Golder Associates Ltd.

500 – 4260 Still Creek Drive
Burnaby, British Columbia, Canada V5C 6C6
Telephone (604) 296-4200
Fax (604) 298-5253

REPORT ON

BAKER LAKE FUEL TANK FARM
GEOTECHNICAL DETAIL DESIGN REPORT
MEADOWBANK GOLD PROJECT
BAKER LAKE, NUNAVUT

Submitted to:

Cumberland Resources Ltd.

Suite 950, One Bentall Centre
505 Burrard Street
Vancouver, BC
V7X 1M4

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May 8, 2006 06-1413-009/4000

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EXECUTIVE SUMMARY

Cumberland Resources Ltd. is planning to develop the Meadowbank Gold Project site located about 70 km north of Baker Lake, Nunavut. As part of the site infrastructure development, Cumberland will construct a fuel tank farm at the proposed Baker Lake Dry Freight Storage and Marshalling Yard, which is located on the north shore of Baker Lake, approximately 2 km east of the hamlet of Baker Lake, Nunavut. The proposed materials handling facility at Baker Lake will act as a transfer point and temporary storage of all dry freight and fuel materials required by the project. The materials will be transported by barge to Baker Lake and transferred to ground transport equipment for delivery to the mine site.

The Baker Lake Dry Freight Storage and Marshalling Yard includes a barge landing facility; dry freight, ammonium nitrate and explosive storage areas; a fuel tank farm and dispensing station and site access roads. The Baker Lake fuel tank farm is designed to receive barged shipments of diesel fuel during summer months, to provide temporary storage of the estimated diesel fuel quantity required to annually operate the project and to dispense the diesel fuel throughout each year into fuel tanker trucks for ground transport to the mine site.

The above ground fuel storage facility at Baker Lake consists of three single-walled above ground storage tanks to be constructed on site from plate steel. The approximate fuel storage capacity of each tank includes one 5.6 million litres tank and two 16 million litres tanks. Each tank is located within a fuel secondary containment area to provide fuel confinement from the environment in case of spills or leakage from the storage tanks and associated fuel handling facilities. A dispensing station will be constructed at the north side of the fuel tank farm for dispensing fuel to the tanker trucks. Vehicle access from Baker Lake to the dispensing station will require an all-season roadway to be constructed to the tank farm location and connected to the proposed all-season access road to the Meadowbank mine site.

This report provides detail geotechnical design of the fuel tank farm facility in support of the Meadowbank Gold Project. The detailed design report is limited to only the geotechnical aspects of the fuel tank farm facility including site preparation and construction of the tank foundations, fuel storage secondary containment, a fuel dispensing station, liner construction and surface water runoff and sediment control structures. This report does not provide structural, mechanical and/or electrical design recommendations, such as for the above ground fuel storage tanks, fuel dispensing and handling equipment, and electrical system requirements.

Previous geotechnical and geophysical site investigations were conducted to provide insight to the subsurface conditions of the proposed material handling facility and specifically the fuel tank farm site for this reporting. Shallow test pits were prepared in 2003 and 2005 to examine the soil and underlying bedrock conditions at selected locations. EM31 ground conductivity, seismic refraction surveys, and ground penetrating radar were used to further investigate the subsurface conditions. The site investigation results provide geotechnical input for design of the fuel tank farm.

This detail design report provides background information, design criteria, engineering analyses and geotechnical recommendations for the Baker Lake fuel tank farm. Construction drawings, technical specifications and an engineering estimate of quantities are included for construction of the fuel tank farm facility.

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1.0 INTRODUCTION

1.1 Background

Cumberland Resources Ltd. (Cumberland) is planning to develop the Meadowbank Gold Project located approximately 70 km north of the hamlet of Baker Lake, Nunavut as shown in Figure 1.1. As part of the project infrastructure development, a Dry Freight Storage and Marshalling Yard is required at Baker Lake to act as a transfer point for materials and fuel which will be transported by barge to Baker Lake, en route to the Meadowbank Gold Project Site.

The site facility is located on the north shore of Baker Lake, approximately 2 km east of the hamlet of Baker Lake as shown in Figure 1.2. As part of the proposed Baker Lake storage facility, a fuel tank farm will be constructed to receive bulk shipments of diesel fuel and to provide sufficient above ground fuel storage capacity required annually to operate the project. The fuel tank farm will provide a dispensing station to transfer fuel from the storage tanks to tanker trucks for ground transport to the mine site. Other proposed infrastructure development at the Baker Lake facility which is not part of this report includes a barge landing facility, storage areas for dry freight, ammonium nitrate and explosive materials and site roads to connect to an all-season access road to the Meadowbank mine site.

1.2 Scope of Services

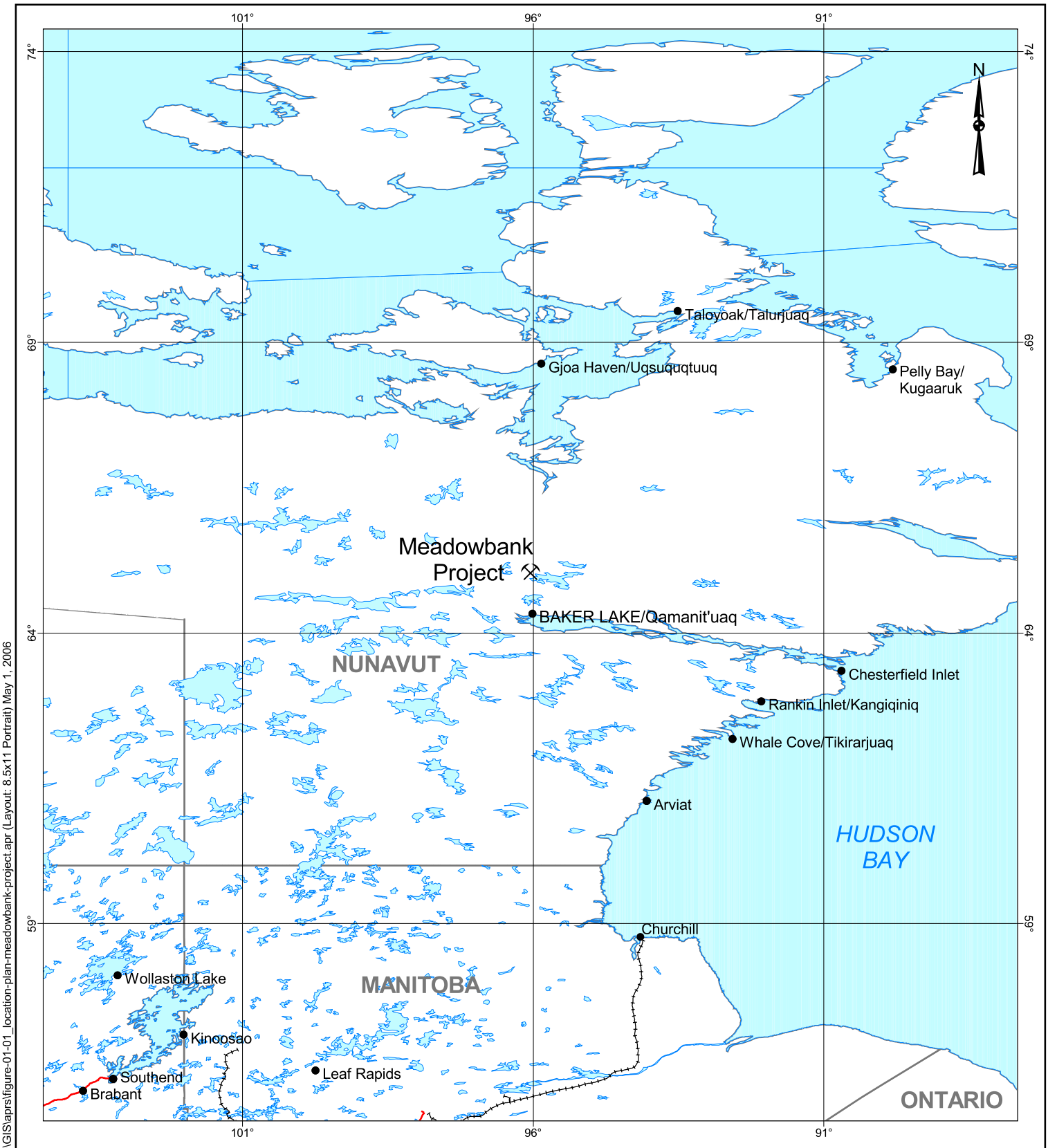
Golder Associates Ltd. (Golder) has been retained by Cumberland to provide geotechnical input for detailed design of the Baker Lake fuel tank farm for the Meadowbank Gold Project. This report provides a summary of the following information for the proposed development:

- Site Description;
- Design Criteria;
- Field Investigation Results;
- Geotechnical Recommendations;
- Construction Drawings; and
- Technical Specifications.

The technical specifications include recommendations for care of water, salvage and stockpiling of organic materials, foundation preparation, bulk excavation, material specifications for backfilling, fuel tank farm construction, liner construction, surface water control structures and survey control. Geotechnical recommendations are provided as input to the fuel tank farm design and construction for consideration by Cumberland. An estimate of construction quantities and a quality control program for use during construction is provided.

1.3 Limitations

The scope of work includes geotechnical design services only. No environmental services have been carried out as part of this report. Furthermore, it is anticipated that the actual in situ conditions and finalized fuel tank farm facility may vary somewhat from those conditions discussed herein. This report does not provide structural, mechanical and/or electrical design recommendations, such as for the above ground fuel storage tanks, fuel dispensing and handling equipment, and electrical system requirements.



LEGEND

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

REFERENCE

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

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

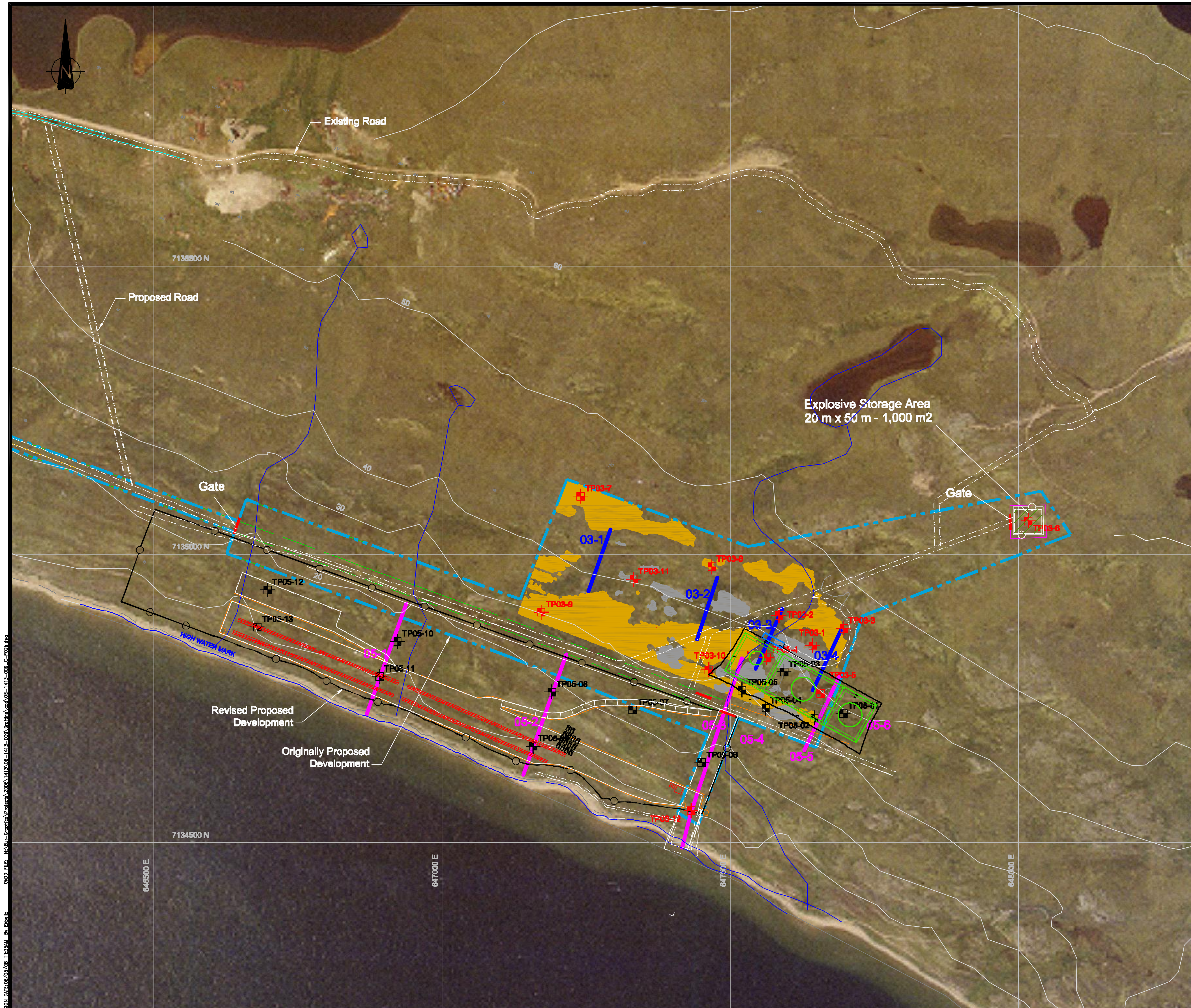
LOCATION PLAN

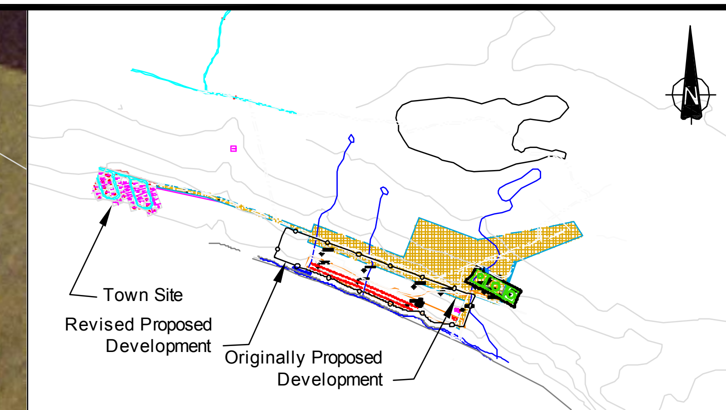
Golder Associates

PROJECT No. 06-1413-009			SCALE AS SHOWN	REV. 0
DESIGN	CJC	01 May 2006		
GIS	CDB	01 May 2006		
CHECK	CJC	01 May 2006		
REVIEW				

FIGURE 1.1

N:\Bur-Graphics\Projects\2006\1413\06-1413-009\GIS\aprs\figure-01-01_location-plan-meadowbank-project.apr (Layout: 8.5x11 Portrait) May 1, 2006





LOCATION MAP

NTS

LEGEND

(black symbol)	2005 Test Pit Location (Approximate)
(red symbol)	2003 Test Pit Location (Approximate)
(cyan dash-dot line)	Property Limit
05-4	Proposed Seismic Line and Number
03-1	Existing Seismic Line and Number
10	Contour Interval
(grey)	Bedrock Outcrop (Approximate)
(orange)	Interpreted Frost-susceptible Ground

NOTES

1) Northings and eastings are in metres referenced to UTM Zone 14, NAD83.

2) Elevations are in metres referenced to geodetic datum.

3) Testpit, bedrock outcrop, seismic line and EM31 survey boundary locations were determined using GPS equipment and are considered approximate.

REFERENCE

1) Base plan information provided by AMEC Americas Ltd. dated February 10, 2004.

2) Aerial photos provided by Cumberland Resources Ltd. dated August 03, 1998.

0 50 100 150 200 250
Scale in Meters

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

BAKER LAKE FUEL TANK FARM PLAN

Golder Associates

PROJECT No.	06-1413-009		FILE No. 06-1413-009c-F02b	
DESIGN	WJP	03MAY06	SCALE AS SHOWN	REV. –
CADD	EA	05MAY06	FIGURE 1.2	
CHECK	CC	05MAY06		
REVIEW	WJP	05MAY06		

2.0 SITE DESCRIPTION

2.1 Location and Topography

The proposed Baker Lake site is located on the north shore of Baker Lake approximately 2 km east of the hamlet of Baker Lake. The project site is covered by low-lying vegetation; primarily a spongy layer of green moss and organic material. There are no trees or shrubs.

In general, the topographic relief within the proposed development area for the Baker Lake fuel tank farm slopes down from north to south at about 10% towards the lakeshore and down about 5 m from east to west across the site.

2.2 Site Description

The proposed development for the Baker Lake fuel tank farm comprises the following structures:

- Three single-walled above ground storage tanks (AGSTs) to store diesel fuel consisting of one 5.6 million litres tank (Tank 1) and two 16 million litres tanks (Tanks 2 and 3).

- Each AGST will be contained within a lined secondary containment area to provide fuel confinement from the environment in case of spills or leakage from the storage tanks and associated fuel handling facilities.

- A dispensing station to dispense fuel from the AGSTs to mobile tanker trucks.

Vehicle access from Baker Lake to the dispensing station will require an all-season roadway to be constructed to the tank farm location and connected to the proposed all-season access road to the Meadowbank mine site.

2.3 Subsurface Condition

Based on the existing geotechnical and geophysical information provided in Golder (2003), Golder (2004), Golder (2005a) and Golder (2005b), the site is generally underlain by a thin layer of organic material overlying zero to at least 1.5 m of overburden mineral soils, comprising primarily soft to firm gravelly clay or loose to compact silty soils with isolated deposits of sand and gravel particle sizes, over weathered to intact bedrock. There are isolated bedrock outcrop locations within the proposed fuel tank farm area. The site experiences surface water runoff and saturated subsurface conditions during periods of seasonal thaw.

For design purposes, it is assumed that during seasonally thawed conditions, the site is underlain by at least 1.5 m of wet, fine grained soils, typically well above optimum water content conditions, which is consistent with frost susceptible ice rich soils. Based on these observed conditions, it is recommended that the native overburden soils should be removed to expose the underlying bedrock to support of all grade supported structures including the AGSTs, containment berms and access roads. Additional bedrock excavation will be required over portions of the site area to prepare level subgrade conditions prior to placement and compaction of thaw stable granular backfill materials.

2.4 Climate and Meteorology

The Baker Lake site is in a climatic region that is cold enough to maintain continuous permafrost with the exception of widely scattered areas of taliks (areas of unfrozen ground) beneath deeper rivers and lakes. Thermistors installed at the Meadowbank site indicate that the permafrost is on the order of 400 m to 500 m in thickness. It is expected that the permafrost thickness at the Baker Lake site would be similar to that at the Meadowbank site, with lesser thickness adjacent to Baker Lake.

A summary of climatic and meteorological data for the Baker Lake site is detailed in Table 2.1 below. Data presented are the 30-year climate normal and extreme conditions collected on site between 1971 and 2000. Sources of information are obtained at the Environment Canada's website (Environment Canada, 2006).

Table 2.1: Summary of Baker Lake Monthly Average Climate Data (1971-2000)

Temperature (°C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily Mean	-32.3	-31.5	-27.2	-17.4	-5.8	4.9	11.4	9.5	2.6	-7.5	-20.1	-28.4
Daily Maximum	-28.7	-27.9	-22.9	-12.6	-2.2	9.2	16.7	14.0	5.9	-4.2	-16.3	-24.8
Daily Minimum	-35.8	-35.1	-31.5	-22.1	-9.4	0.5	6.0	5.0	-0.6	-10.7	-23.9	-31.9
Extreme Maximum	-1.7	-4.1	1.5	19.2	13.9	28.1	33.6	30.9	22.6	9.7	2.2	-1.1
Extreme Minimum	-50.6	-50.0	-50.0	-41.1	-27.8	-13.9	-1.7	-3.4	-14.4	-30.6	-42.7	-45.6
Rainfall (mm)												
Average Monthly	0.0	0.0	0.0	0.5	6.7	20.8	41.8	45.7	35.8	5.3	0.1	0.0
Snowfall (cm)												
Average Monthly	8.4	8.4	12.8	15.3	10.2	3.3	0.0	1.3	8.1	29.4	21.3	12.2
Precipitation (mm)												
Average Monthly	7.5	7.2	10.5	13.6	15.6	24.1	41.8	47.0	44.1	32.1	17.0	10.2
Wind												
Days with Wind Speed at least 52 km/hr	7.8	7.3	5.9	3.4	2.2	1.0	1.0	1.3	1.8	3.9	5.2	5.9
Degree-Days												
Above 0 °C	0.0	0.0	0.0	0.1	8.4	153.4	351.6	294.6	100.0	4.7	0.0	0.0

2.5 Seismic Considerations

Based on a seismic hazard assessment provided by Pacific Geoscience Centre for this site, the proposed development is located within Seismic Zone 0 of the current National Building Code, which is a negligible seismic risk. The peak horizontal ground accelerations for 10 and 5 percent probability of exceedance in 50 years (475-year and 975-year return periods) are 0.034 g and 0.044 g, respectively.

From the field investigation results, the site is generally underlain by a thin deposit of soft to firm gravelly clay or loose to compact silty soils over intact bedrock below the existing ground surface. It is recommended that a Foundation Factor, F, of 1.0 be used in accordance with the National Building Code (2005), considering all settlement-sensitive foundations to be supported on rock or dense, granular fills over rock.

3.0 DESIGN CRITERIA

3.1 General

This section outlines the design criteria and methodology for the evaluation of the construction for the Baker Lake fuel tank farm and associated dispensing station and fuel handling facilities. It is understood that Cumberland will proceed with sufficient site development activities to construct Tank 1 at 5.6 million litre capacity, the associated secondary containment, the dispensing station road, access and water control structures at the western end of the site followed by sequential site development for construction of Tanks 2 and 3 (each tank at 16 million litre capacity), associated secondary containment, road access and water control structures at the middle and eastern end of the fuel tank farm as the project progresses. However, drilling and blasting activities for preparation of all three tank containment areas will be carried out as part of the initial site preparation activities.

3.2 Foundation Preparation

Foundation preparation activities will be carried out to excavate and remove all unsuitable materials including ice, snow, organic, and ice rich overburden materials to expose the underlying bedrock subgrade surface within the development area. Upon completion of the subgrade preparation activities, approved backfill materials will be used to construct the fuel tank farm to the dimensions, lines and grades shown on the Drawings. Frost sensitive fine grained soils should not be used in this Arctic environment to support and/or construct site grading backfill requirements for the fuel tank farm.

3.3 Above Ground Storage Tank Foundation Requirements

The three proposed AGSTs will be supported on compacted granular fill founded on the underlying bedrock surface. Structural design information provided by Cumberland from GemSteel Edmonton Ltd. dated February 3, 2006, for a 24.4 m (80 ft) diameter by a 12.2 m (40 ft) high AGST is summarized as follows:

- Shell load for a 15 cm wide surface bearing area around the tank circumference is 104 kPa (2,165 lbs/sqft).

- Centre loading of the tank at the 30 cm (12") diameter centre post supported on a 1.2 m by 1.2 m (4 ft by 4 ft) base plate is 284 kPa (5,932 lbs/sqft).

- Floor loading is 122 kPa (2,548 lbs/sqft).

- All tank load calculations include full product load and a 1.68 kPa (35 lbs/sqft) snow load conditions.

3.4 Secondary Containment

Each AGST will be contained within a fully lined secondary containment area capable of storing at least 110 percent of the largest AGST storage capacity. Based on the proposed development sequence, the secondary containment requirements for the fuel tank farm are provided as follows:

- Tank 1 shall have secondary containment storage of at least 6.2 million litres.

- Tanks 1, 2 and 3 shall have secondary containment storage of at least 18.1 million litres.

Section 4.3.2 from the National Fire Code 2005 provides guidelines as input for design location of AGSTs relative to the secondary containment limits, as follows:

- Minimum distance from the AGST containing diesel fuel, which is considered to be a combustible liquid, to nearest building or property line shall be 22.5 m based on the storage volume is greater than 5 million litres and gauge pressure is greater than 17 kPa.

- Minimum distance between Tanks 1 and 2 shall be at least 16.5 m and between Tanks 2 and 3 shall be at least 20.75 m.

- The fuel tank farm will not contain flammable liquid, unstable liquid, boil-over liquid such as gasoline or liquefied petroleum gas. Therefore, clearance provisions related to these items do not apply.

- Firefighting equipment requires road access to within 60 m of each storage tank.

- The AGSTs are less than 45 m diameter; therefore, fire protection systems are not required and minimum tank spacing using fire protection systems do not apply.

The design criteria requested by Cumberland to locate each of the three AGST is provided as follows:

- Provide a common back slope along the north side of the fuel tank farm.

- Tanks 2 and 3 shall be located at the centre of their respective secondary containment areas.

- Tank 1 shall be centered from east to west in its secondary containment area and maintain a common offset distance from the northern limit of the secondary containment as Tanks 2 and 3.

- The sole plate elevation for each AGST shall be the same for all three tanks and determined by the optimization of the excavation and backfill volumes for the overall secondary containment construction.

The secondary containment area will be lined with a low permeable geomembrane material to provide fuel confinement from the environment in case of spills or leakage from the storage tanks and associated fuel handling facilities. The geomembrane liner material shall be chemically compatible to contain the storage product without degradation and shall operate satisfactorily within the temperature range of this Arctic environment. Each secondary containment area shall be designed to provide positive surface runoff away from the AGST for collection and removal of contained liquids including fuel and precipitation at a surface collection sump.

3.5 Dispensing Station

Fuel shall be dispensed from the AGSTs to fuel tanker trucks at a lined dispensing station located at the north side of the fuel tank farm, adjacent to the secondary containment area for Tank 1 and no more than 2 m above the design sole plate elevation. The dispensing station shall be of sufficient size to allow fuel dispensing of one Super-B tanker truck and a service vehicle at the same time. Based on the above information, it was agreed that the dispensing station dimensions shall be as follows:

- Length: 40 m; and
- Width: 14 m, including a 10 m roadway, 3 m dispensing module and 1 m crest of slope setback distance.

The dispensing station shall be fully contained within a geomembrane liner and the liner shall gravity drain into the secondary containment for Tank 1.

4.0 FIELD INVESTIGATION RESULTS

Golder carried out field investigations in 2003 at the originally proposed Baker Lake site and at the revised location in 2005 to obtain geotechnical and geophysical information required as input for design of the material storage facility and specifically the fuel tank farm for this reporting. The geotechnical investigations and geophysical survey programs relevant to the Baker Lake site are identified in the following sections. The approximate investigation locations are shown in plan on Figure 1.2.

4.1 2003 Geophysical Investigation

EM31 ground conductivity and seismic refraction geophysical surveys were carried out at the originally proposed location for the Baker Lake Dry Freight Storage and Marshalling Yard from September 2 to 12, 2003. The purpose for the geophysical investigation was to obtain subsurface data to indicate the presence of ground ice, the depth to bedrock and to identify areas of potential permafrost conditions as input to detailed engineering design of the proposed development.

The EM31 investigation covered an area of approximately 250 m by 550 m and seismic refraction was performed along four lines (Seismic Lines 03-1 to 03-4) totaling about 470 m length to obtain the approximate depth to bedrock below original ground surface for bedrock profiling. Global positioning (GPS) was used to map approximate bedrock outcrop locations. The results of the geophysical investigation are summarized in Golder (2003).

4.2 2003 Geotechnical Investigation

A total of twelve test pits (TP03-1 to 03-12) were completed on September 8 to 11, 2003 to investigate the subsurface conditions at the originally configured site location for the Baker Lake Dry Freight Storage and Marshalling Yard, as follows:

- five test pits (TP03-1 to 03-5) at the fuel tank farm site;
- one test pit (TP03-6) at the explosives storage area;
- five test pits (TP03-7 to 03-11) at the dry freight storage area; and
- one test pit (TP03-12) at the push barge landing site.

The purpose of the geotechnical investigation was to determine the subsurface conditions and to measure the depth below original ground to either the underlying bedrock or frozen ground surface. The test pits were geotechnically logged and selected soil samples were obtained for laboratory testing including moisture content, Atterberg Limits, grain size distribution and Standard Proctor density testing. A thermistor string was installed in TP03-2, 03-3 and 03-12 to monitor future ground temperature conditions. Detail results of the investigation are summarized in Golder (2004).

4.3 2005 Field Geotechnical Investigations

A total of thirteen test pits (TP05-1 to 05-13) were completed at the revised location for the Baker Lake Dry Freight Storage and Marshalling Yard on July 22 to 24, 2005. The purpose of the geotechnical investigation was to determine the subsurface conditions at the revised site configuration, as follows:

- five test pits (TP05-1 to 05-5) at the fuel tank farm site; and
- eight test pits (TP05-6 to 05-13) at the dry freight storage area.

The test pits were excavated using a rubber-tired backhoe and terminated in bedrock or frozen ground. The test pits were geotechnically logged and selected soil samples were obtained for laboratory testing including moisture content, grain size distribution, Standard Proctor density and specific gravity testing. A thermistor string was installed in TP05-1 and 05-5. Detail results of the investigation are summarized in Golder (2005a).

4.4 2005 Geophysical Bedrock Profiling

Seismic and Ground Penetrating Radar (GPR) surveys were completed along six profile lines (Seismic Lines 05-1 to 05-6) during September 8 to 13, 2005 at the revised Baker Lake site. The objective of the geophysical investigation was to determine the bedrock surface profile at selected locations. Seismic refraction and GPR surveys were carried out to better distinguish bedrock surface and permafrost layers. The results of the geophysical investigation are summarized in Golder (2005b).

5.0 GEOTECHNICAL COMMENTS AND RECOMMENDATIONS

5.1 Fuel Tank Farm

5.1.1 Foundation Design

The foundation recommendations for the above-ground storage tanks have considered the following assumptions as part of the design criteria:

- The fuel storage tanks will be operated at ambient conditions. The structures will not be heated to manage the fuel products.

- Successful operation of the fuel storage facility is considered critical to the mining operation. Temporary or permanent loss of fuel operations is unacceptable.

- An uncontrolled fuel spill from the tank farm facility is considered an unacceptable risk to the environment. Therefore, sufficient design measures are required to adequately support the above-ground storage tanks and to provide adequate secondary containment capacity in accordance with the applicable industry standards.

Based on available information, the proposed tank farm location is underlain by at least 1.5 m of overburden soils comprising a mixture of saturated granular materials and frost susceptible soils. To minimize post-construction differential and long-term settlements, the storage tanks should be supported on relatively consistent subgrade conditions comprising either intact bedrock or on a thick layer of structural fill overlying thaw stable subgrade conditions.

The tank farm site will require site preparation to remove all organic material, ice-rich and frost-susceptible soils prior to constructing a level surface for grade support of the above-ground storage tanks and secondary containment structures. Consideration should be given to conducting a supplementary investigation prior to commencing construction activities to confirm the quality and thickness of the overburden materials and the underlying bedrock conditions at the proposed tank farm facility. Based on the results of the additional field results, final geotechnical input may be provided to assess the tank farm grades prior to proceeding with bulk excavation.

The above-ground storage tanks should be supported on a layer of well-compacted granular fill overlying the thaw stable native bedrock excavation surface. It is recommended that the granular fill layer should be at least 1.5 m thick and comprise the following granular fill structure:

- 300 mm of Type 1 Fill comprising minus 19 mm crushed sand and gravel base;
- 450 mm of Type 2 Fill comprising minus 75 mm select granular sand and gravel sub-base;
- 150 mm of Type 4 Fill comprising minus 9.5 mm sand to protect the HDPE Liner;
- 60 mil high density polyethylene (HDPE) with allowance for further protection by applying layers top and bottom by a thick non-woven geotextile;
- 150 mm of Type 4 Fill; and
- 450 mm of Type 2 Fill.

The material quality and compaction density of each fill type is defined in Section 6 of the Technical Specifications in Appendix I.

Provided that the above granular materials are manufactured, placed and compacted according to the attached Technical Specifications, an allowable bearing capacity of up to 200 kPa may be used for footings founded on well-compacted granular fills. The proposed granular thickness assumes that some fuel capacity will be maintained in the tanks to provide additional insulation capacity of the underlying frozen subgrade surface during seasonally warm conditions. The underlying bedrock surface should be inspected to assess the foundation conditions and approved by Golder prior to placement of the granular fill materials.

5.1.2 Fuel Tank Farm Construction

The secondary containment for constructing three AGST in three phases would require each phase to provide at least 110% of the storage volume capacity of the largest operating tank. Based on this requirement, bulk excavation and backfill optimization analyses were carried out to evaluate the optimum sole plate elevation for the AGSTs, dimensions of the secondary containment for each phase, as well as the crest elevation for the containment berms. With the aim of minimizing the variation of the design while considering the constructability and stability issues, the height of the containment berms was set at 1.5 m above the finished grade elevation. Based on the results of the optimization analyses, the fuel tank farm design conditions are summarized as follows:

- AGST sole plate elevation shall be EL. 33.0 m;
- Base of Bulk Excavation for AGST foundation shall be EL. 31.5 m;
- Containment Berm Crest Elevation shall be EL. 34.2 m;
- Containment Berms Backfill Slopes:
    - Lined surfaces: 3 Horizontal to 1 Vertical (3H:1V)
    - Unlined surfaces: 2 Horizontal to 1 Vertical (2H:1V)
- Containment Berm Crest Width shall be 1 m; and
- Dispensing Station Crest Elevation shall be EL. 35.0 m.

5.1.3 HDPE Liner Construction

A secondary containment liner is required for care and control of all petroleum products stored in the above-ground storage tanks. Conventional design standards established by the petroleum industry permit the use of natural clay or synthetic liner materials for secondary containment. However, due to the lack of natural deposits of clay near to the site, synthetic material options, which are specifically formulated for containment of hydrocarbon materials, may be considered in order of preference as follows:

- HDPE Geomembrane Liner (such as HDPE 40 or 60 by Layfield or Nilex);
- PVC Geomembrane Liner (such as Isoflex 30 by Nilex or 30 mil Arctic liner by Layfield); or
- Geocomposite Clay Liner (GCL, such as Bentomat and/or Claymax by Nilex or Bentomat and/or Bentofix by Layfield).

Other synthetic products with similar material specifications may also be considered for use as a secondary containment material. Final selection of the preferred geomembrane liner material will be subject to the design layout, granular material availability, operations and cost. The geomembrane liner recommended for this installation shall be HDPE 60, as defined in the attached Technical Specifications.

Protection of the HDPE liner integrity will be important to maintain during installation and construction of the granular fill materials. To minimize the risk of puncture or penetration through the HDPE liner during placement and compaction of angular particle fill materials, the above design section will consider cushioning layers of sand fill and thick non-woven geotextile materials above and below the HDPE liner, subject to review of the available granular materials and the liner installer's recommendations.

The layout of the secondary containment area shall be to a common site grade for all three AGSTs. Excavation activities will be carried out to remove frost susceptible soil from the work area and backfill with the following materials:

- 200 mm of Type 1 Fill comprising minus 19 mm crushed sand and gravel base;
- 150 mm of Type 4 Fill comprising minus 9.5 mm sand to protect the HDPE;
- Extension of the 60 mil high density polyethylene (HDPE) from the foundation of the AGST with allowance for further protection by applying layers top and bottom by a thick non-woven geotextile;
- 150 mm of Type 4 Fill; and
- 450 mm of Type 3 Fill comprising minus 150 mm granular or common fill.

Containment berms would be constructed at the perimeter to provide storage capacity inside the secondary containment. The berms are generally constructed with the Type 3 Fill materials with HDPE and Type 4 sand fill cushioning layers extended from the secondary containment area for anchoring. A layer of 200 mm thick of Type 1 Fill would be placed at the top for cover.

Drainage inside the secondary containment would be necessary. A 1% downward gradient would be provided to establish positive drainage towards the perimeter of the secondary containment and eventually drain into the designated collection sumps.

5.1.4 Collection Sump

Collection sumps will be installed at the southern end of each of the three secondary containment facilities. The sumps are designated to provide temporary storage for precipitation into the tank farm facility and fuel collected at the dispensing station.

Each secondary containment collection sump should be constructed to the following minimum requirements:

- Sump materials should be fabricated from galvanized metal or HDPE materials;
- Sump diameter shall be at least one meter diameter;
- Sump height shall be at least 0.5 meter height;
- A rigid screen material should be fixed to the sump base; and
- A rigid screen material should be secured to the top of the sump to provide access into the sump for inspection and removal of contained liquids.

Sump locations were selected based on the local topography defined by existing survey information, to maximize volume and to minimize footprint area.

5.2 Dispensing Station

A lined dispensing station will be constructed at the north side of the fuel tank farm for dispensing fuel to the tanker trucks and support vehicles. Vehicle access from Baker Lake to the dispensing station will require an all-season roadway to be constructed to the tank farm location and connected to the proposed all-season access road to the Meadowbank mine site. It is recommended that a minimum road width of 10 m and turning radius of 50 m be considered for preliminary design of the site access road. It is understood that Cumberland will confirm the actual ground surface conditions by field survey as input for civil design of the site access road.

The dispensing station will be located at the north end of the first phase of the fuel tank farm facility. It is designed to accommodate the servicing of a "Super-B" twin tanker truck. The dispensing station will be fully contained within a HDPE liner for prevention of any accidental spill or mishandling of fuel, which will self-drain into the secondary containment.

5.3 Runoff and Sediment Control Structures

Prior to commencing construction of the Baker Lake fuel tank farm, it is recommended that provisions are undertaken to control surface water runoff and sediment control. Drainage ditches and collection sumps or monitoring ponds should be constructed down gradient of the proposed development to allow for collection of sedimentation and visual observation of surface runoff water prior to discharge to the environment.

For preliminary assessment and installation purposes, each monitoring pond should have minimum dimensions of 20 m length, 10 m width and 1.5 m depth, and should be increased up to a maximum storage volume capacity of 1,000 m^3 subject to observed site conditions. The drainage ditches should have a cross-sectional area of less than about 2 m^2 per metre run of ditch, with either v-notch or flat bottom ditch inverts and sideslopes prepared at 2 horizontal to 1 vertical (2H:1V) or flatter.

The exact location of the monitoring pond(s) and drainage ditches should be determined in the field prior to construction with input from a geotechnical engineer. The monitoring ponds should be located at least 25 m away from settlement-sensitive structures.

Consideration should be given to investigate the subsurface conditions at the proposed monitoring pond location(s) by putting down at least one test pit to the underlying bedrock surface and/or frozen ground surface. The results from the geotechnical investigation would provide input for final determination of each pond location and size. Monitoring ponds should not be placed over thick peat deposits.

Each monitoring pond should be field fit to meet existing topographic and surface runoff conditions. The monitoring ponds should be of sufficient size to provide adequate residence time to collect the runoff and allow the discharge water to have little to no visible sediment in the surface water runoff from the fuel tank farm development.

Sedimentation control measures should be considered at the time of construction to minimize future erosion and siltation of the water control structures, including rip rap protection of the ditch inverts and pond bottoms and/or siltation fencing, as necessary.

6.0 CONSTRUCTION DRAWINGS AND TECHNICAL SPECIFICATIONS

As part of this reporting for the Baker Lake Fuel Tank Farm, Golder submits a set of Construction Drawings, (3000-C-100 to 110, Rev. 0, Issued for Construction, dated May 5, 2006), as summarized in Table 5.1. A set of stamped and signed Construction Drawings are provided in Appendix II.

Table 6.1: List of Construction Drawings, Baker Lake Fuel Tank Farm

Drawing Number	Drawing Title
3000-C-100	Title Sheet, Baker Lake Fuel Tank Farm
3000-C-101	General Arrangement Plan, Baker Lake Fuel Tank Farm
3000-C-102	Tank Farm Facility Layout Plan, Baker Lake Fuel Tank Farm
3000-C-103	Tank Farm Excavation Plan And Profile, Baker Lake Fuel Tank Farm
3000-C-104	Tank Farm Excavation Cross-Sections, Baker Lake Fuel Tank Farm
3000-C-105	Tank Farm Backfill Plan And Profile, Baker Lake Fuel Tank Farm
3000-C-106	Tank Farm Backfill Cross-Sections, Baker Lake Fuel Tank Farm
3000-C-107	Tank Farm Backfill Details, Baker Lake Fuel Tank Farm
3000-C-108	Secondary Containment HDPE Liner Plan And Sump Details, Baker Lake Fuel Tank Farm
3000-C-109	Dispensing Station Plan, Baker Lake Fuel Tank Farm
3000-C-110	Dispensing Station Section And Details, Baker Lake Fuel Tank Farm

As part of this reporting for the Baker Lake Fuel Tank Farm, Golder submits a set of Technical Specifications (SP-GAL-03-01 to 10, Rev. 0, Issued for Construction, dated May 5, 2006), as summarized in Table 6.2 and provided in Appendix I.

Table 6.2: List of Technical Specifications, Baker Lake Fuel Tank Farm

Specification Number	Specification Title
SP-GAL-03-01	Scope of Work
SP-GAL-03-02	Care of Water
SP-GAL-03-03	Salvage and Stockpile Organic Materials
SP-GAL-03-04	Foundation Preparation
SP-GAL-03-05	Bulk Excavation
SP-GAL-03-06	Backfill Materials
SP-GAL-03-07	Fuel Tank Farm Construction
SP-GAL-03-08	HDPE Liner Construction
SP-GAL-03-09	Runoff and Sediment Control Ditches and Monitoring Ponds
SP-GAL-03-10	Survey Control

The Construction Drawings and Technical Specifications should form part of the contract documents and should be used to define the limits of work, work description, material products, construction methods, and quality control inspection requirements to develop the Baker Lake Fuel Tank Farm.

7.0 MATERIAL QUANTITY ESTIMATE

The material quantity estimate for construction of the Baker Lake Tank Farm is summarized in Table 7.1. These estimated quantities are based on the proposed construction activities summarized on the Construction Drawings and Technical Specifications, as defined in Section 6.

Table 7.1: Bake Lake Fuel Tank Farm Estimated Quantities

Item	Description	Quantity	Unit
1.0	**EXCAVATION**		
1.1	Phase 1: 2006 Construction Bulk Excavation		
1.1.1	Tank 1 Area (depth varies between about 1 m and 6 m)	32,400	m^3
1.1.2	Dispensing Station (depth about 5 m)	5,900	m^3
1.1.3	Subtotal Phase 1 Bulk Excavation	38,300	m^3
1.2	Phase 1: 2006 Construction, Perimeter Drainage Control		
1.2.1	Perimeter Drainage Ditches (assume 2 m^2 per metre length)	1,300	m^3
1.2.2	Collection Sumps (assume 2 sumps at 1,000 m^3 per sump)	2,400	m^3
1.2.3	Subtotal Phase 1 Perimeter Drainage Control Excavation	3,700	m^3
1.3	Subtotal Phase 1 Excavation	42,000	m^3
1.4	Phase 2: Future Work, Tanks 2 and 3 Areas		
1.4.1	Bulk Excavation (depth varies between about 1 m and 9 m)	60,300	m^3
1.4.2	Access Roads (depth varies between about 1 m and 9 m)	140,400	m^3
1.4.3	Subtotal Phase 2 Excavation	200,700	m^3
1.5	Phase 2: Perimeter Drainage Control		
1.5.1	Perimeter Drainage Ditches (assume 2 m^2 per metre length)	1,700	m^3
1.5.2	Collection Sumps (assume 2 sumps at	4,800	m^3

Item	Description	Quantity	Unit
	2,000 m^3 per sump)		
1.5.3	Subtotal Phase 2 Perimeter Drainage Control Excavation	6,500	m^3
1.6	Subtotal Phase 2 Excavation	207,200	m^3
1.7	Excavation Total	249,200	m^3
2.0	**BACKFILL**		
2.1	Phase 1: 2006 Construction		
2.1.1	Type 1 Fill	2,400	m^3
2.1.2	Type 2 Fill	800	m^3
2.1.3	Type 3 Fill	11,400	m^3
2.1.4	Type 4 Fill	3,400	m^3
2.1.5	Subtotal Phase 1 Backfill	18,000	m^3
2.2	Phase 2: Future Work, Tanks 2 and 3 Areas		
2.2.1	Type 1 Fill	3,800	m^3
2.2.2	Type 2 Fill	3,900	m^3
2.2.3	Type 3 Fill	15,800	m^3
2.2.4	Type 4 Fill	5,100	m^3
2.2.5	Subtotal Phase 2 Tank Farm Backfill	28,600	m^3
2.3	Access Road Fills		
2.3.1	Type 1 Fill	3,800	m^3
2.3.2	Type 2 Fill	9,100	m^3
2.3.3	Subtotal Phase 2 Access Road Backfill	12,900	m^3
2.3	Backfill Total	59,500	m^3
3.0	**PRODUCTS**		
3.1	Phase 1: 2006 Construction		
3.1.1	HDPE Liner	9,300	m^2
3.1.2	Geotextile	18,600	m^2
3.1.3	Collection Sump	1	ls
3.1.4	Fencing	600	m

Item	Description	Quantity	Unit
3.2	Phase 2: Future Work		
3.1.1	HDPE Liner	20,200	m^2
3.1.2	Geotextile	40,400	m^2
3.1.3	Collection Sump	2	ls
3.1.4	Fencing	600	m

8.0 QUALITY CONTROL PLAN

The Quality Control Plan for the construction of the Baker Lake Fuel Tank Farm, hereafter referred to as the Work, is summarized as follows:

8.1 The Work will be completed in accordance with the detailed design information provided on the Construction Drawings and in the Technical Specifications.

8.2 The Work will be laid out in the field by survey measurement according to the information shown on the Construction Drawings and supplemented by information provided by the Owner's Representative.

8.3 The survey layout will be checked in the field by the Owner's Representative for any errors or omissions before proceeding with construction activities.

8.4 The Work will be inspected on a daily or more frequently basis, as necessary, by a Geotechnical Engineer to confirm that the ground conditions encountered during construction is consistent with the conditions assumed for design. Daily reporting will be carried out to document the progress of the Work and form part of the as-built documentation for this phase of project development.

8.5 Upon completion of the foundation preparation, the subgrade conditions within the fuel tank farm areas will be inspected by a Geotechnical Engineer. Recommendations will be provided to address any remedial measures that may be identified by the geotechnical inspection.

8.6 An as-built record of the Baker Lake Fuel Tank Farm will be prepared by the Owner's Representative. The as-built records will be submitted to the Geotechnical Engineer for review and comments.

8.7 The results of the geotechnical site inspections and review of the as-built records will be summarized in a report to the Owner.

9.0 CLOSURE

We trust that the information provided in this report is sufficient for your needs at this time. Should you have any questions regarding the above information or require additional information, please do not hesitate to contact us.

GOLDER ASSOCIATES LTD.

Joe Pun, E.I.T.
Geotechnical Engineer

William J. Purdy, P.Eng.
Associate

Reviewed by:

John A. Hull, P.Eng.
Principal

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APPENDIX I

TECHNICAL SPECIFICATIONS

Specification Number: SP-GAL-03, Rev. 0

Issued for Construction, dated May 5, 2006

APPENDIX II

CONSTRUCTION DRAWINGS

Drawing Numbers: 3000-C-100 to 110, Rev. 0

Issued for Construction, dated May 5, 2006