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E/06/0644

May 1, 2006 06-1413-009

Cumberland Resources Ltd.
Suite 950, One Bentall Center
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Vancouver BC V7X 1M4

Attention: Mr. Raj Anand

RE: SUBMISSION OF INFORMATION PACKAGE FOR WATER LICENSE AMENDMENT APPLICATION TO ALLOW FUEL TANK FARM CONSTRUCTION - MEADOWBANK PROJECT SITE

Dear Mr. Anand:

The following information package and supporting documentation is provided as part of a submission of supplemental material to the Nunavut Water Board for a water license amendment application to allow construction of a proposed single fuel tank with 5M litre capacity at Cumberland Resources Ltd's Meadowbank Project in Nunavut. The single fuel tank will replace eight smaller, double walled fuel "vaults" that are currently being used to store diesel fuel at the exploration camp. The single fuel tank will be constructed in a bermed enclosure area underlain by a geomembrane liner system. The bermed area will be within a footprint area of approximately 100 m by 100 m.

A proposal to construct the tank at the Meadowbank Site (the 'Site') was approved by Nunavut Impact Review Board (NIRB) in March of 2004, pending review and approval by the Kivalliq Inuit Assocation (KIA) and Nunavut Water Board (NWB). Construction of the tank is planned for 2006.

This information package contains information directly relating to the geotechnical aspects of the requirements for the water license amendment application, only.

1.0 INTRODUCTION

Cumberland Resources Ltd. (Cumberland) has been carrying out exploration activities at their Meadowbank Project since 1995. The project is located in the Kivalliq region approximately 70 km north of the Hamlet of Baker Lake on Inuit-owned surface lands (see Figure 1). Engineering, environmental baseline studies, and community consultations have paralleled these exploration programs and have been integrated to form the basis of current project design.

A general site plan is shown in Figure 2. The site plan shows the location of geotechnical boreholes drilled in the plant site and tank farm areas.

1.1 Physical Setting

The site area consists of low, rolling hills with numerous small lakes. Laterally extensive deposits of glacial till cover the area, with thicknesses typically of 2 m to 4 m. Bedrock consists of a sequence of Archean greenstone (ultramafic and mafic flow sequences and intermediate volcanic rock) and metasedimentary rocks.

2.0 AVAILABLE INFORMATION AND GEOTECHNICAL STUDIES

Geotechnical engineering investigations have been undertaken at the Meadowbank Project site since 1996, and have included the following studies:

- Geotechnical data collection from drill core;
- Hydraulic conductivity testing in open boreholes;
- Thermistor installations for permafrost characterization;
- Bathymetric surveys;
- EM31 surveys for ground ice evaluation;
- Laboratory testing of materials;
- Seismic risk assessment; and,
- Geochemical studies.

Results of the various studies have been reported separately. The following partial list of reports is presented to identify studies that may be relevant to the current submission to the Nunavut Water Board relating to the current water license amendment application to allow construction of a fuel tank farm at the Meadowbank Project site.

- Golder Associates Ltd., Report on *Geotechnical Input to Infrastructure Design, Meadowbank Gold Project, Nunavut*, March 2004.

- Golder Associates Ltd., Report on *Geomorphology and Soils, Meadowbank Gold Project, Nunavut*, March 5, 2004.

- Golder Associates Ltd., Progress Report on *Permafrost Thermal Regime Baseline Studies, Meadowbank Gold Project, Nunavut,* December 18, 2003.

- Golder Associates Ltd., Progress Report on *Static Test Results for Overburden, Mine Site Infrastructure Rock, Pit Rock and Tailings, Meadowbank Gold Project, Nunavut,* December 12, 2003.

- Golder Associates Ltd., Technical Memorandum on "Evaluation of Potential Concrete Aggregate Sources, Meadowbank Gold Project, Nunavut", November 26, 2003.

- Golder Associates Ltd., Report on *Ground Ice EM31 Investigation,, Meadowbank Project, Nunavut*, September 3, 2003.

- Golder Associates Ltd., Factual Report on *Summer 2002, Geotechnical Drilling, Hydrogeological and Permafrost Investigations, Meadowbank Gold Project, Nunavut*, December 13, 2002.

- Golder Associates Ltd., Factual Report on *Geotechnical Drilling, Hydrogeological, and Geophysical Investigations, Meadowbank Project, Nunavut Territory*, July 12, 2002.

- Golder Associates Ltd., Letter on *GPR Bedrock Investigation*, January 20, 2003.

Portions of the above list of available information are included with this submission as follows:

- **Appendix I**, attached, contains the report titled "*Geotechnical Input to Infrastructure Design, Meadowbank Gold Project, Nunavut,*" dated March 2004. In addition to the report, geotechnical borehole logs from boreholes drilled in the general plant site and tank farm areas are included in Appendix I, and identified with blue page separators. Ground temperature profiles from three thermistors installed in the general plant site and tank farm areas are included.

- **Appendix II** contains geotechnical specifications for materials types and construction methodology to be used in the construction of the tank farm facility.

- **Appendix III** contains design drawings and plans for construction at the site.

3.0 GENERAL DESCRIPTION OF THE TANK FARM SITE

The general layout for the tank farm areas has remained relatively consistent throughout revisions to the project site layout, with minor modifications to the locations of specific facilities that have resulted from on-going optimization of the project.

The current proposed tank farm is located between 100 m and 200 m to the southeast of the originally proposed area. However, based on data collected from the drilling of 11 geotechnical boreholes in the general area of the plant site, and 2 geotechnical boreholes in the general area of the tank farm, and on the current understanding of the geomorphology and geology at the site, the foundation conditions can reasonably be expected to be similar at the currently proposed location for the tank farm. While the proposed plant site area is not part of the current amendment application, geotechnical boreholes drilled in the general area of the proposed plant site are relevant to the evaluation of the proposed tank farm area because of similarities in rock type and geotechnical characteristics; hence borehole logs from the proposed plant site area are included with this submission as supporting information.

In general, the plant site and tank farm areas are underlain by a thin, discontinuous cover of organic material, over about 1 to 5 m of mineral soil and slightly weathered to fresh, competent, intact ultramafic, intermediate volcanic and metasedimentary bedrock. Bedrock is typically encountered within about 2 m of the existing ground surface in most areas, and is exposed locally at the plant site and tank farm areas. Although the bedrock is frozen, there is little evidence of ice formation within the bedrock, and thawing into the bedrock foundation is not expected to result in strength loss or large settlement of the proposed facilities.

It is planned to excavate the thaw sensitive overburden materials down to bedrock surface, and to found the tank farm on structural fill overlying bedrock. Containment berms will be constructed around the facility. Ditching around the facility will direct run-off away from the facility to water management areas. A geomembrane and geotextile liner system will underly the facility forming a secondary containment system. A fuel off-loading and dispensing station will be constructed along the southeast side of the tank farm area. The station will be underlain by a geomembrane and geotextile liner system,

graded so that spillage that may occur will be conveyed toward the fuel tank farm facility to be contained there.

4.0 CLOSING REMARKS

Additional information and data relating to any or all of the geotechnical investigations at the site are available on request.

Yours very truly,

GOLDER ASSOCIATES LTD.

William J. Purdy, P. Eng.
Associate, Mining Group

Cameron Clayton, M. Eng., P. Geo.
Associate, Mining Group

WJP\CJC\aaf

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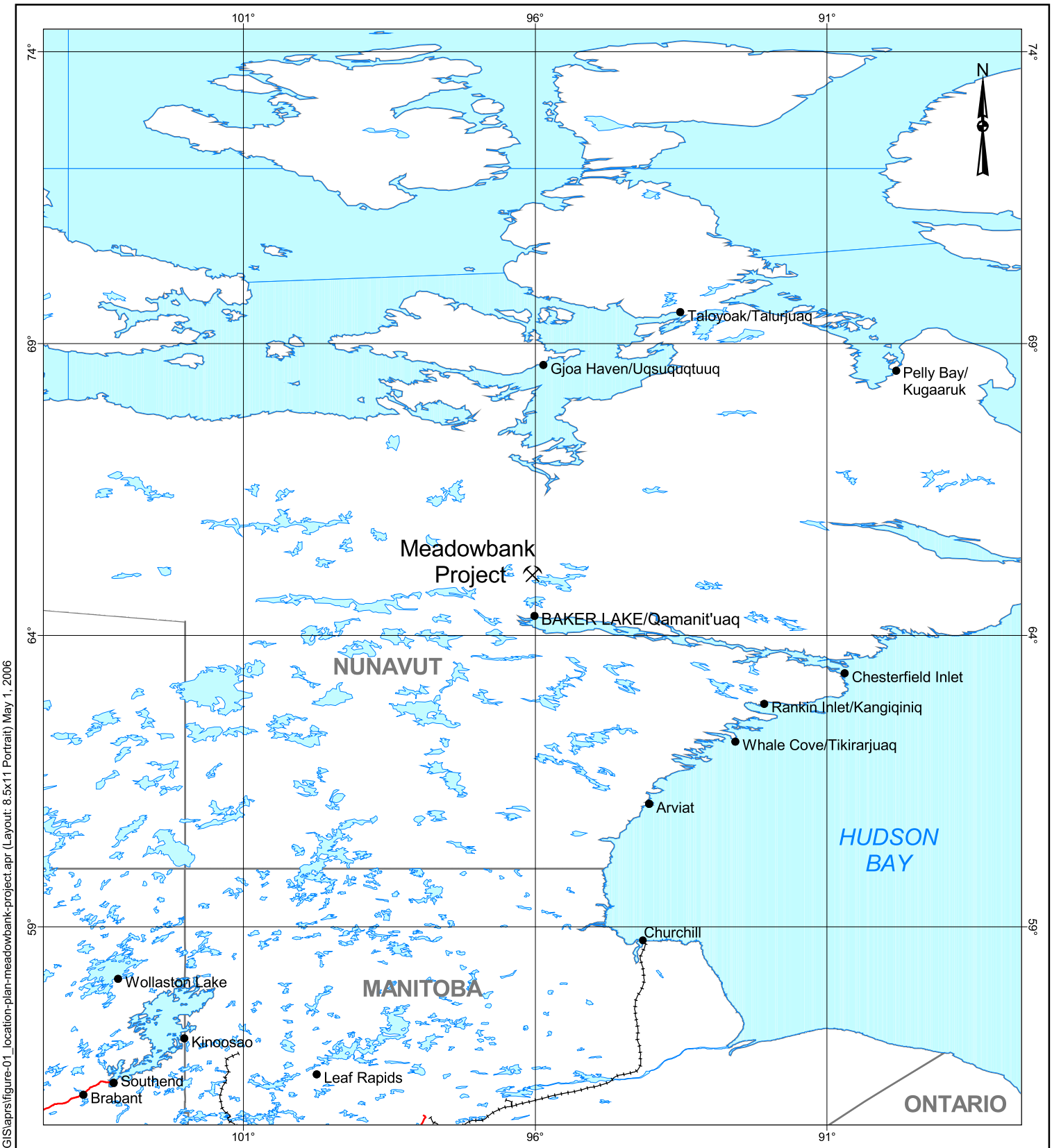

LEGEND

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

200 0 200 Kilometers

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

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

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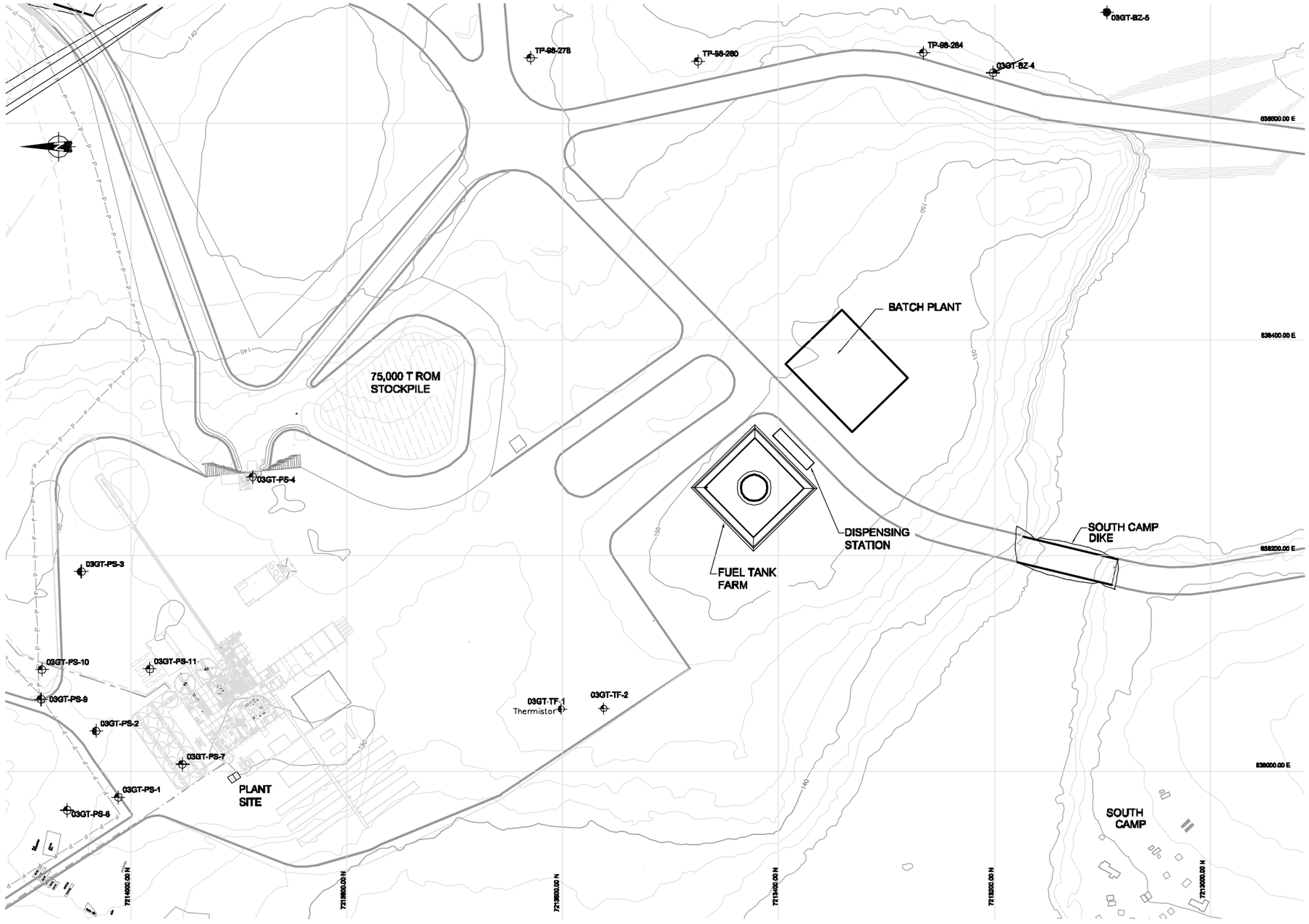

LEGEND

- TP-98-278 - THIRD PORTAGE BOREHOLE DRILLED IN 1998
- 03GT-BZ-5 - BAY ZONE DIKE BOREHOLE DRILLED IN 2003
- 03GT-BZ-4 - BAY ZONE DIKE ABUTMENT BOREHOLE DRILLED IN 2003
- 03GT-PS-1 - PLANT SITE BOREHOLE DRILLED IN 2003
- 03GT-PS-3 - PLANT SITE BOREHOLE WITH THERMISTOR DRILLED IN 2003
- 03GT-TF-2 - TANK FARM BOREHOLE DRILLED IN 2003
- 03GT-TF-1 - TANK FARM BOREHOLE WITH THERMISTOR DRILLED IN 2003

NOTES

1) NORTHING AND EASTING ARE IN METRES REFERENCED TO UTM ZONE 14, NAD83.
2) ELEVATIONS AND DIMENSIONS ARE IN METRES REFERENCED TO GEODETIC DATUM, UNLESS OTHERWISE NOTED.
3) OWNER TO PROVIDE SURVEY CONTROL.

REFERENCE

1) BASE PLAN INFORMATION IS PROVIDED BY CUMBERLAND DATED FEBRUARY 03, 2006.

PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
Plant Site and Tank Farm General Layout and Geotechnical Boreholes

Golder Associates

PROJECT No. 06-1413-009			FILE No. 06-1413-009-SK-F02	
DESIGN	JP/JW	20APR06	SCALE AS SHOWN	REV. –
CADD	EGA	20APR06		
CHECK	CC	20APR06		
REVIEW	WP	20APR06		

Figure 2

REVISION DATE: 06/05/01 02:55PM By: EAbello CADD FILE: N:\Bur-Graphics\Projects\2008\1413\06-1413-009\Drafting\cad\06-1413-009_SK-F02.dwg

APPENDIX I

REPORT ON
GEOTECHNICAL INPUT
TO INFRASTRUCTURE DESIGN
MEADOWBANK GOLD PROJECT, NUNAVUT
MARCH 2004

Golder Associates Ltd.

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REPORT ON

GEOTECHNICAL INPUT TO INFRASTRUCTURE DESIGN MEADOWBANK GOLD PROJECT NUNAVUT

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DISTRIBUTION:

2 Copy - Cumberland Resources Ltd.
1 Copy - AMEC Mining and Metals Ltd.
2 Copies - Golder Associates

March, 2004 03-1413-427/4400

EXECUTIVE SUMMARY

Cumberland Resources Ltd. is planning to develop the Meadowbank Gold Project situated about 70 km north of Baker Lake, Nunavut. As part of the feasibility studies being carried out for the project by AMEC Americas Ltd (Amec), Golder Associates Ltd. was retained to provide geotechnical input for design of the project infrastructure.

The mining plan prepared for CRL by AMEC indicates that approximately 20 million tonnes of ore will be mined over a 10-year mine life from four localized gold deposits and processed at a centrally located process plant. The mine operation will generate approximately 160 million tonnes of mine waste rock comprising 12 million cubic metres of tailings, 80 million cubic metres of mine waste rock and 3.7 million cubic metres of overburden soil and organic materials. The majority of the mine rock will be delivered to waste rock storage areas, with lesser portions used for construction of graded surfaces for the plant site, ancillary facilities, air strip and roads, dike construction and capping of the tailings impoundment.

The plant site topography comprises gently sloping surface features with occasional knolls, bedrock outcrops and localized surface depressions filled with organic materials or water. The site is located in an area of continuous permafrost. The annual average temperature and average precipitation recorded at this site are about -11^{o}C and 190 mm, respectively. The seismic risk is low to negligible.

The planned development for mining operation will include an airstrip and plant site facilities including a process plant, service complex, storage areas and camp accommodations. As such, this report provides geotechnical input and recommendations for the proposed building foundations, airstrip development, site access roads and storage facilities.

In general, the project site has a thin, discontinuous cover of organic material, over about 1 to 5 m of mineral soil overlying weathered to intact ultramafic and metasedimentary bedrock. Bedrock is encountered within 2 m of existing ground surface in most areas and typically exposed at ground surface in the plant site area, with weathered fractures observed within 1 to 2 m of the bedrock contact. Although the bedrock is frozen, little ice occurs within the bedrock and thawing into the foundation would not result in strength loss or large settlement of the proposed facilities.

AMEC is considering a plant site grade of about El. 147.5 m, which is within about 1 m of existing site grades. Site preparation within the plant site area will require excavation and removal of organic material, mineral soil and weathered bedrock materials using conventional drilling, blasting and excavation methods to expose intact bedrock for

building and equipment foundation construction. Foundation recommendations for cast-in-place concrete spread footings and rock anchors are provided.

Design input for grade supported slabs, thermal insulation, gravel surfaced storage areas and secondary containment for above-ground storage tanks are provided. Final plant site grading will provide positive drainage of surface water runoff away from the proposed buildings, roads and laydown areas. All runoff from the plant site area will be collected and directed to the water treatment plant for monitoring and treatment prior to discharging to the environment.

An initial airstrip length and width of 1,100 m by 35 m, respectively, will be constructed, with capabilities for expansion to provide an overall of 1,525 m. It is estimated by AMEC that the initial airstrip will require in the order of about 94,000 cubic metres of rock and granular fill materials for the initial air strip length and about 294,000 cubic metres in total. It is estimated that the maximum fill heights required to complete the initial airstrip to a grade of El. 144 m, will be in the order of 4 m.

Approximately 10 km of mine haul roads will be constructed from non-acid generating waste rock obtained from the Portage, Goose Island and Vault pits to provide mine haul truck route access from each pit to the Run-of-Mine storage area located east of the plant site. The mine haul roads will be about 35 m wide to provide safe two-way passing of 777Cat mine haul trucks having 100 tonne operating capacity. A twin culvert crossing of Turn Lake at its eastern end will be provided for the Vault mine haul road.

Site preparation for airstrip and mine haul road construction will involve the management of surface water and removal of organic material from within the development areas. A localized depression at the south end of the air strip may involve dewatering, excavation and replacement of existing water and peat filled depressions with rockfill materials depending on final airstrip alignment. Construction scheduling should be reviewed to determine the best weather opportunities for completion of the site preparation and embankment filling activities to minimize long-term settlement and maintenance of the granular surface airstrip.

Preliminary recommendations for rock fill and granular material specifications proposed to construct the embankment and surface for the air strip and mine haul roads are provided. Water will be required for dust suppression.

Additional geotechnical input will be required for detailed design of the project infrastructure, review of the contract drawings and specifications, and for provision of quality assurance during construction.

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1.0 INTRODUCTION

Cumberland Resources Ltd. (CRL) is currently evaluating the feasibility of developing the Meadowbank Gold Project. The project is located approximately 70 km north of Baker Lake in Nunavut, as shown on Figure 1-1.

Golder Associates Ltd. (Golder) is performing feasibility level studies for open pit design, mine waste and water management, geochemical and water quality assessment and providing conceptual level input to CRL for the abandonment and restoration plan of the proposed mine and operation facilities. AMEC Mining and Metals Ltd. (AMEC) are simultaneously performing feasibility level studies for the ore resource modeling, ore processing mine layout and mill design. As part of the feasibility level studies for this project, Golder is providing geotechnical input for the conceptual design of the dewatering dikes, tailings dam, plant site and ancillary facilities.

This report provides geotechnical input for the plant site facilities and infrastructure required at the Meadowbank Project. This report provides a summary of the factual information obtained from the field investigation and laboratory testing programs. This report presents geotechnical comments and recommendations as input to the design of the project infrastructure. Factual data reports, which provide detailed results of the site wide surface and subsurface conditions from the geotechnical drilling investigation programs carried out in 2002 and 2003 and a geophysical survey carried out in 2003, are presented in Golder (2002), Golder (2003a) and Golder (2003b), respectively.

This report has considered and included the geotechnical comments and recommendations from previous correspondence related to the project infrastructure. Our scope is limited to the geotechnical aspects of the project infrastructure and the comments and recommendations that are provided are for the feasibility study for the project. Environmental services required as part of this phase of the project are not part of the scope of this work.

The proposed mine development layout for the Meadowbank Gold Project, as of January 28, 2004, is shown in Figure 1-2.

2.0 BACKGROUND INFORMATION

The Meadowbank Gold Project consists of several gold bearing deposits within reasonably close proximity to one another. The four main deposits are:

- Third Portage Deposit (including Bay Zone and Connector Zone).
- North Portage Deposit.
- Goose Island Deposit.
- Vault Deposit.

The run-of-mine (ROM) ore will be trucked from the open pits and stockpiled adjacent to the primary crusher for plant start-up. The ROM ore will be conveyed through a series of crushers and grinders prior to processing the milled ore through gravity and flotation circuits for production of a high-grade concentrate suitable for direct smelting on site.

The mining plan prepared for CRL by AMEC indicates that approximately 20 million tonnes of ore will be mined and processed over a 10-year mine life. The mine operation will generate approximately 160 million tonnes of mine waste rock comprising 12 million cubic metres of tailings, 80 million cubic metres of mine waste rock and 3.7 million cubic metres of overburden soil and organic materials. The majority of the mine rock will be delivered to waste rock storage areas, with lesser portions used for construction of graded surfaces for the plant site, ancillary facilities, air strip and roads, dike construction and capping of the tailings impoundment.

Mine pre-stripping and plant site construction activities are scheduled to commence in March 2005, followed by mine start-up and process operations in December 2006. Upon completion of mine operations by December 2016, mine decommissioning and the majority of the mine closure activities will be carried out and completed by December 2018. Pit flooding, water management and closure monitoring activities will carry on to at least December 2021 and post-closure monitoring will commence in 2022.

3.0 PROPOSED DEVELOPMENT

Based on information provided from AMEC 2004, a description of the proposed infrastructure development including plant site structures, storage facilities, water and waste management facilities, air strip and roads are provided below.

The proposed plant site arrangement, as of January 28, 2004, is shown on the attached Figure 3-1.

3.1 Buildings

Some of the primary buildings planned for process and ancillary facilities are described as follows:

Primary Crusher – The non-heated plant will comprise a pre-engineered structural steel enclosure over a concrete tower approximately 33 m high by 225 square metres and include an overhead crane, truck dump pocket, surge bin, support slabs and apron feeder. Isolated rooms within the plant including an overhead control room and a service room at the base of the structure will be heated. A reinforced earth retaining wall system will be constructed adjacent to the east side of the crusher to provide a truck access ramp and truck dump area, in the order of 19 m above existing grade and extend about 31 m and 45 m beyond each side of the crusher.

Mill Complex – A plant for processing approximately 5,500 tonnes of ore per day will be constructed and will include a SAG Mill, Ball Mill, eight leach tanks, four pre-aeration tanks and two thickener tanks. The plant will be enclosed by a pre-engineered structural steel building with a footprint area of about 8,200 square metres and will be 20 m and 26 m high in the grinding and leach areas, respectively. Operating temperature in the grinding and leach areas will be 10°C and 4°C, respectively.

Service Complex – A pre-engineered structural steel building approximately 150 m by 40 m by 15 m high will extend off the south end of the mill complex and provide approximately 6,620 square metres of heated space for mine maintenance, warehouse, office and first aid facilities.

Power Plant – An ancillary building comprising a pre-engineered structure will house the diesel fuelled generation equipment. The 40 m by 30 m building will be located adjacent to the process plant and connected by a heated utilidor. Fuel will be delivered from the fuel storage area to the power plant in heat traced pipes.

Camp Facilities – The camp facilities will comprise modular trailer type units connected by a heated utilidor west of the process plant and service complex. The camp facilities

will be sized to support a 350 person construction workforce and an average operation workforce of 150 people. A sewage treatment facility will be provided as part of the camp complex with effluent discharged to the tailings impoundment and solid waste will be incinerated.

Aggregate Crushing and Batch Plant – Presently, fine and coarse aggregates will be produced from suitable sources of overburden and waste rock materials. An aggregate crushing and batch plant will be provided for on site concrete production.

3.2 Storage Facilities

Crushed Ore – The coarse ore storage facilities will comprise a 26 m high structural steel A-frame building to cover and protect a 5,000 tonne live crushed ore stockpile from accumulation of rain and snow, and to limit wind blown dust. A concrete reclaim tunnel will be located below the elevated stockpile platform to deliver the crushed ore by a series of conveyers and transfer structures to the process plant. The facilities will be operated at ambient temperatures and a bulldozer will be used to manage the stockpile.

Fuel Storage – On site storage for at least 36 million litres of diesel and gasoline fuel will be provided using three single-walled, welded steel above-ground storage tanks. The diesel fuel will be contained in two 15 million litre 43 m diameter tanks. Additional temporary fuel storage capacity will be provided using existing portable storage equipment. The fuel storage tanks will be contained within a secondary containment dyke and distributed by double-walled pipes on surface. Fuel dispensing stations will be provided on concrete pads for light and heavy vehicle equipment. Jet fuel storage will be provided for emergency use only from a self-contained tank located at the aviation terminal shelter.

Explosive Storage – Explosives storage, Ammonium Nitrate storage, and an emulsion plant will be provided at isolated locations from the mining operations.

Aggregate and Cement Storage – Dry storage will be provided during construction for concrete production.

3.3 Water and Waste Management

Potable Water Intake and Pump House – The water intake structure will be located on the west shore of Third Portage Lake. Potable water will be stored in freshwater tanks adjacent to the process plant and distributed to the service complex and camp facilities by pipeline in the connecting corridor network.

Reclaim Water – Reclaim water will be pumped from the tailings impoundment area using barge mounted equipment and pipelines for use in the process plant.

Water Treatment Plant – A pre-engineered structural steel building will be used to enclose and heat the water treatment plant required for contact water treatment received from the waste rock storage and tailings impoundment facilities.

Discharge Outfall – An insulated and heat traced pipeline will drain from the water treatment plant to the discharge outfall on Third Portage Lake.

Pipelines – Insulated, above-ground and heat traced, high density polyethylene pipe will be utilized for above-ground transport of potable water, reclaim water, fire suppression water, treated water discharge and tailings disposal.

3.4 Airstrip and Site Roads

Air Strip – A gravel surfaced air strip, with nominal dimensions of 1,100 m long by 35 m wide, will be constructed northeast of the plant site area for use by commuter aircraft such as the HS 748. The proposed location allows for the extension of the air strip to about 1,525 m long in the second year of construction for Hercules and 737 aircraft operations, if required.

Site Roads – Double and single lane roads of 10 m and 5 m widths, respectively, will be limited to 8 percent grade or less for light vehicle access and water will be used to control dust as required. Mining vehicles will be restricted to separate dedicated mine haul roads between the open pit and primary crusher areas. The ultimate road width will be about 35 m wide to provide three lane access for safe two-way passing of 777Cat mine haul trucks having 100 tonne operating capacity.

4.0 SITE DESCRIPTION

4.1 General

The Meadowbank Gold Project is situated in a climatic region characterized as having continuous permafrost beneath the exposed land features and taliks beneath the deeper rivers and lakes. Thermistors installed at the site indicate permafrost to be on the order of 400 m to 500 m in depth. The proposed surface facilities will be located on frozen ground and will require engineering allowances to be made for these foundation conditions.

The site area consists of low, rolling hills with numerous small lakes. The topographic relief in the immediate vicinity of the main deposits (Third Portage, Bay Zone, Connector Zone, North Portage, and Goose Island Deposits) ranges on the order of about 10 m to 12 m, but as high as 60 m locally. Elevations vary from about 133 m Above Sea Level (A.S.L.) along the Third and Second Portage Lake shorelines up to maximum elevations of approximately 200 m A.S.L. to the northwest of Second Portage Lake. Elevations in the vicinity of the Vault Deposit range from about 139 m A.S.L. at the Vault Lake shoreline to about 160 m A.S.L. just west of the deposit.

4.2 Surficial Geology

The project area is covered by laterally extensive deposits of glacial till. In general terms, the till can be described as a silty sand with a trace to some gravel till, with between about 30 percent and 40 percent fines (silt and clay particles) as defined in Golder (2002) and Golder (2003a). The material contains up to boulder-sized particles.

As defined in Golder (2004c), sand and gravel deposits may occur in at least four areas: on the east shore of Third Portage Lake, on the north shore of Second Portage Lake, the north shore of the eastern arm of Turn Lake, and to the south of the Vault Deposit. These materials may be a source for granular materials required for construction. Site reconnaissance and material testing is required to ground truth all potential borrow sources and to determine the nature of the deposits identified by the baseline geomorphology assessment.

The material that has been recovered from beneath the lakes during geotechnical drilling along the proposed dike alignments generally can be described as cobbles and gravel with traces of sand, silt, and clay. Locally, samples of sand and clayey sand material have also been obtained.

4.3 Bedrock Geology

4.3.1 Lithology

The Meadowbank Project is underlain by a sequence of Archean greenstone (ultramafic and mafic flow sequences) and metasedimentary rocks which have undergone polyphase deformation resulting in the superposition of at least two major structural events. Enclosed within the greenstone are volcaniclastic sediments, felsic to intermediate flows and tuffs, sediments (greywackes) and oxide iron formations. The sequence also contains sericite schists, which are believed to be altered felsic flows or dykes. The ultramafic rocks are variably altered, containing serpentinite, chlorite, actinolite, and talc.

The ore in the Vault deposit is hosted in intermediate volcanic rocks. The ore in the other deposits is hosted in iron formation rocks.

The general geology of the Meadowbank area and contours showing the approximate thickness of overburden (till) are shown on Figure 4-1.

4.3.2 Faulting

Faulting in the Third Portage area generally takes the form of either high angle, west dipping fault zones (Bay Fault), or bedding-parallel flexural slip features associated with the main stratigraphic contacts.

To the north of the Third Portage peninsula, the Second Portage Lake fault trends northwest, parallel in orientation to Second Portage Lake. The Second Portage Lake Fault dips at between 60 degrees and 80 degrees to the southwest.

The Third Portage peninsula is flanked on the west by the north-south trending Bay Fault, which roughly parallels the western shoreline of the Third Portage peninsula and extends northward along the western flank of the North Portage Deposit area. The fault dips at between 60 degrees and 80 degrees to the west.

The approximate orientations for the Bay Fault and the Second Portage Lake Fault are shown in Table 4-1.

Table 4-1: General Fault Orientations

Fault	Dip	Dip Direction
Bay Fault	70°	270°
Second Portage Lake Fault	70°	235°

Faulting in the Vault area generally takes the form of moderate to high angle, east and south dipping fault zones. In general, the east dipping fault features are inclined at approximately 70 degrees, while the south dipping features are inclined at about 55 degrees.

4.4 Seismicity

The Meadowbank project is located in an area of low seismicity, as shown in Figure 4-2 and Table 4-2.

Table 4-2: Peak Horizontal Ground Accelerations For Meadowbank Site

Return Period of Seismic Event (years)	Peak Horizontal Ground Acceleration (g)
100	0.018
200	0.025
475	0.034
975	0.044

Source: Seismic Risk Calculation for Meadowbank Project Site, Geological Survey of Canada, Natural Resources Canada, Sidney, B.C., July, 2003

4.5 Ground Cover

The Meadowbank site contains continuous vegetation cover interspersed with bedrock outcroppings and continuously aggrading surfaces. The vegetation includes lichens, mosses, shrubs, heaths, grasses and sedges (CRL 2003a).

4.6 Climate

Table 4-3 summarizes precipitation data from the Meadowbank site.

Table 4-3: Annual Precipitation Data 1998 – 2002

Year	Recorded Precipitation (mm)
1998	177.1
1999	190.2
2000	100.5
2001	84.1
2002	146.7

Source: Meadowbank Gold Property – Project Description, 2003.

The annual precipitation at the site generally falls as rain between June and September, while snow falls generally between October and May. Snowfall may, however, occur at any time of year. Table 4-4 summarizes mean monthly climate data collected from the site since 1997. The annual average temperature is around -11°C.

Table 4-4: Summary Of Monthly Climate Data

Month	Mean Monthly					
	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Minimum Relative Humidity (%)	Maximum Relative Humidity (%)	Wind Speed (km/hr)	Soil Temperature[a] (°C)
January	-28.2	-34.9	67.8	76.8	17.1	-24.7
February	-27.9	-35.2	66.6	76.3	16.1	-28.2
March	-21.7	-29.7	69.3	81.9	16.9	-24.4
April	-12.7	-22.1	71.4	90.3	17.1	-17.6
May	-2.3	-9.3	75.7	97.4	19.0	-7.4
June	7.8	0.0	61.7	96.8	16.3	1.9
July	17.2	7.6	47.2	94.0	14.9	11.0
August	13.6	6.7	58.5	97.7	18.3	9.6
September	5.8	1.1	69.6	98.3	18.7	3.7
October	-4.8	-10.6	82.4	97.0	21.1	-2.9
November	-14.5	-21.5	80.8	90.9	17.4	-12.1
December	-22.3	-28.9	74.0	83.4	18.1	-19.2

Note a. Mean soil temperature is reported by AMEC to be measured at a depth between 0.2m and 0.3m below ground surface, but should be confirmed. Installation details such as slope aspect, surficial cover, site drainage, and annual snow cover are not available.

The dominant wind direction is from the north-west. Wind speeds of greater than 100 km/h have been reported at the site. Estimates of wave heights on Third Portage Lake during one such event were reportedly on the order of 2 ft to 3 ft (0.6 m to 0.9 m), based on personal communication with CRL site personnel during 2002.

4.7 Permafrost

A baseline report on the permafrost thermal regimes has been prepared by Golder (Golder 2003c). The Meadowbank Project area is in the area of continuous permafrost as shown on Figure 4-3.

Based on thermal studies carried out to date, this site is considered to have cold temperature permafrost with near surface temperatures reaching about -10° C within 6 m of ground surface. The ground temperatures measured during summer months at the

plant site range from a maximum of between 1° C and 7° C at surface, between -9° C and -11° C at a depth of about 4 to 6 m below ground surface and -7° C and -9° C at a depth of 30 m below ground surface. The depth of permafrost at the site is estimated to be in the order of 550 m depending on the proximity to lakes. The depth of the active layer ranges from about 1.5 m to 2.5 m at the plant site up to about 4 m adjacent to lakes. The depth of permafrost and of the active layer will vary based on proximity to lakes, overburden thickness, vegetation, climate conditions, and slope direction.

Based on ground conductivity surveys and compilation of regional data, the ground ice content is expected to be low (Golder 2003b). Locally on land, ice lenses and ice wedges are present, as indicated by ground conductivity, and by permafrost features such as frost mounds. These areas of local ground ice are generally associated with low lying areas of poor drainage.

Regarding the potential effect of global warming, current information suggests that the average annual temperature for the Meadowbank property, located at around 65°N, may increase by approximately 4°C to 5°C over the next 50 to 100 years. Considering that the design life of the proposed infrastructure will be in the order of 10 years, any potential change in the active layer thickness and or the total thickness of permafrost resulting from global warming should have negligible effect on the proposed development during this time period. Normal annual variation of the climatic conditions, in particular the snow cover, will have a greater effect on the active layer thickness during this short operating period than global warming.

4.8 Hydrogeology

A baseline hydrogeological report (Golder 2004a) was prepared for the project and discussed in detail relative to the waste and water management plan in Golder (2004b). For purposes of geotechnical input to the design of the plantsite infrastructure, this report is limited to a description of the shallow groundwater flow regime.

From late spring to late summer, when temperatures are above 0 degrees Celsius, the active layer becomes thawed. Within the active layer, the water table is expected to be a subdued replica of the topographic surface. Groundwater gradients would, therefore, be similar to topographic gradients. Locally, groundwater in the active layer would flow to local depressions and ponds that drain to Second and Third Portage Lakes or would flow directly to Second and Third Portage Lakes.

5.0 SUBSURFACE CONDITIONS

5.1 Results of Investigations

Golder has carried out geotechnical field investigations to obtain the geotechnical and geological information required for the design of the surface infrastructure. The factual data was obtained from two field investigation programs carried out in 2002 and 2003 and a ground ice EM31 investigation. The data is presented in Golder (2002), Golder (2003a) and Golder (2003b), respectively.

A total of 29 boreholes were considered for this geotechnical assessment including eleven geotechnical boreholes at the proposed Plant Site, two geotechnical boreholes near the proposed Tank Farm and 11 reverse circulation boreholes drilled and logged by Cumberland along the proposed Air Strip alignment. The borehole locations are shown on the attached Figure 5-1 and are summarized on the attached Tables 5-1, 5-2 and 5-3, respectively. Survey co-ordinate and top of hole elevation data for the reverse circulation boreholes was provided by CRL (2003b). Thermistor results for 03GT-PS-02, PS-03 and TF-01 to September 2003 are summarized in Figures 5-2 to 5-4, respectively.

Table 5-1: Plant Site Geotechnical Boreholes

Hole	Northing (m)	Easting (m)	Elevation (m)	Length (m)	Structure or Site Area
03GT-PS-1	7,214,011.441	637,976.438	147.764	29.50	Process Plant
03GT-PS-2	7,214,032.215	638,037.694	147.136	29.40	
03GT-PS-6	7,214,058.896	637,964.353	146.632	9.60	
03GT-PS-7	7,213,952.089	638,006.998	149.366	8.55	
03GT-PS-9	7,214,083.049	638,067.079	146.716	10.05	
03GT-PS-10	7,214,082.158	638,094.492	147.487	10.05	
03GT-PS-11	7,213,982.399	638,095.161	148.877	8.50	
03GT-PS-3	7,214,045.784	638,185.257	148.051	29.10	Ore Stockpile
03GT-PS-4	7,213,886.667	638,273.169	148.676	8.65	Primary Crusher
03GT-PS-5	7,214,189.741	638,042.483	140.076	11.60	Plant Site Area
03GT-PS-8	7,214,012.942	637,812.655	143.720	7.50	

Table 5-2: Tank Farm Geotechnical Boreholes

Hole	Northing (m)	Easting (m)	Elevation (m)	Length (m)	Structure
03GT-TF-1	7,213,587.300	638,062.428	147.62	15.00	North of Tank Farm
03GT-TF-2	7,213,547.829	638,062.867	146.94	10.50	

Table 5-3: Air Strip Primary Reverse Circulation Boreholes

Hole	Northing (m)	Easting (m)	Elevation (m)	Length (m)	Structure
MRC02-001	7,214,759.050	637,579.360	147.79	9.30	Air Strip
MRC02-002	7,214,638.860	637,760.870	146.18	6.70	
MRC02-003	7,214,527.130	637,942.130	147.02	7.14	
MRC02-004	7,214,418.640	638,114.600	143.76	8.70	
MRC02-005	7,214,288.890	638,260.100	139.98	5.75	
MRC02-006	7,214,157.660	638,411.600	138.73	8.50	
MRC02-007	7,214,031.110	638,565.860	137.64	3.80	
MRC02-278	7,214,023.978	638,473.358	138.00	4.60	
MRC02-279	7,214,206.767	638,171.768	142.00	5.35	
MRC02-363	7,214,447.411	637,847.161	144.00	2.60	
MRC02-364	7,214,355.484	638,032.473	143.72	2.10	

The information from an additional 12 reverse circulation boreholes by Cumberland was also reviewed as supplemental input to the ground conditions east of the proposed air strip location and is summarized in Table 5-4.

5.2 Simplified Stratigraphy

In general, the site is underlain by thin organic and/or mineral soil layers, exposed weathered bedrock or felsenmeer over massive bedrock. Although the borehole logs indicate minimal presence of organic cover, unless otherwise noted, the site area is surfaced with a thin layer of tundra vegetation. There are isolated areas comprising greater thickness of organic material, ice-rich silt and silty sand till-like materials. The bedrock is described as fresh to moderately weathered, fine grained, closely foliated, greenish grey, medium strong, intermediate volcanic bedrock. The bedrock contains

wavy quartz bedding and iron staining near surface, and wavy calcite banding, hematite clusters and disseminated pyrite sulphides at depth.

Table 5-4: Air Strip Supplementary Reverse Circulation Boreholes

Hole	Northing (m)	Easting (m)	Elevation (m)	Length (m)	Structure
MRC02-280	7,214,218.996	637,961.473	140.00	4.15	Perimeter Area East of Air Strip
MRC02-281	7,214,270.130	637,775.792	137.63	2.60	
MRC02-282	7,214,691.742	637,898.068	154.00	2.10	
MRC02-283	7,214,788.089	637,773.235	154.00	2.00	
MRC02-284	7,214,878.149	637,626.908	152.00	1.55	
MRC02-359	7,214,891.195	637,485.135	148.82	3.55	
MRC02-360	7,214,754.719	637,580.672	147.09	3.95	
MRC02-361	7,214,745.320	637,723.475	148.30	2.30	
MRC02-362	7,214,601.868	637,893.137	147.61	3.20	
MRC02-365	7,214,513.302	638,079.091	144.95	2.60	
MRC02-366	7,214,412.324	638,257.069	139.36	2.20	
MRC02-367	7,214,293.537	638,411.514	140.00	1.90	

The drilling methods used for the reverse circulation and geotechnical (RC and GT) boreholes to investigate the underlying bedrock conditions provided limited information regarding the overburden conditions, such as organic thickness, soil consistency, moisture content, in situ soil density and ice content. This was primarily due to the drilling methods used, and due to the limited thickness of overburden materials in many areas. In areas where greater thickness of organic material and mineral soil are encountered, a test pit investigation program should be considered to better assess the overburden conditions. Therefore, interpretation of the drilling results, as summarized on the borehole logs, must be reviewed in conjunction with site reconnaissance information, air photo interpretation and EM31 results.

Based on the EM31 results, the majority of the underlying bedrock comprises thaw-stable dry permafrost. In general, the rock fractures are not expected to contain free water or ice at the proposed plant site and tank farm location. Specific near surface conditions for the plant site, tank farm and air strip are provided below.

5.3 Plant Site

Seven boreholes (03GT-PS-01, 02, 06, 07, 09, 10 and 11) were completed in the mill and service complex area, two boreholes (03GT-PS-04 and 03) in the primary crusher and ore storage area, respectively, and two boreholes (03GT-PS-05 and 08) in the yard area north of the process plant. The existing site grades within the plant site area range from about El. 140 m to 150 m with an average elevation of El. 148 m amongst the seven mill and service complex holes, El. 149 m at the crusher location and El. 148 m at the ore stockpile. The original ground surface drops off to the north of the process plant and east of the ore stockpile areas.

The natural ground conditions in the mill and service complex area comprise little to no organic cover, underlain by no to 1.4 m of mineral soil, followed by 0 m to 2.4 m of slightly weathered bedrock over fresh competent bedrock. The mineral soil comprises boulders and cobbles with silty sand and a trace to some gravel. The depth to sound bedrock in the plant site area ranges from about 0.6 m to 2.5 m with an average depth of about 1 m below original ground surface. The depth to sound bedrock at the crusher and ore stockpile area is about 1.2 m and 0.6 m below original ground surface, respectively.

Thermistors were installed in boreholes 03GT-PS-02 and 03 in June 2003 to depths of about 29 m below original ground surface. The measured temperatures range between about 3ºC and 0ºC within 1.2 m of ground surface and between about -6ºC and -10ºC at depths greater than 3 m below original ground surface.

5.4 Tank Farm

The proposed tank farm area is situated south of the plant site area and approximately 130 m from Third Portage Lake. The site relief comprises a relatively level bench with a gentle slope towards Third Portage Lake. The ground surface elevations at the propose site for the facility range between about El. 149 m and 152 m, sloping down to the west towards the lake.

Boreholes 03GT-TF-01 and 02 were drilled west of the originally proposed tank farm location on slightly lower terrain, about 190 and 160 m northwest from the centre of the currently proposed facility. TF-01 encountered approximately 3 m of cobbles and coarse angular gravel overlying massive bedrock and TF-02 encountered 0.35 m of similar coarse overburden, overlying about 1.2 m of weathered bedrock over sound bedrock.

A thermistor was installed in borehole 03GT-TF-01 in August 2003 to a depth of 15.0 m below original ground surface. The data indicates that the ground is thawed to a depth of about 1.5 m below original ground surface and the ground temperatures range between about -2ºC and -10ºC at depths greater than 3 m below original ground surface.

It is recommended that additional geotechnical boreholes are drilled at the proposed tank farm location to determine the subsurface conditions as input to the detailed design requirements for site preparation, tank foundations and secondary containment structures.

5.5 Air Strip

The air strip alignment has been modified since the EM31 survey and reverse circulation drilling programs were carried out in 2002. Based on the centerline profile of the proposed alignment, the ground surface within the planned length of 1,100 m presently ranges between about El. 138 m and 145 m. The south end of the proposed air strip alignment is situated within a low lying area and the north end is approximately 325 m from the shore of Third Portage Lake. The extended air strip length of 1,525 m would require a rockfill extension of at least 100 m into the lake.

The EM31 survey of the originally proposed alignment indicated that the area is generally underlain by dry permafrost, with little evidence of ground ice or thermokarst, except at the southern end where the low lying wet area contains frost mounds, indicative of thick organic cover and frost susceptible fine grained soils. Similar conditions are expected along the new alignment.

There are a total of 11 primary reverse circulation boreholes (as summarized on Table 5-3) completed along or within close proximity to the proposed alignment and an additional 12 supplementary reverse circulation boreholes (as summarized on Table 5-4) located along the previous alignment. There is no borehole information presently available along the northern half of the proposed alignment or within the proposed extension into the lake.

Based on the available drilling results, the ground conditions along the majority of the proposed alignment consist of negligible tundra cover or organic material. The south end of the air strip is situated in up to at least 2.75 m of organic material and ice-rich fine grained soils. The air strip alignment is overlain by 0.25 m to 4.8 m of glacial till mineral soils on average about 2 m thick overlying bedrock, which is consistent with the EM31 results carried out east of the proposed alignment. The mineral soil as defined by the reverse circulation borehole results consists of silty, sandy till with some gravel and traces of cobbles and boulders. Bedrock was not encountered at surface in any of the primary reverse circulation boreholes, as the proposed alignment was shifted approximately 100 m west of an existing bedrock outcrop identified by the supplementary reverse circulation boreholes.

It is recommended that additional geotechnical boreholes are drilled along the proposed air strip alignment to determine the subsurface conditions as input to the detailed design requirements for site preparation and embankment construction.

6.0 GEOTECHNICAL COMMENTS AND RECOMMENDATIONS

Geotechnical comments and recommendations are provided below as input for conceptual design of the plant site and ancillary facilities, tank farm, air strip, roads and storage areas. Some of the key geotechnical issues identified by AMEC to be addressed herein include:

- Depth of frost-shattered bedrock to be removed for support of building foundations on sound bedrock;
- Potential presence of ice rich rock and impact on foundation design;
- Bearing capacity;
- Method of rock excavation;
- Rock anchor design; and
- Sources of structural fill, road building materials, coarse and fine concrete aggregate.

6.1 General

The results of the site investigation programs as defined in Golder (2002), Golder (2003a) and Golder (2003b) and summarized herein indicate that the proposed location for the plant site is considered suitable from a geotechnical perspective for development of the surface facilities. The site is reasonably level and bedrock is either exposed or relatively close to surface for support of all grade fills and structural foundations. The underlying intact bedrock is considered satisfactory to support the proposed building and equipment foundations using either spread footings or raft foundations. Geotechnical comments and recommendations for plant site preparation, foundations and seismic considerations are provided below.

6.2 Site Preparation

In preparation for plant site and ancillary building development, the existing ground surface will be excavated to expose the underlying intact bedrock surface and backfilled to a final plant site grade after foundations are completed to provide surface water runoff away from the building areas. The plant site grade selected for development is El. 147.5 m which is consistent with the existing site grade and will provide sufficient slope for surface drainage to the site perimeter. Further, the proposed site grade of El. 146.5 m for the primary crusher and crushed ore stockpile areas are about 1 m below original site grade.

It is recommended that prior to site development, all organic material and fine grained ice-rich soils should be removed from the plant site area. As discussed in the foundation section below, the plant site building and equipment foundations will be supported on intact bedrock, which is about 1 to 2 m below existing ground surface in the plant site area. The weathered bedrock should be removed to expose the underlying intact bedrock surface within the proposed building areas using conventional drilling and blasting techniques. It is expected that frozen bedrock will shatter during excavation and care should be taken to minimize disturbance of the underlying intact unweathered bedrock. The weathered bedrock excavated from the plant site and ancillary building areas may be considered for use as rockfill for general site grading of level yard area surfaces beyond the building limits.

Clean, free draining, well-graded 100 mm minus quarry or pit run sand and gravel having less than 5 percent passing a 0.075 mm (USS #200) sieve should be used for structural fill to support all grade supported lightly loaded building foundations and floor slabs. The granular fill should be placed in maximum 300 mm level lifts and compacted to at least 100 percent of Standard Proctor maximum dry density. Beyond the proposed building limits, the general plant site grades may be constructed using 300 mm minus coarse rock fill placed in level lifts and compacted using at least 6 passes of a large smooth drum vibratory roller to within about 0.6 m of finished grade.

It is understood that all granular materials required for structural backfill, road building materials, coarse and fine concrete aggregate will be provided from on-site sources of natural granular deposits and crushing of selected rock fill. Although aggregates obtained from the overburden deposits of coarse to fine grained till are considered acceptable for use as concrete aggregates, the washing and screening activities required to process the material are considered impractical for development at this site.

6.3 Foundations

It is our understanding that the process plant equipment is sensitive to differential movements and should not be supported on any existing fills or native silty mineral soil. Similarly, there are heavy live load requirements within the process plant, service complex, and ancillary buildings. Shallow surficial deposit of organic material and ice-rich wet silt, such as the deposits encountered north of the plant site area at PS-05 and PS-08 and south of PS-04 should be avoided for siting the buildings and equipment foundations or removed to expose the underlying intact bedrock surface.

Equipment foundations or structural members subject to high static or dynamic loading conditions should be supported on spread footings founded on intact bedrock. For preliminary assessment purposes only, these foundations may be designed using an allowable bearing pressure of 2 MPa, subject to a minimum footing width of 200 mm.

The foundation conditions and footing width should be reviewed subject to the design load requirements.

Foundation preparation will involve the removal of frost-shattered and weathered bedrock to expose the underlying intact bedrock. Even with careful control of blasting and subgrade preparation, some fracturing or overbreak of the rock below foundation level should be expected. If construction operations, including blasting and rock excavation results in loosening of the rock fragments such that there are open joints or voids within the rock mass, this material would not be suitable for foundation support of the highly loaded equipment foundations and should be sub-excavated. Rock having tight jointing or fracturing is considered suitable for foundation support. However, it is recommended that all footings supported on jointed or fractured rock be provided with sufficient reinforcing steel to "bridge" over these features and prevent local differential settlements or propagation of the joints or fractures through the foundation.

The bedrock surface should be flat and free of any loose rock or soil. In areas where the bedrock surface is sloping more than 10 degrees, the footings should be anchored to the rock using steel dowels. Unless otherwise directed by the structural engineer, the dowels should consist of 25 mm diameter reinforced bars, grouted into 50 mm diameter holes using non-shrink grout. The dowels should be installed at 1 m intervals and penetrate at least 0.4 m into intact bedrock. Footing restraint from lateral or uplift overturning loads may require rock anchors as described below.

Lightly loaded buildings, the crushed ore storage building, skid-mounted equipment or above-ground storage tanks, which can tolerate some settlement or differential movement, may be supported on spread footings founded on well compacted structural fills, placed and compacted as described above. For foundation design purposes, an allowable bearing capacity of up to 150 kPa may be used for footings founded on well-compacted structural fills. Other bearing capacity values may apply for spread footings constructed at shallow depths and should be reviewed on a site specific basis by the geotechnical engineer.

Regardless of bearing pressure considerations, it is recommended that strip or pad footings founded on structural fill, be designed with a minimum width of 450 mm and 600 mm, respectively. All exterior footings or those in unheated areas should be provided with a minimum soil cover of 1 m for partial frost protection purposes. In addition, exterior footings which are movement tolerant should be supported on intact rock, or clean, non-frost susceptible granular fill or blast rock fill extending to a depth of at least 2 m below final site grade to minimize the potential differential movements resulting from seasonal thaw conditions. Consideration should be given to placing synthetic insulation around the building exterior to a depth of at least 1.2 m below final

site grades to retain heat within the building structures and to limit thaw of the surrounding fill grades.

6.4 Rock Anchors

It is understood that rock anchors will be utilized to restrain various foundation elements into the underlying bedrock and to minimize the use of mass concrete support. Rock anchors should be seated into intact bedrock with the unbonded (bond-breaker) length extending completely through the frost shattered zone for bond support in the intact bedrock. Grouted or mechanical anchor may be used for static load conditions. However, for dynamic foundation requirements such as the mill foundations, where load reversal may occur, grouted anchors should be used to minimize the risk of anchor creep and loss of working load capacity. Recommendations for grouted and mechanical anchors are provided below.

6.4.1 Grouted Anchors

Grouted anchors should be designed based on an allowable bond stress of 500 kPa. The minimum length of grouted anchor in the intact bedrock should be 4 m.

The successful installation of grouted anchor will have to contend with freezing downhole conditions from the permafrost by providing specific cold temperature measures, including applying heat to the hole, the grout equipment, the grout mixture and the anchor bar before installation and using cement additives such as aluminous cement, to achieve high early strength conditions prior to freezing the grout. Alternatively, fast acting anchor resins should be considered.

6.4.2 Mechanical Anchors

As an alternative to grouted anchors, consideration may be given to using mechanical anchors, such as DYWIDAG Expansion Shell Threadbar Anchor. Ungrouted mechanical anchors are generally suited for temporary installations or for tie-down of lightly loaded structures under wind gust or sustained uplift load conditions and can be considerably less expensive than grouted anchors. However, for permanent systems and for winter applications, it is recommended that the mechanical anchors be grouted in place. Provision may be considered to delay grouting of winter installations until the summer months by installing tubing together with the anchor to allow access when grouting is more feasible.

If mechanical anchors are considered for Meadowbank, the range in load should be assessed to minimize the effect of load reversal and creep by the expansion shell and the anchors should be grouted upon completion to improve creep resistance.

A grouted system will have greater stiffness to horizontal loads and greater resistance to creep than a mechanical anchor system in the event there are long-term static loads. In contrast, an ungrouted hole will leave some flexibility in the anchor bar due to the greater diameter of the borehole. The size of the bar and the boring will be dependent on the structural loads and the equipment on site. Typical DYWIDAG bar diameters range from 15 mm to 28 mm in diameter with boreholes ranging from 37 mm to 51 mm in diameter. The expansion shell must be ordered to match the anticipated borehole diameter.

DYWIDAG recommends this type of mechanical anchorage for hard and fissure-free rock in the zone where the expansion shell is placed. In addition, there should be sufficient overall rock cover above the anchor bond zone. Since there is the potential of thawing within the frost shattered bedrock zone, it is recommended that the anchors be placed either in sound bedrock or in a zone where the rock will be permanently frozen. It is recommended that the anchors be placed at a minimum depth of 5 m below ground surface. If angled anchors are considered, it is recommended that they be installed at an angle between 45 and 60 degrees. Assuming a 60-degree hole, the hole (and anchor) length would be 6 m.

It is strongly recommended that the initial anchors be tested by jacking to at least two times the design load and that acceptance be made based on standard anchor testing criteria. In areas where geological conditions are not as anticipated (in terms of depth to sound bedrock), the anchor holes should be drilled deeper and longer anchors being installed.

6.5 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 acceleration for 10 and 5 percent probability of exceedence 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 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 (1995), considering all settlement-sensitive foundations to be supported on rock or dense granular fills over rock.

6.6 Tank Farm

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.

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 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. Additional investigation is required to determine the quality and thickness of the overburden materials and the underlying bedrock conditions at the proposed tank farm facility.

Whenever possible, steel above-ground storage tanks should be supported on a concrete ring beam founded on either the underlying bedrock or on structural fill over intact bedrock, provided that the bedrock surface is at or near surface. In either case, the bedrock surface should be exposed to assess the foundation conditions and to prepare the foundation surface. Consideration should be given to benching each storage tank and surrounding secondary containment area to enable placement of the structure on the underlying bedrock surface.

In the event that the subsurface conditions at the proposed tank farm facility comprise a thick deposit of overburden materials overlying bedrock, consideration may be given to supporting the storage tanks on a well-compacted layer of structural fill overlying thaw stable native subgrade soils to maintain frozen subgrade conditions during seasonally warm ambient temperatures. For preliminary cost estimating purposes only, the structural fill layer should be at least 1.5 m thick. This thickness assumes that some fuel capacity will be maintained in the tanks to provide additional insulation capacity of the underlying frozen subgrade soils during seasonally warm conditions. Alternatively,

greater fill thickness or a layer of synthetic insulation may be required. Thermal analysis of the actual subgrade and operating conditions should be carried out during detailed design to determine the minimum granular thickness required to adequately support the storage tanks.

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 may also be considered for use as a secondary containment material. Final selection of the preferred synthetic liner material will be subject to the design layout, granular material availability, operations and cost.

6.7 Air Strip

It is understood that the proposed air strip will require fill to raise the existing site grades to the proposed air strip grade of El. 144 m from the north end to about the mid-point of the initial air strip length and will slope down to the south end at a gradient of 0.46 percent to El. 141.6 m. The primary geotechnical issue associated with the air strip construction is material selection and subgrade preparation to minimize settlement and operational maintenance. In order to minimize settlement, it is desirable to achieve suitable subgrade conditions within the development area prior to fill placement, all fill materials should comprise free-draining granular and or rock fill materials and the final surfacing materials are non-frozen during construction. Furthermore, finished grades should be designed to provide adequate care and control of surface water drainage away from the air strip.

6.7.1 Subgrade Preparation

Subgrade preparation will be required in specific development locations to prepare the existing ground surface prior to construction and to help limit future settlement of engineered backfill materials. Depending on the final air strip alignment and design cross-section, the proposed air strip and surrounding site lines may require some bedrock blasting in isolated locations to prepare the site for development.

In general, the types of subgrade preparation may include, but not be limited to, the following activities:

- Management of surface water;
- Surface 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 in the detailed design report once we have information on the airstrip construction schedule and the plans for the infrastructure (roads etc.) that will be associated with the airstrip.

6.7.2 Backfill Materials

The proposed air strip grade may be constructed using coarse rock fill placed in level lifts and compacted to within about 600 mm of finished grade. The rock fill surface should be covered with a layer of well-compacted, select granular fill materials. For preliminary cost assessment purposes only, a total granular thickness of 600 mm should be considered for surfacing the air strip and the thickness may vary subject to material availability and aggregate process plant capabilities. Some maintenance of soft areas encountered within the finished grade should be expected during the first year of operation, particularly in areas where fills are placed over thick peat and/or soft soil conditions that are not removed prior to construction.

All granular fills used for construction of the air strip should comprise non-frozen, free-draining, clean hard durable uncoated particles, free from clay lumps, cementation, organic or other objectionable materials. Rockfill in excess of 300 mm nominal size

should be avoided within 1 m of the finished rough grade. Smaller rockfill particles should be used to transition the coarse rock fill to a smaller particle size, minimize the fill voids and provide a more suitable material for grading within the desired design tolerances. The existing native, silty mineral glacial till soils should not be used for air strip fill construction.

The air strip and fill pad surfaces should be sloped to provide positive drainage to the site perimeter. Perimeter ditches may be required to control surface water runoff from this site area by directing the runoff to a collection pond or sump for monitoring prior to discharging to the natural drainage system or pumped to a contained area for treatment.

6.8 Mine Haul Roads

The mine haul road between the Plant Site and Vault Pit is in the order of about 8 km in length and requires one water course crossing at east end of Turn Lake. It is understood that the ultimately road width will be at least 25 m wide to provide 3 lane access for safe two-way passing of 777 Cat mine haul trucks having 90 to 100 tonne operating capacity.

Based on a preliminary review of the topographic information, the proposed mine haul route will cross relatively level to slightly undulating terrain with subgrade conditions probably comprising fine grained till materials, weathered (felsenmeer or block field) and unweathered bedrock in the local highs and organic material and frost-sensitive, wet fine grained soils in the low areas. It is understood that the water course crossing at Turn Lake is less than 6 m deep.

In general, to minimize capital expenditure and post construction operating costs, the design criteria for the mine haul road should utilize locally available construction materials from the mine operations and maintain frozen subgrade conditions. As the road grade will be subjected to seasonal thaw, fine grained soils should be avoided within the upper 2 m of the road embankment.

The fill materials required for mine haul road construction should comprise non-acid generating rockfill from mine waste material sources and possibly supplemented with smaller quantities of granular soil and weathered bedrock from within the road alignment.

In areas where the road subgrade does not comprise bedrock within about 1 m of existing ground surface, the access road should be constructed with at least 2 m of granular or rock fill to provide an insulation layer to maintain the underlying frozen subgrade conditions. Greater fill thicknesses may be required in areas where the route crosses ice-rich fined grained soils or organic-filled depressions.

The road grade may be reduced to about 1 m thickness in exposed bedrock locations. However, excavations to remove felsenmeer or intact bedrock to achieve the desired grades or provide supplementary quantities of excavated materials for road fill locations, will probably require at least 1 m of granular fill cover above the rough excavated rock surface to enable adequate grading and load distribution for the proposed mine haul traffic.

The construction schedule will demand large reliable sources of road fill materials from the mining operations to accommodate winter construction. Preliminary geotechnical assessment indicates that there appears to be limited sources of suitable overburden deposits and or bedrock outcrops available from within the road alignment to warrant conventional balanced cut to fill construction. A site reconnaissance of the proposed alignment should be carried out by an experienced geotechnical engineer to assess the existing subgrade conditions and provide additional input for detailed design of the proposed road grades for the mine haul road.

All granular fills used for construction of the mine haul road should comprise non-frozen, free-draining, clean hard durable uncoated particles, free from clay lumps, cementation, organic or other objectionable materials. Mine waste material and or coarse rockfill from locally available quarries may be considered in any deeper fill sections. However, rockfill in excess of 300 mm nominal size should be avoided within 1 m of the finished rough grade. Smaller rockfill particles from a screened mine waste source should be used within 1 m of the finished rough grade to transition the coarse rock fill to a smaller particle size for the proposed granular fill pavement structure, minimize the fill voids and provide a more suitable material for final grading and operational tire wear.

For preliminary cost assessment purposes only, a total granular thickness of 1 m should be considered for surfacing the mine haul road. The design thickness may vary subject to material availability and aggregate process plant capabilities. Some maintenance of soft areas encountered within the finished grade should be expected during the first year of operation, particularly in areas where fills are placed over thick peat and/or soft soil conditions that are not removed prior to construction. The existing native, silty mineral soils located within the road alignment is frost-sensitive and generally poor quality road fill material, and should not be used for mine haul road fill construction, if possible.

All granular fills for the pavement structure should be placed and compacted in dry conditions and during warm weather conditions to minimize long term settlement. Consideration may be given to placing the rock fills during cold weather conditions, provided adequate measures are taken to prepare the subgrade surface and protect the work during inclement weather conditions.

When fills are placed over the silty mineral soil subgrade, fill placement operations should comprise placement of an initial fill lift at least 450 mm thickness using a light bulldozer or equivalent operating on previously placed fill to spread this material. Haul trucks and other construction equipment should be operated only on the granular fill and not over the silty mineral subgrade to prevent softening and rutting of the fine grained material. Where heavy equipment is used to deliver the fill to the site, additional thickness of rock fill may be required to develop a suitable haul road and prevent rutting or softening of the underlying silty mineral soil.

Winter construction will provide better site access for transport and placement of fill materials at the risk of achieving lower insitu fill density and long-term maintenance of the embankment fills. Some additional fill placement and regrading maintenance activities should be expected during the warmer months each year, until the embankment fill has finished settling.

To help minimize the risk of long-term settlement and maintenance in soft subgrade areas, consideration may have to be given to scheduling the subgrade preparation and initial fill placement in the winter months, with completion of the remainder of the fill placement in the summer months. An initial fill thickness of at least 3 m should provide sufficient cover for thermal insulation and site access over poor subgrade conditions.

The mine haul road surface should be sloped to provide positive drainage to the road perimeter. The granular pavement structure will provide a good moisture seal and minimize infiltration into the underlying road fills, provided good construction practices are followed and the surface is maintained during operations to minimize pavement flexure and tire rutting. Perimeter ditches may be required to control surface water runoff along this route by directing the runoff to a collection pond or sump for monitoring prior to discharging to the natural drainage system or pumped to a contained area for treatment.

6.8.1 Turn Lake Crossing

The mine haul road will require a water course crossing of Turn Lake. Based on a design flow velocity of 0.6 metres per second (m/s) and a granular bed infill requirement of one-third the cross-sectional area to maintain adequate aquatic habitat, the crossing should comprise two by 2,500 mm diameter steel corrugated culverts. The culverts should be constructed in a dry installation to achieve the lateral support required to distribute the weight of the road embankment and traffic loading conditions. The crossing profile should be surveyed to determine the optimum siting location, invert elevation and culvert length.

The minimum culvert length will depend on the haul road crest width, height of cover above the pipe invert as measured from the road surface and proposed embankment side

slopes. Based on a minimum road width of 35 m, which includes 25 m for three truck lanes and two shoulder width of 5 m each side for protection berms, a 6 m embankment height and 2H:1V side slopes for geotechnical considerations; the culverts lengths will be at least 60 m long. Flatter slopes may be required for improved aquatic habitat.

Other design considerations for aquatic and geotechnical input are listed as follows:

- Silt curtains should be used during crossing construction.

- Use of boulder and cobble material to cover the embankment fill should consist of clean, angular rock, 15 to 40 cm diameter, at a mixture of boulder and cobble sizes of 50 to 75 percent and 25 to 50 percent, respectively.

- Place larger rock fill cover material (minimum 50 cm diameter) within 2 m of the finished slopes to resist ice scour and maintain structure integrity.

- Extend rock placement to the lake bottom and along approaches towards the culvert openings.

- The height of the culvert roof from the stream bed should be at least 2 m or more.

- The bottom of the culvert should be lined with a 30 cm thick layer of coarse gravel and cobble, with itinerant large (50 cm) boulders to provide complexity and cover habitat for fish to prevent fish from being deterred from moving through the culvert.

- Provision to remove seasonal ice blockages during operations by mechanical means, such as steam tracing should be considered.

Corrugated culverts may be used successfully if constructed in the dry, using conventional cofferdam and dewatering construction practices. Thin-walled elements, such as a round or flat bottom arch, require good base preparation and lateral passive strength from well compacted granular backfill. If not, thin-walled elements have a greater risk of collapse under dead and live loading conditions. Dry installations may also provide opportunity to apply a bedding layer inside the steel culvert(s) for improved aquatic habitat.

Coarse, select mine waste rockfill should be used to construct the embankment crossing. Although, material zoning of the embankment may be considered to reduce the quantity of coarse rockfill by include a central core of fine rockfill and blanketed by larger size coarse rockfill to the underside of the pavement structure, it may be more practical to provide a homogeneous cross-section of coarse rockfill which meets the geotechnical and hydraulic design requirements.

6.9 Storage Yards and Laydown Areas

Fill pads required to complete final grading around the plant site and ancillary buildings as well as for storage yards and laydown areas should be prepared and constructed consistent with the recommendations provided in Section 6.2.

The fill pads may be constructed using selected materials including weathered bedrock obtained from local building site excavations, waste rock and or granular materials obtained from the mining operations. It is desirable to utilize minus 300 mm rock fill within 600 mm of final grades and all surfaces should be capped with a granular surface layer of minus 100 mm sand and gravel fill.

The rock fill should be compacted by a minimum of 6 complete passes of a smooth drum vibratory roller and the granular fill material should be compacted to at least 98 percent of the standard Proctor maximum dry density and to 100 percent within 300 mm of final grade.

The fill pad surfaces should be sloped to provide positive drainage to the storage yard or laydown area perimeter. Perimeter ditches may be required to control surface water runoff from each area by directing the runoff to a collection sump for monitoring prior to discharging to the natural drainage system or pumped to a contained area for treatment.

7.0 CONCLUSIONS

The geotechnical comments and recommendations provided in this report are intended as design input for use by AMEC in their design and feasibility assessment of the project infrastructure. It is understood that further design input will be required for the detailed design and subsequent stages.

Currently, it is recommended that additional investigation and geotechnical assessment should be conducted to refine the infrastructure design, namely for the revised tank farm location and air strip alignment, in the next stage of the work.

We trust the information contained in the above report meets your requirements at this time. Please feel free to contact us if you need more detailed information on any of the information presented in the report.

GOLDER ASSOCIATES LTD.

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Senior Geotechnical Engineer

Terry L. Eldridge, P.Eng.
Principal

WJP/TLE/vee/dmb
03-1413-427/4400

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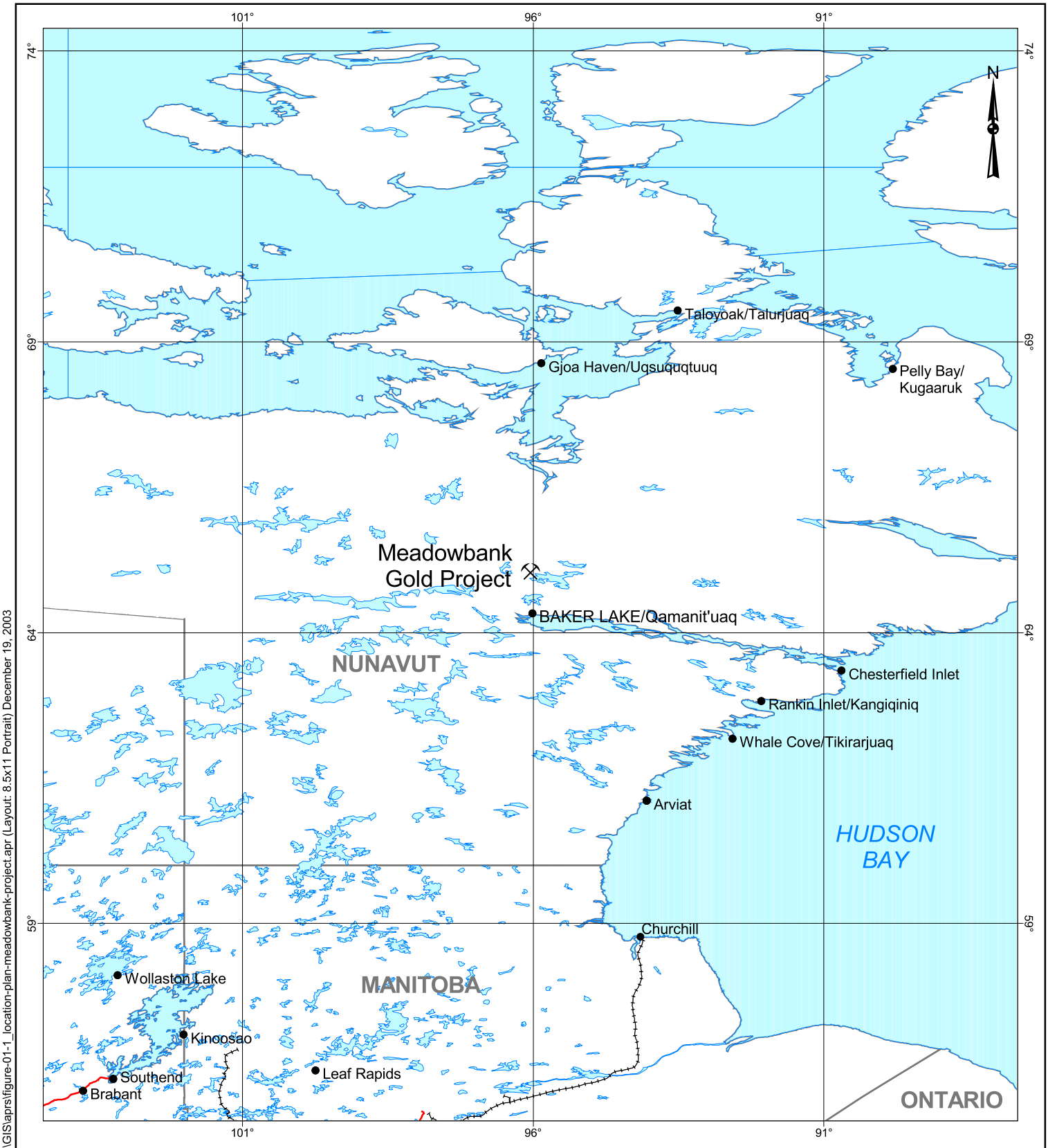
Golder Associates Ltd., 2003b. Report on Ground Ice EM31 Investigation, Meadowbank Project, Nunavut. Report No. 03-1413-427 submitted to Cumberland Resources Ltd., dated September 3, 2003.

Golder Associates Ltd., 2003c. Report on Permafrost Thermal Regime Baseline Studies, Meadowbank Project, Nunavut. Report No. 03-1413-427 submitted to Cumberland Resources Ltd., dated September 2003.

Golder Associates Ltd., 2004a. Report on Hydrogeology Baseline Studies, Meadowbank Gold Project, Nunavut. Report No. 03-1413-078 submitted to Cumberland Resources Ltd., dated February 3, 2004.

Golder Associates Ltd., 2004b. Mine Waste and Water Management, Meadowbank Gold Project, Nunavut. Report No. 03-1413-427/5000 submitted to Cumberland Resources Ltd., dated March 5, 2004.

Golder Associates Ltd., 2004c. Report on Geomorphology and Soils, Meadowbank Gold Project, Nunavut. Report No. 03-1413-078/3200 submitted to Cumberland Resources Ltd., dated March 5, 2004.



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
MEADOWBANK GOLD PROJECT

Golder Associates

PROJECT No. 03-1413-427			SCALE AS SHOWN	REV. 0
DESIGN	DAH	19 Dec. 2003	FIGURE 1.1	
GIS	CDB	19 Dec. 2003		
CHECK	CJC	19 Dec. 2003		
REVIEW				

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7 222 000 N
7 220 000 N
7 218 000 N
7 216 000 N
7 214 000 N
7 212 000 N
642 000 E
640 000 E
638 000 E
636 000 E
LOCAL MINE GRID NORTH
UTM NORTH
ASTRO NORTH
N
WALLY LAKE
DEWATERING BARGE
VAULT DIKE
VAULT DEPOSIT
MINE SHOP/OFFICE
VAULT WASTE ROCK STORAGE FACILITY
PHASER LAKE
DEWATERING BARGE
POWER LINE
SECOND PORTAGE LAKE
W.L. 133.7 ±
AN STORAGE
EMULSION PLANT
EAST DIKE
TEMPORARY VAULT HAUL ROAD
BAY ZONE DIKE
NORTH PORTAGE DEPOSIT
THIRD PORTAGE DEPOSIT
GOOSE ISLAND DEPOSIT
TURN LAKE
EXPLOSIVES MAGAZINE
PORTAGE WASTE ROCK STORAGE FACILITY
TAILINGS DIKE
TAILINGS DISPOSAL RECLAIM
SOUTH CAMP DIKE
GOOSE ISLAND DIKE
FUEL STORAGE
RUN-OFF POND RECLAIM YEAR 6
AIRSTRIP
PLANT SITE
NORTH CAMP
SOUTH CAMP
FRESH WATER PUMPS
DEWATERING BARGE
THIRD PORTAGE LAKE
W.L. 134.7 ±
0 250 500 750 1000 1250 1500 1750 2000m
Scale In Meters

REFERENCES

AMEC Drawing #A1-131395-100-C-0001 . Revision A - Overall Site Plan Year 1-5 . Dated 28-01-04

CADD FILE: N:\Bur-Graphics\Projects\2003\1413\03-1413-427\4400\Drafting\cadd\P031413427-1.2.dwg
REVISION DATE: 04/03/12 9:03am By: snoby

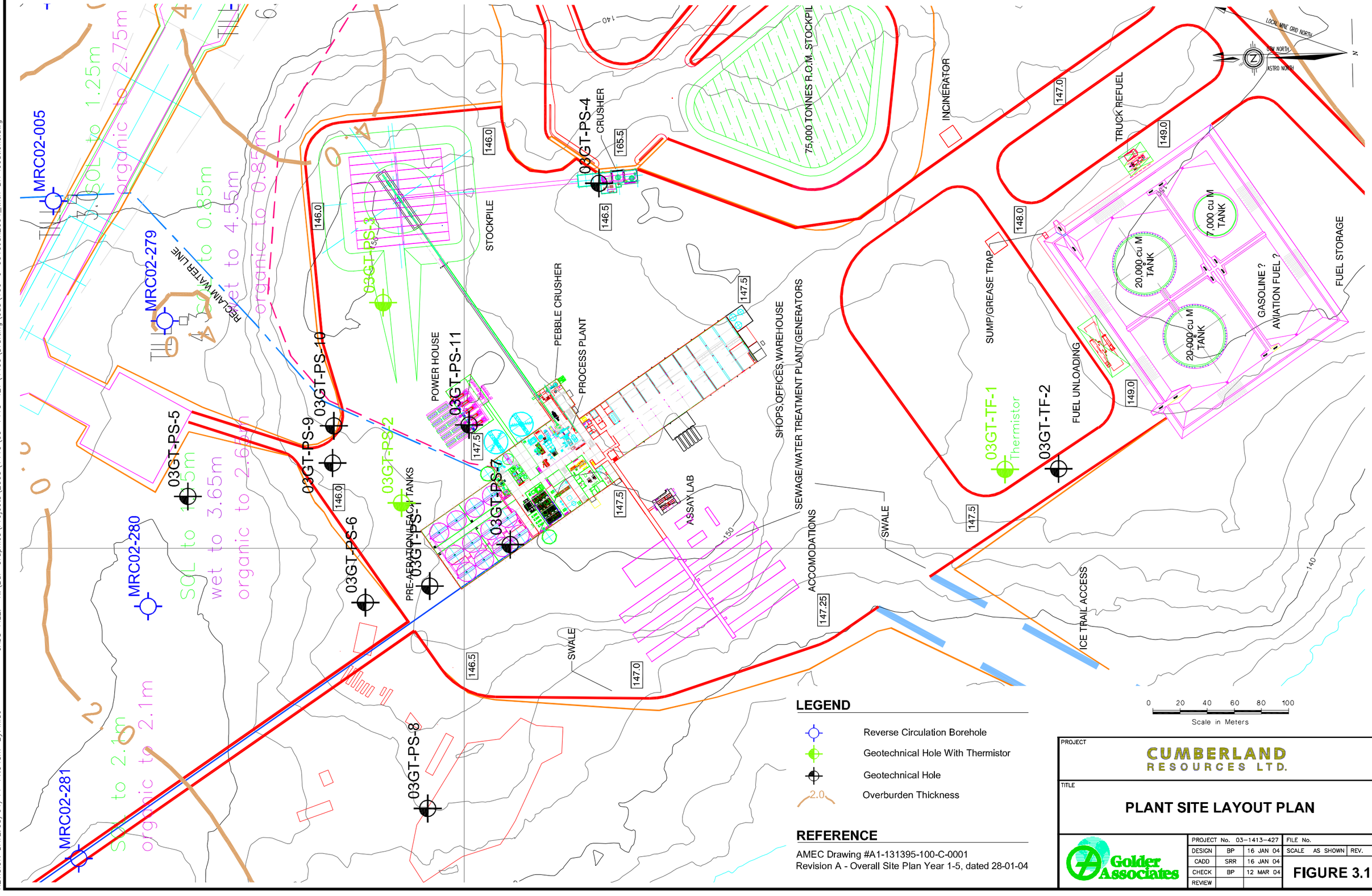
PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
MEADOWBANK GOLD PROJECT GENERAL SITE PLAN

Golder Associates

PROJECT No.	03-1413-427		FILE No.	P031413427-1.2
DESIGN	CJC	05 JAN 04	SCALE	AS SHOWN REV. 0
CADD	RCR	05 JAN 04		
CHECK	BP	12 MAR 04		
REVIEW				

FIGURE 1.2



LEGEND

- Reverse Circulation Borehole
- Geotechnical Hole With Thermistor
- Geotechnical Hole
- 2.0 Overburden Thickness

REFERENCE

AMEC Drawing #A1-131395-100-C-0001
Revision A - Overall Site Plan Year 1-5, dated 28-01-04

0 20 40 60 80 100
Scale in Meters

PROJECT
CUMBERLAND RESOURCES LTD.

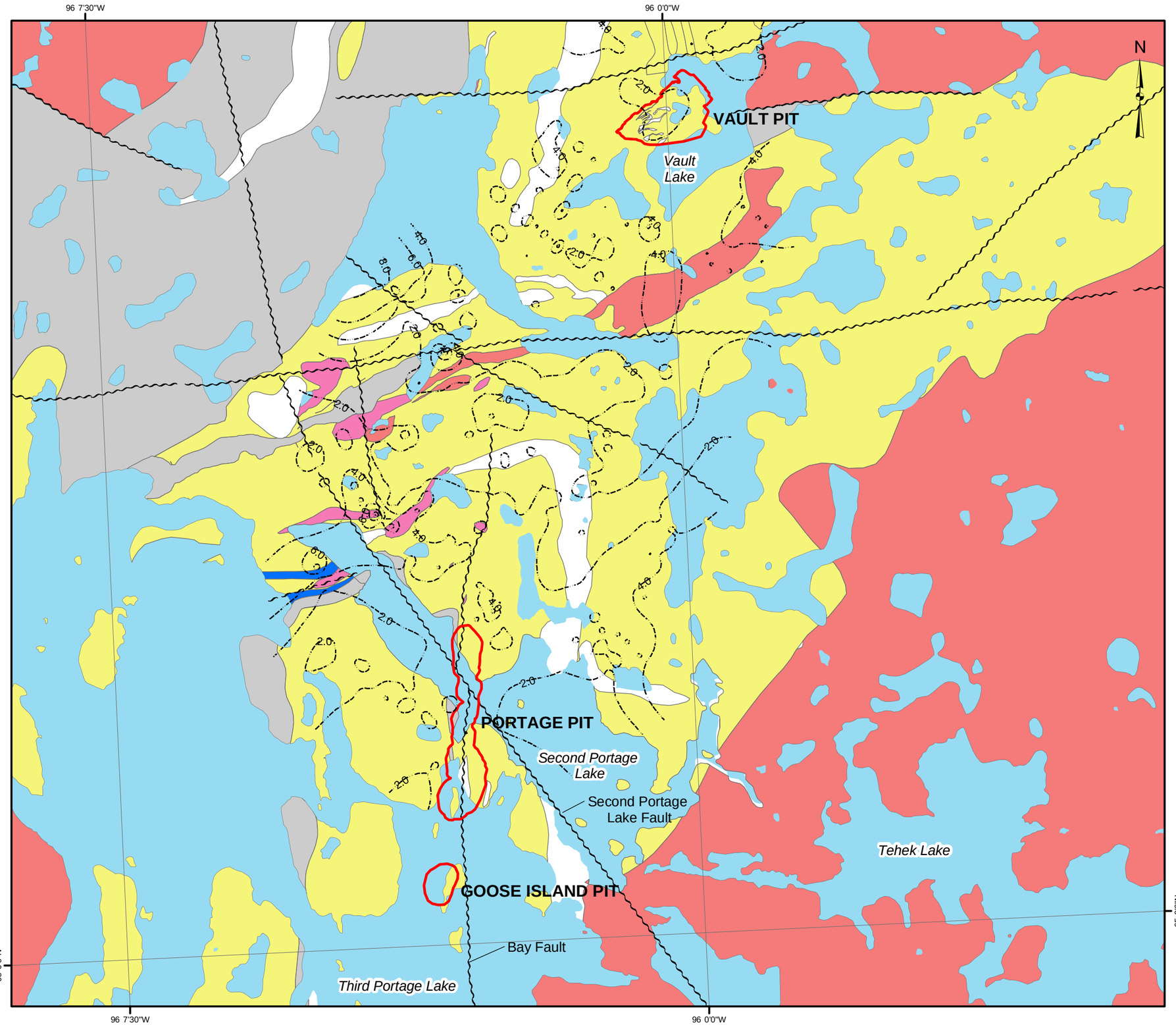
TITLE
PLANT SITE LAYOUT PLAN

Golder Associates

PROJECT No. 03-1413-427			FILE No.		
DESIGN	BP	16 JAN 04	SCALE AS SHOWN	REV.	0
CADD	SRR	16 JAN 04			
CHECK	BP	12 MAR 04			
REVIEW					

FIGURE 3.1

REVISION DATE: 05/01/14 11:54am By: lxiao CADD FILE: N:\Bur-Graphics\Projects\2003\1413\03-1413-427\4400\Drafting\cad\100-c-0010.Jan2004_with BH locations.dwg



LEGEND

- Regional Fault
- Possible Local Fault
- Approximate Overburden Thickness (m)
- Pit Outline

Regional Geology

- Granite
- Iron Formation
- Intermediate Volcanics
- Metavolcanics
- Quartzite
- Ultramafics
- Other
- Waterbody

REFERENCE

Base geology provided by Cumberland Resources Ltd.
Datum: NAD83 Projection: UTM Zone 14

0 0.5 1 2 Kilometers

Scale - 1:40,000

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

REGIONAL GEOLOGY

Golder Associates

PROJECT No. 03-1413-427			SCALE AS SHOWN	REV. 0
DESIGN	AS	04 Dec. 2003	FIGURE 4.1	
GIS	CDB	04 Dec. 2003		
CHECK	CJC	04 Dec. 2003		
REVIEW				

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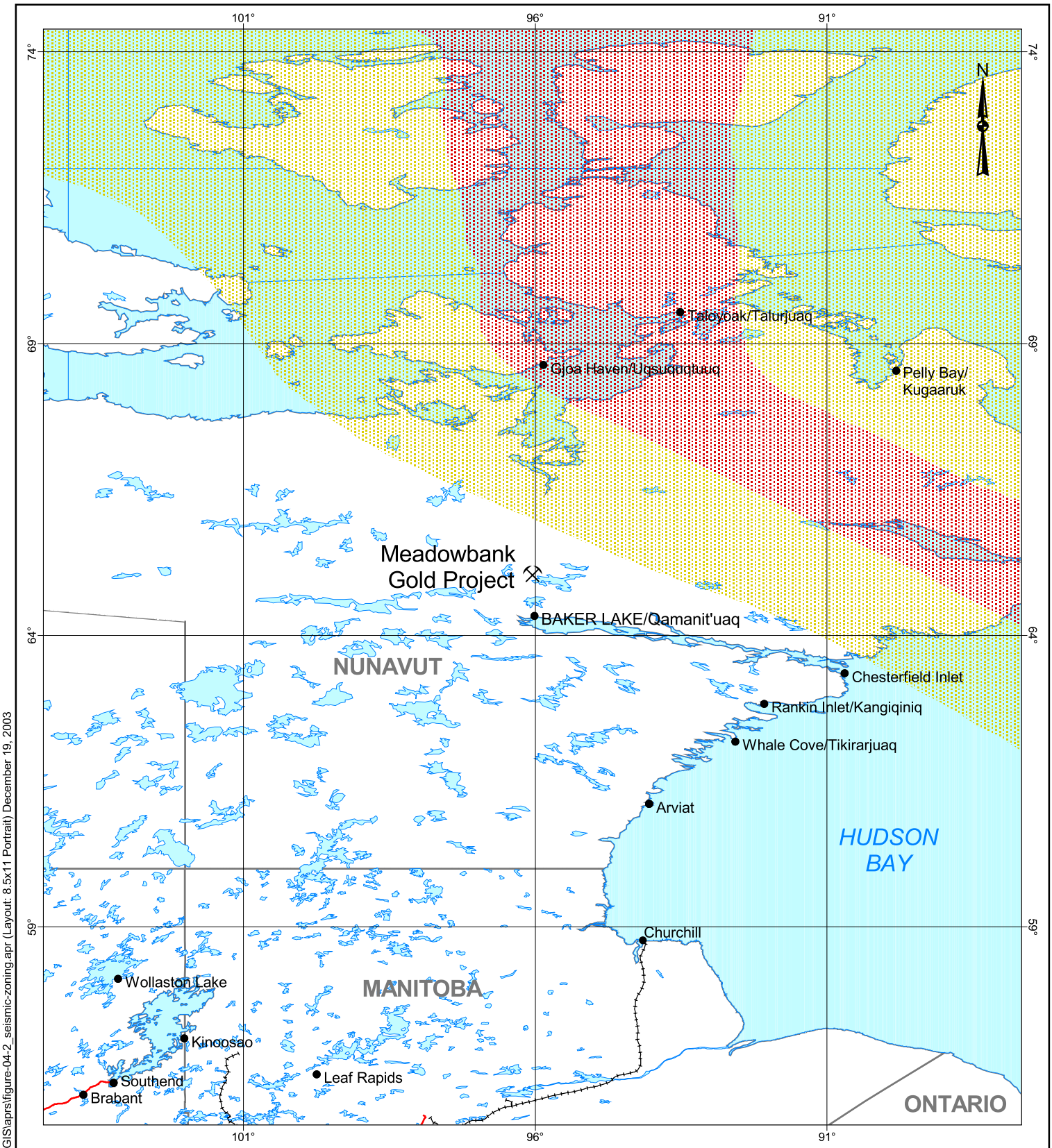

LEGEND

- Meadowbank Project
- Town/Village

Peak Horizontal Ground Acceleration (g), for 10% probability of exceedance in 50 Year Event

- 0 - 0.039
- 0.04 - 0.079
- 0.08 - 0.109
- Provincial Border
- Water
- Primary Highway
- Railroad

200 0 200 Kilometers

Scale - 1:10,000,000

REFERENCE

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

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

SEISMIC ZONING MAP

Golder Associates

PROJECT No. 03-1413-427			SCALE AS SHOWN	REV. 0
DESIGN	DAH	19 Dec. 2003		
GIS	CDB	19 Dec. 2003		
CHECK	DAH	10 Feb. 2004		
REVIEW				

FIGURE 4.2

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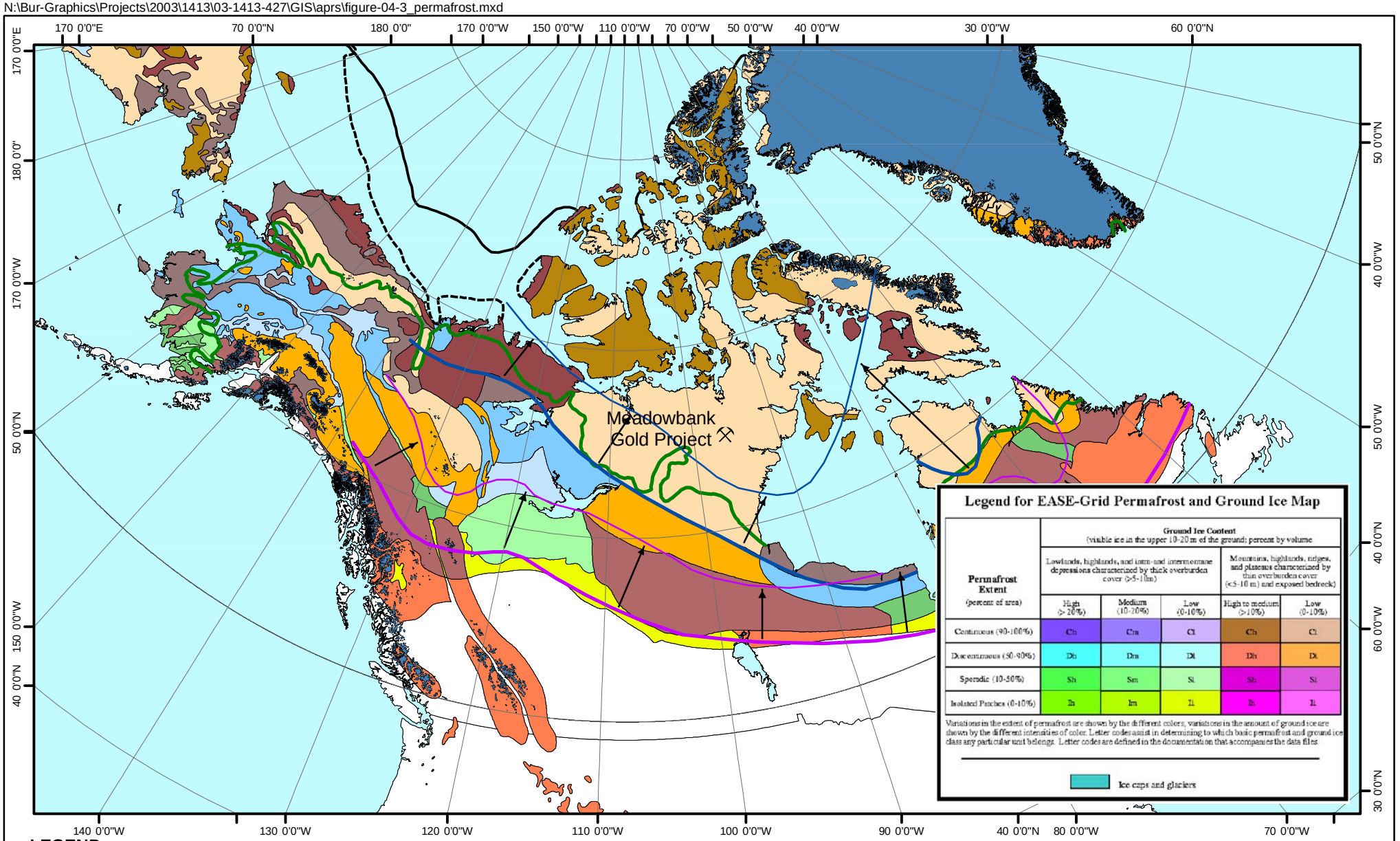


Legend for EASE-Grid Permafrost and Ground Ice Map

Permafrost Extent (percent of area)	Ground Ice Content (visible ice in the upper 10-20 m of the ground; percent by volume)				
	Lowlands, highlands, and intra- and intermontane depressions characterized by thick overburden cover (>5-10m)			Mountains, highlands, ridges, and plateaus characterized by thin overburden cover (<5-10 m) and exposed bedrock)	
	High (> 20%)	Medium (10-20%)	Low (0-10%)	High to medium (>10%)	Low (0-10%)
Continuous (90-100%)	Ch	Cm	Cl	Ch	Cl
Discontinuous (50-90%)	Dh	Dm	Dl	Dh	Dl
Sporadic (10-50%)	Sh	Sm	Sl	Sh	Sl
Isolated Patches (0-10%)	Ih	Im	Il	Ih	Il

Variations in the extent of permafrost are shown by the different colors; variations in the amount of ground ice are shown by the different intensities of color. Letter codes assist in determining to which basic permafrost and ground ice class any particular unit belongs. Letter codes are defined in the documentation that accompanies the data files.

Ice caps and glaciers

LEGEND

- Treeline
- Sea-ice Edge Limit
- Subsea Permafrost Limit
- Southern boundary of discontinuous permafrost - Present
- Southern boundary of discontinuous permafrost - Predicted
- Southern boundary of continuous permafrost - Present
- Southern boundary of continuous permafrost - Predicted
- Predicted movement of permafrost boundaries

REFERENCE

Brown, J., O.J. Ferrians Jr., J.A. Heginbottom, and E.S. Melnikov. 1998. Circum-Arctic Map of Permafrost and Ground-Ice Conditions. Boulder, CO: National Snow and Ice Data Center/World Data Center for Glaciology. Digital Media.
Predicted permafrost boundaries based on Woo et al., 1992.
PROJECTION: Lambert Azimuthal Equal Area

0 250 500 1,000 Kilometers

Scale - 1:30,000,000

PROJECT

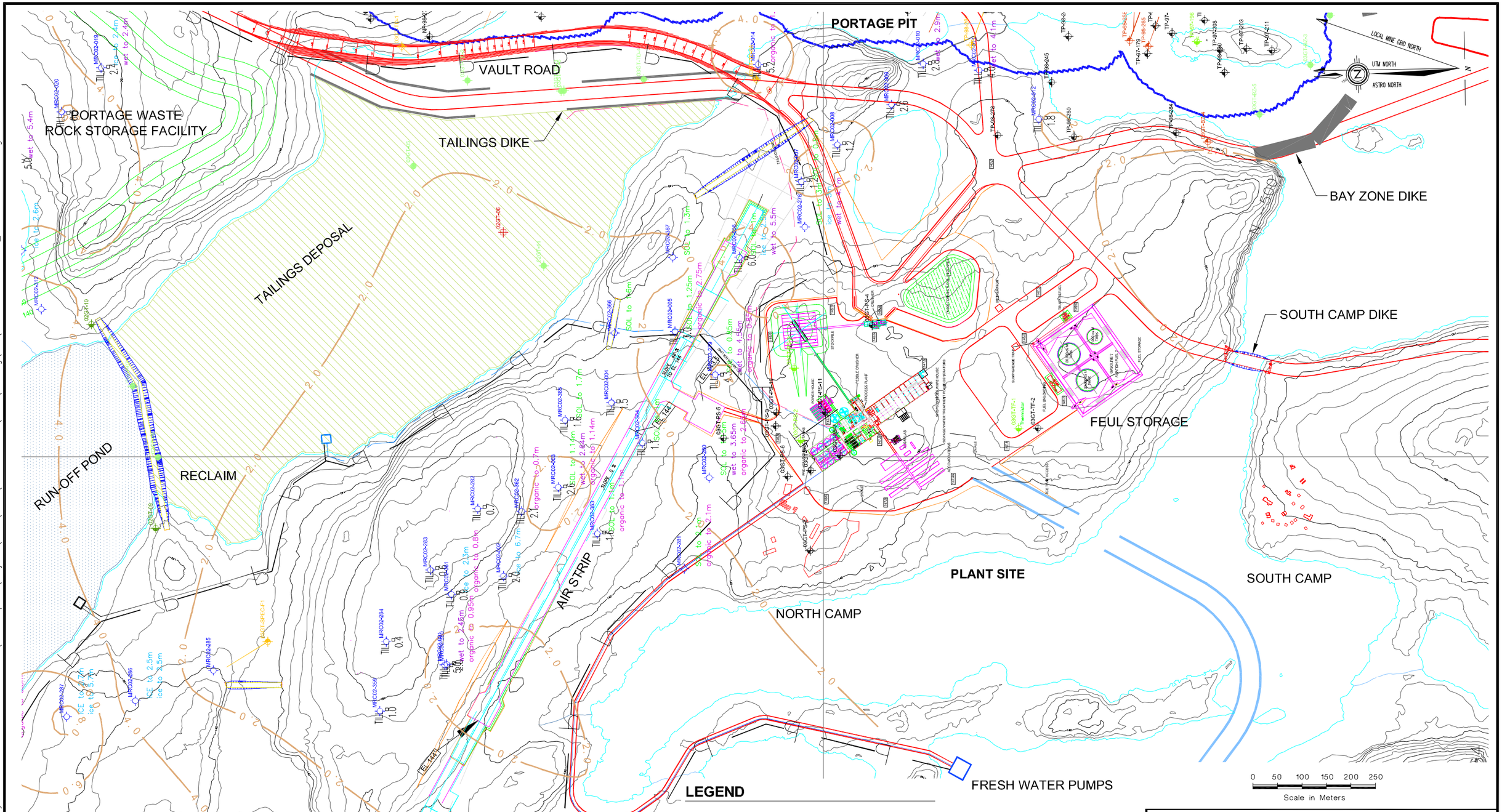
CUMBERLAND RESOURCES LTD.

TITLE

PERMAFROST MAP OF CANADA

Golder Associates

PROJECT No. 03-1413-427			SCALE AS SHOWN	REV. 0
DESIGN	CJC	12 Dec. 2003	FIGURE 4.3	
GIS	CDB	12 Dec. 2003		
CHECK	CJC	12 Dec. 2003		
REVIEW				



LEGEND

- Reverse Circulation Borehole
- Geotechnical Hole With Thermistor
- Geotechnical Hole
- Overburden Thickness

REFERENCE

AMEC Drawing #A1-131395-100-C-0001
Revision A - Overall Site Plan Year 1-5, dated 28-01-04

PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
BOREHOLE LOCATION PLAN

Golder Associates

PROJECT No. 03-1413-427			FILE No.		
DESIGN	BP	16 JAN 04	SCALE AS SHOWN	REV.	0
CADD	SRR	16 JAN 04			
CHECK	BP	12 MAR 04			
REVIEW					

FIGURE 5.1

REVISION DATE:05/01/14 12:03pm By: lxiao CADD FILE: N:\Bur-Graphics\Projects\2003\1413\03-1413-427\4400\Drafting\cad\100-c-0010Jan2004_with BH locations.dwg

APPENDIX I – I

BOREHOLE LOGS

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-TF-1

SHEET 1 OF 3

LOCATION: Tank Farm Foundation
N: 7213587.3 E: 638062.428

DRILLING DATE: 11-Aug-03
DRILL RIG: LF-70
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	CORE: RUN No.	CORE: RECOVERY %	GRADATION %: GRAVEL	GRADATION %: SAND	GRADATION %: FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		147.62											
0	HQ3	Overburden: Cobbles and coarse angular gravel, granitic and intermediate volcanic rock		0.00	1	RC		1							
1															
2					2	RC		2							
3		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.		144.62											
4															
5															
6															
7															
8															
9															
10															

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp — W — Wl; 10 20 30 40

DEPTH SCALE
1 : 50

LOGGED: TS/MT
CHECKED: CJC

Golder Associates

CUSTOM LOG 3 03-1413-427_OCT1_2003.GPJ GLDR_CAN.GDT 28/4/06

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-TF-1

SHEET 2 OF 3

LOCATION: Tank Farm Foundation
N: 7213587.3 E: 638062.428

DRILLING DATE: 11-Aug-03

DATUM: Local

INCLINATION: -90°

DRILL RIG: LF-70

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
		Continued from SOIL LOG.		144.62													
3	Boart-Longyear HQ3	Fresh, closely foliated with calicte veins, dark gray green, medium strength, INTERMEDIATE VOLCANICS		3.00	3									JN,ST,SM JN,PL,RO CA JN,PL,SM x2	R5 R4 R3 R2 R1	W1 W2 W3 W4	
4														FO,CU,RO FO,CU,RO CA CH			
5					4									JN,PL,SM JN,PL,SM CH			
6				141.62										FO,PL,SM CA CH JN,PL,SM CH JN,PL,SM			
7		Fresh, closely foliated with calicte veins, dark gray green, medium strength, INTERMEDIATE VOLCANICS (foliation less uniform)		6.00	5									JN,PL,RO SU CH FO,UN,RO FO,UN,RO FO,UN,RO			
8					6									JN,CU,SM			
9														JN,PL,SM JN,PL,SM JN,PL,SM JN,PL,SM			
10					7									JN,PL,RO CA CH JN,PL,SM JN,PL,SM CA			
11														JN,PL,SM JN,UN,SM			
12		Fresh, closely foliated with calicte veins, dark gray green, medium strength, INTERMEDIATE VOLCANICS (quartz veins dispersed randomly)		135.62 12.00	8									JN,PL,SM CH JN,PL,SM			
13		*CONTINUED NEXT PAGE*			9									FO,PL,SM JN,PL,SM JN,PL,SM CH			

DRILLHOLE 03-1413-427_OCT1_2003.GPJ GLDR_CAN.GDT 28/4/06

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-TF-1

SHEET 3 OF 3

LOCATION: Tank Farm Foundation
N: 7213587.3 E: 638062.428

DRILLING DATE: 11-Aug-03
DRILL RIG: LF-70
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

INCLINATION: -90°

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm/min)	FLUSH COLOUR % RETURN	RECOVERY TOTAL CORE % (80 60 40 20)	RECOVERY SOLID CORE % (80 60 40 20)	R.Q.D. % (80 60 40 20)	FRACT. INDEX PER 0.25 (2 4 6 8)	DISCONTINUITY DATA DIP w.r.t. CORE AXIS (0 30 60 90)	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX (R5 R4 R3 R2 R1)	WEATHERING INDEX (W1 W2 W3 W4)	NOTES WATER LEVELS INSTRUMENTATION
13	Boart-Longyear HQ3	Fresh, closely foliated with calicte veins, dark gray green, medium strength, INTERMEDIATE VOLCANICS (quartz veins dispersed randomly)*(continued)*			9								VN,PL,RO QZ			
14					10								JN,CU,SM FO,PL,SM FO,PL,SM			
15				132.62									JN,PL,SM FO,PL,SM			
		End of BOREHOLE.		15.00												
16																
17																
18																
19																
20																
21																
22																
23																

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

DRILLHOLE 03-1413-427_OCT1_2003.GPJ GLDR_CAN.GDT 28/4/06

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-TF-2

SHEET 1 OF 3

LOCATION: Tank Farm Foundation
N: 7213547.829 E: 638062.867

DRILLING DATE: 11-Aug-03
DRILL RIG: LF-70
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	CORE: RUN No.	CORE: RECOVERY %	GRADATION %: GRAVEL	GRADATION %: SAND	GRADATION %: FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		146.94											
0	HQ3	Overburden: Granitic COBBLES		0.00 / 146.59	1	RC		1							
		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp — W — Wl; 10 20 30 40

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

CUSTOM LOG 3 03-1413-427_OCT1_2003.GPJ GLDR_CAN.GDT 28/4/06

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-TF-2

SHEET 2 OF 3

LOCATION: Tank Farm Foundation
N: 7213547.829 E: 638062.867

DRILLING DATE: 11-Aug-03

DATUM: Local

INCLINATION: -90°

DRILL RIG: LF-70

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT INDEX PER 0.25	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
		Continued from SOIL LOG.		146.59												
				0.35												
1		Fresh, closely foliated, gray green, medium strength, INTERMEDIATE VOLCANICS with Calcite veins			2											
				145.44												
				1.50												
2					3								JN,PL,SM CA			
													VN,IR,RO CA			
													VN,IR,RO CA			
													FO,UN,SM x2			
													JN,CU,RO			
													JN,PL,RO			
3													FO,UN,SM			
													JN,PL,SM			
					4								JN,UN,SM			
													JN,ST,SM CA			
													FO,UN,SM			
4													JN,PL,RO			
													JN,UN,SM			
													JN,PL,SM			
					5								FO,UN,SM			
5	Boart-Longyear HQ3												JN,PL,RO			
													JN,PL,K CA			
													JN,PL,K CA			
		Fresh, closely foliated, gray green, medium strength, INTERMEDIATE VOLCANICS with fewer veins											JN,PL,SM CA			
6					6								JN,UN,SM			
													JN,PL,SM			
7													JN,PL,SM			
					7								JN,PL,SM			
8													JN,PL,SM			
													JN,PL,SM			
9					8								FO,UN,RO			
													JN,PL,RO			
10													JN,UN,SM			
		CONTINUED NEXT PAGE														

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

DRILLHOLE 03-1413-427_OCT1_2003.GPJ GLDR_CAN.GDT 28/4/06

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-TF-2

SHEET 3 OF 3

LOCATION: Tank Farm Foundation
N: 7213547.829 E: 638062.867

DRILLING DATE: 11-Aug-03

DATUM: Local

INCLINATION: -90°

DRILL RIG: LF-70

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

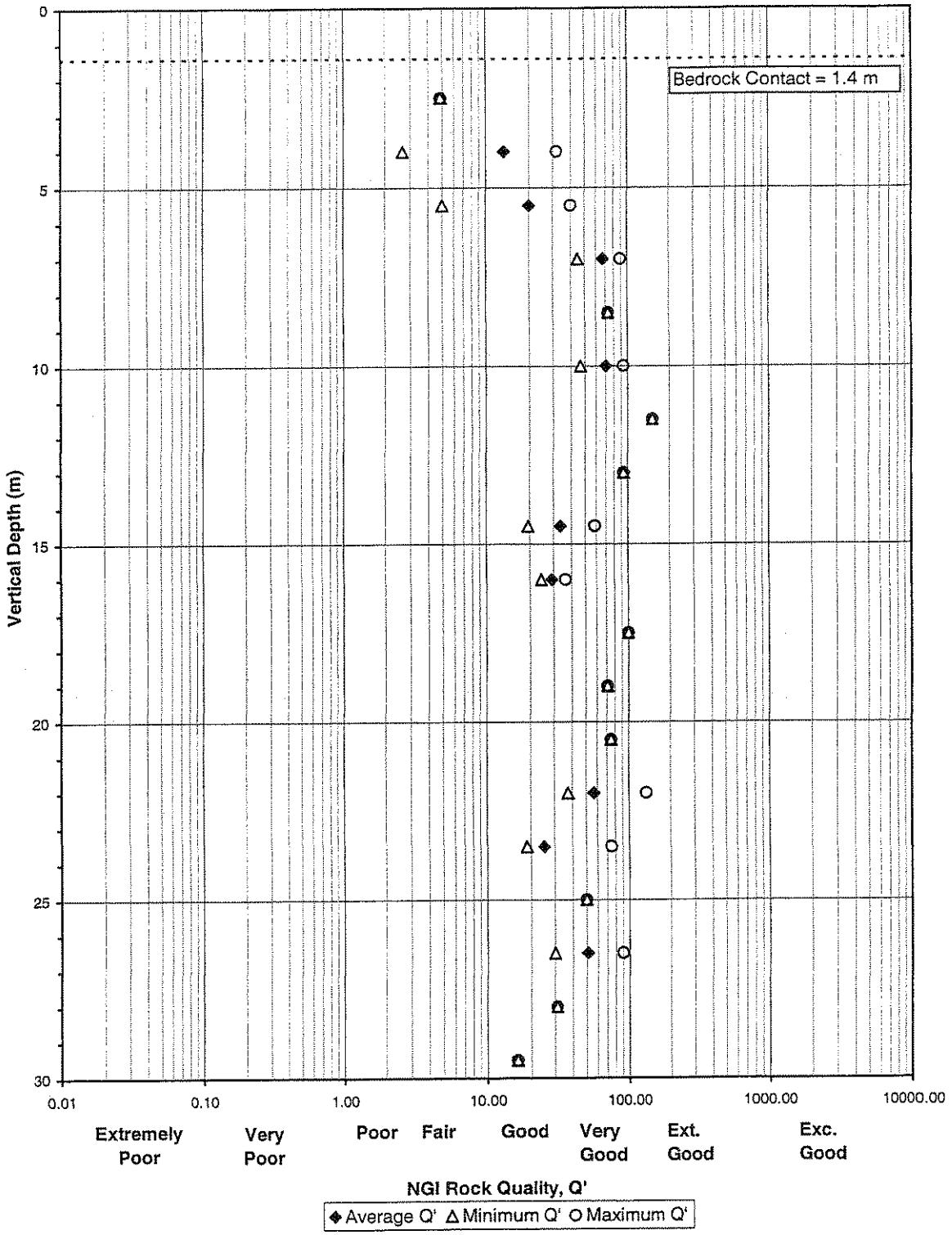
DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE % (80 60 40 20)	RECOVERY: SOLID CORE % (80 60 40 20)	R.Q.D. % (80 60 40 20)	FRACT. INDEX PER 0.25 (2 4 6 8)	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS (0 30 60 90)	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX (R5 R4 R3 R2 R1)	WEATHERING INDEX (W1 W2 W3 W4)	NOTES WATER LEVELS INSTRUMENTATION
				136.44	B												
		End of BOREHOLE.		10.50													

DEPTH SCALE
1 : 50

LOGGED: TS/MT
CHECKED: CJC

Golder Associates

DRILLHOLE 03-1413-427_OCT1_2003.GPJ GLDR_CAN.GDT 28/4/06



NOTE: Q' = RQD/Jn x Jr/Ja.
For calculation purposes, where a value of RQD=0 has been recorded, a default value of 10% has been used in order to calculate Q'

Golder Associates	**NGI ROCK QUALITY, Q'** **Meadowbank Gold Project** **03-1413-427, Borehole 03GT-PS-1**	Figure **I-23**

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-PS-1

SHEET 1 OF 4

LOCATION: Plant Site
N: 7214011.441 E: 637976.438

BORING DATE: 3-4 June 2003

DATUM: Local

Reference: Ground Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	CORE: RUN No.	CORE: RECOVERY %	GRADATION %: GRAVEL	GRADATION %: SAND	GRADATION %: FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		147.76											
0	HQ3	BOULDERS and cobbles with silty sand and trace gravel.		0.00 147.26											
1	HQ3	COBBLES with gravel and trace silt.		0.50 146.36											
2		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
3															
4															
5															
6															
7															
8															
9															
10															

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp — W — Wl; 10 20 30 40

DEPTH SCALE
1 : 50

LOGGED: CS/TS

CHECKED: CJC

Golder Associates

CUSTOM LOG 2 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-1

SHEET 2 OF 4

LOCATION: Plant Site
N: 7214011.441 E: 637976.438

DRILLING DATE: 3-4 June 2003

DATUM: Local

INCLINATION: -90°

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
		Continued from SOIL LOG.		146.36													
				1.40													
2					1									JN,UN,Ro Si			
3					2									FO,PL,SM Qz,Bi JN,PL,SM Si JN,UN,SM			
4														JN,PL,Ro Qz,Su JN,IR,Ro Qz JN,UN,Ro Bi JN,IR,Ro Cl,Si JN,PL,Ro Cl,Si JN,PL,Ro x3 Qz			
5					3									FO,PL,Ro Cl			
6	Boart-Longyear HQ3	Fresh to slightly weathered, highly foliated, fine grained, greenish grey, medium strength, INTERMEDIATE VOLCANICS with hematite clustered with quartz.			4									FO,PL,Ro Bi,Qz JN,PL,Ro Bi,Qz JN,PL,SM JN,IR,SM Qz			
7					5									JN,PL,Ro Ep			
8														JN,PL,Ro Su			
9					8									JN,IR,Ro Qz,He JN,PL,Ro JN,IR,Ro Qz,He			
10														JN,ST,Ro JN,UN,Ro			
11					7									JN,UN,Ro			
		CONTINUED NEXT PAGE															

DRILLHOLE 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-1

SHEET 3 OF 4

LOCATION: Plant Site
N: 7214011.441 E: 637976.438

DRILLING DATE: 3-4 June 2003

DATUM: Local

INCLINATION: -90°

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
					7												
12	Boart-Longyear HQ3				8									JN,IR,Ro Qz,He JN,IR,Ro Qz,He JN,PL,Ro Qz,He			
13														JN,UN,Ro			
14		Fresh to slightly weathered, highly foliated, fine grained, greenish grey, medium strength, INTERMEDIATE VOLCANICS with hematite clustered with quartz.*(continued)*			9									FO,PL,SM JN,UN,SM FO,PL,Ro			
15														FO,UN,Ro			
16					10									JN,IR,Ro Qz JN,PL,Ro JN,PL,SM			
17				130.26	11									JN,PL,Ro JN,PL,Ro			
18				17.50	12									FO,UN,SM Qz FO,PL,SM JN,PL,SM JN,PL,SM FO,UN,SM He JN,UN,Ro JN,UN,Ro JN,PL,Ro JN,PL,Ro JN,PL,Ro			
19		Fresh, fine grained, closely foliated, greenish grey, medium strength, INTERMEDIATE VOLCANICS.															
20					13									JN,PL,Ro Qz			
21					14									JN,PL,Ro			
		CONTINUED NEXT PAGE															

NOTES
WATER LEVELS
INSTRUMENTATION

ROCK STRENGTH INDEX: R5 R4 R3 R2 R1
WEATHERING INDEX: W1 W2 W3 W4

DEPTH SCALE
1 : 50

LOGGED: CS/TS
CHECKED: CJC

Golder Associates

DRILLHOLE 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-1

SHEET 4 OF 4

LOCATION: Plant Site
N: 7214011.441 E: 637976.438

DRILLING DATE: 3-4 June 2003

DATUM: Local

INCLINATION: -90°

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
22					14				100 100 100 100 100	100 100 100 100 100	100 100 100 100	2 4 6 8	0 30 60 90	JN,PL,SM JN,PL,Ro JN,PL,Ro	R5 R4 R3 R2 R1	W1 W2 W3 W4	
23					15									JN,PL,Ro Qz,Cl JN,PL,Ro Qz,Cl JN,PL,Ro Qz			
24					16									JN,PL,SM Qz			
25	Boart-Longyear HQ3	Fresh, fine grained, closely foliated, greenish grey, medium strength, INTERMEDIATE VOLCANICS. *(continued)*												JN,PL,SM			
26					17									JN,UN,Ro He JN,PL,Ro JN,PL,Ro x2 FO,PL,SM			
27					18									JN,PL,SM JN,PL,SM JN,PL,Ro Qz			
28					19									JN,PL,SM x2			
29				118.26										JN,PL,SM JN,PL,SM			
		End of BOREHOLE.		29.50													
30																	
31																	

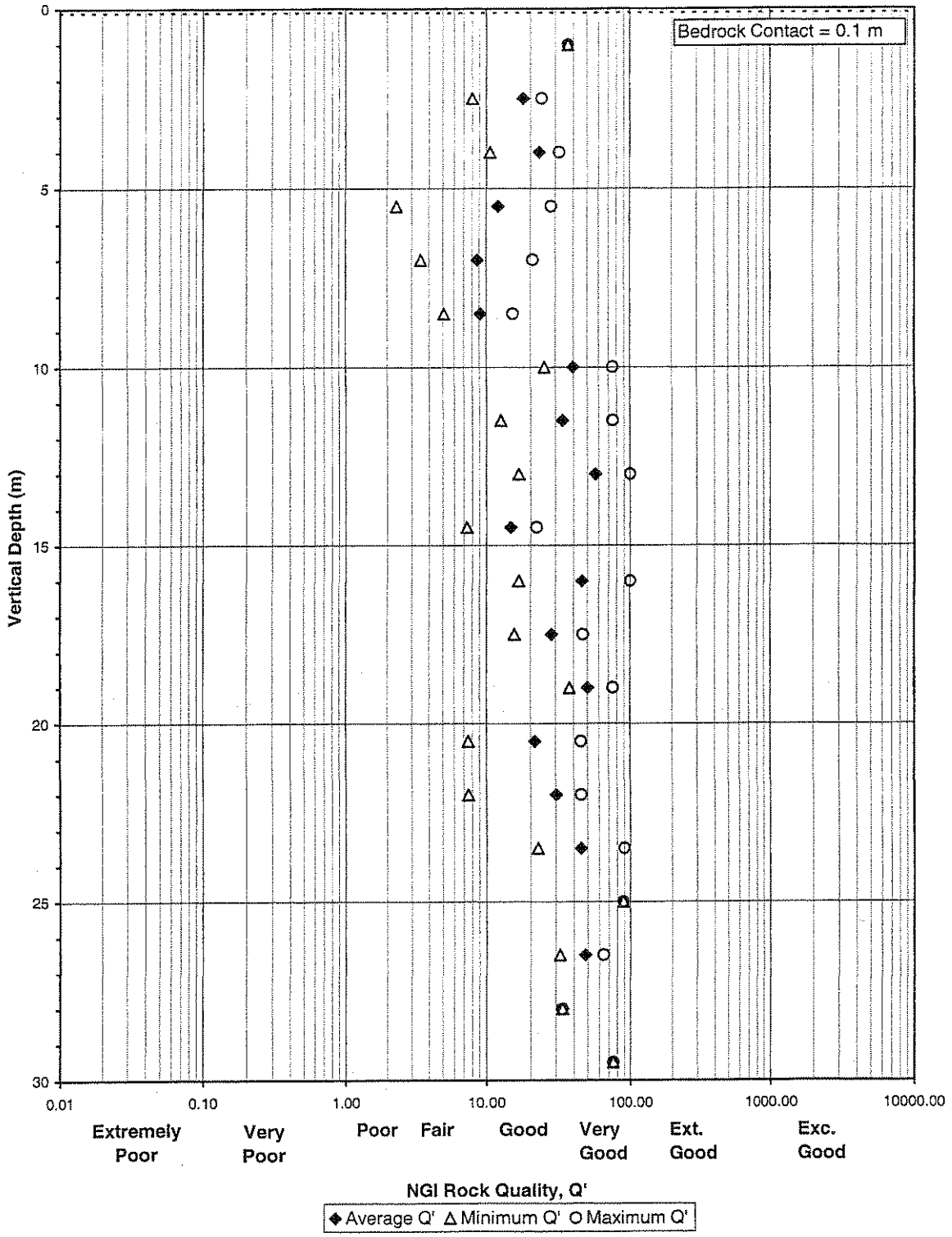
DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS

CHECKED: CJC

DRILLHOLE 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03



NOTE: Q' = RQD/Jn x Jr/Ja.
For calculation purposes, where a value of RQD=0 has been recorded, a default value of 10% has been used in order to calculate Q'

Golder Associates

NGI ROCK QUALITY, Q'
Meadowbank Gold Project
03-1413-427, Borehole 03GT-PS-2

Figure
I-24

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-2

SHEET 1 OF 3

LOCATION: Plant Site
N: 7214032.215 E: 638037.694

DRILLING DATE: 4-5 June 2003

DATUM: Local

DRILL RIG: LY38

Reference: Ground Surface

INCLINATION: -90°

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (min/m)	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
		Ground Surface		147.14													
0				0.00	1									FO,UN,SM Su			
														FO,CU,SM Su			
1					2									FO,CU,SM Su JN,CU,SM			
														JN,PL,SM x3 Su JN,IR,SM Su			
														JN,IR,SM			
														JN,CU,SM x4			
2														JN,IR,Ro JN,IR,Ro JN,PL,Ro JN,IR,Ro x4 JN,PL,SM JN,ST,Ro x3 JN,PL,Ro x3 Su			
					3									JN,PL,Ro Su,Qz FO,UN,SM Su,Ca JN,IR,Ro Su JN,IR,Ro Su,Qz JN,IR,Ro Qz JN,IR,Ro Su JN,CU,Ro Su,Qz JN,CU,SM Su FO,PL,SM FO,PL,SM Ca JN,IR,SM Ca FO,CU,SM Su FO,CU,SM Su			
3		Fresh to moderately weathered, fine grained, closely foliated with wavy calcite banding, greenish grey, medium strong, INTERMEDIATE VOLCANICS with iron staining in discontinuities.												JN,PL,SM Ch,Ca JN,PL,SM Su,Ca JN,PL,SM x3 Su,Ca JN,PL,SM Ca JN,PL,Ro Ca,Cl,Su			
					4									JN,CU,Ro Su,Ca JN,PL,SM Ca JN,UN,SM Ca FO,PL,SM Qz,Ca,Su,Cl JN,UN,Ro Su,Ca JN,IR,Ro Su,Ca JN,IR,Ro x3 Ca,Su			
4														JN,PL,VR Su,Ca JN,UN,Ro Fe JN,PL,Ro Su,Fe JN,PL,Ro Su,Fe			
					5									JN,UN,Ro Ca,Fe FO,PL,SM FO,PL,SM			
5	Boart-Longyear HQ3																
				140.24													
6				6.90	6									FO,PL,SM FO,UN,Ro Fe,Sl JN,PL,Ro			
		Fresh to slightly weathered, greenish grey, fine grained, closely foliated, medium strength, INTERMEDIATE VOLCANICS with calcite in fine with foliation and iron staining in spots, dispersed quartz veinlets.															
7					7									FO,PL,Ro Fe,Su,Qz FO,PL,Ro Fe,Su FO,PL,SM Su,Qz			
8					8												
9																	
10		*CONTINUED NEXT PAGE*															

DRILLHOLE 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS

CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-2

SHEET 2 OF 3

LOCATION: Plant Site
N: 7214032.215 E: 638037.694

DRILLING DATE: 4-5 June 2003

DATUM: Local

INCLINATION: -90°

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm/m)	COLOUR % RETURN	FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
10		Fresh to slightly weathered, greenish grey, fine grained, closely foliated, medium strength, INTERMEDIATE VOLCANICS with calcite in line with foliation and iron staining in spots, dispersed quartz veinlets *(continued)*			8									FO,UN,SM Fe FO,PL,SM Fe			
11														VN,PL,SM Qz,Bl VN,IR,VR Qz,Bl			
				135.74 11.40													
12					9									JN,PL,Ro JN,ST,Ro x2 Su,Fe			
13														JN,PL,SM Fe JN,PL,Ro			
14					10									JN,PL,Ro Fe FO,UN,SM FO,PL,Ro Fe,Qz JN,PL,Ro Qz JN,PL,VR Qz FO,PL,SM			
15	Boart-Longyear HQ3	Fresh, greenish grey, fine grained, closely foliated, medium strength, INTERMEDIATE VOLCANICS with calcite bedded along foliation planes quartz veins and iron staining on many joint surfaces.			11									JN,UN,Ro Fe,Qz JN,PL,Ro Qz FO,PL,SM			
16					12									VN,UN,Ro Su,Qz,Fe JN,UN,SM Fe,Qz JN,PL,Ro			
17														VN,PL,Ro Qz			
18					13									JN,PL,Ro Fe JN,PL,Ro Qz			
19														VN,UN,Ro Qz,Fe			
20		*CONTINUED NEXT PAGE*			14									JN,PL,Ro Su			

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS

CHECKED: CJC

DRILLHOLE 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-2

SHEET 3 OF 3

LOCATION: Plant Site
N: 7214032.215 E: 638037.694

DRILLING DATE: 4-5 June 2003

DATUM: Local

DRILL RIG: LY38

INCLINATION: -90°

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

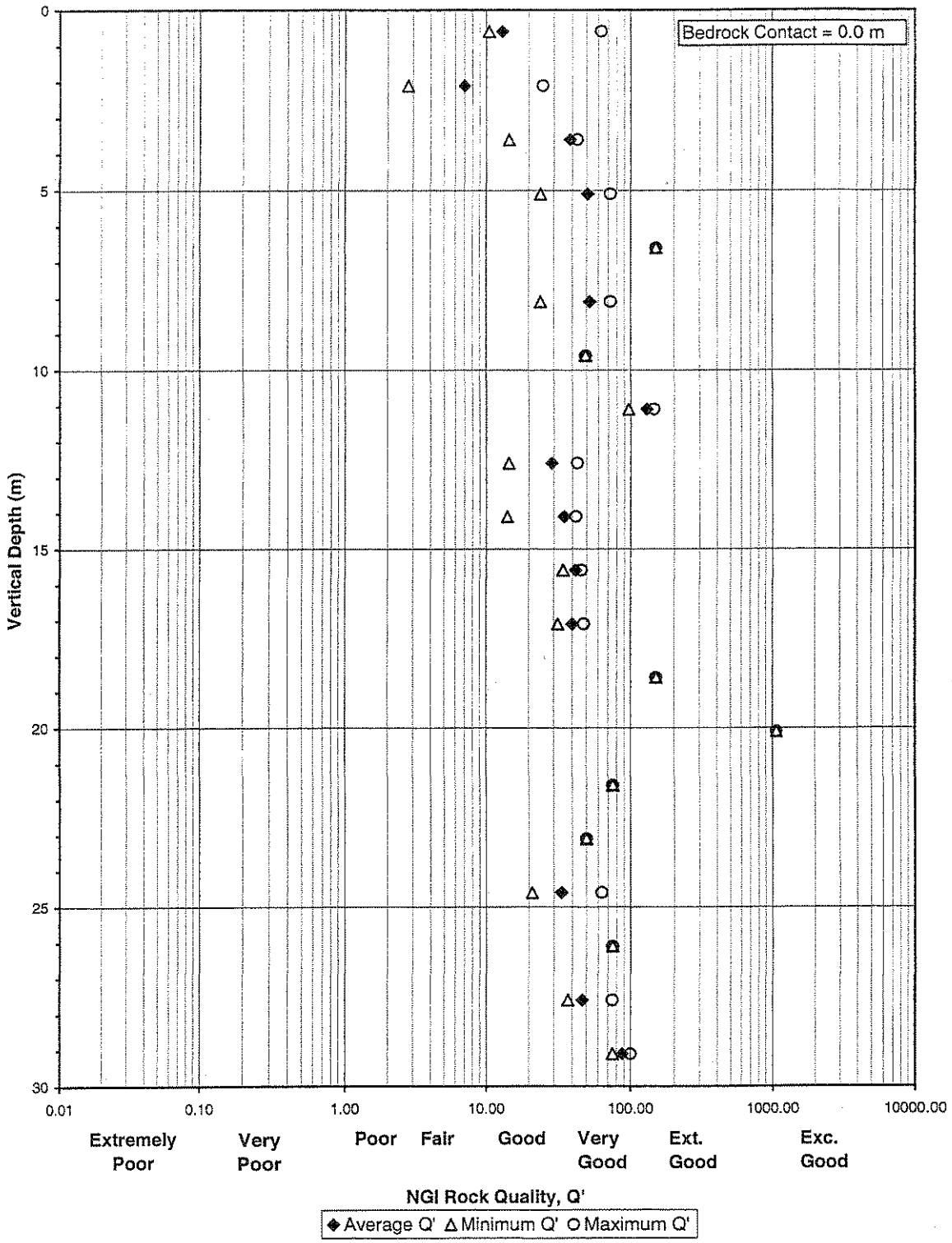
DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	COLOUR % RETURN	FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
20	Boart Longyear HQ3	Fresh, greenish grey, fine grained, closely foliated, medium strength, INTERMEDIATE VOLCANICS with calcite bedded along foliation planes quartz veins and iron staining on many joint surfaces.*(continued)*			14									JN,PL,Ro Su JN,IR,Ro Su,Qz,Ch FO,PL,SM			
21					15									JN,PL,SM Fe FO,UN,Ro Su JN,UN,Ro Su JN,IR,Ro Qz,Su,Fe FO,IR,Ro x2 Fe			
22					16									JN,PL,Ro Fe,Ca,Su VN,IR,Ro Qz,Fe			
23														VN,IR,Ro Qz,Fe			
24					17									FO,IR,Ro			
25																	
26					18									JN,UN,SM Fe JN,PL,SM Fe			
27					19									FO,PL,SM JN,PL,SM			
28																	
29				117.74	20									JN,PL,Ro			
30		End of BOREHOLE.		29.40													

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS
CHECKED: CJC

DRILLHOLE 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03



NOTE: Q' = RQD/Jn x Jr/Ja.
For calculation purposes, where a value of RQD=0 has been recorded, a default value of 10% has been used in order to calculate Q'

Golder Associates

NGI ROCK QUALITY, Q'
Meadowbank Gold Project
03-1413-427, Borehole 03GT-PS-3

Figure
I-25

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-3

SHEET 1 OF 3

LOCATION: Plant Site
N: 7214045.784 E: 638185.257

DRILLING DATE: 05-Jun-03

DATUM: Local

DRILL RIG: LY38

Reference: Ground Surface

INCLINATION: -90°

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH / COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX R5 R4 R3 R2 R1	WEATHERING INDEX W1 W2 W3 W4	NOTES WATER LEVELS INSTRUMENTATION
		Ground Surface		148.05												
0		Fresh to moderately weathered, fine grained, closely foliated, greenish grey, medium strong, INTERMEDIATE VOLCANICS with wavy quartz bedding and iron staining.		0.00	1								FO,ST,SM x5 Cl,Su FO,CU,Ro Ca,Qz			
1					2								JN,IR,Ro Fe FO,PL,SM x2 Si JN,UN,Ro Si			
2				145.95									JN,PL,Ro Si,Fe,Ca JN,PL,SM Fe JN,CU,SM Ca JN,IR,Ro Qz,Fe			
		Fresh, fine grained, closely foliated, greenish grey, medium strong, INTERMEDIATE VOLCANICS with wavy quartz bedding and distinct quartzite veir from 3.10 m to 3.18 m.		2.10	3								VN,IR,Ro x2 Qz JN,CU,Ro FO,CU,Ro Ca JN,PL,SM Su FO,CU,Ro Su			
3				144.45												
				3.60									FO,PL,SM x2 Ca			
4					4								JN,PL,Ro Ca JN,PL,Ro Fe FO,PL,SM Fe JN,IR,Ro Ca VN,ST,Ro Qz			
5	Boart-Longyear HQ3				5								JN,CU,Ro Ca,Qz,Ch JN,ST,Ro JN,UN,Ro Qz JN,CU,Ro Fe			
6		Fresh, fine grained, closely foliated, greenish grey, medium strong, INTERMEDIATE VOLCANICS with wavy quartz bedding, and disseminated sulphides (Pyrite).			6								JN,IR,Ro Fe FO,PL,Ro JN,IR,Ro Fe,Qz JN,IR,Ro Fe,Qz JN,ST,Ro Fe,Qz FO,PL,SM FO,PL,SM			
7					7								JN,PL,Ro x2 JN,PL,Ro			
8					8											
9																
10		*CONTINUED NEXT PAGE*														

DRILLHOLE 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS

CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-3

SHEET 2 OF 3

LOCATION: Plant Site
N: 7214045.784 E: 638185.257

DRILLING DATE: 05-Jun-03

DATUM: Local

INCLINATION: -90°

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
10	Boart-Longyear HQ3	Fresh, fine grained, closely foliated, greenish grey, medium strong, INTERMEDIATE VOLCANICS with wavy quartz bedding, and disseminated sulphides (Pyrite). *(continued)*			8			80 60 40 20	80 60 40 20	80 60 40 20	2 4 6 8	0 30 60 90	JN,IR,Ro Qz JN,PL,Ro Qz,Fe	R5 R4 R3 R2 R1	W1 W2 W3 W4	
11					9								JN,IR,Ro JN,PL,SM JN,ST,Ro Qz,Fe JN,IR,Ro Qz,Fe			
12					10								JN,PL,SM JN,IR,SM FO,CU,SM JN,IR,Ro Fe,Qz JN,PL,Ro Ch JN,ST,Ro JN,IR,Ro x2 Fe,Qz JN,IR,Ro Fe FO,PL,Ro JN,PL,SM			
13					11								JN,UN,SM x2 JN,PL,Ro			
14					12								FO,PL,SM Fe FO,PL,Ro Qz,Ch			
15					13								JN,UN,Ro			
16					14											
17																
18																
19																
20		*CONTINUED NEXT PAGE*														

DRILLHOLE 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS

CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-3

SHEET 3 OF 3

LOCATION: Plant Site
N: 7214045.784 E: 638185.257

DRILLING DATE: 05-Jun-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

INCLINATION: -90°

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

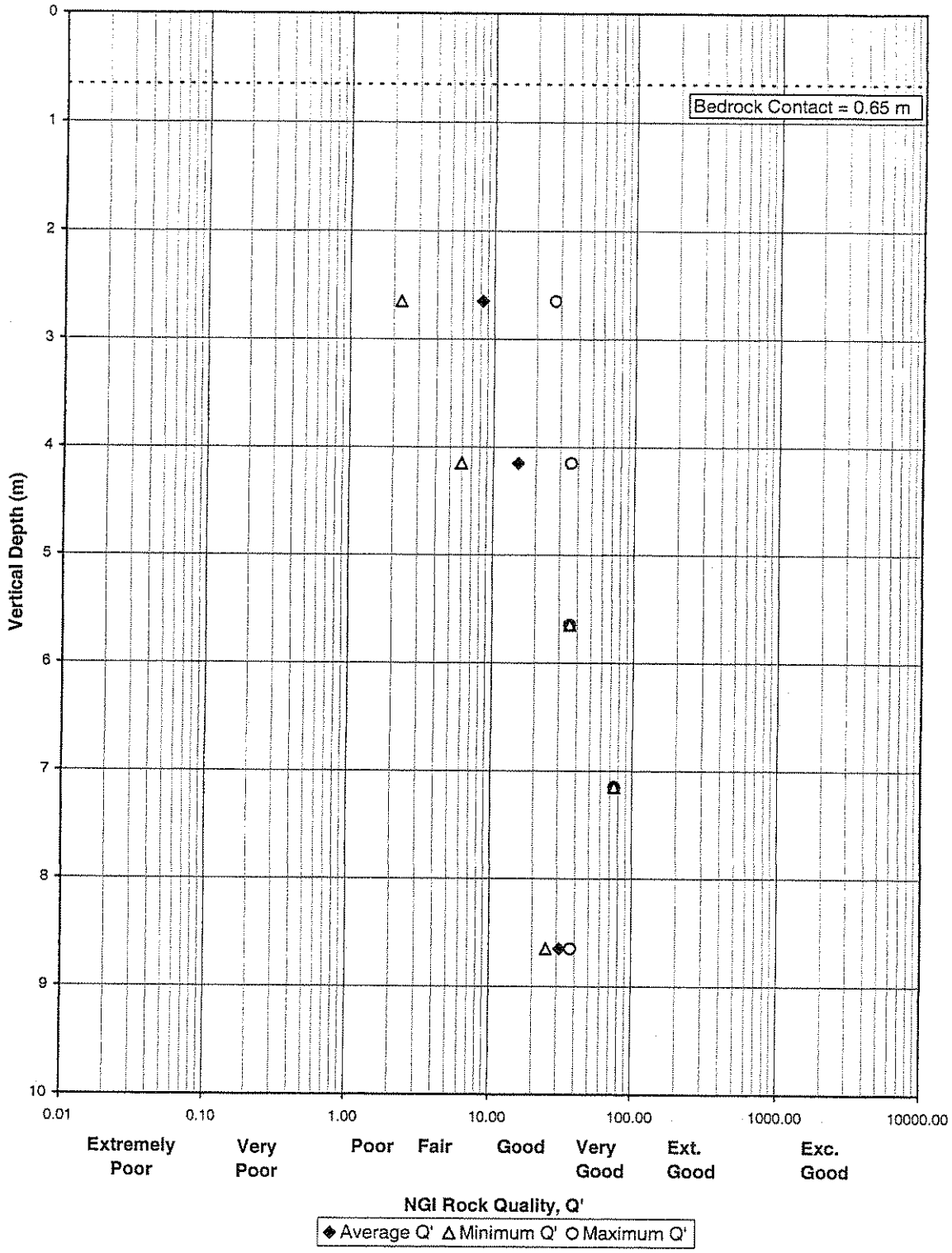
DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
20					14											
													JN,PL,Ro Qz			
21					15											
22													JN,PL,Ro Fe			
					16											
23													FO,PL,Ro			
24	Boart-Longyear HQ3	Fresh, fine grained, closely foliated, greenish grey, medium strong, INTERMEDIATE VOLCANICS with wavy quartz bedding, and disseminated sulphides (Pyrite).*(continued)*			17								JN,UN,Ro x2 Qz			
													FO,UN,SM Qz			
													FO,PL,Ro			
25													FO,PL,Ro			
					18											
26													FO,PL,Ro Qz			
													FO,PL,Ro			
													JN,PL,Ro Qz FO,PL,Ro			
27					19								JN,PL,Ro			
													JN,IR,Ro Qz,Su			
28					20											
													JN,UN,Ro Fe,Qz			
29				118.95									JN,PL,Ro Fe			
		End of BOREHOLE.		29.10												
30																

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS
CHECKED: CJC

DRILLHOLE 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03



NOTE: Q' = RQD/Jn x Jr/Ja.
For calculation purposes, where a value of RQD=0 has been recorded, a default value of 10% has been used in order to calculate Q'

Golder Associates	**NGI ROCK QUALITY, Q'** **Meadowbank Gold Project** **03-1413-427, Borehole 03GT-PS-4**	Figure **I-26**

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-PS-4

SHEET 1 OF 2

LOCATION: Plant Site
N: 7213886.667 E: 638273.169

BORING DATE: 09-Jun-03

DATUM: Local

Reference: Ground Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	CORE: RUN No.	CORE: RECOVERY %	GRADATION %: GRAVEL	GRADATION %: SAND	GRADATION %: FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		148.68											
0	HQ3	COBBLES and Boulders with some gravel		0.00 / 148.03											
1		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
2															
3															
4															
5															
6															
7															
8															
9															
10															

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp — W — Wl; 10 20 30 40

RECOVERY %: 80 60 40 20

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS

CHECKED: CJC

CUSTOM LOG 2 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-4

SHEET 2 OF 2

LOCATION: Plant Site
N: 7213886.667 E: 638273.169

DRILLING DATE: 09-Jun-03

DATUM: Local

INCLINATION: -90°

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
		Continued from SOIL LOG.		148.03													
1	Boart-Longyear HQ3	Fresh to slightly weathered, closely foliated, greenish grey, fine grained, medium strength, INTERMEDIATE VOLCANICS, with slight amounts of quartz and vuggy in sections (this run drilled with starting bar)		0.65 147.53 1.15					100	100	100		90	JN,PL,Ro JN,PL,Ro JN,PL,Ro	R5	W1	
2		Fresh to slightly weathered, closely foliated, greenish grey, fine grained, medium strength, INTERMEDIATE VOLCANICS, with slight amounts of quartz and vuggy in sections			1				100	100	100		90 90 90	JN,UN,SM x2 Fe JN,PL,Ro Fe,Qz JN,PL,Ro Cl	R5	W1	
3					2				100	100	100		90 90 90	JN,PL,Ro Cl,Fe,Qz JN,PL,Ro Ch VN,IR,Ro Qz JN,PL,Ro Qz	R5	W1	
4				144.53 4.15													
5		Fresh, closely foliated, greenish grey, fine grained, medium strength, INTERMEDIATE VOLCANICS with slight amounts of quartz			3				100	100	100		90 90 90	FO,PL,Ro FO,PL,Ro Qz,Ch FO,PL,Ro Qz,Ch	R5	W1	
6					4				100	100	100		90	FO,PL,Ro	R5	W1	
7					5				100	100	100		90 90	JN,PL,SM JN,PL,Ro	R5	W1	
8				140.03													
		End of BOREHOLE.		8.65													
9																	
10																	

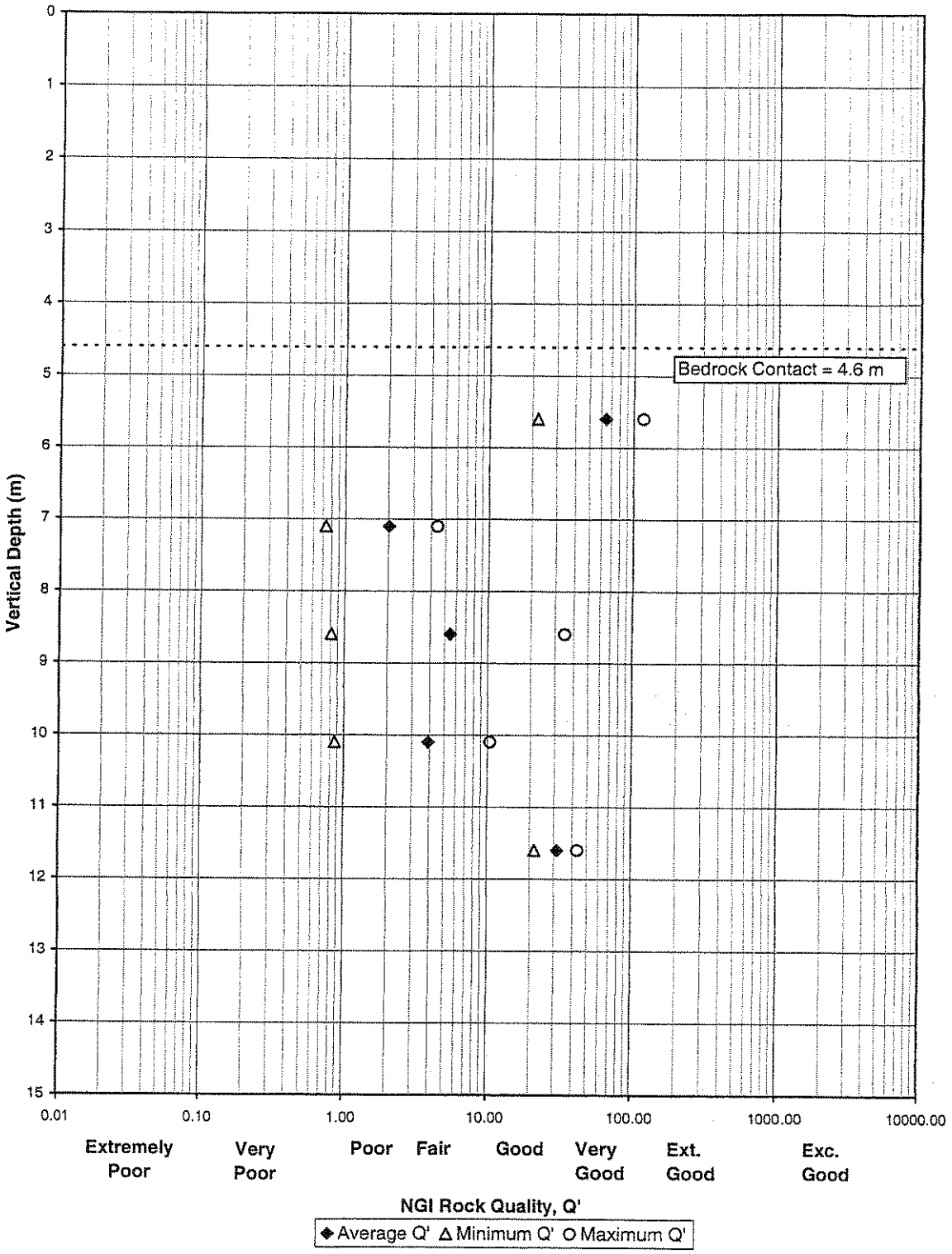
DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS

CHECKED: CJC

DRILLHOLE 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03



NOTE: Q' = RQD/Jn x Jr/Ja.
For calculation purposes, where a value of RQD=0 has been recorded, a default value of 10% has been used in order to calculate Q'

Golder Associates	**NGI ROCK QUALITY, Q'** **Meadowbank Gold Project** **03-1413-427, Borehole 03GT-PS-5**	Figure **I-27**

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-PS-5

SHEET 1 OF 2

LOCATION: Plant Site
N: 7214189.741 E: 638042.483

BORING DATE: 08-Jun-03

DATUM: Local

Reference: Ground Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	CORE: RUN No.	CORE: RECOVERY %	GRADATION %: GRAVEL	GRADATION %: SAND	GRADATION %: FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		140.08											
0	HQ3	COBBLES and Boulders with trace angular gravel		0.00											
				135.48											
5		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
10															

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp — W — Wl; 10 20 30 40

DEPTH SCALE
1 : 50

LOGGED: CS/TS

CHECKED: CJC

Golder Associates

CUSTOM LOG 2 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-5

SHEET 2 OF 2

LOCATION: Plant Site
N: 7214189.741 E: 638042.483

DRILLING DATE: 08-Jun-03

DATUM: Local

INCLINATION: -90°

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
		Continued from SOIL LOG.		135.48													
				4.60													
5					1									FO,PL,SM JN,IR,Ro JN,IR,Ro x3 Qz,Fe			
6					2									JN,UN,Ro Qz JN,PL,SM x2 JN,UN,SM JN,PL,SM x2 Qz,Ch JN,IR,Ro Qz,Ch JN,PL,Ro Fe,Ch JN,PL,SM			
7		Fresh to moderately weathered, closely foliated, greenish grey, fine grained, medium to low strength INTERMEDIATE VOLCANICS.												FO,PL,SM FO,IR,Ro Qz,Ch FO,PL,SM JN,PL,SM Qz FO,PL,SM Ch FO,PL,SM Ch,Qz			
8	Boart-Longyear HQ3				3									VN,IR,SM Ch,Qz FO,PL,SM Ch FO,PL,SM FO,PL,SM Ch JN,PL,Ro Cl			
9					4									JN,PL,SM x2 Ch VN,PL,Ro Qz FO,PL,SM Ch JN,IR,Ro Ch FO,PL,SM Cl FO,PL,SM x2 Ch FO,PL,Ro x2 Fe			
10				129.98										JN,UN,SM Qz JN,PL,SM x2 JN,IR,SM JN,PL,SM x2			
				10.10													
11		Fresh, closely foliated, greenish grey, fine grained, medium strength, INTERMEDIATE VOLCANICS and Quartz			5									JN,UN,SM Bi,Ch,Qz VN,IR,Ro Qz FO,PL,Ro Ch			
				128.48													
12		End of BOREHOLE.		11.60													
13																	
14																	

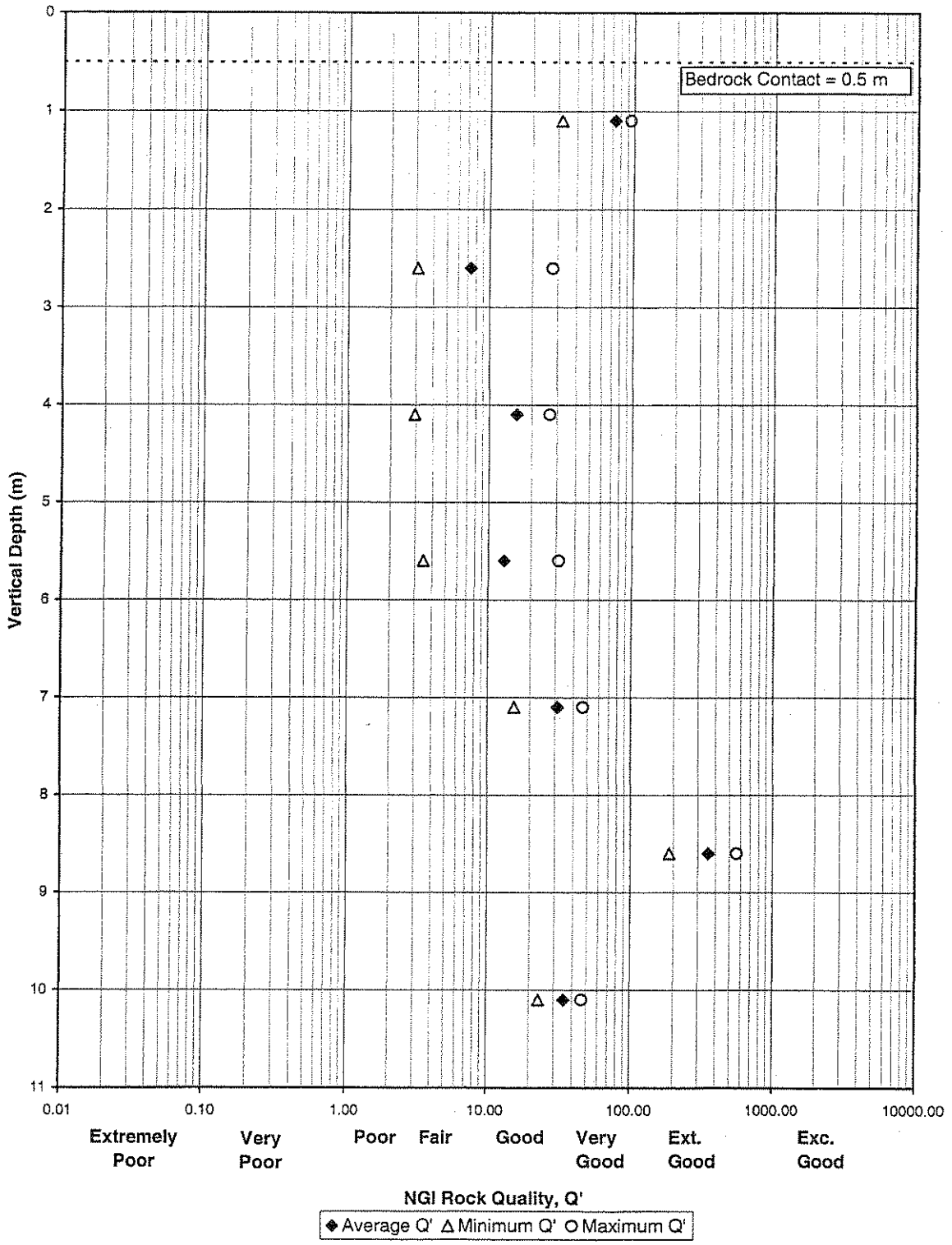
DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS

CHECKED: CJC

DRILLHOLE 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03



NOTE: Q' = RQD/Jn x Jr/Ja.
For calculation purposes, where a value of RQD=0 has been recorded, a default value of 10% has been used in order to calculate Q'

Golder Associates	**NGI ROCK QUALITY, Q'** **Meadowbank Gold Project** **03-1413-427, Borehole 03GT-PS-6**	Figure **I-28**

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-6

SHEET 1 OF 1

LOCATION: Plant Site
N: 7214058.896 E: 637964.353

DRILLING DATE: 08-Jun-03

DATUM: Local

DRILL RIG: LY38

Reference: Ground Surface

INCLINATION: -90°

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
		Ground Surface		146.63													
0	Boart-Longyear HQ3	Fresh to slightly weathered, fine grained, closely foliated to massive, medium strong, INTERMEDIATE VOLCANICS with quartz veins, pyrite, and occasional iron staining.		0.00	1									VN,IR,Ro Qz,Su JN,IR,Ro Qz FO,PL,SM Ca			
1														JN,PL,Ro Ca FO,PL,SM x2 Ca			
					2									JN,PL,SM x2 Qz,Ca JN,IR,Ro Fe,Sl FO,PL,SM Su			
2				144.53										FO,PL,SM FO,PL,Ro Ca,Qz			
		Fresh to slightly weathered, fine grained, closely foliated, medium strong, INTERMEDIATE VOLCANICS with quartz veins and occasional iron staining in discontinuities.		2.10										VN,UN,Ro x2 Fe,Ca,Su VN,IR,Ro Fe,Ca,Su			
3					3									FO,IR,Ro Sl,Ca,Fe FO,PL,Ro Qz JN,PL,Ro Qz FO,PL,SM			
				143.03													
		Fresh, fine grained, closely foliated to massive, medium strong, INTERMEDIATE VOLCANICS with quartz veins.		3.60										JN,PL,SM Sl,Ca VN,IR,Ro Sl,Ca,Qz JN,PL,SM Ca JN,PL,SM Ca			
4					4									JN,IR,Ro x2 Qz,Ca JN,PL,Ro Ca			
5				141.53										JN,UN,Ro Ca,Qz VN,PL,Ro Qz			
		Fresh, fine grained, closely foliated to massive, medium strong, INTERMEDIATE VOLCANICS with quartz veins and wavy calcite banding.		5.10	5									FO,PL,SM Ca FO,ST,Ro x2 Qz,Ca			
6					6									FO,PL,Ro JN,ST,SM Ca JN,IR,Ro JN,PL,SM Ca			
7														JN,IR,Ro Ca JN,PL,SM Ca FO,UN,SM Ca VN,IR,Ro Qz,Ch			
8					7									FO,IR,Ro Ch			
9														FO,PL,Ro Qz,Ch			
				137.03													
		End of BOREHOLE.		9.60													
10																	

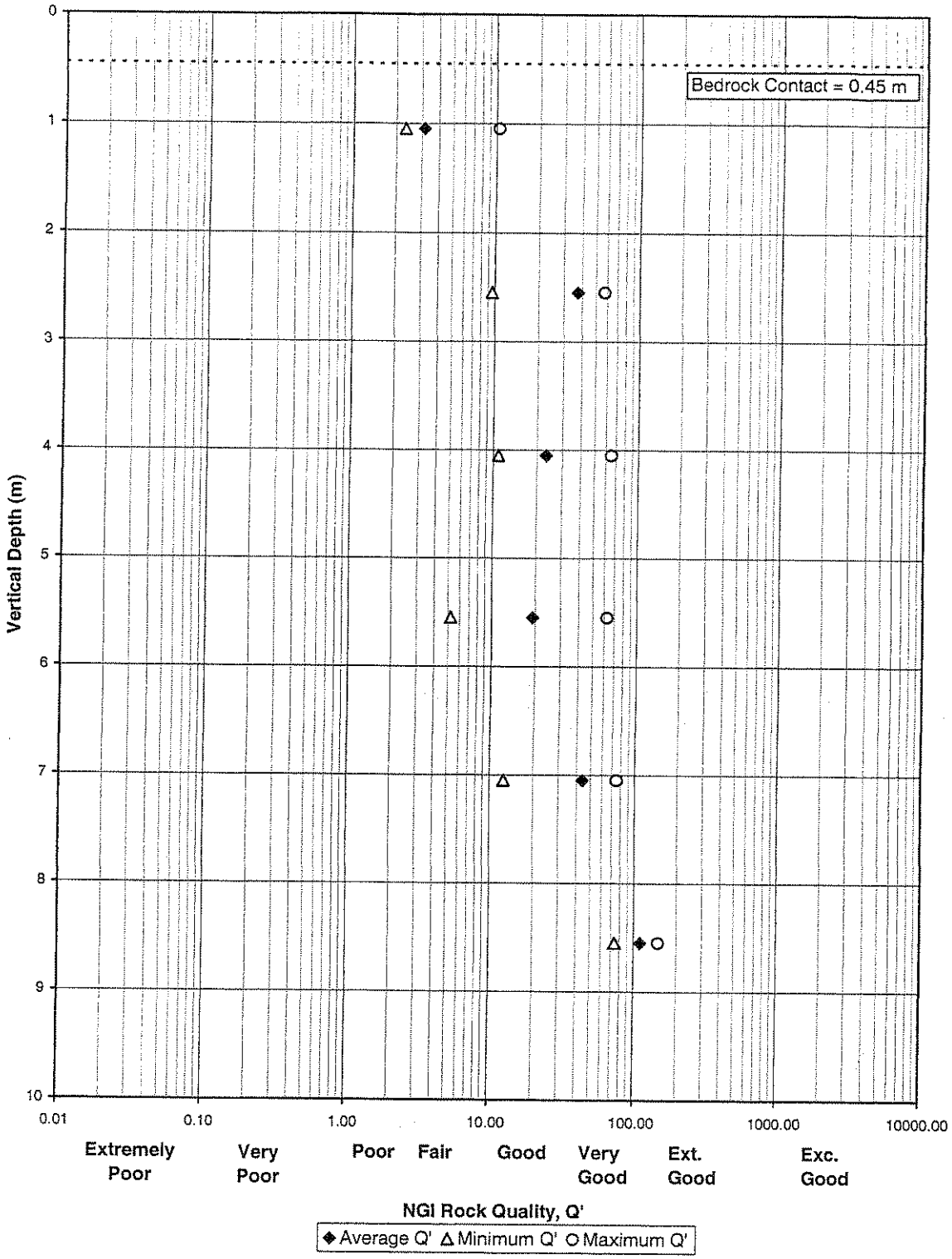
DRILLHOLE 03-1413-427 GPJ GLDR_CAN.GDT 22/8/03

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS

CHECKED: CJC



NOTE: Q' = RQD/Jn x Jr/Ja.
For calculation purposes, where a value of RQD=0 has been recorded, a default value of 10% has been used in order to calculate Q'

Golder Associates

NGI ROCK QUALITY, Q'
Meadowbank Gold Project
03-1413-427, Borehole 03GT-PS-7

Figure
I-29

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-PS-7

SHEET 1 OF 2

LOCATION: Plant Site
N: 7213952.089 E: 638006.989

BORING DATE: 06-Jun-03

DATUM: Local

Reference: Ground Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	CORE: RUN No.	CORE: RECOVERY %	GRADATION %: GRAVEL	GRADATION %: SAND	GRADATION %: FINES	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		149.37											
0	HQ3	COBBLES AND BOULDERS with trace gravel and 5 cm of organics.		0.00 / 148.92											
		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS
CHECKED: CJC

CUSTOM LOG 2 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-7

SHEET 2 OF 2

LOCATION: Plant Site
N: 7213952.089 E: 638006.989

DRILLING DATE: 06-Jun-03

DATUM: Local

INCLINATION: -90°

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (min/m)	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
		Continued from SOIL LOG.		148.92													
		Fresh to slightly weathered, closely foliated, fine grained, greenish grey, medium strong, INTERMEDIATE VOLCANICS with wavy quartzite banding and iron staining.		0.45	1									JN,PL,Ro Qz JN,PL,SM x2 Qz,Si JN,PL,SM Qz,Si			
1				148.32													
				1.05										FO,CU,Ro JN,PL,Ro Qz			
					2									FO,UN,Ro Qz FO,PL,Ro Qz,Fe JN,CU,Ro Ch JN,IR,Ro Qz,Si JN,PL,Ro JN,ST,Ro Qz			
2																	
3														FO,PL,Ro FO,IR,Ro			
					3									JN,ST,SM Si JN,PL,SM Si FO,ST,SM Si JN,PL,Ro Si			
4	Boart-Longyear HQ3													JN,PL,Ro Si FO,PL,Ro Qz FO,PL,Ro Qz JN,UN,Ro Fe,Qz			
		Fresh, fine grained, closely foliated, greenish grey, medium strong, INTERMEDIATE VOLCANICS with wavy quartzite banding.			4									FO,PL,SM JN,IR,Ro Qz,Fe JN,CU,SM Fe,Cl JN,CU,SM Fe,Cl			
5														JN,PL,SM			
														JN,PL,SM JN,CU,Ro Qz			
6					5									FO,UN,Ro Qz JN,UN,Ro Qz,Su JN,PL,Ro Si,Qz			
7																	
					6									JN,ST,Ro x2 Si JN,PL,Ro Qz JN,PL,Ro Qz			
8				140.82													
		End of BOREHOLE.		8.55													
9																	
10																	

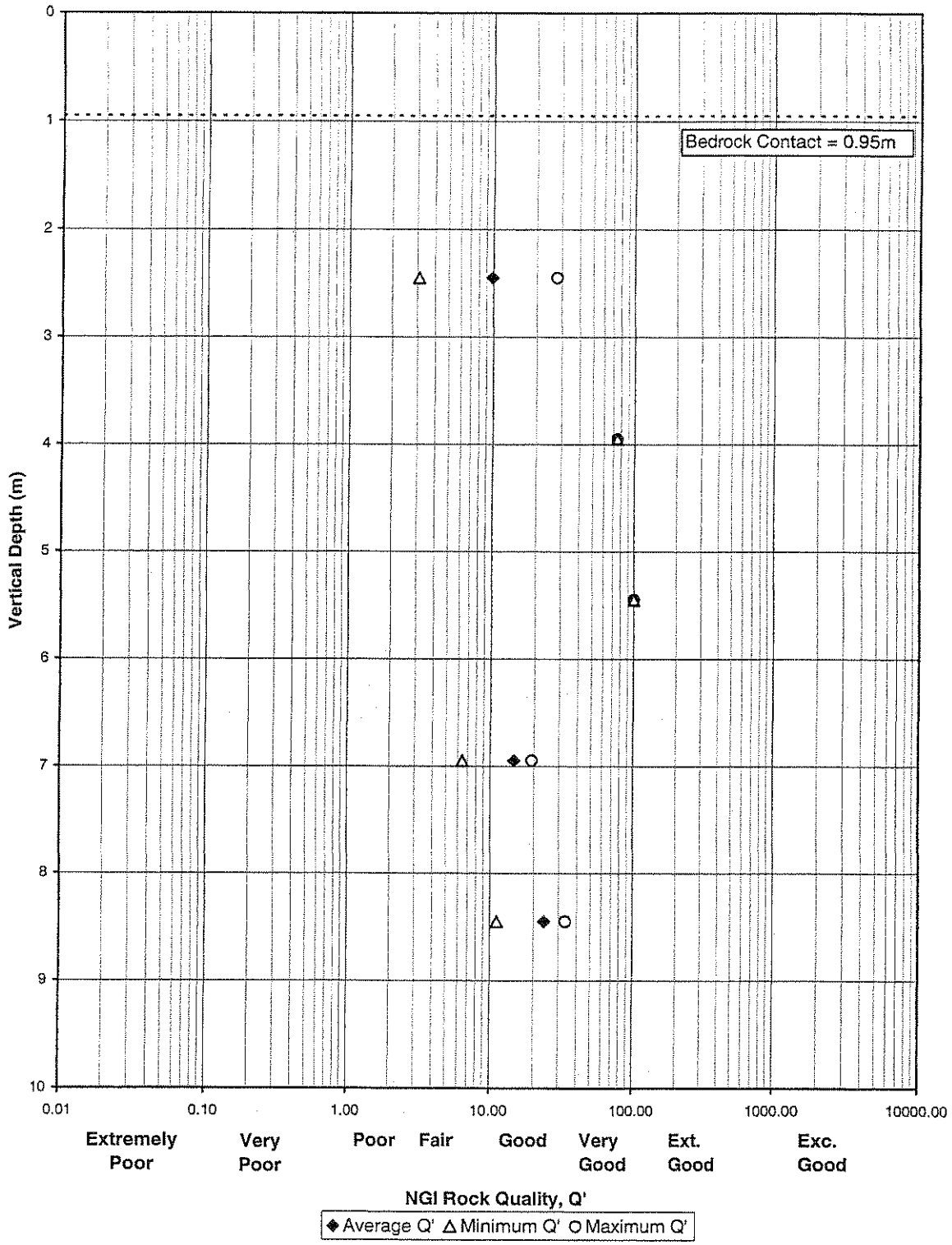
DRILLHOLE 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS

CHECKED: CJC



NOTE: Q' = RQD/Jn x Jr/Ja.
For calculation purposes, where a value of RQD=0 has been recorded, a default value of 10% has been used in order to calculate Q'

Golder Associates	**NGI ROCK QUALITY, Q'** **Meadowbank Gold Project** **03-1413-427, Borehole 03GT-PS-8**	Figure **I-30**

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-8

SHEET 1 OF 1

LOCATION: Plant Site
N: 7214012.942 E: 637812.665

DRILLING DATE: 09-Jun-03

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

Reference: Ground Surface

INCLINATION: -90°

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	COLOUR & % RETURN FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
		Ground Surface		143.72												
0		Fresh to slightly weathered, fine grained to massive, greenish grey, INTERMEDIATE VOLCANICS, with black banding and iron staining.		0.00	1								FO,PL,SM Fe JN,PL,Ro Fe,Si JN,IR,Ro FO,PL,SM FO,PL,SM FO,PL,SM JN,PL,Ro Fe JN,IR,Ro x2 Si			
1				142.22												
2	Boart-Longyear HQ3			1.50	2								VN,IR,Ro Qz,Fe,Ca FO,ST,Ro Su FO,ST,Ro Su			
3					3								JN,IR,Ro JN,IR,Ro Su			
4		Fresh, fine grained, closely foliated to massive, greenish grey, INTERMEDIATE VOLCANICS, with quartz veins, occasional calcite veinlets, and iron staining in discontinuities.											JN,IR,Ro			
					4								JN,UN,Ro JN,IR,Ro Fe,Qz			
5													JN,UN,Ro Fe,Si CJ,IR,Ro Ca,Fe			
													VN,IR,Ro Su JN,ST,Ro Fe,Si			
6					5								JN,IR,Ro Fe			
													JN,PL,Ro			
7				136.22									FO,UN,Ro FO,PL,SM			
		End of BOREHOLE.		7.50												
8																
9																
10																

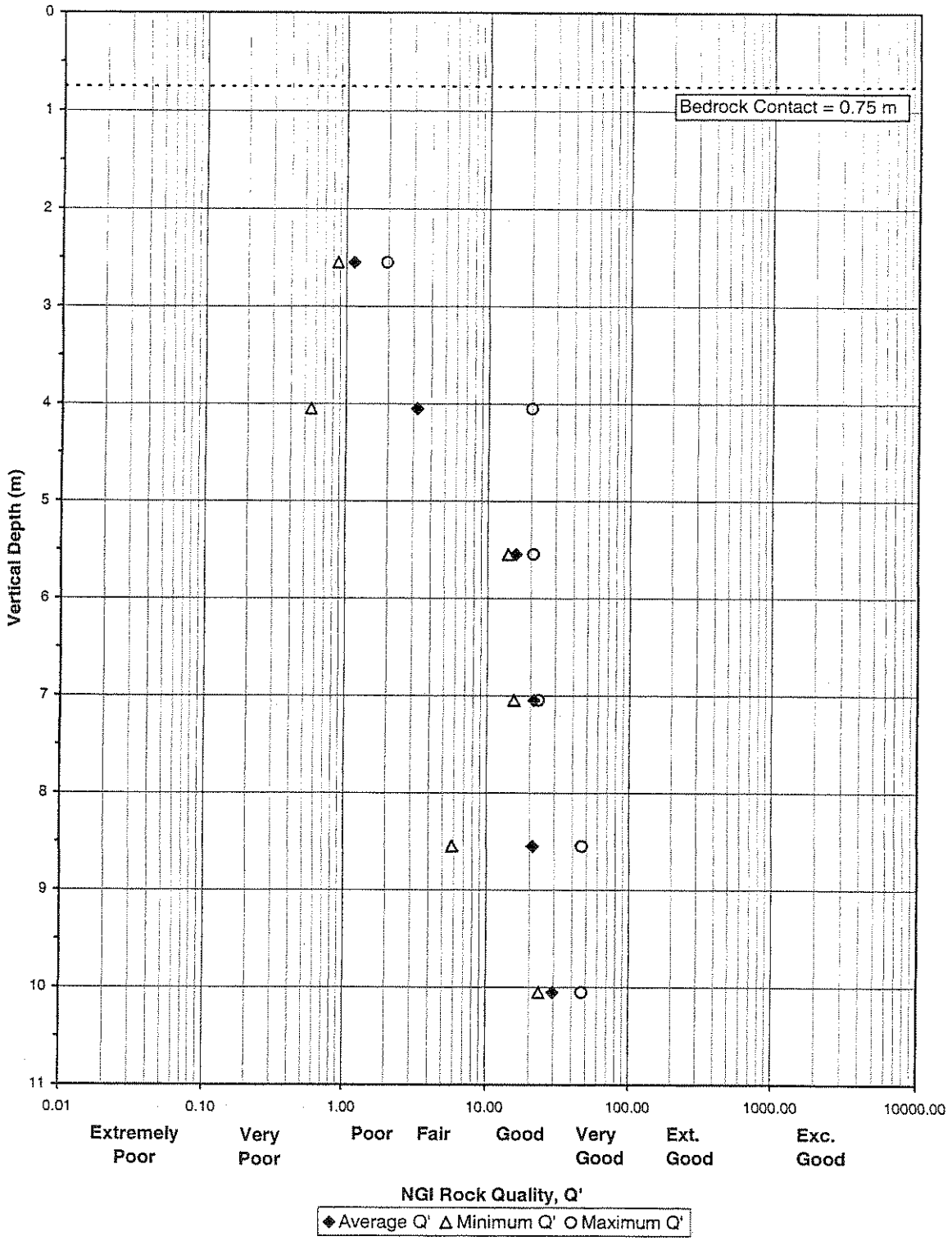
DRILLHOLE 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS

CHECKED: CJC



NOTE: Q' = RQD/Jn x Jr/Ja.
For calculation purposes, where a value of RQD=0 has been recorded, a default value of 10% has been used in order to calculate Q'

Golder Associates	**NGI ROCK QUALITY, Q'** **Meadowbank Gold Project** **03-1413-427, Borehole 03GT-PS-9**	Figure **I-31**

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-PS-9

SHEET 1 OF 2

LOCATION: Plant Site
N: 7214083.049 E: 638067.079

BORING DATE: 07-Jun-03

DATUM: Local

Reference: Ground Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	CORE: RUN No.	CORE: RECOVERY %	GRADATION %: GRAVEL	GRADATION %: SAND	GRADATION %: FINES	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		146.72											
	HQ3	COBBLES AND BOULDERS with trace gravel (no wash sample)		0.00 / 145.97											
1		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
2															
3															
4															
5															
6															
7															
8															
9															
10															

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp — W — Wl; 10 20 30 40

RECOVERY %: 80 60 40 20

DEPTH SCALE
1 : 50

LOGGED: CS/TS

CHECKED: CJC

Golder Associates

CUSTOM LOG 2 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-9

SHEET 2 OF 2

LOCATION: Plant Site
N: 7214083.049 E: 638067.079

DRILLING DATE: 07-Jun-03

DATUM: Local

INCLINATION: -90°

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH / % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
		Continued from SOIL LOG.		145.97												
1	Boart-Longyear HQ3	Fresh to moderately weathered, closely foliated, fine grained, greenish grey, strong to weak INTERMEDIATE VOLCANICS with Iron Banding and some Quartz		0.75 145.37												
2		Fresh to moderately weathered, closely foliated, fine grained, greenish grey, strong to weak Intermediate Volcanics with Iron Banding and some Quartz		1.35 144.17	1								FO,PL,SM Fe,Qz JN,PL,SM Fe,Qz,Su JN,PL,Ro Fe,Qz,Su			
3				2.55	2								FO,ST,Ro Fe JN,PL,SM Fe,Cl JN,PL,Ro x2 Qz,Fe			
4													FO,PL,SM JN,UN,Ro Cl			
5					3								FO,PL,SM x2 Ch FO,PL,Ro x2 Fe FO,PL,SM x2 Fe JN,PL,SM Fe FO,PL,SM			
6		Fresh to slightly weathered, closely foliated, fine grained, greenish grey, medium strong, INTERMEDIATE VOLCANICS with Iron Banding and some Quartz			4								FO,PL,SM Ch FO,PL,Ro Ch FO,PL,Ro x2 Ch			
7													JN,PL,VR Fe,Qz			
8					5								JN,UN,Ro Ch JN,PL,Ro Ch JN,PL,Ro Cl,Ch FO,PL,Ro Fe VN,IR,Ro Qz,Fe			
9					6								JN,PL,Ro Qz JN,UN,Ro Fe JN,PL,Ro Fe,Ch			
10		End of BOREHOLE.		136.67 10.05									JN,PL,Ro Fe			

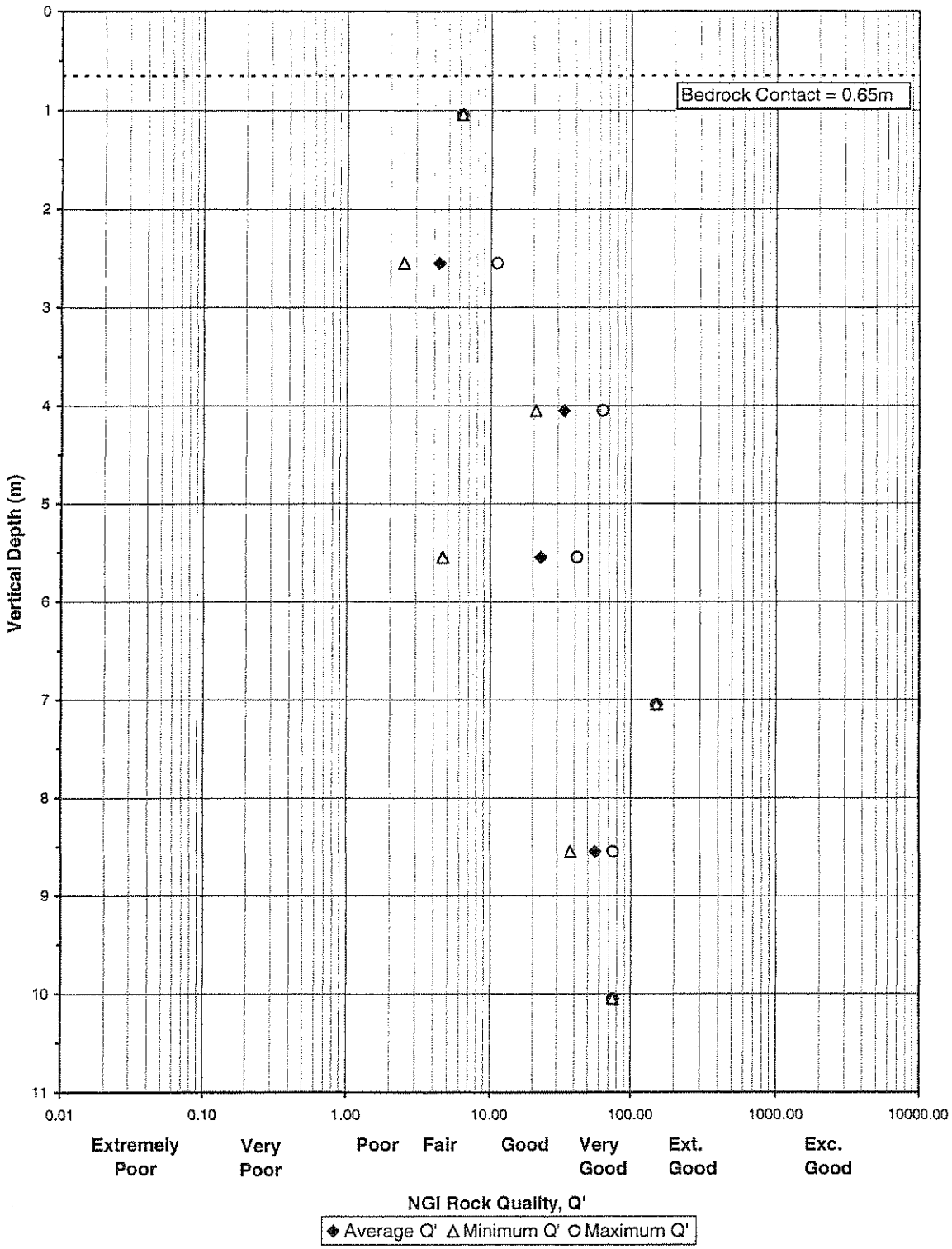
DRILLHOLE 03-1413-427 GPJ GLDR_CAN.GDT 22/8/03

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS

CHECKED: CJC



NOTE: Q' = RQD/Jn x Jr/Ja.
For calculation purposes, where a value of RQD=0 has been recorded, a default value of 10% has been used in order to calculate Q'

Golder Associates	**NGI ROCK QUALITY, Q'** **Meadowbank Gold Project** **03-1413-427, Borehole 03GT-PS-10**	Figure **I-32**

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-PS-10

SHEET 1 OF 2

LOCATION: Plant Site
N: 7214082.158 E: 638094.492

BORING DATE: 07-Jun-03

DATUM: Local

Reference: Ground Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	CORE: RUN No.	CORE: RECOVERY %	GRADATION %: GRAVEL	GRADATION %: SAND	GRADATION %: FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		147.49											
0	HQ3	COBBLES AND BOULDERS with some gravel.		0.00											
				146.84											
1		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
2															
3															
4															
5															
6															
7															
8															
9															
10															

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp — W — Wl; 10 20 30 40

DEPTH SCALE
1 : 50

LOGGED: CS/TS

CHECKED: CJC

Golder Associates

CUSTOM LOG 2 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-10

SHEET 2 OF 2

LOCATION: Plant Site
N: 7214082.158 E: 638094.492

DRILLING DATE: 07-Jun-03

DATUM: Local

INCLINATION: -90°

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
		Continued from SOIL LOG.		146.84													
				0.65	1									JN,IR,Ro Si			
1		Fresh to slightly weathered, fine grained, closely foliated, greenish grey, medium strong, INTERMEDIATE VOLCANICS with silt and iron staining in discontinuities.												JN,IR,Ro Si,Fe			
														FO,PL,SM Fe			
					2									FO,IR,SM Fe			
2														FO,PL,SM			
														FO,PL,SM Fe			
														JN,PL,SM Si			
														JN,PL,SM Si			
														JN,PL,SM Si			
														JN,PL,SM Si			
														JN,ST,SM Si			
				144.94													
				2.55										JN,UN,SM			
3					3									FO,PL,SM x2 Fe			
														JN,IR,Ro			
														JN,PL,Ro Fe,Qz			
4		Fresh to slightly weathered, fine grained, closely foliated massive, greenish grey, medium strong, INTERMEDIATE VOLCANICS with silt and iron staining in discontinuities.			4									JN,ST,Ro			
														FO,PL,Ro Fe			
														JN,IR,Ro Si			
														JN,PL,SM			
5	Boart-Longyear HQ3													FO,UN,Ro Qz			
				141.94													
				5.55													
6					5									JN,IR,Ro Qz,Fe			
		Fresh to slightly weathered, fine grained, closely foliated massive, greenish grey, medium strong, INTERMEDIATE VOLCANICS with pyrite and iron staining in quartzite veins.												JN,UN,SM			
8					6									JN,IR,Ro Qz,Fe			
9					7												
														JN,PL,Ro			
10				137.44													
		End of BOREHOLE.		10.05													

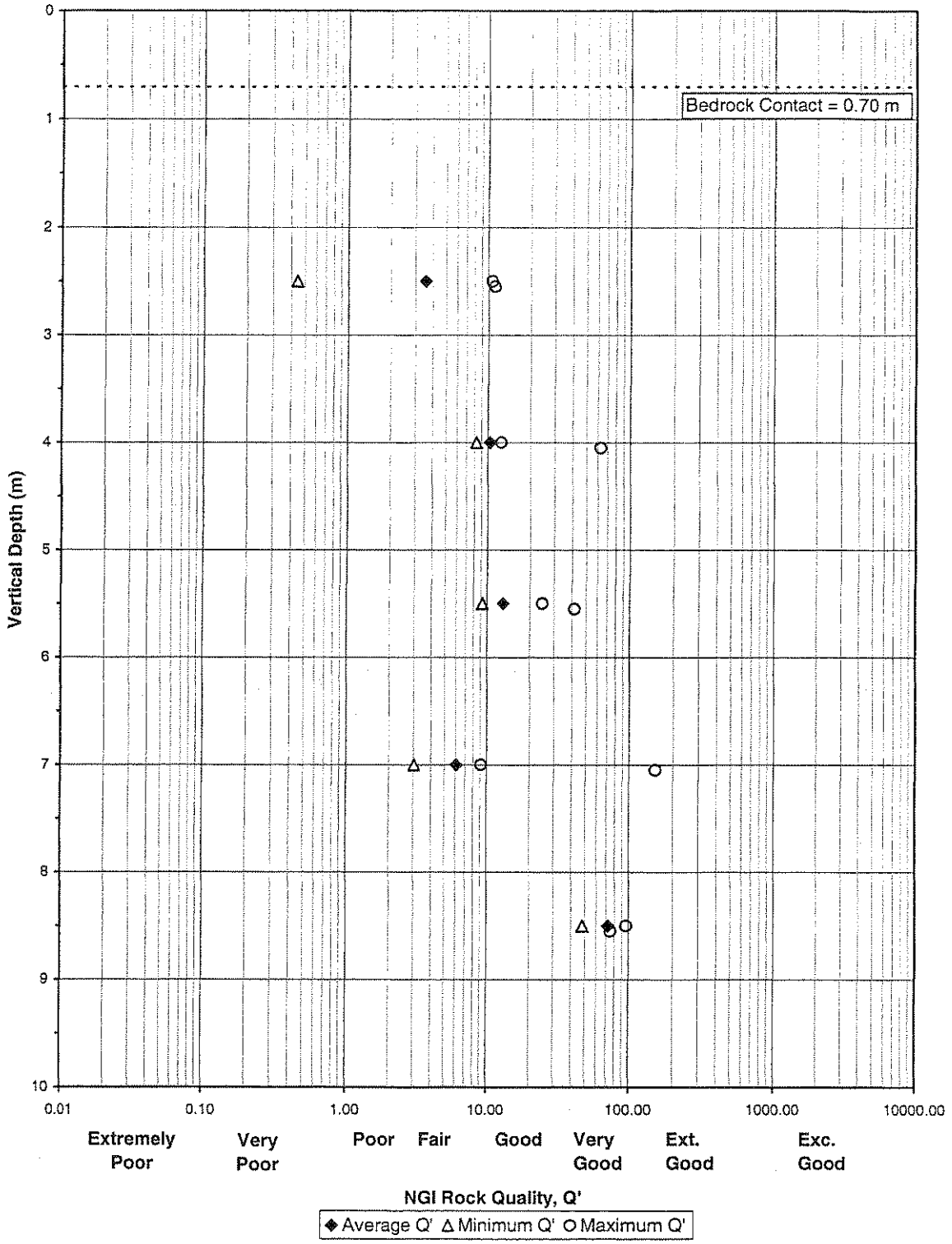
DRILLHOLE 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS

CHECKED: CJC



NOTE: Q' = RQD/Jn x Jr/Ja.
For calculation purposes, where a value of RQD=0 has been recorded, a default value of 10% has been used in order to calculate Q'

Golder Associates	**NGI ROCK QUALITY, Q'** **Meadowbank Gold Project** **03-1413-427, Borehole 03GT-PS-11**	Figure **I-33**

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-PS-11

SHEET 1 OF 2

LOCATION: Plant Site
N: 7213982.399 E: 638095.161

BORING DATE: 15-Jun-03

DATUM: Local

Reference: Ground Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	CORE: RUN No.	CORE: RECOVERY %	GRADATION %: GRAVEL	GRADATION %: SAND	GRADATION %: FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		148.88											
0	HQ3	COBBLES and BOULDERS with trace gravel (small pieces angular and rough)		0.00 / 148.18											
1		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
2															
3															
4															
5															
6															
7															
8															
9															
10															

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp — W — Wl; 10 20 30 40

DEPTH SCALE
1 : 50

LOGGED: CS/TS

CHECKED: CJC

Golder Associates

CUSTOM LOG 2 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-PS-11

SHEET 2 OF 2

LOCATION: Plant Site
N: 7213982.399 E: 638095.161

DRILLING DATE: 15-Jun-03

DATUM: Local

INCLINATION: -90°

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED CH-CHLORITIZED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (mm/min)	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
		Continued from SOIL LOG.		148.18												
				0.70												
1	Boart-Longyear HQ3	Fresh to slightly weathered, closely foliated, greenish black, fine grained, medium strength, INTERMEDIATE VOLCANICS.			1								JN,UN,Ro JN,UN,Ro			
													JN,IR,Ro Cl			
2													FO,PL,Ro x2			
													JN,PL,SM FO,PL,SM x5 Fe			
3					2								JN,PL,Ro JN,PL,SM FO,PL,SM JN,PL,Ro			
													FO,PL,SM JN,PL,Ro			
4					3								JN,PL,Ro Qz,Ch JN,UN,SM Qz,Ch			
													VN,PL,Ro Qz,Ch			
5													JN,PL,Ro x3 Fe,Ch			
6					4								FO,PL,SM x2 JN,PL,SM			
													JN,PL,SM JN,PL,SM FO,PL,Ro FO,PL,SM JN,PL,Ro			
7																
					5								VN,IR,Ro			
8													FO,UN,Ro VN,PL,Ro VN,PL,Ro			
				140.38												
		End of BOREHOLE.		8.50												
9																
10																

DEPTH SCALE
1 : 50

Golder Associates

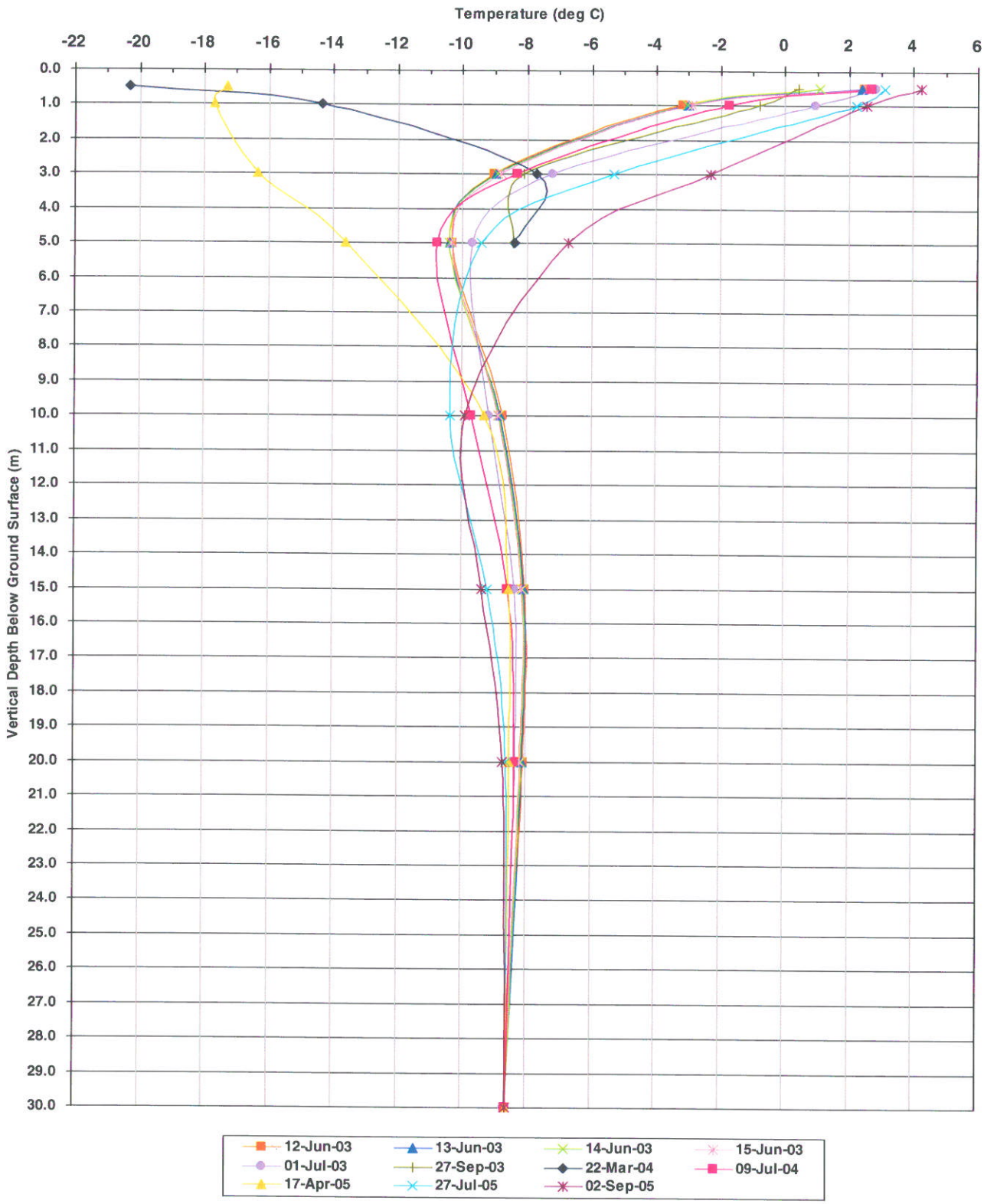
LOGGED: CS/TS

CHECKED: CJC

DRILLHOLE 03-1413-427.GPJ GLDR_CAN.GDT 22/8/03

APPENDIX I – II

TEMPERATURE PROFILES



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Collar Easting	638037.694
Collar Elevation	147.736
UTM Azimuth	N/A
Inclination	-90.00

TITLE

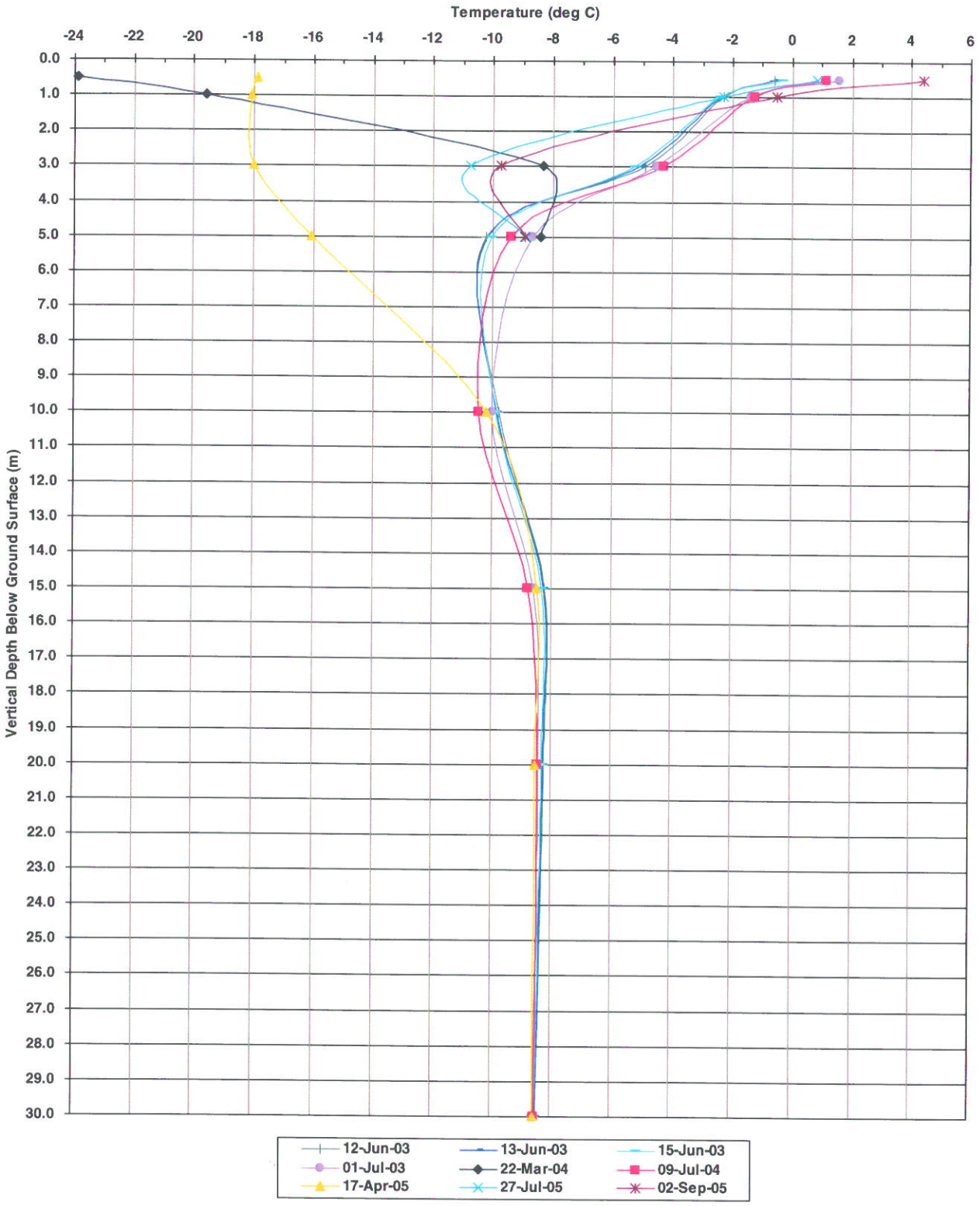
MEADOWBANK GOLD PROJECT
BOREHOLE THERMISTOR 03GT-PS-2
PLANT SITE

Golder Associates

PROJECT No. 06-1413-009			FILE No. ----	
DESIGN	JJC	16OCT03	SCALE NTS	REV. 0
CADD	JJC	16OCT03		
CHECK	CJC	17OCT03		
REVIEW	CJC	28APR06		

FIGURE 1

O:\Active\2003\1413\03-1413-078 Cumberland_Baseline\3000_Permafrost\tempprofilesrev0



Installation Details	
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Collar Easting	638185.257
Collar Elevation	148.951
UTM Azimuth	N/A
Inclination	-90.00

TITLE

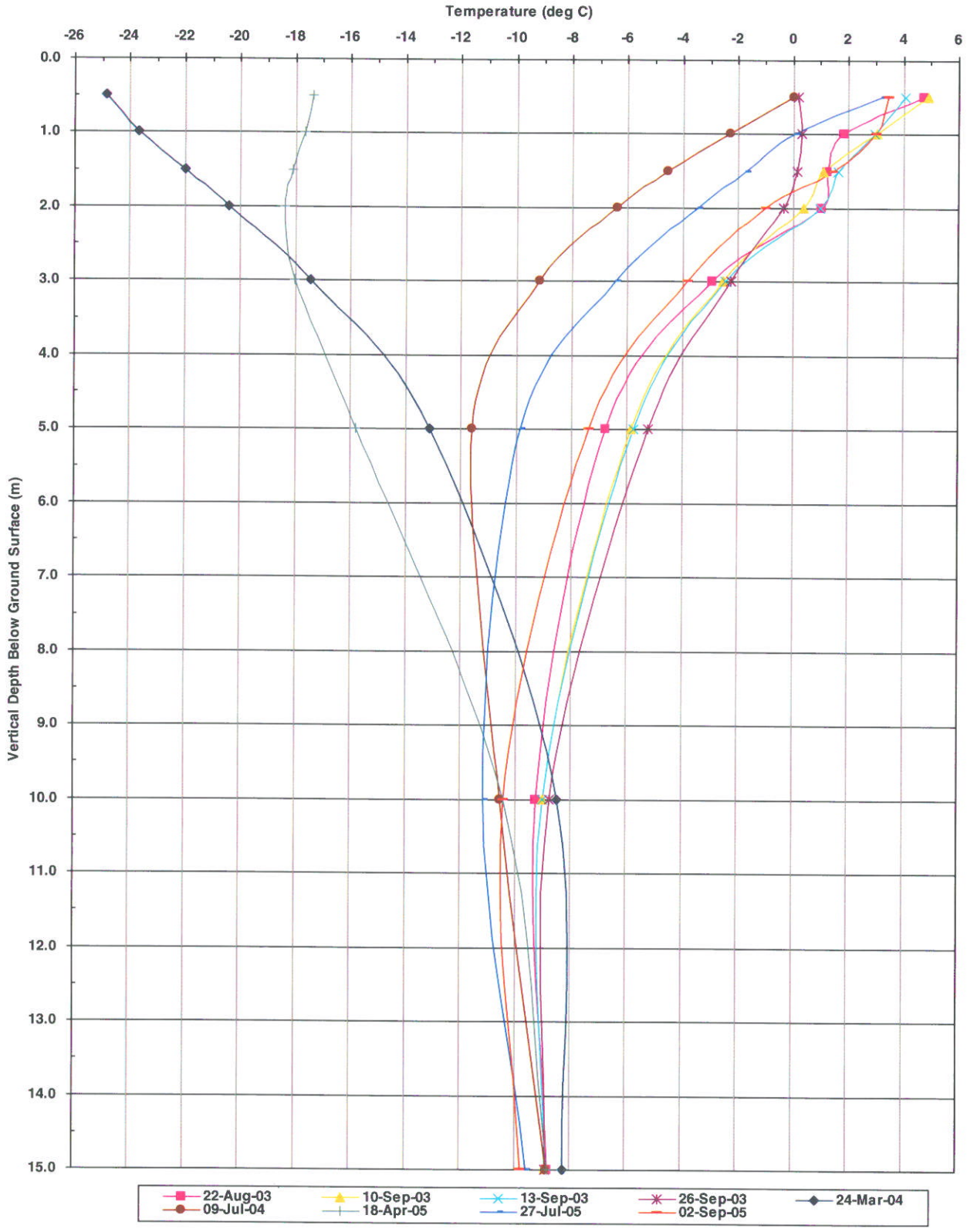
MEADOWBANK GOLD PROJECT
BOREHOLE THERMISTOR 03GT-PS-3
PLANT SITE

Golder Associates

PROJECT No. 06-1413-009			FILE No. ----	
DESIGN	JJC	16OCT03	SCALE NTS	REV. 0
CADD	JJC	16OCT03		
CHECK	CJC	17OCT03		
REVIEW	CJC	28APR06		

FIGURE 2

O:\Active\2003\1413\03-1413-078 Cumberland_Baseline\3000_Permafrost\tempprofilesrev0



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Collar Elevation	147.620
UTM Azimuth	N/A
Inclination	-90.00

TITLE

MEADOWBANK GOLD PROJECT
BOREHOLE THERMISTOR 03GT-TF-1
TANK FARM

Golder Associates

PROJECT No. 06-1413-009			FILE No. ----	
DESIGN	JJC	16OCT03	SCALE NTS	REV. 0
CADD	JJC	16OCT03		
CHECK	CJC	17OCT03	FIGURE 3	
REVIEW	CJC	28APR06		

O:\Active\2003\1413\03-1413-078 Cumberland_Baseline\3000_Permafrost\tempprofilesrev0

APPENDIX II

TECHNICAL SPECIFICATIONS

CUMBERLAND RESOURCES LTD.

Golder Associates

SPECIFICATION

The document revision number is indicated below. Please replace all revised pages of this document and destroy the superseded copies.

PROJECT:	MEADOWBANK GOLD PROJECT	NO: SP-GAL-02	REV 0
PROJECT NO:	06-1413-009		
TITLE:	MEADOWBANK FUEL TANK FARM		

ISSUED FOR	REV No.	ORIGIN	DATE OUT	DATE IN	ISSUED-PAGES/SECTIONS		INITIAL
Construction	0	WJP	28Apr06				

New Issue x

Revised Sheets Only Attached _____

Entire Document Re-issued _____

FINAL DOCUMENT APPROVAL

CUMBERLAND APPROVAL

Project Manager _____

Date: _____

Engineering Lead _____

Date: _____

GOLDER APPROVAL

Project Manager _____

Date: _____

Engineering Manager _____

Date: _____

Discipline Area Lead

Date: _____

Originator _____

Date:

Project No:	**06-1413-009**	**Specification Number: SP-GAL-02**	**Date: April 28, 2006**
TITLE	**Meadowbank Fuel Tank Farm**		**Rev: 0**

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Project No:	**06-1413-009**	**Specification Number: SP-GAL-02**	**Date: April 28, 2006**
TITLE	**Meadowbank Fuel Tank Farm**		**Rev: 0**

1.0 SCOPE OF WORK

1.1 General

.1 This Specification defines the requirements for furnishing of all labour, equipment and materials required for construction of the Meadowbank Fuel Tank Farm as specified herein for Cumberland Resources Ltd.'s Meadowbank Gold Project in Nunavut, Canada. Specifically, this Specification defines the requirements for the construction of the Fuel Tank Farm, Dispensing Station and Drainage Control Structures.

.2 Scope of Work required for construction of the fuel tank farm is presented as follows:

- .a Scope of Work
- .b Care of Water
- .c Salvage and Stockpile Organic Materials
- .d Foundation Preparation
- .e Bulk Excavation
- .f Backfill Materials
- .g Fuel Tank Farm Construction
- .h HDPE Liner Construction
- .i Runoff and Sediment Control Ditch and Monitoring Ponds
- .j Survey Control

.3 The technical specifications and proposed construction methodology may be revised as site conditions are better understood, during the construction process, at the discretion of the Engineer.

1.2 Construction Drawings

.1 This Specification defines the requirements for performing the work and as outlined on the Construction Drawings (hereafter referred to as "the Drawings") presented in the table below. In the event of discrepancy between the Specifications and the Drawings, the Drawings shall be given priority.

Drawing Number	Drawing Title
3000-C-200	TITLE SHEET, MEADOWBANK FUEL TANK FARM
3000-C-201	GENERAL ARRANGEMENT PLAN, MEADOWBANK FUEL TANK FARM
3000-C-202	FUEL STORAGE FACILITY LAYOUT PLAN, MEADOWBANK FUEL TANK FARM
3000-C-203	TANK FARM EXCAVATION PLAN AND SECTIONS, MEADOWBANK FUEL TANK FARM
3000-C-204	TANK FARM BACKFILL PLAN AND SECTIONS, MEADOWBANK FUEL TANK FARM
3000-C-205	TANK FARM BACKFILL DETAILS, MEADOWBANK FUEL TANK FARM
3000-C-206	SECONDARY CONTAINMENT HDPE LINER PLAN AND SUMP DETAILS, MEADOWBANK FUEL TANK FARM
3000-C-207	DISPENSING STATION PLAN, PROFILE AND DETAILS, MEADOWBANK FUEL TANK FARM
3000-C-208	DISPENSING STATION SECTIONS AND DETAILS, MEADOWBANK FUEL TANK FARM

1.3 Codes and Standards

.1 Work shall conform to, but not be limited to, the requirements of the most recent editions of the following standards and codes which are part of this Specification:

a. ASTM D422 Test Method for Particle-Size Analysis of Soils

b. ASTM D1140 Test Method for Amount of Material in Soils Finer Than the No. 200 (75 µm) Sieve

c. ASTM C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates

d. ASTM D698-70 Test Method for determination of Standard Proctor Maximum Dry Density of Soil.

e. ASTM D2216 Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock

f. ASTM D1556 Test Method for Density of Soil in Place by the Sand-Cone Method

g. ASTM D2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (shallow depths)

h. CAN/CGSB-8.1-88 Sieve analysis

i. Occupational Health and Safety Act of Nunavut

j. Mining Act and Regulations for Nunavut

1.4 Description of Items

.1 The Meadowbank Fuel Tank Farm is designed to contain one Above Ground Storage Tank (AGST), including:

.a One 5.6 million litre tank to be constructed in 2006.

.2 The Fuel Tank Farm construction is comprised of:

.a AGST foundation;

.b Secondary containment berms; and

.c Dispensing Station.

.3 The Fuel Tank Farm and Dispensing Station construction includes care of water, salvage and stockpile organic materials, foundation preparation, bulk excavation and backfilling activities. A High Density Polyethylene (HDPE) liner will be constructed in each Work Area to provide secondary containment for above ground storage and handling of flammable fuel liquids.

.4 The runoff and sediment control structures are comprised of:

.a Collection ditches; and

.b Monitoring pond stations.

1.5 Dimensional Tolerances

.1 All excavation and backfilling activities shall be completed to within 50 mm vertically and 100 mm horizontally of specified lines and grades unless otherwise approved by the Owner's Representative. Fill placement and/or removal to meet these tolerances to the lines and limits shown on the Drawings, shall be performed by the Contractor at no additional cost to the Owner.

.2 Slopes shall not be steeper than those shown on the Drawings unless otherwise approved by the Owner's Representative.

.3 Temporary mineral soil excavation and fill slopes shall not be steeper than two horizontal to one vertical (2H:1V) unless otherwise approved by the Owner's Representative.

.4 Temporary bedrock excavation slopes shall not be steeper than one tenth horizontal to one vertical (0.1H:1V) unless otherwise approved by the Owner's Representative.

2.0 CARE OF WATER

.1 The working and finished surfaces of the fuel tank farm shall be sloped to provide positive drainage towards the perimeter at all times during placement of fill materials.

.2 Surface runoff water will be directed by way of sloped surfaces to ditches, and collected in Monitoring Pond(s) for visual monitoring for suspended solids prior to discharge to the natural drainage system.

.3 If sediments are observed in discharge during construction activities, corrective action will be immediately taken to mitigate sediment transport, with the objective of having clear discharge water. This could require adding greater capacity to the Monitoring Pond(s), or installation of silt fencing or other measures to reduce the concentration of suspended solids.

3.0 SALVAGE AND STOCKPILE ORGANIC MATERIALS

3.1 Products

.1 “Organic Materials” are the naturally occurring organic rich, A-Horizon soils found at ground surface and may include topsoil and/or fibrous peat.

3.2 Execution

.1 Salvage Organic Materials by excavation and loading for transport from Work Site area(s) designated by the Owner’s Representative.

.2 Excavation of Organic Materials may require the use of drilling, blasting, ripping and or other approved techniques to prepare the Organic Materials for salvaging.

.3 Organic Materials encountered within the Work Site areas of less than 0.1 m measured thickness are considered impractical to salvage and may be incorporated as part of the common excavation.

.4 Haul and stockpile Organic Materials in area(s) designated by the Owner’s Representative.

.5 Shape stockpile(s) of Organic Materials to smooth, uniform surface with side slopes not steeper than three horizontal to one vertical (3H:1V).

4.0 FOUNDATION PREPARATION

4.1 Products

.1 “Unsuitable Materials” include topsoil, organic soils, vegetation, boulders, etc. to a depth or in a location that will impede the removal of the competent materials.

Unsuitable Material may be frozen in situ depending on time of year and/or ground ice conditions. Within the foundation preparation limits of secondary containment area including the AGST and containment berms, Unsuitable Materials may include Mineral Soil that has a high silt, clay and/or ice content.

.2 "Competent Materials" may include Mineral Soil overburden material, Existing Fill Material and the underlying Bedrock formation as defined in Section 5.

.3 "Existing Fill Materials" include existing granular pads and stockpiles. The materials underlying Existing Fill Materials are not known and will be the subject of investigation by the Contractor as directed by the Owner's Representative. Existing Fills are not expected to be encountered at the Meadowbank site during construction in 2006.

.4 Determination of Unsuitable Materials and Competent Materials will be at the discretion of the Owner's Representative, as recommended by the Geotechnical Engineer. The Contractor may be required to assist during the determination by performing such work as proof rolling, test pit excavation and the like as directed by the Owner's Representative.

4.2 Execution

.1 The tank foundation will be constructed on the underlying intact unweathered bedrock surface. The Contractor is responsible for the excavation and removal of all materials within the Work Area to the depths and approved subgrade surface as defined by the layout information and details shown on the Drawings.

.2 Salvage and Stockpile Organic Materials, as outlined in Section 3, to be performed.

.3 Remove Unsuitable Materials in areas indicated by the Owner's Representative and to the limits of Competent Materials.

.4 In areas where Unsuitable Materials within the limits of the Work are encountered, the Contractor may be requested to advance test pit excavations as directed by the Owner's Representative to delineate the extent of the deposits. The materials encountered will be inspected by the Geotechnical Engineer. A determination of Competent Materials of the excavated and underlying materials shall be made by the Owner's Representative using recommendations provided by the Geotechnical Engineer.

.5 The Contractor shall allow the Geotechnical Engineer to review the prepared foundation to evaluate conformance to the Specifications. Acceptance of foundation preparation shall be performed by the Owner's Representative using recommendations provided by the Geotechnical Engineer.

.6 Stockpile excavated material which is considered by the Owner's Representative suitable for reuse as Fill Material (as defined in Section 5) at a location directed by the Owner's Representative.

.7 Stockpile excavated material which is considered by the Owner's Representative unsuitable for fuel tank farm construction at a location directed by the Owner's Representative.

5.0 BULK EXCAVATION

5.1 Products

.1 "Mineral Soil" is the near surface layer of earth materials generally composed of till-like soil, including but not limited to varying proportions of sand, gravel, silt, clay cobbles and boulders. Thawed Mineral Soil materials are normally suitable for mechanical excavation. Frozen Mineral Soil materials may require the use of drilling, blasting, ripping and or other approved techniques to prepare the Mineral Soil materials for excavation.

.2 "Bedrock" is the underlying rock formation comprising frost-shattered weathered Bedrock and/or intact unweathered Bedrock that will require the use of drilling, blasting, ripping and/or other approved techniques to prepare the Bedrock materials for excavation.

5.2 Execution

.1 Salvage and Stockpile Organic Materials, as outlined in Section 3, to be performed.

.2 Drill, blast, excavate and remove bulk excavation materials to the depths and approved subgrade surface as defined by the layout information and details shown on the Drawings. Excavation of Mineral Soil and Bedrock are expected.

.3 Haul, stockpile and/or place the bulk excavation materials according to the technical specifications defined in Section 6 or stockpile Mineral Soil and Bedrock in area(s) designated by the Owner's Representative.

.4 Prepare Mineral Soil and or Bedrock subgrade to uniformly graded surfaces intended to minimize ponding of water within the Area of Work as defined on the Drawings and to the satisfaction of the Owner's Representative.

.5 Where frozen soils are encountered, they shall be excavated using methods that conform to all applicable laws and regulations and to proven safe practices. The proposed method shall be submitted to the Engineer in writing for review and approval at least two weeks prior to beginning such excavation.

.6 Where blasting is required, all operations in connection with transporting, storage and use of explosives shall be subject to the rules and regulations of governing authorities. Perform blasting using experienced and licensed personnel. Obtain prior approval of the Owner for blasting operations.

.7 The Contractor is responsible for preparation and submission of a "Safe Work Procedure for Drilling and Blasting" to be submitted to the Owner's Representative in writing for review and approval at least two weeks prior to beginning such activity. The Contractor shall apply adequate care and precaution to prevent over-break and uncontrolled damage from blasting activities. "Fly Rock" conditions are not acceptable.

.8 Final cut slopes in Mineral Soil shall be trimmed no steeper than three Horizontal to one Vertical (3H:1V). Cut slopes in areas of peat or any soft or weak soil(s) may require flatter slopes, as determined by the Engineer.

.9 Final cut slopes in bedrock shall be no steeper than one-tenth Horizontal to one Vertical (0.1H:1V). Flatter slopes may be required for environmental or other reasons defined by the Owner.

6.0 BACKFILL MATERIALS

6.1 General

.1 Four structural fill types shall be used to construct the fuel tank farm as follows:

.a Type 1 Fill – Minus 19 mm Crushed Granular Base;

.b Type 2 Fill – Minus 75 mm Select Granular Sub-Base;

.c Type 3 Fill – Minus 150 mm Select Native Material; and

.d Type 4 Fill – Minus 9.5 mm Granular Bedding Material.

6.2 Type 1 Fill - Minus 19 mm Crushed Granular Base

.1 Type 1 Fill shall consist of crushed sand and gravel particles of hard, durable rock, and meet the gradation specification in Table 6.1.

.2 Type 1 Fill shall have a minimum CBR value of eighty (80).

.3 Type 1 Fill shall be placed with a moisture content within 2% of the optimum moisture content, as determined by the Engineer.

Table 6.1: Type 1 Fill Gradation Specification

Sieve Designation	Per cent by Weight Passing
19 mm	100%
12.5 mm	75 – 100%
9.5 mm	60 – 90%
4.75 mm	40 – 70%
2.36 mm	27 – 55%
0.850 mm	10 – 35%
0.300 mm	5 – 20%
0.075 mm	0 – 5%

6.3 Type 2 Fill – Minus 75 mm Select Granular Sub-Base

.1 Type 2 Fill shall consist of select native granular mineral soil, imported granular borrow and/or quarried rock fill materials excavated from cut areas or local borrow areas. The maximum particle diameter shall be 75 mm, and meet the gradation specification in Table 6.2.

Table 6.2: Type 2 Fill Gradation Specification

Sieve Designation	Per cent by Weight Passing
75 mm	100%
50 mm	70 – 100%
25 mm	50 – 100%
4.75 mm	25 – 100%
2.00 mm	10 – 80%
0.075 mm	0 – 5%

.2 Care shall be taken to place the Type 2 Fill material within 2% of the optimum moisture content. If frozen material is worked until thawed, special attention must be given to observing the moisture content.

6.4 Type 3 Fill – Minus 150 mm Select Native Material

.1 Type 3 Fill shall consist of select native mineral soil, bedrock and/or quarried rock fill materials excavated from cut areas or local borrow areas. The maximum particle diameter shall be 150 mm, and meet the gradation specification in Table 6.3.

Table 6.3: Type 3 Fill Gradation Specification

Sieve Designation	Per cent by Weight Passing
150 mm	100%
90 mm	50 – 85%
60 mm	25 – 40%
20 mm	0 – 10%

.2 Care shall be taken to place the Type 3 material within approximately 4% of the optimum moisture content. If frozen material is worked until thawed, special attention must be given to observing the moisture content. Material that is visibly too wet, as determined by the Engineer, shall not be incorporated into the fuel tank farm containment berm fills, and shall be placed in a designated stockpile area.

6.5 Type 4 Fill – Minus 9.5 mm Granular Bedding Material

.1 Type 4 Fill shall consist of crushed or screened sand and gravel particles from quarried rock fill and/or local borrow areas. The maximum particle diameter shall be 9.5 mm and meet the gradation specification in Table 6.4.

Table 6.4: Type 4 Fill Gradation Specification

Sieve Designation	Per cent by Weight Passing
9.5 mm	100%
4.75 mm	45 – 70%
1.25 mm	20 – 45%
0.315 mm	9 – 22%
0.160 mm	5 – 15%
0.075 mm	0 – 10%

6.6 Oversize Particles

.1 Oversize particles are considered to be cobble and/or rock fragments with a diameter greater than 150 mm. Where oversize particles are encountered, the particles shall be selectively removed from the Type 3 Fill materials prior to compaction unless otherwise defined by the Engineer.

.2 Oversize particles may be incorporated in the crushing production of Type 1 Fill, Type 2 Fill and/or Type 4 Fill, or salvaged and stockpiled in a designated locations approved by the Owner's Representative.

6.7 Placement and Compaction

.1 Backfill materials including quarried rock fill and granular fill materials, should be placed in loose lifts not exceeding 150 mm in thickness, unless otherwise noted and all backfill materials should be moisture conditioned prior to compaction. Water should be added to adjust the in situ moisture content to within the prescribed amount of the optimum moisture content, as determined by the Proctor density – moisture relationship.

.2 Backfill materials should be placed so as to minimize disturbance of the subgrade.

.3 Compaction of Type 1 Fill and Type 2 Fill materials shall be obtained using a 3.5-tonne smooth-drum vibratory compactor. The compactor shall maintain a minimum 0.2 m overlap between passes. Carry out rolling over large surfaces and execute turns carefully to obtain uniform compaction.

.4 Compaction of Type 3 Fill material shall be obtained using the smooth drum vibrator roller and/or loaded haul trucks. The trucks shall take care to traffic over the entire working surface of each lift. Where required, the Engineer shall indicate where additional compaction traffic is required.

.5 Compaction of Type 4 Fill material shall be obtained using a smooth drum vibrator roller or plate tamper unless otherwise directed by the Engineer.

.6 Place and compact fill materials in horizontal lifts beginning in the lowest area of the foundations unless specified otherwise.

.7 All lifts must pass density and gradation requirements prior to placement of subsequent lift.

.8 All lifts shall be uniformly compacted using a smooth drum 3.5 tonne vibratory roller to the following in situ density:

.a Type 1 Fill: Granular base should be compacted to 100 per cent of the standard Proctor maximum dry density, as determined by ASTM Test Method D698-70.

.b Type 2 Fill: Select granular sub-base should be compacted to 98 per cent of the standard Proctor maximum dry density, as determined by ASTM Test Method D698-70.

.c Type 3 Fill: Select native material should be compacted to at least 95 per cent of the standard Proctor maximum dry density, as determined by ASTM Test Method D698-70. Alternatively, by an approved method specification such as a minimum of 6 complete passes of a smooth drum 3.5 tonne vibratory roller, or equivalent to be determined in the field and approved by the Engineer.

.d Type 4 Fill: Granular bedding material should be compacted by a minimum of 6 complete passes of a smooth drum 3.5 tonne vibratory roller, or equivalent, unless otherwise defined by the Engineer.

.9 For each fill type, a Method Compaction Technique test fill will be completed on site to determine the number of compactor passes required to meet placed fill density specifications and confirm the maximum lift thicknesses.

.10 Test fills used for determining specifics of the method compaction technique, to the extent possible, will employ the compaction equipment and simulate placement methods proposed.

.11 Wherever possible, the degree of compaction shall be evaluated by nuclear densometer testing.

.12 The fill surfaces should be sloped to provide positive drainage to the site perimeter. Perimeter ditches may be required to control surface water runoff from this area by directing the runoff to a designated sump location(s) for monitoring prior to treatment and discharging to the environment.

7.0 FUEL TANK FARM CONSTRUCTION

7.1 Scope of Work

.1 This section specifies the requirements for the construction of the Fuel Tank Farm conforming to the lines, grades and dimensions as shown on the Drawings, or as otherwise established by the Owner's Representative.

.2 Upon completion of the bulk excavation activities as defined in Section 5, the Contractor shall proceed to construct the Fuel Tank Farm using approved Backfill Materials as defined in Section 6 and Manufactured Products as defined in Section 8 to the lines and grades shown on the Drawings.

.3 The Contractor shall proceed to construct the Fuel Tank Farm in a sequence of construction steps, unless otherwise approved by the Owner's Representative, as follows:

.a Tank Foundation area to AGST Sole Plate elevation;

.b Tank Fabrication (possibly by others);

.c Secondary containment area; and

.d Dispensing Station.

.4 The Contractor shall submit a "Work Plan" and "Construction Schedule" at least two weeks in advance of commencing Fuel Tank Farm Construction for review and approval by the Owner's Representative.

.5 The Contractor shall protect all aspects of work completed during each step of construction as activities proceed with subsequent steps of construction, including but not limited to the insitu quality and density of all constructed Backfill Materials and integrity of all constructed Manufactured Products.

.6 The Contractor is responsible for repairs and/or replacement of any Backfill Materials and/or Manufactured Products that may be damaged as a result of the construction activities to the satisfaction of the Owner's Representative and at no additional cost to the Owner.

7.2 Products

.1 "Mineral Soil" as defined in Section 5.

.2 "Bedrock" as defined in Section 5.

.3 "Fill Material" is non-frozen, excavated Mineral Soil, Bedrock, processed material and/or other approved imported fill material that is suitable for use in the fuel tank farm construction (Type 1 Fill, Type 2 Fill and Type 3 Fill are expected, as defined in Section 6).

.4 Fill Materials will be approved by the Owner's Representative, using recommendations provided by the Geotechnical Engineer, prior to usage by the Contractor.

.5 "Manufactured Products" as defined in Section 8.

7.3 Execution

.1 The fuel tank farm tank foundation, containment berms and dispensing station shall be constructed to the lines, grades and cross-sections shown on the Drawings.

.2 Salvage and Stockpile Organic Materials, as outlined in Section 3, to be performed.

.3 Foundation Preparation, as outlined in Section 4, to be performed. No Fill Materials to be placed on prepared foundation surface without approval from the Engineer.

.4 Native Fill materials for construction of the fuel tank farm containment berms and dispensing station will be obtained preferentially from areas of cut. In the event that insufficient quantities of bulk excavation materials are available, local borrow areas may be developed, as approved by the Engineer.

.5 All fuel tank farm tank foundation, containment berms and dispensing station fills shall be placed and compacted in dry conditions at temperatures above 0°C. Processed granular materials may be placed at temperatures below 0°C, at the discretion of the Engineer.

.6 The minimum insitu compacted thickness of Fill Material placed at any fill areas shall consist of 150 mm for all fill materials.

.7 Unless otherwise defined, Oversize Particles shall be removed from all fill materials. Where reduced lift thicknesses are required, particles larger than two-thirds (2/3) of the reduced lift thickness shall be removed prior to compaction. Requirements for reduced lift thicknesses shall be determined by the Owner's Representative.

.8 In areas where the total thickness of fuel tank farm containment berms and/or dispensing station fill is greater than two metres, Oversize Particles to a maximum diameter of 300 mm may be considered in the Type 3 Fill material at the discretion of the Engineer. The topmost lift of the oversize Type 3 Fill material shall be of a noticeably finer gradation, as directed by the Engineer, in order to transition to the Type 3 Fill Material.

.9 Oversize Particles (minus 300mm diameter) may be considered for placement at the base of deep fills for the fuel tank farm containment berms and/or dispensing station fill where the total fill thickness is greater than 2 metres, subject to approval by the Owners Representative. Oversize Particles shall be 'scalped off' by blading the particles off the fill grade with a bulldozer and pushing ahead of the fill into the advancing toe of the fill.

.10 All Fill Materials used for construction of the fuel tank farm tank foundation, containment berms and dispensing station shall comprise unfrozen materials, within the specified limits for particle size and moisture content.

.11 Hauling and spreading equipment shall be routed approximately parallel to the axis of the fuel tank farm tank foundation, containment berms and dispensing station, and the traffic patterns shall be varied to prevent rutting. Any damage to the Fill Materials already placed shall be repaired to the satisfaction of the Owner's Representative prior to the placement of the next lift. This may include, but shall not be limited to, the removal of ruts and repairs to fill boundaries.

.12 Haul trucks should not follow existing tracks. If, however, rutting occurs, scarify and re-compact to produce an even surface. Develop a traffic pattern to achieve required densities to the satisfaction of the Owner's Representative.

.13 Haul to designated fill placement area(s) within fuel tank farm footprint area.

.14 Adjacent lifts shall have a maximum elevation difference of one compacted lift thickness.

.15 During dumping and spreading activities, remove any waste materials such as, but not limited to, debris, organics, vegetation or any other unsuitable material if such material has been transported into the working areas.

.16 Spread Fill Materials in even, horizontal lifts, of which the maximum loose lift thickness will be specified by the Owner's Representative based on the results of field compaction tests. The maximum loose lift thickness is expected to be in the order of 200 mm for suitable Fill Materials.

.17 Compaction shall be performed using the smooth drum vibratory 3.5 tonne compactor and full-loaded haul trucks or equivalent.

.18 During compaction of all Fill Materials, the placement water content of the Fill Material shall be adjusted to within the prescribed amount (by weight) of the optimum water content.

.19 Fill Materials shall be compacted to the minimum density conditions noted in Section 6. The compaction requirements shall be confirmed in the field as recommended by the Geotechnical Engineer. The resulting compaction achieved will be to the satisfaction of the Owner's Representative. The Contractor shall cooperate with the Geotechnical Engineer and the Owner's Representative to develop the performance-based requirement.

.20 Water shall not be permitted to pond on surface. Ponded water shall be removed from the fill.

.21 Any Fill Material which has become saturated, softened, loosened or has undergone a reduction in density by precipitation, ponded water, construction traffic or frost action is to be excavated and replaced with suitable material. The Geotechnical Engineer shall identify areas in which material should be removed. This work shall be performed to the satisfaction of the Owner's Representative. The excavated material may be dried and/or thawed and used for fill upon approval from the Owner's Representative.

.22 Shape the fuel tank farm tank foundation, containment berms and dispensing station fills to a dense, uniform surface free of ruts or loose material at a slope sufficient to promote free drainage of surface water at all times.

.23 Slope fuel tank farm tank foundation, containment berms and dispensing station surfaces to be plane and uniform and to the lines and grades shown on the Drawings. This will require the placement and compaction of Fill Material beyond the lines and grades shown on the Drawings followed by trimming to the said lines and grades.

.24 Before suspension of operations each day or before inclement weather, the Fill Materials in place shall be compacted and the surface rolled smooth and crowned to facilitate free drainage of precipitation.

.25 Where possible, Fill Material placed in the fuel tank farm tank foundation, containment berms and dispensing station shall be free from lenses, pockets or layers of materials which are significantly different in gradation from the surrounding material. The Contractor shall employ methods to limit the amount and limits of segregated materials. The Contractor shall work with the Geotechnical Engineer to develop such methods which may include, but not be limited to, the placement of parallel strips of Fill Material within a given lift and/or material blending. The Geotechnical Engineer shall provide recommendations to the Owner's Representative as to the acceptability of the results of the placed materials. Fill Material shall be placed to the satisfaction of the Owner's Representative.

8.0 HDPE LINER CONSTRUCTION

8.1 Scope of Work

.1 This section specifies the requirements for construction of the High Density Polyethylene (HDPE) Liner conforming to the lines, grades and dimensions as shown on the Drawings, or as otherwise established by the Owner's Representative.

.2 The Contractor shall supply all materials, labour and equipment to construct the HDPE Liner according to the details shown on the Drawings, or as otherwise established by the Owner's Representative.

.3 The HDPE Liner is considered a compatible material for this application. Never the less, the Contractor is required to provide adequate care and protection of the liner system during and upon completion of the HDPE Liner installation and overall Fuel Tank Farm construction.

.4 As indicated on the Drawings, the Fuel Tank Farm and Dispensing Station areas are underlain by an HDPE Liner to contain potential future liquid fuel spills. Upon successful installation of the HDPE Liner, the liner integrity is protected above and below the material surface by sequential layers of Geotextile and granular bedding material (Type 4 Fill). The Contractor is responsible for providing adequate care and protection of the HDPE Liner during construction of all materials above, below, adjacent or near to the HDPE Liner.

.5 Upon completion of each appropriate construction step as defined in Section 7, the Contractor shall proceed to construct the HDPE Liner in the fuel tank farm tank foundation, containment berms and dispensing station Work Areas using approved Backfill Materials as defined in Section 6 and Manufactured Products as defined in Section 8 to the lines and grades shown on the Drawings.

.6 The Contractor shall protect all aspects of work completed during each step of construction as activities proceed with subsequent steps of construction, including but not limited to the insitu quality and density of all constructed Backfill Materials and integrity of all constructed Manufactured Products.

.7 The Contractor is responsible for repairs and/or replacement of any Backfill Materials and/or Manufactured Products that may be damaged as a result of the construction activities to the satisfaction of the Owner's Representative and at no additional cost to the Owner.

8.2 Products

.1 "Backfill Materials" as defined in Section 6.

.2 "Manufactured Products" listed as follows:

.a "HDPE Liner" as defined below;

.b "Geotextile" as defined below; and

.c "Secondary Containment Sump" as defined below.

8.3 Manufactured Material Properties

8.2.1 HDPE Liner

.1 Contractor shall furnish HDPE Liner whose material properties meet or exceed the requirements of these Specifications.

.2 The specific material properties for HDPE Liner or its equivalent as listed in the table below shall be met. The Contractor shall provide Manufacturer's test results for these properties as well as certification that the materials meet these Specifications.

Property Specifications for High Density Polyethylene (HDPE 60):

Style	ASTM	Qualifier	Unit	Specified Value	Minimum Test Frequency
Average Thickness	D5994	minimum	mm	1.5	1 per 50,000 kg
Density (Untextured)	D792	minimum		0.94	1 per 50,000 kg
Tensile Strength	D638	minimum	kN/m	23.1	1 per 4,000 m^2
Tear Resistance	D1004	minimum	N	200	1 per 4,000 m^2
Low Temperature	D746	minimum	°C	-60	1 per 4,000 m^2
Dimension Stability	D1204	maximum	%	+/- 1.5	1 per 4,000 m^2
Notched Constant Load	D5397	minimum	hours	200	1 per 4,000 m^2
Puncture Resistance	2065	minimum	N	347	1 per 4,000 m^2
Carbon Black Content	D1603	minimum	%	2.0	1 per 4,000 m^2

8.2.2 Geotextile

.1 Contractor shall furnish a Geotextile whose material properties meet or exceed the requirements of these Specifications.

.2 The specific Geotextile material properties for GSE Nonwoven Geotextile NW8 or its equivalent as listed in the table below shall be met. The Contractor shall provide Manufacturer's test results for these properties as well as certification that the materials meet these Specifications.

Property Specifications for Geotextile:

Material Property	Qualifier	Unit	Specified Value	Test Method	Minimum Test Frequency
Mass / Unit Area	minimum	g/m	270	ASTM D5261	1 per 10,000 m^2
Grab Tensile Strength	minimum	N	975	ASTM D4632	1 per 10,000 m^2
Grab Elongation	minimum	%	50	ASTM D4632	1 per 10,000 m^2
Puncture Strength	minimum	N	525	ASTM D4833	1 per 10,000 m^2
Apparent Opening Size	maximum	mm	0.180	ASTM D4751	1 per 60,000 m^2
Permeability	minimum	cm/sec	0.30	ASTM D4491	1 per 60,000 m^2
Water Flow Rate	minimum	L/min/m^2	4,480	ASTM D4491	1 per 60,000 m^2
UV Resistance	minimum	%	70	ASTM D355	1 per 60,000 m^2

8.2.3 Secondary Containment Sump

.1 Contractor shall furnish a Secondary Containment Sump for each Secondary Containment area whose material properties meet or exceed the requirements of these Specifications.

.2 Each Secondary Containment Sump as defined on the Drawings shall comprise the following material components, or suitable equivalent:

.d A galvanized corrugated steel pipe (CSP) of nominal size 1,000 mm diameter by 500 mm long;

.e A galvanized bottom screen base plate comprising expanded wire mesh with a nominal mesh opening of 6 mm and at least 1,000 mm diameter to be welded to the base of the corrugated steep pipe sump; and

.f A reinforced galvanized top screen cover plate complete with lifting handles, comprising expanded wire mesh (nominal mesh opening of 6 mm) and at least 1,100 mm diameter complete with a galvanized metal rim strip (nominal 25 mm wide by 6 mm thick) welded perpendicular to the circumference of the cover plate, for placement over the top of the corrugated steep pipe sump and secured to the sump.

.3 The Contractor shall prepare and submit a fabrication shop drawing of the Secondary Containment Sump signed and sealed by a Registered Engineer in Nunavut for approval by the Owner's Representative.

8.4 Manufacturing Quality Control

.1 Quality Control testing shall be carried out by the Manufacturer to demonstrate that the product meets this Specification. Additional testing may be requested by the Geotechnical Engineer to be carried out for purposes of conformance by the Owner's Representative and will be paid for by the Owner. If the results of the Manufacturer's and the Owner's Representative's testing differ, the testing shall be repeated by the Owner's Representative, and the Manufacturer shall be allowed to monitor this testing. The results of this latter series of tests will prevail, provided that the applicable test methods have been followed.

.2 Prior to shipment, the Contractor shall provide the Owner's Representative with a Quality Control Certificate for each roll of manufactured material provided. The Quality Control Certificate shall be signed by a responsible party employed by the Manufacturer, such as the production manager. The Quality Control Certificate shall include:

.a Roll numbers and identification;

.b Sampling procedures and results of Quality Control tests; as a minimum, results shall be given for material properties which may include but not limited to thickness, tensile strength, tear resistance, and puncture resistance, and evaluated in accordance with the methods indicated in the Specifications or equivalent methods acceptable to the Owner's Representative.

8.5 Transportation, Handling and Storage

.1 Transportation of the Manufactured Products is the responsibility of the Manufacturer and Contractor. All handling on-site is the responsibility of the Contractor.

.2 The Contractor shall ensure the handling equipment used on the site is adequate and does not pose any risk of damage to the Manufactured Products.

.3 Upon delivery at the site, the Contractor and the Owner's Representative shall conduct a surface observation of all rolls, factory panels or sump items for defects and for damage. This inspection shall be conducted without unrolling rolls or unfolding factory panels unless defects or damages are found or suspected.

.4 The Owner's Representative may:

.c Identify rolls, factory panels, screens, lengths of pipe or portions thereof, which should be rejected and removed from the site because they have severe flaws;

.d Identify rolls, factory panels, screens, lengths of pipe or portions thereof which include minor repairable flaws.

.5 The Contractor shall be responsible for the storage of the Manufactured Products on site. The Owner shall provide storage space in a location (or several locations) such that on-site transportation and handling are optimized if possible. Storage space shall be protected by the Contractor from theft, vandalism, passage of vehicles, etc.

.6 The Contractor shall ensure that storage of the Manufactured Products provides adequate protection against UV exposure, dirt, shock, and other sources of damage.

8.6 Quality of Workmanship

.1 Any damage to the Manufactured Products due to penetration by foreign objects or distress from rough subgrade shall be corrected and suitably repaired to the satisfaction of the Owner's Representative.

.2 The Contractor shall submit to the Owner's Representative a written certification indicating that the Manufactured Products were installed in an acceptable manner as per the Manufacturer's instruction. The Manufacturer is not directly responsible for the quality of the work involved; such responsibility will be solely that of the Contractor.

8.7 Execution

.1 All work shall be done in strict accordance with the Drawings, these Specifications and the Manufacturer's recommendations.

.2 Sufficient HDPE Liner and Geotextile materials shall be furnished to cover all lined areas approved by the Owner's Representative for covering as shown on the Drawings including overlaps at field seams and anchor zones.

.3 It is the intent of these Specifications to ensure a quality finished product. It shall be the responsibility of the Contractor to ensure that this requirement is met.

8.8 Subgrade Preparation

.1 Liner installation shall not begin until a proper base has been adequately prepared to accept the liner system. Base material shall be free from massive ice, angular rocks, roots, grass and vegetation. Foreign materials and protrusions shall be removed, and all cracks and voids shall be filled and the surface made level or uniformly sloping to the lines and grades shown on the Drawings.

.2 There shall be no standing water or saturated areas of the subgrade that could diminish the quality of the liner placement prior to backfilling.

.3 The prepared subgrade surface shall be inspected by the Geotechnical Engineer. Approval for placement of the liner installation shall be given to the Contractor by the Owner's Representative.

.4 The approved subgrade surface for the Liner shall be maintained in a firm, clean, dry and smooth condition during liner installation.

8.9 HDPE Liner Installation

.1 For simplification of these specifications in all areas that require installation of an HDPE Liner as detailed on the Drawings, unless otherwise defined by the Manufacturer or Owner's Representative, the HDPE Liner construction sequence is defined to include a five layer liner system, from bottom to top as follows:

.a A compacted granular bedding layer of Type 4 Fill;

.b A cushioning layer of Geotextile below the HDPE Liner;

.c A layer of HDPE Liner;

.d A cushioning layer of Geotextile above the HDPE Liner; and

.e A nominally compacted granular bedding layer of Type 4 Fill.

.2 The prepared subgrade surfaces will be inspected for placement of the HDPE Liner by the Geotechnical Engineer and approved by the Owner's Representative based on observed subgrade conditions.

.3 The HDPE Liner shall be placed over the prepared subgrade surface in a manner which minimizes handling. Anchor zone excavation shall be completed before HDPE Liner installation begins.

.4 All HDPE Liner panels shall be positioned in the field and heat seamed in accordance with the Manufacturer's recommendations.

.5 The HDPE Liner shall underlay the containment areas for the Fuel Tank Farm and Dispensing Station as shown on the Drawings.

.6 Upon successful installation, field testing and approval, the HDPE Liner will be covered by the appropriate Geotextile layer and granular surface layers as detailed on the Drawings.

.7 The soil cover must be placed in a manner that prevents the soil from displacing the GCL or entering the panel overlap.

.8 The HDPE Liner panels shall be placed in such a manner as to minimize seams. Horizontal seams shall not be permitted on slopes.

.9 The HDPE Liner shall not be installed in standing water or during rain. Seaming of the HDPE Liner shall not be carried out during rain or on sheet material with wet surfaces.

.10 In areas where wind is prevalent, HDPE Liner installation should be started at the upwind side of the project and proceed downwind. The leading edge of the HDPE Liner shall be secured at all times with sandbags or other means sufficient to hold the HDPE Liner down during high winds.

.11 Sandbags, cobbles, rubber tires or other suitable objects may be used as required to hold the HDPE Liner in position during installation. Materials, equipment, or other items dragged across the surface of the HDPE Liner or allowed to slide down slopes on the HDPE Liner shall be minimized.

.12 The HDPE Liner shall be installed in a relaxed condition and shall be free of tension or stress upon completion of the installation. Stretching of the HDPE Liner to fit will not be permitted. The HDPE Liner shall be pulled taut to smooth out creases or irregularities in each panel or as directed by the Manufacturer's recommendations.

.13 Sufficient slack shall be incorporated in the HDPE Liner to allow for thermal contraction.

8.10 Field Testing

.1 The Contractor shall conduct adequate field and/or laboratory testing to demonstrate that the HDPE Liner has been installed and constructed according to these specifications and to the satisfaction of the Owner's Representative.

.2 The Contractor shall submit a certified copy of the test results to the Owner's Representative.

.3 The Contract shall repair and/or replace those portions of the HDPE Liner that do not meet specification and retest the installation to the satisfaction of the Owner's Representative and at no additional cost to the Owner.

.4 The HDPE Liner shall be subject to inspection by the Geotechnical Engineer to check conformity with the specified requirements. Approval by the Owner's Representative as to the acceptability will not be given until the HDPE Liner is adequately installed and the work and materials are in accordance with the Specifications.

9.0 RUNOFF AND SEDIMENT CONTROL DITCHES AND MONITORING PONDS

9.1 Products

.1 "Rip Rap" is the quarried and or granular material used to armour the drainage ditch. It shall consist of clean, hard, durable, angular stones and shall be free of Organic, Mineral Soil and other Unsuitable Materials.

.2 Rip Rap shall conform to select Type 3 Fill gradation.

.3 Alternate Rip Rap gradations may be considered.

9.2 Ditches

.1 Ditches shall be constructed as required to:

.a Capture runoff from areas impacted by construction activities, and;

.b Promote drainage away from the as-constructed Fuel Tank Farm, in the longer term.

.2 The locations and sizes of the ditches will be determined in the field by the Engineer. In general, ditches will have a minimum cross-sectional area of 1.0 m^2 or greater and channel side slopes will not be steeper than 3 Horizontal to 1 Vertical (3H:1V).

.3 Ditches shall be graded at a minimum 0.5% slope, or as directed by the Engineer, toward the monitoring ponds.

9.3 Monitoring Pond

.1 Monitoring ponds shall be constructed to allow for sedimentation and visual observation of surface runoff water prior to discharge to the environment.

.2 For preliminary installation purposes, each monitoring pond shall 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.

.3 The exact location of the Monitoring Pond(s) will be determined by the Geotechnical Engineer during construction. The Monitoring Pond(s) shall be located at least 25 m away from settlement-sensitive structures.

.4 As part of the construction program, provision for at least one test pit to be excavated in each proposed pond area and geotechnically logged of the pond foundation conditions shall be carried out as input for final determination of each pond location. Monitoring ponds will not be placed over thick peat deposit(s).

.5 Each Monitoring Pond will be field fit during the course of construction, and will collect ditch flow at a common point. The Monitoring Pond(s) shall be of sufficient capacity to provide adequate residence time to the collected runoff for sedimentation to a degree so that discharge from each Monitoring Pond contains little to no visible sediment in surface water runoff from the Fuel Tank Farm.

.6 The details of erosion protection to minimize erosion and/or sedimentation will be determined during the course of construction.

.7 Where necessary, the Monitoring Pond(s) and the collection ditch inverts within at least 5 m of the entrance to each Monitoring Pond, shall be lined with a 150 mm thick layer of Rip Rap (select Type 3 Fill) material to minimize erosion and siltation of the underlying fine grained soil conditions.

.8 Ditches and Monitoring Ponds shall be constructed and commissioned prior to beginning construction activities.

.9 During the construction phase, monitoring will be limited to identifying suspended sediments in runoff discharge at the point of release from the Monitoring Pond(s).

.10 If sediments are observed in discharge flows, immediate action shall be taken to mitigate sediment concentration to a non-observable level, or the project permit levels.

9.4 Access

.1 Free, unrestricted access to the general open areas surrounding the developed site will not be available. Equipment movements and work operations shall be confined to the areas designated by the Owner's Representative.

9.5 Temporary Protection of Works

.1 If a section of fill is to be left for a period of time (e.g., overnight) before subsequent lifts are placed, or when rain is imminent, roll smooth the surface of the top lift in order to promote drainage of surface water. Before restart of the Work on this section, scarify and re-compact, as directed by the Owner's Representative.

9.6 Weather

.1 Do not place material when satisfactory work cannot be performed due to intense periods of inclement weather such as, rain, snow, extreme cold or any other unsatisfactory conditions.

10.0 SURVEY CONTROL

.1 Sufficient survey control shall be provided to:

.a Lay out the construction;

.b Measure as-constructed quantities;

.c Prepare as-built drawings;

.d Periodically verify the accuracy of the constructed works.

.2 Survey shall be provided as required by the Owner's Representative as part of the QA/QC control.

.3 In general, the constructed works shall be carried out within 50 mm vertically and 100 mm horizontally of the dimensions indicated on the Drawings. In the event that these tolerances are in conflict, the vertical tolerance shall prevail.

.4 Where stricter grade control is required, it shall be provided for at the discretion of the Owner's Representative.

END OF SECTION: SP-GAL-02

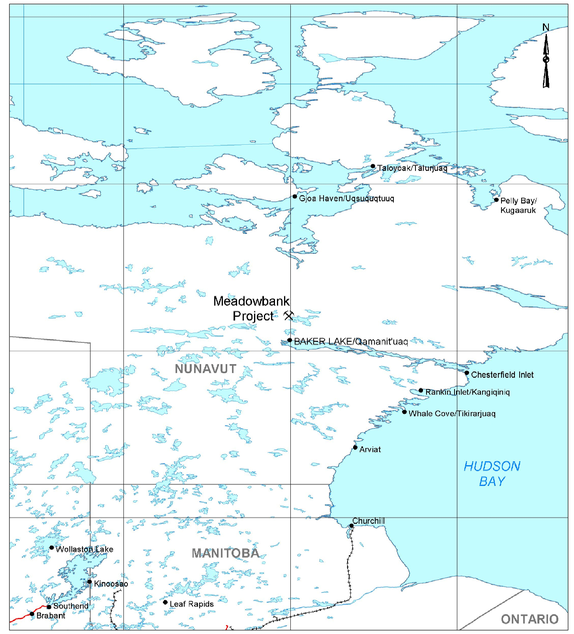
APPENDIX III

DRAWINGS

CUMBERLAND
RESOURCES LTD.
MEADOWBANK GOLD PROJECT
MEADOWBANK FUEL TANK FARM
ISSUED FOR CONSTRUCTION

INDEX TO DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
3000-C-200	TITLE SHEET MEADOWBANK FUEL TANK FARM	0
3000-C-201	GENERAL ARRANGEMENT PLAN MEADOWBANK FUEL TANK FARM	0
3000-C-202	FUEL STORAGE FACILITY LAYOUT PLAN MEADOWBANK FUEL TANK FARM	0
3000-C-203	TANK FARM EXCAVATION PLAN AND SECTIONS MEADOWBANK FUEL TANK FARM	0
3000-C-204	TANK FARM BACKFILL PLAN AND SECTIONS MEADOWBANK FUEL TANK FARM	0
3000-C-205	TANK FARM BACKFILL DETAILS MEADOWBANK FUEL TANK FARM	0
3000-C-206	SECONDARY CONTAINMENT HDPE LINER PLAN AND SUMP DETAILS MEADOWBANK FUEL TANK FARM	0
3000-C-207	DISPENSING STATION PLAN, PROFILE, AND DETAILS MEADOWBANK FUEL TANK FARM	0
3000-C-208	DISPENSING STATION SECTIONS AND DETAILS MEADOWBANK FUEL TANK FARM	0

LIST OF SPECIFICATIONS		
SPECIFICATION NO.	SPECIFICATION TITLE	REVISION NO.
SP-GAL-02-1	SCOPE OF WORK	0
SP-GAL-02-2	CARE OF WATER	0
SP-GAL-02-3	SALVAGE AND STOCKPILE ORGANIC MATERIALS	0
SP-GAL-02-4	FOUNDATION PREPARATION	0
SP-GAL-02-5	BULK EXCAVATION	0
SP-GAL-02-6	BACKFILL MATERIALS	0
SP-GAL-02-7	FUEL TANK FARM CONSTRUCTION	0
SP-GAL-02-8	HDPE LINER CONSTRUCTION	0
SP-GAL-02-9	RUNOFF AND SEDIMENT CONTROL DITCH AND MONITORING PONDS	0
SP-GAL-02-10	SURVEY CONTROL	0



KEY PLAN

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REV	D/M/Y	REVISION	DR	CHK	APP	APP	APP	APP
0	28APR06	–	CONSTRUCTION					
B	20APR06	–	FIRE MARSHALL INITIAL REVIEW					
A	07APR06	–	CLIENT REVIEW					

ISS	D/M/Y	APP	ISSUED FOR

REF	NUMBER	TITLE
–		

REFERENCES

STAMP/SEAL

APPROVED FOR CONSTRUCTION

– CLIENT PROJECT MGR. – ENGINEERING MGR. – PROJECT MGR.

PROJECT NO.	ACTIVITY NO.	PACKAGE CODE
–		

PROJECT PHASE

SCALE –

	BY	DD/MMM/YY
DSN.	WJP	28APR06
DRN.	JK/CJC	28APR06

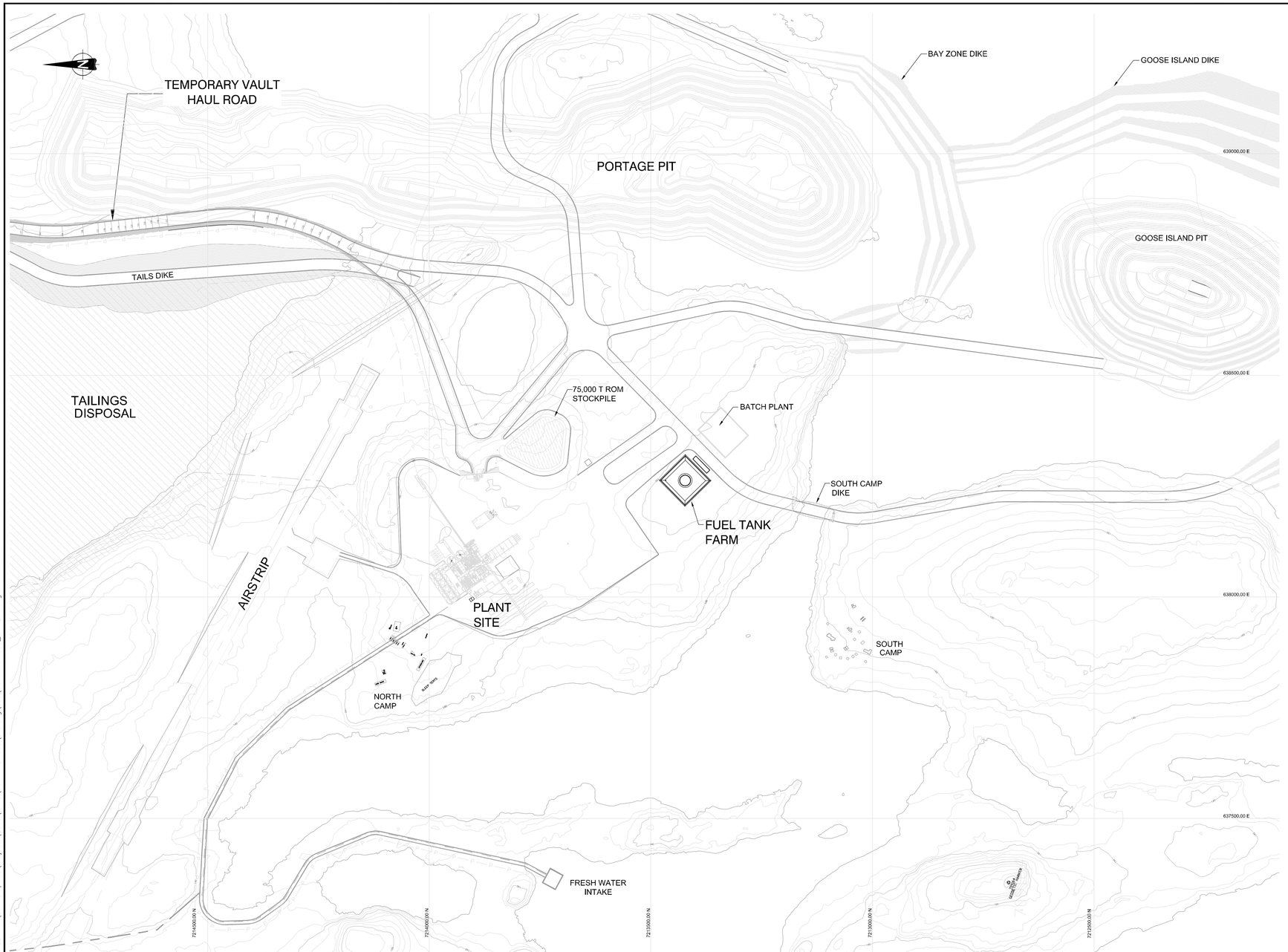
PROJECT
CUMBERLAND RESOURCES LTD.

TITLE
TITLE SHEET
MEADOWBANK FUEL TANK FARM

Golder Associates

PROJECT No.	FILE No.
06-1413-009	061413009_SK-200

DRAWING NO.	REV.
3000-C-200	0



PLAN

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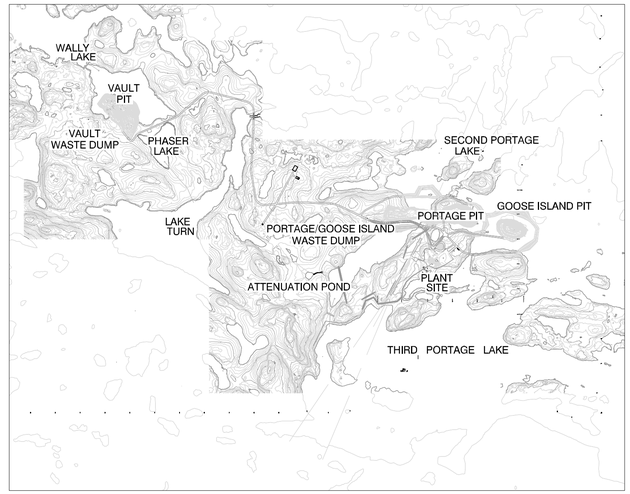
Scale in Meters



LOCATION MAP

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Scale in Meters

NOTES

1) NORTHING AND EASTING ARE IN METRES REFERENCED TO UTM ZONE 14, NAD83.
2) ELEVATIONS AND DIMENSIONS ARE IN METRES REFERENCED TO GEODETIC DATUM, UNLESS OTHERWISE NOTED.
3) THE WORK AREA CONCERNED ONLY WITH THE TANK FARM AND DISPENSING STATION FACILITY.

REFERENCE

1) BASE PLAN INFORMATION IS PROVIDED BY CUMBERLAND DATED FEBRUARY 03, 2006.

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REV	D/M/Y	REVISION	DR	CHK	CHK	APP	APP	APP	APP

ISS	D/M/Y	APP	ISSUED FOR
0	28APR06	–	CONSTRUCTION
B	20APR06	–	FOR FIRE MARSHALL INITIAL REVIEW
A	07APR06	–	CLIENT REVIEW

REF	NUMBER	TITLE
	–	

REFERENCES

STAMP/SEAL

APPROVED FOR CONSTRUCTION

CLIENT PROJECT MGR.	ENGINEERING MGR.	PROJECT MGR.
–	–	–

PROJECT NO.	ACTIVITY NO.	PACKAGE CODE
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PROJECT PHASE

SCALE: AS SHOWN

	BY	DD/MMM/YY
DSN.	WJP	28APR06
DRN.	JK/CJC	28APR06

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

GENERAL ARRANGEMENT PLAN MEADOWBANK FUEL TANK FARM

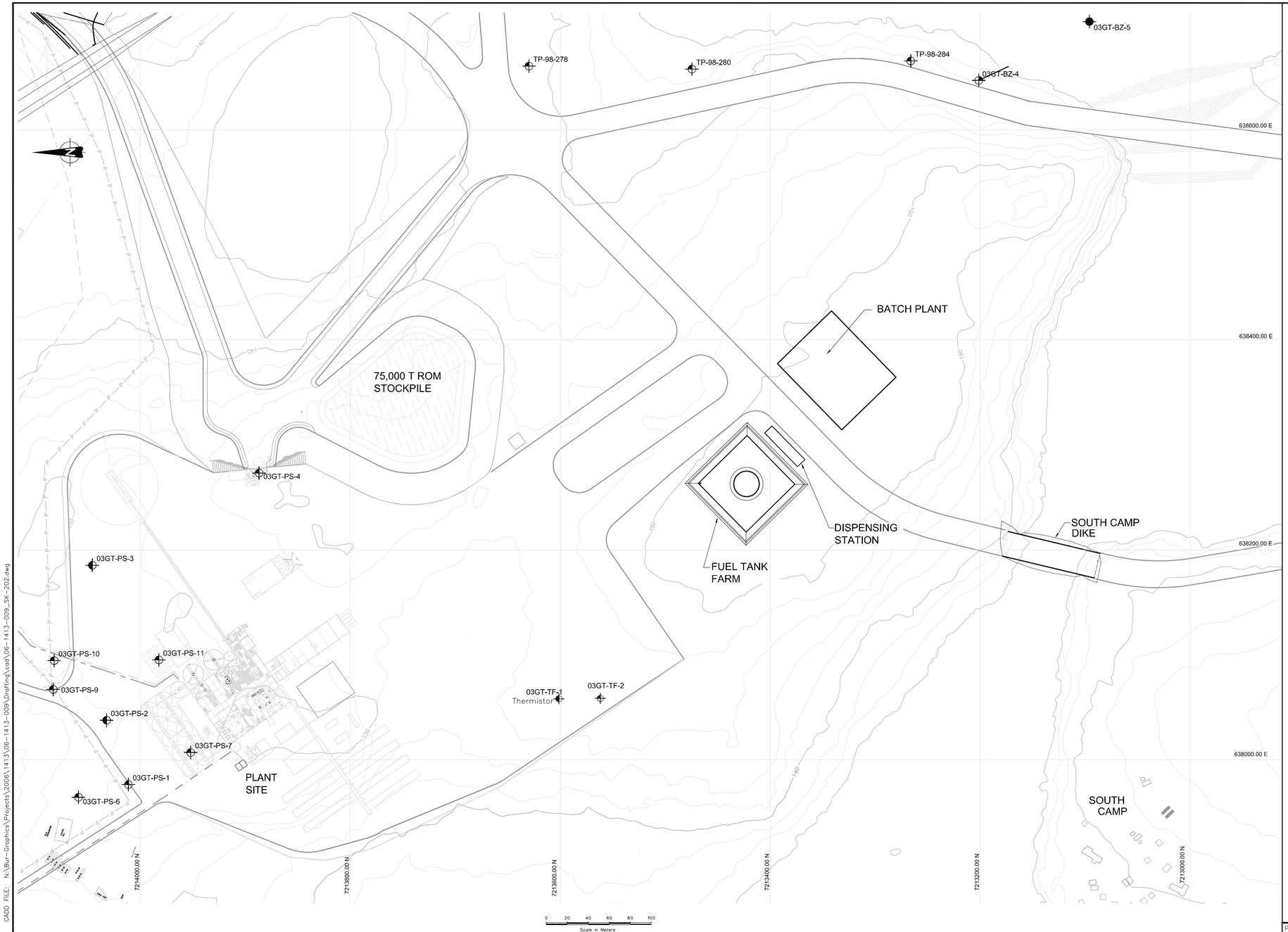
Golder Associates

PROJECT No. 06-1413-009

FILE No. 061413009_SK-201

DRAWING NO. 3000-C-201

REV. 0



LEGEND

- TP-98-278 - THIRD PORTAGE BOREHOLE DRILLED IN 1998
- 03GT-BZ-5 - BAY ZONE DIKE BOREHOLE DRILLED IN 2003
- 03GT-BZ-4 - BAY ZONE DIKE ABUTMENT BOREHOLE DRILLED IN 2003
- 03GT-PS-1 - PLANT SITE BOREHOLE DRILLED IN 2003
- 03GT-PS-3 - PLANT SITE BOREHOLE WITH THERMISTOR DRILLED IN 2003
- 03GT-TF-2 - TANK FARM BOREHOLE DRILLED IN 2003
- 03GT-TF-1 - TANK FARM BOREHOLE WITH THERMISTOR DRILLED IN 2003

NOTES

1) NORTHING AND EASTING ARE IN METRES REFERENCED TO UTM ZONE 14, NAD83.
2) ELEVATIONS AND DIMENSIONS ARE IN METRES REFERENCED TO GEODETIC DATUM, UNLESS OTHERWISE NOTED.
3) OWNER TO PROVIDE SURVEY CONTROL.

REFERENCE

1) BASE PLAN INFORMATION IS PROVIDED BY CUMBERLAND DATED FEBRUARY 03, 2006.

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REV	D/M/Y	REVISION	DR	CHK	CHK	APP	APP	APP	APP

ISS	D/M/Y	APP	ISSUED FOR
0	28APR06	–	CONSTRUCTION
B	20APR06	–	FIRE MARSHALL INITIAL REVIEW
A	07APR06	–	CLIENT REVIEW

REF	NUMBER	TITLE
	–	

REFERENCES

STAMP/SEAL

APPROVED FOR CONSTRUCTION

CLIENT PROJECT MGR. – ENGINEERING MGR. – PROJECT MGR. –

PROJECT NO.	ACTIVITY NO.	PACKAGE CODE
–		

PROJECT PHASE

SCALE: AS SHOWN

	BY	DD/MMM/YY
DSN.	WJP	28APR06
DRN.	JK/CJC	28APR06

PROJECT: CUMBERLAND RESOURCES LTD.

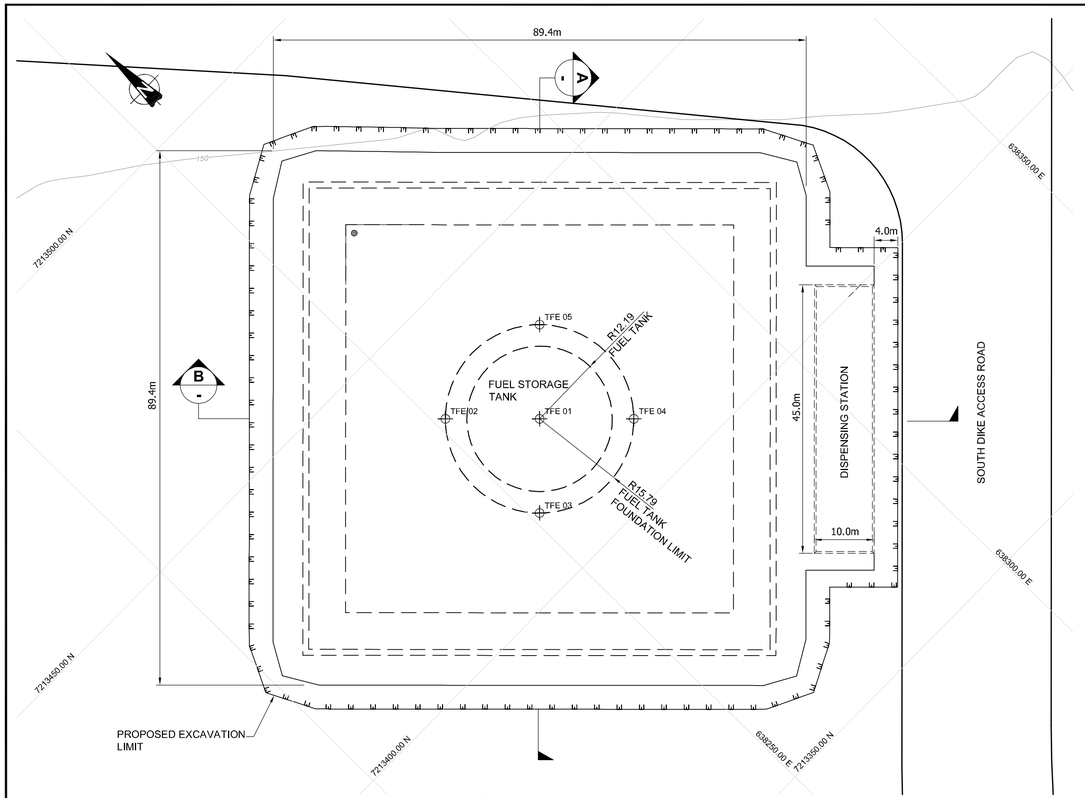
TITLE

FUEL STORAGE FACILITY LAYOUT PLAN
MEADOWBANK FUEL TANK FARM

Golder Associates

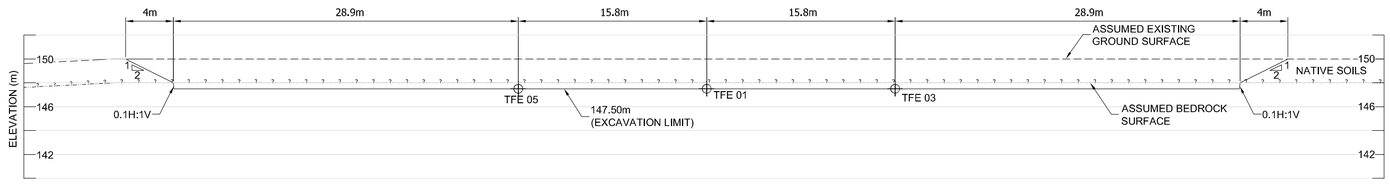
PROJECT No.	FILE No.
06-1413-009	061413009_SK-202

DRAWING NO.	REV.
3000-C-202	0



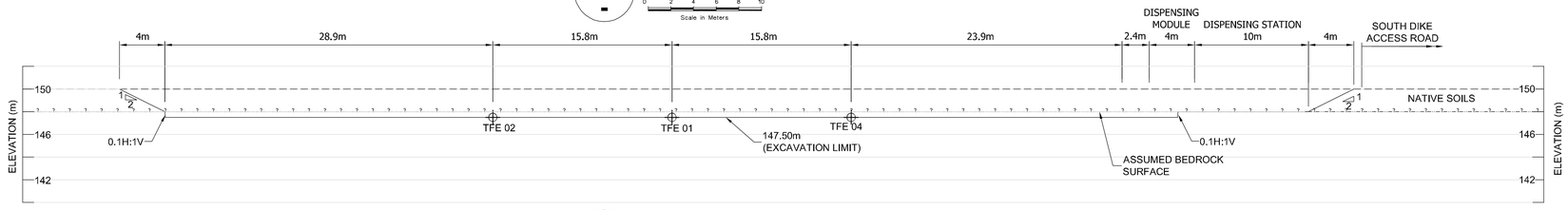
PLAN

Scale in Meters



A SECTION

Scale in Meters



B SECTION

Scale in Meters

TANK FARM EXCAVATION LAYOUT CONTROL POINTS			
POINT ID	EASTING	NORTHING	ELEVATION
TFE 01	638,262.79	7,213,422.63	147.50
TFE 02	638,251.72	7,213,433.89	147.50
TFE 03	638,251.53	7,213,411.56	147.50
TFE 04	638,273.86	7,213,411.36	147.50
TFE 05	638,274.05	7,213,433.69	147.50

LEGEND

- TFE 01 — TANK FARM EXCAVATION LAYOUT CONTROL POINT
- PROPOSED LIMIT OF EXCAVATION
- APPROXIMATE BACKFILL LIMITS

NOTES

1) NORTHING AND EASTING ARE IN METRES REFERENCED TO UTM ZONE 14, NAD83.
2) ALL DIMENSIONS AND ELEVATIONS ARE IN METRES REFERENCED TO GEODETIC DATUM, UNLESS OTHERWISE NOTED.
3) BASE OF EXCAVATION TO BE CONFIRMED IN THE FIELD BY OWNER. EXCAVATION BASE TO BE INSPECTED BY GEOTECHNICAL ENGINEER OR REPRESENTATIVE BEFORE ANY BACKFILL PLACED.
4) BEDROCK SHOWN AS FLAT SURFACE. ACTUAL SURFACE WILL BE UNEVEN. HIGH POINTS IN BEDROCK ABOVE MINIMUM EXCAVATION DEPTH TO BE REMOVED. LOW AREAS BELOW 147.5m TO BE BACKFILLED AS PER DRAWING 3000-C-204.

REFERENCE

1) BASE PLAN INFORMATION IS PROVIDED BY CUMBERLAND DATED FEBRUARY 03, 2006.

REV	D/M/Y	REVISION	DR	CHK	CHK	APP	APP	APP	APP
0	28APR06	–	CONSTRUCTION						
B	20APR06	–	FIRE MARSHALL INITIAL REVIEW						
A	07APR06	–	CLIENT REVIEW						

ISSUED FOR

REF	NUMBER	TITLE
	–	

REFERENCES

STAMP/SEAL

APPROVED FOR CONSTRUCTION

– CLIENT PROJECT MGR. – ENGINEERING MGR. – PROJECT MGR.

PROJECT NO.	ACTIVITY NO.	PACKAGE CODE
–		

PROJECT PHASE

SCALE: AS SHOWN

	BY	DD/MMM/YY
DSN.	WJP	28 APR 06
DRN.	JK	28 APR 06

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

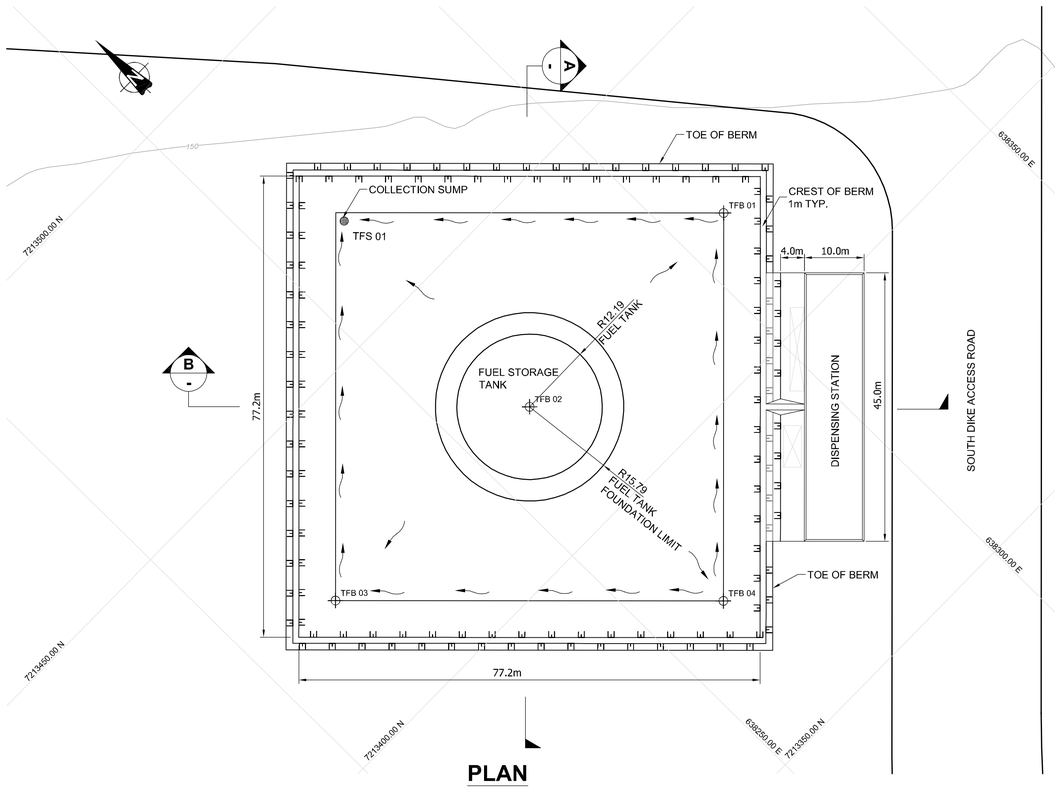
TANK FARM EXCAVATION PLAN AND SECTIONS MEADOWBANK FUEL TANK FARM

Golder Associates

PROJECT No.	FILE No.
– 06-1413-009	061413009_SK-203

DRAWING NO.	REV.
3000-C-203	0

REVISION DATE: 06/05/01 09:40AM By: EAbella CADD FILE: N:\Bur-Graphics\Projects\2006\1413\06-1413-009\Drafting\cad\06-1413-009_SK-203.dwg



PLAN

Scale in Meters

TANK FARM BACKFILL LAYOUT CONTROL POINTS			
ID	EASTING	NORTHING	ELEVATION
TFB 01	638,308.75	7,213,422.19	148.17
TFB 02	638,262.79	7,213,422.63	149.00
TFB 03	638,216.83	7,213,423.06	148.17
TFB 04	638,262.35	7,213,376.67	148.45
TFS 01	638,263.21	7,213,466.61	147.88

LEGEND

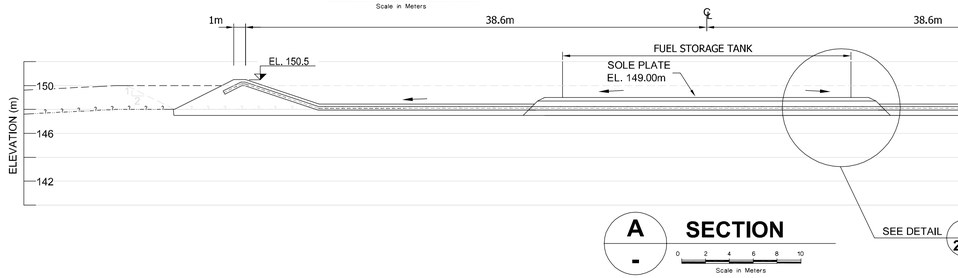
- TFS 01 — TANK FARM SUMP LAYOUT CONTROL POINT.
- TFB 03 — TANK FARM BACKFILL LAYOUT CONTROL POINT.
- PROPOSED BACKFILL LIMITS.

NOTES

1) NORTHING AND EASTING ARE IN METRES REFERENCED TO UTM ZONE 14, NAD83.
2) ALL DIMENSIONS AND ELEVATIONS ARE IN METRES REFERENCED TO GEODETIC DATUM, UNLESS OTHERWISE NOTED.
3) ACCESS ROAD TO DISPENSING STATION BY OTHERS. DETAILS NOT SHOWN FOR CLARITY.
4) SOUTH DIKE ACCESS ROAD BY OTHERS. BARRIER BETWEEN SOUTH DIKE ACCESS ROAD AND DISPENSING STATION BY OTHERS.
5) SURFACE WATER TO DRAIN AWAY FROM DISPENSING STATION AND PERIMETER DIKES TO PERIMETER DRAINAGE DITCHES, NOT SHOWN FOR CLARITY.

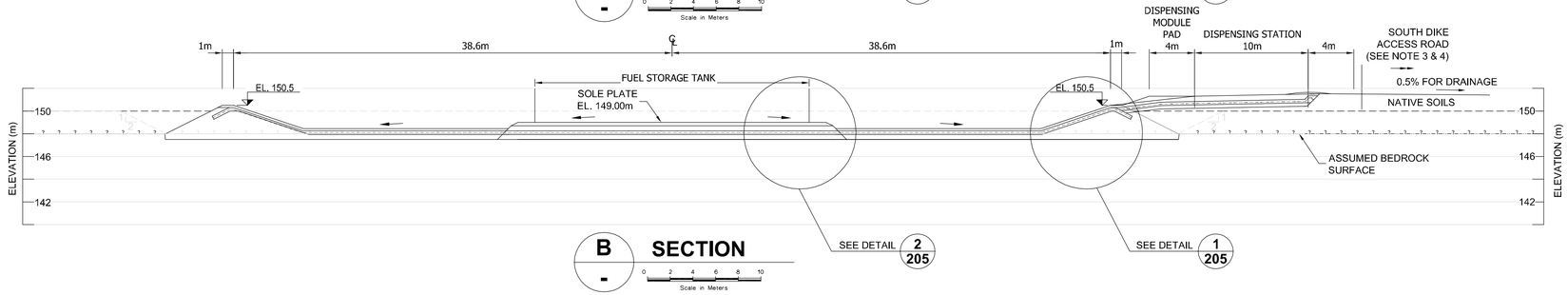
REFERENCE

1) BASE PLAN INFORMATION IS PROVIDED BY CUMBERLAND DATED FEBRUARY 03, 2006.



A SECTION

Scale in Meters



B SECTION

Scale in Meters

REV	D/M/Y	REVISION	DR	CHK	CHK	APP	APP	APP	APP
0	28APR06	–	CONSTRUCTION						
B	20APR06	–	FIRE MARSHALL INITIAL REVIEW						
A	10APR06	–	CLIENT REVIEW						

ISSUED FOR

REF	NUMBER	TITLE
	–	

REFERENCES

STAMP/SEAL

APPROVED FOR CONSTRUCTION

– CLIENT PROJECT MGR. – ENGINEERING MGR. – PROJECT MGR.

PROJECT NO.	ACTIVITY NO.	PACKAGE CODE
–		

PROJECT PHASE

SCALE: AS SHOWN

	BY	DD/MMM/YY
DSN.	WJP	28 APR 06
DRN.	JK	28 APR 06

PROJECT: CUMBERLAND RESOURCES LTD.

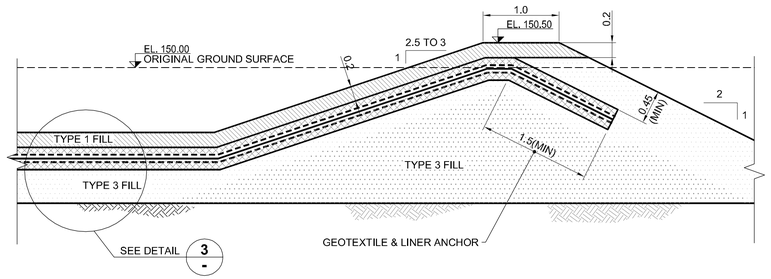
TITLE: **TANK FARM BACKFILL PLAN AND SECTIONS MEADOWBANK FUEL TANK FARM**

Golder Associates

PROJECT No.	FILE No.
– 06-1413-009	061413009_SK-204

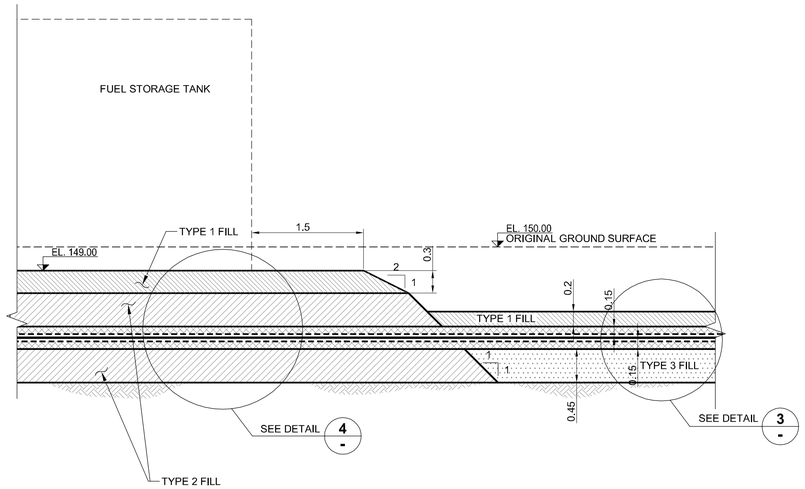
DRAWING NO. 3000-C-204 | REV. 0

REVISION DATE: 06/04/29 12:51PM By: jkownacki
CADD FILE: N:\Bur-Graphics\Projects\2006\14413\06-1413-009\Drafting\cad\06-1413-009_SK-204.dwg



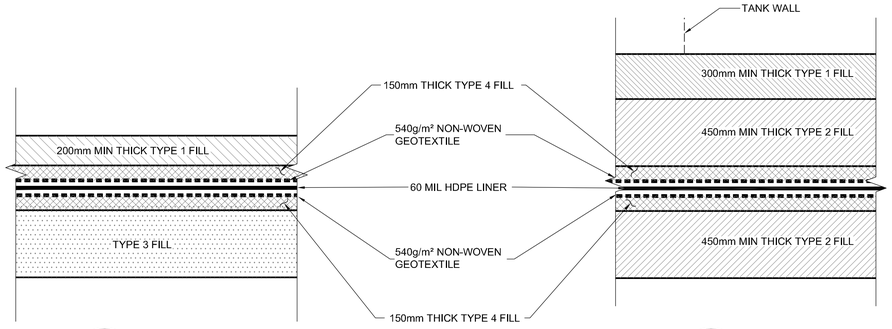
1 / 204 **DETAIL**

0 0.4 0.8 1.2 1.6 2
Scale in Meters



2 / 204 **DETAIL**

0 0.4 0.8 1.2 1.6 2
Scale in Meters



3 / - **DETAIL**

4 / - **DETAIL**

0 0.2 0.4 0.6 0.8 1
Scale in Meters

LEGEND

- TYPE 1 FILL; MINUS 19mm GRANULAR BASE
- TYPE 2 FILL; MINUS 75mm GRANULAR SUB-BASE
- TYPE 3 FILL; MINUS 150mm GRANULAR OR COMMON FILL
- TYPE 4 FILL; MINUS 9.5mm SAND BEDDING AND COVER
- BEDROCK
- 540g/m² NON-WOVEN GEOTEXTILE
- 60mil HDPE LINER

NOTES

1) GEOTECHNICAL ENGINEER TO INSPECT AND APPROVE EXPOSED BEDROCK SUBGRADE SURFACE PRIOR TO PLACEMENT OF GRANULAR FILL MATERIALS.

2) GRANULAR FILLS PROVIDED FROM CRUSHING AND SCREENING OPERATIONS AT MINE SITE QUARRY.

3) PLACEMENT AND COMPACTION SPECIFICATION REFERENCE SPECIFICATION SP-GAL-02-6.

4) ALL DIMENSIONS AND ELEVATIONS ARE IN METRES REFERENCED TO GEODETIC DATUM.

5) TANK FOUNDATION DETAILS BY OTHERS.

REVISION DATE: 06/04/28 12:52PM By: jkownacki CADD FILE: N:\Bur-Graphics\Projects\2006\1413\06-1413-009\Drafting\cad\06-1413-009_SK-212.dwg

REV	D/M/Y	REVISION	DR	CHK	APP	APP	APP	APP

ISS	D/M/Y	APP	ISSUED FOR
0	28APR06	–	CONSTRUCTION
B	20APR06	–	FIRE MARSHALL INITIAL REVIEW
A	10APR06	–	CLIENT REVIEW

REF	NUMBER	TITLE
–		

REFERENCES

STAMP/SEAL

APPROVED FOR CONSTRUCTION

– CLIENT PROJECT MGR. – ENGINEERING MGR. – PROJECT MGR.

PROJECT NO.	ACTIVITY NO.	PACKAGE CODE
–		

PROJECT PHASE

SCALE		BY	DD/MMM/YY
–	DSN.	WJP	28 APR 06
	DRN.	JK	28 APR 06

PROJECT

CUMBERLAND RESOURCES LTD.

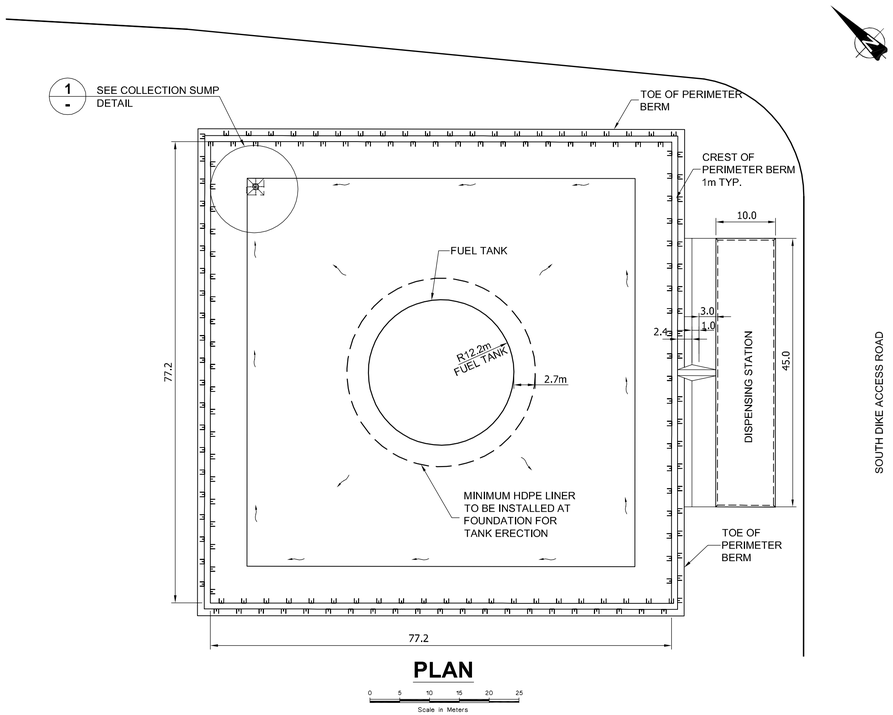
TITLE

TANK FARM BACKFILL DETAILS MEADOWBANK FUEL TANK FARM

Golder Associates

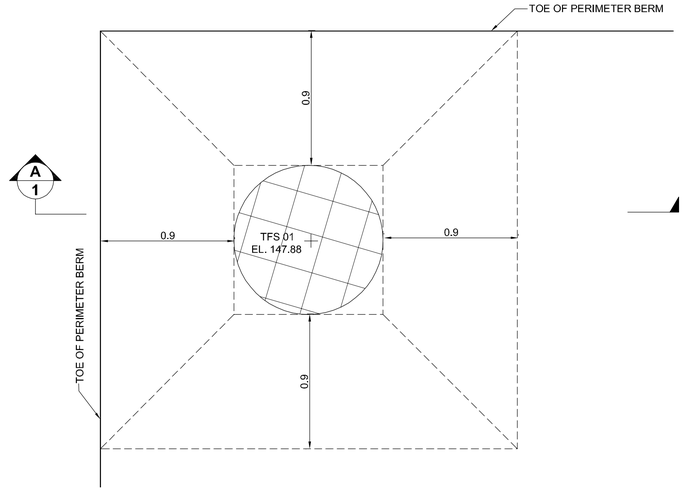
PROJECT No.	FILE No.
06-1413-009	061413009_SK-212

DRAWING NO.	REV.
3000-C-205	0



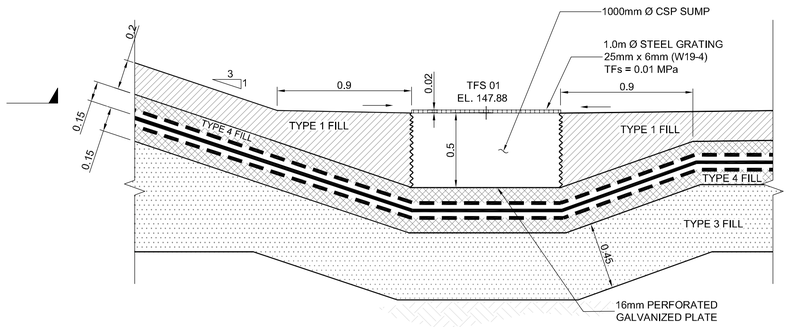
PLAN

Scale in Meters



1 - COLLECTION SUMP DETAIL

Scale in Meters



A - SECTION

Scale in Meters

LEGEND

- TYPE 1 FILL; MINUS 19mm GRANULAR BASE
- TYPE 3 FILL; MINUS 150mm GRANULAR OR COMMON FILL
- TYPE 4 FILL; MINUS 9.5mm SAND BEDDING AND COVER
- BEDROCK
- PROPOSED BACKFILL LIMITS
- PROPOSED LIMITS FOR HDPE LINER PLACEMENT.
- 540g/m² NON-WOVEN GEOTEXTILE
- 60mil HDPE LINER

NOTES

1) ALL DIMENSIONS AND ELEVATIONS ARE IN METRES REFERENCED TO GEODETIC DATUM, UNLESS OTHERWISE NOTED.

REV	D/M/Y	REVISION	DR	CHK	CHK	APP	APP	APP	APP
0	28APR06	– CONSTRUCTION							
B	20APR06	– FIRE MARSHALL INITIAL REVIEW.							
A	10APR06	– CLIENT REVIEW							

ISS	D/M/Y	APP	ISSUED FOR

REF	NUMBER	TITLE
–		

REFERENCES

STAMP/SEAL

APPROVED FOR CONSTRUCTION

– CLIENT PROJECT MGR. – ENGINEERING MGR. – PROJECT MGR.

PROJECT NO.	ACTIVITY NO.	PACKAGE CODE
–		

PROJECT PHASE

SCALE: AS SHOWN

	BY	DD/MMM/YY
DSN.	WJP	28 APR 06
DRN.	JK	28 APR 06

PROJECT: CUMBERLAND RESOURCES LTD.

TITLE: SECONDARY CONTAINMENT HDPE LINER PLAN AND SUMP DETAILS MEADOWBANK FUEL TANK FARM

Golder Associates

PROJECT No. – 06-1413-009

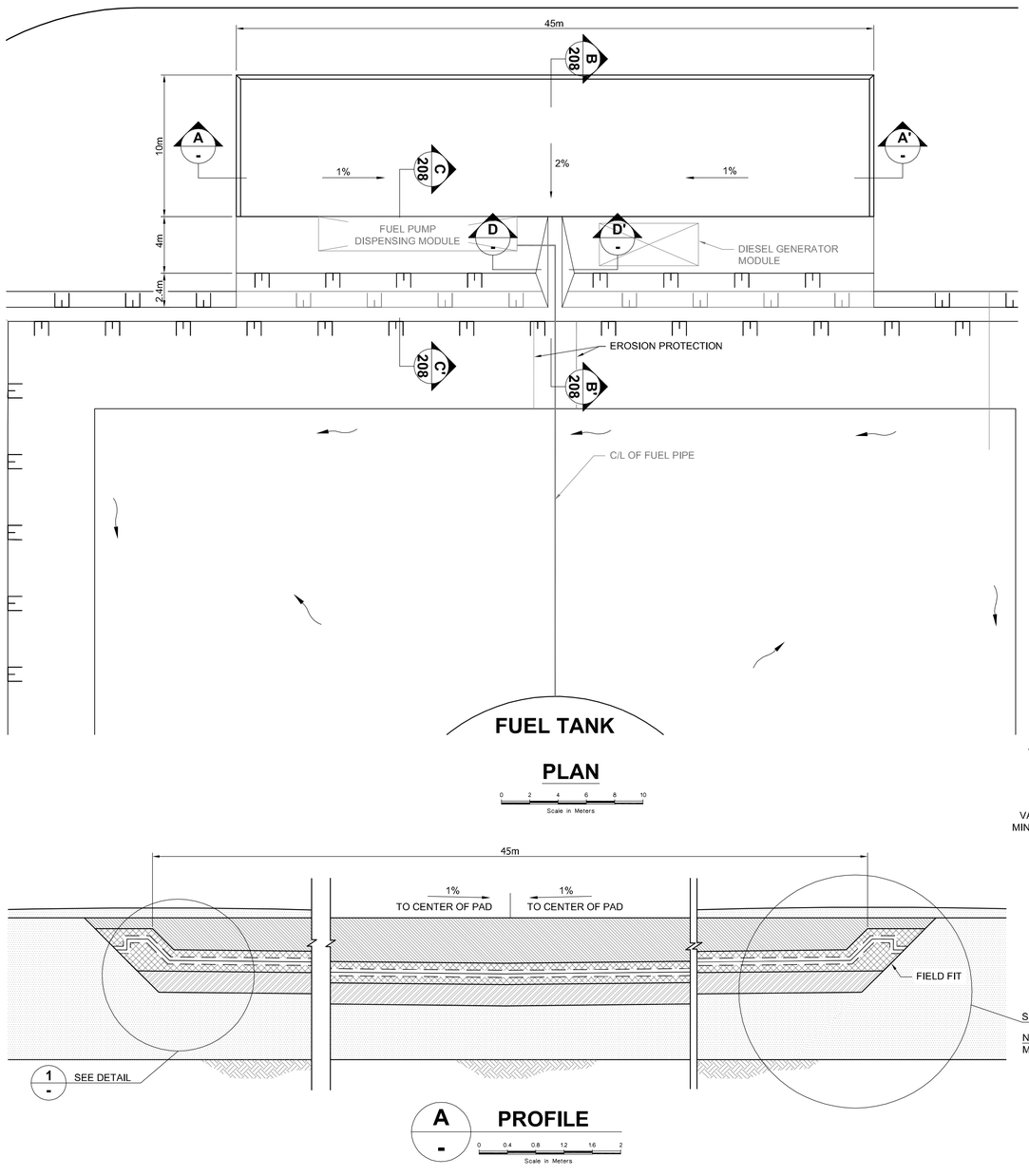
FILE No. 061413009_SK-214

DRAWING NO. 3000-C-206

REV. 0

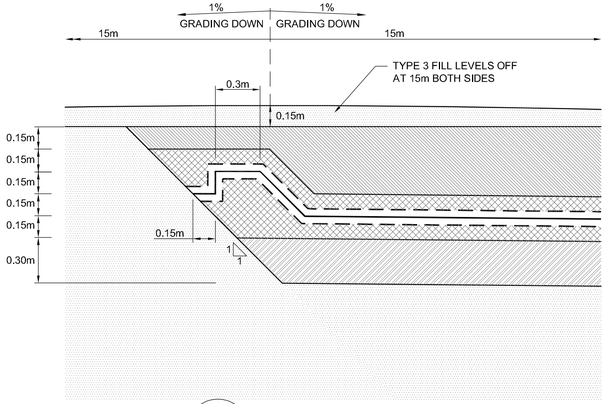
REVISION DATE: 06/04/29 12:55PM By: jkownacki CADD FILE: N:\Bur-Graphics\Projects\2006\14413\06-1413-009\Drafting\cad\06-1413-009_SK-214.dwg

SOUTH DIKE ACCESS ROAD



PLAN

0 2 4 6 8 10
Scale in Meters



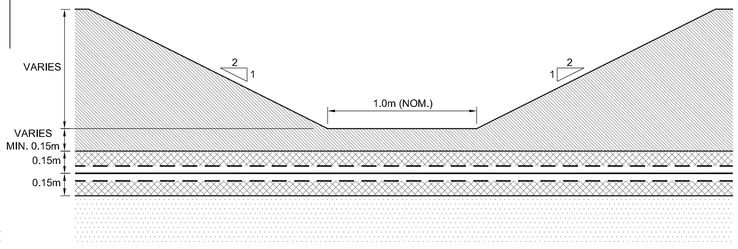
1 DETAIL -

0 0.2 0.4 0.6 0.8 1
Scale in Meters

NOTE
MIRROR IMAGE OF DETAIL 1

A PROFILE -

0 0.4 0.8 1.2 1.6 2
Scale in Meters



D SWALE SECTION -

0 0.2 0.4 0.6 0.8 1
Scale in Meters

LEGEND

- TYPE 1 FILL; MINUS 19mm GRANULAR BASE
- TYPE 2 FILL; MINUS 75mm GRANULAR SUB-BASE
- TYPE 3 FILL; MINUS 150mm GRANULAR OR COMMON FILL
- TYPE 4 FILL; MINUS 9.5mm SAND BEDDING AND COVER
- BEDROCK
- 540g/m² NON-WOVEN GEOTEXTILE
- 60mil HDPE LINER

REV	D/M/Y	REVISION	DR	CHK	CHK	APP	APP	APP	APP
0	28APR06	–	CONSTRUCTION						
B	20APR06	–	FIRE MARSHALL REVIEW						
A	10APR06	–	CLIENT REVIEW						

ISS	D/M/Y	APP	ISSUED FOR

REF	NUMBER	TITLE
	–	

REFERENCES

STAMP/SEAL

APPROVED FOR CONSTRUCTION

– CLIENT PROJECT MGR. – ENGINEERING MGR. – PROJECT MGR.

PROJECT NO.	ACTIVITY NO.	PACKAGE CODE
–		

PROJECT PHASE

SCALE		BY	DD/MMM/YY
AS SHOWN	DSN.	WJP	28 APR 06
	DRN.	JK	28 APR 06

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

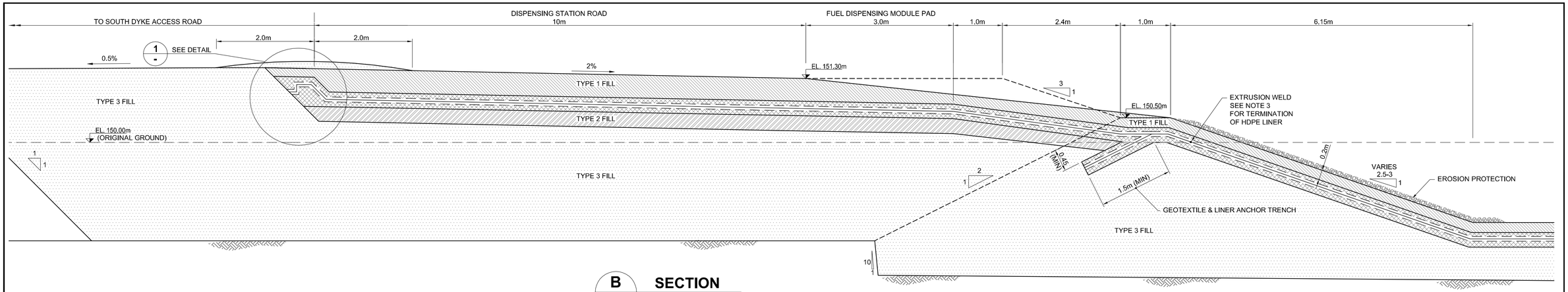
DISPENSING STATION PLAN, PROFILE AND DETAILS MEADOWBANK FUEL TANK FARM

Golder Associates

PROJECT No.	FILE No.
– 06-1413-009	061413009_SK-213

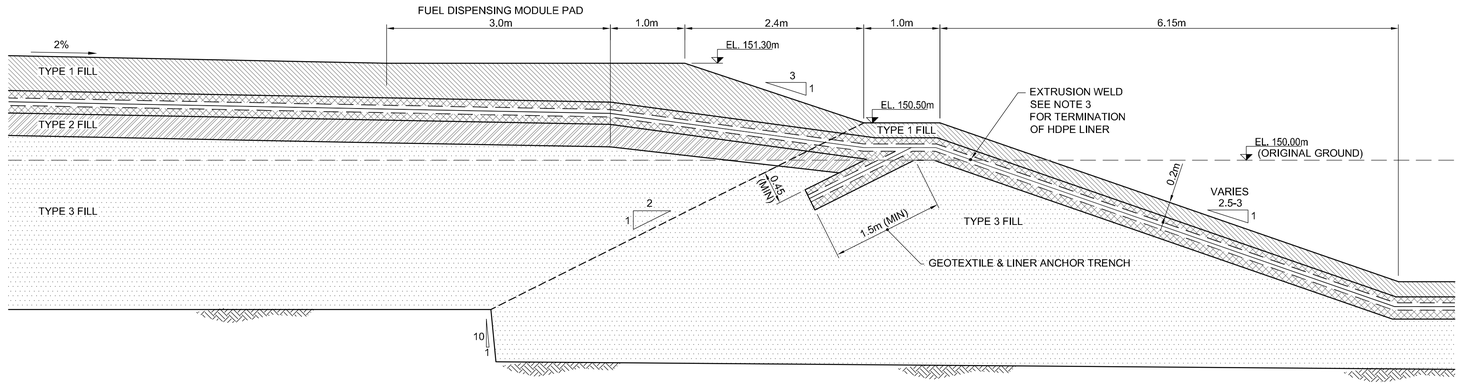
DRAWING NO.	REV.
3000-C-207	0

REVISION DATE: 06/04/29 12:50PM By: jkownacki CADD FILE: N:\Bur-Graphics\Projects\2006\1413\06-1413-009\Drafting\cad\06-1413-009_SK-213.dwg



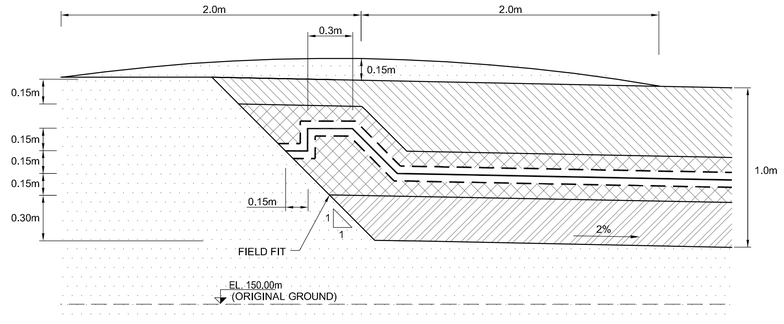
B 207 SECTION

Scale in Meters



C 207 SECTION

Scale in Meters



1 - DETAIL

Scale in Meters

LEGEND

- TYPE 1 FILL; MINUS 19mm GRANULAR BASE
- TYPE 2 FILL; MINUS 75mm GRANULAR SUB-BASE
- TYPE 3 FILL; MINUS 150mm GRANULAR OR COMMON FILL
- TYPE 4 FILL; MINUS 9.5mm SAND BEDDING AND COVER
- BEDROCK
- 540g/m² NON-WOVEN GEOTEXTILE
- 60mil HDPE LINER

NOTES

1) GEOTECHNICAL ENGINEER TO INSPECT AND APPROVE EXPOSED BEDROCK SUBGRADE SURFACE PRIOR TO PLACEMENT OF GRANULAR FILL MATERIALS.
2) GRANULAR FILL PROVIDED FROM CRUSHING AND SCREENING OPERATIONS AT MINE SITE QUARRY.
3) LIMIT OF HDPE LINER FROM DISPENSING STATION TO BE TERMINATED 0.5m BEYOND THE CREST OF ANCHOR TRENCH ON TOP OF CONTAINMENT BERM AND EXTRUSION WELDED TO CONTAINMENT BERM HDPE.
4) HDPE LINER SYSTEM BENEATH DISPENSING STATION RUNS FULL LENGTH OF STATION AND DRAPES OVER HDPE OF TANK FARM BERM.

REV	D/M/Y	REVISION	DR	CHK	CHK	APP	APP	APP	APP
0	28APR06	–	CONSTRUCTION						
B	20APR06	–	FIRE MARSHALL REVIEW						
A	10APR06	–	CLIENT REVIEW						

ISS	D/M/Y	APP	ISSUED FOR

REF	NUMBER	TITLE
	–	

REFERENCES

STAMP/SEAL

APPROVED FOR CONSTRUCTION

– CLIENT PROJECT MGR. – ENGINEERING MGR. – PROJECT MGR.

PROJECT NO.	ACTIVITY NO.	PACKAGE CODE
–		

PROJECT PHASE

SCALE		BY	DD/MMM/YY
AS SHOWN	DSN.	WJP	28 APR 06
	DRN.	JK	28 APR 06

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

DISPENSING STATION SECTIONS AND DETAILS MEADOWBANK FUEL TANK FARM

Golder Associates

PROJECT No.	FILE No.
– 06-1413-009	061413009_SK-213

DRAWING NO.	REV.
3000-C-208	0

REVISION DATE: 06/04/29 12:50PM By: jkownacki CADD FILE: N:\Bur-Graphics\Projects\2006\1413\06-1413-009\Drafting\cad\06-1413-009_SK-213.dwg