west.	Field verification required, no air photos.	83.5
R18	Unknown conditions – no air photos or ground photos.	Field verification required, no air photos. Two route options available (R18A).	86
R19/B05	Ground photos indicate areas of frost shattered bedrock (angular rock fragments) that would provide a more favourable crossing location. Avoid areas possibly underlain by till (i.e., rounded/sub-rounded boulders in stream). Approaches are dominated by poorly-drained till deposits. Gradients are quite gentle in this area so there may be an opportunity to shorten the route between kilometre 89 and kilometre 87 to reduce road construction across poorly-drained till deposits.	Two route options available (R19A/B05A).	89
R20	Poorly-drained tills (terrain types 4 and 6) dominate this crossing (see photos D-c-1 to D-c-4 on the traverse photos CD). Rock quarry site 19 is about 0.5 kilometres southeast.	Two route options available (R20A).	91.5
R21	Poorly-drained tills are present at the immediate crossing (terrain type 6), areas of blocky to rubbly frost-shattered bedrock and small bedrock outcrops are present on the approaches to the crossing (see photo D-a-1 on the traverse photos CD, the crossing area is on the right hand side of this photo).	Field verification required; shift to green route between R21 and R22.	93.5
R22	Ground photos indicate unconsolidated materials but there may be localised areas of frost shattered bedrock (upstream areas) that could provide more favourable ground conditions for the approaches and the crossing. The air photos indicate opportunities for bedrock approaches on at least one side of the crossing depending on exact route selection.	Crossing excluded from revised route alignment.	98
R23	Rubbly, frost-shattered bedrock is present at the crossing. Areas of poorly- to imperfectly-drained tills are present on the approaches to the crossing.		100
R24	The crossing site is dominated by blocky to rubbly, frost-shattered bedrock limited areas of till may be present in meadow area upstream of crossing (see photos C2-1 and C2-2 on accompanying traverse photos CD).		105
R25	Air photo review indicates that the crossing site is dominated by bedrock outcrops, areas of frost-shattered bedrock and till veneers may be present locally.		109

4.4 Permafrost Conditions

Frozen ground was encountered mostly in the poorly-drained areas dominated by till. The depth of the thaw zone at the time of the site visit varied from about 0.3 m to 0.7 m below the soil surface, and was typically 0.6 m to 0.7 m, or slightly deeper, in the poorly-drained tills. In areas where frozen ground was encountered it was not possible to excavate the frozen soil with hand tools. Consequently no samples were taken within the frozen ground.

Frozen ground occurred at depths of 0.6 m to 0.8 m in several of the hand-dug soil pits excavated in till in late July 2005. In many cases, during excavation of hand-dug pits, the overburden soils flowed into the excavation indicating saturated soil conditions. This resulted in difficulty in confirming the depth of frozen ground. Seepage was observed in most soil pits dug in tills in the meadow areas (e.g., Terrain Types 3 and 4) at depths of 0.5 m or less.

Indications of thermokarst terrain, normally associated with massive segregated ice, were generally not visible on the air photos, suggesting that segregated ice is not common along the road location. This interpretation could not be confirmed in the field because hand-dug soil pits could not be excavated into the frozen ground.

5.0 PERIGLACIAL PROCESSES

The features observed on the aerial photographs are typical of periglacial processes known to occur in permafrost terrain. The meaning and definition of the various geomorphic features and processes interpreted from the air photos follows the standard definitions given in Everdingen, 1998.

5.1 Observed Periglacial Geomorphology

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

1. Physical weathering of *in situ* materials
   - Frost shattering
   - Frost wedging
2. Freezing induced displacement of soils
   - Frost creep and creep of frozen ground
   - Frost heave (and cryoturbation in general)
   - Frost jacking
   - Frost sorting
3. Thaw-induced displacement of soils
   - Solifluction
   - Thaw consolidation leading to thaw settlement

The observed periglacial processes are typical of areas underlain by permafrost. The surface expression for these processes is subdued due to the relatively thin cover of surficial materials and the generally well-drained conditions in shallower materials.

5.2 Physical Weathering

Frost wedging and frost shattering occur on exposed bedrock and in coarse-grained block fields.

5.3 Freezing Induced Displacement

Evidence of cryoturbation of the morainal (M), frost shattered bedrock or felsenmeer (D) and organic soils (O) occurs in the form of patterned ground, primarily stone streams. These terrain features indicate that periglacial processes such as frost sorting, frost heave, frost jacking, and frost creep are acting on the surficial materials. These processes result in uplift perpendicular to the ground surface during freezing. During thaw, the uplifted material settles vertically leading to lateral displacement on sloped surfaces.

5.4 Thaw Induced Displacement

Possible evidence of solifluction of surficial materials, likely in till, was observed on the air photos in the form of subdued lobe-like features and weakly-developed stone stripes. The surficial materials will potentially be subject to some level of solifluction on sloping terrain and thaw settlement in low-lying areas adjacent to streams where ground ice may be present. The rate movement of material downslope should be slow due to a general lack of evidence of rapid mass movement (i.e., debris slides or debris flows). A cautionary note is that smaller landslides are difficult to see on 1:60,000 scale air photos.

Slope gradient and soil water conditions will control the magnitude and rate of downslope movement of surficial materials, either by solifluction or soil creep.

Thaw settlement was not discernable from the air photos, but is may occur to a limited extent along the route as small patches of weakly-patterned ground are present locally. Thaw consolidation leading to thaw settlement may occur following surface disturbance in areas where the soils and surficial materials are thicker (e.g. >2 m thick) and wetter (e.g. low-lying and near surface water). These areas are more prone to thaw settlement than drier, thinner soils.

5.5 Rapid Thaw Induced Displacement

Very limited evidence for rapid mass-movement of slopes through detachment failures or retrogressive thaw slumping was observed on the air photos. The likelihood of detachment failures and retrogressive thaw slumping within the project area is low.

5.6 Nivation

Nivation is an active process along the road location, and likely accelerates the general processes discussed above. There are frequent long, low bedrock scarps and non-vegetated linear depressions visible along the edges of many bedrock outcrops on the air photos. These features are easy to discern on the 1:10,000 scale colour air photos, but less so on the smaller-scale black and white air photos. However, similar features are expected to be present along the entire route. Some of the black and white air photos were taken early in the year when limited snow cover was still present in many areas. These photos show a number of long narrow strips of snow that likely cover nivation hollows. There appears to be preferential orientation of these features towards the southeast and southwest. That is, the long axes of these features trend northeast and northwest and are likely controlled local joint orientations. The road location should avoid these areas as they represent areas of increased, or prolonged, snow accumulation. Systematic mapping of nivation hollows is not feasible because of the small-scale of the black and white air photos.

6.0 STABILITY DISCUSSION

The terrain along the proposed road route does not show any obvious features or processes that preclude the development of the access road, provided appropriate permafrost engineering design methods that account for specific site conditions are used. However, where possible the road should be located on well-drained (dry), granular soils. Sites underlain by fine-grained, poorly-drained, ice-rich, frost-susceptible tills should be avoided where possible, as these soils may require significant ground treatment. There are one or two possible landslides adjacent to the northern portion of the route, but none were observed on the route itself.

Ratings (upper-case letters) ranging from low (L) to high (H) indicating the likelihood for thaw- and freezing-induced soil and rock displacement for each terrain type are listed in Appendix I, and maps depicting the distribution of these conditions are contained in Appendix IV.

The following table summarises the susceptibility of various terrain types identified in the mapping to periglacial processes.

Table 6.1: Susceptibility of Terrain to Periglacial Processes

Active Layer Process	Description	Susceptibility		
		Low	Moderate	High
Physical weathering of *in situ* materials	• Rockfall or Minor Rock Displacement • Frost Shattering • Frost Wedging	• Non-bedrock areas • Bedrock areas with slope gradients typically < 60% • Rubbly gravely beach ridges and veneers (gWrv)	• Bedrock areas with slope gradients typically > 60%	• Observed rockfall areas
Freezing-induced displacements of soils	• Frost Creep • Frost Jacking • Cryoturbation	• Felsenmeer (rD_b) • Bedrock (R) • Flat, thin till veneers or organic veneers • Rubbly gravely beach ridges and veneers (gWrv)	• Similar terrain as “High” but no sign of lateral movement	• Thick till or organics (M_w, M_b, O_w, O_b) • Terrain showing signs of lateral movement (e.g. solifluction lobes) • Patterned ground
Thaw-induced displacements of soils	• Thaw Settlement • Thaw Slumping	• Felsenmeer (rD_b) • Bedrock (R) • Flat, thin till veneers or organic veneers • Rubbly-gravely beach ridges and veneers (gWrv)	• Thin till or organics (M_x, M_v, O_x, O_v)	• Thick till or organics (M_w, M_b, O_w, O_b) • Polygons including obvious patterned ground • Settlement, slopes typically <10% gradient • Slumping, slopes typically >10% gradient

Some of the identified ground conditions will require conventional cold climate, or permafrost, engineering practices to be used. These areas are identified in Appendix I as having either a High (H), Moderate (M), or Low (L) likelihood of requiring specific permafrost design considerations and construction methods. The following table summarises general engineering and construction methods to consider during the detailed design phase and to be used during the construction phase to manage ground stability in permafrost terrain.

Table 6.2: Engineering and Construction Methods Based on Sensitivity to Freeze/Thaw Induced Displacements

Sensitivity to Ground Disturbance	Facility Type	Engineering/Construction Methods Based on Sensitivity to Ground Disturbance
Sensitive to Settlement or Heave	Bridge abutments, heated structures, water retaining structures, fuel storage tanks, machine foundations, and cut slopes. Structures will likely include modular units on grade supported foundations or skids.	Appropriate engineering design: • Excavate ice rich soils; • Excavate to bedrock; • Use thaw stable fills; • Manage drainage; • Fill to preserve permafrost; • Insulate/Ventilate/Refrigerate; • Realign/Relocate if necessary; and • Flatten cut slopes.
Moderately Sensitive to Settlement or Heave	Ditches, cut slopes, building pads, explosives, and storage pads.	Appropriate engineering design: • Excavate ice rich soils as required, or accept slight increase in annual maintenance associated with controlled subsidence; • Use thaw stable fills; • Manage drainage; • Fill to preserve permafrost; • Insulate; and • Realign/Relocate if necessary.
Insensitive to Settlement or Heave	Site roads, soil stockpiles, and dry freight storage areas.	Appropriate engineering design: • Fill to preserve permafrost; • Use thaw stable fills where possible; • Annual maintenance; • Control drainage; and • Insulate where possible.

Additional field inspection may be necessary to assess specific, poorly-drained areas (i.e., till deposits), and to assess local variations in permafrost conditions.

7.0 RECOMMENDATIONS

Based on the results of the air photo overview and of the current field studies and mapping traverses, it is desirable, from a geotechnical perspective, to locate the road alignment along well-drained mid- to upper- slope areas, which are underlain by angular fragments of frost-shattered bedrock or bedrock and thin, discontinuous veneers of till (e.g., Terrain Types 1 and 2). Areas underlain by granite will be somewhat less suitable as bedrock outcrops tend to be more extensive and more pronounced than in areas underlain by volcanic and meta-sedimentary rocks. Areas of deeper till, unless well-drained, will provide a less suitable base, and will need to be covered with other materials to provide a suitable road subgrade. Granular marine deposits extend 200 m to 300 m up-slope from the shoreline of Baker Lake in localised areas, but do not appear to occur further north except in small isolated areas. These granular deposits are uniformly coarse, ranging from well-graded, sandy gravel to sand and gravel with a trace of silt and clay. These materials are considered to be excellent for at-grade support of a road bed, provided that the thickness of these materials is greater than the depth of annual thaw, and they are not underlain by frost susceptible soils within the active layer.

The spatial variability and thickness of coarse rubbly frost shattered bedrock materials is currently unknown. In some areas, these materials may form a veneer (<1 m) or a blanket (>1 m) overlying bedrock. It is unlikely that significant treatment, such as stripping and removal of frost-susceptible soils and replacement with clean granular fill, will be required in areas of frost-shattered bedrock, although local areas requiring specific treatment may be encountered.

7.1 General Geotechnical Comments

If the frost shattered bedrock deposits are determined to be shallow in thickness, bedrock may be exposed during road construction. There is little indication of significant quantities of marine gravels or glaciofluvial gravels that will be suitable for road construction. In all likelihood pit run shot rock and/or crushed rock will need to be used for subgrade and road surfacing in both areas dominated by bedrock outcrops and in areas mantled with till or weathered bedrock.

It will be desirable to construct the road during frozen active layer conditions. Areas of potential ground ice, high moisture content, and thaw susceptible soils should be padded over with a free-draining granular sub-grade to a depth of at least 1.5 m to insulate the frozen ground from thaw.

Additional comments and recommendations will be made during the design phase of the project, and will be based on the field mapping and sampling, and geophysical surveys carried out along the route.

7.2 Subgrade Preparation

As with any road, subgrade preparation may include, but not be limited to, the following activities:

- Management of surface water;
- Tundra vegetation removal;
- Ice, snow, and frozen soil removal;
- Stripping of organic material;
- Excavation of thick peat deposits; and
- Excavation of loose mineral soils, cobbles, and boulders.

The details for these tasks will be developed during detailed road design and will depend on the level of serviceability, desired construction schedule, and the plans for any infrastructure that will be associated with the road.

8.0 SUMMARY AND CONCLUSIONS

The air photo mapping study indicates the route location to be generally underlain by:

- Extensive areas of mineral soils possibly less than 2-m thick, of poorly-drained, frost-susceptible till overlying frost shattered bedrock; and
- Extensive areas of fresh- to slightly-frost shattered bedrock outcrops and associated frost-shattered bedrock fragments (felsenmeer).

The till is comprised of a matrix of fine-grained soil with coarse sub-angular- to sub-rounded-gravel, cobble, and boulder particles and is likely frost-susceptible. Areas underlain by fine-grained till may require treatment in preparation for the subgrade. It will be desirable to build over the fine-grained till when it is frozen.

The marine deposits where present should be granular, and moderately- to well-drained, and consequently are considered to be thaw-stable. These deposits would provide excellent material for road construction. However, these deposits appear to be limited to the Baker Lake area itself.

The presence of local glaciofluvial deposits along the route was noted. However, these are generally thin deposits of limited lateral extent, and are not of sufficient quantity or regularity to rely on for thaw-stable aggregate material.

Regional scale geology maps indicate the bedrock along the access road route to be of igneous, metamorphic, volcanic, and sedimentary origin. Individual bedrock types tend to extend over considerable distances spatially. A series of quarry sites will need to be developed along the route alignment at efficient haul distances to allow construction of the road using suitable fill materials.

9.0 CLOSING REMARKS

We trust this information is sufficient. Should you require additional information, please do not hesitate to contact us.

GOLDER ASSOCIATES LTD.

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Senior Geoscientist

Karine Doucet, E.I.T.
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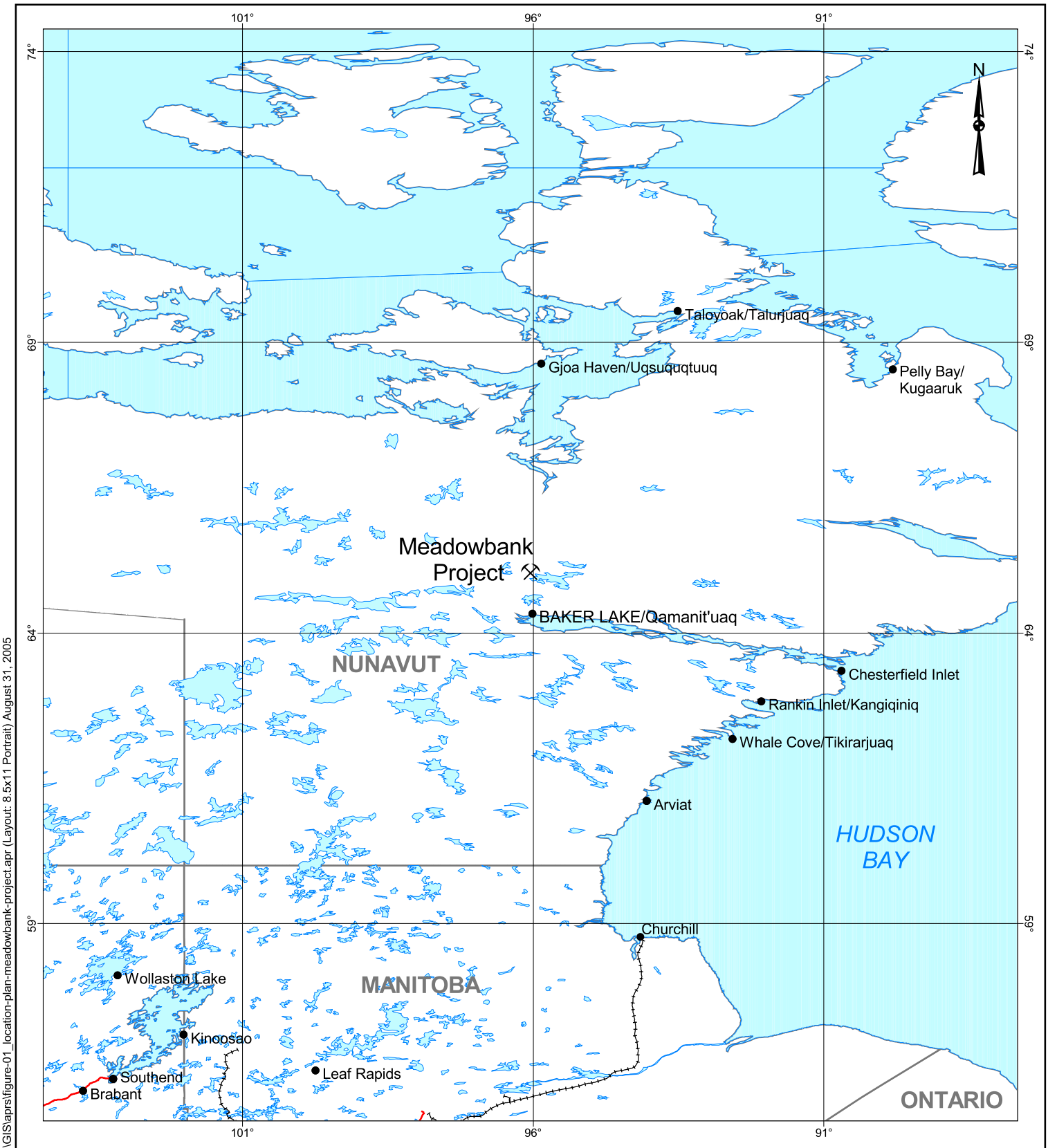

LEGEND

- Meadowbank Project
- Town/Village
- Provincial Border
- Water
- Primary Highway
- Railroad

200 0 200 Kilometres

Scale - 1:10,000,000

REFERENCE

Base digital data obtained from ESRI Inc.,
DATUM: WGS84 PROJECTION: Geographic

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

LOCATION PLAN
MEADOWBANK PROJECT

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	CJC	31 Aug. 2005		
GIS	CDB	31 Aug. 2005		
CHECK	CJC	31 Aug. 2005		
REVIEW				

FIGURE 1

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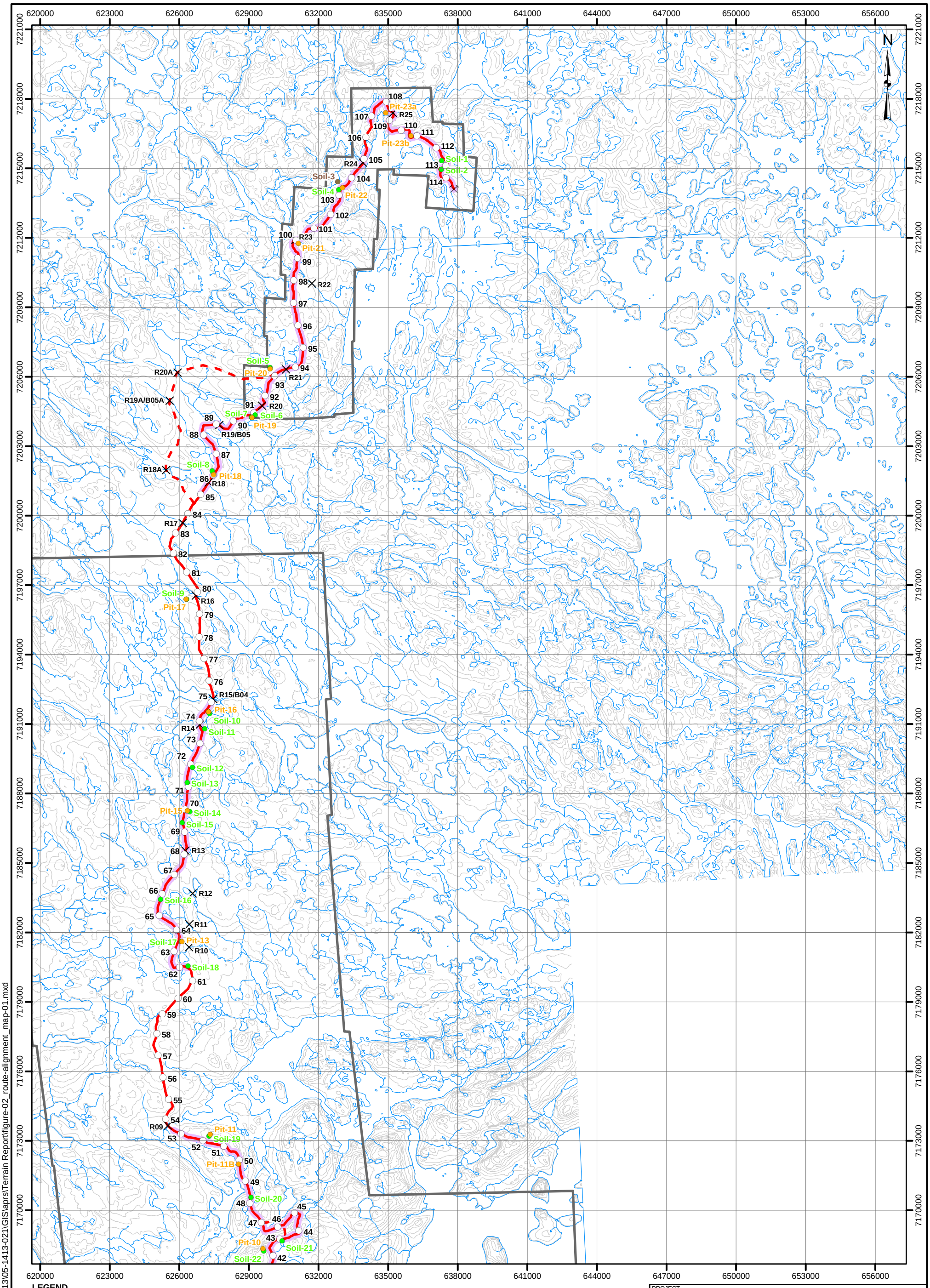
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R17
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R18A
R19/B05
R19A/B05A
R20
R20A
R21
R22
R23
R24
R25
LEGEND
Meadowbank Project
Approximate Location of Potential Rock Quarry Site
Approximate Location of Hand-Dug Soil Pit
Approximate Location of Glaciofluvial Gravel Deposit
Kilometre Marker
Proposed Route
Proposed Alternate Route
Foot Traverse
Stream Crossing
Airphoto Coverage
Watercourse
Waterbody
Contour (10 m interval)
REFERENCE
Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14
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Metres
Scale - 1:150,000
PROJECT
CUMBERLAND RESOURCES LTD.
TITLE
ROUTE ALIGNMENT AND SOIL AND ROCK SAMPLING SITES
1:150,000 Mapsheet 1 of 2
Golder Associates
Burnaby, B.C.
PROJECT No. 05-1413-021
SCALE AS SHOWN
REV. 0
DESIGN KD 31 Aug. 2005
GIS CDB 31 Aug. 2005
CHECK CJC 31 Aug. 2005
REVIEW
FIGURE 2
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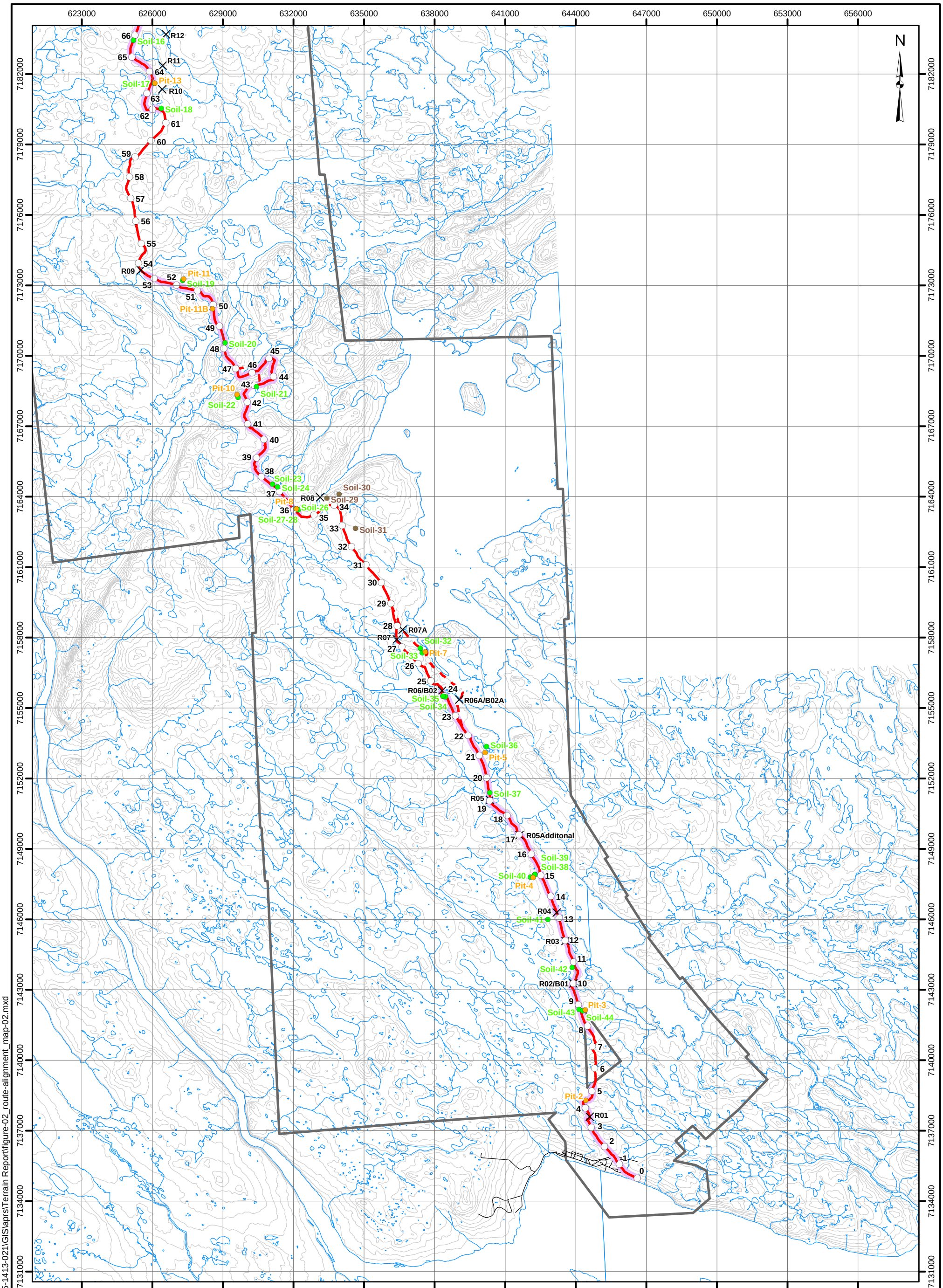

LEGEND

- Meadowbank Project
- Approximate Location of Potential Rock Quarry Site
- Approximate Location of Hand-Dug Soil Pit
- Approximate Location of Glaciofluvial Gravel Deposit
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- Airphoto Coverage
- Watercourse
- Waterbody
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.

Datum: NAD 83 Projection: UTM Zone 14

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Scale - 1:150,000

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

ROUTE ALIGNMENT AND
SOIL AND ROCK SAMPLING SITES
1:150,000 Mapsheet 2 of 2

Golder Associates
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PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	KD	31 Aug. 2005	FIGURE 2	
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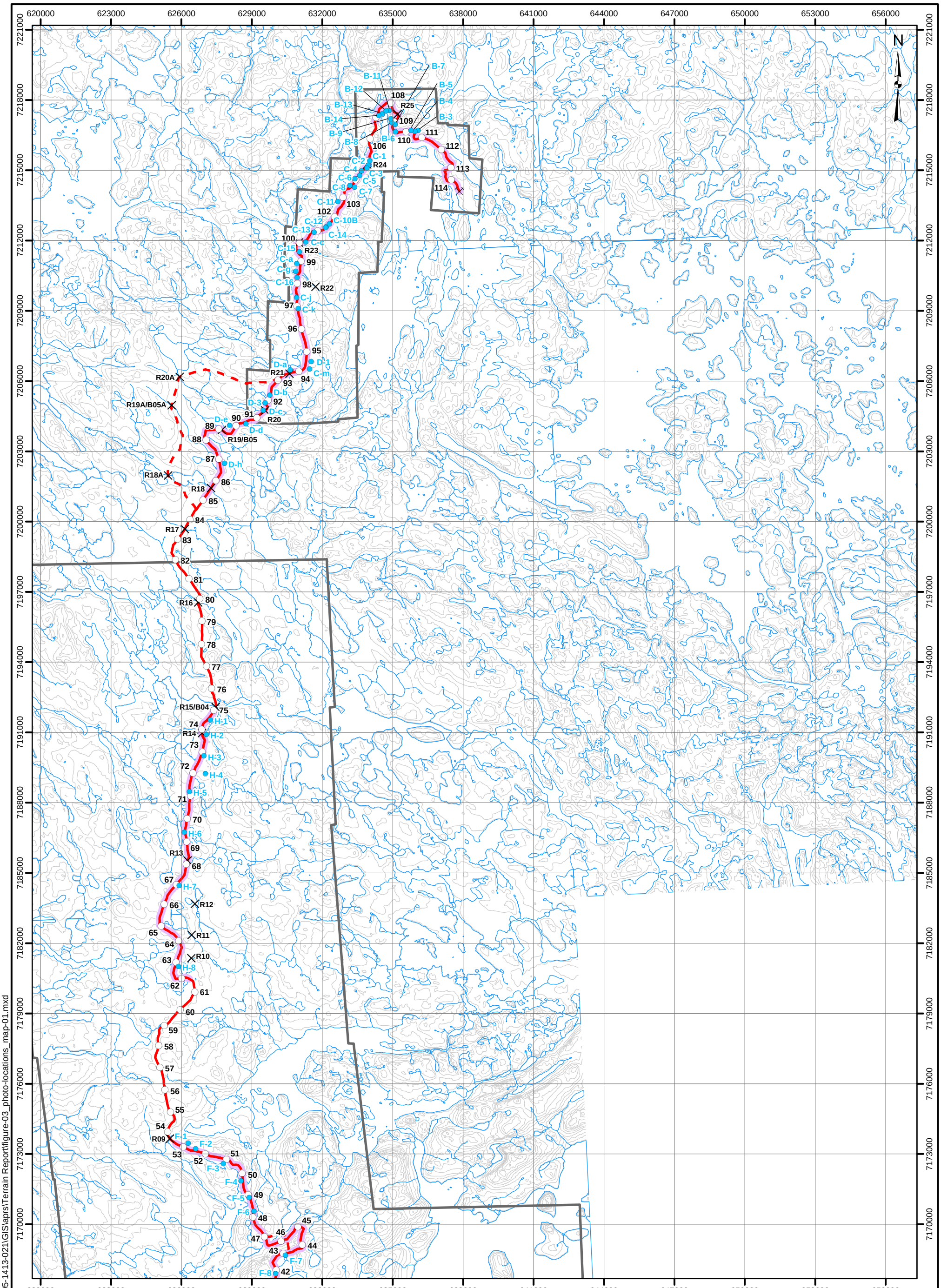

LEGEND

- Meadowbank Project
- Approximate Location of Terrain Assessment Viewpoint
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- Airphoto Coverage
- Watercourse
- Waterbody
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

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Scale - 1:150,000

PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
PHOTO LOCATIONS
1:150,000 Mapsheet 1 of 2

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	KD	31 Aug. 2005	FIGURE 3	
GIS	CDB	31 Aug. 2005		
CHECK	CJC	31 Aug. 2005		
REVIEW				

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APPENDIX I

GEOMORPHOLOGY AND SOILS POLYGON DATA

Polygon Number	Terrain Type	Soil Description	Ground Ice Conditions/ Soil Drainage	Typical Active Layer Processes	Thaw Stability	Freezing Stability	Frozen Stability	Potential Need for Permafrost Design and Construction Methods	Hazard for thaw and/or freezing induced displacement[1]/ Aggregate Suitability
0	Dbv	Veneers and blankets of frost-shattered bedrock and occasionally minor till veneers or minor bedrock outcrops.	Limited/ Well-drained to imperfectly-drained, occasional small ponds.	Frost Shattering Frost Wedging Some areas represent nivation hollows alongside bedrock outcrops where snow may persist late in the season.	Stable to Minor Instability.	Stable to Minor Instability.	Stable	L	L-M/ Adequate with bedrock likely at shallow depths.
1	Dbv/Mv/R	Limited bedrock outcrops with veneers of frost shattered bedrock and localised till veneers.	Limited/ Well- drained	Frost Shattering/ Frost Wedging	Stable to Minor Instability.	Stable to Minor Instability.	Stable	L	L/ Bedrock at, or near, surface.
2	Dbv/Mv/R	Very minor bedrock outcrops, dominated by areas of frost shattered bedrock and discontiunous till veneers.	Limited/ Generally well-drained, occasionally localised areas of imperfectly- to poorly-drained soils.	Frost Shattering/ Frost Wedging.	Stable to Minor Instability.	Stable to Minor Instability.	Stable	L	L/ Bedrock at, or near, surface.
3	Mb/Mv/Dbv	Blankets and veneers of till and locally with frost shattered bedrock occasionally with very minor bedrock outcrops or organic veneers.	Likely present/ Imperfectly-drained to poorly-drained, very occasional small, shallow ponds.	Frost Creep; Frost Heave; Frost Sorting; Frost Jacking Solifluction; and Thaw Settlement.	Thaw settlement likely under loading, minor solifluction.	Frost heave will result in uplift of ground surface.	Frost creep may occur under loading.	M-H	M/ Poor

[1] Note that the hazard ratings for thaw- and freezing-induced displacement are generalised interpretations. Conditions may vary substantively across map units. For example, bedrock dominated areas containing areas of frost shattered bedrock or till are classified as a low hazard, but may contain localised areas with a moderate- or high-displacement hazard.

Polygon Number	Terrain Type	Soil Description	Ground Ice Conditions/ Soil Drainage	Typical Active Layer Processes	Thaw Stability	Freezing Stability	Frozen Stability	Potential Need for Permafrost Design and Construction Methods	Hazard for thaw and/or freezing induced displacement[1]/ Aggregate Suitability
4	Mb/Mv/Ov -XLS (soifluction may be present)	Blankets and veneers of till and occasionally very minor areas of frost shattered bedrock, shallow organic veneers in grassy areas. Indications of permafrost processes and/or seepage.	Likely present/ Poorly- to imperfectly-drained, small, shallow ponds in portions of the grassy areas.	Frost Creep; Frost Heave; Frost Sorting; Solifluction; and Thaw Settlement.	Limited solifluction; Thaw Settlement possible with loading.	Frost heave will result in uplift of ground surface.	Frost creep may occur under loading.	M-H	M-H/ Poor
5 5-F	Cbv -F = failing	Blankets and/or veneers of morainal and colluvial materials and/or slope wash (fluvial) materials.	Likely present/ Imperfectly-drained	Solifluction; Frost Shattering; Frost Wedging; Rockfall; and Thaw Settlement.	Minor solifluction; Thaw Settlement possible.	Minor heave and uplift at ground surface Minor frost-shattering of coarse clastics.	Frost creep may occur under loading.	M	M-H/ Poor
6	Mbv/Ov (-LSX) (soilfluction may be present)	Till and/occasionally very minor frost shattered bedrock mantles with organic veneers. Seepage, small shallow ponds, and/or small surface stream channels. Limited fluvial sediments (sands or gravel) may be present. Indications of permafrost processes.	Likely present/ Poorly- to very poorly-drained.	Frost Creep; Frost Heave; Frost Sorting; Solifluction; and Thaw Settlement.	Minor solifluction Thaw Settlement possible.	Minor heave and uplift at ground surface.	Frost creep may occur under loading.	M-H	H/ Poor

[1] Note that the hazard ratings for thaw- and freezing-induced displacement are generalised interpretations. Conditions may vary substantively across map units. For example, bedrock dominated areas containing areas of frost shattered bedrock or till are classified as a low hazard, but may contain localised areas with a moderate- or high-displacement hazard.

Polygon Number	Terrain Type	Soil Description	Ground Ice Conditions/ Soil Drainage	Typical Active Layer Processes	Thaw Stability	Freezing Stability	Frozen Stability	Potential Need for Permafrost Design and Construction Methods	Hazard for thaw and/or freezing induced displacement[1]/ Aggregate Suitability
7	Mbv/Ov -VX	Mantels of till and shallow organic veneers with gullies or incised stream channels. Very minor areas of weathered bedrock, fluvial deposits, or organics may be present.	Likely present/ Imperfectly- to poorly-drained.	Frost Creep; Frost Heave; Frost Sorting; Solifluction; and Thaw Settlement	Limited solifluction and thaw settlement possible with loading.	Frost heave will result in uplift of ground surface	Frost creep may occur under loading	M-H	M-H/ Poor
8	Mbv/Dv	Blankets and/or veneers of morainal materials. Likely contains some frost shattered bedrock.	Likely present/ Imperfectly- to poorly-drained.	Solifluction; Frost Shattering; Frost Wedging; Rockfall; and Thaw Settlement.	Minor solifluction and thaw settlement possible.	Minor heave and uplift at ground surface Minor frost shattering of coarse clastics	Frost creep may occur under loading.	M	M-H/ Poor
9	Obv-X	Blankets and/or veneers of organic materials generally overlying till and occasionally frost shattered bedrock.	Likely present Possibility of excess ice/ Very poorly-drained to poorly-drained.	Frost Heave; Thaw Settlement.	Thaw settlement likely under loading Solifluction likely during thaw Possible flooding.	Frost heave will result in uplift of ground surface.	Frost creep may occur under loading.	H	H/ Very poor
10	gWrv over Mb (10a – gWrv with anthropogenic disturbance)	Relic beach deposits likely overlying till and/or frost shattered bedrock.	Limited/ Well-drained to imperfectly-drained.	Stable to minor instability.	Stable to minor instability Minor solifluction and thaw settlement possible.	Stable to minor instability Minor heave and uplift at ground surface.	Stable to minor instability Frost creep may occur under loading	M	L-M/ Adequate

[1] Note that the hazard ratings for thaw- and freezing-induced displacement are generalised interpretations. Conditions may vary substantively across map units. For example, bedrock dominated areas containing areas of frost shattered bedrock or till are classified as a low hazard, but may contain localised areas with a moderate- or high-displacement hazard.

Polygon Number	Terrain Type	Soil Description	Ground Ice Conditions/ Soil Drainage	Typical Active Layer Processes	Thaw Stab	Freezing Stability	Frozen Stability	Potential Need for Permafrost Design and Construction Methods	Hazard for thaw and/or freezing induced displacement[1]/ Aggregate Suitability
11	rDvx/Mvx/R	Veneers and blankets of frost shattered bedrock and till veneers with very minor bedrock outcrops.	Limited/ occasional small ponds Well-drained to imperfectly-drained,	Frost Shattering/ Frost Wedging	Stable to Minor Instability.	Stable to Minor Instability.	Stable	L	L-M/ Adequate to poor with bedrock likely at shallow depths

[1] Note that the hazard ratings for thaw- and freezing-induced displacement are generalised interpretations. Conditions may vary substantively across map units. For example, bedrock dominated areas containing areas of frost shattered bedrock or till are classified as a low hazard, but may contain localised areas with a moderate- or high-displacement hazard.

APPENDIX II

TERRAIN CODES

Legend of Geomorphology and Soils
(Howes & Kenk, 1997)

TEXTURE			
Symbol	**Name**	**Size (mm)**	**Other Characteristics**
a	blocks	>256	Angular particles.
b	boulders	>256	Rounded & sub-rounded particles.
k	cobble	64-256	Rounded & sub-rounded particles.
p	pebbles	2-64	Rounded & sub-rounded particles.
s	sand	2-.062	
z	silt	.062-.002	
c	clay	<.002	
d	mixed fragments	>2	Mix of rounded and angular particles.
g	gravel	>2	Mix of boulders, cobbles, and pebbles.
x	angular fragments	>2	Mix of rubble and blocks.
r	rubble	2-256	Angular particles.
m	mud	<.062	Mix of clay and silt.
y	shells	-	Shells or shell fragments.
e	fibric	Well-preserved fibre: (40%) identifies after rubbing.	
u	mesic	Intermediate decomposition between fibric and mesic.	
h	humic	Decomposed organic material; (10%) identified after rubbing.	

SURFICIAL MATERIALS			
Symbol	**Name**	**Assumed Status of Formative Process**	**Description**
A	anthropogenic	(A)	Man-made or man-modified material.
C	colluvial	(A)	Products of mass wastage.
D	weathered rock	(A)	*In situ* bedrock.
E	eolian	(I)	Materials deposited by wind action.
F	fluvial	(I)	River deposits.
F^G	Glacio-fluvial	(I)	Fluvial materials deposited by meltwater streams.
I	ice	(A)	Permanent snow; glaciers and icefields.
L	lacustrine	(I)	Lake sediments: includes littoral deposits.
L^G	glaciolacustrine	(I)	Sediments deposited in glacial lakes.
M	morainal	(I)	Material deposited directly by glaciers.
O	organic	(A)	Accumulation/decay of vegetative matter.
R	bedrock	(-)	Outcrops/rocks covered by less than 10 cm.
U	undifferentiated	(-)	Layered sequence of three materials or more.
V	volcanic	(I)	Unconsolidated pyroclastic sediments.
W	marine	(I)	Marine sediments: includes littoral deposits.
W^G	glaciomarine	(I)	Sediments of glacial origin deposited in a marine environment.

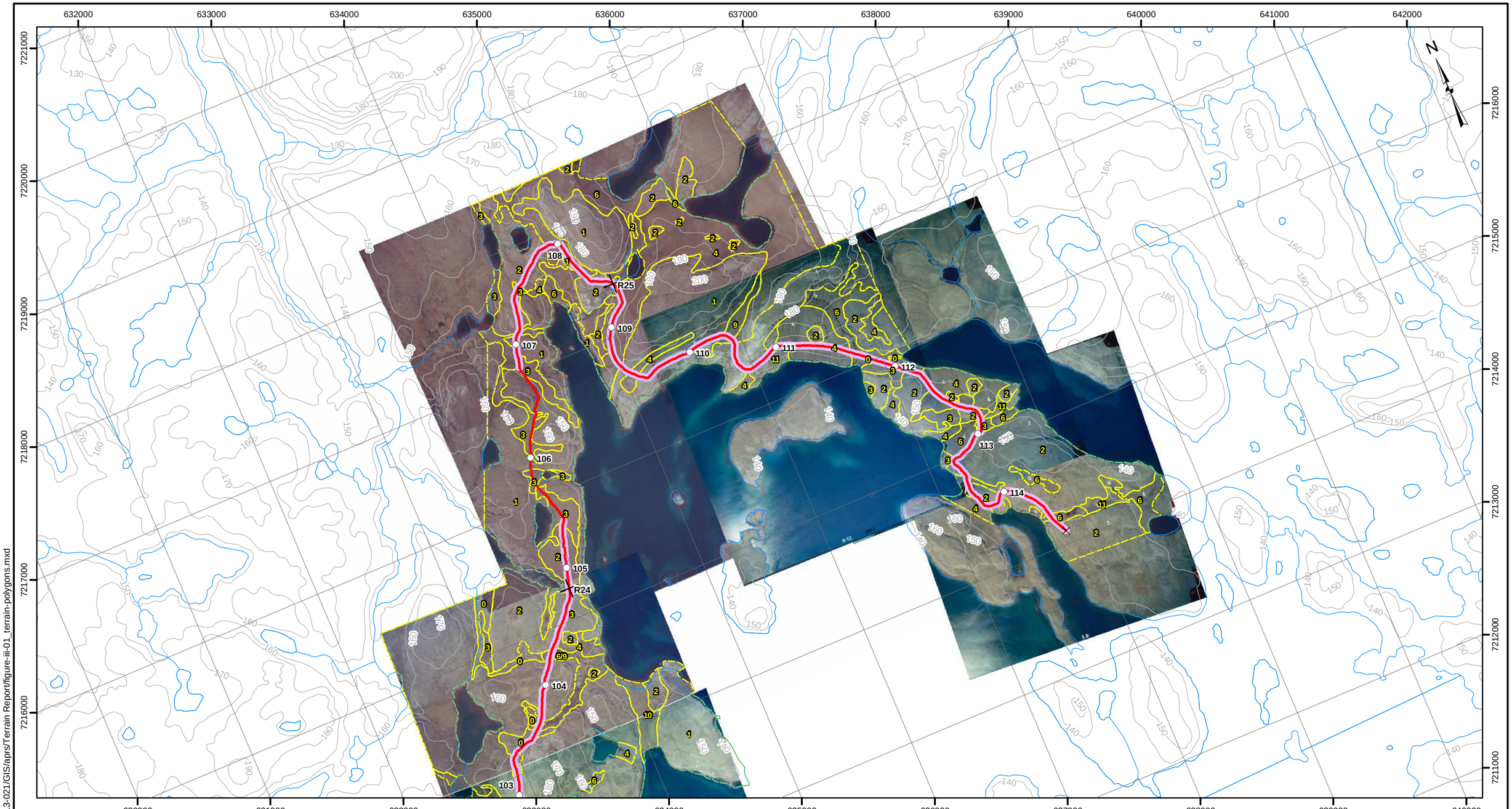
QUALIFIERS		
Symbol	**Name**	**Description**
G	glacial	Used to qualify surficial material where there is evidence that glacier ice affected the mode of deposition of material.
A	active	Used to qualify surficial material and geomorphological processes with regard to their current state of activity.
I	inactive	

SURFACE EXPRESSION		
Symbol	**Name**	**Description**
a	moderate slope	Unidirectional surface: 16 to 26°.
b	blanket	A mantle of unconsolidated materials: >1 m thick.
c	cone	A cone or sector of a cone: >15°.
d	depression	A sharply demarked hollow.
f	fan	A sector of a cone: up to 15°.
h	hummocky	Hillocks and hollows, irregular plan: 15 to 35°.
j	gentle slope	Unidirectional surface: 4 to 15°.
k	moderately steep	Unidirectional surface 27 to 35°.
m	rolling	Elongate hillocks: parallel in plan: 3 to 15°.
p	plain	Unidirectional surface: 0 to 3°.
r	ridged	Elongated hillocks: parallel in plan: 15 to 35°.
s	steep	Steep slopes: >35°.
t	terraced	Step like topography.
u	undulating	Hillocks and hollows: irregular in plan: 0 to 15°.
v	veneer	Mantle of unconsolidated material: 10 cm to 1 m thick.
w	mantle of variable thickness	Surficial material of variable thickness: (0 to about 3 m).
x	thin veneer	Similar to veneer (2 cm to 20 cm thick).

GEOMORPHOLOGICAL PROCESSES			
Symbol	**Name**	**Assumed Status of Formative Process**	**Description**
A	avalanches	(A)	Terrain modified by snow avalanches.
B	braiding	(A)	Diverging/converging channels: unvegetated bars.
C	cryoturbation	(A)	Sediments modified by frost heaving and churning.
D	deflation	(A)	Removal of sand and silt by wind action.
E	channelled	(I)	Channel formation by glacial meltwater.
F	slow mass movement	(A)	Slow down-slope movement of masses of cohesive or non-cohesive material and/or bedrock.
H	kettled	(I)	Depressions due to the melting of buried glacier ice.
I	irregular channel	(A)	A single, clearly defined main channel displaying irregular turns and bends.
J	anatomising channel	(A)	A channel zone where channels diverge and converge around vegetated islands.
K	karst	(A)	Processes associated with the solution of carbonates.
L	surface seepage	(A)	Abundant surface seepage.
M	meandering channels	(A)	Channels characterised by regular patterns of bends with uniformed amplitude and wave length.
N	nivation	(A)	Erosion beneath, and along, the margin of snow patches.
P	piping	(A)	Subterranean erosion by flowing water.
R	rapid mass movement	(A)	Rapid downslope movement of dry, moist or saturated debris.
S	solifluction	(A)	Slow downslope movement of saturated overburden across a frozen, or otherwise impermeable, substrate.
U	inundation	(A)	Seasonally under water due to high water table.
V	gully erosion	(A)	Parellel/subparallel ravines due to erosion by various processes.
W	washing	(A)	Removal of fines by waves and running water.
X	permafrost	(A)	Processes controlled by the presence of permafrost.
Z	periglacial processes	(A)	Solifluction, cryoturbation, and nivation processes occurring within a single unit.

APPENDIX III

TERRAIN CLASSIFICATION POLYGONS



LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Terrain Classification Polygon
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

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Metres
Scale - 1:30,000

PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
TERRAIN CLASSIFICATION POLYGONS
1:30,000 Mapsheet - 1 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	CJC	01 Sep. 2005	FIGURE III-1	
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

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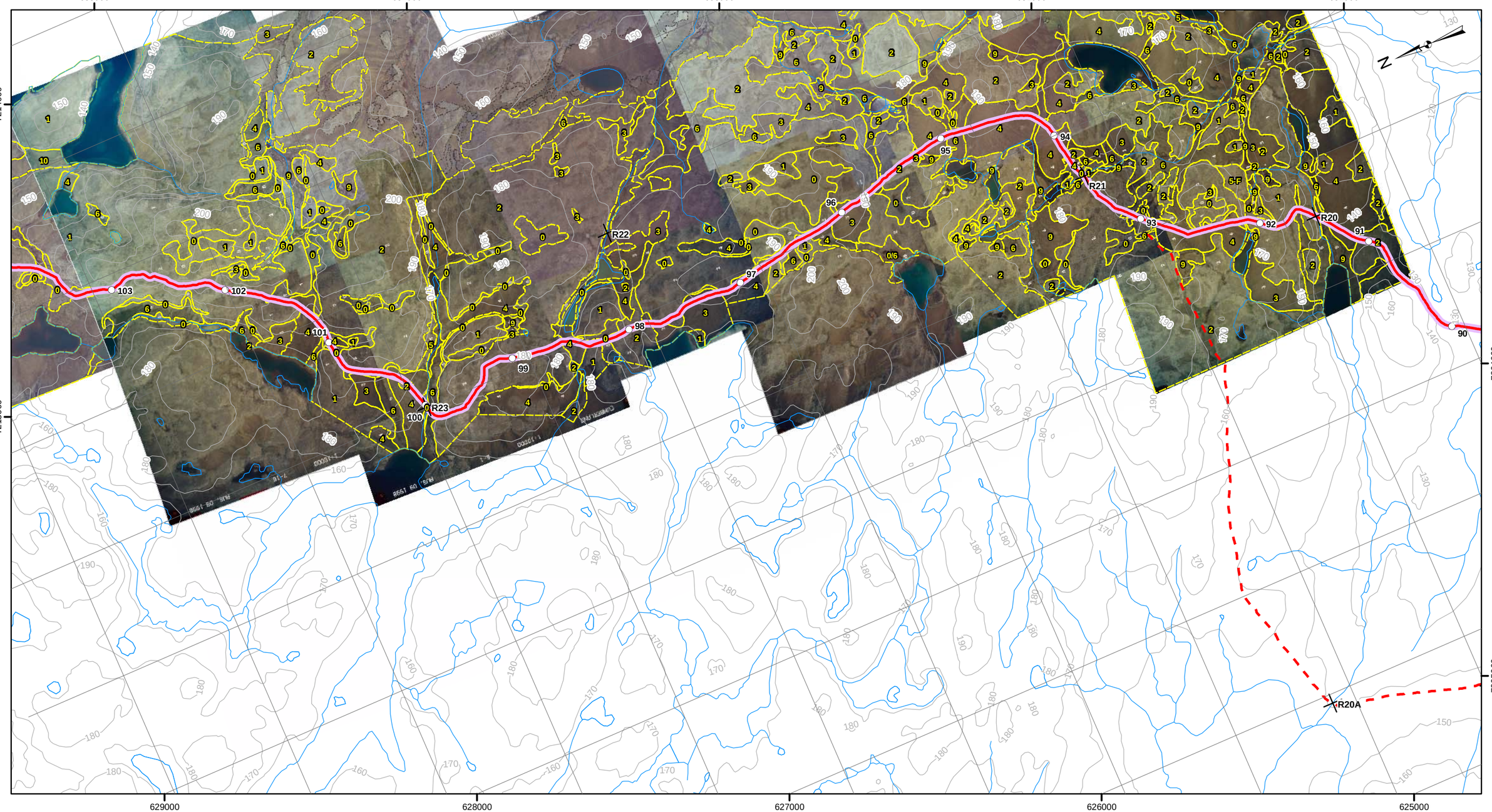

LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Terrain Classification Polygon
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

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PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
TERRAIN CLASSIFICATION POLYGONS
1:30,000 Mapsheet - 2 of 9

Golder Associates
Burnaby, B.C.

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REVIEW				

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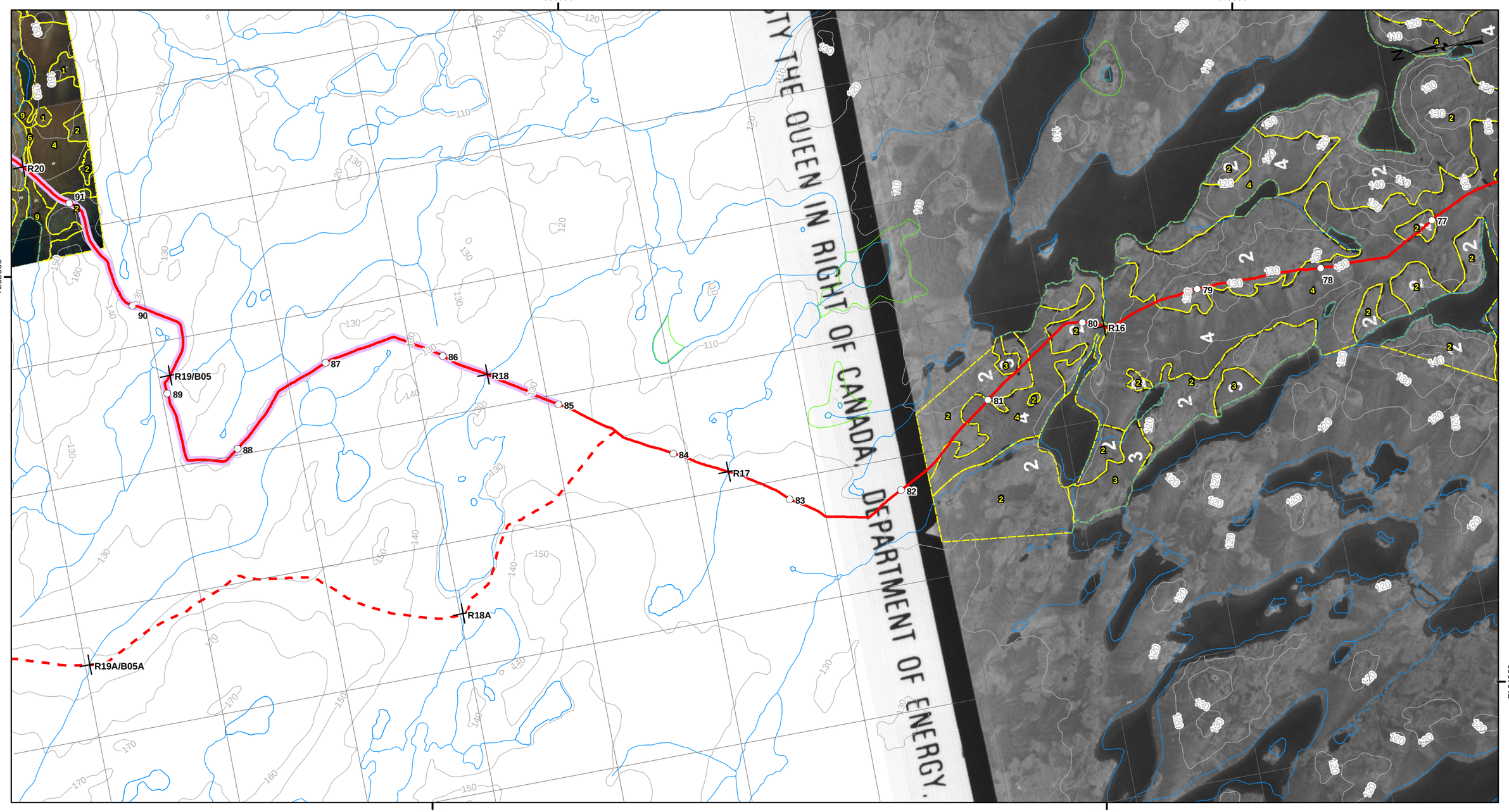

LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Terrain Classification Polygon
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

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Scale - 1:30,000

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

TERRAIN CLASSIFICATION POLYGONS
1:30,000 Mapsheet - 3 of 9

Golder Associates
Burnaby, B.C.

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CHECK	CJC	01 Sep. 2005		
REVIEW				

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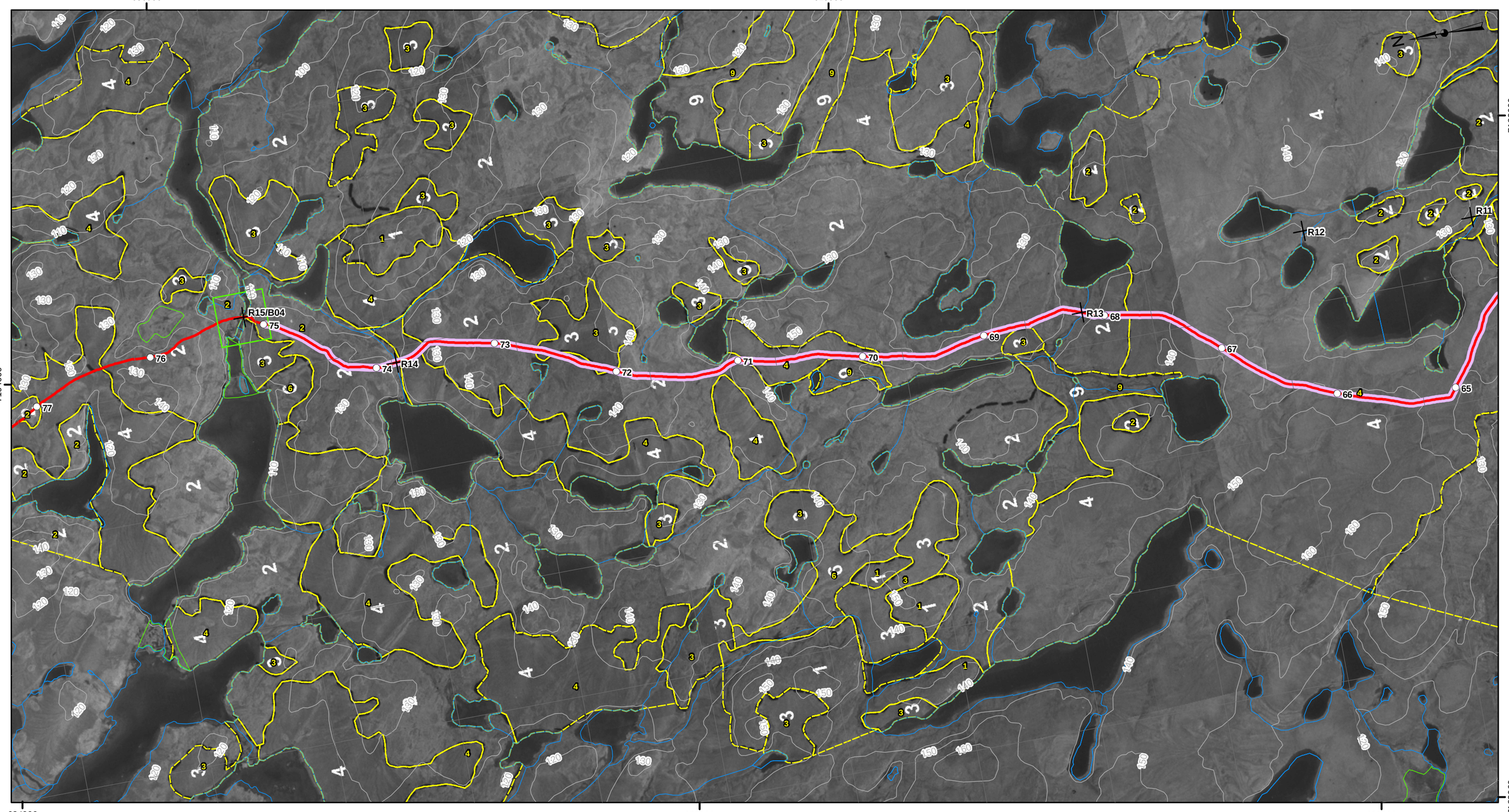

LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Terrain Classification Polygon
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

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Scale - 1:30,000

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

TERRAIN CLASSIFICATION POLYGONS
1:30,000 Mapsheet - 4 of 9

Golder Associates
Burnaby, B.C.

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R09 R10 R11

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LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Terrain Classification Polygon
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

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Metres
Scale - 1:30,000

PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
TERRAIN CLASSIFICATION POLYGONS
1:30,000 Mapsheet - 5 of 9

Golder Associates
Burnaby, B.C.

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R08

8-46

LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Terrain Classification Polygon
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

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Scale - 1:30,000

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

TERRAIN CLASSIFICATION POLYGONS
1:30,000 Mapsheet - 6 of 9

Golder Associates
Burnaby, B.C.

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R08 R07A R07 R06A/B02A R06/B02

34 33 32 31 30 29 28 27 26 25 24 23 36 35

N

LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Terrain Classification Polygon
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

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Scale - 1:30,000

PROJECT

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TITLE

TERRAIN CLASSIFICATION POLYGONS
1:30,000 Mapsheet - 7 of 9

Golder Associates
Burnaby, B.C.

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CHECK	CJC	01 Sep. 2005		
REVIEW				

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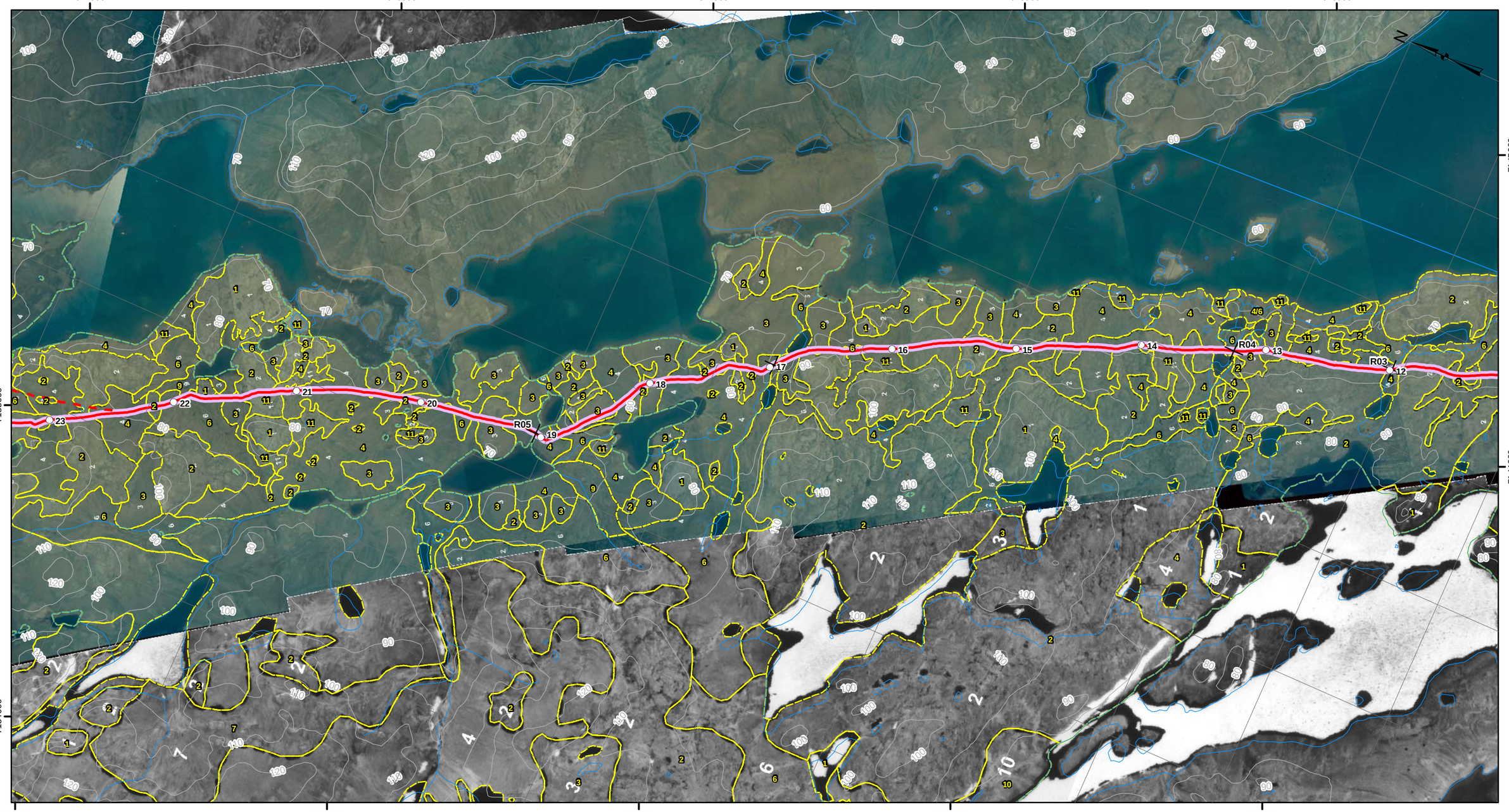

LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Terrain Classification Polygon
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

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PROJECT

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TITLE

TERRAIN CLASSIFICATION POLYGONS
1:30,000 Mapsheet - 8 of 9

Golder Associates
Burnaby, B.C.

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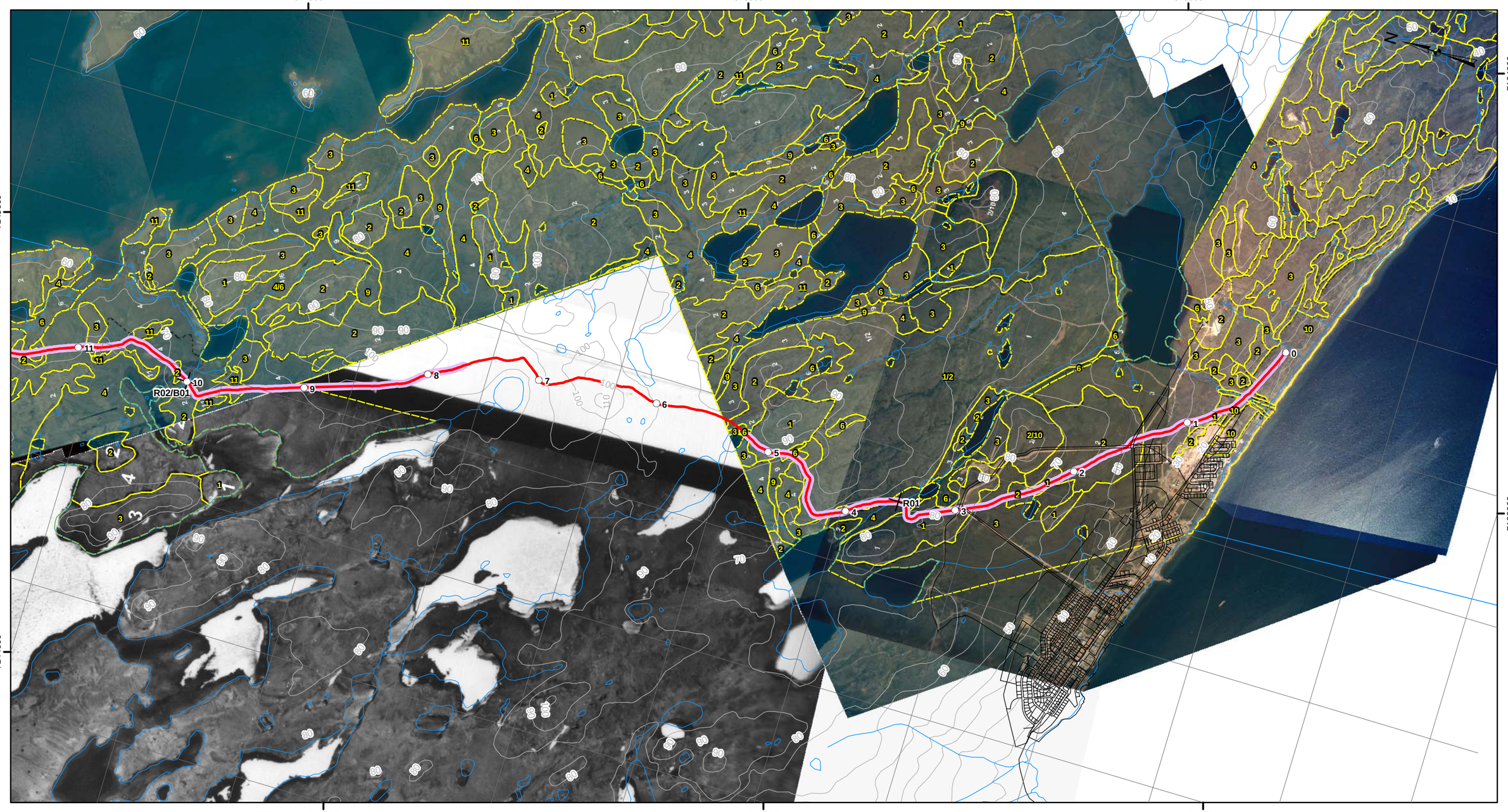

LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Terrain Classification Polygon
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

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Metres
Scale - 1:30,000

PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
TERRAIN CLASSIFICATION POLYGONS
1:30,000 Mapsheet - 9 of 9

Golder Associates
Burnaby, B.C.

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REVIEW				

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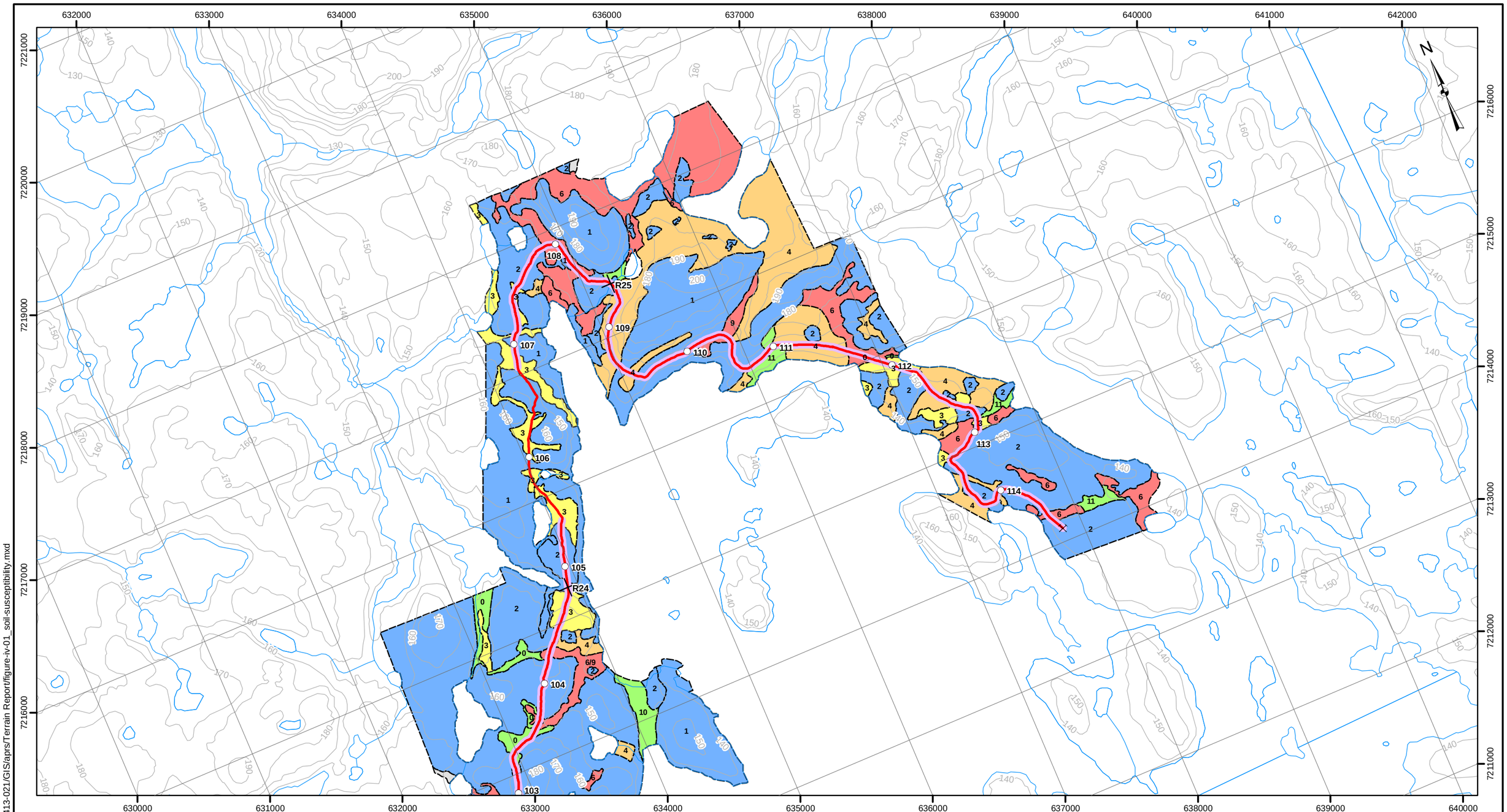
APPENDIX IV

SOIL SUSCEPTIBILITY TO PERIGLACIAL PROCESSES



LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

Thaw Susceptibility

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low
- Unclassified

600 300 0 600 Metres

Scale - 1:30,000

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

SOIL SUSCEPTIBILITY TO PERIGLACIAL PROCESSES
1:30,000 Mapsheet - 1 of 9

Golder Associates
Burnaby, B.C.

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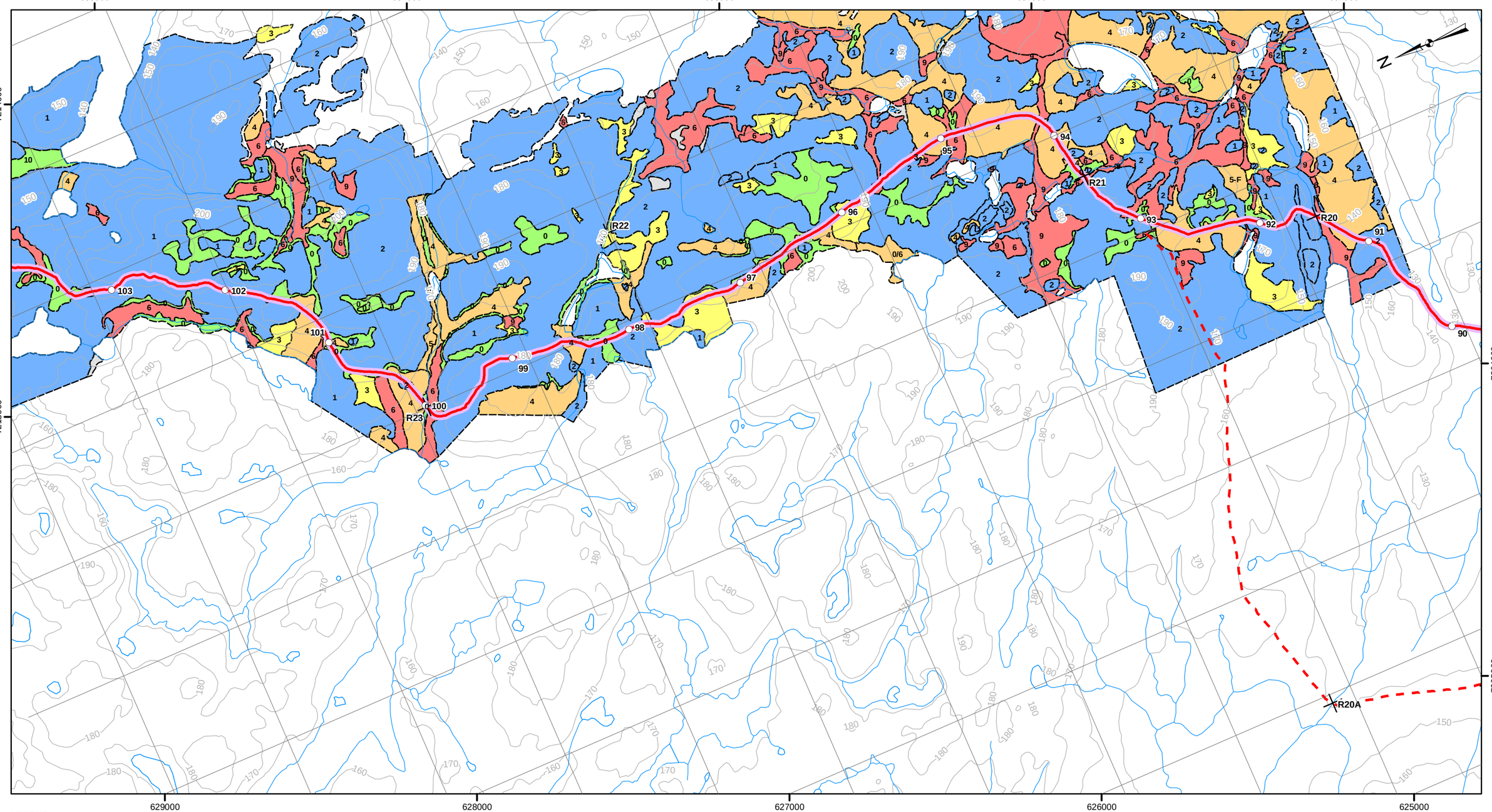


LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

Thaw Susceptibility

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low
- Unclassified

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600 Metres

Scale - 1:30,000

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

SOIL SUSCEPTIBILITY TO PERIGLACIAL PROCESSES
1:30,000 Mapsheet - 2 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	TR	01 Sep. 2005	FIGURE IV-2	
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-iv-02_soil-susceptibility.mxd

630000

629000

7205000

7194000

624000

623000

N

R20 91 90 R19/B05 89 88 87 86 R18 85 84 R17 83 82 R16 80 81 79 78 77 R18A R19A/B05A

LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

Thaw Susceptibility

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low
- Unclassified

600 300 0 600 Metres

Scale - 1:30,000

REFERENCE

Cumberland Resources Ltd.

Datum: NAD 83 Projection: UTM Zone 14

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

SOIL SUSCEPTIBILITY TO PERIGLACIAL PROCESSES

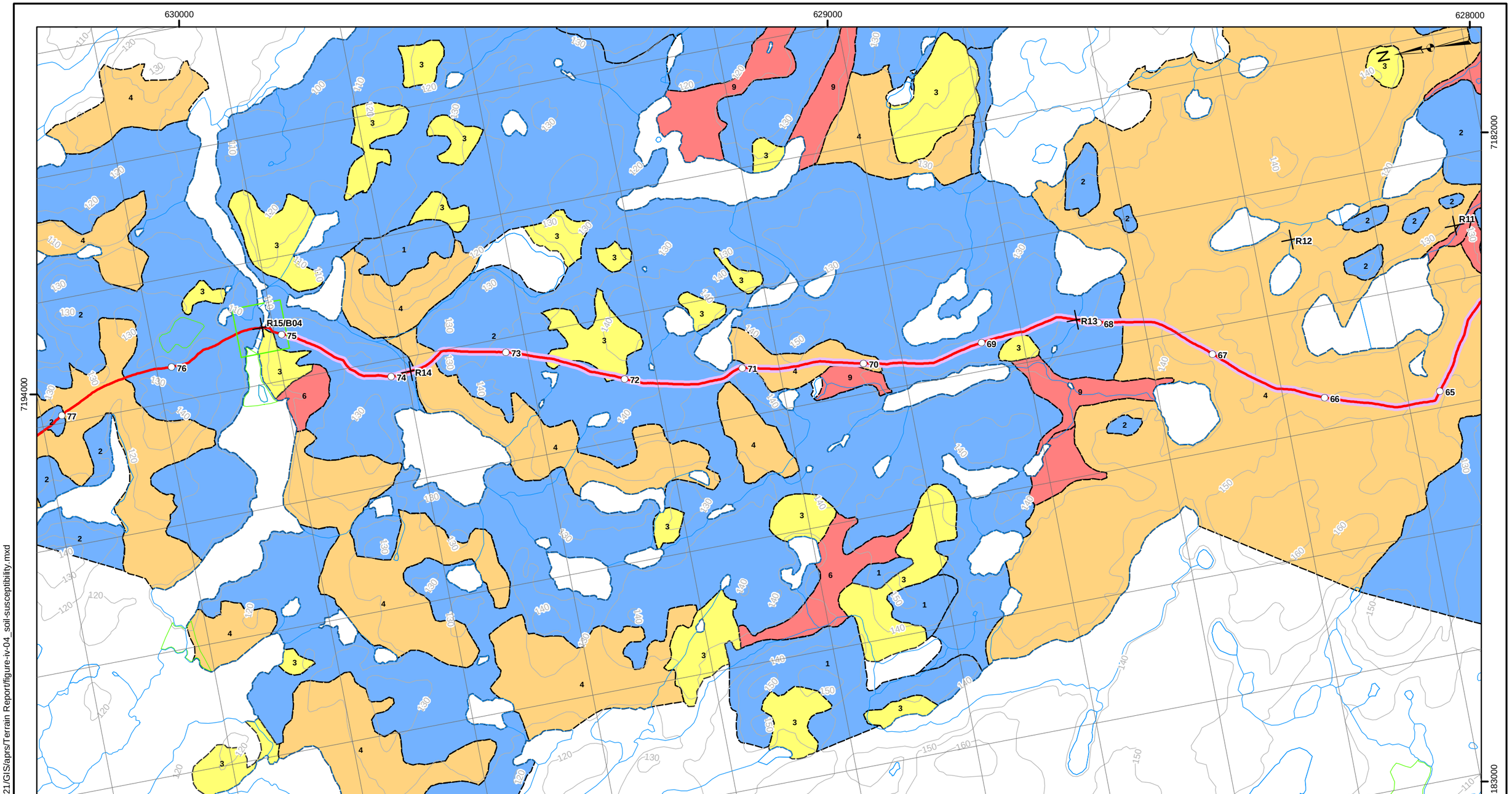
1:30,000 Mapsheet - 3 of 9

Golder Associates Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	TR	01 Sep. 2005		
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

FIGURE IV-3

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-iv-03_soil-susceptibility.mxd



LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

Thaw Susceptibility

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low
- Unclassified

600 300 0 600 Metres

Scale - 1:30,000

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

SOIL SUSCEPTIBILITY TO PERIGLACIAL PROCESSES
1:30,000 Mapsheet - 4 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	TR	01 Sep. 2005	FIGURE IV-4	
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-iv-04_soil-susceptibility.mxd

629000

628000

7171000

7183000

623000

622000

N

R09 R10 R11

51 52 53 54 55 56 57 58 59 60 61 62 63 64 65

LEGEND

Meadowbank Project	Road	Thaw Susceptibility
Kilometre Marker	Watercourse	High
Proposed Route	Waterbody	Moderate - High
Proposed Alternate Route	Wetland	Moderate
Foot Traverse	Sandbar	Low - Moderate
Stream Crossing	Contour (10 m interval)	Low
EM31/GPR Survey Location		Unclassified

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600 Metres

Scale - 1:30,000

PROJECT

CUMBERLAND RESOURCES LTD.

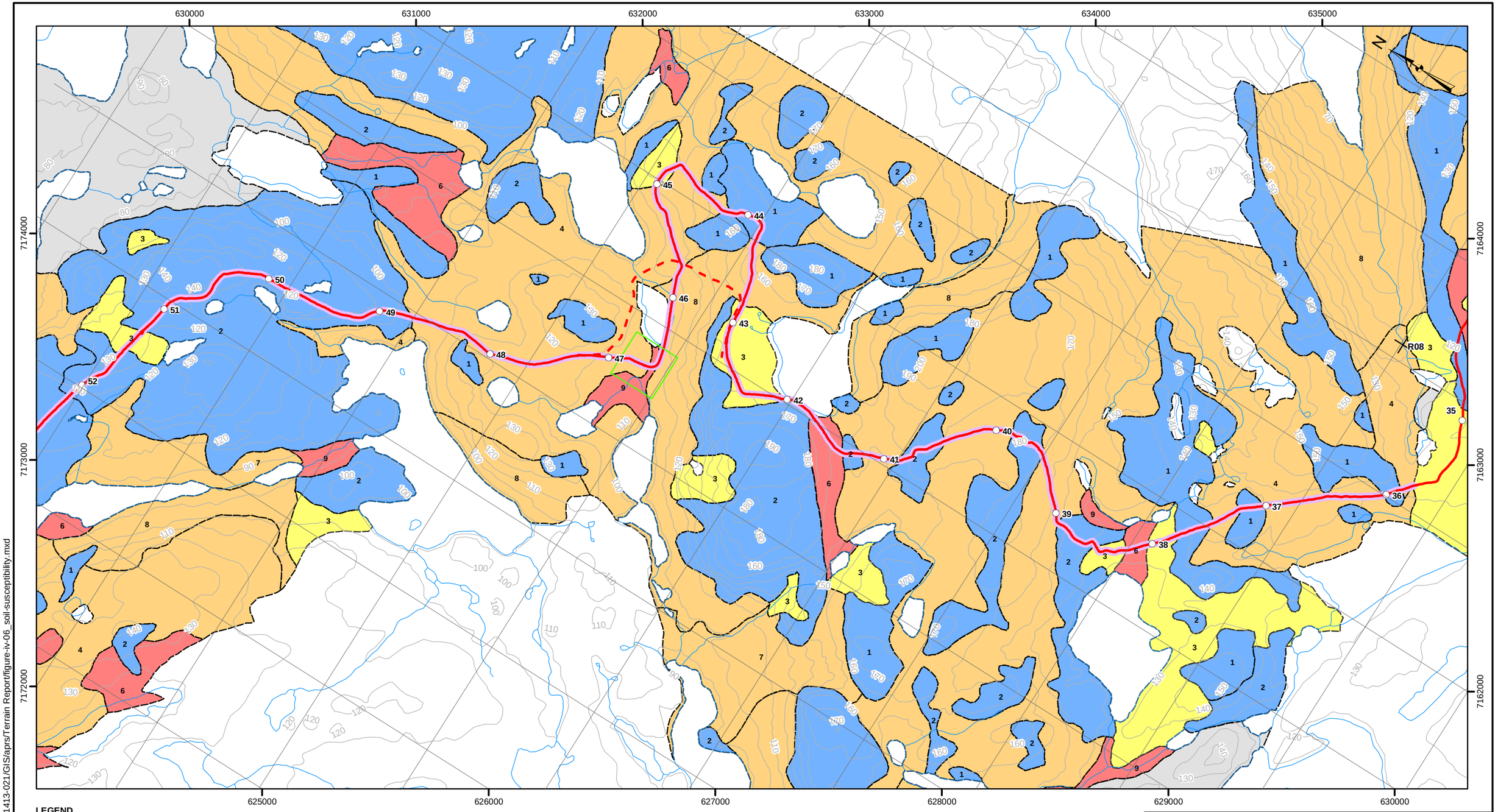
TITLE

SOIL SUSCEPTIBILITY TO PERIGLACIAL PROCESSES
1:30,000 Mapsheet - 5 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	TR	01 Sep. 2005	FIGURE IV-5	
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-iv-05_soil-susceptibility.mxd



LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

Thaw Susceptibility

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low
- Unclassified

600 300 0 600 Metres

Scale - 1:30,000

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

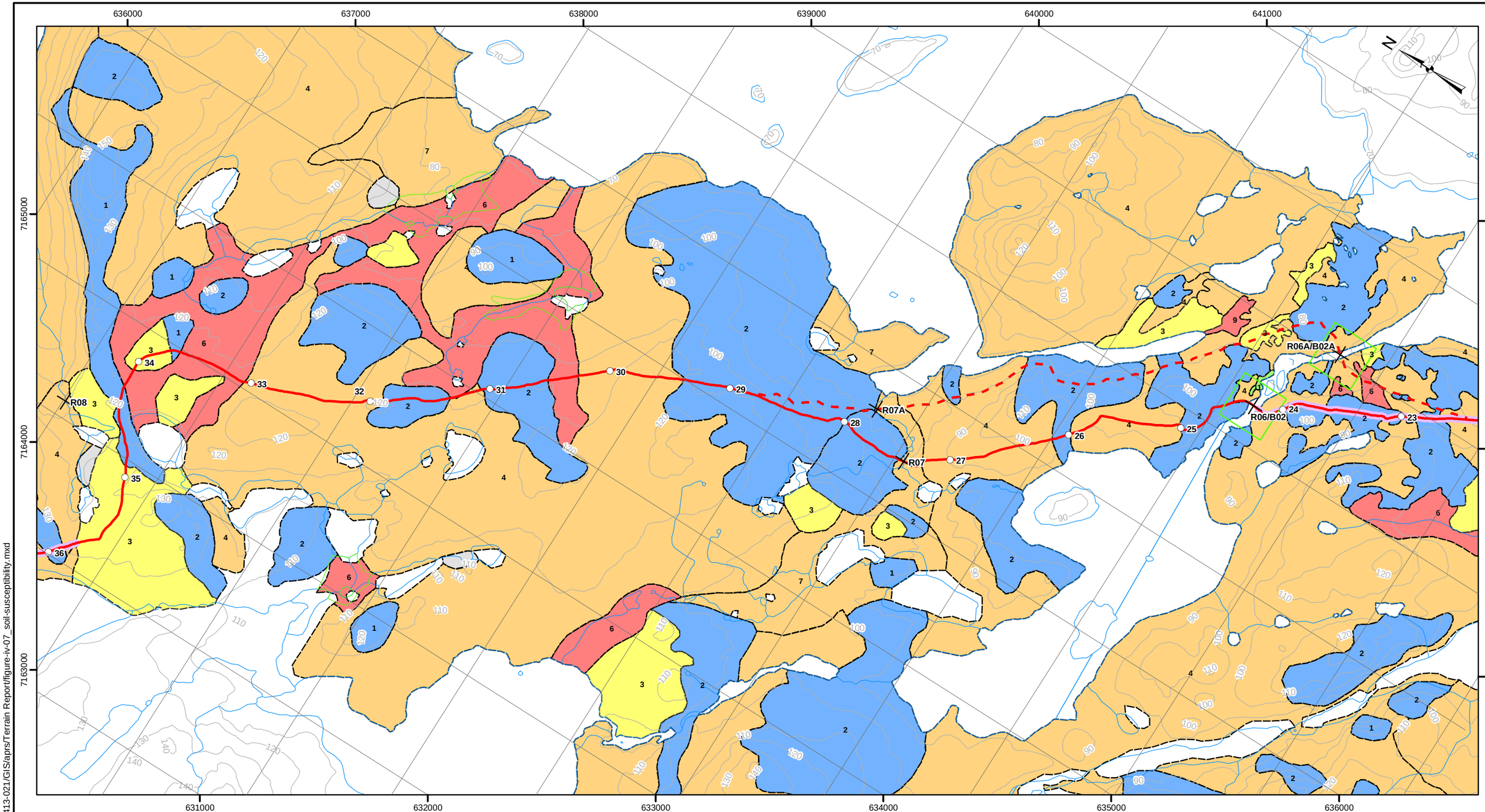
SOIL SUSCEPTIBILITY TO PERIGLACIAL PROCESSES
1:30,000 Mapsheet - 6 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	TR	01 Sep. 2005		
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

FIGURE IV-6

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-iv-06_soil-susceptibility.mxd



LEGEND

Meadowbank Project	Road	Thaw Susceptibility
Kilometre Marker	Watercourse	High
Proposed Route	Waterbody	Moderate - High
Proposed Alternate Route	Wetland	Moderate
Foot Traverse	Sandbar	Low - Moderate
Stream Crossing	Contour (10 m interval)	Low
EM31/GPR Survey Location		Unclassified

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600
Metres
Scale - 1:30,000

PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
SOIL SUSCEPTIBILITY TO PERIGLACIAL PROCESSES
1:30,000 Mapsheet - 7 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	TR	01 Sep. 2005	FIGURE IV-7	
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-iv-07_soil-susceptibility.mxd

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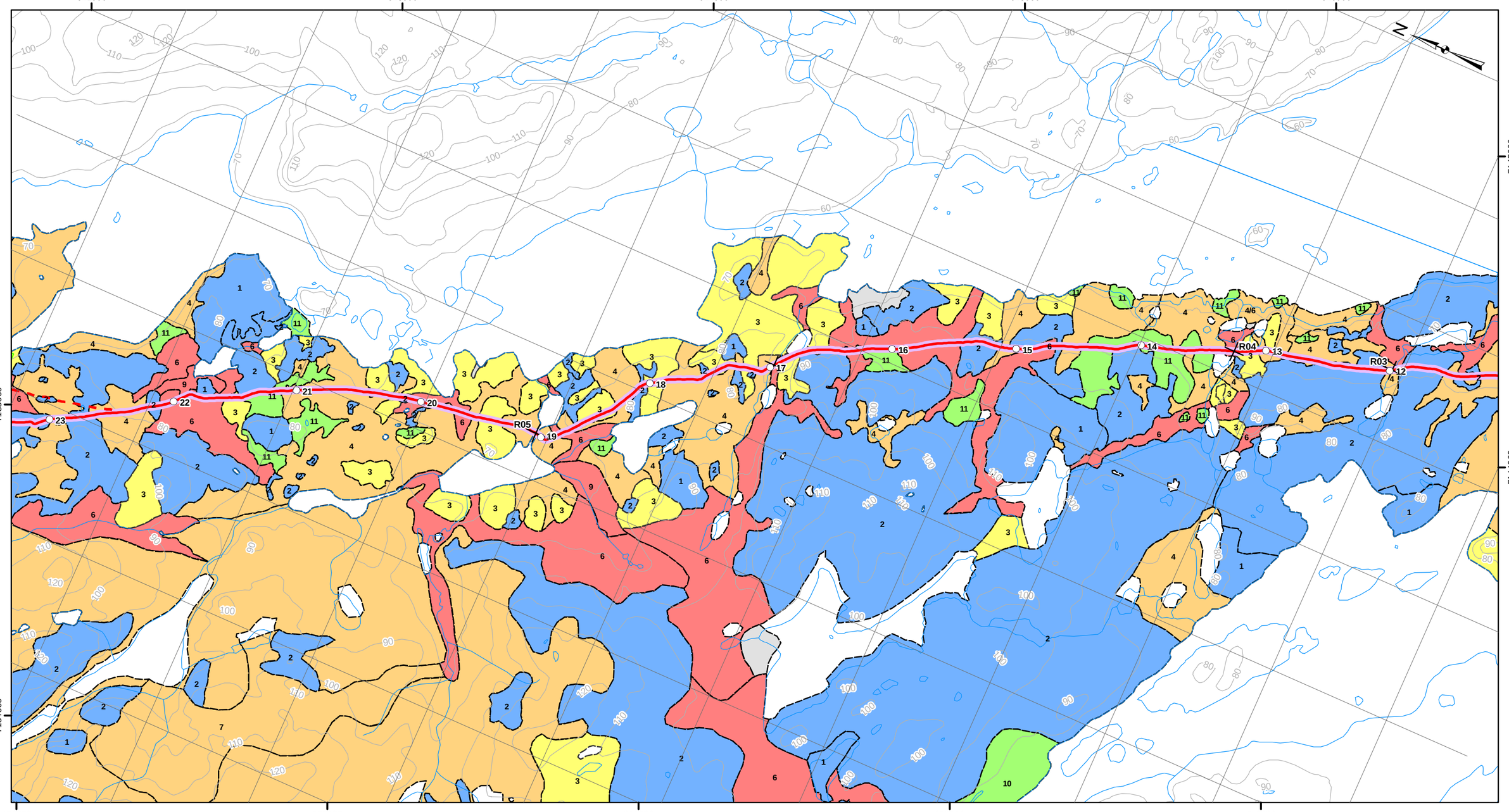
7145000 7144000 7155000 7154000

636000 637000 638000 639000 640000

N



LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

Thaw Susceptibility

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low
- Unclassified

600 300 0 600 Metres

Scale - 1:30,000

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-iv-08_soil-susceptibility.mxd

PROJECT

CUMBERLAND RESOURCES LTD.

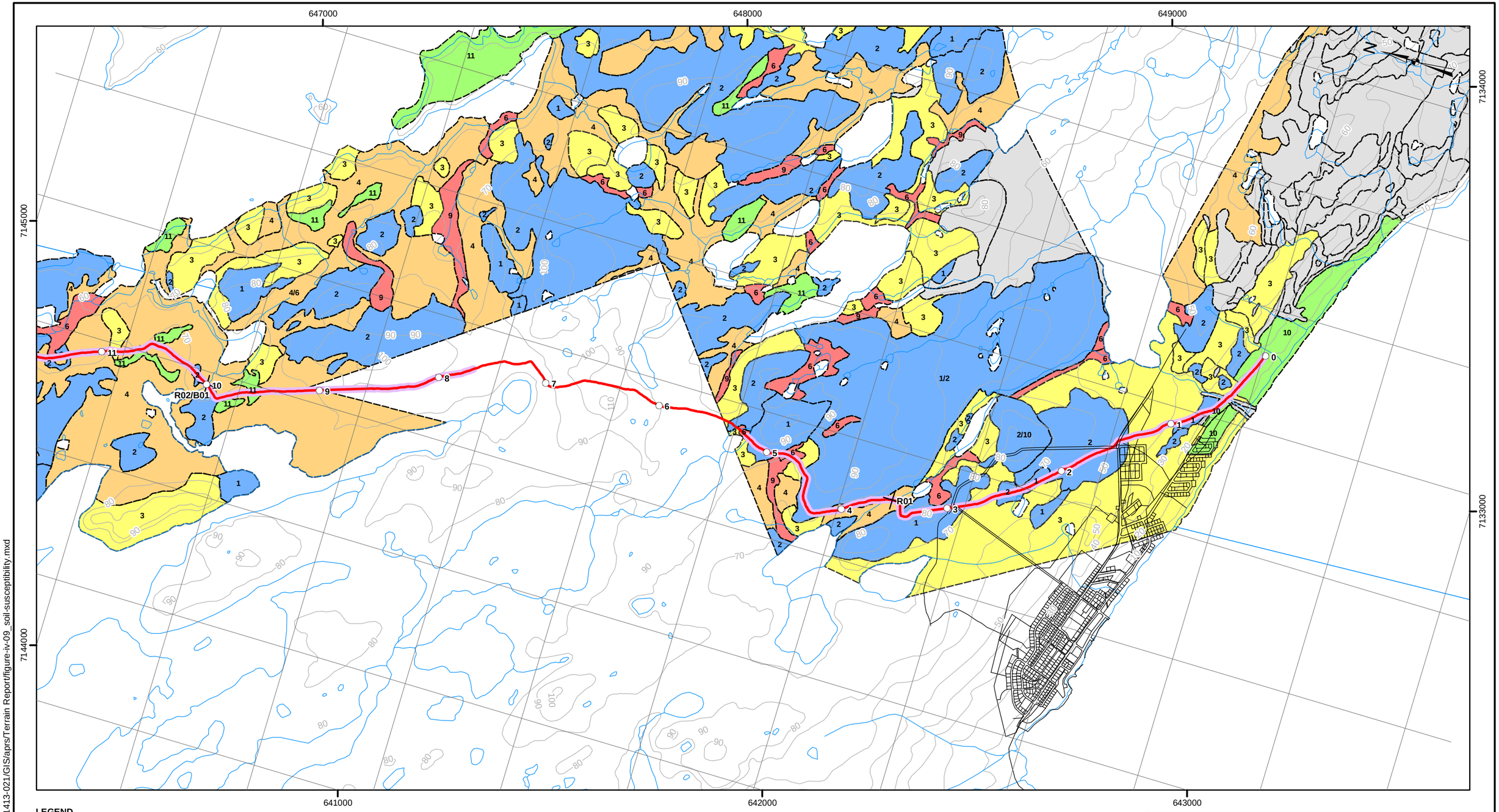
TITLE

SOIL SUSCEPTIBILITY TO PERIGLACIAL PROCESSES
1:30,000 Mapsheet - 8 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	TR	01 Sep. 2005		
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

FIGURE IV-8



LEGEND

- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

Thaw Susceptibility

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low
- Unclassified

600 300 0 600 Metres

Scale - 1:30,000

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

SOIL SUSCEPTIBILITY TO PERIGLACIAL PROCESSES
1:30,000 Mapsheet - 9 of 9

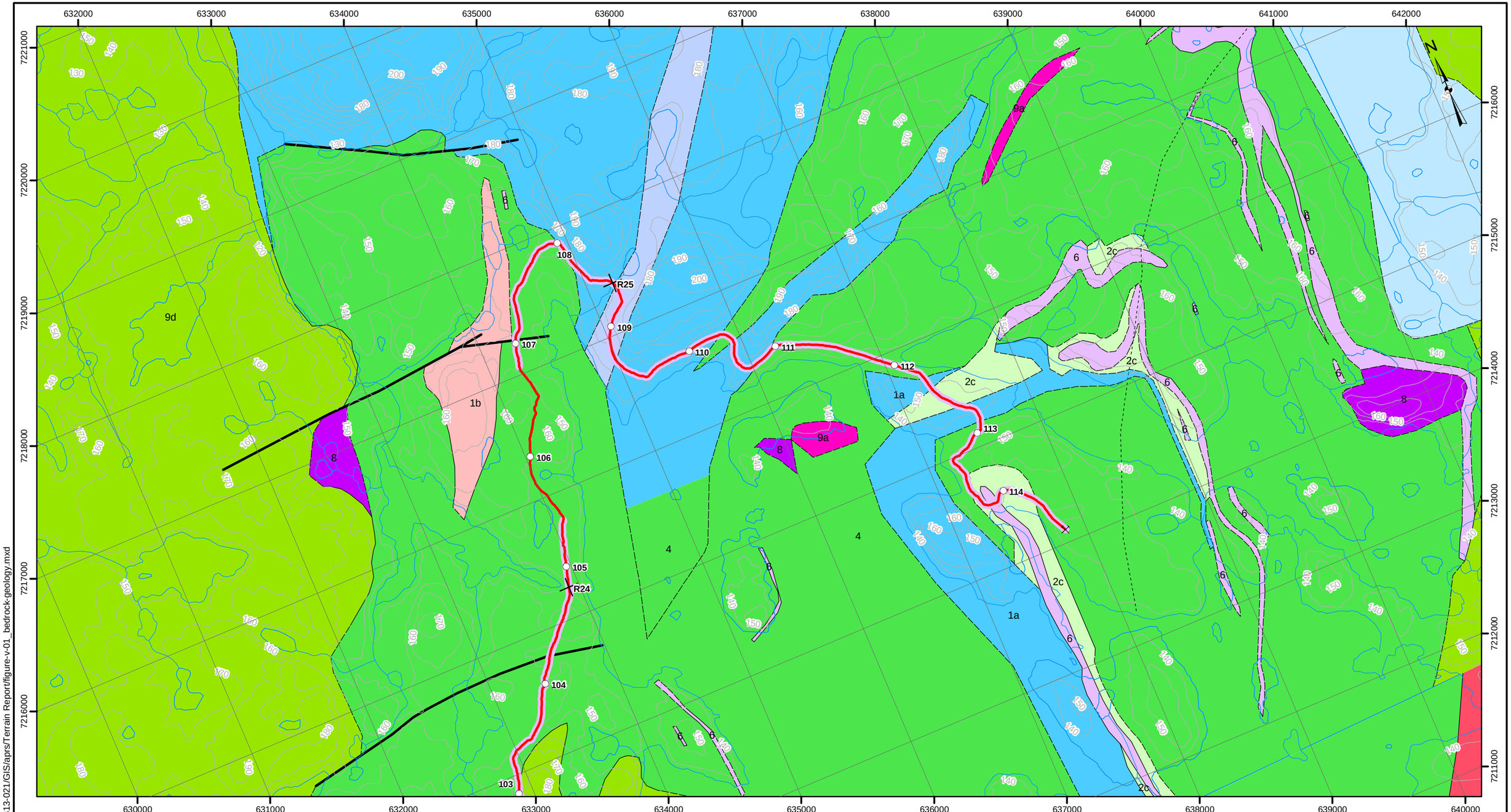
Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	TR	01 Sep. 2005	FIGURE IV-9	
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-iv-09_soil-susceptibility.mxd

APPENDIX V

REGIONAL BEDROCK GEOLOGY



LEGEND

- Archaeological Site
- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)
- Contact - Defined
- Contact - Inferred
- Dyke - Defined
- Dyke - Inferred
- Fault - Defined
- Fault - Inferred
- Fold Trace

Schultz Geology

Na-Pgd	Na-m	Pp-P	Pp-mdb	1a	5a	9a		
Na-fvc	Na-qz	Pp-T	Pp-mi	1b	5b	9b		
Na-g	Na-tng	Pp-Tr	Pp-qcg	2a	6	9c		
Na-gcfz	Na-wkq	Pp-cg	Pp-qz	2b	7a	9d		
Na-gd	Pp-A	Pp-db	Pp-wk	2c	7b			
Na-gt	Pp-Cl	Pp-gt		3	7c			
Na-if	Pp-M	Pp-if		4	8			

Woodburn Geology

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600 Metres

Scale - 1:30,000

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

REGIONAL BEDROCK GEOLOGY
1:30,000 Mapsheet - 1 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	CJC	01 Sep. 2005	FIGURE V-1	
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-v-01_ bedrock-geology.mxd

635000 634000 633000 632000 631000

7214000 7215000 7204000 7205000

629000 628000 627000 626000 625000

9d

R22 R21 R20 R20A R23

90 91 92 93 94 95 96 97 98 99 100 101 102 103

N

LEGEND

- Archaeological Site
- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)
- Contact - Defined
- Contact - Inferred
- Dyke - Defined
- Dyke - Inferred
- Fault - Defined
- Fault - Inferred
- Fold Trace

Schultz Geology: Na-Pgd, Na-fvc, Na-g, Na-gcfz, Na-gd, Na-gt, Na-if, Na-m, Na-qz, Na-tng, Na-wkq, Pp-A, Pp-Cl, Pp-M, Pp-P, Pp-T, Pp-Tr, Pp-cg, Pp-db, Pp-gt, Pp-if, Pp-mdb, Pp-mi, Pp-qcg, Pp-qz, Pp-wk

Woodburn Geology: 1a, 1b, 2a, 2b, 2c, 3, 4, 5a, 5b, 6, 7a, 7b, 7c, 8, 9a, 9b, 9c, 9d

600 300 0 600 Metres

Scale - 1:30,000

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

PROJECT: CUMBERLAND RESOURCES LTD.

TITLE: REGIONAL BEDROCK GEOLOGY
1:30,000 Mapsheet - 2 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	CJC	01 Sep. 2005		
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

FIGURE V-2

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-v-02_bedrock-geology.mxd

630000

629000

7205000

7194000

624000

623000

N

Na-if

R20 91 90 R19/B05 89 88 87 86 R18 85 84 R17 83 82 81 80 R16 79 78 77

R18A

R19A/B05A

LEGEND

- Archaeological Site
- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)
- Contact - Defined
- Contact - Inferred
- Dyke - Defined
- Dyke - Inferred
- Fault - Defined
- Fault - Inferred
- Fold Trace

Schultz Geology

Na-Pgd	Na-m	Pp-P	Pp-mdb	1a	5a	9a		
Na-fvc	Na-qz	Pp-T	Pp-mi	1b	5b	9b		
Na-g	Na-tng	Pp-Tr	Pp-qcg	2a	6	9c		
Na-gcfz	Na-wkq	Pp-cg	Pp-qz	2b	7a	9d		
Na-gd	Pp-A	Pp-db	Pp-wk	2c	7b			
Na-gt	Pp-Cl	Pp-gt		3	7c			
Na-if	Pp-M	Pp-if		4	8			

Woodburn Geology

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600 Metres

Scale - 1:30,000

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

REGIONAL BEDROCK GEOLOGY
1:30,000 Mapsheet - 3 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	CJC	01 Sep. 2005	FIGURE V-3	
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-v-03_bedrock-geology.mxd

630000
629000
7182000
7194000
624000
623000
622000
7183000
N

R15/B04
R14
R13
R12
R11
6
65
66
67
68
69
70
71
72
73
74
75
76
77

LEGEND

- Archaeological Site
- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)
- Contact - Defined
- Contact - Inferred
- Dyke - Defined
- Dyke - Inferred
- Fault - Defined
- Fault - Inferred
- Fold Trace

Schultz Geology

Na-Pgd	Na-m	Pp-P	Pp-mdb					
Na-fvc	Na-qz	Pp-T	Pp-mi					
Na-g	Na-tng	Pp-Tr	Pp-qcg					
Na-gcfz	Na-wkq	Pp-cg	Pp-qz					
Na-gd	Pp-A	Pp-db	Pp-wk					
Na-gt	Pp-Cl	Pp-gt						
Na-if	Pp-M	Pp-if						

Woodburn Geology

1a	5a	9a
1b	5b	9b
2a	6	9c
2b	7a	9d
2c	7b	
3	7c	
4	8	

600 300 0 600 Metres

Scale - 1:30,000

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

REGIONAL BEDROCK GEOLOGY
1:30,000 Mapsheet - 4 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	CJC	01 Sep. 2005		
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

FIGURE V-4

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-v-04_bedrock-geology.mxd

629000

628000

7171000

7183000

623000

622000

Pp-db

Na-fvc

N

R09

R10

R11

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

4

5

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-v-05_bedrock-geology.mxd

LEGEND

- Archaeological Site
- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)
- Contact - Defined
- Contact - Inferred
- Dyke - Defined
- Dyke - Inferred
- Fault - Defined
- Fault - Inferred
- Fold Trace

Schultz Geology

Na-Pgd	Na-m	Pp-P	Pp-mdb	
Na-fvc	Na-qz	Pp-T	Pp-mi	
Na-g	Na-tng	Pp-Tr	Pp-qcg	
Na-gcfz	Na-wkq	Pp-cg	Pp-qz	
Na-gd	Pp-A	Pp-db	Pp-wk	
Na-gt	Pp-Cl	Pp-gt		
Na-if	Pp-M	Pp-if		

Woodburn Geology

1a	5a	9a
1b	5b	9b
2a	6	9c
2b	7a	9d
2c	7b	
3	7c	
4	8	

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600 Metres

Scale - 1:30,000

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

REGIONAL BEDROCK GEOLOGY
1:30,000 Mapsheet - 5 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN / REV. 0
DESIGN	CJC	01 Sep. 2005	
GIS	CDB	01 Sep. 2005	FIGURE V-5
CHECK	CJC	01 Sep. 2005	
REVIEW			

630000 631000 632000 633000 634000 635000

7174000 7173000 7172000

7164000 7163000 7162000

Pp-qz

Pp-cg

Pp-mi

Na-fvc

Na-gd

R08

45 44 46 43 42 41 40 39 38 37 36 35 47 48 49 50 51 52

625000 626000 627000 628000 629000 630000

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-v-06_bedrock-geology.mxd

LEGEND

- Archaeological Site
- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)
- Contact - Defined
- Contact - Inferred
- Dyke - Defined
- Dyke - Inferred
- Fault - Defined
- Fault - Inferred
- Fold Trace

Schultz Geology

Na-Pgd	Na-m	Pp-P	Pp-mdb	
Na-fvc	Na-qz	Pp-T	Pp-mi	
Na-g	Na-tng	Pp-Tr	Pp-qcg	
Na-gcfz	Na-wkq	Pp-cg	Pp-qz	
Na-gd	Pp-A	Pp-db	Pp-wk	
Na-gt	Pp-Cl	Pp-gt		
Na-if	Pp-M	Pp-if		

Woodburn Geology

1a	5a	9a	
1b	5b	9b	
2a	6	9c	
2b	7a	9d	
2c	7b		
3	7c		
4	8		

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600 Metres

Scale - 1:30,000

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

REGIONAL BEDROCK GEOLOGY
1:30,000 Mapsheet - 6 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	CJC	01 Sep. 2005		
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

FIGURE V-6

636000 637000 638000 639000 640000 641000

7165000 7164000 7163000

7155000 7154000 7153000

631000 632000 633000 634000 635000 636000

Pp-mi

R08 R07A R07 R06/B02 R06A/B02A

34 33 32 31 30 29 28 27 26 25 24 23 35 36

N

LEGEND

- Archaeological Site
- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)
- Contact - Defined
- Contact - Inferred
- Dyke - Defined
- Dyke - Inferred
- Fault - Defined
- Fault - Inferred
- Fold Trace

Schultz Geology

Na-Pgd	Na-m	Pp-P	Pp-mdb	1a	5a	9a	
Na-fvc	Na-qz	Pp-T	Pp-mi	1b	5b	9b	
Na-g	Na-tng	Pp-Tr	Pp-qcg	2a	6	9c	
Na-gcfz	Na-wkq	Pp-cg	Pp-qz	2b	7a	9d	
Na-gd	Pp-A	Pp-db	Pp-wk	2c	7b		
Na-gt	Pp-Cl	Pp-gt		3	7c		
Na-if	Pp-M	Pp-if		4	8		

Woodburn Geology

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600 Metres

Scale - 1:30,000

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

REGIONAL BEDROCK GEOLOGY
1:30,000 Mapsheet - 7 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	CJC	01 Sep. 2005	FIGURE V-7	
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-v-07_ bedrock-geology.mxd

642000 643000 644000 645000 646000

7155000 7154000 7145000 7144000

636000 637000 638000 639000 640000

N

R05 R05Additonal R04 R03

1 2

23 22 21 20 19 18 17 16 15 14 13 12

LEGEND

- Archaeological Site
- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)
- Contact - Defined
- Contact - Inferred
- Dyke - Defined
- Dyke - Inferred
- Fault - Defined
- Fault - Inferred
- Fold Trace

Schultz Geology

Na-Pgd	Na-m	Pp-P	Pp-mdb		
Na-fvc	Na-qz	Pp-T	Pp-mi		
Na-g	Na-tng	Pp-Tr	Pp-qcg		
Na-gcfz	Na-wkq	Pp-cg	Pp-qz		
Na-gd	Pp-A	Pp-db	Pp-wk		
Na-gt	Pp-Cl	Pp-gt			
Na-if	Pp-M	Pp-if			

Woodburn Geology

1a	5a	9a
1b	5b	9b
2a	6	9c
2b	7a	9d
2c	7b	
3	7c	
4	8	

600 300 0 600 Metres

Scale - 1:30,000

REFERENCE

Cumberland Resources Ltd.

Datum: NAD 83 Projection: UTM Zone 14

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

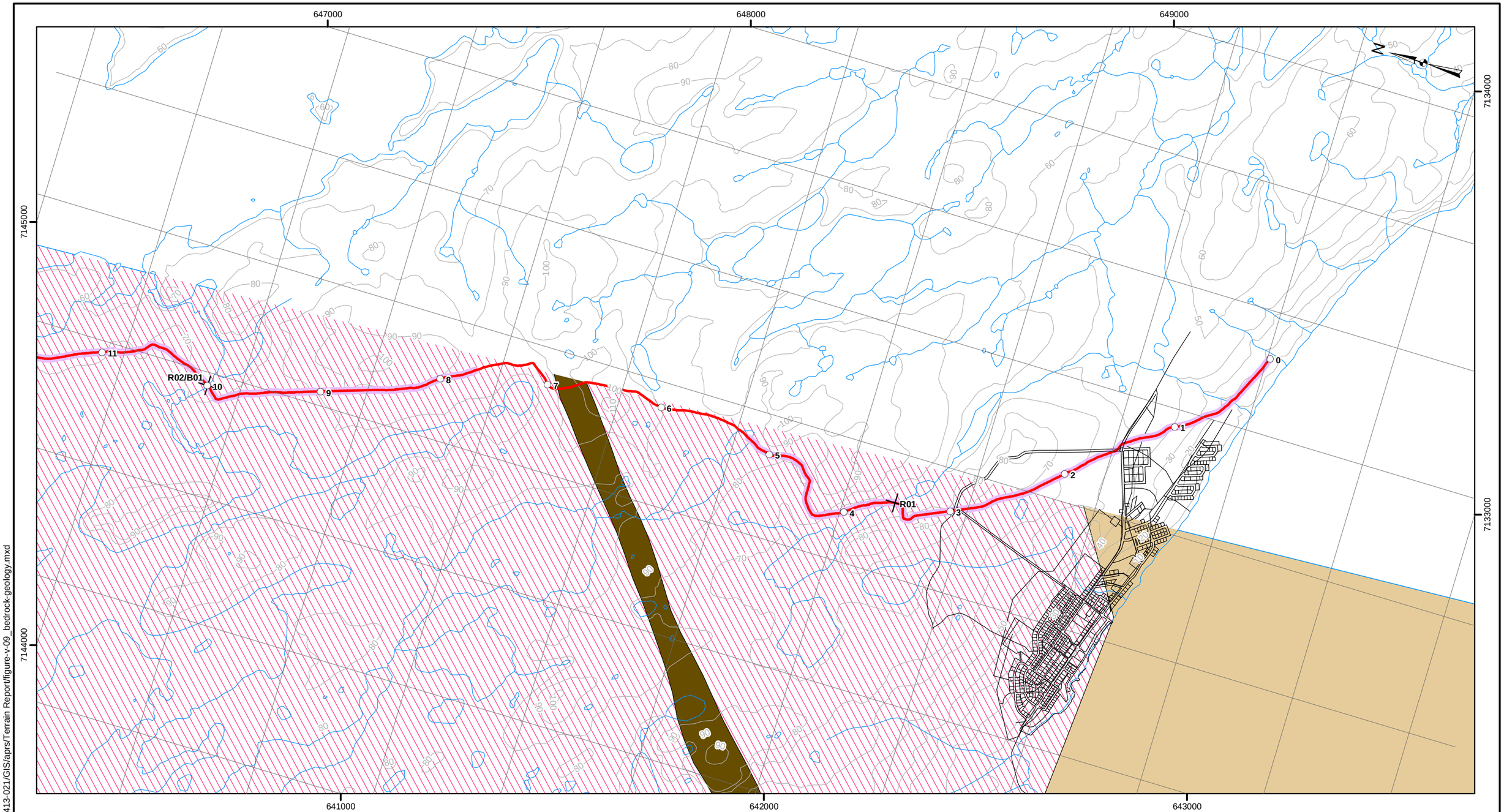
REGIONAL BEDROCK GEOLOGY
1:30,000 Mapsheet - 8 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	CJC	01 Sep. 2005		
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

FIGURE V-8

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-v-08_bedrock-geology.mxd



LEGEND

- Archaeological Site
- Meadowbank Project
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Stream Crossing
- EM31/GPR Survey Location
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)
- Contact - Defined
- Contact - Inferred
- Dyke - Defined
- Dyke - Inferred
- Fault - Defined
- Fault - Inferred
- Fold Trace

Schultz Geology

Na-Pgd	Na-m	Pp-P	Pp-mdb			
Na-fvc	Na-qz	Pp-T	Pp-mi			
Na-g	Na-tng	Pp-Tr	Pp-qcg			
Na-gcfz	Na-wkq	Pp-cg	Pp-qz			
Na-gd	Pp-A	Pp-db	Pp-wk			
Na-gt	Pp-Cl	Pp-gt				
Na-if	Pp-M	Pp-if				

Woodburn Geology

1a	5a	9a
1b	5b	9b
2a	6	9c
2b	7a	9d
2c	7b	
3	7c	
4	8	

600 300 0 600 Metres

Scale - 1:30,000

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

REGIONAL BEDROCK GEOLOGY
1:30,000 Mapsheet - 9 of 9

Golder Associates
Burnaby, B.C.

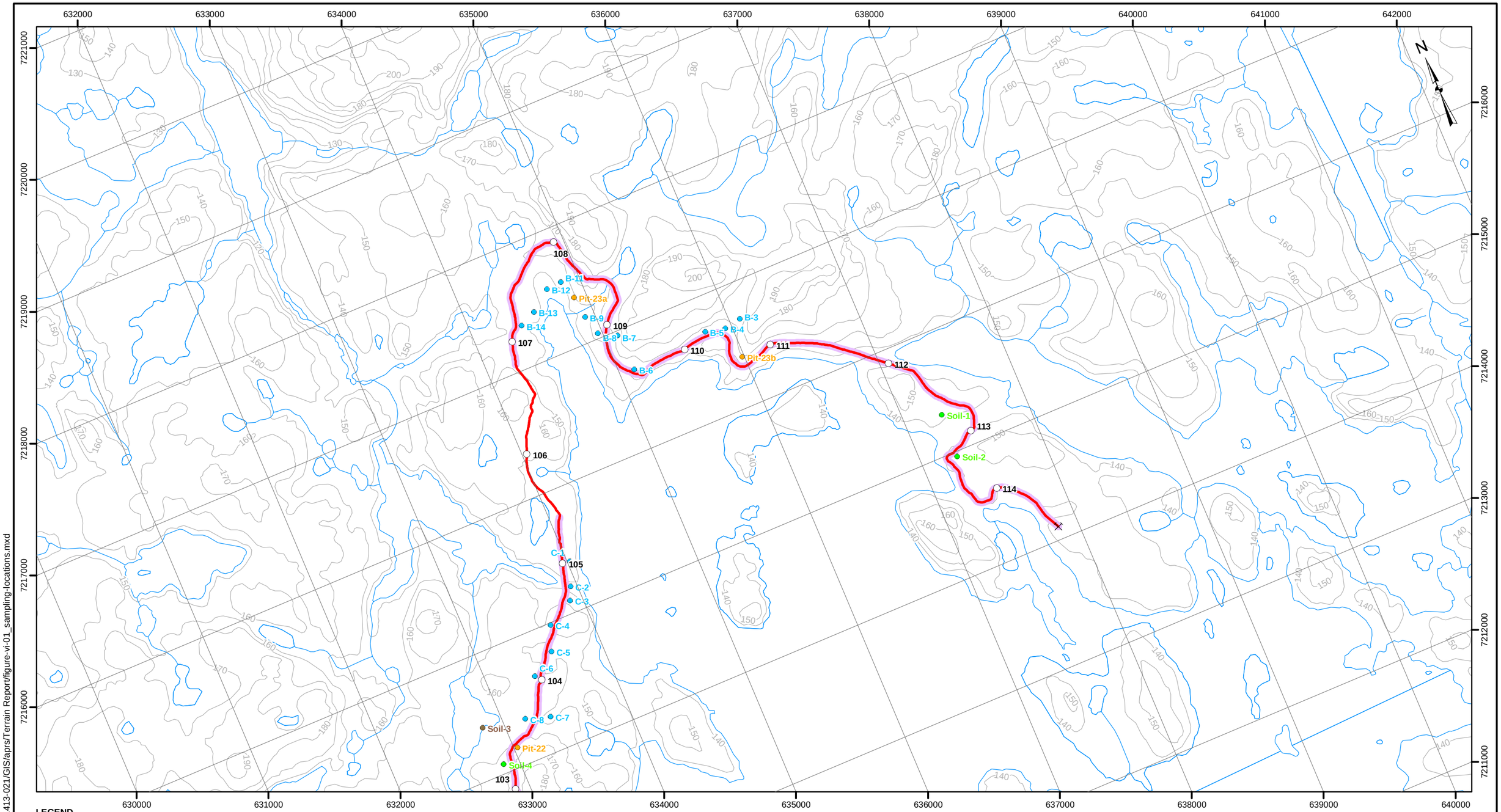
PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	CJC	01 Sep. 2005		
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

FIGURE V-9

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-v-09_bedrock-geology.mxd

APPENDIX VI

TRAVERSE AND SAMPLING LOCATIONS



LEGEND

- Meadowbank Project
- Approximate Location of Potential Rock Quarry Site
- Approximate Location of Hand-Dug Soil Pit
- Approximate Location of Glaciofluvial Gravel Deposit
- Approximate Location of Terrain Assessment Viewpoint
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600
Metres
Scale - 1:30,000

PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
TRAVERSE AND SAMPLING LOCATIONS
1:30,000 Mapsheet - 1 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	KD	01 Sep. 2005		
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

FIGURE VI-1

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-vi-01_sampling-locations.mxd

635000 634000 633000 632000 631000

7214000

7215000

7204000

7205000

629000 628000 627000 626000 625000

C-7 C-8 Pit-22 103 102 C-10B C-12 C-14 Soil-4 C-11 Soil-4 101 C-13 C-c Pit-21 C-15 100 99 C-a C-g C-16 98 C-j C-k 97 96 95 D-1 C-m 94 D-a 93 Soil-5 Pit-20 D-b 92 D-3 D-c Soil-6 Pit-19 91 Soil-7 D-d 90 D-e

N

LEGEND

- Meadowbank Project
- Approximate Location of Potential Rock Quarry Site
- Approximate Location of Hand-Dug Soil Pit
- Approximate Location of Glaciofluvial Gravel Deposit
- Approximate Location of Terrain Assessment Viewpoint
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600 Metres

Scale - 1:30,000

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

TRAVERSE AND SAMPLING LOCATIONS
1:30,000 Mapsheet - 2 of 9

Golder Associates
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PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	KD	01 Sep. 2005	FIGURE VI-2	
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-vi-02_sampling-locations.mxd

630000

629000

7205000

7194000

624000

623000

D-c
Soil-6
91
Pit-19
Soil-7
D-d
90
D-e
89
88
87
D-h
Pit-18
86
Soil-8
85
84
83
82
81
80
Soil-9
Pit-17
79
78
77

N

LEGEND

- Meadowbank Project
- Approximate Location of Potential Rock Quarry Site
- Approximate Location of Hand-Dug Soil Pit
- Approximate Location of Glaciofluvial Gravel Deposit
- Approximate Location of Terrain Assessment Viewpoint
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600
Metres
Scale - 1:30,000

PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
TRAVERSE AND SAMPLING LOCATIONS
1:30,000 Mapsheet - 3 of 9

Golder Associates
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PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	KD	01 Sep. 2005	FIGURE VI-3	
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-vi-03_sampling-locations.mxd

630000
629000
7182000
7194000
624000
623000
622000
7183000
N

Pit-16
Soil-10
H-1
Soil-11
H-2
H-3
H-4
Soil-12
Soil-13
H-5
Soil-14
Pit-15
Soil-15
H-6
H-7
Soil-16
65
66
67
68
69
70
71
72
73
74
75
76
77

LEGEND

- Meadowbank Project
- Approximate Location of Potential Rock Quarry Site
- Approximate Location of Hand-Dug Soil Pit
- Approximate Location of Glaciofluvial Gravel Deposit
- Approximate Location of Terrain Assessment Viewpoint
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600
Metres
Scale - 1:30,000

PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
TRAVERSE AND SAMPLING LOCATIONS
1:30,000 Mapsheet - 4 of 9

Golder Associates
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PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
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GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-vi-04_sampling-locations.mxd

629000

628000

7171000

7183000

623000

622000

N

51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

F-1
F-2
F-3
H-8
Soil-17
Soil-18
Soil-19
Pit-11
Pit-13

LEGEND

- Meadowbank Project
- Approximate Location of Potential Rock Quarry Site
- Approximate Location of Hand-Dug Soil Pit
- Approximate Location of Glaciofluvial Gravel Deposit
- Approximate Location of Terrain Assessment Viewpoint
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600
Metres
Scale - 1:30,000

PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
TRAVERSE AND SAMPLING LOCATIONS
1:30,000 Mapsheet - 5 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	KD	01 Sep. 2005	FIGURE VI-5	
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

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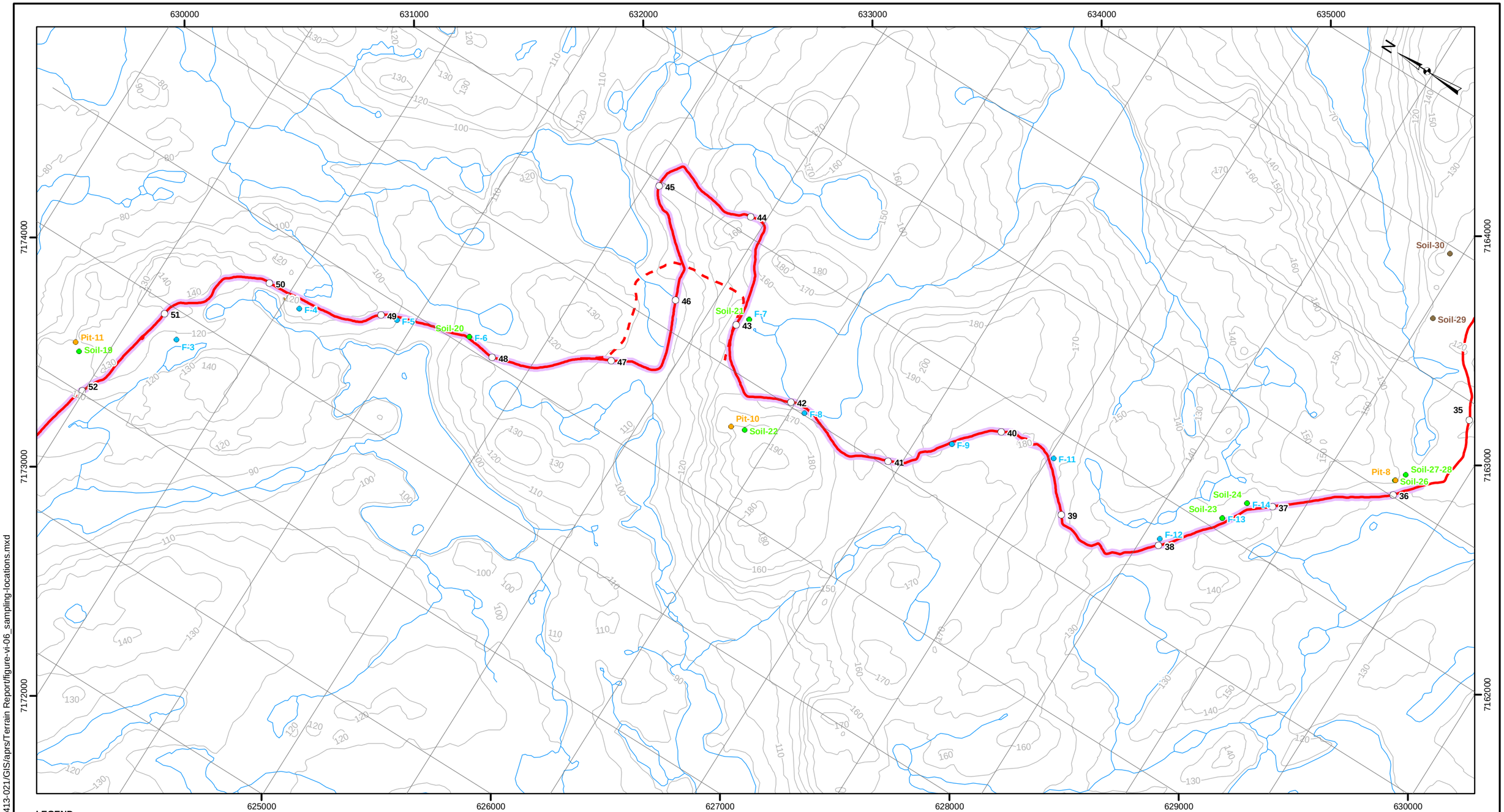

LEGEND

- Meadowbank Project
- Approximate Location of Potential Rock Quarry Site
- Approximate Location of Hand-Dug Soil Pit
- Approximate Location of Glaciofluvial Gravel Deposit
- Approximate Location of Terrain Assessment Viewpoint
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600 Metres

Scale - 1:30,000

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

TRAVERSE AND SAMPLING LOCATIONS
1:30,000 Mapsheet - 6 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	KD	01 Sep. 2005	FIGURE VI-6	
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-vi-06_sampling-locations.mxd

636000 637000 638000 639000 640000 641000

7165000 7164000 7163000

7155000 7154000 7153000

631000 632000 633000 634000 635000 636000

N

Soil-30
Soil-31
Soil-29
Soil-27-28
Soil-26
Pit-7
Soil-32
Soil-33
Soil-35
Soil-34
G-1
G-2
G-3
G-4
G-5

34 33 32 31 30 29 28 27 26 25 24 23 35 36

LEGEND

- Meadowbank Project
- Approximate Location of Potential Rock Quarry Site
- Approximate Location of Hand-Dug Soil Pit
- Approximate Location of Glaciofluvial Gravel Deposit
- Approximate Location of Terrain Assessment Viewpoint
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600
Metres
Scale - 1:30,000

PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
TRAVERSE AND SAMPLING LOCATIONS
1:30,000 Mapsheet - 7 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
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GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-vi-07_sampling-locations.mxd

642000 643000 644000 645000 646000

7155000 7145000 7144000 7154000

636000 637000 638000 639000 640000

N

Soil-36 Pit-5 G-7 G-8 G-9 G-10 G-11 G-13 G-24 Soil-37 Soil-39 Soil-38 Pit-4 Soil-40 I-1 Soil-41 I-2 G-3 G-4 G-5 G-6

12 13 14 15 16 17 18 19 20 21 22 23

LEGEND

- Meadowbank Project
- Approximate Location of Potential Rock Quarry Site
- Approximate Location of Hand-Dug Soil Pit
- Approximate Location of Glaciofluvial Gravel Deposit
- Approximate Location of Terrain Assessment Viewpoint
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600 Metres

Scale - 1:30,000

PROJECT

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TITLE

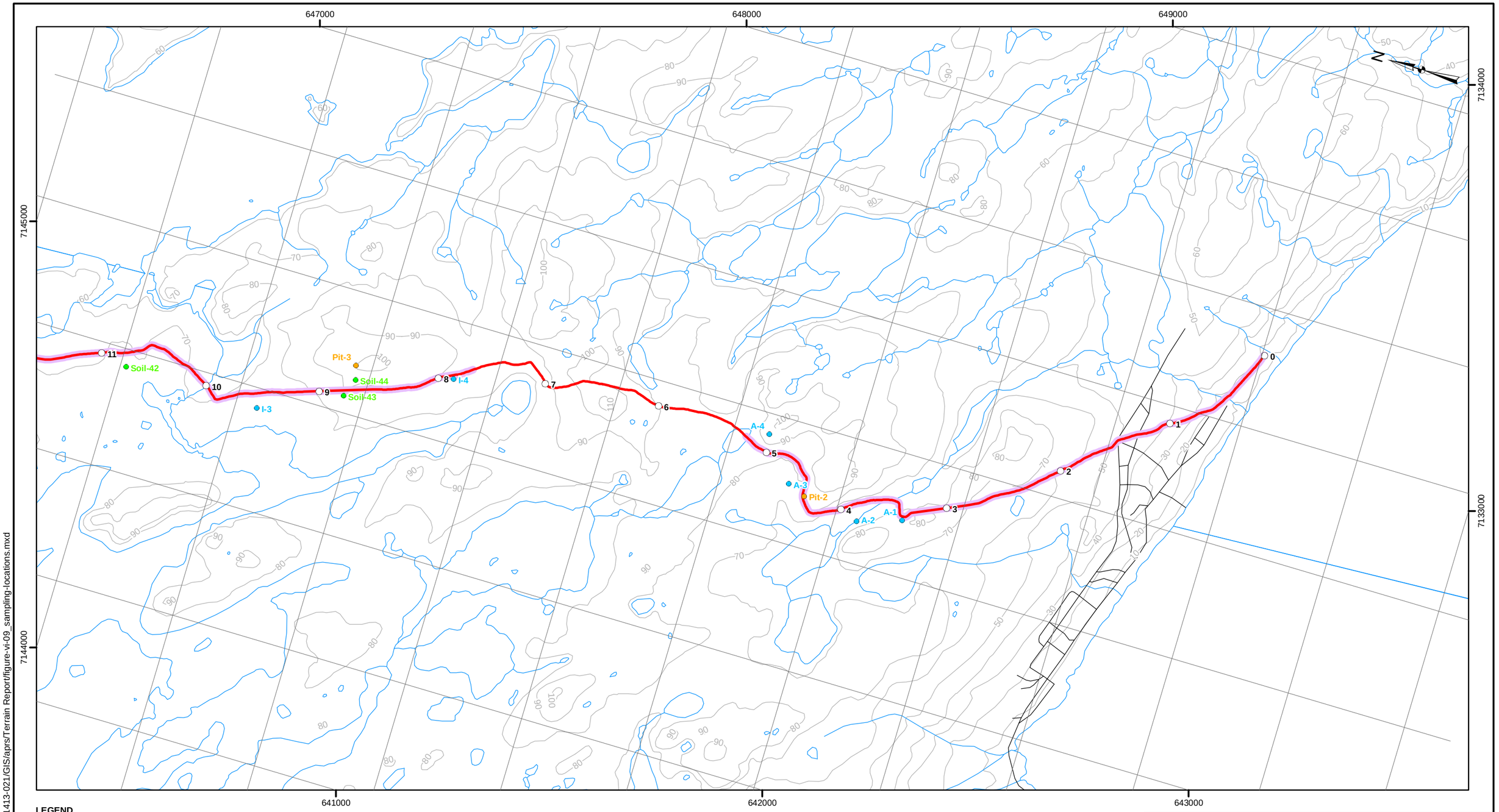
TRAVERSE AND SAMPLING LOCATIONS
1:30,000 Mapsheet - 8 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	KD	01 Sep. 2005		
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

FIGURE VI-8

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-vi-08_sampling-locations.mxd



LEGEND

- Meadowbank Project
- Approximate Location of Potential Rock Quarry Site
- Approximate Location of Hand-Dug Soil Pit
- Approximate Location of Glaciofluvial Gravel Deposit
- Approximate Location of Terrain Assessment Viewpoint
- Kilometre Marker
- Proposed Route
- Proposed Alternate Route
- Foot Traverse
- Road
- Watercourse
- Waterbody
- Wetland
- Sandbar
- Contour (10 m interval)

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

600 300 0 600
Metres
Scale - 1:30,000

PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
TRAVERSE AND SAMPLING LOCATIONS
1:30,000 Mapsheet - 9 of 9

Golder Associates
Burnaby, B.C.

PROJECT No. 05-1413-021			SCALE AS SHOWN	REV. 0
DESIGN	KD	01 Sep. 2005		
GIS	CDB	01 Sep. 2005		
CHECK	CJC	01 Sep. 2005		
REVIEW				

FIGURE VI-9

N:/Bur-Graphics/Projects/2005/1413/05-1413-021/GIS/aprs/Terrain Report/figure-vi-09_sampling-locations.mxd

APPENDIX VII

FIELD NOTES AND PHOTO DESCRIPTIONS

July 12, 2005 Terrain Field Assessment: Meadowbank Road South End

Observation	A1	A2	A3	A4
Location			Around corner from A2	Rock ridge N of A2
Terrain	R_G//Mv	Ov/Mbv	(Ov/mb)/Mb	
Slope position	up	low	mid	
Slope morphology	und	un	un	
Slope curvature	cvx	pl	pl-cvx	
Soils	B	Organic		
Seepage	-	-	In grass	
Aspect (º)				
Slope us (%)	10-20	0-10	5-20	
Slope ds (%)	10-20	0-10	5-20	
Bedrock	Granite	Granite	Granite	
Bedrock structure	Weakly fract			
ABD (m)	1.0 – 1.5			
Stability conditions	S			
Rooting depth				
Stand structure				
Stand height				
Vegetation cover type	Heather	Grass	Heather/Grass	
Windthrow orient (º)				
Frozen ground depth	?			
Photo times	11:21 - &	11:27	11:53	12:00
	panning E	11:42		
	then N			
		12:15 return		
		traverse		
Comment/photos		looking S-SE		
	Traverse from Baker Lake road to vicinity of rock pit site 2			

Personnel: TR, KD, TM	Recorded by: TR
	Date: July 12 2005

July 13, 2005 Terrain Field Assessment: Tehek North (Page 1 of 2)

Observation	B2	B4	B5	B6	B7	B9
Location	Rx pit 23b					
Terrain	Rr/rDv/Mv	Ox/M Mbv	Mbv/ Dbv//R	Mbv	Mbv	Ov Mbv
Slope position	ridge	low	mid-crest	mid	√	low
Slope morphology	un	un	und	un	√	un
Slope curvature	cvx	ccv	Cvx-pl	pl	pl	pl
Soils	B	OG	B	HB	B//GB	GB/G
Seepage	-	√	-	- WD	WD	P-LP
Aspect (º)	S			220	270	260-270
Slope us (%)	20-30	5-10	10-20	5-10	5-10	±5
Slope ds (%)	10-20	0-5	20-40	0-5	±5	±5
Bedrock	Quartzite		Quartzite			
Bedrock structure	Weakly fract. foliated					
ABD (m)	0.5-1					
Stability conditions	S	S	S		S	
Rooting depth		Poorly- to imperfectly-drained				
Stand structure						
Stand height						
Vegetation cover type		Heather/ Grass				
Windthrow orient (º)						
Snowbank aspect(º)			156	160		
Photo times	9:37	11:31	11:37	12:02	12:55	13:03
			11:54	12:07 wedge of B6 against B5- nivation hollow		
Comment/photos				12:11		
8:36 & 8:44	NW & W across head of Third Portage Lake ***B-c, B-d***					
8:36	Traverse from Meadowbank Camp to head of Third Portage Lake					
9:10	Area E of hook shaped island ***B-e***					
9:37	Potential rock pit #25 ***B-f***					
12:14	Head of third portage lake – rock pit potential - qzite ***B-g***					

Personnel: TR, KD, TM	Recorded by: TR
	Date: July 13 2005

Legend: ***B-c:*** point name for photos on Figure 2

July 13, 2005 Terrain Field Assessment: Tehek North (Page 2 of 2)

Observation	B10	B11	B12	B13	B14
Location	Pit 23a	Mb			
Terrain	Rrh/Dv/Mv	Mb/Mv	Ov/Mv Mb/D	Mb/Dbv/R	Mbv/ Dbv
Slope position	mid-up	mid-low	low	mid-up	low-mid
Slope morphology	und	un	un	un-und	un
Slope curvature	cvx	pl-cvx	pl	pl-cvx	pl
Soils	B	B/GB	GB/G/H	B	GB/B
Seepage					
Aspect (º)	220	240	√		120
Slope us (%)	10-15	5-15		10-20	5
Slope ds (%)	±10	5-10	0-5	5-40	10
Bedrock	Quartzite/ Volcanic				
Bedrock structure	Foliated				
ABD (m)	0.5-1				
Stability conditions	S	S			
Rooting depth		WD-ID			
Stand structure					
Stand height					
Vegetation cover type					
Windthrow orient (º)					
Snowpack aspect (º)					200 mag
Photo times	14:16				
Comment/photos	23a-1 to 3				
	Quartzite				
	23a-4				
	Volcanic				
	<5% of site				

Personnel: TR, KD, TM	Recorded by: TR
	Date: July 13 2005

July 14, 2005 Terrain Field Assessment: Tehek Road (Page 1 of 3)

Observation	C1	C2	C3	C4	C5
Location					O unit to crest
Terrain	Mbv/Vbv//R	aDbv/Ov D	Mbv	Mbv/Dbv/R	Ovb
Slope position	up-mid	low	mid	mid/up	low
Slope morphology	un-und	un	un	un	un
Slope curvature	pl-cvx	pl	pl (cvx)	pl/cvx	pl
Soils	B	? 110	B	B	H/G
Seepage		√			√ small pond
Aspect (º)					
Slope us (%)	5-10	0-5	8-10	0-8	0-2
Slope ds (%)	5-10				
Bedrock	Volcaniclastic	√	√	√	√ contact with granite-pink
Bedrock structure	Weakly fract	√			
ABD (m)					
Stability conditions	S	S	S	S	S
Rooting depth					
Stand structure					
Stand height					
Vegetation cover type	Heather	Rock/ Heather & Grass	Heather		Grass
Windthrow orient (º)					
Photo times	8:13	8:19	8:30	8:45	8:51
					Move road 100 m to west onto well-drained ground
Comment/photos					
	Traverse from crossing R22 to vicinity of proposed pit 20 GPS: 630926, 7210423				

Personnel: TR, KD, TM	Recorded by: TR
	Date: July 14 2005

July 14, 2005 Terrain Field Assessment: Tehek Road (Page 2 of 3)

Observation	C5b	C6	C7	C10A	C11
Location	0 unit to crest				
Terrain	arDbv/Mbv	Dbv/Mbv/R	Ov Mbv/Dbv	Ru/Dv/Mv	Ov Dbv Mbv/Ovb
Slope position	low	mid-up		mid-up	low
Slope morphology	un	un-und		un-irreg	un
Slope curvature	pl	pl-cvx		pl-cvx	pl-ccv
Soils		B	H/G small	B	H/G
Seepage	WD		ponds		v.small ponds
Drainage				W-R drained	PHI
Slope us (%)	0-5	5-10	0-2	5-20	0-2
Slope ds (%)				Granite	
Bedrock	Granite	Volcanic?		Volcaniclastic	Granite
Bedrock structure				Well fract.	
ABD (m)				0.5-0.2	
Stability conditions	S	S	S	S	
Rooting depth					
Stand structure					
Stand height					
Vegetation cover type		Heather	Grass	Heather	Grass
Windthrow orient (º)					
Photo times		9:09	9:21	9:31	11:12
		9:16		10:14	11:29 – SW from SW end of C-11/C10
		C8 => aDbv/Ov D		S-1 till sample	
				10:56	
				11:16	
Comment/photos				11:37-S end	
				11:45 : Block field in shallow drainage at S end of C10B	

Personnel: TR, KD, TM	Recorded by: TR
	Date: July 14 2005

July 14, 2005 Terrain Field Assessment: Tehek Road (Page 3 of 3)

Observation	C12	C13	C14	C15	C16
Location				Type 1 not 2	Type 1
Terrain	Dv/Mv//R	aDbv	Mbv/Ov	Rs/arC/arD	arDbv/Mbv/Ru
Slope position	up crest	low (saddle)	mid-low	mid	mid-up
Slope morphology	un- hill crest	un - irreg	un	irr	un-irreg
Slope curvature	cvx	pl	pl	pl-cvx	pl-cvx
Soils	B			rx	B//R
Seepage					
Aspect (º)	W/R	W/P	I/P		
Slope us (%)	5-10	0-5	0-5	15-20	5-15
Slope ds (%)	5-10			40-50	
Bedrock	Granite	Granite		Granite	Granite
Bedrock structure	Weak fract.				
ABD (m)	1.0			0.5	0.5
Stability conditions	S, bdrx exposed on site			S	S possible site for rx pit – no sample
Rooting depth					
Stand height					
Vegetation cover type	Heather	Rock	Grass		Heather
Windthrow orient (º)					
Photo times	12:10	12:14	14:30	13:11	14:5- exposed bdrx on very small hill
				14:16 – 500m S of R23	
				14:30 SE & S	
					14:54 : general landscape
Comment/photos					
12:40/12:41	Type 1 exposed granite arDv/Mv/R – potential for rock pit (no sample) ***C-b***				
12:57	Perspective looking S from N of xing R23 towards rx pit 21 ***C-c***				
13:11	Looking N form S side of xing 23 & site of rx pit 21 ***C-d***				
14:37	Pan looking SE through WSW – across type 4 to pype 1 @ rx outcrop ***C-g***				
14:43	Nivation hollow base of slope aspect SSE-S (seepage) ***C-i***				
15:25	On type 3 @ type 2 upslope E of large lake ***C-j***				
15:37	N-S on type 2, upslope of type 4 ***C-k***				
15:52	Type 1 – potential for small pit, shallow ±0.5-1m overburden of granite ***C-l***				
16:38	Small 20X20X3 m granite outcrop – limited potential other similar in general area ***C-m***				

Personnel: TR, KD, TM	Recorded by: TR
	Date: July 14 2005

Legend: ***C-b:*** point name for photos on Figure 2

July 15, 2005 Terrain Field Assessment: Tehek Road

Observation	D1	D3	
Location		Potential Rx pit site	
Terrain	Mb	R/Dv/Mv	
Slope position	mid	ridge	
Slope morphology	un	un-irreg	
Slope curvature	pl-cvx	cvx	
Soils	B/GB	B	
Seepage	√ very small pond		
Aspect (º)			
Slope us (%)	± 5	5-10	
Slope ds (%)	3-5	30-40	
Bedrock	granite	granite	
Bedrock structure		moderately frac	
ABD (m)		0.5	
Stability conditions			
Rooting depth			
Stand structure			
Stand height			
Vegetation cover type	heather/ grass		
Windthrow orient (º)			
			13:43: Mafic volcanic outcrop 20X 20 m good relief. 13:43. SE of xing R19 minor overburden. Temp. storage ring. Better than site closer to R18 ***D-h*** (potential pit)
Photo times	9:46	10:00 outcrop & view to S	
			8:21 Small type 1 @ xing R21 ***D-a***
			9:46 N→S→SE rx outcrops (granite) to S at E end of small lake D1 = Type 4, D2= Type1 D3= Type2 ***D-b***
Comment/photos			10:28 type 9 & type 4 @ xing R20 ***D-c***
			11:49: Nivation hollow - SSE facing slope, road stakes run through dry part of nivation hollow 3-5 m upslope of snow ***D-d***
			12:11 : 30X20 m granite outcrop – good for small rx pit ***D-e***
			12:29 200-300m, E of R19 other photos looking W to R19 & SSE ***D-g***
			D-h

Personnel: TR, KD, TM	Recorded by: TR
	Date: July 15 2005

Legend: ***D-a:*** point name for photos on Figure 2

July 16, 2005 Terrain Field Assessment: Tehek Road

Observation	E1
Location	Type 4 near pit 17
Terrain	Mb
Slope position	Mid
Slope morphology	un
Slope curvature	pl-cvx
Soils	B-GB
Seepage	
Aspect (º)	
Slope us (%)	5-10
Slope ds (%)	5-10
Bedrock	metavolcanic
Bedrock structure	
ABD (m)	
Stability conditions	
Rooting depth	
Stand structure	
Stand height	
Vegetation cover type	
Windthrow orient (º)	
Photo times	9:08
Comment/photos	

Personnel: TR, KD, TM	Recorded by: TR
	Date: July 16 2005

July 19, 2005 Terrain Field Assessment: Tehek Road (Page 1 of 5)

Observation	F1	F2	F3	F4	F5
Terrain Type	7 could be 6	2	2	2	2
Terrain	Mb	Mbv//Db//Rr	Mbv/RDbv	Mbv/RDbv	Mbv/RDbv
Slope position	mid	up	up	up	low
Slope morphology	un	un-und	un-und	un-und	un-und
Slope curvature	pl	pl-cvx	pl-cvx	pl-cvx	pl-cvx
Soils/ drainage	poorly	Well-imp	Well-imp	Well-imp	Well-imp
Seepage		minor poorly	none	none	none
Aspect (º)	230	--	--	S	S
Slope us (%)	±5	0-5	0-5	0-5	0-5
Slope ds (%)	±5	0-5	0-5 (10)	0-5 (20)	0-5
Bedrock	volcanic graywacke	volcanic graywacke	volcanic graywacke	andesites & other volcs	
Bedrock structure	Frost shattered	Frost shattered/ platy	Frost shattered/ platy	Frost shattered/ platy	
ABD (m)					
Stability conditions					
Rooting depth					
Stand structure					
Stand height					
Vegetation cover type	Grass minor heather	Heather/ birch	Heather/ birch	Heather/ birch	Heather/ birch
Windthrow orient (º)					
Pit dept	0.5m		0.4 & rx		
permafrost	None observed				
Photo times	8:18	8:32	9:14 N then S	9:48 good pit outcrop near old pit 11 andesite?	10:39
		8:40	9:40 look S by 2nd of 3 lakes. S of point 3 at old pit 11		
		8:48			
		8:59		10:11 right beside rod	
Comment/photos				10:08 general type 2 terrain →S	
	Traverse from ~ old pit 12 location			10:10 W	
				10:18 N	
				10:26 W &S	

Personnel: TR, Alec	Recorded by: TR
	Date: July 19 2005

July 19, 2005 Terrain Field Assessment: Tehek Road (Page 2 of 5)

Observation	F6	F7	F8	F9	F10
Terrain Type	4	3	2	4	2
Terrain	Mb//Ov Mb	Mb	Dv//Mv/Rr	Mb	arDbv/Mr//Rr
Slope position	low-mid	up	up	up-mid	up
Slope morphology	un	un	un	un	ineg
Slope curvature	pl	pl-cvx	pl-cvx	pl	cvx
Soils	Imp-poor			Humic gleysol?	WD
Seepage	None	E		√	
Aspect (º)	N				
Slope us (%)	0-5	5	5-15		0-5-10
Slope ds (%)	0-5	5			
Bedrock	quartzite	quartzite		quartzite	bedded dipping S @ 30º ~45º
Bedrock structure	Mod. frac	Mod. frac			
ABD (m)					
Stability conditions					
Rooting depth					
Stand structure					
Stand height					
Vegetation cover type	Grass/heather strips			Grassy area of type 4	
Windthrow orient (º)		SE of Pit 10			
Pit dept	Sample TR-1				
permafrost	None at 0.6m	60-70 cm			
Photo times	10:47	Sample TR-2		13:56	
	11:43 further south-looking S from N side of valley immediately N of pit sit 10	12:28	13:01	14:03 – small shallow ponds in grassy area	14:10
		12:40 SE & near pit sit 10 half way hills	13:09		14:16
			13:36 type 2 ~ 800 N of old rx pit 9 site		14:18 till
					14:25
Comment/photos					
	11:50 looking SW upslope to pit 10 site and NW across xing				

Personnel: TR, Alec	Recorded by: TR
	Date: July 19 2005

July 19, 2005 Terrain Field Assessment: Tehek Road (Page 3 of 5)

Observation	F11	F12	F13	F14
Terrain type	4/6	6	2	4
Terrain	Mb	Ov Mb	arDbv/Mv/Rr	Mb
Slope position	mid-low	low	low-mid	up-low
Slope morphology	un	un	ridge	un
Slope curvature	pl	pl	cvx	pl
Soils	Imp/poorly-drained	Poorly (imp)	B/Regosol	Gleysol // humic gleysol
Seepage				present
Aspect (º)				
Slope us (%)	5-10	0-2	5-10	0-5
Slope ds (%)	0-5	0-2	5-10	0-5
Bedrock			mafic volc	mafic volc
Bedrock structure			Well fract /platy	Well fract/platy
ABD (m)				
Stability conditions				
Rooting depth				
Stand structure				
Stand height				
Vegetation cover type				
Windthrow orient (º)				
permafrost		none at 50 cm	Rock @ 0.3m	None @ .6-.7m
sample			Dry till (TR-3)	Wet till (TR-4)
Photo times	14:36 S & SE tran old rx pit 9 site. Going E around lake, may be better drained route	15:15 to 15:26	15:43	16:20-16:25
				Humic gleysol? Lithic humisoil?
Comment/photos				16:59 ~ 20-30 cm H over till
	15:05			

Personnel: TR, Alec	Recorded by: TR
	Date: July 19 2005

July 19, 2005 Terrain Field Assessment: Tehek Road (Page 4 of 5)

Observation	H1	H2	H3	H4	H5
Terrain type	2	4	2	3	2
Terrain	Meadow mixed with boulders	meadow	Rock and meadow	Rock and some meadow	Meadow and some rock
Slope position	up			mid	low
Slope morphology	rough		Slightly rough	rough	smooth
Slope curvature	cvx	none	none	cvx	cvx
Soils	rock/till	till	till	till	till
Seepage	Pond lower part	Some wet place	none	none	Pond lower part
Aspect (º)	S			NW	N
Slope us (%)	gentle				Gentle
Slope ds (%)	8				9
Bedrock					
Bedrock structure					
ABD (m)					
Stability conditions					
Rooting depth					
Stand structure					
Stand height					
Vegetation cover type	Heather lichen	heather	Heather moss	Heather	Heather moss
Windthrow orient (º)					
sample		Hole #1 8:45		10:10 Hole #2	10:51 Hole #3
Photo times	8:15 Pan S-E-N-W	8:35 Pan S-E-N-W	9:10 Pan S-E-N-W	9:30 Pan S-E-N-W	10:55
	8:25 R14, gravel, no water in creek	Till, brown		Br. Silty till	Brown till
		silty			
Comment/photos					

Personnel: KD, TM	Recorded by: KD
	Date: July 19 2005

July 19, 2005 Terrain Field Assessment: Tehek Road (Page 5 of 5)

Observation	H6	H7	H8
Terrain type	2	4	1
Terrain	Meadow some rocks	Meadow	Meadow and rock
Slope position			crest
Slope morphology			Rough
Slope curvature			Plane
Soils	Till		Till
Seepage	None	well drained	None
Aspect (º)			
Slope us (%)			
Slope ds (%)			10
Bedrock			volcanic
Bedrock structure			foliated
ABD (m)			
Stability conditions			
Rooting depth			
Stand structure			
Stand height			
Vegetation cover type	Heather, yellow grass	Heather	
Windthrow orient (º)			
Soil Samples	12:41Hole #4	14:15 Hole #5	16:40 Hole #6
Photo times	12:20	1:45 pan S/E/N/W	15:55
	Till plastic	80 cm deep	Br. weathered
	Max 45 cm	till	Rock mixed
	Hole was		With till
Comment/photos	Closing by		30cm deep
	itself		

Personnel: KD, TM	Recorded by: KD
	Date: July 19 2005

July 20, 2005 Terrain Field Assessment: Tehek Road (Page 1 of 3)

Observation	G1	G2	G3	G4	G5
Terrain type	4	2	4	2	4
Terrain	Mb	Mbv//Dbv//R	Mb	Mv/Dbv/R	Mb
Slope position	mid-low	up	mid	mid	mid
Slope morphology	un	und-irr	un	und	un
Slope curvature	pl	cvx	pl	pl-cvx	pl
Soils	gleysol	B/R	poorly-drained	well drained	poorly-drained
Seepage	√	none	√ small ponds		
Aspect (º)					
Slope us (%)	3-8	±5	2-3	5-10	3-5
Slope ds (%)	0-5	±5	0-3	3-5	3-5
Bedrock		Granite			
Bedrock structure		Mod. Fract			
ABD (m)		0.3-0.5			
Stability conditions		S			
Rooting depth					
Stand structure					
Stand height					
Vegetation cover type	Heather/grass	Heather moss	Heather/grass	Heather(grass)	grass /Heather
Sample #	TR-6	TR-5			
Sampling depth	3-50 cm	3-50cm			
permafrost	@ ~50cm	None @ 50 cm			
Photo times	8:30	8:19	9:21 SW	9:27 SE&SW	9:37 SE
	8:43 ~100m W of Xing R06	9:02 SE	9:23 E	9:29 SE	9:39 pond
		9:121 SE			9:45-9:49 soil pit
		8:53 type 2 @ xing R06			
					9:55 – 9:57
Comment/photos					Pit with water

Personnel: TR, Alec	Recorded by: TR
	Date: July 20 05

July 20, 2005 Terrain Field Assessment: Tehek Road (Page 2 of 3)

Observation	G6	G7	G8	G9	G10
Terrain type	2	1	11 could be a type 2	4	2
Terrain	Mv/Dv/R	Rr/rDv//Mv	Dv//R	Mb	Mv/Dv/R
Slope position	mid	low	low	low	mid
Slope morphology	und	und-irreg	und-irreg	un	und
Slope curvature	cvx	pl	pl	pl	
Soils	well drained	well drained	minor ponds	small ponds	
Seepage					
Aspect (º)					
Slope us (%)	±5	5-10	0-5		5-10
Slope ds (%)	±5	5-10	0-5		5-10
Bedrock		granite	granite		granite
Bedrock structure		Mod. fract	Mod. Fract		Mod well frac
ABD (m)		0.3-1			0.2-0.5
Stability conditions		S			
Rooting depth					
Stand structure					
Stand height					
Vegetation cover type	Heather	Heather/moss /lichen	Heather	Grass heather	heather
Windthrow orient (º)					
Photo times	10:10	10:24 E	10:47	10:57	11:05
	10:13	10:30 Type6 upslope & to N			
	10:14 E small ponds on type 6 at base of slope looking towards road location				
		10:31 SE			
		10:39 on type 2 at S end of type 1			
Comment/photos					

Personnel: TR, Alec	Recorded by: TR
	Date: July 20 2005

July 20, 2005 Terrain Field Assessment: Tehek Road (Page 3 of 3)

Observation	G11	G12	G13	G14
Terrain type	Small pocket of type 2	3		6
Terrain	Dv/Mv/R	Mb	Mv/Dvb/Rr	Mb/sgF
Slope position	low	mid	up	low
Slope morphology	und	un	ridge- irreg	un- valley frost
Slope curvature	cvx	pl	cvx	pl
Soils	well	imp-poor	WD	v. porly D
Seepage				√ ponds, stream
Aspect (º)				
Slope us (%)	5-10	0-3	0-5	0-3
Slope ds (%)	5-10	0-3	0-10	0-3
Bedrock	Granite			metavolcanic
Bedrock structure	Mod well fractured			
ABD (m)				
Stability conditions				
Rooting depth				
Stand structure				
Vegetation cover type	Heather moss lichen	Heather birch grass lichen	Heather Licen	Green grass willow
Sample #		TR-7		
Sample depth		3-50		
Permafrost		None at .6m		
Photo times		12:19 ~300 m N of X inf R05	13:17 Type 2 looking E then N across type 4 then type 3 & across type 3 to type 1	
		12:43 R05 xing & lake edge		
Comment/photos	11:25	12:48 type 3		
		13:02 :E side of dinosaur foot lake, S end, type 3 foreground type 1 in background	13:28 N from 200 m S of dinosaur foot lake	
			13:31 looking S across R05 Type 6 valley	

Personnel: TR, Alec	Recorded by: TR
	Date: July 20 2005

July 20, 2005 Terrain Field Assessment: Tehek Road (close to camp)

Observation	TR-8	TR-9
Terrain type	Type 4	Type 2
Slope position	mid	mid-upper
Slope morphology	un	un-und
Slope curvature	pl	pl-cvx
Soils	Poorly imp	Well
Seepage		
Aspect (º)		
Slope us (%)	0-3	5-8
Slope ds (%)	3-5	5-8
Bedrock		Metavolcanic
Bedrock structure		
ABD (m)		
Stability conditions		
Rooting depth		
Stand structure		
Stand height		
Vegetation cover type	Grass Heather	Heather lichen
Sample #	TR-8	TR-9
Sample depth	5-40 cm	3-35 cm
Permafrost depth	Not reached	Rock at 35 cm
Photo times	16:58	17:21 17:27
	Samples sites west of Meadowbank Camp	
Comment/photos		

Notes: From helicopter observed small esker S of R8 – bkgF^{G} and 1 or 2 other small gravel deposits just E of R8.

Personnel: TR, Alec	Recorded by: TR
	Date: July 20 2005

July 20, 2005 Terrain Field Assessment: Tehek Road (Page 1 of 2)

Observation	I1	I2	I3	I4	I5
Terrain type	1	11	4	3	
Terrain	Meadow, trace of rock	Rock and moss	meadow	Rock 50% meadow 50%	Rock 40% rest meadow
Slope position	none	none	none	Mid	
Slope morphology				Rough top smooth bottom	
Slope curvature					
Soils		till	till	till	sand
Seepage	Some ponds	surrounded by wet land, but this area is well drained	wet	WD	WD
Aspect (º)					
Slope us (%)				15	
Slope ds (%)				10	
Bedrock					
Bedrock structure					
ABD (m)					
Stability conditions					
Rooting depth					
Stand structure					
Stand height					
Vegetation cover type		moss	Meadow		
Sample #			Hole #7		Hole #8
Sample depth			5-45cm		5-30cm
permafrost			@ 45 cm		
Photo times	8:20 pan S E N W	8:55	9:50	10:25	11:30
			Permafrost		
			@ 45 cm		
Comment/photos					

Personnel: KD, TM	Recorded by: KD
	Date: July 20 2005

July 20, 2005 Terrain Field Assessment: Tehek Road (Page 2 of 2)

Observation	I6	I7
Terrain type	2	11
Terrain	Rock 40%, bdrx 10% meadow rest	Rock outcrop
Slope position	bottom	mid
Slope morphology	rough	Rough
Slope curvature	ccv	cvx
Soils	till	till
Seepage	WD	WD
Aspect (º)	south	NE
Slope us (%)		23
Slope ds (%)		30
Bedrock		
Bedrock structure		
ABD (m)		
Stability conditions		
Rooting depth		
Stand structure		
Stand height		
Vegetation cover type	heather	Heather Moss
Windthrow orient (º)		
Photo times	12:37 pan S E N W	13:45 pan S E N W
		large outcrop, potential borrow site, very close to the road
Comment/photos		

Personnel: KD, TM	Recorded by: KD
	Date: July 20 2005

July 21, 2005 Terrain Field Assessment: Tehek Road

Observation	TR-10 esker?	TR-11
Terrain	kgF^{G}r	gF^{G}lt
Slope position	up	Up
Slope morphology	flat ridge	level, uniform
Slope curvature	pl - cvx	pl
Soils	regosol	regosol
Seepage		
Deposit thickness	3-5m deep	1-2 m deep
Slope us (%)	0-2	0-2
Slope ds (%)	60-70	
Bedrock		
Rooting depth		
Stand structure		
Stand height		
Vegetation cover type	heather, lichen	heather, lichen
Windthrow orient (º)		
Sample #	TR-10	TR-11
Sample depth	0-50	0-60
permafrost	Not found	Not found
Comment/photos	8:14	8:55

Notes: From helicopter - small gF$^{G}_{L}$ well west of top end of xing R06 ~50 X 20 X 1m

Personnel: TR, Alec	Recorded by: TR
	Date: July 21 2005

APPENDIX VIII

ROCK QUARRY FIELD NOTES

BEDROCK/ARD SAMPLING/FIELD FORM
Meadowbank Access Road – Project 05-1413-040

Field Mapping Checklist: *Date:* 21 July 2005 *Time*: pm

Observations	Station/Sample No. 2	Station/Sample No.
Bedrock Type[1] and description	Granite	
GPS Coordinates	644423, 7138287	
PAG Indicators		
Fe-Staining etc.	None and/or very minor	
Sulfides[2] type and %	None	
Carbonate: type & %	None	
PAG/NAG		
Physical Features		
Weathering[3]	FR to SW	
Strength[4]	R5	
Fabric	Medium grained	
Structure	Weakly to mod fractured	
ABD	± 1.0	
Suitability for re-use	Good	
Seepage/groundwater	None	
Flow/color/pH		
Other		
Photo times	13:33 to 13:46	
Photo times	360 pan -counterclockwise	
Photo times		
Comments:		

Personnel: TR, Karine Doucet	Recorded by: Terry Rollerson
Weather: cloudy, light rain, wind	Date: 21 July 2005
Watershed: Baker Lake	Project number: 05-1413-040

Notes:
1. Bedrock type
2. Disseminated, granular, clusters of grains, etc.
3. Weathering: FR = fresh; SW = Slightly weathered; MW = moderately weathered; HW = highly weathered; EW = extremely weathered
4. Strength: R1 through R6, R1 = very weak; R2 = weak; R3 = medium strong; R4 = strong; R5 = very strong; R6 - extremely strong.

Field Mapping Checklist: *Date:* 17 July 2005 *Time*: pm

Observations	Station/Sample No. 3	Station/Sample No.
Bedrock Type[1] and description	granite	
GPS Coordinates	644406, 7142139	
PAG Indicators		
Fe-Staining etc.	v. minor on fracture surfaces	
Sulfides[2] type and %	None	
Carbonate: type & %	None	
PAG/NAG	Low	
Physical Features		
Weathering[3]	Fresh to SW	
Strength[4]	R5	
Fabric	Medium grained	
Structure	Well fractured	
ABD	< 0.3m	
Suitability for re-use	Good	
Seepage/groundwater	None	
Flow/color/pH		
Other	Sample 3-1 to 3-3	
Photo times	14:28 gravel beach lines	
Photo times	to 14:50	
Photo times		
Comments:	Discontinuous thin gWvr	
	on top of outcrop	
	S3-2 - sample on Type 4 to W of P2 – till poorly-drained 16:01-15:58, 15:45	16:01-15:58, 15:45
	S3-1 on gravelly sandy Wvb at base of outcrop 15:32	

Personnel: TR, KD, Tom Mannik	Recorded by: TR
Weather: cloudy windy	Date: 17 July 2005
Watershed	Project number: 05-1413-040

Notes:
1. Bedrock type
2. Disseminated, granular, clusters of grains, etc.
3. Weathering: FR = fresh; SW = Slightly weathered; MW = moderately weathered; HW = highly weathered; EW = extremely weathered
4. Strength: R1 through R6, R1 = very weak; R2 = weak; R3 = medium strong; R4 = strong; R5 = very strong; R6 - extremely strong.

Field Mapping Checklist: *Date:* 17 July 2005 *Time*: pm

Observations	Station/Sample No. 4	Station/Sample No. 5
Bedrock Type[1] and description	Granite-granodiorite Type 1 terrain	Hudson granite
GPS Coordinates	642184, 7147786	640144, 7153108
PAG Indicators		
Fe-Staining etc.	None to v. minor	None to v. minor on some fractures
Sulfides[2] type and %	None	Nil
Carbonate: type & %	None	Nil
PAG/NAG	Low	Nil
Physical Features		
Weathering[3]	Fresh locally up to 0.5cm weathering rind	Fresh
Strength[4]	R5	R5
Fabric	Fine to med grained	Weakly foliated- fine to medium grained
Structure	Mod to well fractured	Well fractured.
ABD	<0.5 to 0.3	<1.0 to 0.5
Suitability for re-use	Good	Good
Seepage/groundwater		
Flow/color/pH		
Other	Samples 4-1 to 4-3	
Photo times	12:41 – 12:54 outcrop	11:19 – 11:31 outcrop
Photo times	13:06 looking NW-N-NE	
Photo times	100X 200 m X20 m relief	100X50mX5m relief
Comments:	Similar outcrop nearby	several other similar outcrops nearby and may be closer to road
	Road crosses toe of one of these outcrops ~ 1 km N at small lake	
	Soil S4-1 in type 6 terrain at toe of outcrop – ice at 30 cm in sand and also in peat with inclusion of sand & pebbles.	Sample S5-1 – Till poorly-drained in small type 4 area
	Thin discontinuous venues of till & Dv locally on outcrop 13:53, 13:51	Sample S5-2 – 0-50 cm seepage at ~ 50 cm
Personnel: TR, KD, TM	Recorded by: TR	
Weather: cloudy windy	Date: 17 July 2005	
Watershed	Project number: 05-1413-040	

Notes:
1. Bedrock type
2. Disseminated, granular, clusters of grains, etc.
3. Weathering: FR = fresh; SW = Slightly weathered; MW = moderately weathered; HW = highly weathered; EW = extremely weathered
4. Strength: R1 through R6, R1 = very weak; R2 = weak; R3 = medium strong; R4 = strong; R5 = very strong; R6 - extremely strong.

Field Mapping Checklist: *Date:* 16 July 2005 *Time*: am

Observations	Station/Sample No. 7	Station/Sample No. 8
Bedrock Type[1] and description	Hudson granite? type 2 terrain	Quartzite – 10 m relief
GPS Coordinates	637603, 7157384	632127, 7163487
PAG Indicators		
Fe-Staining etc.	Very minor iron staining on some fractures	Iron staining on some fractures
Sulfides[2] type and %	None	Very minor to none
Carbonate: type & %	None	None
PAG/NAG	Low	Low
Physical Features		
Weathering[3]	Fresh	Fresh
Strength[4]	R5	R5
Fabric	Med - fine grained weakly foliated	Med - fine grained, weakly foliated
Structure	Mod. Well fractured	Well fractured
ABD	<0.5±	<0.5±
Suitability for re-use	Good	Good
Seepage/groundwater	None	None
Flow/color/pH		
Photo times	9:23 to 9:31 to 10:28	8:18 - 8:42
Photo times	10:31 Type 4 terrain at S7-2 site	100 X50X10
Photo times	10:13 S7-1 and S7-2 site, 10:28 S7-2 on type 4 poorly-drained on and just E of road location (red dashed line) ~ 20 ± m relief, 100 m X 100 m	8:22 – "iron stained" frost shattered bedrock 2-3 m wide, recessive, sampled as S8-1
Comments:		8:42 nivation hollow / scarp on SE side of outcrop
	Soil sample – Till on type 2 terrain, 50 m W of Pit 7	Soil samples – gravels S8-2 lower sample 40-60 cm, unweathered
	S7-1 type 2 terrain- well drained S7-2 type 4 terrain, very poorly-drained.	S8-3 is weathered 0-40 cm

Personnel:	Recorded by:
Weather:	Date:
Watershed	Project number: 05-1413-040

Notes:
1. Bedrock type
2. Disseminated, granular, clusters of grains, etc.
3. Weathering: FR = fresh; SW = Slightly weathered; MW = moderately weathered; HW = highly weathered; EW = extremely weathered
4. Strength: R1 through R6, R1 = very weak; R2 = weak; R3 = medium strong; R4 = strong; R5 = very strong; R6 - extremely strong.

Field Mapping Checklist: *Date:* 16 July 2005 *Time*: pm

Observations	Station/Sample No. 10	Station/Sample No. 11
Bedrock Type[1] and description	Granite gneiss ?(quartzite)	Felsite – intermediate volcanic
GPS Coordinates	629603, 7168346	627372, 7173275
PAG Indicators		
Fe-Staining etc.	Very minor or absent	Very minor to absent
Sulfides[2] type and %	None visible	None visible
Carbonate: type & %	None	Very minor
PAG/NAG	low	low
Physical Features		
Weathering[3]	Fresh	SW to fresh
Strength[4]	R5	R5
Fabric	Medium grained	Fine grained
Structure	Mod to weakly fractured	Moderately fractured
ABD	0.5 -1.0	± 0.5 m
Suitability for re-use	good	Good
Seepage/groundwater	none	None
Flow/color/pH		
Other		
Photo times	15:28 -15:47	14:09 to 14:31
Photo times	Soil 16:10 – 50 cm +deep sampled 0-30 cm	Soil pit 14:46 H=10 cm C= 30 cm
Photo times		~ 150-100m E of road ~ 20 m relief on N side & 5-10 on W side
Comments:	Rx samples 10-1 to 10-3	
	Soil sample S10-1	
	Minor veneers of till and weathered bedrock	Rx samples 11-1 & 11-3
	~50 to 100m above & N of road on ridge crest	Soil sample S11-1

Personnel: TR, KD, TM	Recorded by: TR
Weather: Sunny, windy	Date: 16 July 2005
Watershed	Project number: 05-1413-040

Notes:
1. Bedrock type
2. Disseminated, granular, clusters of grains, etc.
3. Weathering: FR = fresh; SW = Slightly weathered; MW = moderately weathered; HW = highly weathered; EW = extremely weathered
4. Strength: R1 through R6, R1 = very weak; R2 = weak; R3 = medium strong; R4 = strong; R5 = very strong; R6 - extremely strong.

Field Mapping Checklist: *Date:* 21 July 2005 *Time*: am

Observations	Station/Sample No. 11B	Station/Sample No.
Bedrock Type[1] and description	Volcanic – andesite	
GPS Coordinates	628555, 7171995	
PAG Indicators		
Fe-Staining etc.	None	
Sulfides[2] type and %	None	
Carbonate: type & %	None	
PAG/NAG		
Physical Features		
Weathering[3]	MW	
Strength[4]	R3-R4	
Fabric	Fine grained	
Structure	Moderately fractured	
ABD	±0.2	
Suitability for re-use	Good	
Seepage/groundwater	Pond at bottom of north-east side	
Flow/color/pH		
Other		
Photo times	8:40 panorama W-N-E-S	
Photo times		
Photo times		
Comments:	Rock samples 11b-1 to 11b-3	

Personnel: KD, TM	Recorded by: KD
Weather: rainy, windy	Date: 21 July 2005
Watershed	Project number: 05-1413-040

Notes:
1. Bedrock type
2. Disseminated, granular, clusters of grains, etc.
3. Weathering: FR = fresh; SW = Slightly weathered; MW = moderately weathered; HW = highly weathered; EW = extremely weathered
4. Strength: R1 through R6, R1 = very weak; R2 = weak; R3 = medium strong; R4 = strong; R5 = very strong; R6 - extremely strong.

Field Mapping Checklist: *Date:* 16 July 2005 *Time*: am

Observations	Station/Sample No. 13	Station/Sample No. 15
Bedrock Type[1] and description	Metawake	Metawake
GPS Coordinates	626110, 7181610 (mid way between B13- B14)	626347, 7187254
PAG Indicators		
Fe-Staining etc.	Very minor to none	Very minor to none
Sulfides[2] type and %	Nil	Nil
Carbonate: type & %	Minor quartz	Check sample / minor quartz
PAG/NAG	Low	Low
Physical Features		
Weathering[3]	SW to fresh	Sw to fresh
Strength[4]	R4	R4-R5
Fabric	Fine grained	
Structure	Thinly bedded – vertical dip	Well fractured and bedded
ABD	<0.1-0.02	0.2- 0.5
Suitability for re-use		Good
Seepage/groundwater	None	None
Flow/color/pH		
Other	Sample 13-1 to 13-3	
Photo times	12:20-13:20, 13:28	11:10±aerial
Photo times		To 11:54 including soil pit ~ 60 cm deep
Photo times		
Comments:	Soil sample – till mixed with frost shattered bedrock 0-30 cm over bedrock. Discontinuous Mv/Dv over top of outcrop	Sample till on adjacent type 4 terrain
		Rock sample 15-1 to 15-3 ~ 50% thin till & weathered
	Rx best exposed on 2-3 high exposure facing E ~ 50 m east of road location	Bedrock veneer across pit area ~ 5m of relief on outcrop
		Exposed bedrock 50-100m

Personnel: TR, KD, TM	Recorded by: TR
Weather: sunny, windy	Date: 16 July 2005
Watershed	Project number: 05-1413-040

Notes:
1. Bedrock type
2. Disseminated, granular, clusters of grains, etc.
3. Weathering: FR = fresh; SW = Slightly weathered; MW = moderately weathered; HW = highly weathered; EW = extremely weathered
4. Strength: R1 through R6, R1 = very weak; R2 = weak; R3 = medium strong; R4 = strong; R5 = very strong; R6 - extremely strong.

Field Mapping Checklist: *Date:* 16 July 2005 *Time*: am

Observations	Station/Sample No. 16	Station/Sample No. 17
Bedrock Type[1] and description	Metawacke	Metawacke or granite gneiss?
GPS Coordinates	626295, 7196394	627255, 7191532
PAG Indicators		
Fe-Staining etc.	Very minor	Very minor
Sulfides[2] type and %	Nil – trace	Nil
Carbonate : type & %	Nil	Nil
PAG/NAG	Low	Low
Physical Features		
Weathering[3]	SW	SW
Strength[4]	R4	R4
Fabric	Weakly foliated	Weakly foliated
Structure	Well fractured to platy/ bedded	Moderately fractured
ABD	0.1 ±	0.5
Suitability for re-use		
Seepage/groundwater	Nil	Nil
Flow/color/pH		
Other	Some area of outcrop may be weaker than area sampled photo 10:33	
Photo times		9:12
Photo times	10:23 of outcrop & surrounding type 2 terrain	Samples 17-1 to 17-3
Photo times		Mapped as type 1 should be 2
Comments:	Terrain type 2 – 4 adjacent S	Good pit site – ridge vertical 10 + m exposed rock
	Samples 16-1 to 16-3	
	Mud pit site 5-10m of relief	
	50X50 m minor overburden in places – other smaller outcrops within 50-100 m	100X50 m other similar outcrops nearby
	Pit within 50 m of road location	
	10:31 soil sampling site on type 4 adjacent to Pit 16	
Personnel: TR, KD, TM	Recorded by: TR	
Weather: sunny windy	Date: 16 July 2005	
Watershed	Project number: 05-1413-040	

Notes:
1. Bedrock type
2. Disseminated, granular, clusters of grains, etc.
3. Weathering: FR = fresh; SW = Slightly weathered; MW = moderately weathered; HW = highly weathered; EW = extremely weathered
4. Strength: R1 through R6, R1 = very weak; R2 = weak; R3 = medium strong; R4 = strong; R5 = very strong; R6 - extremely strong.

Field Mapping Checklist: *Date:* 15 July 2005 *Time*: am

Observations	Station/Sample No. 18	Station/Sample No. 19
Bedrock Type[1] and description	Mafic volcanics	Granite (type 1 terrain)
GPS Coordinates	627477, 7201768	629135, 7204236
PAG Indicators		
Fe-Staining etc.	Minor to very minor	Nil to Very minor
Sulfides[2] type and %	None	None to very minor
Carbonate: type & %	None	None
PAG/NAG	Low	Low
Physical Features		
Weathering[3]	SW	Fresh to slightly weathered
Strength[4]	R4-R5	R4-R5
Fabric	Foliated	
Structure	Well fractured	Moderate to well fractured
ABD	0.2 -0.5	0.3-0.5
Suitability for re-use	Ok	Good
Seepage/groundwater	None	None
Flow/color/pH		
Other		
Photo times	14:16 to 14:13	11:04, 11:32
Photo times		Soil pit photo #24, 1rx hammer deep
Photo times		
Comments:		Sample 19-1 to 19-3
		Soil (till sample)
		Soil Dv/Mv sample
Personnel: TR, KD, TM	Recorded by: TR	
Weather: cloudy	Date: 15 July 2005	
Watershed:	Project number: 05-1413-040	

Notes:
1. Bedrock type
2. Disseminated, granular, clusters of grains, etc.
3. Weathering: FR = fresh; SW = Slightly weathered; MW = moderately weathered; HW = highly weathered; EW = extremely weathered
4. Strength: R1 through R6, R1 = very weak; R2 = weak; R3 = medium strong; R4 = strong; R5 = very strong; R6 - extremely strong.

Field Mapping Checklist: *Date:* 15 July 2005 *Time*: am

Observations	Station/Sample No. 20	Station/Sample No.
Bedrock Type[1] and description	Granite (terrain type 2)	
GPS Coordinates	629915, 7206339	
PAG Indicators		
Fe-Staining etc.	Very minor on fracture surface	
Sulfides[2] type and %	None	
Carbonate: type & %	None	
PAG/NAG	Low	
Physical Features		
Weathering[3]	Fresh	
Strength[4]	R4-R5	
Fabric		
Structure	Mod. Well fractured	
ABD	0.2 to 0.5	
Suitability for re-use	Good	
Seepage/groundwater	None	
Flow/color/pH		
Other		
Photo times		
Photo times	8:34, 8:42, 8:43	
Photo times	Samples 20-1 to 20-3	
Comments:		

Personnel: TR, KD, TM	Recorded by: TR
Weather: cloudy	Date: 15 July 2005
Watershed:	Project number: 05-1413-040

Notes:
1. Bedrock type
2. Disseminated, granular, clusters of grains, etc.
3. Weathering: FR = fresh; SW = Slightly weathered; MW = moderately weathered; HW = highly weathered; EW = extremely weathered
4. Strength: R1 through R6, R1 = very weak; R2 = weak; R3 = medium strong; R4 = strong; R5 = very strong; R6 - extremely strong.

Field Mapping Checklist: *Date:* 14 July 2005 *Time*: am

Observations	Station/Sample No. 21	Station/Sample No. 22
Bedrock Type[1] and description	granite	granite
GPS Coordinates	631132, 7211751	633030, 7214160
PAG Indicators		
Fe-Staining etc.	v. minor	v. minor
Sulfides[2] type and %	Nil	Nil
Carbonate: type & %	Nil	Nil
PAG/NAG		
Physical Features		
Weathering[3]	Fresh	fresh
Strength[4]	R5	R5
Fabric		Weakly foliated
Structure	Mod – well fractured	Well-mod fractured
ABD	± 0.5	0.3-0.5
Suitability for re-use	Good	good
Seepage/groundwater	Nil	Nil
Flow/color/pH		
Other		Till sample S22-1
Photo times	13:11, 13:53 from R23 crossing looking S	9:31, 10:
Photo times		
Photo times		
Comments:	Sample P21-1 to P21-3 in granite	Samples:
		27-1 to 27-3 granite
		27-4 qz ~less than 5%
		Hard grey volcaniclastics exposed 100m N not sampled would also serve as a rx source
		Personnel :TR, KD, TM
		Weather: sunny
		Watershed: Third Portage Lake

Notes:
1. Bedrock type
2. Disseminated, granular, clusters of grains, etc.
3. Weathering: FR = fresh; SW = Slightly weathered; MW = moderately weathered; HW = highly weathered; EW = extremely weathered
4. Strength: R1 through R6, R1 = very weak; R2 = weak; R3 = medium strong; R4 = strong; R5 = very strong; R6 - extremely strong.

APPENDIX IX

LABORATORY RESULTS

Project Number : 05-1413-021 **Tech :** JM

Laboratory Determination of Water Content of Soil and Rock
ASTM D 2216-92

Sample Name	Soil 6	Soil 9	Soil 10	Soil 17	Soil 19	Soil 21
Depth (m)		0.00-0.30	0.00-0.30	0.00-0.35	0.00-0.40	
CONTAINER NUMBER	3A	187	M-14	1A	M11	50
MASS WET SOIL + TARE	585.8	410.8	1003.2	1410.2	1157.0	948.8
MASS DRY SOIL + TARE	505.3	382.9	942.3	1293.7	1069.9	826.8
MASS OF WATER	80.5	27.9	60.9	116.5	87.1	122.0
MASS OF CONTAINER	112.3	17.1	210.9	179.0	203.0	103.3
MASS OF DRY SOIL	393.0	365.8	731.4	1114.7	866.9	723.5
Water Content W (%)	**20.5**	**7.6**	**8.3**	**10.5**	**10.0**	**16.9**

Sample Name	Soil 24	Soil 27	Soil 29	Soil 30	Soil 33	Soil 36
Depth (m)		0.40-0.50			0.00-0.45	
CONTAINER NUMBER	M8	I	20	250	#33	47
MASS WET SOIL + TARE	1463.9	1022.0	2544.7	1122.6	718.5	418.4
MASS DRY SOIL + TARE	1300.1	979.7	2473.8	1097.0	691.2	373.0
MASS OF WATER	163.8	42.3	70.9	25.6	27.3	45.4
MASS OF CONTAINER	211.5	194.8	361.0	103.8	111.4	17.1
MASS OF DRY SOIL	1088.6	784.9	2112.8	993.2	579.8	355.9
Water Content W (%)	**15.0**	**5.4**	**3.4**	**2.6**	**4.7**	**12.8**

Sample Name	Soil 37	Soil 38	Soil 41	Soil 44		
Depth (m)		0.00-0.30		0.00-0.50		
CONTAINER NUMBER	Pan F	31	K2	D		
MASS WET SOIL + TARE	1249.8	642.7	1371.7	861.3		
MASS DRY SOIL + TARE	1115.0	559.4	1312.1	844.3		
MASS OF WATER	134.8	83.3	59.6	17.0		
MASS OF CONTAINER	193.2	110.8	199.3	194.1		
MASS OF DRY SOIL	921.8	448.6	1112.8	650.2		
Water Content W (%)	**14.6**	**18.6**	**5.4**	**2.6**		

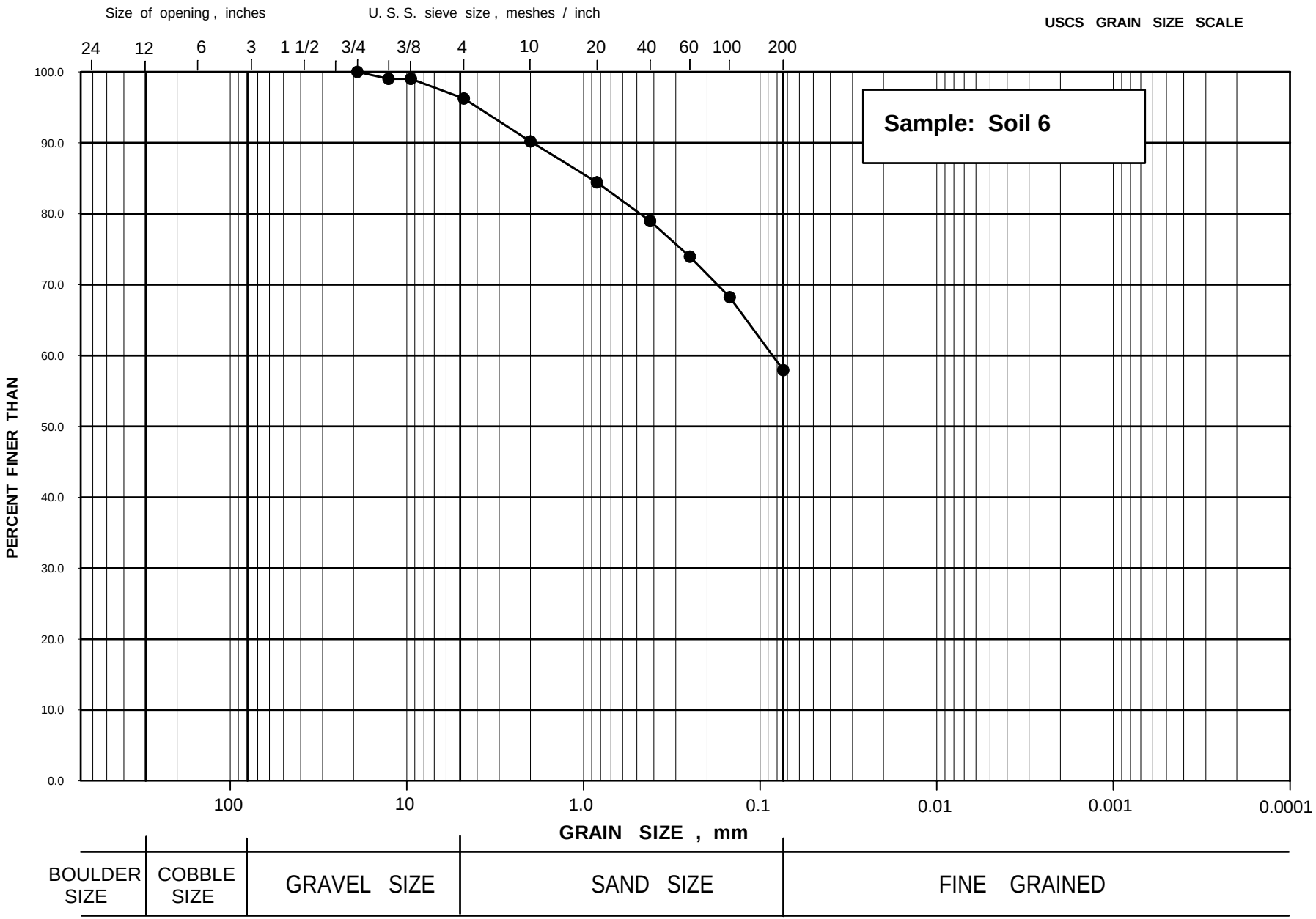
SIEVE ANALYSIS

Project No.	**05-1413-021**	**Client**	**Cumberland Resources Ltd.**	**Sample**	**Soil 6**
Sch#	**161**	**Project**	**Baker Lake Terrain Assess.**	**Depth**	
Lab Work	**JM**	**Location**	**Nunavut**		

1st SIEVING +#4		**2nd SIEVING -#4**		**Wash Sieving - #4**	
Weight before sieving		Quarter - #4 (Y/N)	Y	Weight before wash	113.0
Total weight	392.4	Wash Sieve (Y/N)	Y	Weight after wash	47.4
Total Wt -#4	377.7	Total Wt of -#4 sieved	113	Pan Weight	2.4

Sieve (USS)	Weight Retained	% Retained	Weight Retained	% Retained	% Retained of Total	Diameter (mm)	% Passing
12"	0.0	0.0			0.0	**304.8**	**100.0**
6"	0.0	0.0			0.0	**152.4**	**100.0**
3"	0.0	0.0			0.0	**76.2**	**100.0**
1 1/2 "	0.0	0.0			0.0	**38.1**	**100.0**
1"	0.0	0.0			0.0	**25.4**	**100.0**
3/4"	0.0	0.0			0.0	**19.1**	**100.0**
1/2"	3.8	1.0			1.0	**12.7**	**99.0**
3/8"	0.0	0.0			0.0	**9.50**	**99.0**
#4	10.9	2.8			2.8	**4.76**	**96.3**
#10			7.1	6.3	6.0	**2.00**	**90.2**
#20			6.8	6.0	5.8	**0.84**	**84.4**
#40			6.4	5.7	5.5	**0.42**	**79.0**
#60			5.9	5.2	5.0	**0.25**	**73.9**
#100			6.7	5.9	5.7	**0.149**	**68.2**
#200			12.1	10.7	10.3	**0.074**	**57.9**
-200			68.0	60.2	57.9		

REMARKS :



Project No. 05-1413-021 **Drawn** JM **Reviewed** LL **Date** 09/09/05	Golder Associates	**GRAIN SIZE DISTRIBUTION**	**Figure**

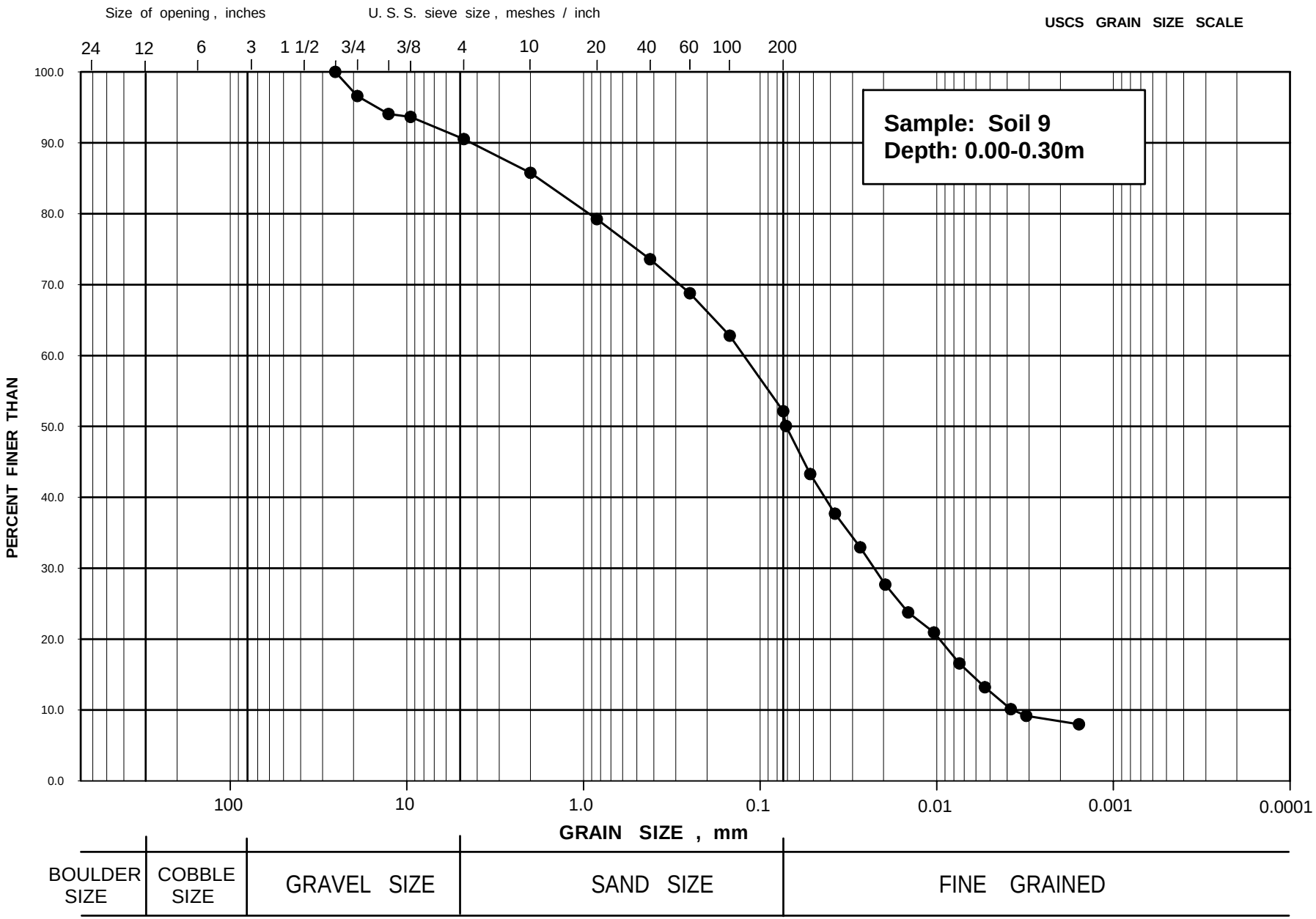
PARTICLE SIZE ANALYSIS OF SOILS ASTM D 422-63

Project No. :	05-1413-021	**Client :**	Cumberland Resources Ltd.		**Sample :**	Soil 9	
Sch#	161	**Project :**	Baker Lake Terrain Assess.		**Depth :**	0.00-0.30m	
Lab Work:	TM/JM	**Location:**	Nunavut				
	1ST SIEVING		**Hydrometer: (Minus #10)**		Residual #200	0.6	
	Total Weight	365.4	Before Wash	50.0	Total -200	30.4	
			After Wash	20.2	Gs	2.70	(assumed)

Size (USS)	Weight Retained	Retained (%)	Weight Retained	Retained (%)	% Retained Total	Diameter (mm)	% Passing
							100.0
6"	0.0					**152.4**	**100.0**
3"	0.0					**76.2**	**100.0**
1 1/2"	0.0					**38.1**	**100.0**
1"	0.0					**25.4**	**100.0**
3/4"	12.4	3.4			3.4	**19.1**	**96.6**
1/2"	9.3	2.5			2.5	**12.7**	**94.1**
3/8"	1.5	0.4			0.4	**9.52**	**93.7**
#4	11.4	3.1			3.1	**4.76**	**90.5**
#10	17.4	4.8			4.8	**2.00**	**85.8**
#20			3.8	7.6	6.5	**0.840**	**79.3**
#40			3.3	6.6	5.7	**0.420**	**73.6**
#60			2.8	5.6	4.8	**0.250**	**68.8**
#100			3.5	7.0	6.0	**0.149**	**62.8**
#200			6.2	12.4	10.6	**0.074**	**52.1**
Pan			30.4	60.8	52.1		

HYDROMETER ANALYSIS

Time (min)	Hydrometer Reading	Temperature (^{o}C)		Composite Correction	Hydrometer Corrected	Diameter (mm)	% Passing
0.5	33.0	22.0		-3.48	29.5	**0.0714**	**50.1**
1	29.0	22.0		-3.48	25.5	**0.0520**	**43.3**
2	25.7	22.0		-3.48	22.2	**0.0377**	**37.7**
4	22.9	22.0		-3.48	19.4	**0.0271**	**32.9**
8	19.8	22.0		-3.48	16.3	**0.0196**	**27.7**
15	17.5	22.0		-3.48	14.0	**0.0145**	**23.8**
30	15.9	21.5		-3.56	12.3	**0.0104**	**20.9**
60	13.4	21.0		-3.63	9.8	**0.0075**	**16.6**
120	11.5	20.5		-3.70	7.8	**0.0053**	**13.2**
240	9.6	21.0		-3.63	6.0	**0.0038**	**10.1**
360	8.9	22.0		-3.48	5.4	**0.0031**	**9.2**
1440	8.2	20.0		-3.48	4.7	**0.0016**	**8.0**



Project No. 05-1413-021.
Drawn JM
Reviewed LL
Date 09/09/05

Golder Associates

GRAIN SIZE DISTRIBUTION

Figure

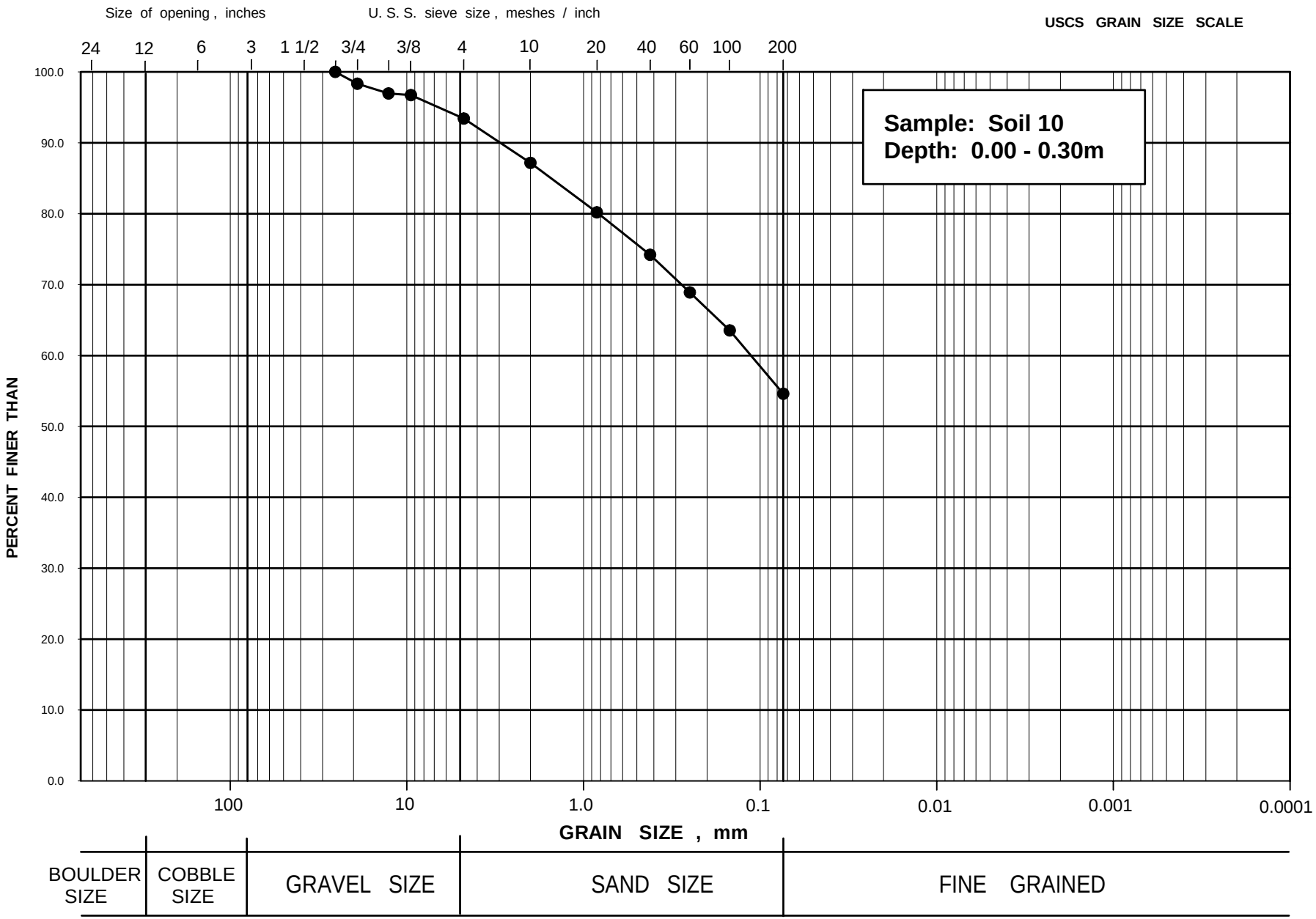
SIEVE ANALYSIS

Project No.	**05-1413-021**	**Client**	**Cumberland Resources Ltd.**	**Sample**	**Soil 10**
Sch#	**161**	**Project**	**Baker Lake Terrain Assess.**	**Depth**	**0.00-0.30m**
Lab Work	**JM**	**Location**	**Nunavut**		

1st SIEVING +#4		**2nd SIEVING -#4**		**Wash Sieving - #4**	
Weight before sieving		Quarter - #4 (Y/N)	Y	Weight before wash	210.3
Total weight	731.5	Wash Sieve (Y/N)	Y	Weight after wash	88.7
Total Wt -#4	683.5	Total Wt of -#4 sieved	210.3	Pan Weight	1.3

Sieve (USS)	Weight Retained	% Retained	Weight Retained	% Retained	% Retained of Total	Diameter (mm)	% Passing
12"	0.0	0.0			0.0	**304.8**	**100.0**
6"	0.0	0.0			0.0	**152.4**	**100.0**
3"	0.0	0.0			0.0	**76.2**	**100.0**
1 1/2 "	0.0	0.0			0.0	**38.1**	**100.0**
1"	0.0	0.0			0.0	**25.4**	**100.0**
3/4"	12.2	1.7			1.7	**19.1**	**98.3**
1/2"	10.0	1.4			1.4	**12.7**	**97.0**
3/8"	1.7	0.2			0.2	**9.50**	**96.7**
#4	24.1	3.3			3.3	**4.76**	**93.4**
#10			14.1	6.7	6.3	**2.00**	**87.2**
#20			15.7	7.5	7.0	**0.84**	**80.2**
#40			13.5	6.4	6.0	**0.42**	**74.2**
#60			11.9	5.7	5.3	**0.25**	**68.9**
#100			12.1	5.8	5.4	**0.149**	**63.5**
#200			20.1	9.6	8.9	**0.074**	**54.6**
-200			122.9	58.4	54.6		

REMARKS :



Project No. 05-1413-021 **Drawn** JM **Reviewed** LL **Date** 09/09/05	Golder Associates	**GRAIN SIZE DISTRIBUTION**

Figure

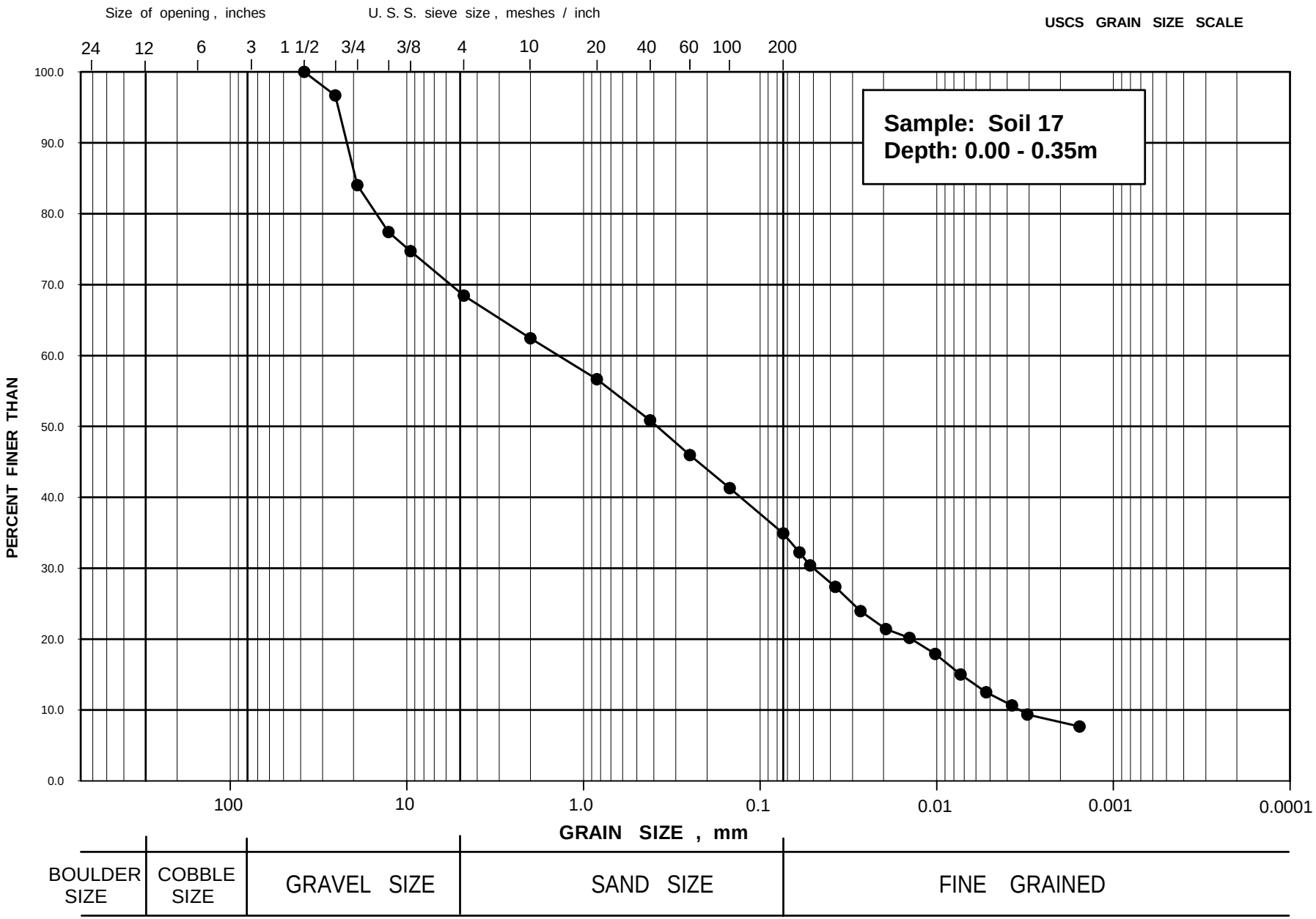
PARTICLE SIZE ANALYSIS OF SOILS ASTM D 422-63

Project No. :	05-1413-021	**Client :**	Cumberland Resources Ltd.		**Sample :**	Soil 17	
Sch#	161	**Project :**	Baker Lake Terrain Assess.		**Depth :**	0.00-0.35m	
Lab Work:	TM/JM	**Location:**	Nunavut				
	1ST SIEVING		**Hydrometer: (Minus #10)**		Residual #200	0.1	
	Total Weight	1112.4	Before Wash	50.8	Total -200	28.4	
			After Wash	22.5	Gs	2.70	(assumed)

Size (USS)	Weight Retained	Retained (%)	Weight Retained	Retained (%)	% Retained Total	Diameter (mm)	% Passing
							100.0
6"	0.0					**152.4**	**100.0**
3"	0.0					**76.2**	**100.0**
1 1/2"	0.0					**38.1**	**100.0**
1"	36.8	3.3			3.3	**25.4**	**96.7**
3/4"	140.8	12.7			12.7	**19.1**	**84.0**
1/2"	73.6	6.6			6.6	**12.7**	**77.4**
3/8"	30.1	2.7			2.7	**9.52**	**74.7**
#4	69.8	6.3			6.3	**4.76**	**68.4**
#10	66.9	6.0			6.0	**2.00**	**62.4**
#20			4.7	9.3	5.8	**0.840**	**56.6**
#40			4.7	9.3	5.8	**0.420**	**50.9**
#60			4.0	7.9	4.9	**0.250**	**46.0**
#100			3.8	7.5	4.7	**0.149**	**41.3**
#200			5.2	10.2	6.4	**0.074**	**34.9**
Pan			28.4	55.9	34.9		

HYDROMETER ANALYSIS

Time (min)	Hydrometer Reading	Temperature (^{o}C)		Composite Correction	Hydrometer Corrected	Diameter (mm)	% Passing
0.5	30.0	22.0		-3.48	26.5	**0.0600**	**32.2**
1	28.5	22.0		-3.48	25.0	**0.0522**	**30.4**
2	26.0	22.0		-3.48	22.5	**0.0376**	**27.4**
4	23.2	22.0		-3.48	19.7	**0.0271**	**24.0**
8	21.1	22.0		-3.48	17.6	**0.0194**	**21.4**
15	20.1	22.0		-3.48	16.6	**0.0143**	**20.2**
30	18.3	21.5		-3.56	14.7	**0.0102**	**17.9**
60	16.0	21.0		-3.63	12.4	**0.0073**	**15.0**
120	14.0	20.5		-3.70	10.3	**0.0053**	**12.5**
240	12.4	21.0		-3.63	8.8	**0.0037**	**10.7**
360	11.2	22.0		-3.48	7.7	**0.0031**	**9.4**
1440	9.8	20.0		-3.48	6.3	**0.0016**	**7.7**



Project No. 05-1413-021 **Drawn** JM **Reviewed** LL **Date** 09/09/05	Golder Associates	**GRAIN SIZE DISTRIBUTION**	**Figure**

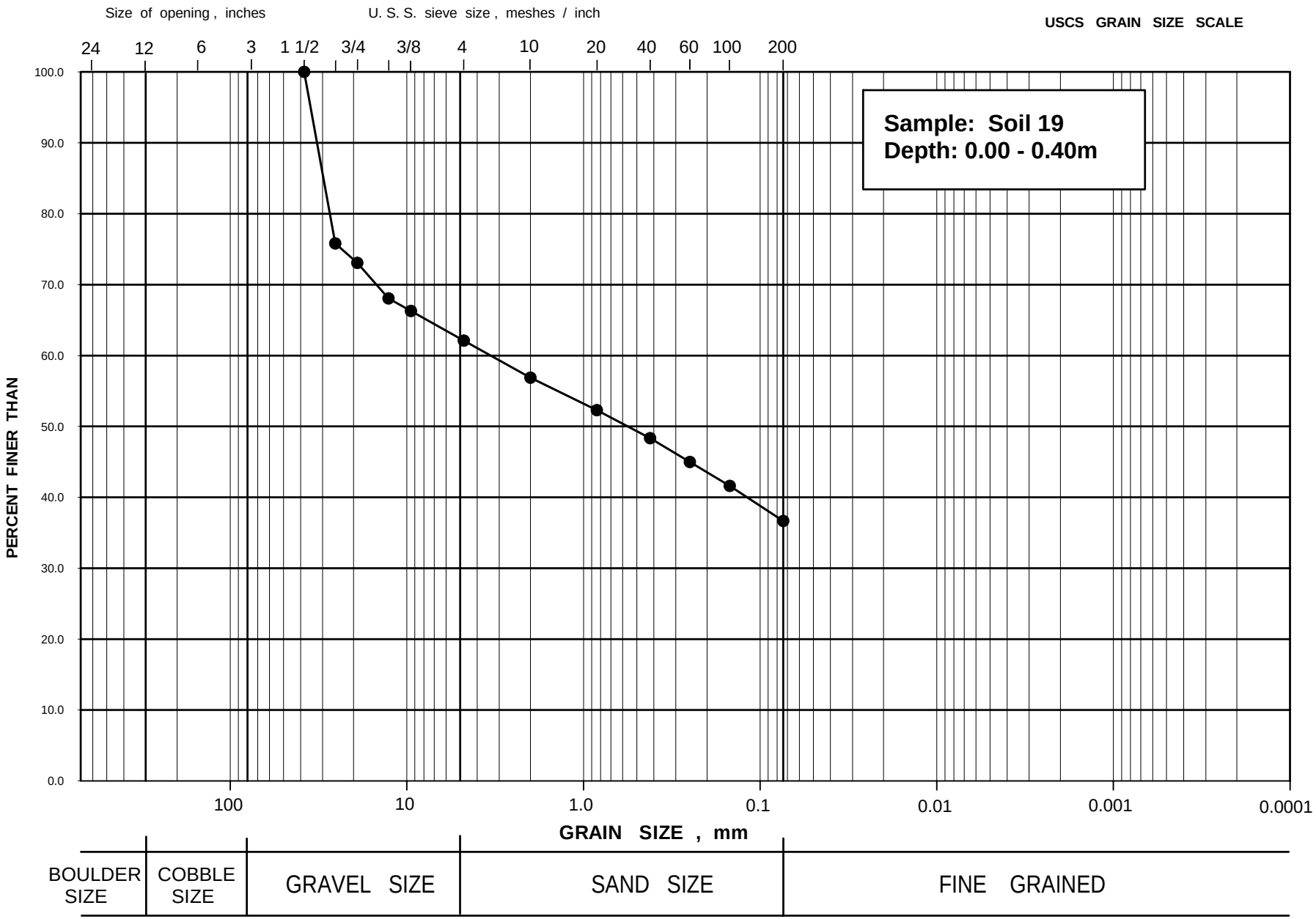
SIEVE ANALYSIS

Project No.	**05-1413-021**	**Client**	**Cumberland Resources Ltd.**	**Sample**	**Soil 19**
Sch#	**161**	**Project**	**Baker Lake Terrain Assess.**	**Depth**	**0.00-0.40m**
Lab Work	**JM**	**Location**	**Nunavut**		

1st SIEVING +#4		**2nd SIEVING -#4**		**Wash Sieving - #4**	
Weight before sieving		Quarter - #4 (Y/N)	Y	Weight before wash	210.5
Total weight	865.3	Wash Sieve (Y/N)	Y	Weight after wash	87.9
Total Wt -#4	537.3	Total Wt of -#4 sieved	210.5	Pan Weight	1.7

Sieve (USS)	Weight Retained	% Retained	Weight Retained	% Retained	% Retained of Total	Diameter (mm)	% Passing
12"	0.0	0.0			0.0	**304.8**	**100.0**
6"	0.0	0.0			0.0	**152.4**	**100.0**
3"	0.0	0.0			0.0	**76.2**	**100.0**
1 1/2 "	0.0	0.0			0.0	**38.1**	**100.0**
1"	209.4	24.2			24.2	**25.4**	**75.8**
3/4"	23.6	2.7			2.7	**19.1**	**73.1**
1/2"	43.5	5.0			5.0	**12.7**	**68.0**
3/8"	15.2	1.8			1.8	**9.50**	**66.3**
#4	36.3	4.2			4.2	**4.76**	**62.1**
#10			17.7	8.4	5.2	**2.00**	**56.9**
#20			15.5	7.4	4.6	**0.84**	**52.3**
#40			13.4	6.4	4.0	**0.42**	**48.3**
#60			11.4	5.4	3.4	**0.25**	**45.0**
#100			11.4	5.4	3.4	**0.149**	**41.6**
#200			16.8	8.0	5.0	**0.074**	**36.7**
-200			124.3	59.0	36.7		

REMARKS :



Project No. 05-1413-021 **Drawn** JM **Reviewed** LL **Date** 09/09/05	Golder Associates	**GRAIN SIZE DISTRIBUTION**	**Figure**

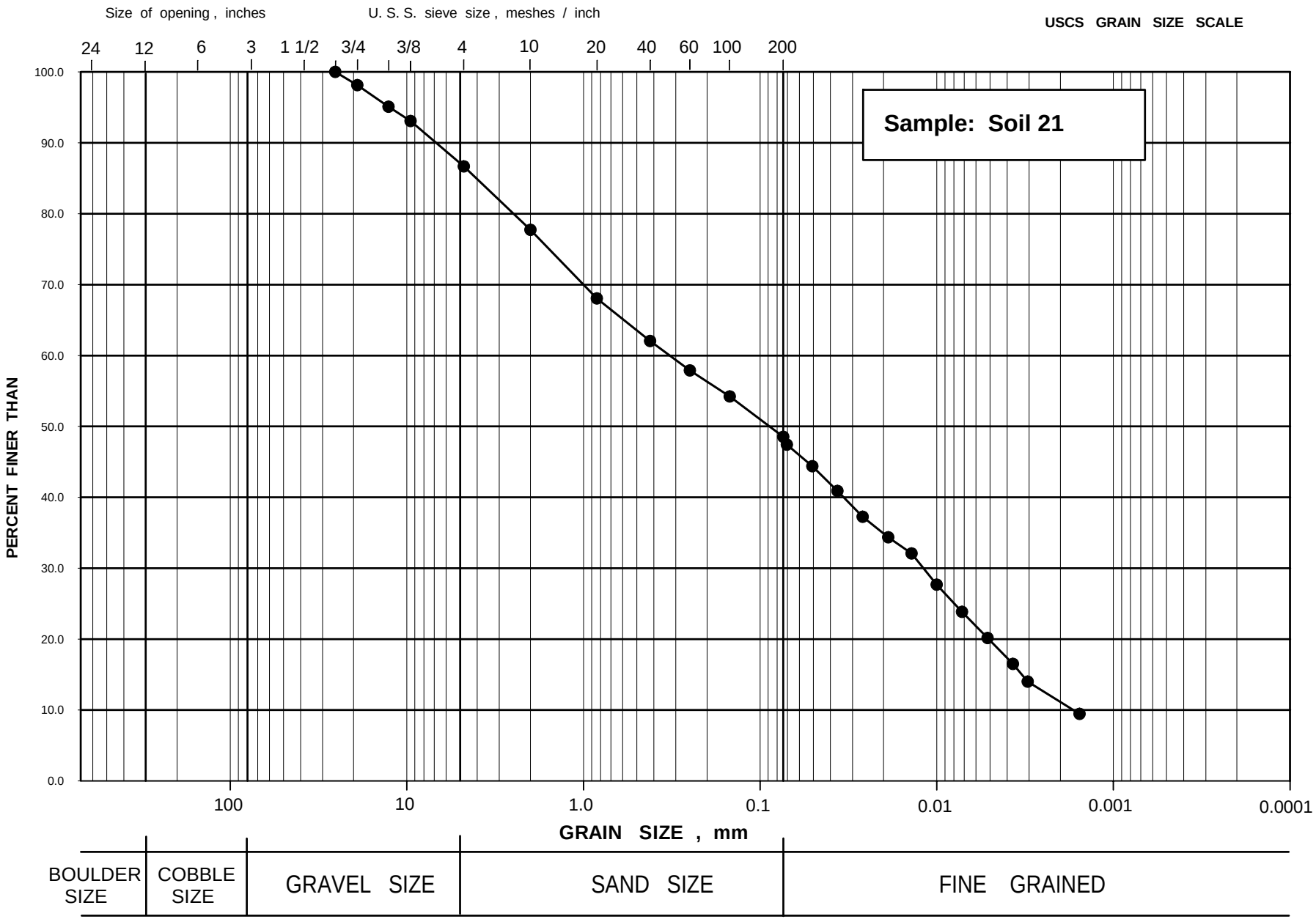
PARTICLE SIZE ANALYSIS OF SOILS ASTM D 422-63

Project No. :	05-1413-021	**Client :**	Cumberland Resources Ltd.		**Sample :**	Soil 21	
Sch#	161	**Project :**	Baker Lake Terrain Assess.		**Depth :**		
Lab Work:	TM/JM	**Location:**	Nunavut				
	1ST SIEVING		**Hydrometer: (Minus #10)**		Residual #200	0.0	
	Total Weight	719.5	Before Wash	50.6	Total -200	31.6	
			After Wash	19.0	Gs	2.70	(assumed)

Size (USS)	Weight Retained	Retained (%)	Weight Retained	Retained (%)	% Retained Total	Diameter (mm)	% Passing
							100.0
6"	0.0					**152.4**	**100.0**
3"	0.0					**76.2**	**100.0**
1 1/2"	0.0					**38.1**	**100.0**
1"	0.0					**25.4**	**100.0**
3/4"	13.4	1.9			1.9	**19.1**	**98.1**
1/2"	21.8	3.0			3.0	**12.7**	**95.1**
3/8"	14.6	2.0			2.0	**9.52**	**93.1**
#4	46.0	6.4			6.4	**4.76**	**86.7**
#10	64.4	9.0			9.0	**2.00**	**77.7**
#20			6.3	12.5	9.7	**0.840**	**68.1**
#40			3.9	7.7	6.0	**0.420**	**62.1**
#60			2.7	5.3	4.1	**0.250**	**57.9**
#100			2.4	4.7	3.7	**0.149**	**54.2**
#200			3.7	7.3	5.7	**0.074**	**48.5**
Pan			31.6	62.5	48.5		

HYDROMETER ANALYSIS

Time (min)	Hydrometer Reading	Temperature (^{o}C)		Composite Correction	Hydrometer Corrected	Diameter (mm)	% Passing
0.5	35.0	20.0		-3.77	31.2	**0.0706**	**47.4**
1	33.0	20.0		-3.77	29.2	**0.0507**	**44.4**
2	30.7	20.0		-3.77	26.9	**0.0365**	**40.9**
4	28.3	20.0		-3.77	24.5	**0.0263**	**37.3**
8	26.4	20.0		-3.77	22.6	**0.0188**	**34.4**
15	24.9	20.0		-3.77	21.1	**0.0139**	**32.1**
30	22.0	20.0		-3.77	18.2	**0.0100**	**27.7**
60	19.4	20.5		-3.70	15.7	**0.0072**	**23.8**
120	16.9	21.0		-3.63	13.3	**0.0052**	**20.2**
240	14.5	21.0		-3.63	10.9	**0.0037**	**16.5**
360	13.0	20.0		-3.77	9.2	**0.0031**	**14.0**
1440	10.0	20.0		-3.77	6.2	**0.0016**	**9.5**



Project No. 05-1413-021 **Drawn** JM **Reviewed** LL **Date** 09/09/05	Golder Associates	**GRAIN SIZE DISTRIBUTION**	**Figure**

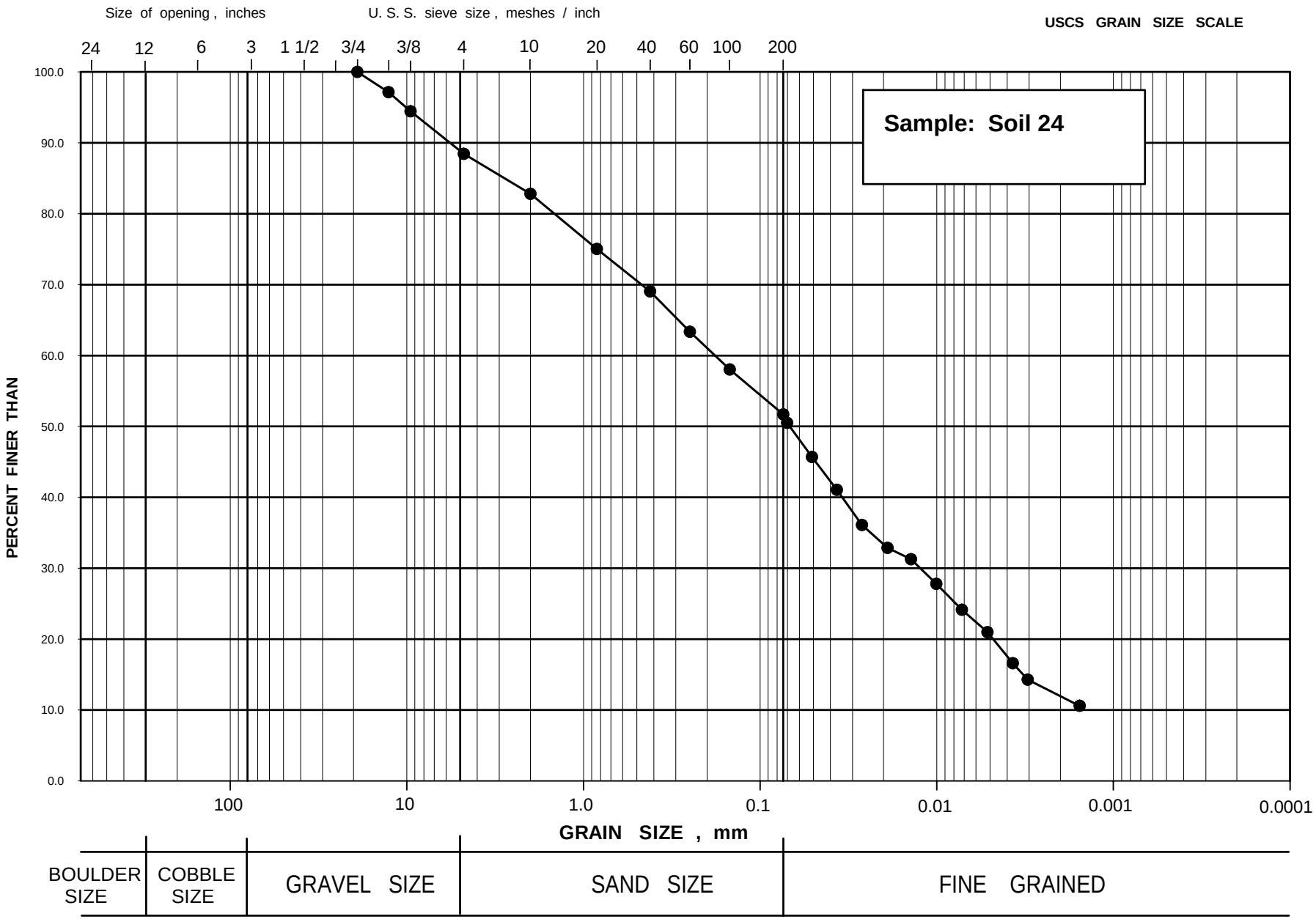
PARTICLE SIZE ANALYSIS OF SOILS ASTM D 422-63

Project No. :	05-1413-021	**Client :**	Cumberland Resources Ltd.		**Sample :**	Soil 24	
Sch#	161	**Project :**	Baker Lake Terrain Assess.		**Depth :**		
Lab Work:	TM/JM	**Location:**	Nunavut				
	1ST SIEVING		**Hydrometer: (Minus #10)**		Residual #200	0.3	
	Total Weight	1085.1	Before Wash	51.1	Total -200	31.9	
			After Wash	19.5	Gs	2.70	(assumed)

Size (USS)	Weight Retained	Retained (%)	Weight Retained	Retained (%)	% Retained Total	Diameter (mm)	% Passing
							100.0
6"	0.0					**152.4**	**100.0**
3"	0.0					**76.2**	**100.0**
1 1/2"	0.0					**38.1**	**100.0**
1"	0.0					**25.4**	**100.0**
3/4"	0.0					**19.1**	**100.0**
1/2"	31.1	2.9			2.9	**12.7**	**97.1**
3/8"	29.3	2.7			2.7	**9.52**	**94.4**
#4	65.0	6.0			6.0	**4.76**	**88.4**
#10	61.0	5.6			5.6	**2.00**	**82.8**
#20			4.8	9.4	7.8	**0.840**	**75.0**
#40			3.7	7.2	6.0	**0.420**	**69.0**
#60			3.5	6.8	5.7	**0.250**	**63.4**
#100			3.3	6.5	5.3	**0.149**	**58.0**
#200			3.9	7.6	6.3	**0.074**	**51.7**
Pan			31.9	62.4	51.7		

HYDROMETER ANALYSIS

Time (min)	Hydrometer Reading	Temperature (^{o}C)		Composite Correction	Hydrometer Corrected	Diameter (mm)	% Passing
0.5	35.0	22.0		-3.48	31.5	**0.0703**	**50.5**
1	32.0	22.0		-3.48	28.5	**0.0509**	**45.7**
2	29.1	22.0		-3.48	25.6	**0.0368**	**41.1**
4	26.0	22.0		-3.48	22.5	**0.0266**	**36.1**
8	24.0	22.0		-3.48	20.5	**0.0191**	**32.9**
15	23.0	22.0		-3.48	19.5	**0.0140**	**31.3**
30	20.9	21.5		-3.56	17.3	**0.0101**	**27.8**
60	18.7	21.0		-3.63	15.1	**0.0072**	**24.2**
120	16.8	20.5		-3.70	13.1	**0.0052**	**21.0**
240	14.0	21.0		-3.63	10.4	**0.0037**	**16.6**
360	12.4	22.0		-3.48	8.9	**0.0031**	**14.3**
1440	10.1	20.0		-3.48	6.6	**0.0016**	**10.6**



Project No. 05-1413-021 **Drawn** JM **Reviewed** LL **Date** 09/09/05	Golder Associates	**GRAIN SIZE DISTRIBUTION**	**Figure**

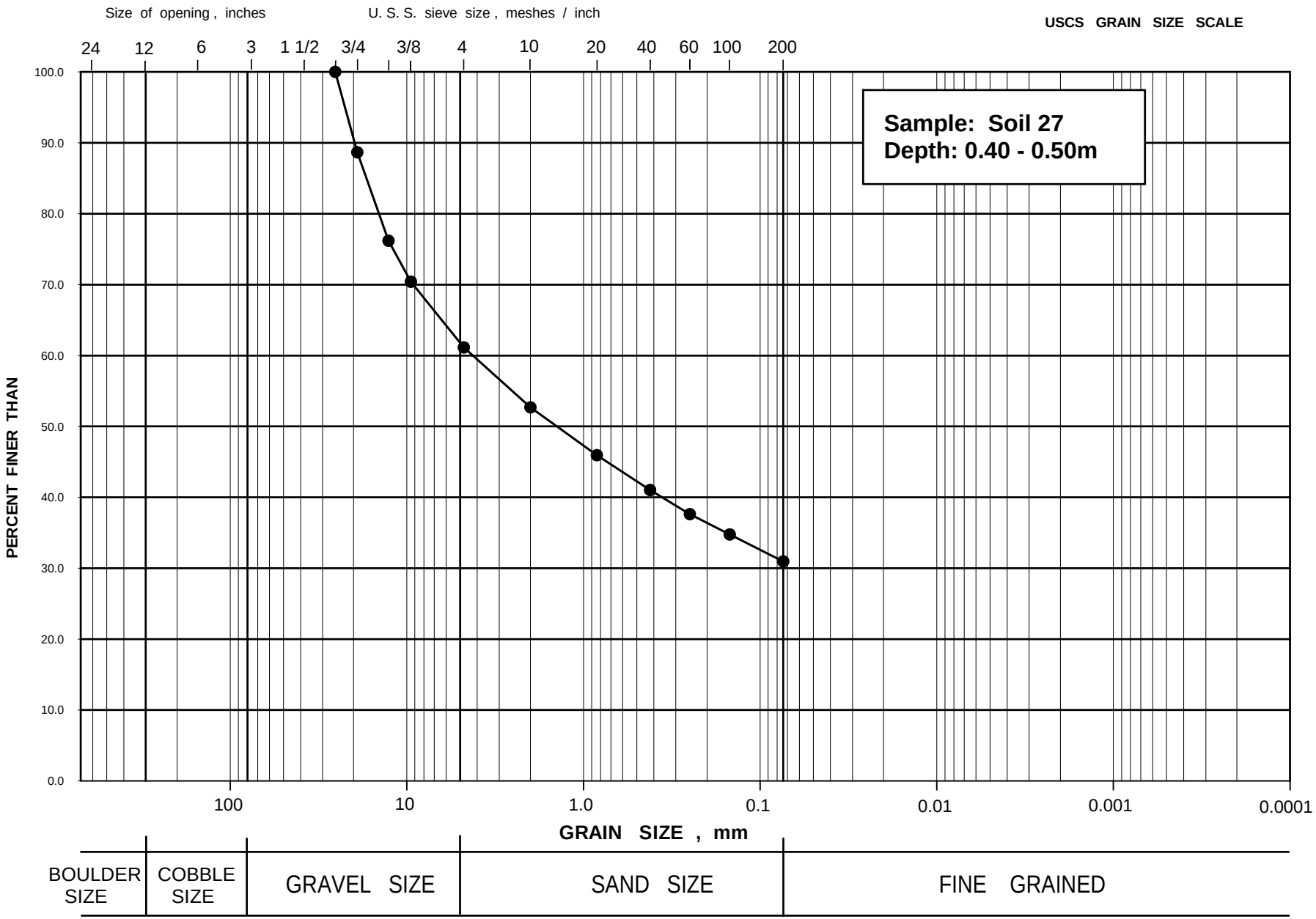
SIEVE ANALYSIS

Project No.	**05-1413-021**	**Client**	**Cumberland Resources Ltd.**	**Sample**	**Soil 27**
Sch#	**161**	**Project**	**Baker Lake Terrain Assess.**	**Depth**	**0.40-0.50m**
Lab Work	**JM**	**Location**	**Nunavut**		

1st SIEVING +#4		**2nd SIEVING -#4**		**Wash Sieving - #4**	
Weight before sieving		Quarter - #4 (Y/N)	Y	Weight before wash	208.2
Total weight	785.9	Wash Sieve (Y/N)	Y	Weight after wash	103.9
Total Wt -#4	480.6	Total Wt of -#4 sieved	208.2	Pan Weight	1.1

Sieve (USS)	Weight Retained	% Retained	Weight Retained	% Retained	% Retained of Total	Diameter (mm)	% Passing
12"	0.0	0.0			0.0	**304.8**	**100.0**
6"	0.0	0.0			0.0	**152.4**	**100.0**
3"	0.0	0.0			0.0	**76.2**	**100.0**
1 1/2 "	0.0	0.0			0.0	**38.1**	**100.0**
1"	0.0	0.0			0.0	**25.4**	**100.0**
3/4"	89.0	11.3			11.3	**19.1**	**88.7**
1/2"	98.2	12.5			12.5	**12.7**	**76.2**
3/8"	45.4	5.8			5.8	**9.50**	**70.4**
#4	72.7	9.3			9.3	**4.76**	**61.2**
#10			28.8	13.8	8.5	**2.00**	**52.7**
#20			23.0	11.0	6.8	**0.84**	**45.9**
#40			16.7	8.0	4.9	**0.42**	**41.0**
#60			11.6	5.6	3.4	**0.25**	**37.6**
#100			9.7	4.7	2.8	**0.149**	**34.8**
#200			13.0	6.2	3.8	**0.074**	**31.0**
-200			105.4	50.6	31.0		

REMARKS :



Project No. 05-1413-021. **Drawn** JM **Reviewed** LL **Date** 09/09/05	Golder Associates	**GRAIN SIZE DISTRIBUTION**

Figure

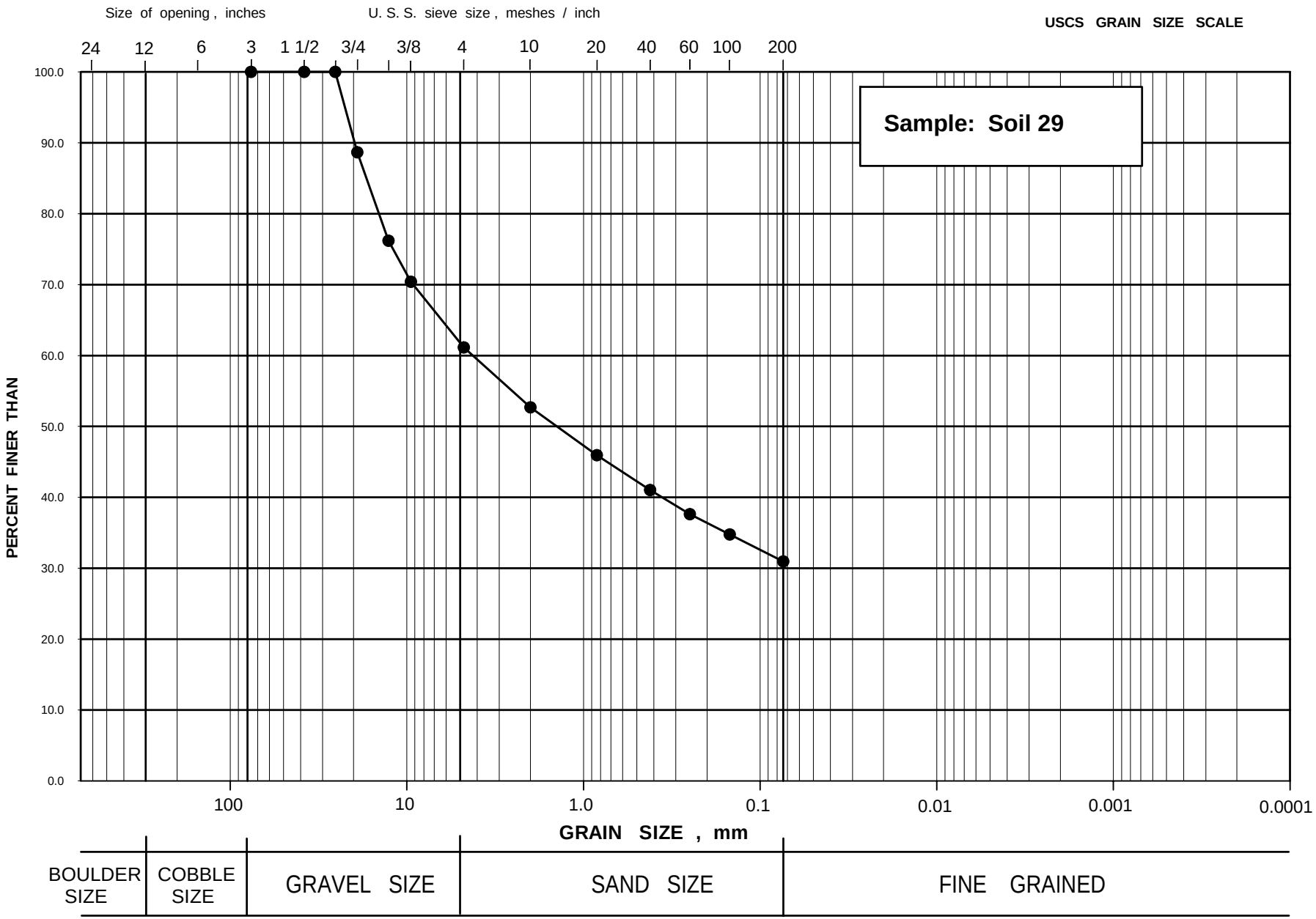
SIEVE ANALYSIS

Project No.	**05-1413-021**	**Client**	**Cumberland Resources Ltd.**	**Sample**	**Soil 29**
Sch#	**161**	**Project**	**Baker Lake Terrain Assess.**	**Depth**	
Lab Work	**JM**	**Location**	**Nunavut**		

1st SIEVING +#4		**2nd SIEVING -#4**		**Wash Sieving - #4**	
Weight before sieving		Quarter - #4 (Y/N)	Y	Weight before wash	202.4
Total weight	2113.2	Wash Sieve (Y/N)	Y	Weight after wash	191.3
Total Wt -#4	861.9	Total Wt of -#4 sieved	202.4	Pan Weight	2.7

Sieve (USS)	Weight Retained	% Retained	Weight Retained	% Retained	% Retained of Total	Diameter (mm)	% Passing
12"	0.0	0.0			0.0	**304.8**	**100.0**
6"	0.0	0.0			0.0	**152.4**	**100.0**
3"	0.0	0.0			0.0	**76.2**	**100.0**
1 1/2 "	181.6	8.6			8.6	**38.1**	**91.4**
1"	297.2	14.1			14.1	**25.4**	**77.3**
3/4"	242.4	11.5			11.5	**19.1**	**65.9**
1/2"	216.2	10.2			10.2	**12.7**	**55.6**
3/8"	78.8	3.7			3.7	**9.50**	**51.9**
#4	235.1	11.1			11.1	**4.76**	**40.8**
#10			77.3	38.2	15.6	**2.00**	**25.2**
#20			68.9	34.0	13.9	**0.84**	**11.3**
#40			21.5	10.6	4.3	**0.42**	**7.0**
#60			7.5	3.7	1.5	**0.25**	**5.5**
#100			5.2	2.6	1.0	**0.149**	**4.4**
#200			8.2	4.1	1.7	**0.074**	**2.8**
-200			13.8	6.8	2.8		

REMARKS :



Project No. 05-1413-021. **Drawn** JM **Reviewed** LL **Date** 09/09/05	Golder Associates	**GRAIN SIZE DISTRIBUTION**

Figure

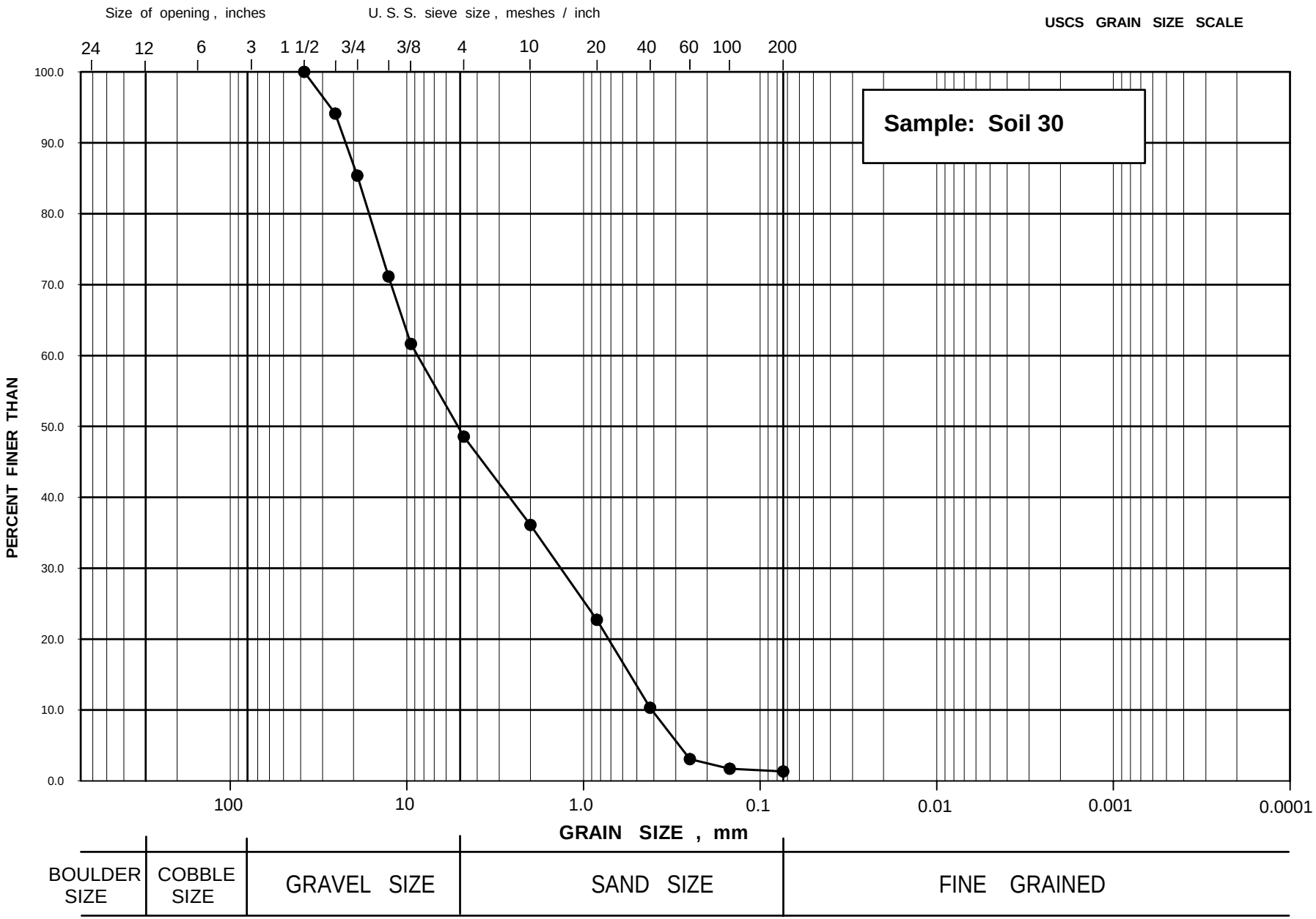
SIEVE ANALYSIS

Project No.	**05-1413-021**	**Client**	**Cumberland Resources Ltd.**	**Sample**	**Soil 30**
Sch#	**161**	**Project**	**Baker Lake Terrain Assess.**	**Depth**	
Lab Work	**JM**	**Location**	**Nunavut**		

1st SIEVING +#4		**2nd SIEVING -#4**		**Wash Sieving - #4**	
Weight before sieving		Quarter - #4 (Y/N)	Y	Weight before wash	217.4
Total weight	994.1	Wash Sieve (Y/N)	Y	Weight after wash	211.5
Total Wt -#4	482.7	Total Wt of -#4 sieved	217.4	Pan Weight	0.1

Sieve (USS)	Weight Retained	% Retained	Weight Retained	% Retained	% Retained of Total	Diameter (mm)	% Passing
12"	0.0	0.0			0.0	**304.8**	**100.0**
6"	0.0	0.0			0.0	**152.4**	**100.0**
3"	0.0	0.0			0.0	**76.2**	**100.0**
1 1/2 "	0.0	0.0			0.0	**38.1**	**100.0**
1"	58.4	5.9			5.9	**25.4**	**94.1**
3/4"	86.9	8.7			8.7	**19.1**	**85.4**
1/2"	141.6	14.2			14.2	**12.7**	**71.1**
3/8"	94.4	9.5			9.5	**9.50**	**61.6**
#4	130.1	13.1			13.1	**4.76**	**48.6**
#10			55.8	25.7	12.5	**2.00**	**36.1**
#20			59.9	27.6	13.4	**0.84**	**22.7**
#40			55.5	25.5	12.4	**0.42**	**10.3**
#60			32.4	14.9	7.2	**0.25**	**3.1**
#100			6.1	2.8	1.4	**0.149**	**1.7**
#200			1.7	0.8	0.4	**0.074**	**1.3**
-200			6.0	2.8	1.3		

REMARKS :



Project No. 05-1413-021
Drawn JM
Reviewed LL
Date 09/09/05

Golder Associates

GRAIN SIZE DISTRIBUTION

Figure

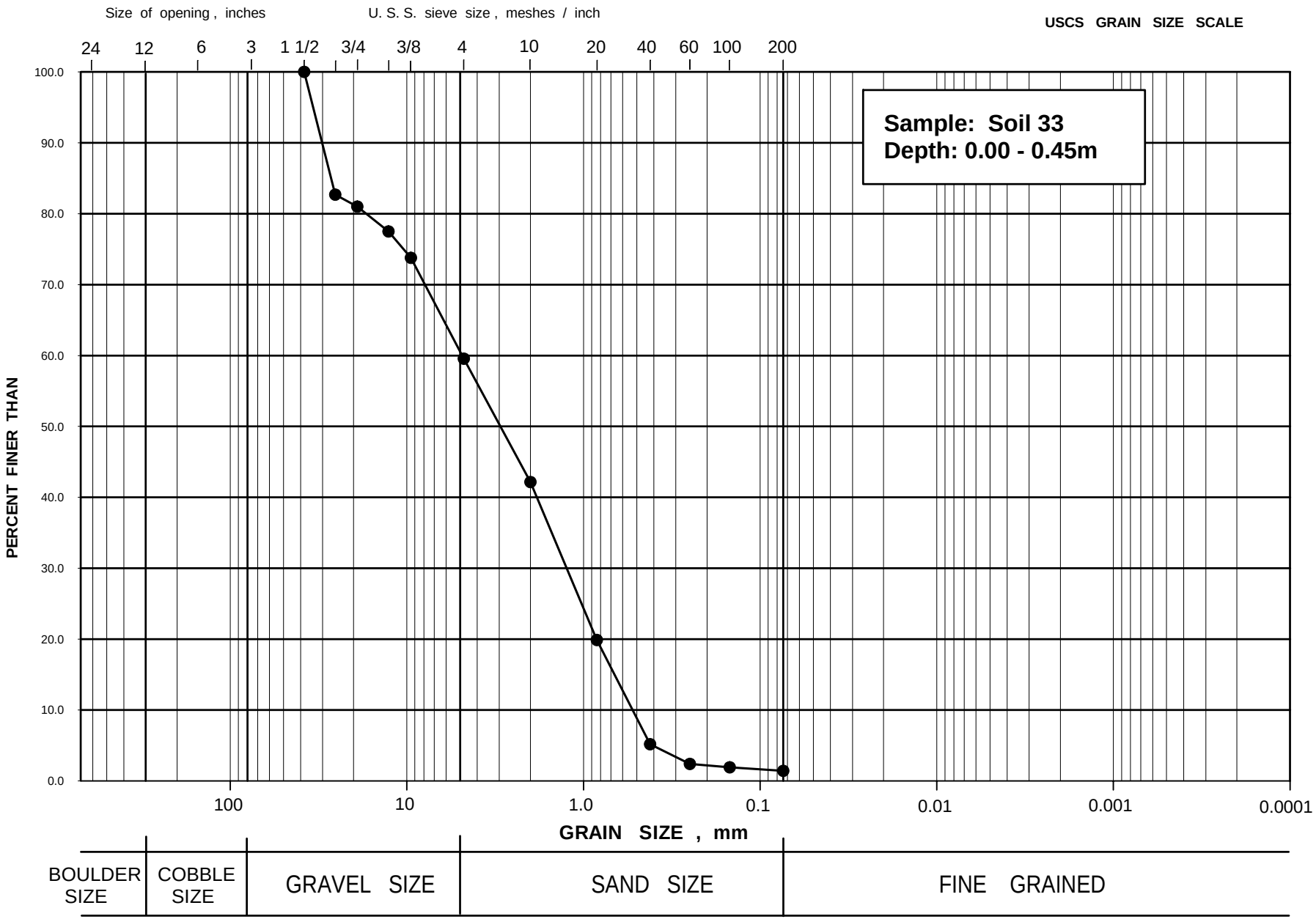
SIEVE ANALYSIS

Project No.	**05-1413-021**	**Client**	**Cumberland Resources Ltd.**	**Sample**	**Soil 33**
Sch#	**161**	**Project**	**Baker Lake Terrain Assess.**	**Depth**	**0.00-0.45m**
Lab Work	**JM**	**Location**	**Nunavut**		

1st SIEVING +#4		**2nd SIEVING -#4**		**Wash Sieving - #4**	
Weight before sieving		Quarter - #4 (Y/N)	Y	Weight before wash	145.8
Total weight	579.4	Wash Sieve (Y/N)	Y	Weight after wash	142.8
Total Wt -#4	345.1	Total Wt of -#4 sieved	145.8	Pan Weight	0.5

Sieve (USS)	Weight Retained	% Retained	Weight Retained	% Retained	% Retained of Total	Diameter (mm)	% Passing
12"	0.0	0.0			0.0	**304.8**	**100.0**
6"	0.0	0.0			0.0	**152.4**	**100.0**
3"	0.0	0.0			0.0	**76.2**	**100.0**
1 1/2 "	0.0	0.0			0.0	**38.1**	**100.0**
1"	100.3	17.3			17.3	**25.4**	**82.7**
3/4"	9.7	1.7			1.7	**19.1**	**81.0**
1/2"	20.4	3.5			3.5	**12.7**	**77.5**
3/8"	21.5	3.7			3.7	**9.50**	**73.8**
#4	82.4	14.2			14.2	**4.76**	**59.6**
#10			42.6	29.2	17.4	**2.00**	**42.2**
#20			54.5	37.4	22.3	**0.84**	**19.9**
#40			36.0	24.7	14.7	**0.42**	**5.2**
#60			6.8	4.7	2.8	**0.25**	**2.4**
#100			1.2	0.8	0.5	**0.149**	**1.9**
#200			1.2	0.8	0.5	**0.074**	**1.4**
-200			3.5	2.4	1.4		

REMARKS :



Project No. 05-1413-021 **Drawn** JM **Reviewed** LL **Date** 09/09/05	Golder Associates	**GRAIN SIZE DISTRIBUTION**

Figure

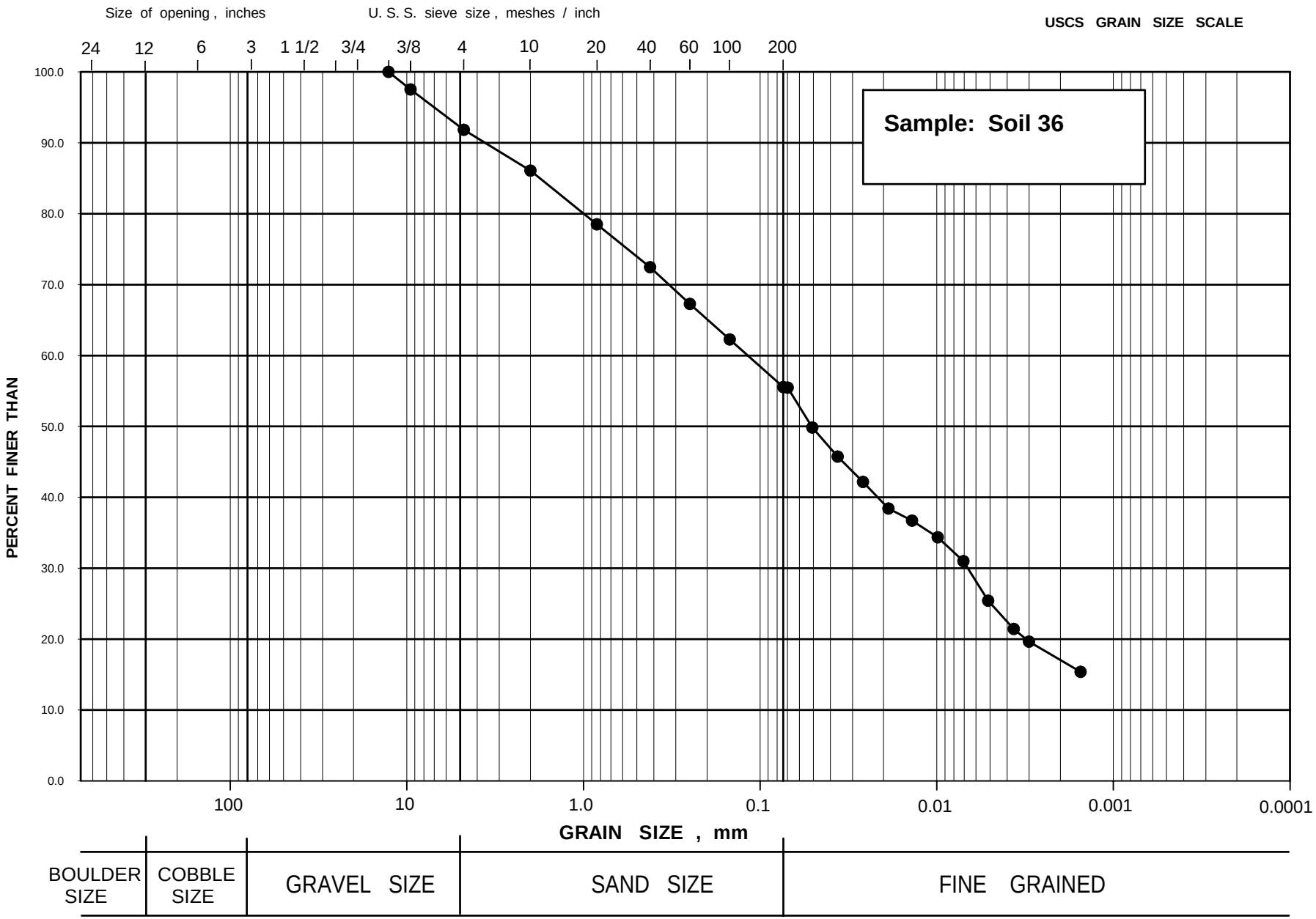
PARTICLE SIZE ANALYSIS OF SOILS ASTM D 422-63

Project No. :	05-1413-021	**Client :**	Cumberland Resources Ltd.		**Sample :**	Soil 36	
Sch#	161	**Project :**	Baker Lake Terrain Assess.		**Depth :**		
Lab Work:	TM/JM	**Location:**	Nunavut				
	1ST SIEVING		**Hydrometer: (Minus #10)**		Residual #200	0.3	
	Total Weight	354.4	Before Wash	49.9	Total -200	32.2	
			After Wash	18.0	Gs	2.70	(assumed)

Size (USS)	Weight Retained	Retained (%)	Weight Retained	Retained (%)	% Retained Total	Diameter (mm)	% Passing
							100.0
6"	0.0					**152.4**	**100.0**
3"	0.0					**76.2**	**100.0**
1 1/2"	0.0					**38.1**	**100.0**
1"	0.0					**25.4**	**100.0**
3/4"	0.0					**19.1**	**100.0**
1/2"	0.0					**12.7**	**100.0**
3/8"	8.8	2.5			2.5	**9.52**	**97.5**
#4	20.1	5.7			5.7	**4.76**	**91.8**
#10	20.4	5.8			5.8	**2.00**	**86.1**
#20			4.4	8.8	7.6	**0.840**	**78.5**
#40			3.5	7.0	6.0	**0.420**	**72.5**
#60			3.0	6.0	5.2	**0.250**	**67.3**
#100			2.9	5.8	5.0	**0.149**	**62.3**
#200			3.9	7.8	6.7	**0.074**	**55.6**
Pan			32.2	64.5	55.6		

HYDROMETER ANALYSIS

Time (min)	Hydrometer Reading	Temperature (^{o}C)		Composite Correction	Hydrometer Corrected	Diameter (mm)	% Passing
0.5	36.0	22.0		-3.48	32.5	**0.0698**	**55.5**
1	32.7	22.0		-3.48	29.2	**0.0506**	**49.8**
2	30.3	22.0		-3.48	26.8	**0.0365**	**45.8**
4	28.2	22.0		-3.48	24.7	**0.0262**	**42.2**
8	26.0	22.0		-3.48	22.5	**0.0188**	**38.4**
15	25.0	22.0		-3.48	21.5	**0.0138**	**36.7**
30	23.7	21.5		-3.56	20.1	**0.0099**	**34.4**
60	21.8	21.0		-3.63	18.2	**0.0071**	**31.0**
120	18.6	20.5		-3.70	14.9	**0.0051**	**25.4**
240	16.2	21.0		-3.63	12.6	**0.0037**	**21.4**
360	15.0	22.0		-3.48	11.5	**0.0030**	**19.6**
1440	12.5	20.0		-3.48	9.0	**0.0015**	**15.4**



Project No. 05-1413-021 **Drawn** JM **Reviewed** LL **Date** 09/09/05	Golder Associates	**GRAIN SIZE DISTRIBUTION**	**Figure**

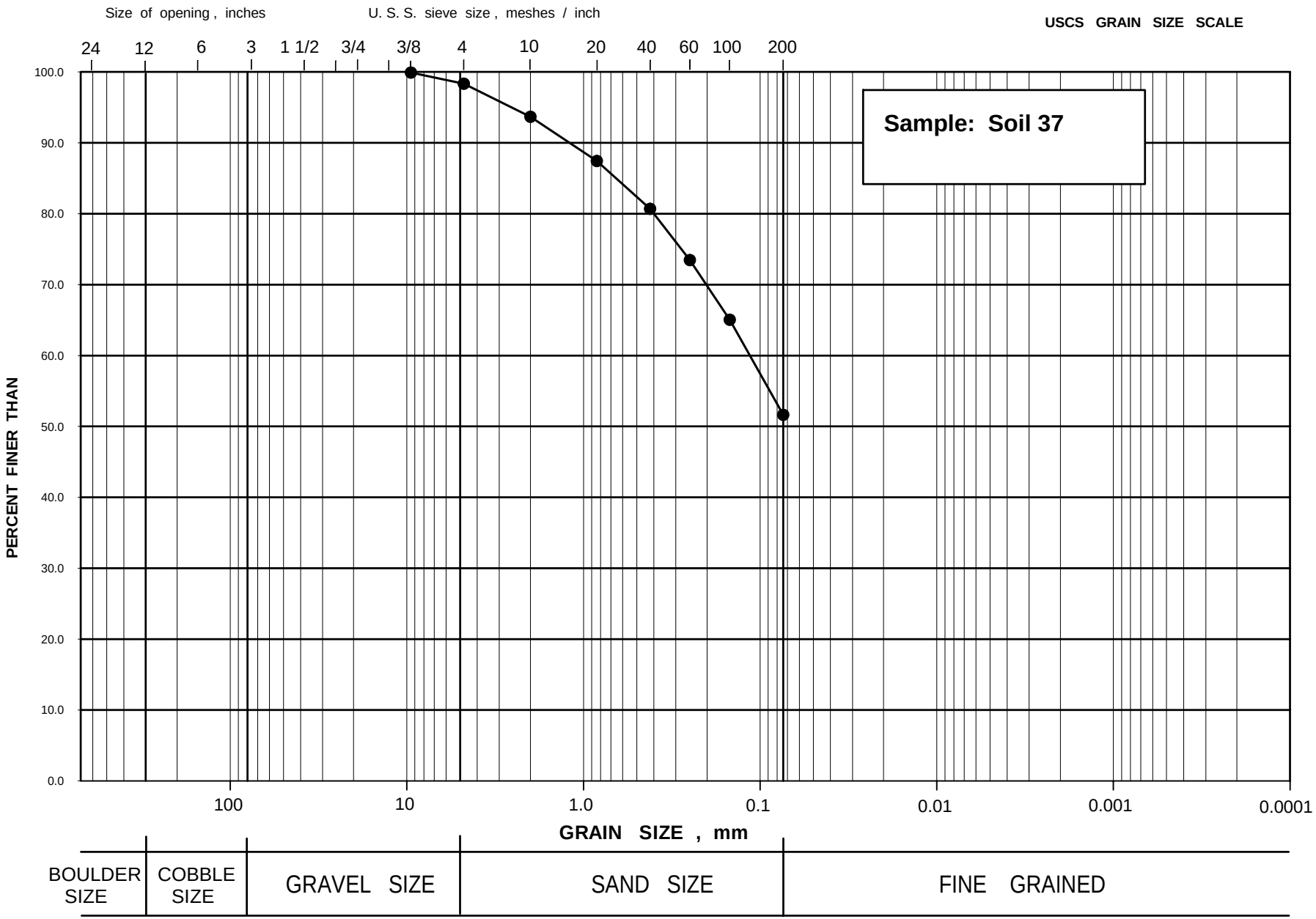
SIEVE ANALYSIS

Project No.	**05-1413-021**	**Client**	**Cumberland Resources Ltd.**	**Sample**	**Soil 37**
Sch#	**161**	**Project**	**Baker Lake Terrain Assess.**	**Depth**	
Lab Work	**JM**	**Location**	**Nunavut**		

1st SIEVING +#4		**2nd SIEVING -#4**		**Wash Sieving - #4**	
Weight before sieving		Quarter - #4 (Y/N)	Y	Weight before wash	178.8
Total weight	919.0	Wash Sieve (Y/N)	Y	Weight after wash	87.3
Total Wt -#4	903.7	Total Wt of -#4 sieved	178.8	Pan Weight	2.4

Sieve (USS)	Weight Retained	% Retained	Weight Retained	% Retained	% Retained of Total	Diameter (mm)	% Passing
12"	0.0	0.0			0.0	**304.8**	**100.0**
6"	0.0	0.0			0.0	**152.4**	**100.0**
3"	0.0	0.0			0.0	**76.2**	**100.0**
1 1/2 "	0.0	0.0			0.0	**38.1**	**100.0**
1"	0.0	0.0			0.0	**25.4**	**100.0**
3/4"	0.0	0.0			0.0	**19.1**	**100.0**
1/2"	0.0	0.0			0.0	**12.7**	**100.0**
3/8"	1.0	0.1			0.1	**9.50**	**99.9**
#4	14.3	1.6			1.6	**4.76**	**98.3**
#10			8.5	4.8	4.7	**2.00**	**93.7**
#20			11.3	6.3	6.2	**0.84**	**87.4**
#40			12.3	6.9	6.8	**0.42**	**80.7**
#60			13.1	7.3	7.2	**0.25**	**73.5**
#100			15.3	8.6	8.4	**0.149**	**65.1**
#200			24.4	13.6	13.4	**0.074**	**51.6**
-200			93.9	52.5	51.6		

REMARKS :



Project No. 05-1413-021. **Drawn** JM **Reviewed** LL **Date** 09/09/05	Golder Associates	**GRAIN SIZE DISTRIBUTION**	**Figure**

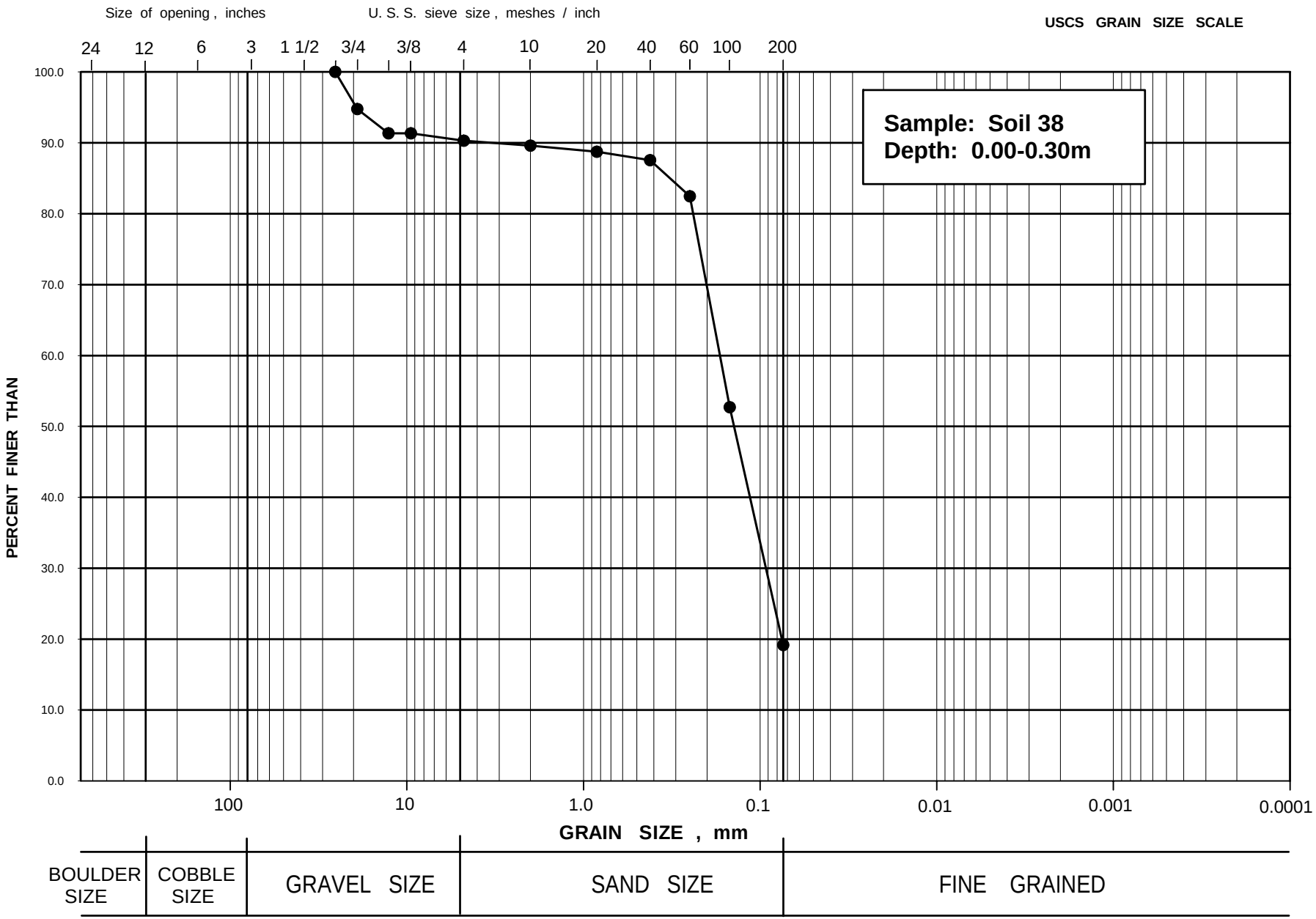
SIEVE ANALYSIS

Project No.	**05-1413-021**	**Client**	**Cumberland Resources Ltd.**	**Sample**	**Soil 38**
Sch#	**161**	**Project**	**Baker Lake Terrain Assess.**	**Depth**	**0.00-0.30m**
Lab Work	**JM**	**Location**	**Nunavut**		

1st SIEVING +#4		**2nd SIEVING -#4**		**Wash Sieving - #4**	
Weight before sieving		Quarter - #4 (Y/N)	Y	Weight before wash	145.1
Total weight	448.2	Wash Sieve (Y/N)	Y	Weight after wash	116.5
Total Wt -#4	404.7	Total Wt of -#4 sieved	145.1	Pan Weight	2.2

Sieve (USS)	Weight Retained	% Retained	Weight Retained	% Retained	% Retained of Total	Diameter (mm)	% Passing
12"	0.0	0.0			0.0	**304.8**	**100.0**
6"	0.0	0.0			0.0	**152.4**	**100.0**
3"	0.0	0.0			0.0	**76.2**	**100.0**
1 1/2 "	0.0	0.0			0.0	**38.1**	**100.0**
1"	0.0	0.0			0.0	**25.4**	**100.0**
3/4"	23.5	5.2			5.2	**19.1**	**94.8**
1/2"	15.3	3.4			3.4	**12.7**	**91.3**
3/8"	0.0	0.0			0.0	**9.50**	**91.3**
#4	4.7	1.0			1.0	**4.76**	**90.3**
#10			1.1	0.8	0.7	**2.00**	**89.6**
#20			1.4	1.0	0.9	**0.84**	**88.7**
#40			1.9	1.3	1.2	**0.42**	**87.6**
#60			8.2	5.7	5.1	**0.25**	**82.5**
#100			47.8	32.9	29.7	**0.149**	**52.7**
#200			53.9	37.1	33.5	**0.074**	**19.2**
-200			30.8	21.2	19.2		

REMARKS :



Project No. 05-1413-021 **Drawn** JM **Reviewed** LL **Date** 09/09/05	Golder Associates	**GRAIN SIZE DISTRIBUTION**	**Figure**

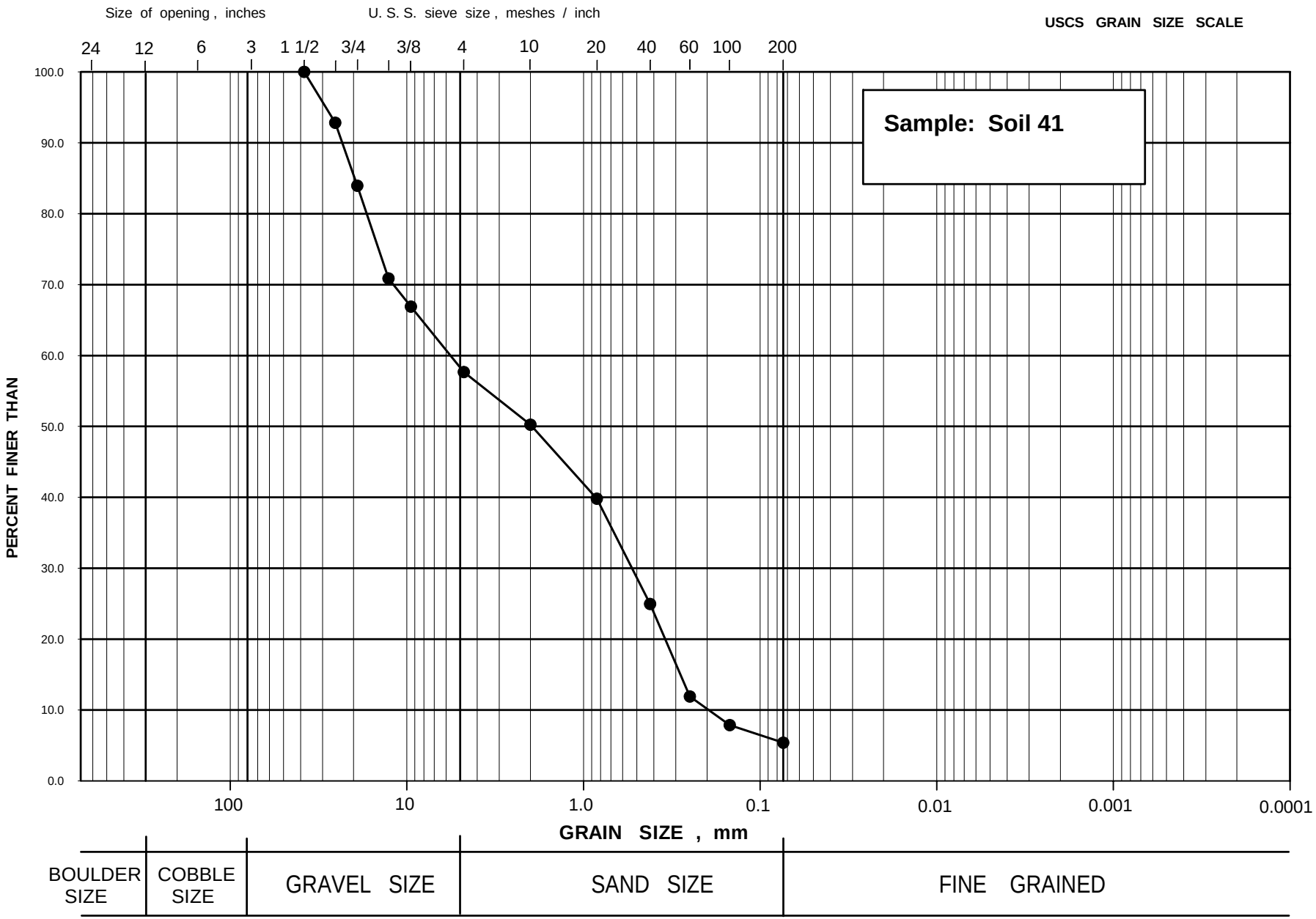
SIEVE ANALYSIS

Project No.	**05-1413-021**	**Client**	**Cumberland Resources Ltd.**	**Sample**	**Soil 41**
Sch#	**161**	**Project**	**Baker Lake Terrain Assess.**	**Depth**	
Lab Work	**JM**	**Location**	**Nunavut**		

1st SIEVING +#4		**2nd SIEVING -#4**		**Wash Sieving - #4**	
Weight before sieving		Quarter - #4 (Y/N)	Y	Weight before wash	192.4
Total weight	1111.6	Wash Sieve (Y/N)	Y	Weight after wash	175.1
Total Wt -#4	641.1	Total Wt of -#4 sieved	192.4	Pan Weight	0.7

Sieve (USS)	Weight Retained	% Retained	Weight Retained	% Retained	% Retained of Total	Diameter (mm)	% Passing
12"	0.0	0.0			0.0	**304.8**	**100.0**
6"	0.0	0.0			0.0	**152.4**	**100.0**
3"	0.0	0.0			0.0	**76.2**	**100.0**
1 1/2 "	0.0	0.0			0.0	**38.1**	**100.0**
1"	79.6	7.2			7.2	**25.4**	**92.8**
3/4"	98.9	8.9			8.9	**19.1**	**83.9**
1/2"	145.4	13.1			13.1	**12.7**	**70.9**
3/8"	44.0	4.0			4.0	**9.50**	**66.9**
#4	102.6	9.2			9.2	**4.76**	**57.7**
#10			24.8	12.9	7.4	**2.00**	**50.2**
#20			34.8	18.1	10.4	**0.84**	**39.8**
#40			49.5	25.7	14.8	**0.42**	**25.0**
#60			43.6	22.7	13.1	**0.25**	**11.9**
#100			13.4	7.0	4.0	**0.149**	**7.9**
#200			8.3	4.3	2.5	**0.074**	**5.4**
-200			18.0	9.4	5.4		

REMARKS :



Project No. 05-1413-021 **Drawn** JM **Reviewed** LL **Date** 09/09/05	Golder Associates	**GRAIN SIZE DISTRIBUTION**	**Figure**

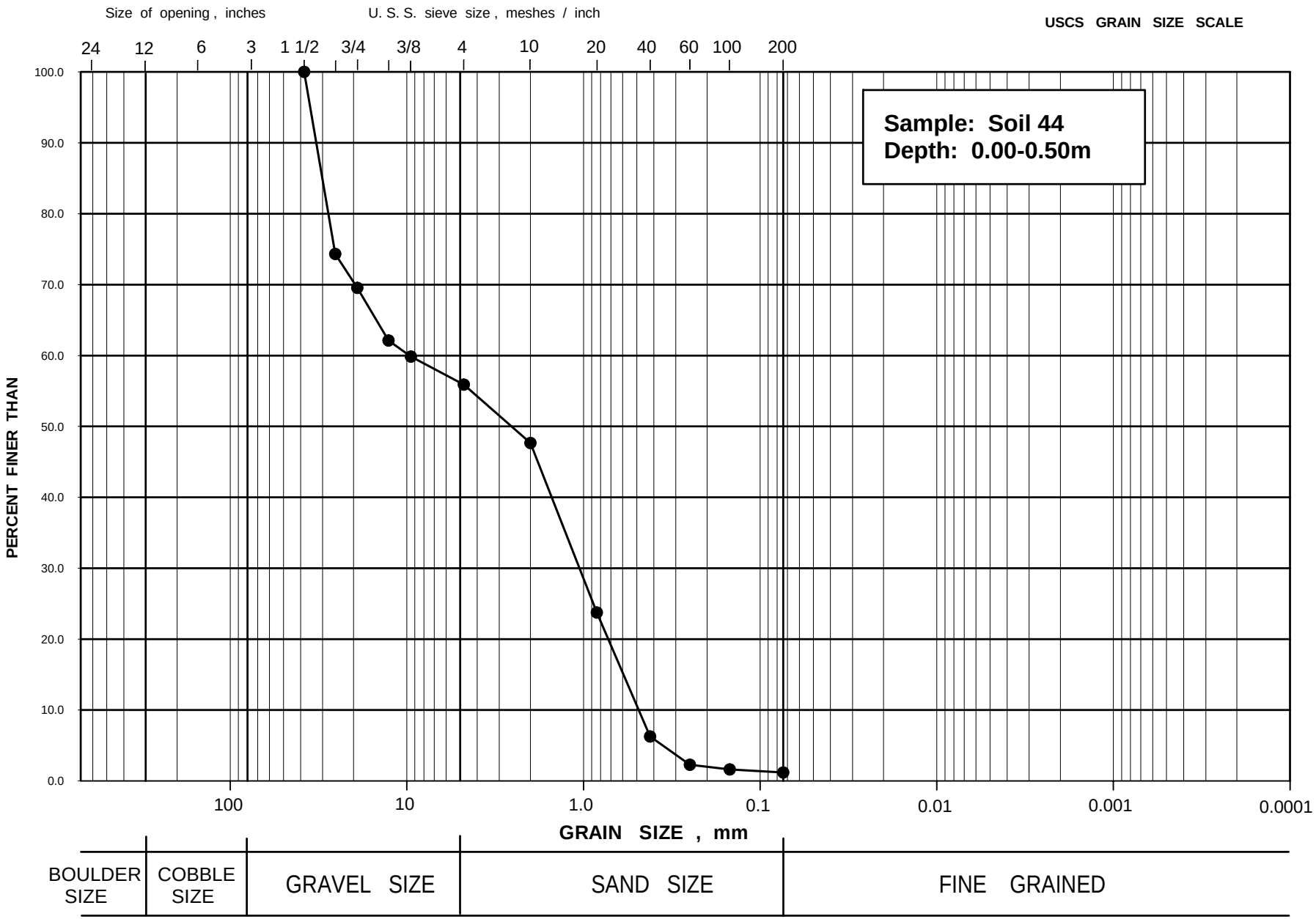
SIEVE ANALYSIS

Project No.	**05-1413-021**	**Client**	**Cumberland Resources Ltd.**	**Sample**	**Soil 44**
Sch#	**161**	**Project**	**Baker Lake Terrain Assess.**	**Depth**	**0.00-0.50m**
Lab Work	**JM**	**Location**	**Nunavut**		

1st SIEVING +#4		**2nd SIEVING -#4**		**Wash Sieving - #4**	
Weight before sieving		Quarter - #4 (Y/N)	Y	Weight before wash	158.9
Total weight	650.5	Wash Sieve (Y/N)	Y	Weight after wash	155.8
Total Wt -#4	363.7	Total Wt of -#4 sieved	158.9	Pan Weight	0.3

Sieve (USS)	Weight Retained	% Retained	Weight Retained	% Retained	% Retained of Total	Diameter (mm)	% Passing
12"	0.0	0.0			0.0	**304.8**	**100.0**
6"	0.0	0.0			0.0	**152.4**	**100.0**
3"	0.0	0.0			0.0	**76.2**	**100.0**
1 1/2 "	0.0	0.0			0.0	**38.1**	**100.0**
1"	167.0	25.7			25.7	**25.4**	**74.3**
3/4"	31.2	4.8			4.8	**19.1**	**69.5**
1/2"	48.2	7.4			7.4	**12.7**	**62.1**
3/8"	14.8	2.3			2.3	**9.50**	**59.8**
#4	25.6	3.9			3.9	**4.76**	**55.9**
#10			23.4	14.7	8.2	**2.00**	**47.7**
#20			68.0	42.8	23.9	**0.84**	**23.8**
#40			49.7	31.3	17.5	**0.42**	**6.3**
#60			11.3	7.1	4.0	**0.25**	**2.3**
#100			1.9	1.2	0.7	**0.149**	**1.6**
#200			1.2	0.8	0.4	**0.074**	**1.2**
-200			3.4	2.1	1.2		

REMARKS :



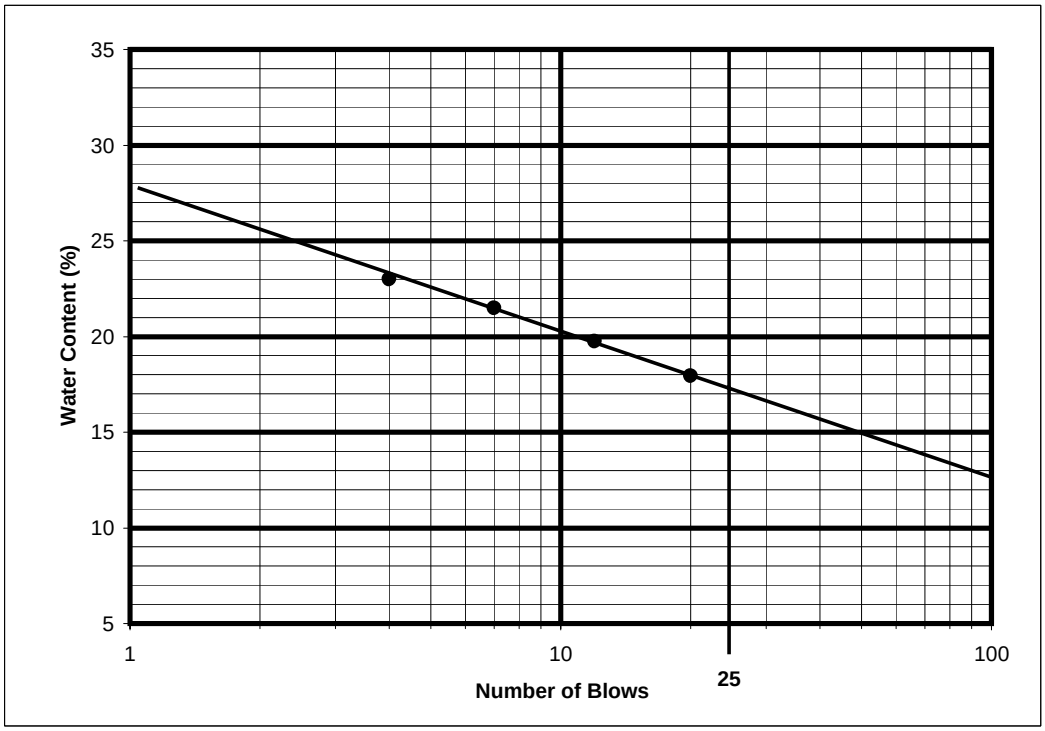
Project No. 05-1413-021 **Drawn** JM **Reviewed** LL **Date** 09/09/05	Golder Associates	**GRAIN SIZE DISTRIBUTION**	**Figure**

Project # 05-1413-021 **Tech : TM**

Liquid Limit, Plastic Limit and Plasticity Index of Soils
ASTM D 4318-93

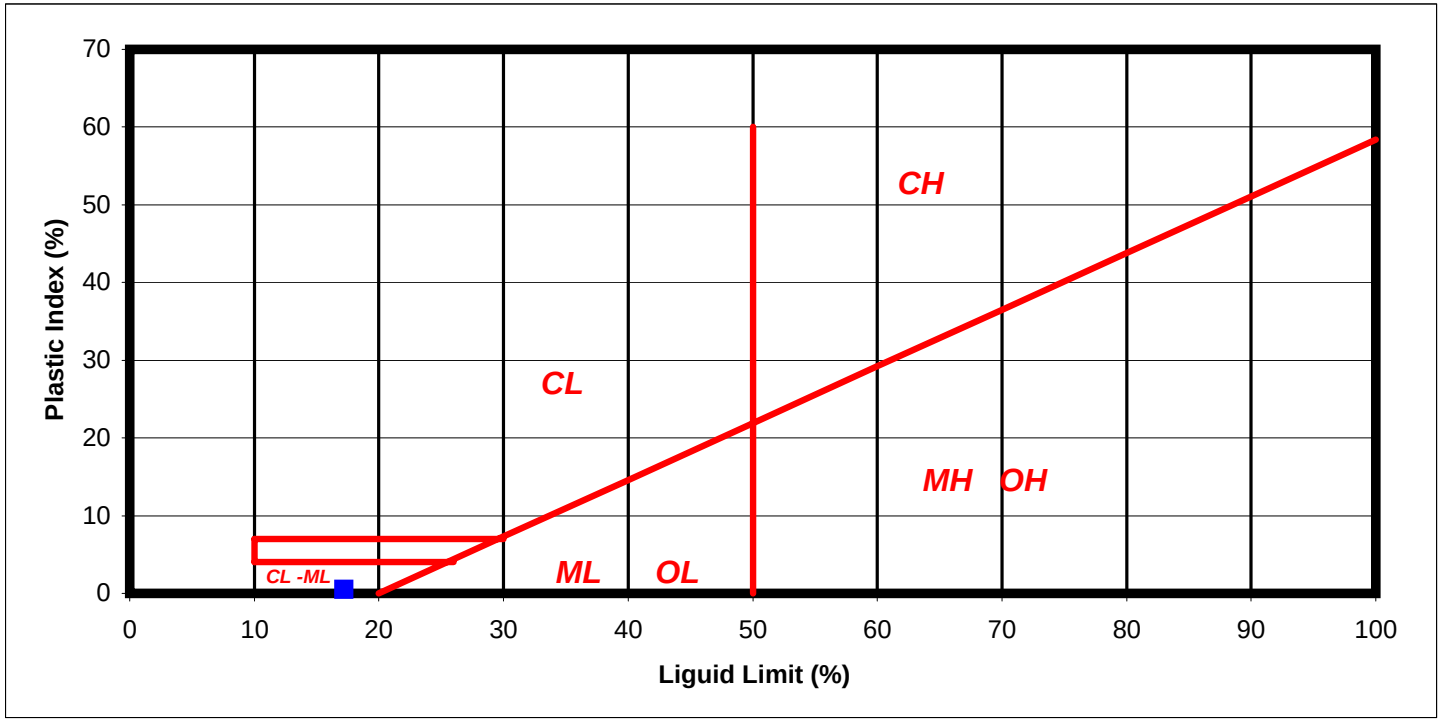
TYPE OF TEST	LL	LL	LL	LL		W% Nat.
CONTAINER NUMBER	193	94	E	88		
NUMBER OF BLOWS	**12**	**7**	**4**	**20**		
MASS WET SOIL + TARE	11.81	13.44	13.91	12.88		1410.20
MASS DRY SOIL + TARE	10.13	11.34	11.57	11.15		1293.70
MASS OF WATER	1.68	2.10	2.34	1.73		116.50
MASS OF CONTAINER	1.63	1.56	1.40	1.51		179.00
MASS OF DRY SOIL	8.50	9.78	10.17	9.64		1114.7
WATER CONTENT W (%)	**19.8**	**21.5**	**23.0**	**17.9**		**10.5**

TYPE OF TEST	PL	PL	BOREHOLE NO.	
CONTAINER NUMBER	99	164A	SAMPLE	**Soil 17**
MASS WET SOIL + TARE	6.45	6.65	DEPTH	
MASS DRY SOIL + TARE	5.74	5.91	LIQUID LIMIT (%)	**17.2**
MASS OF WATER	0.71	0.74	PLASTIC LIMIT (%)	**16.7**
MASS OF CONTAINER	1.47	1.50	PLASTICITY INDEX (%)	**0.5**
MASS OF DRY SOIL	4.27	4.41	W% Natural (%)	**10.5**
WATER CONTENT W (%)	**16.6**	**16.8**	LIQUIDITY INDEX	**-12.60**



SAMPLE DESCRIPTION : **CL-ML**

Casagrande Plasticity Chart



Classification of Fined Grained Soils

Silts and Clays L.L.<50

ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silt-clays of low plasticity

Silts and Clays L.L.>50

MH	Inorganic silts, micaeous or diatomaceous fine sandy or silty soils, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity, organic silts

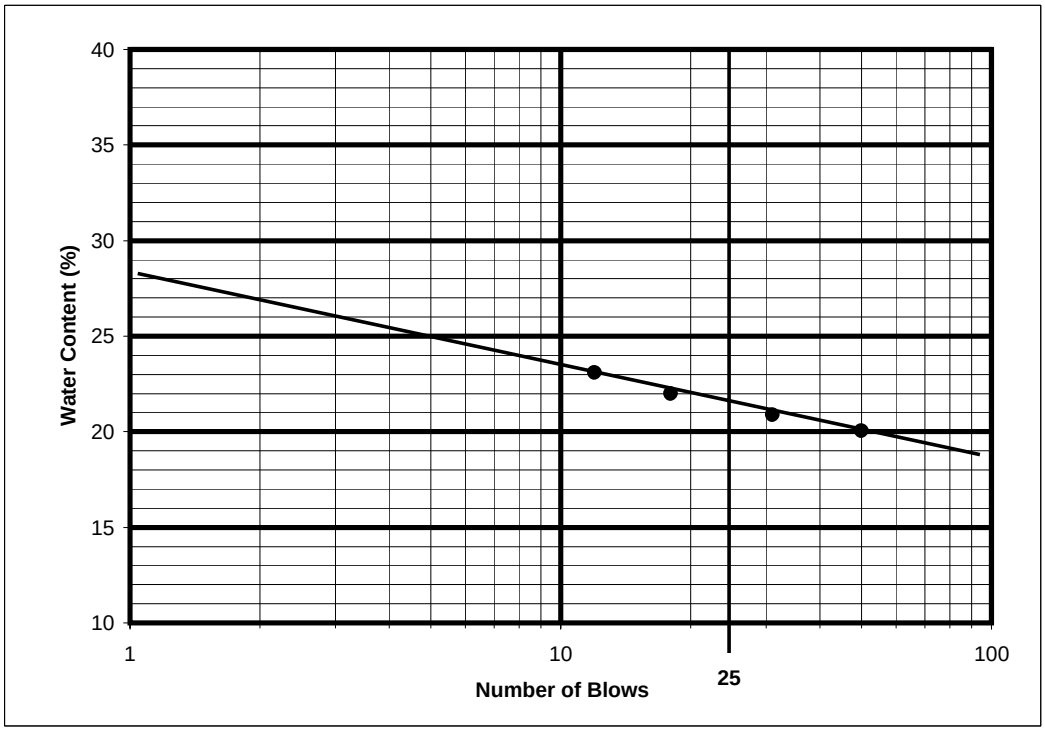
Golder Associates Ltd.

Project # 05-1413-021 **Tech : TM**

Liquid Limit, Plastic Limit and Plasticity Index of Soils
ASTM D 4318-93

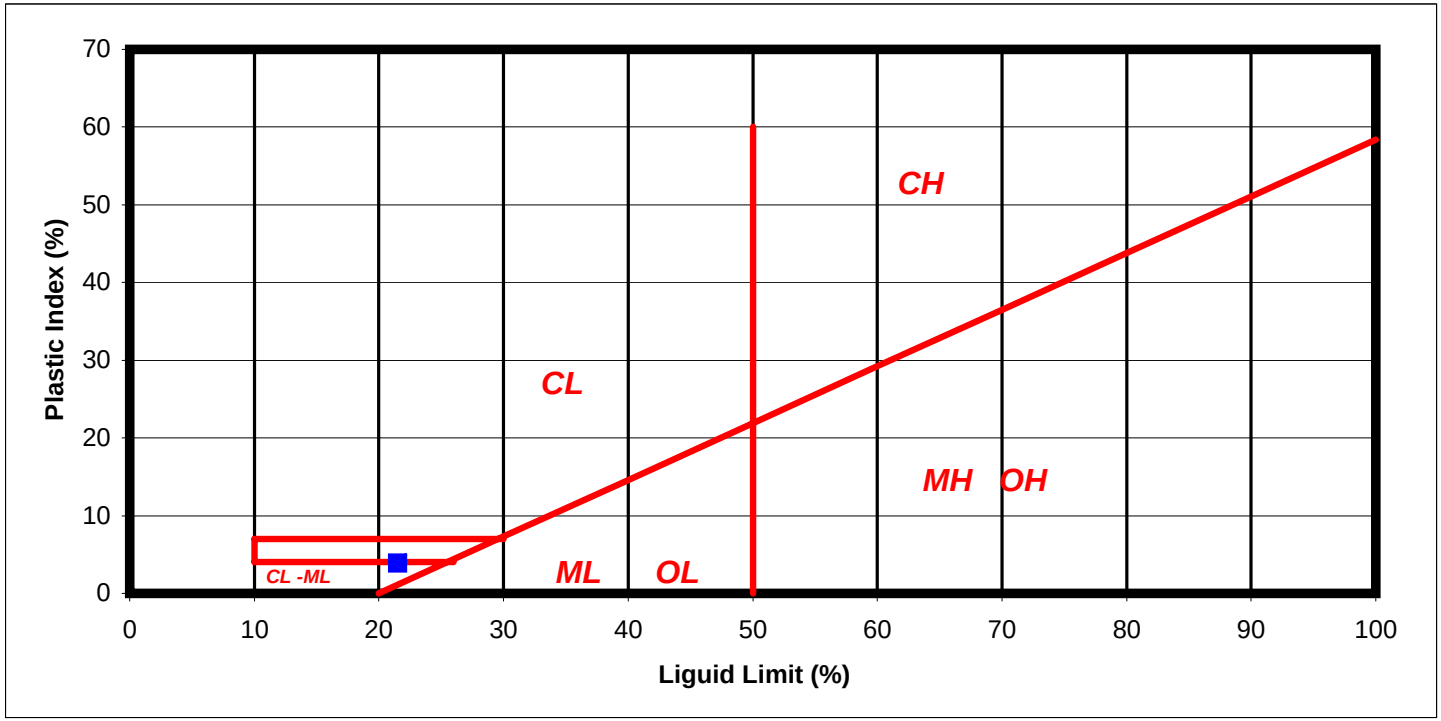
TYPE OF TEST	LL	LL	LL	LL		W% Nat.
CONTAINER NUMBER	158	164	203	196		
NUMBER OF BLOWS	**31**	**50**	**18**	**12**		
MASS WET SOIL + TARE	11.69	14.29	14.03	12.65		1463.90
MASS DRY SOIL + TARE	9.92	12.15	11.78	10.58		1300.10
MASS OF WATER	1.77	2.14	2.25	2.07		163.80
MASS OF CONTAINER	1.44	1.48	1.54	1.62		211.50
MASS OF DRY SOIL	8.48	10.67	10.24	8.96		1088.6
WATER CONTENT W (%)	**20.9**	**20.1**	**22.0**	**23.1**		**15.0**

TYPE OF TEST	PL	PL	BOREHOLE NO.	
CONTAINER NUMBER	133	136	SAMPLE	**Soil 24**
MASS WET SOIL + TARE	6.10	6.00	DEPTH	
MASS DRY SOIL + TARE	5.40	5.33	LIQUID LIMIT (%)	**21.5**
MASS OF WATER	0.70	0.67	PLASTIC LIMIT (%)	**17.6**
MASS OF CONTAINER	1.49	1.46	PLASTICITY INDEX (%)	**3.9**
MASS OF DRY SOIL	3.91	3.87	W% Natural (%)	**15.0**
WATER CONTENT W (%)	**17.9**	**17.3**	LIQUIDITY INDEX	**-0.66**



SAMPLE DESCRIPTION : **CL-ML**

Casagrande Plasticity Chart



Classification of Fined Grained Soils

Silts and Clays L.L.<50

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CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silt-clays of low plasticity

Silts and Clays L.L.>50

MH	Inorganic silts, micaeous or diatomaceous fine sandy or silty soils, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity, organic silts

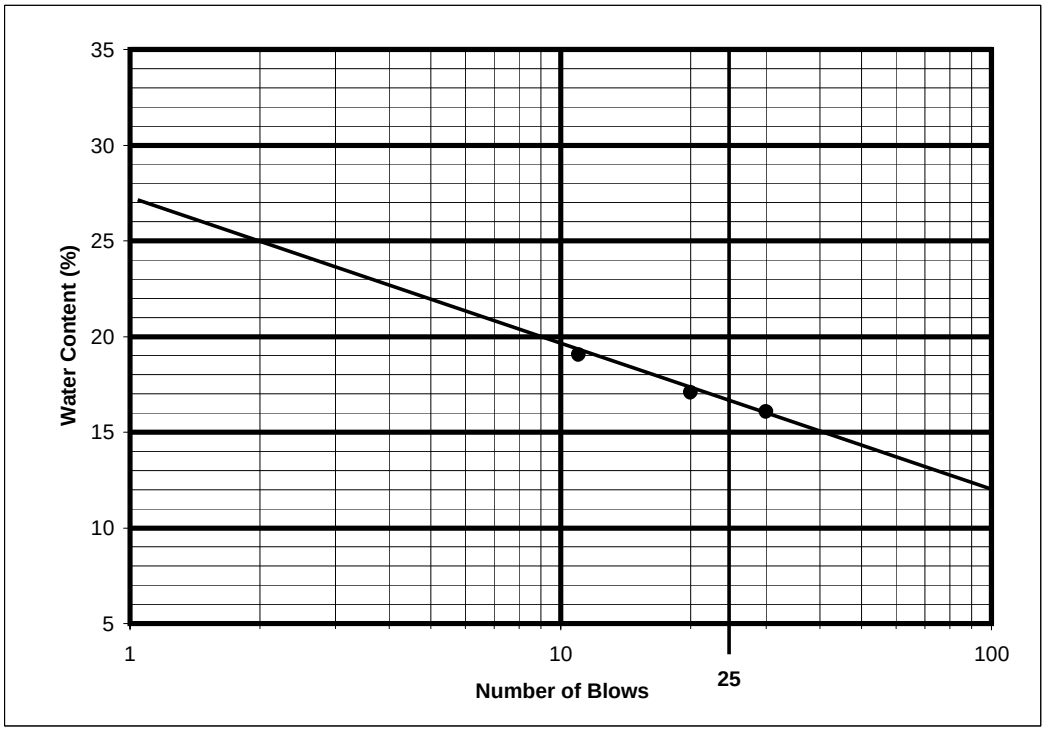
Golder Associates Ltd.

Project # 05-1413-021 **Tech : TM**

Liquid Limit, Plastic Limit and Plasticity Index of Soils
ASTM D 4318-93

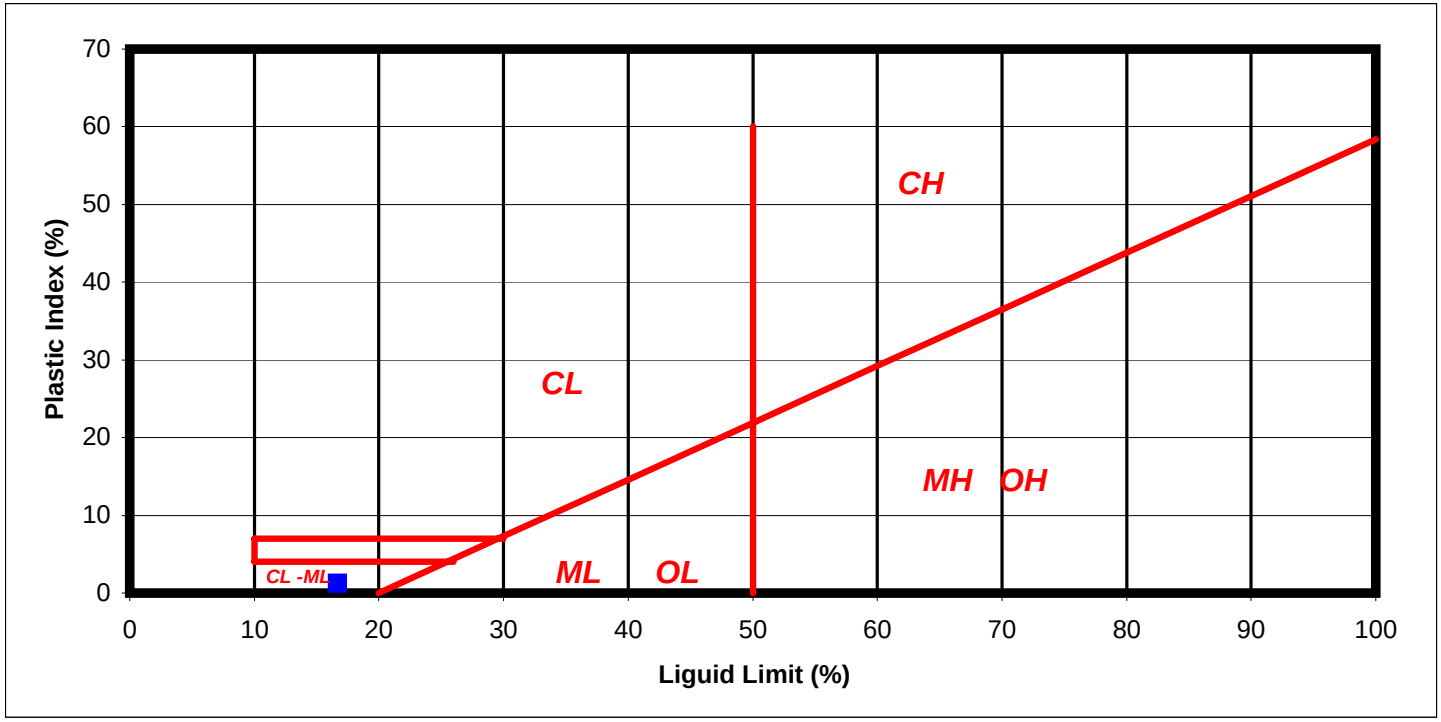
TYPE OF TEST	LL	LL	LL	LL		W% Nat.
CONTAINER NUMBER	109	218	144			
NUMBER OF BLOWS	**30**	**20**	**11**			
MASS WET SOIL + TARE	12.16	13.05	11.99			1249.80
MASS DRY SOIL + TARE	10.68	11.36	10.30			1115.00
MASS OF WATER	1.48	1.69	1.69			134.80
MASS OF CONTAINER	1.47	1.47	1.43			193.20
MASS OF DRY SOIL	9.21	9.89	8.87			921.8
WATER CONTENT W (%)	**16.1**	**17.1**	**19.1**			**14.6**

TYPE OF TEST	PL	PL	BOREHOLE NO.	
CONTAINER NUMBER	155	125	SAMPLE	**Soil 37**
MASS WET SOIL + TARE	5.96	6.20	DEPTH	
MASS DRY SOIL + TARE	5.34	5.57	LIQUID LIMIT (%)	**16.7**
MASS OF WATER	0.62	0.63	PLASTIC LIMIT (%)	**15.5**
MASS OF CONTAINER	1.43	1.41	PLASTICITY INDEX (%)	**1.2**
MASS OF DRY SOIL	3.91	4.16	W% Natural (%)	**14.6**
WATER CONTENT W (%)	**15.9**	**15.1**	LIQUIDITY INDEX	**-0.73**



SAMPLE DESCRIPTION : **CL-ML**

Casagrande Plasticity Chart



Classification of Fined Grained Soils

Silts and Clays L.L.<50

ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silt-clays of low plasticity

Silts and Clays L.L.>50

MH	Inorganic silts, micaeous or diatomaceous fine sandy or silty soils, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity, organic silts

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APPENDIX X

TERRAIN TYPE CHARACTERISATION PHOTOGRAPHS

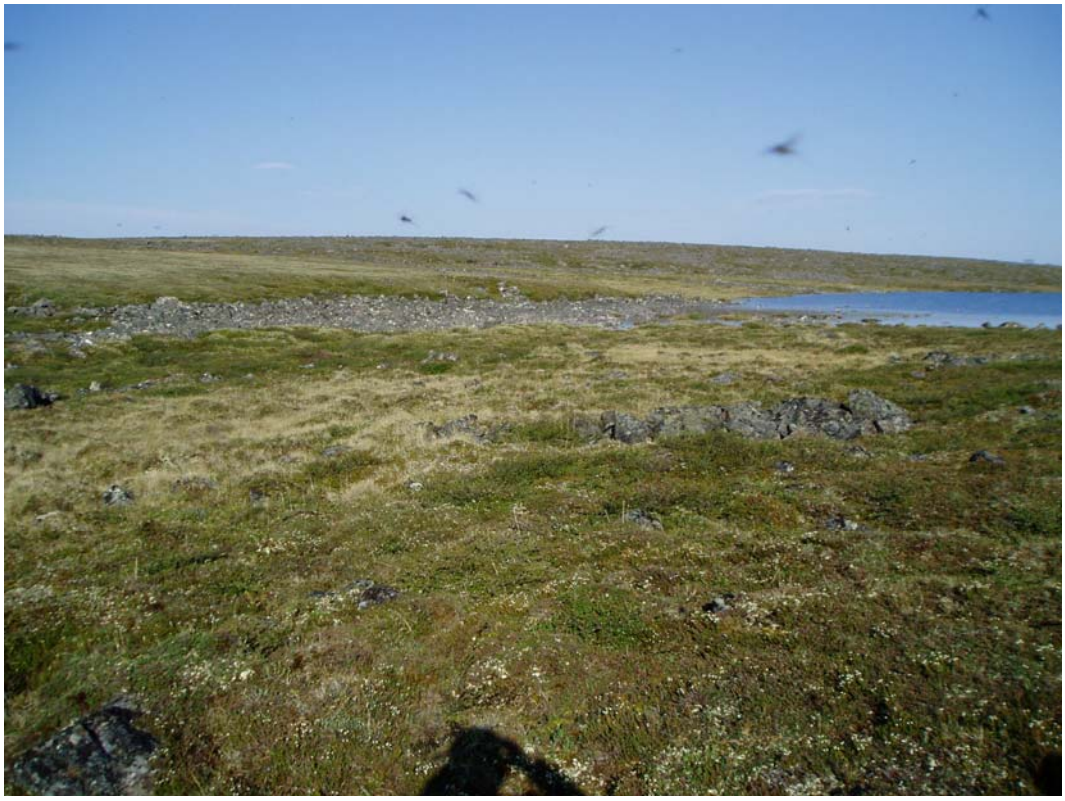

Photo 1: Example of type 0 terrain in an area of volcaniclastic bedrock at crossing R24 south of kilometre 105.

Photo 2: Terrain type 1 in granitic bedrock near kilometre 22.

Photo 3: Type 2 terrain in an area dominated by granitic bedrock west of kilometre 22.

Photo 4: Type 2 terrain in an area of volcaniclastic bedrock near kilometre 105.

Photo 5: Type 2 terrain in an area dominated by volcanics near kilometre 49.

Photo 6: Type 3 terrain near kilometre 43.

Photo 7: Type 4 terrain near kilometre 43.

Photo 8: Type 6 terrain at stream crossing R05 additional near kilometre 17.

Photo 9: Small beach deposit on a bedrock ridge southeast of kilometre 9.

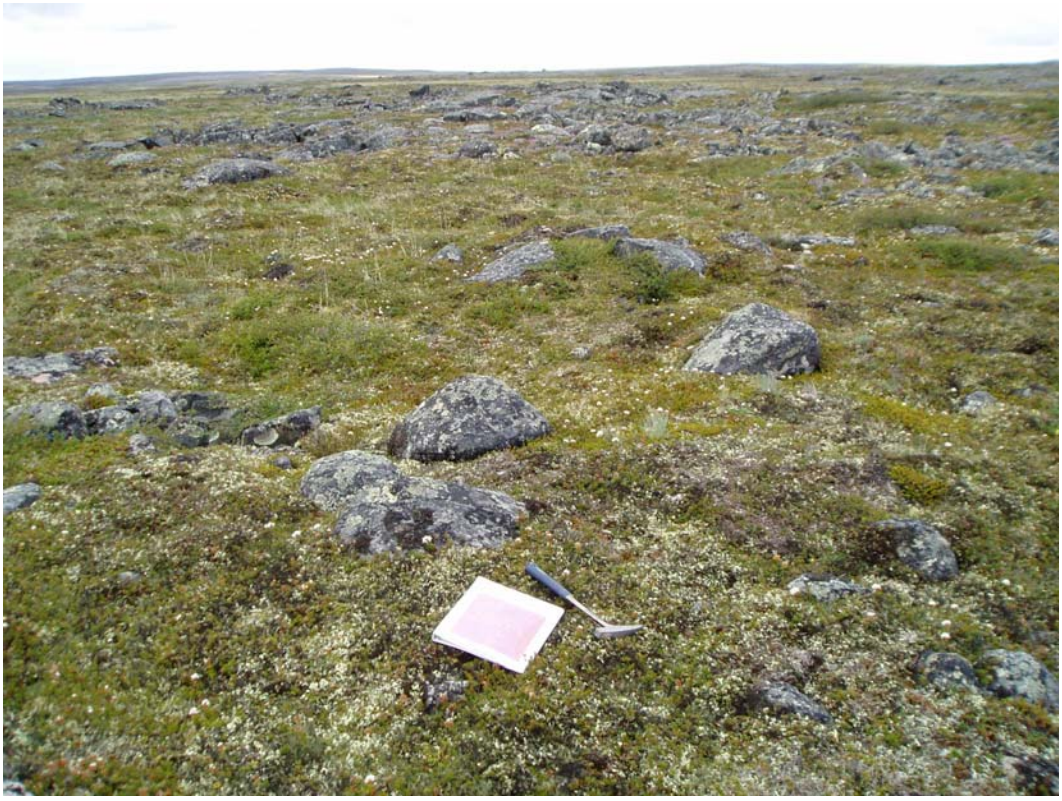

Photo 10: Type 11 terrain north of kilometre 21.

Photo 11: Small esker about 600 metres east of kilometre 33.

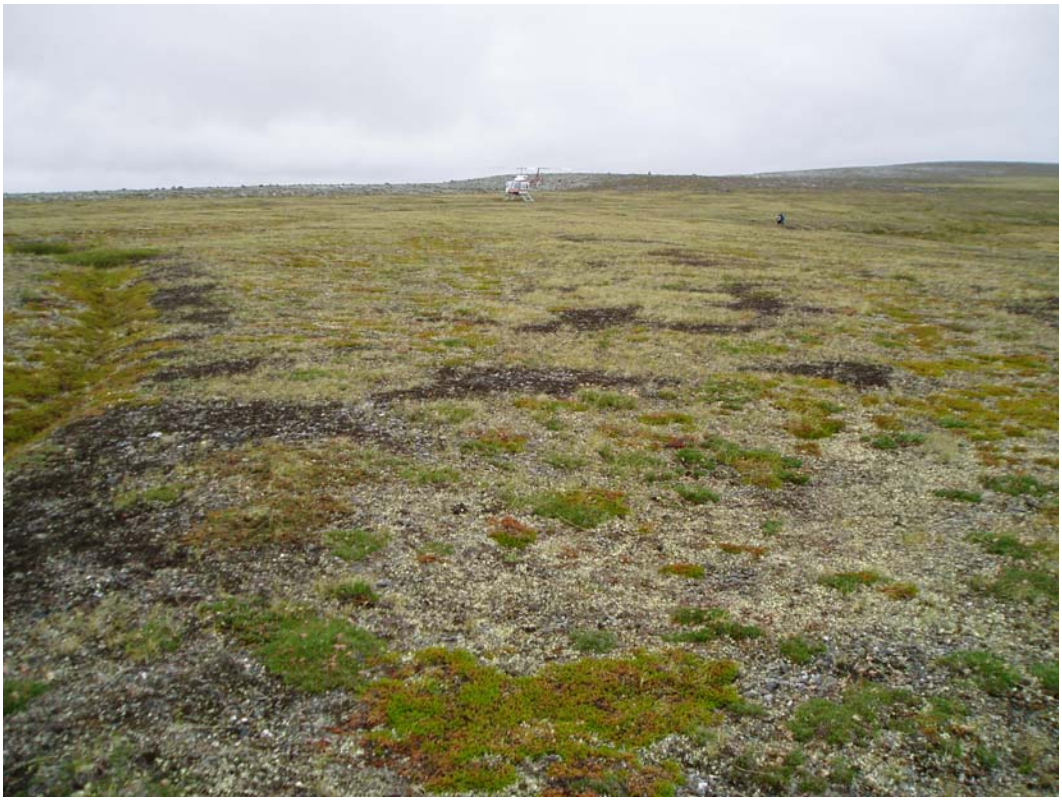

Photo 12: Shallow ice-marginal glacio-fluvial deposit north of kilometre 34.

APPENDIX XI

TRAVERSE AND SAMPLING SITE PHOTO CD APPENDED