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FINAL REPORT
DETAILED DESIGN OF DEWATERING DIKES
MEADOWBANK GOLD PROJECT
VOLUME 3

Submitted to:

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March 13, 2007

06-1413-081/6000
Doc. No. 342 Ver. 0

APPENDIX VII

FEASIBILITY LEVEL DESIGN REPORT

The feasibility-level design for the dewatering dikes at the Meadowbank Gold Project was presented in the report:

Golder, 2003. Design of Dikes with Soil-Bentonite Cutoff Wall – Meadowbank Gold Project. Report. Golder Associates Ltd. October 2003.

Key differences between the feasibility level design and the final design are noted as follows.

- Dike alignments updated with 2006 bathymetry. The main differences include:
  - removal of a dogleg and causeway in the East Dike, and
  - design criteria for setback (distance from downstream dike toe to pit crest) changed from 80 m to 70 m. Change in setback based on review of pit wall stability by Golder (2007a).
- Granular filter changed from one zone to two zone.
- Cutoff changed from soil bentonite cutoff only to soil cement bentonite cutoff and jet grout cutoff to increase erosion resistance in deeper portions of the dikes. Selection of cutoff type based on hydraulic gradient across the cutoff.
- Bedrock grouting program added for near surface bedrock.
- Cutoff-bedrock contact grouting program added – removes the reliance on a key of the cutoff into bedrock.
- Instrumentation program added.
- East Dike crest elevation raised to 136.1 masl to provide additional freeboard across the dike at closure.
- The mine plan was changed requiring Goose Dike construction prior to Year 2 of the mine life, rather than Year 5.
- Minor changes in material parameters reflect updated laboratory test results.

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REPORT ON

DESIGN OF DIKES WITH SOIL- BENTONITE CUTOFF WALL MEADOWBANK GOLD PROJECT

Submitted to:

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October 23, 2003 03-1413-427/4200

EXECUTIVE SUMMARY

This report presents a basic engineering design of the proposed dikes at the Meadowbank Gold Project near Baker Lake, in Nunavut. The proposed dikes are required to allow mining of the proposed open pits at the Third Portage and North Portage Deposits (including the Connector Zone and Bay Zone), and the Goose Island Deposit.

The three dikes included in this report are:

- Second Portage dike (including a causeway) – to be constructed prior to mill startup
- Bay Zone dike – to be constructed prior to mill startup
- Goose Island dike – to be constructed in Year 5 of the mine life.

The typical dike section comprises two rockfill embankments with a till core, a filter zone and a soil-bentonite cutoff wall excavated to the underlying bedrock. The causeway section will consist of run-of-mine rockfill. The dike crest will be surfaced with material suitable as haul road running course.

The rockfill to be used for construction will initially come from pre-stripping operations and through the development of a starter pit at the Third Portage Deposit. Quantity estimates indicate that between 360,000 m^3 and 420,000 m^3 of rockfill and between 80,000 m^3 and 110,000 m^3 of till will be required for the dikes prior to startup.

Based on current materials balance calculations, sufficient quantities of suitable rockfill and till borrow materials will be available from pre-mining activities. The material for the till core will be derived from pre-stripping activities at the North Portage and Third Portage Deposits.

Similarly, sufficient quantities of rockfill and till will be available from ongoing mining activities in Year 5 to build the Goose Island dike.

The construction quantities are sensitive to the sideslopes that will be achieved on the rockfill embankments. These slopes are likely to be in the range of 1.5H:1V to 2.0H:1V but in some areas could be as flat as 2.5H:1V.

Slope stability analyses show that the dikes will be stable under static and earthquake load conditions.

Seepage modeling indicates that the total seepage through all of the dikes will be in the range of approximately 2.4 to 48.3 L/s. This value varies depending on potential cracking in the soil-bentonite cutoff wall and/or a potential gap in the cutoff wall at the bedrock contact.

Cracks through the cutoff wall in the section through the overburden would result in the largest increase in seepage through the cutoff wall. The increase is in the range of one to two orders of magnitude more than a wall with no cracks or defects in the overburden section. Cracks within the till core section have a negligible effect on seepage.

A gap in the soil-bentonite cutoff wall at the bedrock contact would result in an increase in seepage of approximately one order of magnitude more than a wall with no gap at the bedrock contact.

For the Bay Zone and Second Portage dikes, the soil-bentonite cutoff wall trench will be excavated to depths less than 12 m. This can be achieved with standard long-reach excavation equipment.

For the Goose Island dike, the soil-bentonite cutoff wall trench will be excavated to depths greater than 12 m. This will require custom-made long-reach excavators or booms.

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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 the hamlet of Baker Lake in Nunavut, as shown on Figure 1.1.

The Meadowbank Gold Project consists of several gold bearing deposits within reasonably close proximity to one another. A site plan of the Meadowbank Mine is shown in Figure 1.2. The four main deposits are:

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

The Third Portage Deposit is located on a peninsula, and extends northward under Second Portage Lake, and southward under Third Portage Lake. The North Portage Deposit is located on the northern shore of Second Portage Lake. The Third Portage Deposit, Bay Zone, Connector Zone, and North Portage Deposit will be mined from a single pit that will extend approximately 2 km in a north-south direction, and between about 200 m and 400 m in an east-west direction.

The Goose Island Deposit lies approximately 1000 m to the south of the Third Portage Deposit, and beneath Third Portage Lake.

1.1 Mining

Mining of the deposits will be primarily a truck and shovel open pit operation. About 87% of the overall mine production will be from the open pits. Underground mining methods may be employed to extract the ore from deeper areas of the various deposits where open pit mining may no longer be appropriate.

The deposits are situated adjacent to and beneath lakes. Consequently, a series of dikes will be required to isolate the mining activities from the lakes. (see Figure 1.3). It is proposed to construct the dikes using materials available on site.

This report presents a design for the proposed dikes around the Third Portage, North Portage, and Goose Island Deposits.

2.0 PREVIOUS DIKE DESIGN STUDIES

A preliminary study identifying dike design concepts for the project was completed in 2000. The results were presented in the report titled "Review of Seepage Cutoff Alternatives Open Pit De-Watering Dikes, Meadowbank Gold Project, Nunavut Territory" by Golder Associates Ltd. and dated March 9, 2000." In that report, Golder recommended that the design of a zoned embankment with a low-permeability core within rockfill shells constructed on the overburden materials overlying bedrock be evaluated. Based on the information available at that time, it was that assumed the overburden materials would be a till having a low permeability. Subsequent geotechnical drilling investigations along the proposed dike alignments have indicated that the foundation overburden materials may be pervious. Consequently, a seepage cutoff barrier is required through the overburden materials and extending into the underlying bedrock.

3.0 GENERAL SITE CONDITIONS

Much of the following description of general site conditions is summarized from site studies carried out by Golder, or from the Project Description Report ("Meadowbank Gold Property, Project Description Report", Cumberland Resources Ltd. March, 2003).

3.1 Topography and Lake Bathymetry

The general site area consists of low, rolling hills with numerous small lakes. The topography in the immediate vicinity of the main deposits (Third Portage, Connector Zone, North Portage, and Goose Island Deposits) is generally flat, with topographic relief on the order of 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, and up to maximum elevations of approximately 200 m A.S.L. to the northwest of the deposits.

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.

Bathymetric surveys of the lakes adjacent to and overlying the main deposits have been carried out previously (see Ref. 5). The results of the surveys indicate the lake depths to be extremely variable, ranging from less than 1 m to about 38 m in areas of Second Portage Lake. The current dike alignments have been selected to take advantage of shallow water areas to simplify construction methods and to minimize construction costs.

3.2 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/gravel till, having a fines (silt plus clay) content between about 30% and 40%, based on laboratory grain size analyses (see Refs. 6, 7, 8). The material also contains up to boulder-sized particles.

Glaciofluviual sand and gravel deposits reportedly occur in three areas: on the north shore of Second Portage Lake, the north shore of the eastern arm of Tern Lake, and to the south of the Vault Deposit (see Ref. 9).

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 have been obtained. Samples of clayey sand material have been recovered using split spoon sampling methods.

3.3 Permafrost

The project is located within the zone of continuous permafrost. The land surface in the project area is underlain by continuous permafrost, while lakes that are deeper than about 2 m will be underlain by a talik, or zone of permanently unfrozen ground. Based on thermal studies carried out to date, the depth of permafrost is estimated to be on the order of 400 m to 500 m. The depth of the active layer is estimated to be between 2 m and 4 m. 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 recent ground conductivity surveys and compilation of regional data, the ground ice content is expected to be low. Locally on land, ice lenses and ice wedges are present, as indicated by ground conductivity, and by permafrost features such as peat palsas. These areas of local ground ice are generally associated with low lying areas of poor drainage.

3.4 Climate

Table 3-1 summarizes precipitation data from the Meadowbank site.

Table 3-1: 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 3-2 summarizes mean monthly climate data collected from the site since 1997.

Table 3-2: Summary of Monthly Climate Data

Month	Air Temperature					Mean Soil Temp. (°C)	Wind Speed	
	Extreme Day		Average Monthly					
	Max (°C)	Min (°C)	Max (°C)	Min (°C)	Mean (°C)		Mean (km/h)	Monthly Max (km/h)
January	-4.9	-43.0	-28.9	-35.6	-32.3	-25.4	15.6	54.5
February	-9.1	-43.4	-26.9	-34.4	-30.8	-27.6	15.4	45.2
March	-3.1	-40.1	-21.0	-29.1	-24.9	-23.6	16.8	51.8
April	2.1	-35.4	-12.5	-22.1	-17.1	.17.5	16.9	40.1
May	8.0	-22.3	-2.5	-9.4	-5.7	-8.0	18.9	56.6
June	22.7	-12.9	8.1	0.2	4.1	1.6	16.2	37.6
July	26.9	1.3	17.0	7.6	12.4	11.0	14.9	44.2
August	27.4	-0.4	13.4	6.6	9.9	9.5	18.2	46.7
September	20.5	-7.9	6.1	1.4	3.6	4.0	18.2	81.9
October	5.3	-24.1	-4.9	-10.4	-7.5	-3.2	21.6	62.5
November	-1.3	-32.3	-14.3	-20.9	-17.5	-12.1	16.9	46.1
December	-6.3	-39.6	-22.6	-29.0	-25.9	-19.4	18.4	47.3

Source: Meadowbank Gold Property – Project Description, 2003.

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.

Based on data obtained during recent geotechnical drilling investigations carried out between late April and early June of 2003, ice thickness on the lakes is expected to vary from about 1.5 m to about 2.5 m,

3.5 Seismicity

The Meadowbank project is located in an area of low seismicity, as shown in Figure 3.1 and Table 3.3.

Table 3-3: 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 – See Appendix VI.

4.0 DESIGN BASIS AND CRITERIA

The following form the design basis and criteria for the current dike design.

- Dikes are to be constructed to allow open pit mining operations to be carried out year round.
- A portion of the crests of the Second Portage and Goose Island dikes will be used as mine truck haul roads between the open pit and the crusher.
- The dike sections should maximize the use of materials obtained during pre-stripping operations of the open pits, and during mining of a starter pit at the Third Portage Deposit. These materials are till and run-of-mine rockfill.
- A minimum setback of 80 m between the open pit side toe of the dike and the edge of the open pit has been assumed, based on similar setback distances at the Diavik Project.
- Part of the southeast dike on Second Portage Lake will be constructed as a rockfill causeway to reduce haul distances between North Portage and Third Portage.
- The dike crest width should comply with NWT Mine Health and Safety Act and Regulations, or equivalent regulations for Nunavut, for minimum width of haul roads (see Ref. 2). For single lane traffic the minimum width is twice the width of the widest haulage vehicle used on the road; for double lane traffic the minimum width is three times the width of the widest haulage vehicle. A shoulder barrier of at least three-quarters the height of the largest tire on any vehicle using the road is required.
- The dike alignment should be selected to minimize the height of the dike.
- The dike section incorporates a soil-bentonite cutoff wall keyed into bedrock where possible.
- The dike will be a high consequence structure, based on Canadian Dam Association criteria (see Ref. 1).
- The minimum required Factor-of-Safety for static load conditions is 1.5 (see Ref. 1).
- The minimum required Factor-of-Safety for earthquake load conditions is 1.2 (see Ref. 1).
- The minimum required Factor-of-Safety for end-of-construction condition is 1.3. The end-of-construction condition for these dikes ends when men and equipment begin to enter the area within the dikes. (See Ref. 1).
- The maximum design earthquake acceleration corresponds to the 1000-year (nominal) return period event (see Ref. 1).
- The minimum allowable freeboard between crest of the dikes and lake surface will be 2 m. This is required to provide allowance for settlement, and protection for wave and ice run-up.
- The minimum freeboard between the top of the soil-bentonite cutoff wall and the lake surface must be 1 m.

5.0 PROPOSED DIKE AND CAUSEWAY SECTIONS

The proposed typical dike section is shown on Figure 5.1 and the proposed typical Second Portage causeway section is shown on Figure 5.2.

The dike section has rockfill "shoulders" constructed from run-of-mine waste rock supporting an inverted wedge core constructed from till. The till will be excavated during pre-stripping from the pit areas. The section also includes a soil-bentonite cutoff wall to control seepage through the foundation and a granular filter material between the till core material and the downstream rockfill.

The key dimension for the dike is the separation between the inside toe of the upstream rockfill embankment, and the toe of the filter zone. A minimum width of 5 m has been specified to reduce the possibility that large rocks will roll onto the cutoff wall alignment or the zones of large, segregated rockfill that will develop along the embankment toes do not encroach and produce a highly permeable section through which the cutoff wall must be constructed.

The separation between the upstream rockfill and the downstream filter must be carefully controlled during construction to minimize interference with the cutoff wall construction. It is expected that the location of the toes will be measured on a frequent basis, and the locations of the crests adjusted as required.

The sideslopes of the rockfill embankments will depend on the strength of the foundation soil, the gradation of the rockfill and the depth of the water into which it is pushed. It is expected that, along most of the shallow sections of the alignment, sideslopes in the range of 1.5H:1V will be achieved for the rockfill, within a range of about 1.4H:1V to 1.8H:1V. Slopes of about 2.0H:1V to 2.5:1V are expected for the filter material. In the deeper sections, or where the shallow foundation soils are weak and spread under the load of the advancing rockfill, the rockfill slopes could be in the range of 1.8H:1V to 2.5H:1V. The overall width of the dike, from crest to crest, will vary depending on the depth of the water. Along most of the dike alignment, the crest width will be in the range of about 70 m to 85 m.

Foundation preparation will not be achievable along the dike alignment, as the dikes will be constructed through open water. It is expected that the thin layer of soft, lakebed sediment will be displaced by the advancing rockfill, or incorporated into the voids in the base of the rockfill.

Cross-sections of the dike at the locations identified on Figure 1.2 are presented in Figures 5.3 and 5.4. These sections show the rockfill embankments with 1.8H:1V sideslopes and a 5 m to 10 m separation between the inside toes of the rockfill

embankments. Separation of the rockfill toes of greater than 5 m occurs in areas where the depth of the lake varies over short distances along the dike alignment and maintaining the 5 m width would result in abrupt changes in the alignment of the cutoff wall that would reduce the efficiency of the construction operation.

The proposed section for the Second Portage causeway is a simple run-of-mine rockfill embankment with a running surface. Sideslopes are shown at 1.8H:1V, but steeper sideslopes on the order of 1.5H:1V might be achievable.

6.0 GEOTECHNICAL ANALYSES

6.1 Slope Stability

Slope stability analyses were carried out for three sections along the Goose Island dike. Section locations are shown on Figure 1.3 and the sections are shown on Figure 5.3. Section A is located on a relatively flat foundation, Section B is the deepest section with the foundation sloping away from the pit, and Section C is the deepest section where the foundation is sloping toward the pit. Failure of Section A could potentially occur on the inside of the dike towards the open pit. Section B has the deepest water and steepest lake bottom slope along the dike alignment. The lake bottom slopes away from the pit at Section B, and failure of the dike at this location could potentially occur on the outside of the dike towards the lake. Section C is similar to Section A.

Limit equilibrium analyses were carried out using the commercially available software SLIDE™.

The slope stability scenarios modeled for each of Sections A, B, and C. The scenarios were based on combining the following variables:

1. The surface with the minimum factor-of-safety that would breach the cutoff wall. This scenario is considered most critical, since it would result in a failure of the dike.

2. The surface with the minimum factor-of-safety located completely within the rockfill sections. This scenario would require repair of the dikes, but would not reduce the performance of the cutoff.

3. The end-of-construction period was modeled by applying an undrained strength parameter to the soil foundation materials.

4. Long-term conditions were analyzed using effective strength parameters.

5. Static and pseudostatic conditions were modeled. Pseudostatic analyses for earthquake load conditions were carried out for the long-term condition using effective strength parameters.

6. Both circular and block-type failures were considered. In all cases, circular failures were more critical.

7. The analyses were carried out for rockfill embankment sideslopes inclined at 1.5H:1V.

8. Material properties used in the analyses are summarized in Table 6-1.

Table 6-1: Summary of Material Properties used in Slope Stability Analyses

Material	Unit Weight (kN/m^3)	Effective Stress Parameters		Undrained Strength Parameter, c_u (kPa)	Basis for Property Selection
		Cohesion, c (kPa)	Angle of Internal Friction (°)		
Till Core	15.7	0	22 to 32	n/a	Direct shear testing[1]
Rockfill	18.6	0	40	n/a	Previous experience with similar material
Overburden	17	0	24 to 32	10 to 100	Previous experience with material with similar grain size distribution
Soil-Bentonite Backfill	15.7	0	32	n/a	Direct shear testing[1] – based on testing done on till

Notes: 1. Factual Report - Meadowbank Spring 2002 Geotechnical Investigations – see Ref. 6
2. For till core material, assumed c'=0 for effective stress case.

The pseudostatic analyses have been done using a horizontal acceleration of 0.022g. This value corresponds to one-half of the firm ground acceleration for the 1000-year return period event. The 1000-year return period is considered appropriate, given that:

- The dikes will be retaining water while men and equipment are working in the pits, and;
- The design life of the dikes is less than 20 years.

Results of the stability analyses are included in Appendix I.

6.1.1 Results of Analyses for End-of-Construction Conditions

Slope stability analyses were carried out to evaluate the short-term, end of construction situation. The soil foundation material was assumed to be undrained. Sections A, B, and C were analyzed to determine the values of the undrained shear strength (c_u) which would yield Factors of Safety (FOS) of 1.0 and 1.3.

The analyses show that the minimum required undrained strength of the foundation must be in the range of 20 to 30 kPa, to achieve Factors-of-Safety of 1.0 and 1.3, respectively. The foundation soils that have been recovered during the geotechnical investigations carried out along the proposed dike alignments range from a silty till material containing significant proportions of gravel and cobbles to silty sand and gravel. Undrained strengths of this material are expected to be at least equal to if not greater than 20 to 30 kPa. Undrained shear strength testing will be required during the detailed engineering design stage for the dikes.

The full results of the short-term stability analyses are included in Appendix I.

6.1.2 Results of Analyses for Long-Term Static and Pseudostatic Conditions

Slope stability analyses were done to evaluate the stability of the dikes under long-term, steady-state seepage conditions.

The full results of the long-term analyses are included in Appendix I, and are summarized in Table 6-2.

As seen in Table 6-2, the minimum calculated FOS for static conditions is 1.9, and the minimum calculated FOS for pseudostatic conditions is 1.5, both at Section B.

These values exceed the minimum values indicated by the Dam Safety Guidelines (see Ref. 1).

The minimum yield acceleration (the peak horizontal ground acceleration (PGA) that produces a Factor-of-Safety of 1.0) indicated in Table 6-2 is 0.16g. This value corresponds to a firm ground horizontal acceleration of approximately 0.3g. For the Meadowbank site, the predicted PGA is 0.044 g for a seismic event with a return period of 975 years (see Table 3-3.). Since the predicted PGA is well below the minimum calculated yield acceleration, the dikes are considered stable for the design earthquake event.

Based on the analyses, the dikes will be stable in the long-term, for static and pseudostatic loading conditions.

Table 6-2: Summary of Long-Term Slope Stability Analyses

Failure Mode	Minimum Calculated Factors of Safety		
	Section A	Section B	Section C
Failure through Cutoff Wall Static Conditions (Minimum = 1.5)	4.1	3.5	3.9
Failure through Cutoff Wall Pseudostatic Conditions (Minimum = 1.2)	3.5	3.0	3.3
Failure through Rockfill only Static Conditions (Minimum = 1.5)	2.7	1.9	3.2
Failure through Rockfill only Pseudostatic Conditions (Minimum = 1.2)	2.5	1.7	2.4
Calculated Yield Acceleration (g)			
	Section A	**Section B**	**Section C**
Failure through Cutoff Wall	0.41	0.27	0.37
Failure through Rockfill only	0.36	0.16	0.36

Notes: 1. FOS = 1.5 is minimum specified for long-term – see Ref. 1.
2. FOS = 1.2 is minimum specified for pseudostatic – see Ref. 1.

6.2 Seepage

Seepage analyses were carried out for Sections A and B (see Figure 1.3) using the commercially available software SEEP/W™. The material parameters used in the analyses are presented in Table 6-3.

The cutoff wall was modelled for the following scenarios:

1. A cutoff wall with no gaps at the bedrock contact, and no cracking within the wall.
2. A gap through the soil-bentonite cutoff wall at the bedrock interface.
3. A crack through the soil-bentonite cutoff wall, in the overburden till material
4. A crack through the soil-bentonite cutoff wall, in the till core material.
5. Combinations of 2, 3, and 4.

Table 6-3: Summary of Material Properties used in Seepage Analyses

Material	Hydraulic Conductivity (m/s)	Basis for Properties
Till Core	1×10^{-5}	• Falling head tests from Dec 2002 geotechnical testing and; • Experience with materials with similar genesis and grain size distribution
Rockfill	1×10^{-2}	Experience with similar materials
Overburden	1×10^{-5}	• Falling head tests from Dec 2002 geotechnical testing and; • Experience with materials with similar genesis and grain size distribution
Soil-Bentonite Backfill	1×10^{-9} 1×10^{-8}	Published values
Bedrock	4.7×10^{-7} (Section A) 2.2×10^{-7} (Section B)	• BH 03GT-GI-6 packer tests • BH 03GT-GI-3 packer tests • previous geotechnical field investigations

Fluxes were computed through the soil-bentonite cutoff wall for each scenario. Table 6-4 shows the predicted fluxes for each of the scenarios modelled. Seepage flow-nets are included in Appendix II.

Table 6-4: Seepage Fluxes through the Soil-Bentonite Cutoff Wall

Scenario Modelled	Predicted Flux (L/s/m of length of dike)	
	Section A	Section B
No gap at bedrock contact; no crack in soil-bentonite wall	5.8×10^{-4}	5.6×10^{-4}
No gap at bedrock contact; crack in soil-bentonite wall within overburden till	1.5×10^{-2}	7.5×10^{-3}
No gap at bedrock contact; crack in soil-bentonite wall within till core	5.9×10^{-4}	5.6×10^{-4}
0.5 m gap at bedrock contact; no crack in soil-bentonite wall	1.9×10^{-3}	6.7×10^{-3}
0.5 m gap at bedrock contact; crack in soil-bentonite wall within overburden till	1.5×10^{-2}	1.2×10^{-2}
0.5 m gap at bedrock contact; crack in soil-bentonite wall within till core	1.9×10^{-3}	5.9×10^{-3}

The predicted fluxes result in the following conclusions:

1. Cracks through the cutoff wall in the section through the overburden would result in the largest increase in seepage. The increase is in the range of one to two orders of magnitude more than a wall with no cracks or defects in the overburden section. Cracks within the till core section have a negligible effect on seepage.

2. A gap in the soil-bentonite cutoff wall at the bedrock contact results in an increase in seepage of approximately one order of magnitude.

Preliminary estimates of the range of seepage flows to be expected through the cutoff wall during operations are summarized on Table 6-5.

The estimates were made by applying the predicted seepage flux over the complete lengths of dike. This method results in a "worst case" or maximum seepage for each scenario. Section A is considered to be a more typical section for the Bay Zone, and Second Portage dikes, and for the majority of the Goose Island dike. Section B is the deepest section, and has been applied over 30% of the length of the Goose Island dike.

Table 6-5: Seepage Flows through Dikes

Dike	Predicted Flux (l/s/m of length of dike)		Length of Dike (m)	Predicted Flow through Dike and Overburden (see Note 1) (l/s)
	Section A	Section B		
No gap at bedrock contact, no crack within overburden				
Second Portage	6×10^{-4}	n/a	950	0.6
Bay Zone	6×10^{-4}	n/a	720	0.6
Goose Island	6×10^{-4}	6×10^{-4}	1724	1.2
0.5 m gap at bedrock contact, no crack within overburden (along complete length of dike)				
Second Portage	2×10^{-3}	n/a	950	1.9
Bay Zone	2×10^{-3}	n/a	720	1.4
Goose Island	2×10^{-3}	2×10^{-3}	1724	3.4
Crack in cutoff wall within overburden (along complete length of dike)				
Second Portage	1.5×10^{-2}	n/a	950	14.2
Bay Zone	1.5×10^{-2}	n/a	720	10.8
Goose Island	1.5×10^{-2}	1×10^{-2}	1724	23.3

Notes:
1. To calculate total flow at Second Portage and Bay Zone dikes, the seepage flux at Section A flux was applied over the total length of the dikes. To calculate total flow at the Goose Island dike, the Section A and B seepage fluxes were each applied over 70% and 30% of the dike length, respectively.

It is anticipated that the majority of the seepage flows would be captured in toe drains excavated near the downstream toe of the dikes and pumped, most likely to the water treatment plant. The seepage captured at the drains will likely be pumped to the water treatment plant. The remaining flow would report to the open pit dewatering systems.

The seepage analyses show that the soil-bentonite is effective at controlling seepage through the dike.

7.0 VOLUME ESTIMATES

7.1 Dike and Causeway Materials

Based on the alignments shown in Figure 1.2, and on the typical sections shown in Figures 5.1 and 5.2, volumes of construction fill materials were estimated using previous bathymetry studies, and the 3D terrain modeling software SURPAC™. Table 7-1 summarizes the estimated fill volumes for each section of the dike or causeway. A range of sideslopes from 1.5 to 2.5H:1V were used in the calculation to determine the sensitivity of the construction quantities to this variable.

Table 7-1: Quantity Estimates for Dike Fill Materials

Dike Segment	1.5H:1V		1.8H:1V		2.5H:1V		Approximately Equal for All Rockfill Sideslopes	
	Rockfill (m^3)	Till (m^3)	Rockfill (m^3)	Till (m^3)	Rockfill (m^3)	Till (m^3)	Filter (m^3)	Road Surfacing (m^3)
Materials Required for Construction Prior to Startup								
Second Portage Dike	157,000	40,000	167,000	44,000	181,000	47,000	5,000	8,000
Second Portage Causeway	52,000	0	54,000	0	57,000	0	0	5,000
Bay Zone Dike	153,000	41,000	161,000	47,000	181,000	61,000	5,000	5,000
Totals Prior to Startup	*362,000*	*81,000*	*382,000*	*91,000*	*419,000*	*108,000*	*10,000*	*18,000*
Materials Required for Construction in Year 5								
Goose Island Dike	689,000	172,000	852,000	269,000	1,050,000	330,000	30,000	18,000
Grand Totals	**1,051,000**	**253,000**	**1,234,000**	**360,000**	**1,469,000**	**438,000**	**40,000**	**36,000**

Notes: Filter and Road Surfacing quantities are based on dimensions shown on Figures 5.1 and 5.2.

Given the large variation in quantity with the rockfill embankment sideslope, it is recommended that field trials be conducted to determine what slope will be achieved for the rockfill. Field trials could consist of advancing a test embankment from shore into an area of water 5 m deep and measuring the resulting fill slopes. The field trials should also include use of the filter material, to determine its slope when pushed off the sideslope of the rockfill, into the water.

Table 7.1 also indicates, based on the current mine plan, the volume of materials required to construct the dikes prior to startup, and in Year 5.

It is important to note that, for a given dike alignment, changes in the rockfill slope will also change the required depth of excavation for the soil-bentonite cutoff wall. For example, in the area near section B, where the lake bottom slopes away from the pit area,

flatter rockfill sideslopes result in the centreline of the dike being moved into deeper water, which increases the depth of cutoff wall excavation.

Section 8.0 includes a detailed discussion of the maximum depths of excavation for the cutoff wall.

7.2 Available Till and Rockfill Quantities

Both till and rockfill for the dikes and causeway will come from pre-stripping at the proposed North Portage and Third Portage pit areas, and from mining at a proposed starter pit at the Third Portage Deposit. Currently, the only viable initial source of rockfill will be a Third Portage starter pit. The starter pit would be entirely enclosed by land at the Third Portage Deposit.

Material from the starter pit could be used to construct an initial causeway portion of the Second Portage Lake southeast de-watering dike to allow access to the North Portage Deposit. This would allow construction materials to then be developed from both the North and Third Portage Deposit areas concurrently, if necessary.

The volumes of available till and rockfill are based on the latest mine plan. (see Appendix III).

Materials to construct the Bay Zone and Second Portage dikes will consist of:

- Intermediate volcanic (IV) rock – in the downstream rockfill;
- Iron formation (IF) rock – in the upstream rockfill;
- Ultramafic (UM) rock – 'capping' material for IF rock at the upstream rockfill, and
- Till overburden.

Rockfill to construct the Goose Island dike will also consist of IV, IF, and UM rock types. However, it is possible that the proportion of UM waste rock produced from the pits could be greater in Year 5 than in prior years, which could result in a greater volume of UM being placed at the dikes. Construction of the Goose Island dike will require the till overburden from pit stripping operations be stockpiled, starting in Year 2 of the mine life.

The final determination of the appropriate use of one rock type or the other as fill for either the upstream or downstream rockfills will depend on considerations such as potential for acid generation, and metal to leach. Additional geochemical testing, water balance studies, and lake basin hydraulic modeling will help to address questions relating to the appropriate usage of the particular rock types. These studies are underway.

Preliminary material balance estimates (see Appendix III) indicate that:

- Sufficient quantities of rockfill borrow material will be available through a combination of mining of the Third Portage starter pit, and stripping of the North Portage Deposit.
- Sufficient quantities of till borrow material will be available from stripping of the Third Portage and North Portage deposits.
- The required volumes of till and rockfill material for construction of the Goose Island dike in Year 5 will be sufficient. These materials will come from on-going mining activities at the Portage pit.

8.0 CONSTRUCTION METHODOLOGY

The proposed construction sequence consists of two main components:

1. Construction of rockfill and till core dike, and
2. Construction of soil-bentonite cutoff wall.

The following sections discuss the issues related to each of these components. It is important to note that a sediment control barrier such as a floating or anchored turbidity curtain will be required to minimize the distribution of suspended solids into the lakes during fill placement. This technique has been used on similar projects, including Diavik.

8.1 Construction of Dike Embankments

The dikes will be constructed by 'bulkheading' the two rockfill embankments, leaving sufficient space between them to subsequently place the till. 'Bulkheading' consists of dumping rockfill at the furthest end of the active rockfill berm in the water, then pushing the rockfill over the edge with a bulldozer. This process is shown schematically in Figure 8.1. The crest of each rockfill embankment will be 20 m wide, which is enough to safely accommodate one-lane haul truck traffic, including safety berms (see Ref. 2).

The volumetric estimates in this report are based on 1.8H:1V sideslopes on the rockfill embankments. It is likely that during construction the sideslopes of the rockfill will vary. If the sideslopes are steeper than 1.8H:1V, then the overall crest can be narrower, which will reduce the quantities of both the rockfill and the till. Conversely, if the sideslopes are flatter than 1.8H:1V, then it will be necessary to widen the overall crest of the dike in order to maintain the 5 m minimum base width of the till.

Mine equipment will blast (where necessary), excavate, load, haul, and dump the fill materials. It has been assumed that 60-ton haul trucks (Caterpillar 777 or equivalent) will be used to haul all fill materials.

The rockfill borrow and haul operation will consist of the following:

1. Blast;
2. Excavate;
3. Load onto haul trucks. Attempt to exclude oversize material (particle size greater than about 1000 mm in diameter);
4. Haul to the dike;
5. Dump at the advancing crest of the fill; and
6. Push by bulldozer into the water. Oversized material should be selectively pushed to the outside of the embankments.

Where it is possible (i.e., in excavatable or rippable material) the till borrow operation will comprise the following steps:

1. Excavate;
2. Pass material through a grizzly to remove oversize material;
3. Re-load after screening;
4. Haul to the dike;
5. Dump at the advancing crest of the core fill; and
6. Push by dozer into the water, between the two rockfill shoulders.

Where the till material is frozen at the borrow area, it will have to be ripped, if possible. If necessary, some of till may need to be blasted, crushed and screened. Handling the till in this way is more complex and expensive than the procedure described above for unfrozen till.

In order to produce filter material, it will be necessary to process the rockfill. Depending on the characteristics of the blasted rock, it might be possible to screen the material through an 8" grizzly to obtain the required particle size distribution. The exact method for processing to obtain filter materials will be finalized during construction.

8.2 Construction of Soil-Bentonite Cutoff Wall

The construction of the soil-bentonite cutoff wall will follow behind the placement of the till inside the rockfill shoulders. A typical soil-bentonite wall construction operation is shown schematically in Figures 8.1 and 8.2.

The basic steps of the construction operation are:

1. Excavate the trench through the till core and foundation soil and into the bedrock. The excavated trench material is placed away from the trench to prevent collapse of the sidewall of the trench due to weight of the spoiled material. The trench walls are held stable by the bentonite slurry in the trench.

2. Excavated material is mixed with bentonite slurry to obtain a suitable soil-bentonite mixture. The mixing is usually done with a dozer, in an area away from the excavation activities so that there is no contamination by waste materials.

3. The soil-bentonite mixture is pushed into the trench by the dozer. Typically, the angle of repose of the fill in the trench is about 10H:1V. This means that, if the trench is 8 m deep, the total length of the backfill slope will be approximately 80 m. In addition, a 20-m separation is required between the toe of the backfill and the active excavation area, in order to prevent contamination by excavated material. This means that there would be approximately 100-m length of trench open.

4. As the soil-bentonite backfill is placed into the trench, it displaces the bentonite slurry. This slurry is pumped back to a de-sanding plant, where suspended solids are removed, and new bentonite is added. The slurry is then reused in the trench.

9.0 EXCAVATION EQUIPMENT FOR THE SOIL-BENTONITE CUTOFF WALL

This section deals with the excavation of the trench for the soil-bentonite cutoff wall, and the types of excavators which will be required.

Figures 9.1 and 9.2 show profiles along the centerlines of the dikes (for a 1.8H:1V rockfill sideslope). These figures show dike crest elevations, lake bottom surface (from bathymetry), and possible bedrock contact surface (interpolated/extrapolated from borehole information). The total depth of excavation is taken from the dike crest to the bedrock contact.

As a preliminary assessment of the types of excavators which could be required, three types of excavators were identified that could be used to excavate the cutoff trench, as follows:

- "Standard" – Caterpillar 320 – up to 6 m depth.
- "Standard Long Reach" – Caterpillar 320BL – up to 12 m depth.
- "Custom" Long Reach Excavator or Stick/Boom – up to 30 m depth.

These excavators are intended to be examples of the type of excavator which could be appropriate for the construction of the dikes. There is a wide range of suitable manufacturers and models available.

On Figures 9.1 and 9.2, the profiles have been divided into coloured sections, to display where each type of excavator would be used. Note that the "Standard" excavator would significantly more efficient than the longer-reach models for shallower depths.

Charts 9.1, 9.2, and 9.3 summarize the total horizontal distance along the dikes where each type of excavator would be required. Charts 9.1 to 9.3 indicate the following:

- The standard excavator, and the standard long-reach excavator will be sufficient for the Bay Zone and Second Portage dikes. The custom long reach excavator will not be required for these two dikes.
- The custom long reach excavator will be required for the Goose Island dike.

Based on the currently proposed mine schedule, the Goose Island dike will be constructed in Year 5 of the mine life. Therefore, the custom long reach excavator might not be required to construct dewatering dikes until Year 5.

Chart 9.1: Cutoff Wall Excavation Equipment – Bay Zone Dike

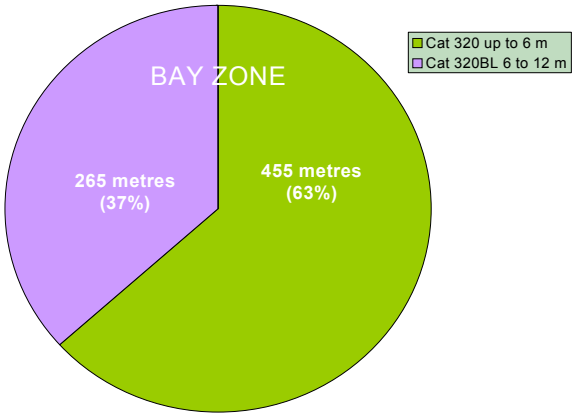


Chart 9.2: Cutoff Wall Excavation Equipment – Second Portage Dike

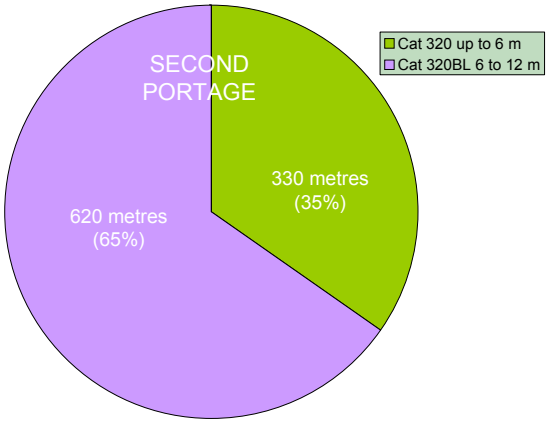
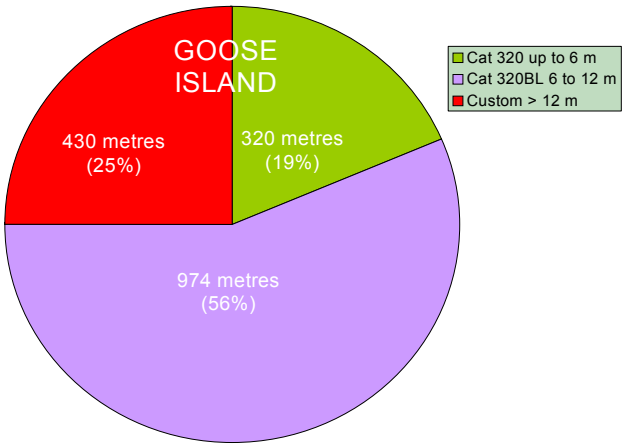


Chart 9.3: Cutoff Wall Excavation Equipment – Goose Island Dike



Details of the example excavators are provided in Appendix IV.

10.0 CONSTRUCTION MATERIAL GUIDELINES

10.1 Rockfill for Embankment Shoulders

The function of the rockfill is to support the core. This material should be a durable, coarse, free-draining material with high shear strength.

The design criteria for the rockfill include the following:

1. The material should be free-draining. Material with a fines content (passing the No. 200 sieve) of less than approximately 8% to 10% is acceptable.

2. It should be non-acid generating and non-metal leaching. The typical dike section could comprise (see Section 7.2):
   - IF rock in the upstream rockfill;
   - IV rock in the downstream rockfill;
   - Till core material;
   - Filter material, and
   - UM rock as a surface capping over the IF rock.

   While the intermediate volcanic rock is indicated to be potentially acid generating, during mining the seepage through the dikes and run-off from the dikes will be collected at the downstream toe and treated. After operation the pits will be flooded and the portions of the dikes above water would be reclaimed to approximately 3 m below final lake surface thus submerging the dikes and minimizing acid generation. The intermediate volcanic rock and ultramafic rock are indicated to be metal leaching under neutral pH conditions. However, some of the key factors that will influence the degree to which metal leaching will occur, and the degree to which it will impact on the environment, are metal release rates, dispersion rates, water balance, and lake hydraulics, which have not yet been fully evaluated and modeled. Laboratory testing and other studies are currently underway to resolve some of these issues.

3. Particles should be large and durable enough to resist wave and ice erosion.

4. The grain size distribution of the filter adjacent to the till core must meet filter requirements with the till. This might require adjusting the blast pattern to produce a finer material than would normally be blasted during pre-strip operations. Additionally, it might be necessary to screen the blast-run rockfill to obtain a fine rockfill filter material.

Based on the above, it is recommended that the rockfill gradation limits be set, on a preliminary basis, as shown on Figure 10.1.

Rockfill placed in the upstream (lakeside) embankment, and the rockfill used in the Second Portage Causeway can consist of run-of-mine rockfill, provided it meets geochemical criteria for these fill materials.

10.2 Till Core

The purpose of the core material is to provide material suitable for the soil-bentonite mixture. The core material should also allow a filter cake to form when the slurry trench is filled with bentonite slurry. Literature indicates (see Ref. 10) that the primary requirement to satisfy these criteria is that the materials contain approximately 20% to 40% of the particle size passing the No. 200 (0.074 mm) sieve. A material guideline grain size distribution for the till core material is shown on Figure 10.1. Grain size determinations of till materials recovered from the Meadowbank project area indicate that the till available from the pre-stripped materials at the Third and North Portage Deposits is within these limits.

10.3 Bentonite Slurry

The bentonite slurry in the active excavation area of the trench is designed with four major properties in mind. These properties are:

- Density. The density of the slurry provides the hydrostatic force necessary to stabilize the sides of the trench during excavation.
- Viscosity. The slurry suspension should have sufficient viscosity to limit the penetration of slurry into the till core material prior to formation of the filter cake.
- Gel strength. The slurry suspension should have sufficient gel strength to maintain a given amount of solids in suspension, for the required slurry density.
- Filtrate loss. The formation of the low-permeability filter cake is the primary means by which the full hydrostatic force of the slurry is applied to the sides of the trench.

Table 10-1: Typical Properties of a 5% Bentonite Slurry

Property	Typical Value	QC Test
Density	1050 kg/m3 (fresh) 1160 kg/m3 (in trench)	Slurry density cup
Viscosity	40 to 50 seconds	Marsh funnel viscosity
Gel Strength	0.5 to 0.7 kPa	10-minute gel strength
Filtrate Loss	20 ml	30-minutes at 100 psi filtrate loss test

The bentonite should be a Wyoming-type, sodium cation-base bentonite.

The bentonite slurry is produced by hydrating dry bentonite for approximately 24 hours. This 'fresh' slurry is then pumped into the trench, where it mixes with 'working' bentonite, which contains suspended solids from the excavation.

10.4 Soil-Bentonite Backfill

The permeability of a soil-bentonite backfill material is dependent on the soil gradation and the quantity of bentonite used in mixing. Typically, the permeability of the backfill is reduced an order of magnitude for each 1% increase in the bentonite concentration by dry weight of backfill.

The soil is usually mixed with bentonite slurry. The slurry typically contains approximately 5% bentonite by dry weight, to obtain a soil-bentonite mixture that is approximately 1% bentonite by weight.

The slump of the backfill should be between 50 mm and 150 mm. Material with this slump will generally form a slope of about 10H:1V in the trench.

11.0 CONCLUSIONS AND RECOMMENDATIONS

The following are conclusions and recommendations based on the results of the Meadowbank dike design study.

1. The dike cross-sections will consist of two rockfill embankments, with a till core zone, a filter zone downstream of the till core, and a soil-bentonite cutoff wall. The cutoff wall will be keyed into bedrock by excavating approximately 0.5 m depth into the bedrock.

2. The slope stability analyses indicate that the dikes will be stable under short-term, undrained, static load conditions, and under long-term, static and earthquake load conditions. The slope stability analyses were done for rockfill sideslopes of 1.5H:1V.

3. Seepage modeling indicates that the total seepage through all of the dikes will be in the range of approximately 2.4 to 48.3 L/s. This value varies depending on potential cracking in the soil-bentonite cutoff wall and/or a potential gap in the cutoff wall at the bedrock contact.

4. Cracks through the cutoff wall in the section through the overburden would result in the largest increase in seepage through the cutoff wall. The increase is in the range of one to two orders of magnitude more than a wall with no cracks or defects in the overburden section. Cracks within the till core have a negligible effect on seepage.

5. A gap in the soil-bentonite cutoff wall at the bedrock contact results in an increase in seepage of approximately one order of magnitude more than a wall with no gap at the bedrock contact.

6. The proposed construction sequence consists of placing the two rockfill shoulders first, then the filter material, leaving a minimum 5-m wide gap between the toes of the filter and the upstream rockfill embankment at the lake bottom. Next, the till core material will be placed between the embankments. The soil-bentonite cutoff wall will be excavated through the till core, through the overburden, and will be keyed into bedrock.

7. The rockfill sideslopes will likely be between 1.5H:1V and 2.5H:1V. Based on these sideslopes, the required rockfill and till volumes in the dikes will be:
   - Between approximately 360,000 m^3 and 420,000 m^3 of rockfill, and 80,000 m^3 to 110,000 m^3 of till prior to startup (for Bay Zone and Second Portage dikes).
   - Between approximately 640,000 m^3 and 1,050,000 m^3 of rockfill, and 170,000 m^3 to 330,000 m^3 of till in Year 5 (for Goose Island dike).

8. Based on preliminary material balance modeling, the quantities of till and rockfill available from mining activities will be sufficient.

   The required volumes of till and rockfill material for construction of dikes prior to startup will be generated during mining of a proposed starter pit at the Third Portage

Deposit, and during on-land pre-stripping activities at the North Portage Deposit. This will require careful sequencing.

The required volumes of till and rockfill material for construction of the Goose Island dike in Year 5 will be sufficient. These materials will come from on-going mining activities at the Portage pit.

9. The construction quantities are sensitive to the sideslopes that will be achieved on the rockfill. A test embankment should be constructed to reduce the uncertainty in the sideslope estimate and quantity estimate. This test will also be useful in determining the anticipated rollout distance of larger particles in the rockfill.

   Vibrating wire piezometers should be installed in the foundation till prior to placing the rockfill. This will allow measurement of the pore pressure response of the foundation till, which will provide more accurate data for future stability analyses.

10. 'Standard' long reach excavators (such as a Caterpillar 320 BL) with a digging depth reach greater than 6 m will be required to construct the Bay Zone and Second Portage dikes. This construction will occur prior to startup.

    'Custom' long reach excavators with a digging depth reach greater than 12 m will be required to construct the Goose Island dike. This construction will take place in Year 5 of the mine life.

11. Currently, it is proposed that the mined materials be placed in the dike section as follows, at the Bay Zone and Second Portage dikes:
    - Intermediate volcanic rock – in the downstream rockfill;
    - Iron formation rock – in the upstream rockfill;
    - Ultramafic rock – capping material for IF rock at the upstream rockfill;
    - Filter material, and
    - Till overburden.

    The Goose Island deposit could have a greater usage of UM rock, depending on availability in Year 5.

12. During mining, any acidic drainage through the dikes would be collected at the downstream toe, and treated. At closure, the dikes would be reclaimed to 2 m to 3 m below lake surface, preventing further acid generation. Additional geochemical testing and lake hydraulic modeling are currently underway to provide additional information on the possible impact of constructing the dikes with the various rock types.

12.0 CLOSING REMARKS

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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Geotechnical Engineer

Cam Clayton, P.Geo.
Geological Engineer

Terry Eldridge, P.Eng.
Principal

DAH/CJC/TLE/vee
03-1413-427/4200

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10. Design Standards Embankment Dams No. 13 Chapter 16 Cutoff Walls, U.S. Dept. of the Interior, Bureau of Reclamation, Denver, Colorado.

PROJECT NO. 03-1413-427 DRAWN BY: GG REVIEWED BY: CJC DATE: 21NOV02 FILE LOCATIN:\Bur Graphics\Projects\2003\1413\03-1413-427\Drafting\coral\ Figure 1.1 - Keyplan.cdr

PROJECT	CUMBERLAND RESOURCES LTD. MEADOWBANK GOLD PROJECT NUNAVUT
TITLE	KEY PLAN

Golder Associates

PROJECT No. 03-1413-427			FILE No. key	
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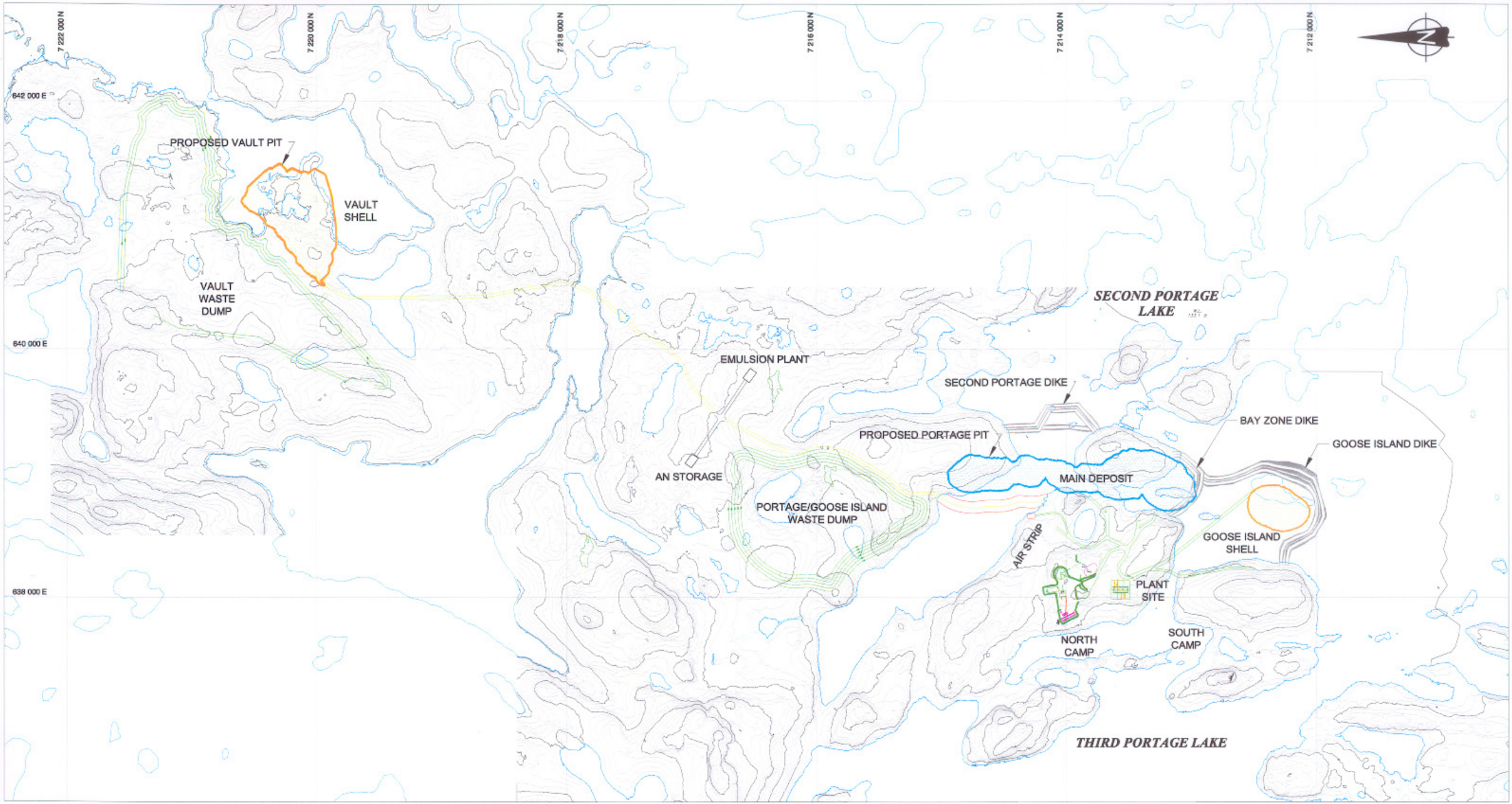
CHECK	DAH	21OCT03		
REVIEW				



NOTES

1) Contour information on land supplied by Cumberland Resources Ltd.
2) Contours below lake surface are based on bathymetric surveys by Golder Associates Ltd., 2002 and 2003.
3) Lake contours are based on surveyed lake surface elevations:
   2nd Portage Lake = 133.1 m
   3rd Portage Lake = 134.1 m

0 3000 6000 9000 12000 15000
Scale in Meters

PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
MEADOWBANK MINE - SITE PLAN

Golder Associates

PROJECT No. 03-1413-427			FILE No. Figure 1.2
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CADD	SRR	21/OCT/03	
CHECK	DAH	21/OCT/03	**FIGURE 1.2**
REVIEW			

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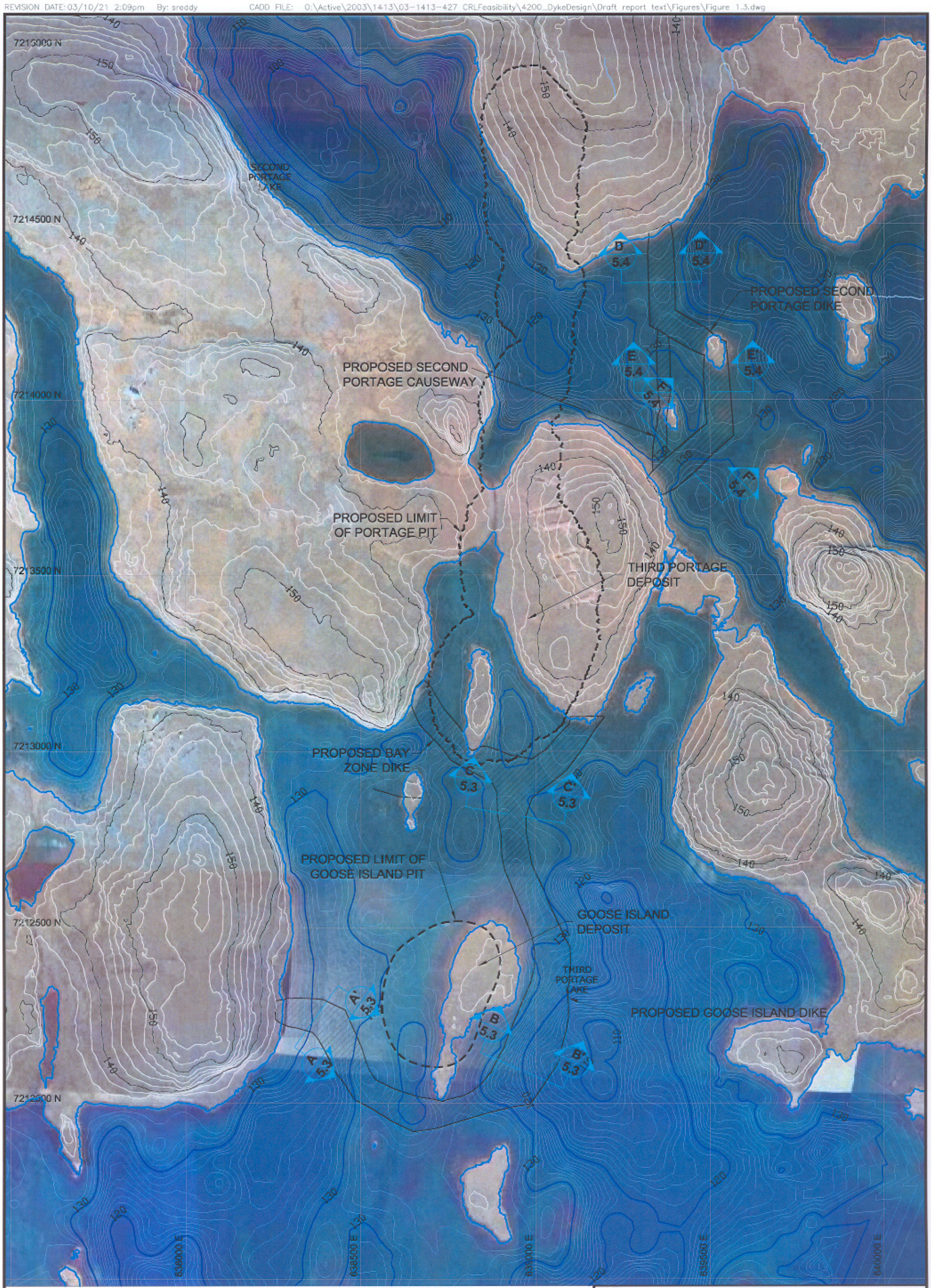

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Scale in Meters

NOTE

1) Contour information on land supplied by Cumberland Resources Ltd.
2) Contours below lake surface are based on bathymetric surveys by Golder Associates Ltd., 2002 and 2003.
3) Lake contours are based on surveyed lake surface elevations:
   2nd Portage Lake = 133.1 m
   3rd Portage Lake = 134.1 m

PROJECT
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TITLE
PROPOSED DIKE ALIGNMENTS

Golder Associates

PROJECT No. 03-1413-427			FILE No. Figure 1.2	
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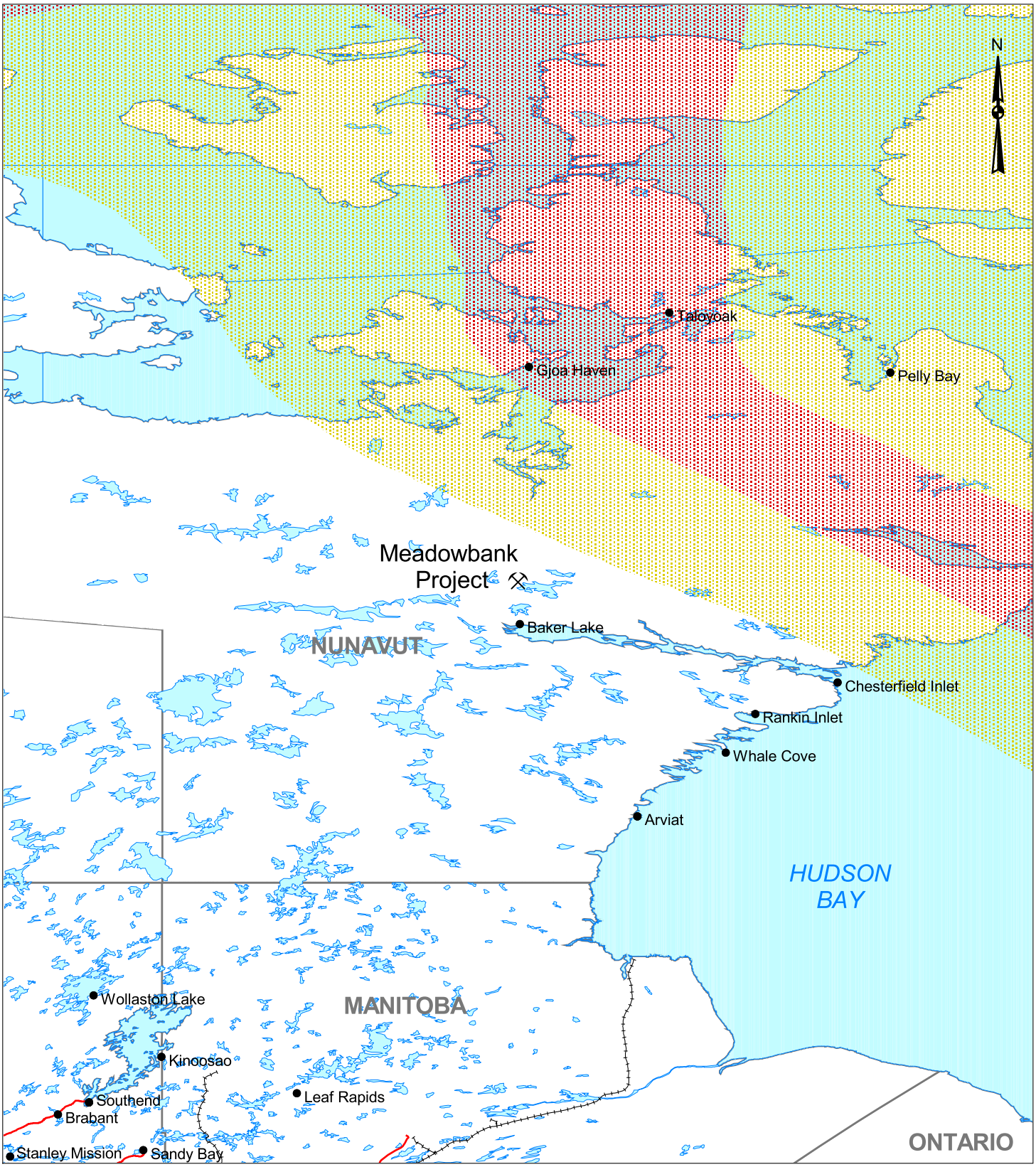

LEGEND

- Meadowbank Project
- Town/Village

Peak Horizontal Ground Acceleration (g), for 10% in 50 Years Event

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

REFERENCE

Ground Acceleration data obtained from National Atlas of Canada,
Base digital data obtained from ESRI Inc.,
DATUM: WGS84 PROJECTION: Geographic

200 0 200 Kilometers

Scale - 1:10,000,000

PROJECT

CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE

SEISMIC ZONING MAP SHOWING MEADOWBANK PROJECT LOCATION

Golder Associates

PROJECT No. 03-1413-427			SCALE AS SHOWN	REV. 0
DESIGN	CJC	18 Jun. 2003	**FIGURE 3.1**	
GIS	CDB	18 Jun. 2003		
CHECK				
REVIEW				

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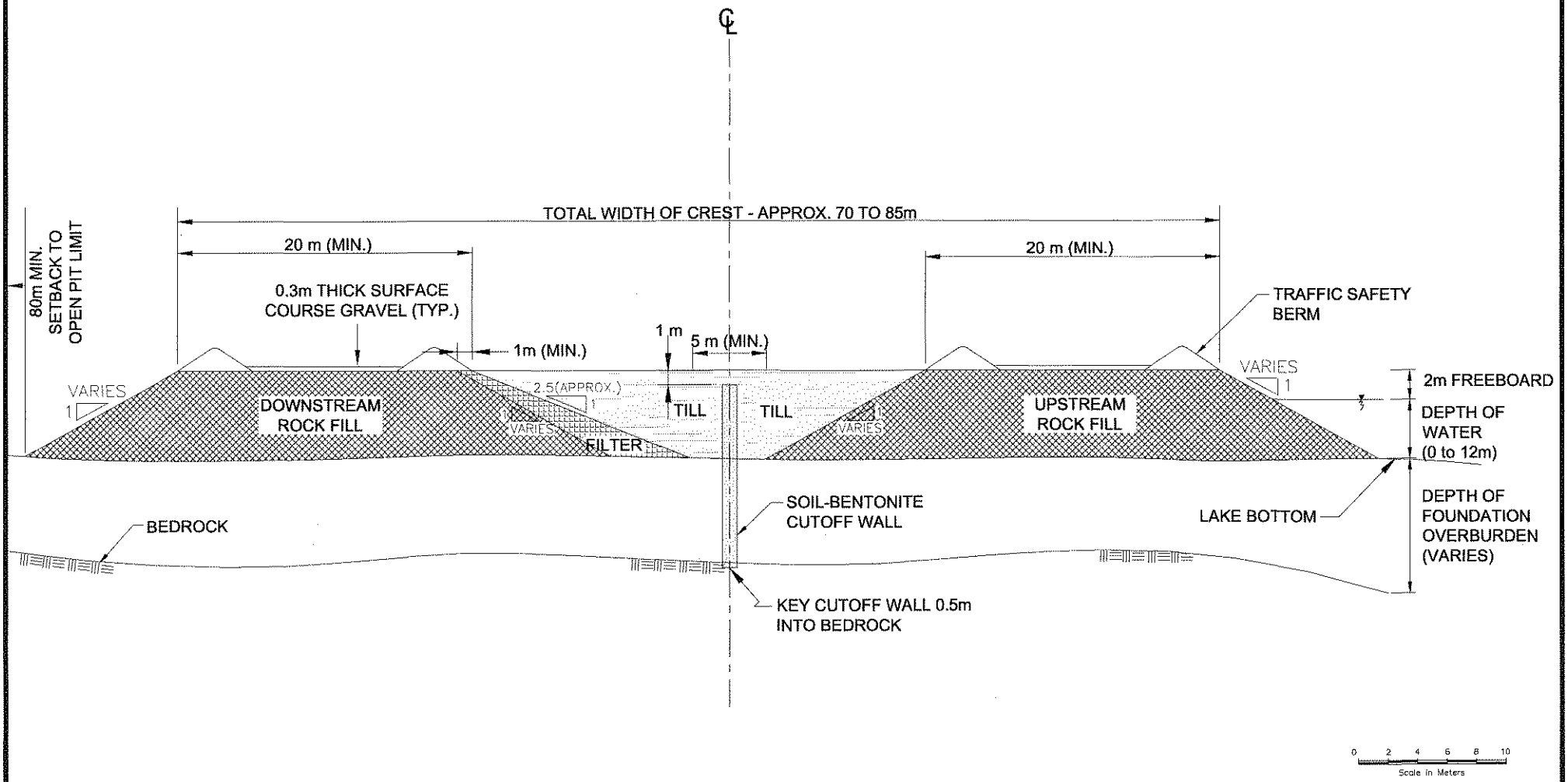


NOTES

1) Sideslopes for rockfill as shown are 1.8H:1V.
   Actual slopes will vary depending on water depth, rockfill grain size and foundation conditions.
2) NWT Mine Safety and Health Act(1995) states that minimum width of haul road is:
- for one-lane traffic: 2X width of largest vehicle
- for two-lane traffic: 3X width of largest vehicle
- minimum height of safety berm = 0.75X diameter of tire of largest vehicle
3) The 80m minimum setback is based on a similar set back of Diavik and to be confirmed during detailed engineering design.
4) Largest vehicle assumed to be a 777 haul truck.

PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

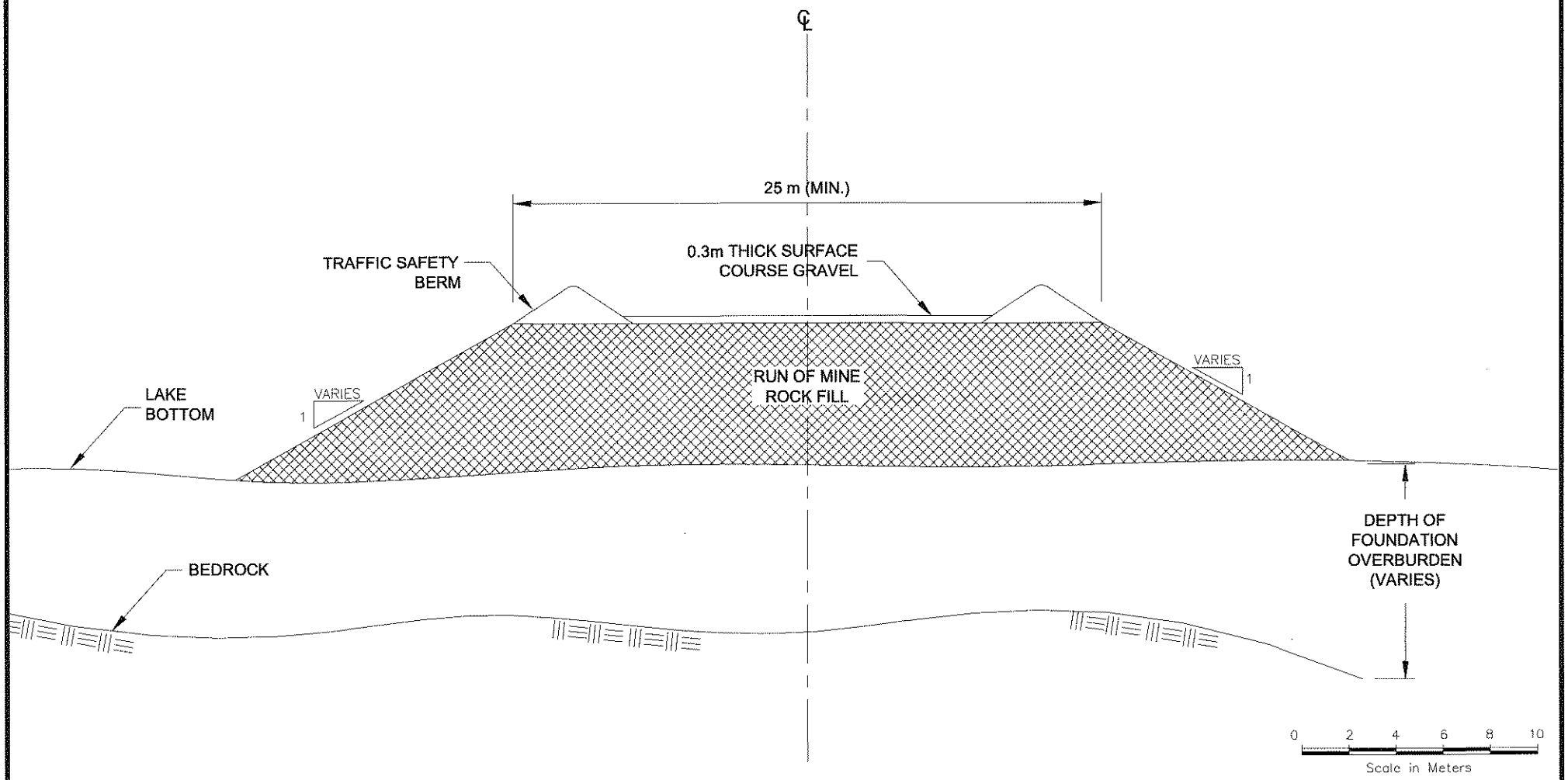
TITLE
TYPICAL DIKE CROSS - SECTION SECOND PORTAGE, GOOSE ISLAND AND BAY ZONE DIKES

Golder Associates

PROJECT No.	03-1413-427		FILE No.	Figure 5.1
DESIGN	DAH	01/APR/03	SCALE 1:400	REV. 0
CADD	WSL	19/JUN/03		
CHECK	DAH	03/OCT/03		
REVIEW				

FIGURE 5.1

REVISION DATE: 03/10/14 4:49pm By: sreddy CADD FILE: O:\Active\2003\1413\03-1413-427 CRLFeasibility\4200_DykeDesign\Draft report text\Figures\Figure 5.2.dwg



NOTES

1) Sideslopes for rockfill as shown are 1.8H:1V.
   Actual slopes will vary depending on water depth, rockfill grain size and foundation conditions.
2) NWT Mine Safety and Health Act(1995) states that minimum width of haul road is:
- for one-lane traffic: 2X width of largest vehicle
- for two-lane traffic: 3X width of largest vehicle
- minimum height of safety berm = 0.75X diameter of tire of largest vehicle
3) Largest vehicle assumed to be a 777 haul truck.

PROJECT

CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

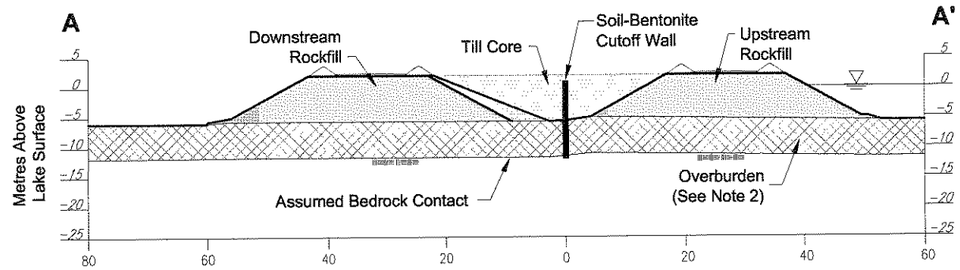
TITLE

TYPICAL CROSS - SECTION
SECOND PORTAGE CAUSEWAY

Golder Associates

PROJECT No.	03-1413-427		FILE No.	Figure 5.2
DESIGN	DAH	01/APR/03	SCALE 1:250	REV. 0
CADD	WSL	19/JUN/03		
CHECK	DAH	03/OCT/03		
REVIEW				

FIGURE 5.2



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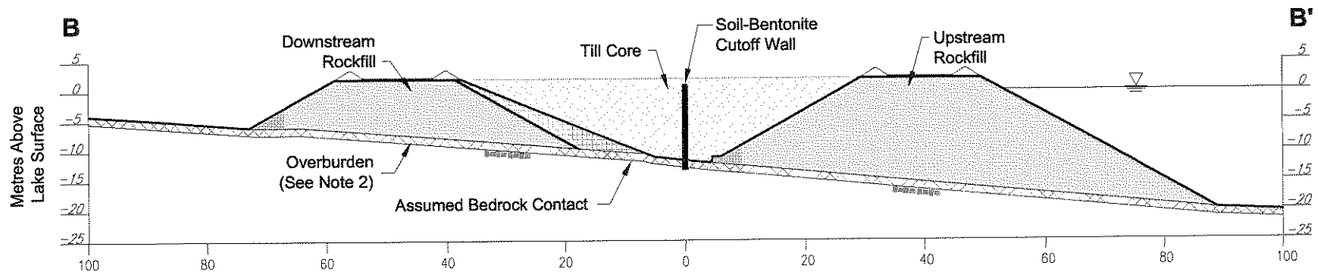
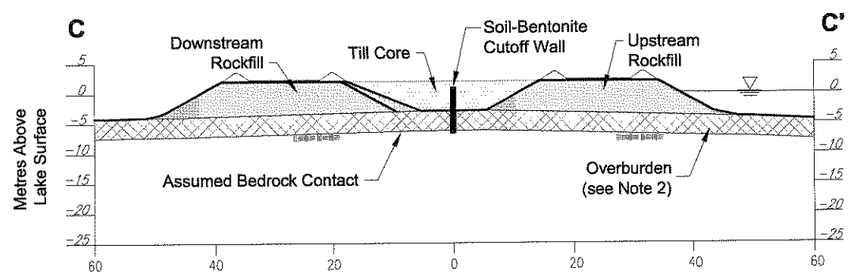


B 1.3 NEAR GOOSE ISLAND



C 1.3 NEAR RIGHT ABUTMENT

NOTES

1. Sections are shown for 1.8H:1.0V sideslopes of rockfill. Actual slopes will vary, depending on water depth, rockfill grain size, and foundation conditions.
2. Overburden depth has been estimated based on results from the 2003 Golder geotechnical drilling investigations. Actual overburden depths will vary.
3. All dimensions are in metres unless noted otherwise.

0 10 20 30 40 50
Scale in Meters

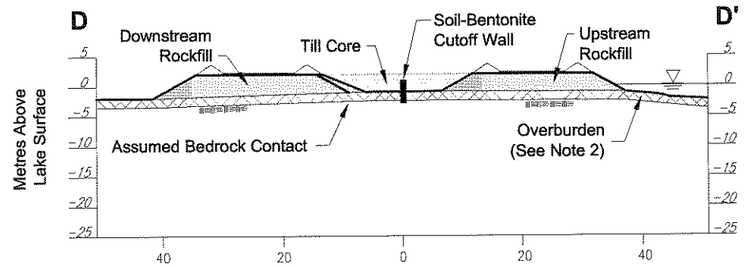
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
GOOSE ISLAND DIKE SECTIONS

Golder Associates

PROJECT No.	03-1413-427		FILE No.	Figure 5.3 and 5.4
DESIGN	DAH	13/JUN/03	SCALE AS SHOWN	REV. 0
CADD	NV/WSL	19/JUN/03		
CHECK	DAH	03/OCT/03		
REVIEW				

FIGURE 5.3



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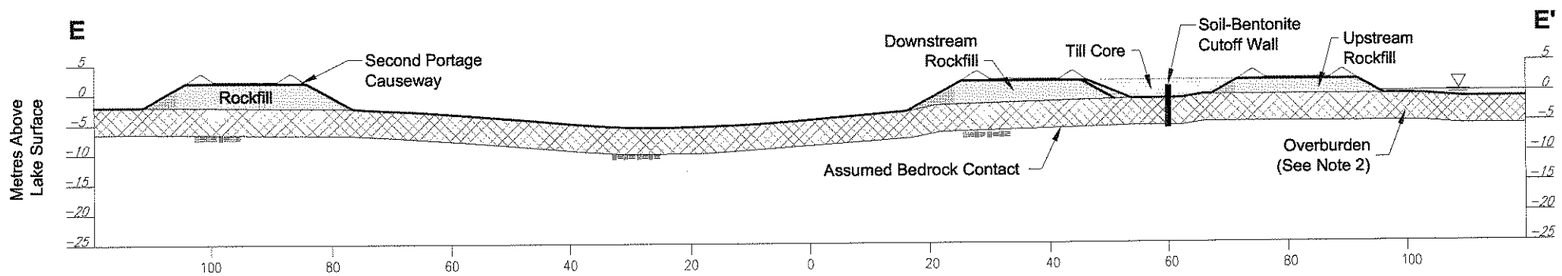
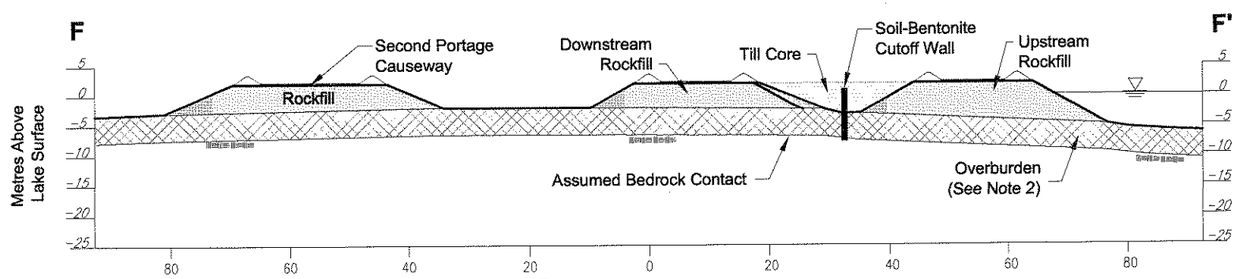


E 1.3 SECTION THROUGH CAUSEWAY AND DIKE



F 1.3 NEAR LEFT ABUTMENT

NOTES

1. Sections are shown for 1.8H:1.0V sideslopes of rockfill. Actual slopes will vary, depending on water depth, rockfill grain size, and foundation conditions.
2. Overburden depth has been estimated based on results from the 2003 Golder geotechnical drilling investigations. Actual overburden depths will vary.
3. All dimensions are in metres unless noted otherwise.

0 10 20 30 40 50
Scale in Meters

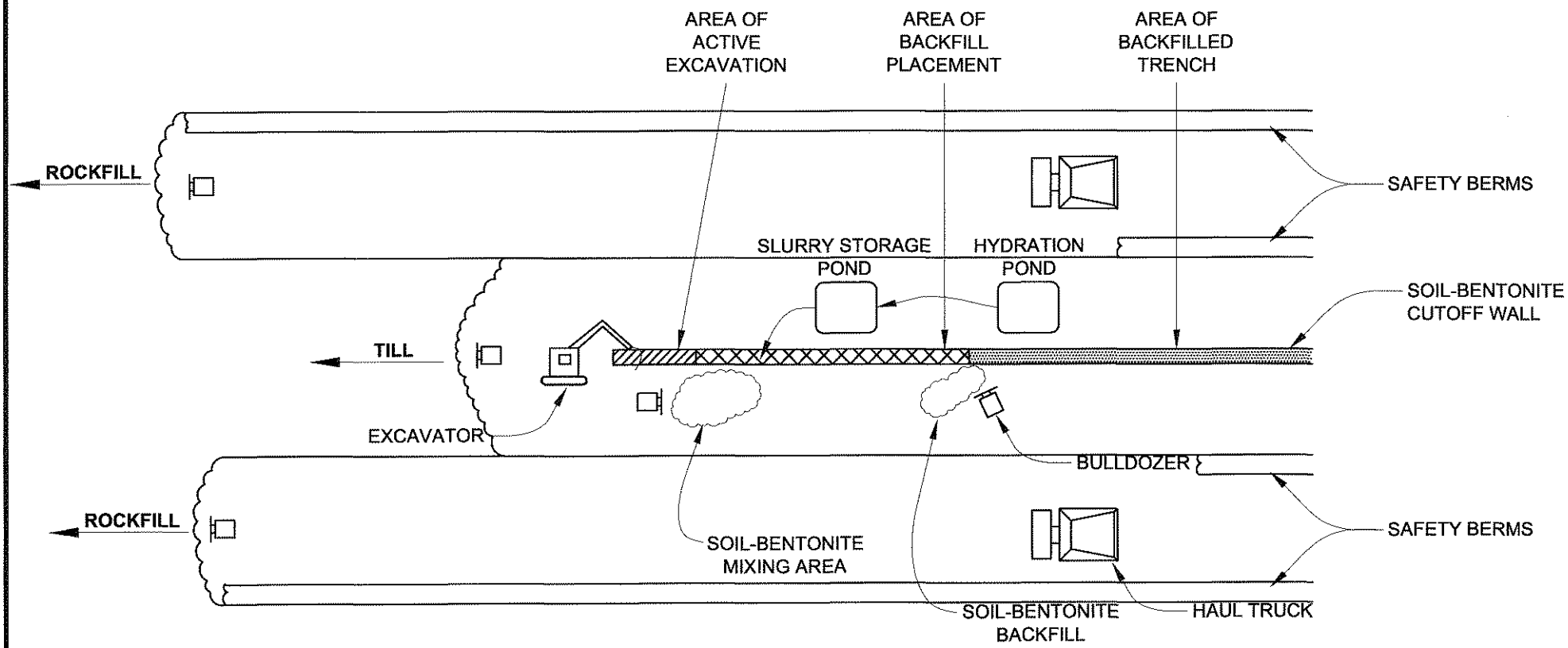
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECOND PORTAGE DIKE AND CAUSEWAY SECTIONS

Golder Associates

PROJECT No.	03-1413-427		FILE No.	Figure 5.3 and 5.4
DESIGN	DAH	13/JUN/03	SCALE AS SHOWN	REV. 0
CADD	NV/WSL	19/JUN/03		
CHECK	DAH	03/OCT/03	**FIGURE 5.4**	
REVIEW				

REVISION DATE: 03/10/14 4:53pm By: sreddy CADD FILE: O:\Active\2003\1413\03-1413-427 CRLFeasibility\4200_DykeDesign\Draft report text\Figures\Figure 8.1.dwg



PROJECT

CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE

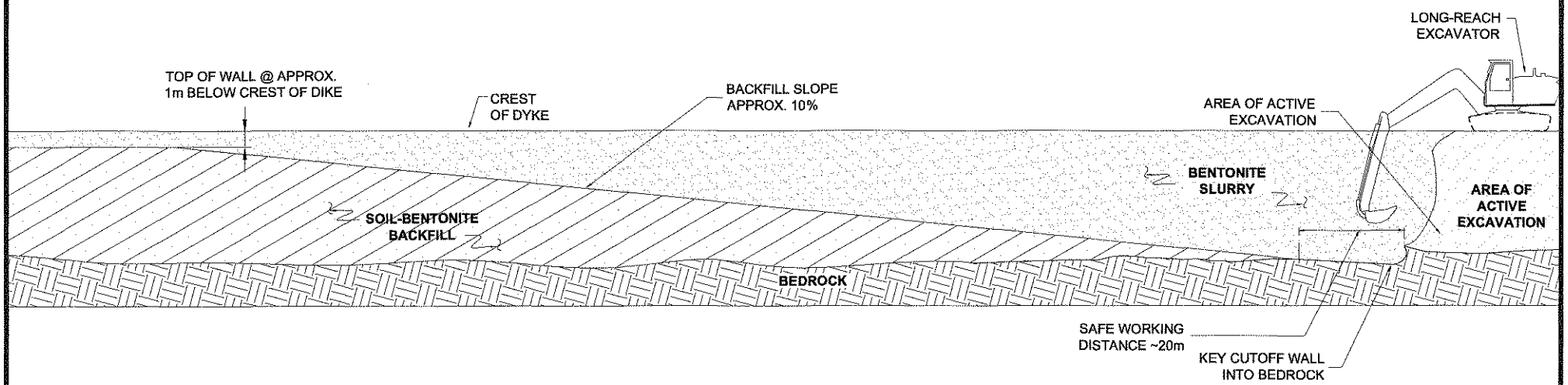
SOIL-BENTONITE CUTOFF WALL CONSTRUCTION OPERATION CONCEPTUAL LAYOUT

Golder Associates

PROJECT No.	03-1413-427		FILE No.	Figure 8.1
DESIGN	DAH	17/APR/03	SCALE N.T.S.	REV. 0
CADD	JK/WSL	19/JUN/03		
CHECK	DAH	03/OCT/03		
REVIEW				

FIGURE 8.1

REVISION DATE: 03/10/14 4:54pm By: sreddy CADD FILE: O:\Active\2003\1413\03-1413-427 CRLFeasibility\4200_DykeDesign\Draft report text\Figures\Figure 8.2.dwg



NOT TO SCALE

PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

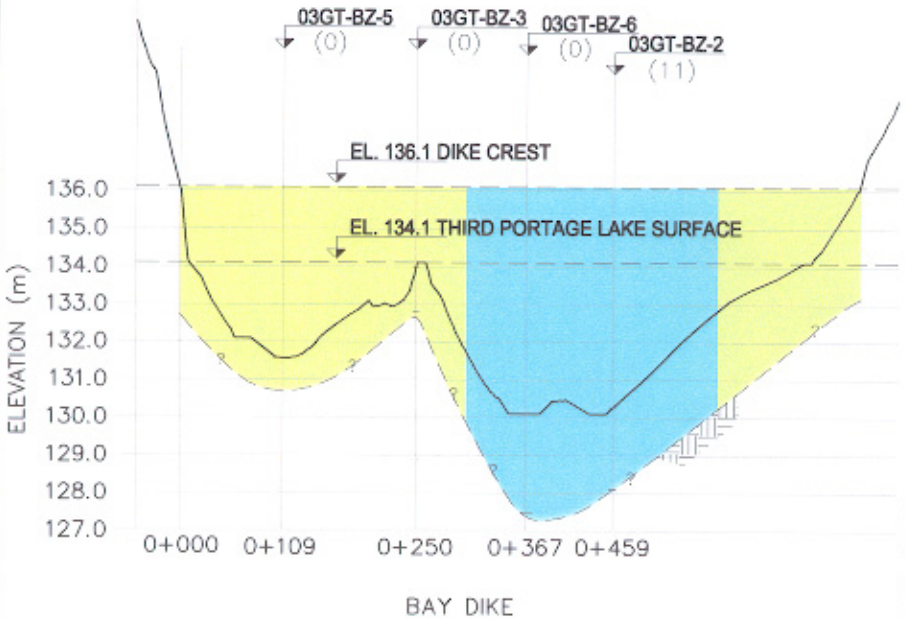
TITLE
SOIL-BENTONITE CUTOFF WALL CONSTRUCTION OPERATION CONCEPTUAL SECTION

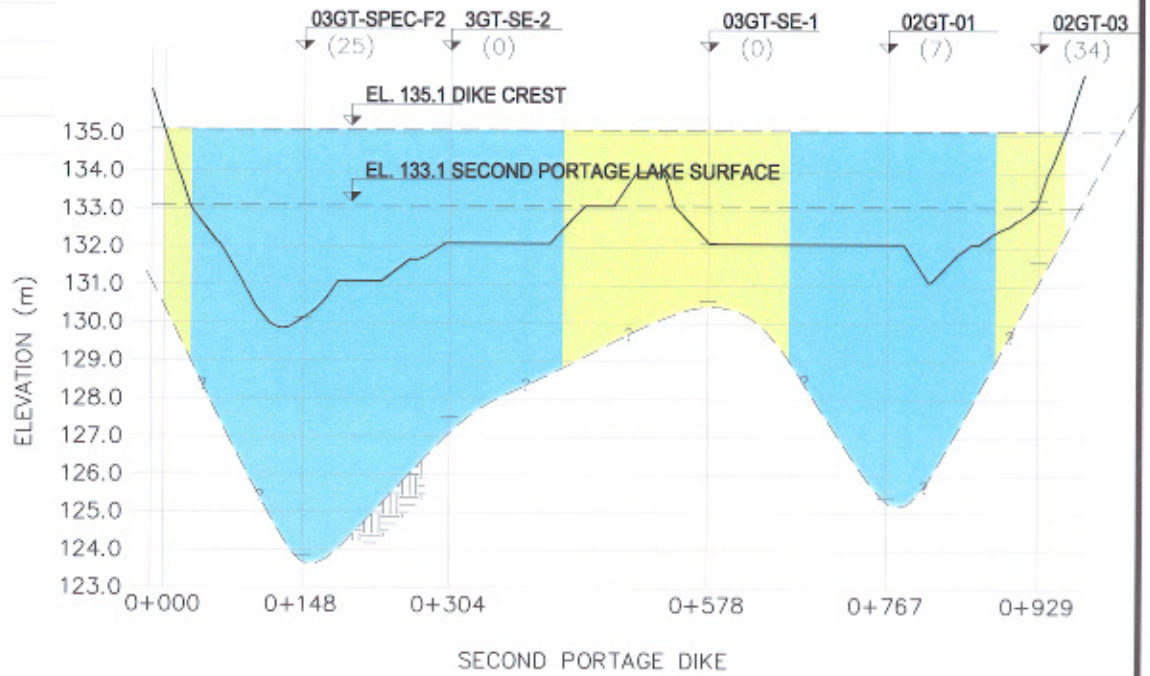
Golder Associates

PROJECT No.	03-1413-427		FILE No.	Figure 8.2
DESIGN	DAH	17/APR/03	SCALE N.T.S.	REV. 0
CADD	JK/WSL	19/JUN/03		
CHECK	DAH	03/OCT/03		
REVIEW				

FIGURE 8.2

REVISION DATE: 03/10/15 10:48am By: sreddy CADD FILE: O:\Active\2003\1413\03-1413-427 CRLFeasibility\4200_DykeDesign\Excavation Investigation\Dike Alignment Sections.dwg





LEGEND

	Up to 6 meters - CAT 320
	6 to 12 meters - CAT 320BL LONG REACH
- - ? - -	Possible Bedrock contact
———	Lake bottom
03-GT-BZ-5	Borehole - Golder 2003
02GT-01	Borehole - Golder 2002

NOTES

1) Numbers in brackets are the offset from centreline of dike.

2) Lake bottom determined from Bathymetric surveys by Golder in 2002 and 2003.

3) Depths to bedrock contact based on boreholes logged and tested by Golder in 2002 and 2003. See Appendix V for complete logs. See Figure 1.2 for borehole locations.

Vertical Scale

0 2 4 6 8 10

Scale in Meters

Horizontal Scale

0 50 100 150 200 250

Scale in Meters

PROJECT

CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE

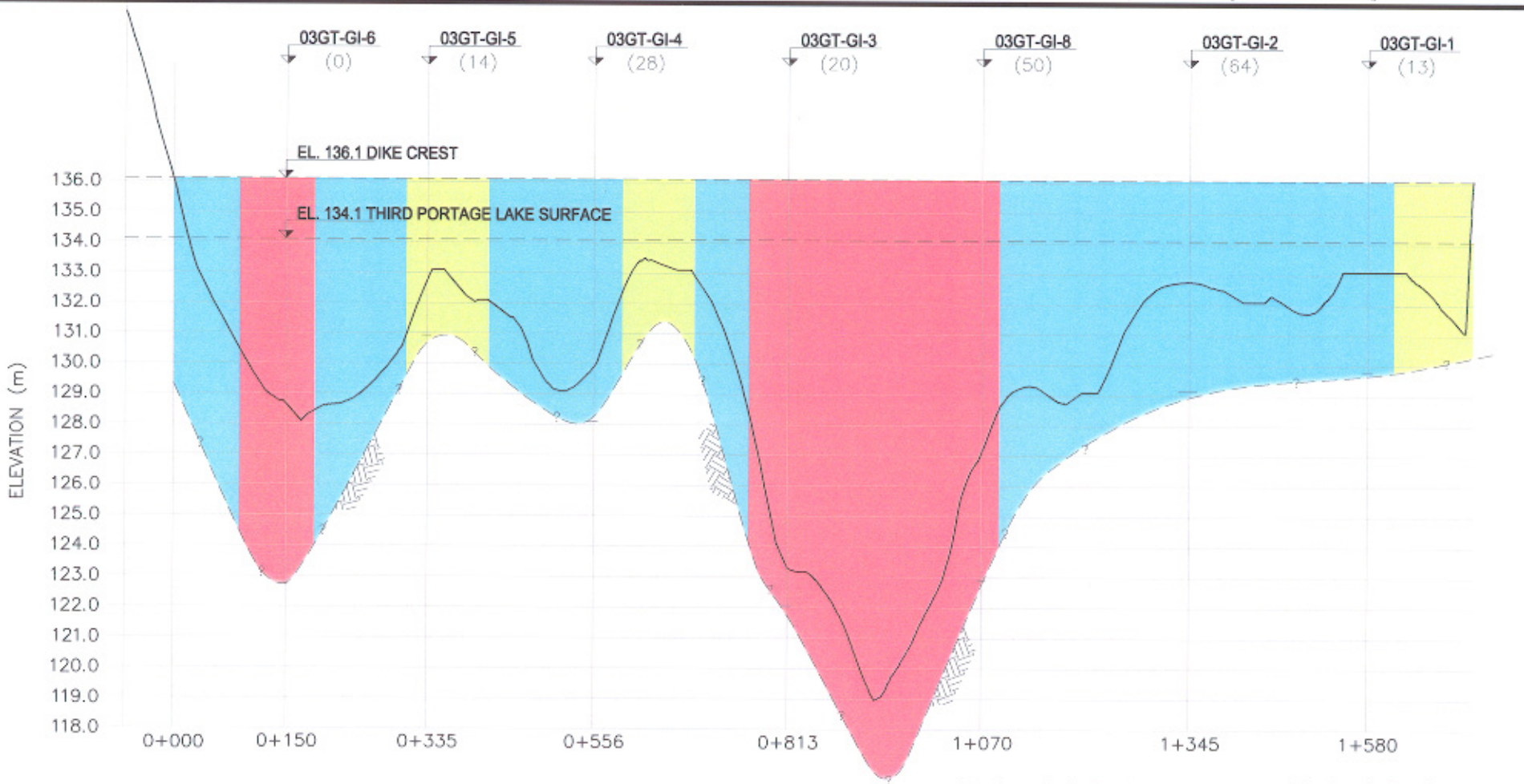
SECOND PORTAGE AND BAY ZONE DIKE - CENTRELINE PROFILE

Golder Associates

PROJECT No. 031413427.4200			FILE No. Dike Alignment Sec-	
DESIGN	DSH	10/07/03	SCALE AS SHOWN	REV. 0
CADD	WSL	29/07/03		
CHECK	DAH	03/OCT/03		
REVIEW				

FIGURE 9.1

REVISION DATE: 03/10/15 10:53am By: sreddy CADD FILE: O:\Active\2003\1413\03-1413-427 CRLFeasibility\4200_DykeDesign\Excavation Investigation\Dike Alignment Sections.dwg



Horizontal Scale

0 50 100 150 200 250

Scale in Meters

Vertical Scale

0 2 4 6 8 10

Scale in Meters

LEGEND

- Up to 6 meters - CAT 320
- 6 to 12 meters - CAT 320BL LONG REACH
- CUSTOM-BUILT LONG REACH BOOM >12 meters
- Possible Bedrock contact
- Lake bottom
- 03-GT-BZ-5 Borehole - Golder 2003
- 02GT-01 Borehole - Golder 2002

NOTES

1) Numbers in brackets are the offset from centreline of dike.

2) Lake bottom determined from Bathymetric surveys by Golder in 2002 and 2003.

3) Depths to bedrock contact based on boreholes logged and tested by Golder in 2002 and 2003. See Appendix V for complete logs. See Figure 1.2 for borehole locations.

PROJECT

CUMERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE

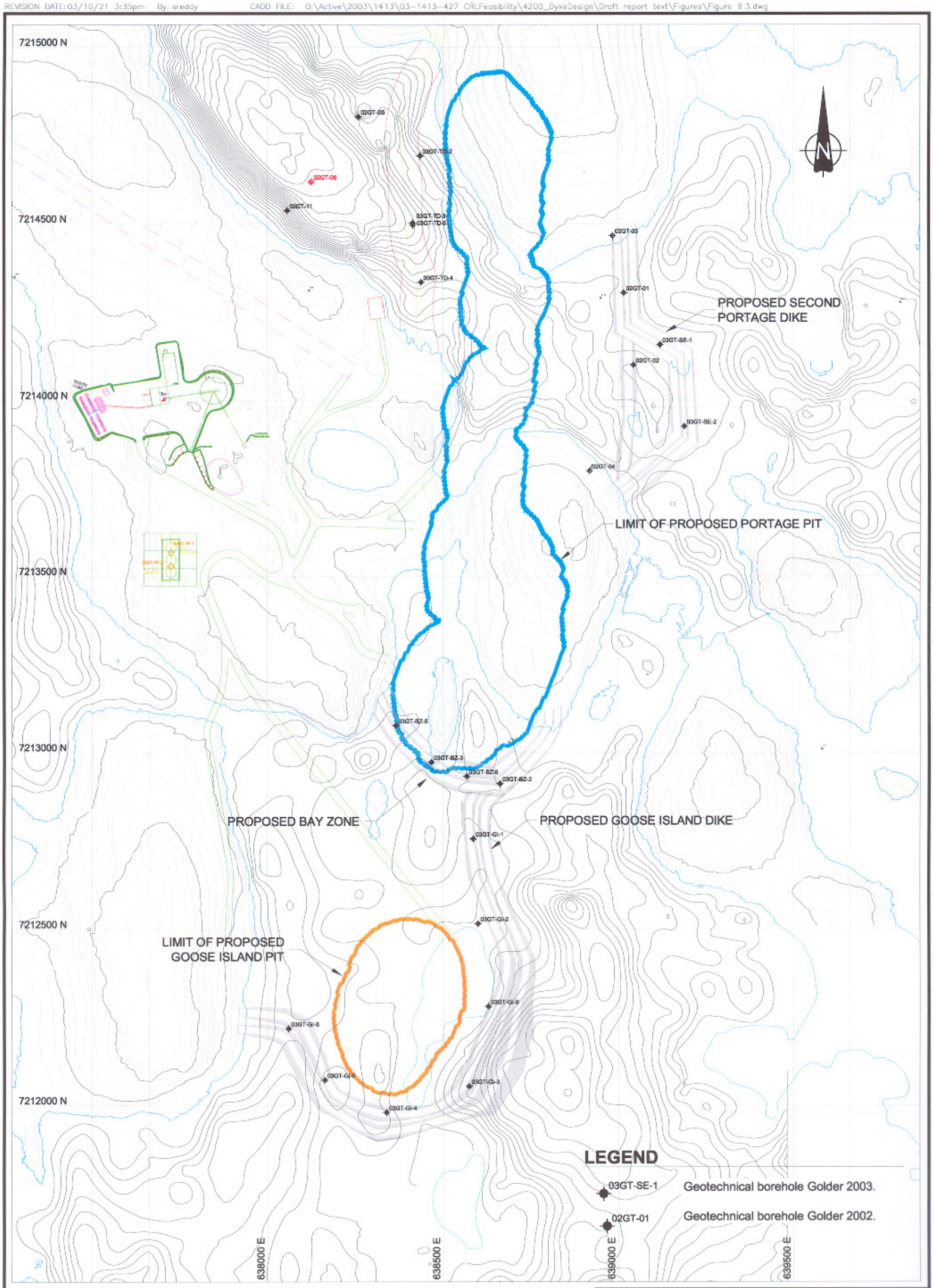
GOOSE ISLAND DIKE - CENTRELINE PROFILE

Golder Associates

PROJECT No. 031413427.4200			FILE No. Dike Alignment Sec~	
DESIGN	DSH	10/07/03	SCALE AS SHOWN	REV. 0
CADD	WSL	29/07/03		
CHECK	DAH	03/OCT/03		
REVIEW				

FIGURE 9.2

REVISION DATE: 03/10/21 3:35pm By: sreddy CADD FILE: O:\Active\2003\1413\03-1413-427 CRLFeasibility\4200_DykeDesign\Draft report text\Figures\Figure 9.3.dwg



0 100 200 300 400 500
Scale in Meters

NOTES

1) Contour information on land supplied by Cumberland Resources Ltd.
2) Contours below lake surface are based on bathymetric surveys by Golder Associates Ltd., 2002 and 2003.
3) Lake contours are based on surveyed lake surface elevations:
   2nd Portage Lake = 133.1 m
   3rd Portage Lake = 134.1 m

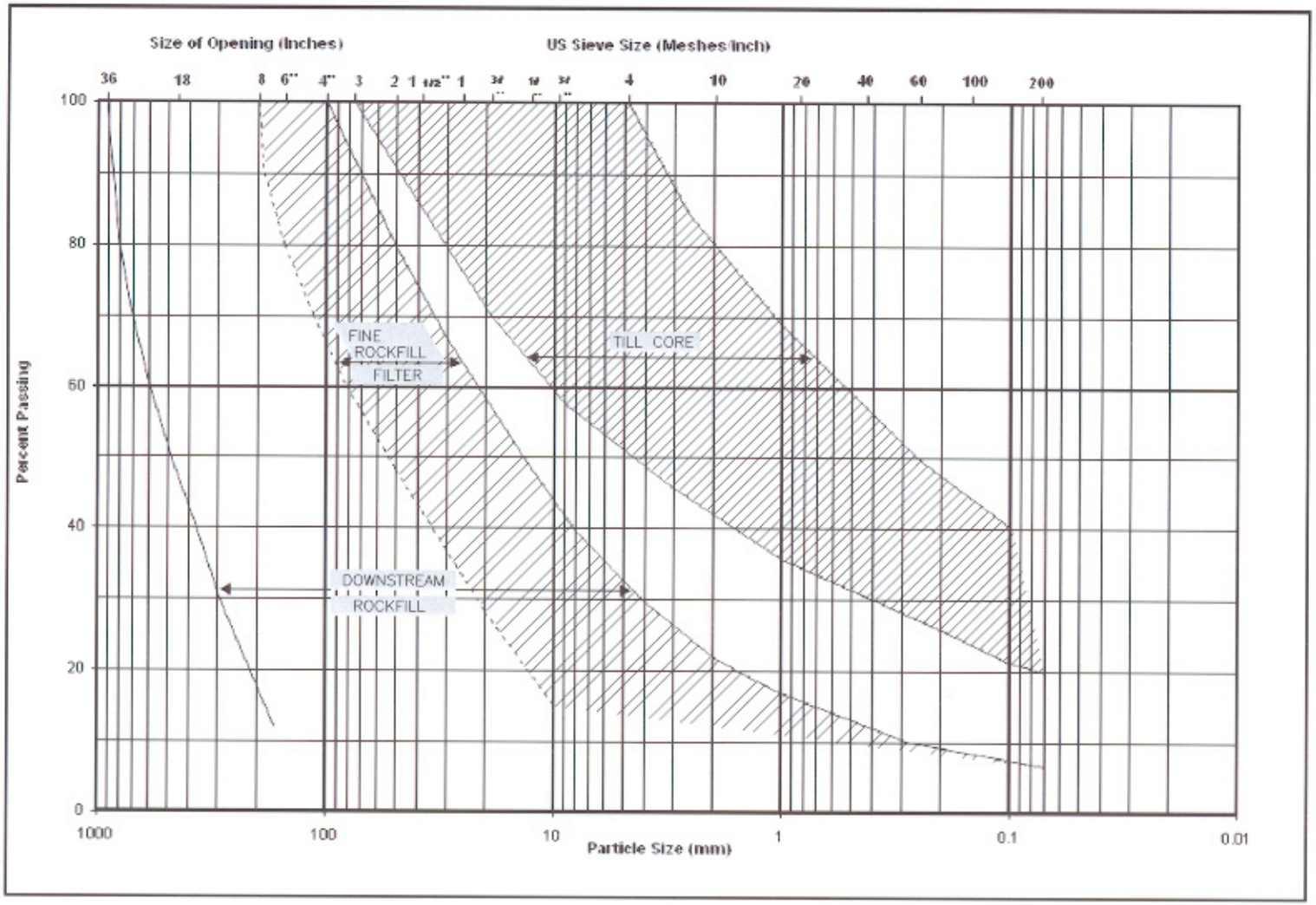
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
GEOTECHNICAL BOREHOLES - DIKES

Golder Associates

PROJECT No. 03-1413-427			FILE No. Figure 9.3	
DESIGN	DAH	16/OCT/03	SCALE: AS SHOWN	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE 9.3**	
REVIEW				

REVISION DATE: 03/10/15 11:13am By: sreddy CADD FILE: O:\Active\2003\1413\03-1413-427 CRLFeasibility\4200_DykeDesign\Slope Stability Analysis\dwg\CumberlandFigures.dwg



NOTES

1) Till core graduation based on samples analyzed as reported in Winter 2002 and Summer 2002 factual reports by Golder.

2) Fine rockfill filter and downstream rockfill designed to be filter-compatible using criteria developed by Sherard, et.al. (self filtering not considered), and presented by U.S. Army Corps of Engineers.

PROJECT

CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE

MATERIAL GUIDELINES
PROPOSED GRAIN SIZE DISTRIBUTION
TILL CORE AND ROCK FILL

Golder Associates

PROJECT No.	03-1413-427		FILE No.	CumberlandFigures
DESIGN	WSL	20/06/03	SCALE N/A	REV. 0
CADD	WSL	20/06/03		
CHECK	DAH	03/09/03		
REVIEW				

Figure 10.1

APPENDIX I

SLOPE STABILITY ANALYSES

Table AI-1: Summary of Limit Equilibrium Slope Stability Analyses – Meadowbank Dikes

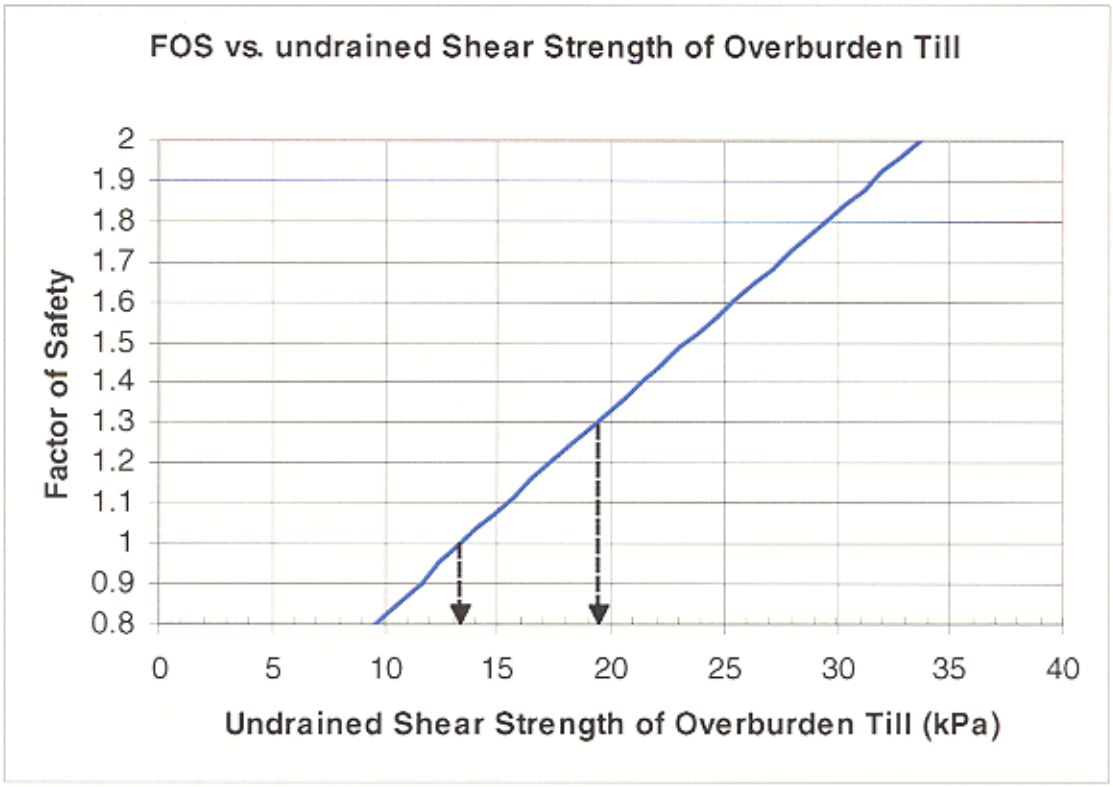
(Page 1 of 2)

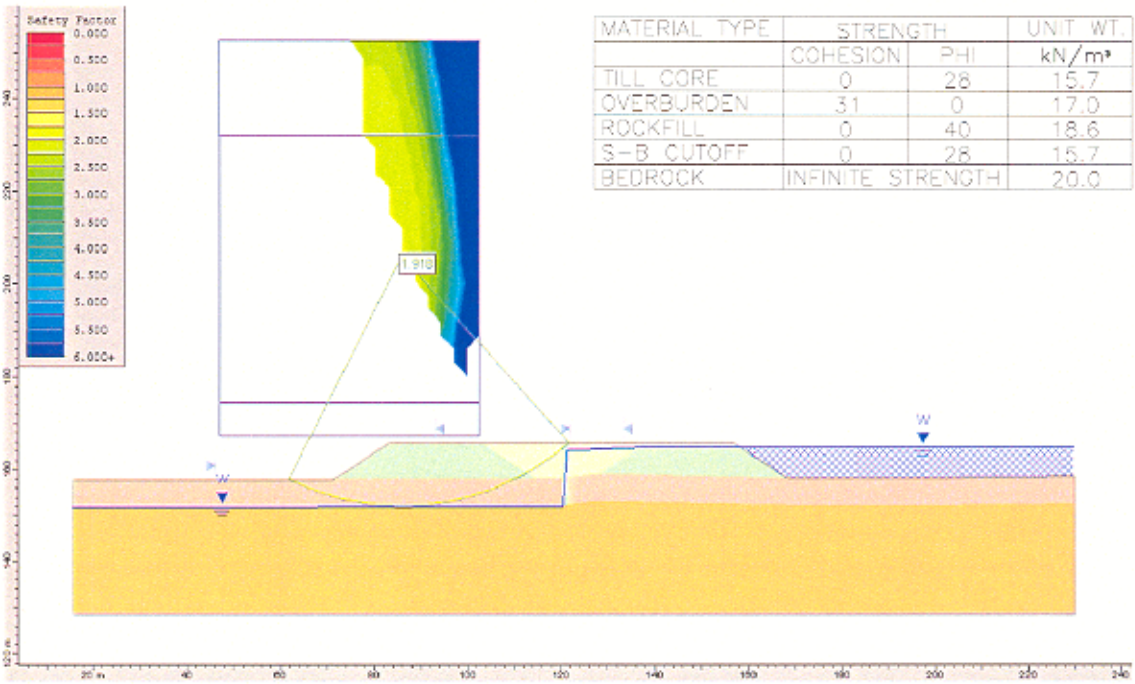
Figure No. (I-)	Section Analyzed	Conditions Modelled	Calculated Minimum FOS	Calculated Yield Acceleration (g)	Maximum Required Undrained Shear Strength of Overburden Till (kPa)	
					FOS=1.0	FOS=1.3
		End of Construction				
A1	A	Failure through Cutoff Wall; Circular Surfaces			13	19
A2		Failure through Cutoff Wall; Block Surfaces			13	18
A3		Failure through Rockfill; Circular Surfaces			20	28
A4		Failure through Rockfill; Block Surfaces			18	24
B1	B	Failure through Cutoff Wall; Circular Surfaces			n/a	n/a
B2		Failure through Cutoff Wall; Block Surfaces			16	23
B3		Failure through Rockfill; Circular Surfaces			n/a	5
B4		Failure through Rockfill; Block Surfaces			20	30
C1	C	Failure through Cutoff Wall; Circular Surfaces			7	9
C2		Failure through Cutoff Wall; Block Surfaces			9	13
C3		Failure through Rockfill; Circular Surfaces			11	16
C4		Failure through Rockfill; Block Surfaces			10	14
		Long-Term Effective Strength				
A5	A	Failure through Cutoff Wall; Circular Surfaces – Static	4.1			
A6		Failure through Cutoff Wall; Block Surfaces - Static	4.3			
A7		Failure through Rockfill; Circular Surfaces – Static	2.7			
A8		Failure through Rockfill; Block Surfaces - Static	2.8			
A9		Failure through Cutoff Wall; Circular Surfaces – Pseudostatic	3.5			
A10		Failure through Cutoff Wall; Block Surfaces - Pseudostatic	3.7			
A11		Failure through Rockfill; Circular Surfaces – Pseudostatic	2.5			
A12		Failure through Rockfill; Block Surfaces - Pseudostatic	2.6			
A13		Failure through Cutoff Wall; Circular Surfaces – Yield Acceleration		0.41		
A14		Failure through Cutoff Wall; Block Surfaces - Yield Acceleration		0.41		
A15		Failure through Rockfill; Circular Surfaces – Yield Acceleration		0.36		
A16		Failure through Rockfill; Block Surfaces - Yield Acceleration		0.38		

Table AI-1: Summary of Limit Equilibrium Slope Stability Analyses – Meadowbank Dikes

(Page 2 of 2)

Figure No. (I-)	Section Analyzed	Conditions Modelled	Calculated Minimum FOS	Calculated Yield Acceleration (g)
B5	B	Failure through Cutoff Wall; Circular Surfaces – Static	3.5	
B6		Failure through Cutoff Wall; Block Surfaces - Static	5.9	
B7		Failure through Rockfill; Circular Surfaces – Static	1.9	
B8		Failure through Rockfill; Block Surfaces - Static	3.1	
B9		Failure through Cutoff Wall; Circular Surfaces – Pseudostatic	3.0	
B10		Failure through Cutoff Wall; Block Surfaces - Pseudostatic	4.9	
B11		Failure through Rockfill; Circular Surfaces – Pseudostatic	1.7	
B12		Failure through Rockfill; Block Surfaces - Pseudostatic	2.8	
B13		Failure through Cutoff Wall; Circular Surfaces – Yield Acceleration		0.27
B14		Failure through Cutoff Wall; Block Surfaces - Yield Acceleration		0.40
B15		Failure through Rockfill; Circular Surfaces – Yield Acceleration		0.16
B16		Failure through Rockfill; Block Surfaces - Yield Acceleration		0.34
C5	C	Failure through Cutoff Wall; Circular Surfaces – Static	5.0	
C6		Failure through Cutoff Wall; Block Surfaces - Static	3.9	
C7		Failure through Rockfill; Circular Surfaces – Static	3.4	
C8		Failure through Rockfill; Block Surfaces - Static	3.2	
C9		Failure through Cutoff Wall; Circular Surfaces – Pseudostatic	3.7	
C10		Failure through Cutoff Wall; Block Surfaces - Pseudostatic	3.3	
C11		Failure through Rockfill; Circular Surfaces – Pseudostatic	2.4	
C12		Failure through Rockfill; Block Surfaces - Pseudostatic	2.8	
C13		Failure through Cutoff Wall; Circular Surfaces – Yield Acceleration		0.48
C14		Failure through Cutoff Wall; Block Surfaces - Yield Acceleration		0.37
C15		Failure through Rockfill; Circular Surfaces – Yield Acceleration		0.42
C16		Failure through Rockfill; Block Surfaces - Yield Acceleration		0.36





MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	31	0	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0

NOTES

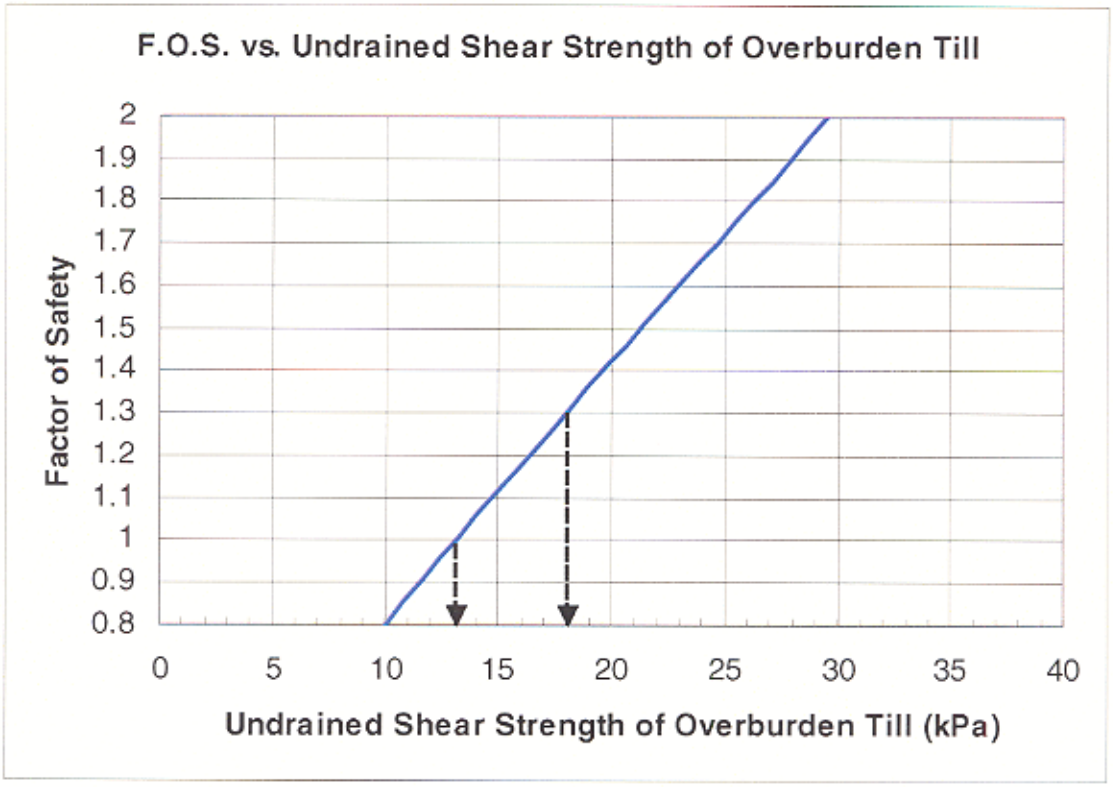
1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

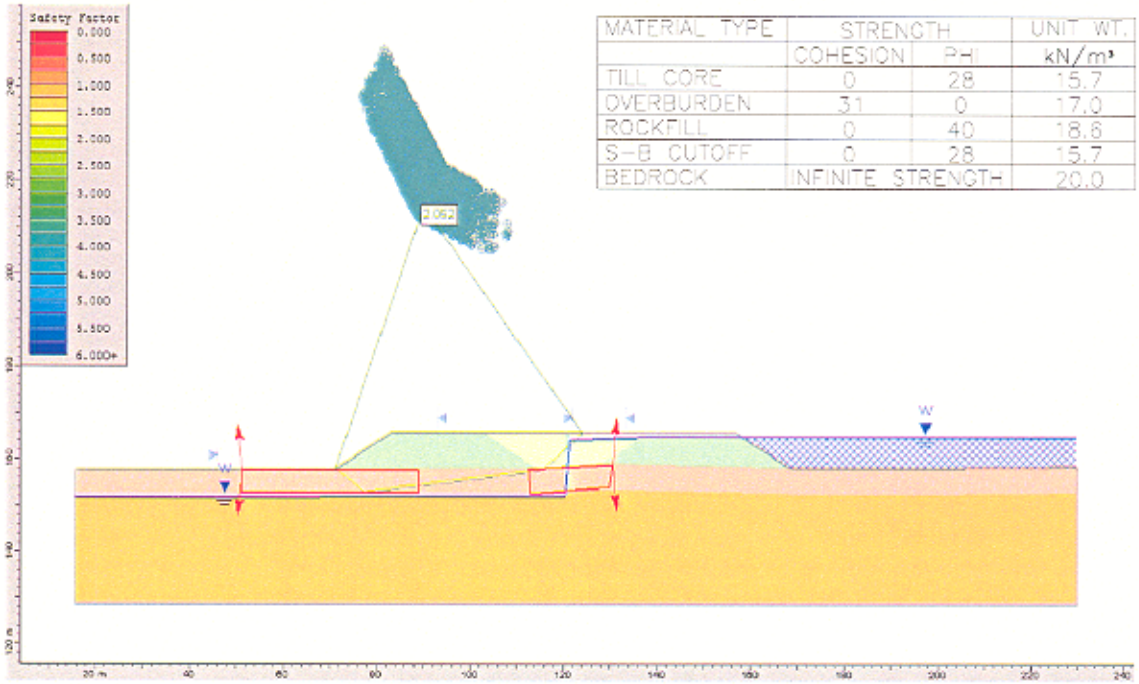
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION A - END OF CONSTRUCTION CUTOFF FAILURE - CIRCULAR

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION A
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-A1**	
REVIEW	RE	23OCT03		





MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	31	0	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION A - END OF CONSTRUCTION CUTOFF FAILURE - BLOCK

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION A
DESIGN	DAH	16/OCT/03	SCALE N/A	REV 0
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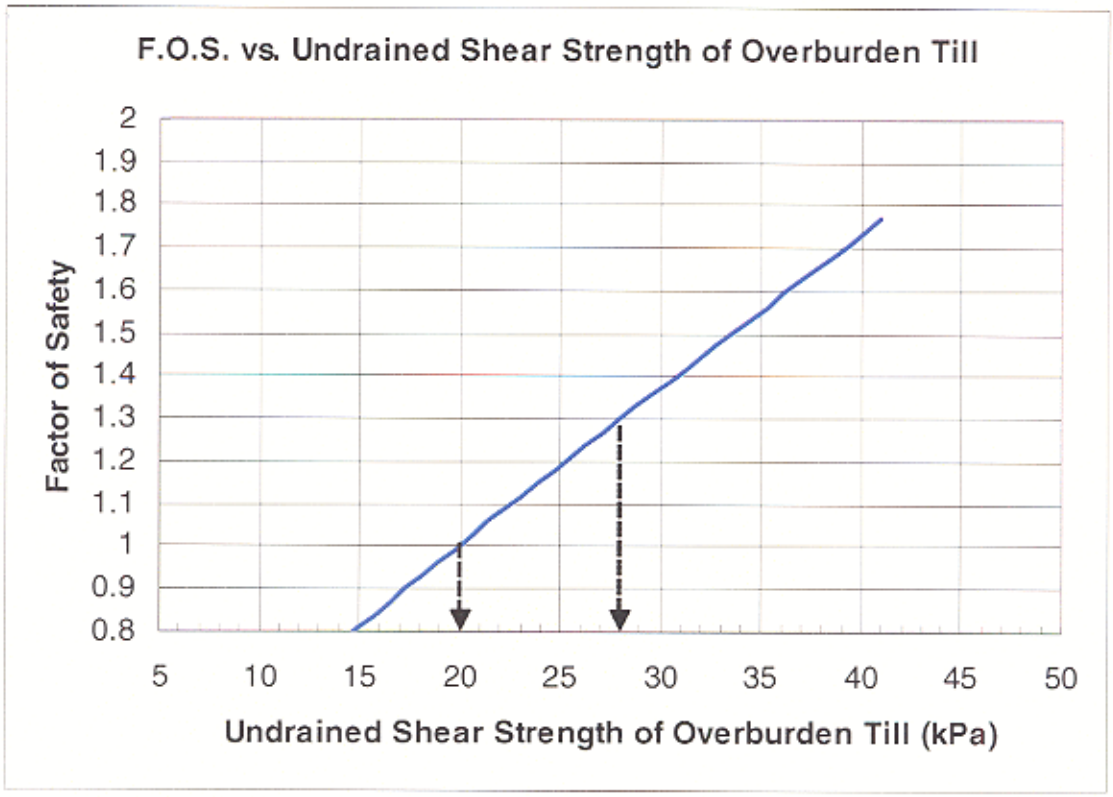
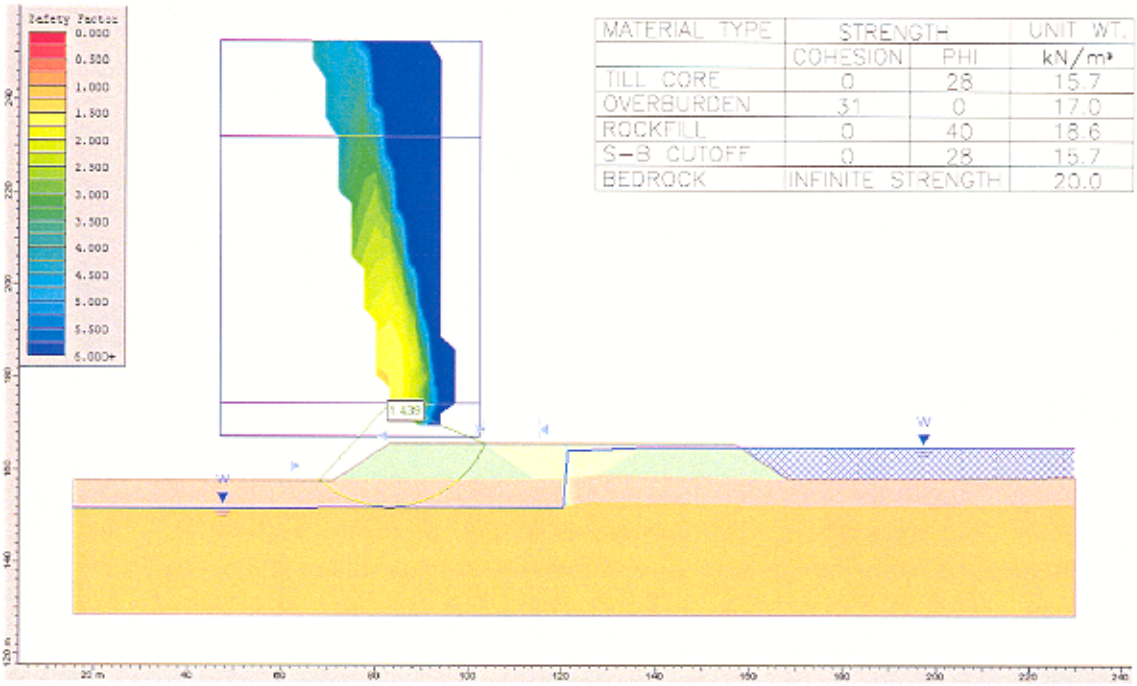
CHECK	DAH	16/OCT/03		
REVIEW		23OCT03		

FIGURE I-A2





MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	31	0	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0

PROJECT

CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE

SECTION A - END OF CONSTRUCTION ROCKFILL FAILURE - CIRCULAR

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

Golder Associates

PROJECT No. 03-1413-427			FILE No. SECTION A
DESIGN	DAH	16/OCT/03	SCALE N/A REV. 0
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CHECK	DAH	16/OCT/03	FIGURE I-A3
REVIEW			

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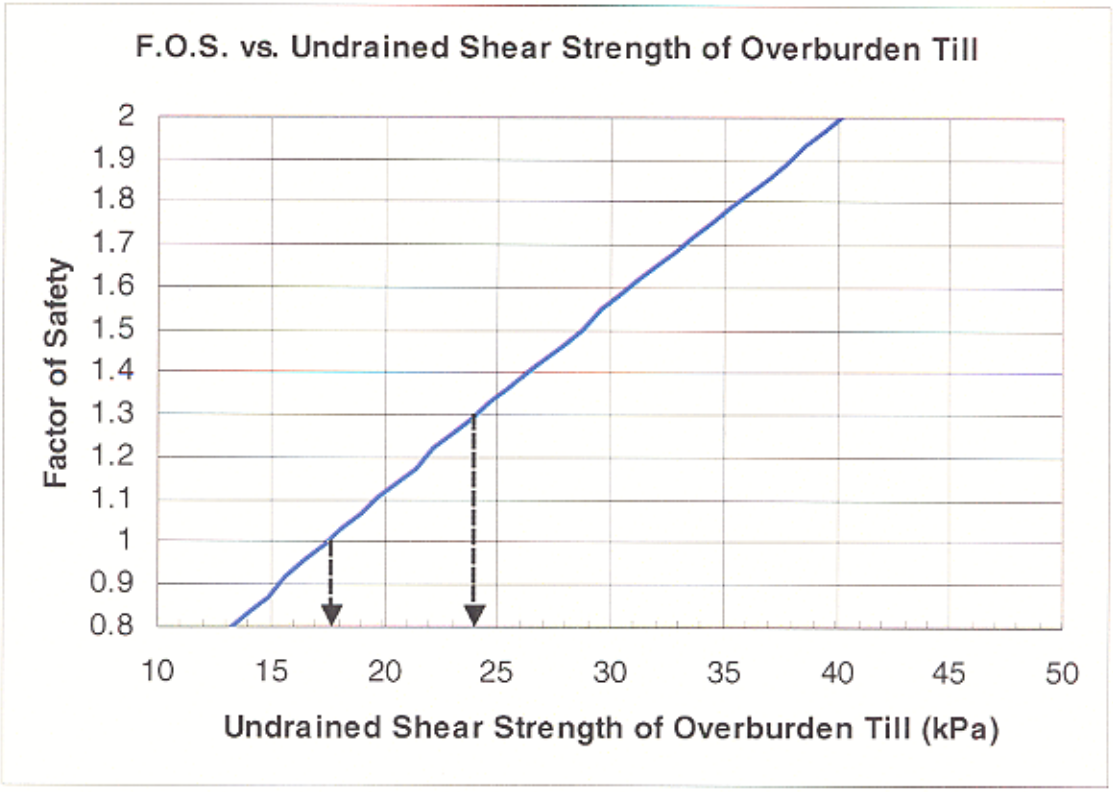
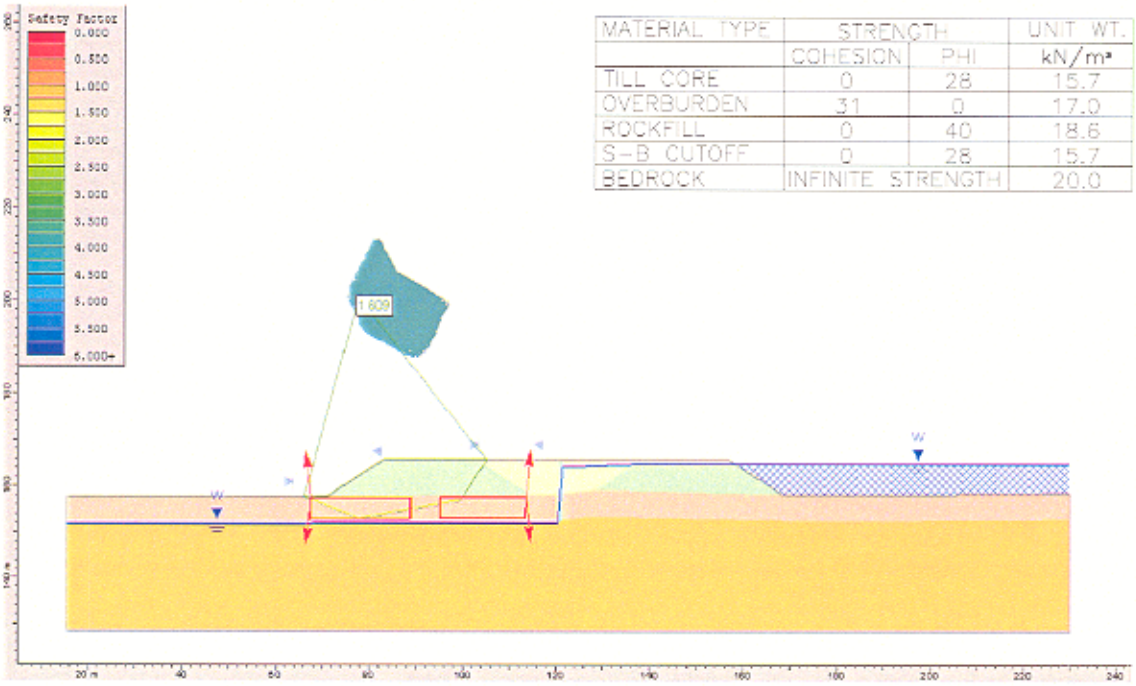
REVISION DATE: 03/10/17 10:31am By: sreddy





MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	31	0	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

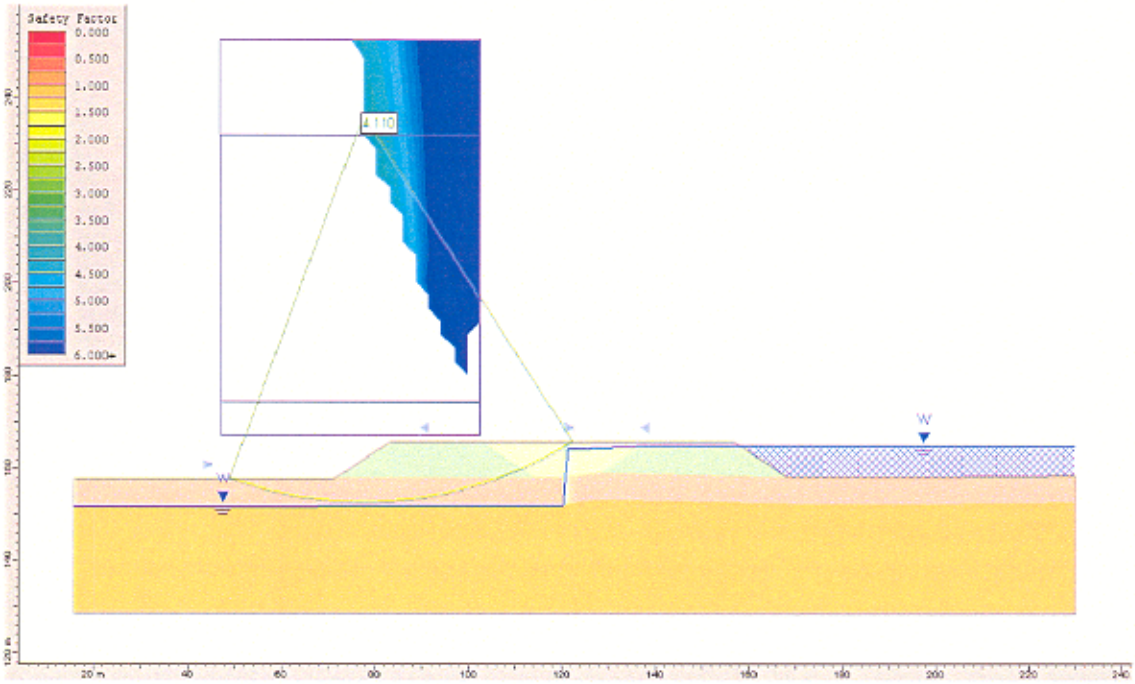
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION A - END OF CONSTRUCTION ROCKFILL FAILURE - BLOCK

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION A
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-A4**	
REVIEW	RK	23OCT03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT

CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

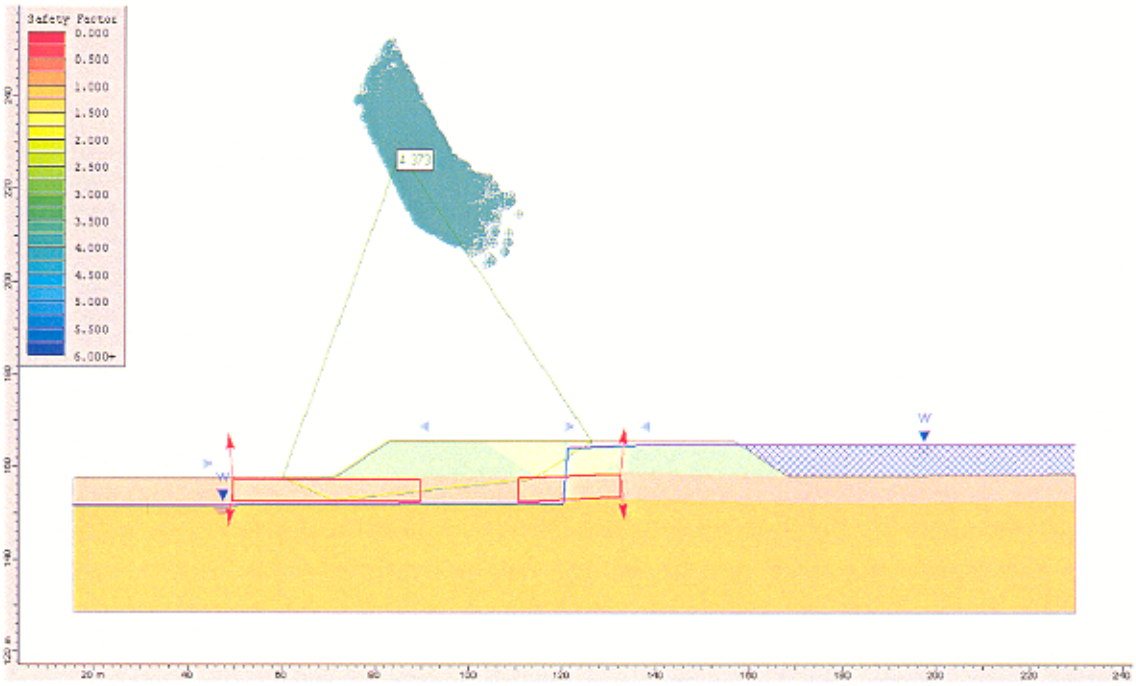
TITLE

SECTION A
CUTOFF FAILURE - CIRCULAR - STATIC

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION A
DESIGN	DAH	16/OCT/03	SCALE N/A	REV 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-A5**	
REVIEW		23/OCT/03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT

CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
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TITLE

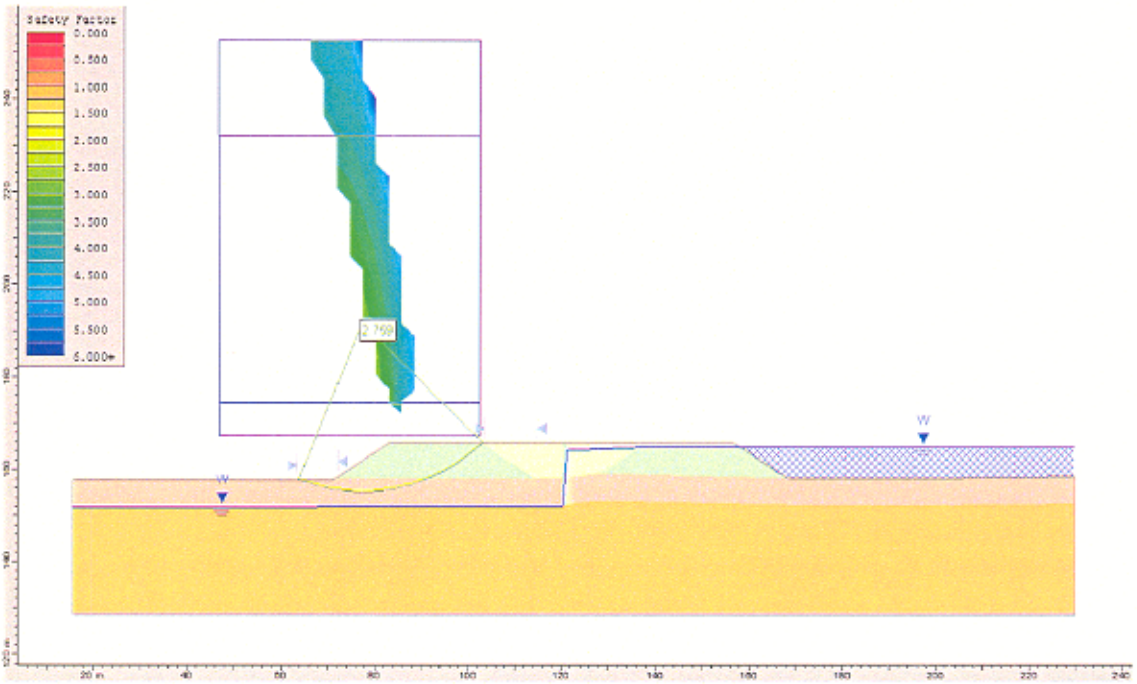
SECTION A
CUTOFF FAILURE - BLOCK - STATIC

Golder Associates

PROJECT No.	03-1413-427		FILE No.	SECTION A
DESIGN	DAH	19/OCT/03	SCALE N/A	REV. 0
CADD	SRR	19/OCT/03		
CHECK	DAH	19/OCT/03		
REVIEW		23OCT03		

FIGURE I-A6

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

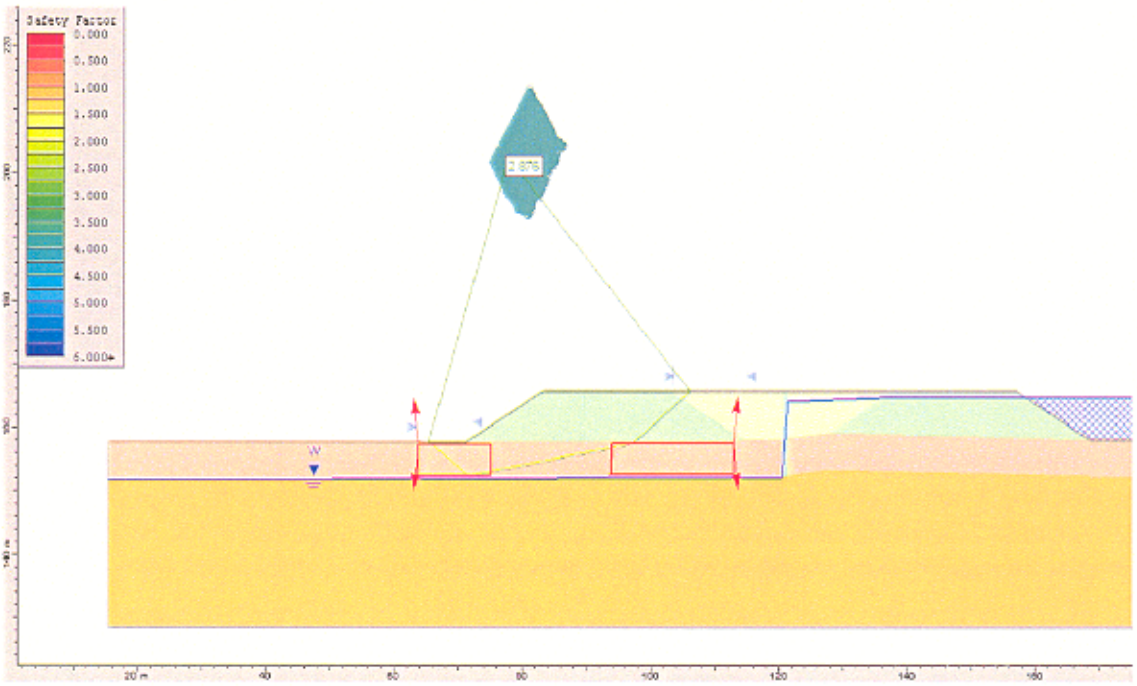
TITLE
SECTION A
ROCKFILL FAILURE - CIRCULAR - STATIC

Golder Associates

PROJECT No.	03-1413-427		FILE No.	SECTION A
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03		
REVIEW		23OCT03		

FIGURE I-A7

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT

CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE

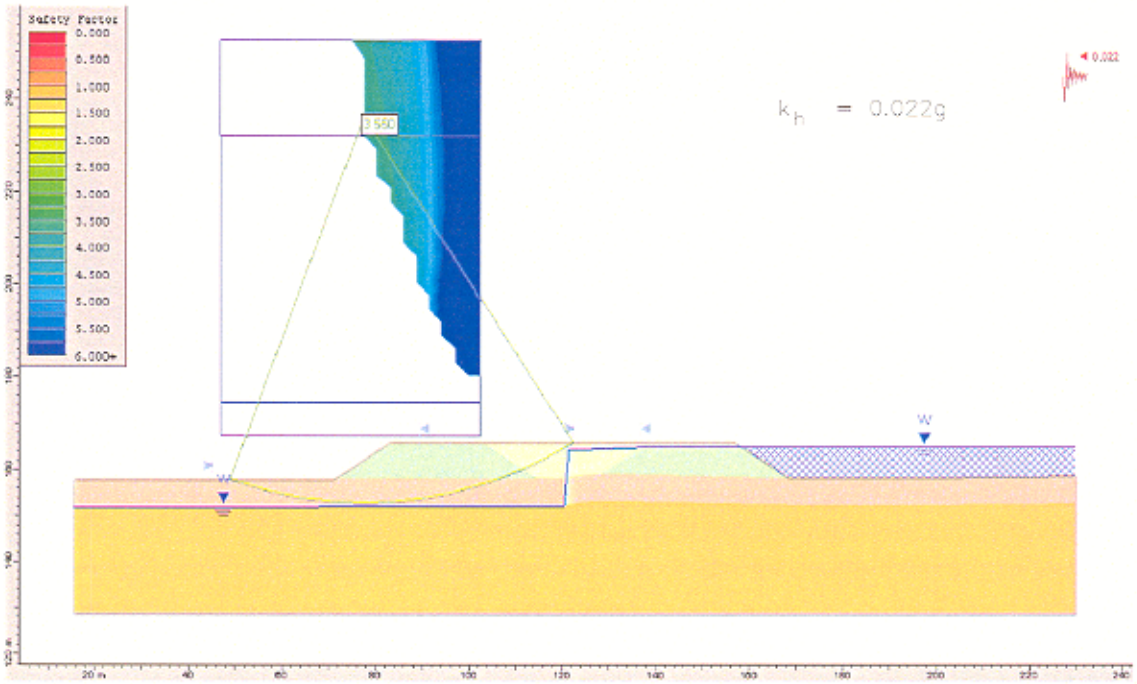
SECTION A
ROCKFILL FAILURE - BLOCK - STATIC

Golder Associates

PROJECT No.	03-1413-427		FILE No.	SECTION A
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03		
REVIEW	JK	23OCT03		

FIGURE I-A8

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

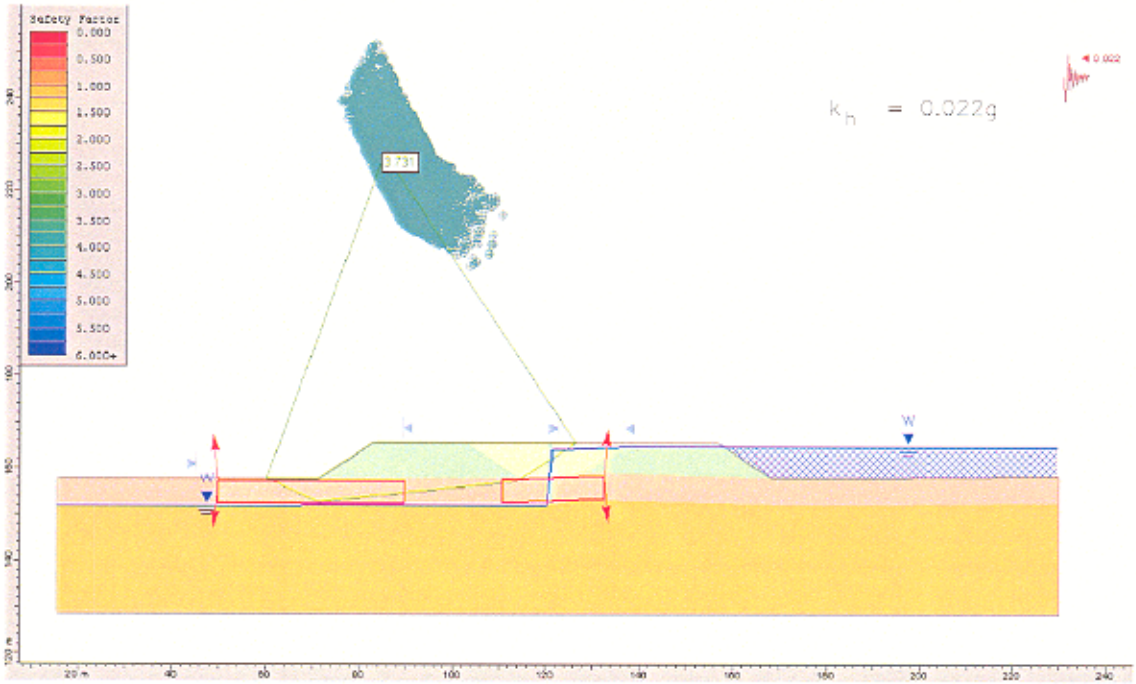
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION A
CUTOFF FAILURE - CIRCULAR
PSEUDOSTATIC

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION A
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-A9**	
REVIEW	RC	23OCT03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

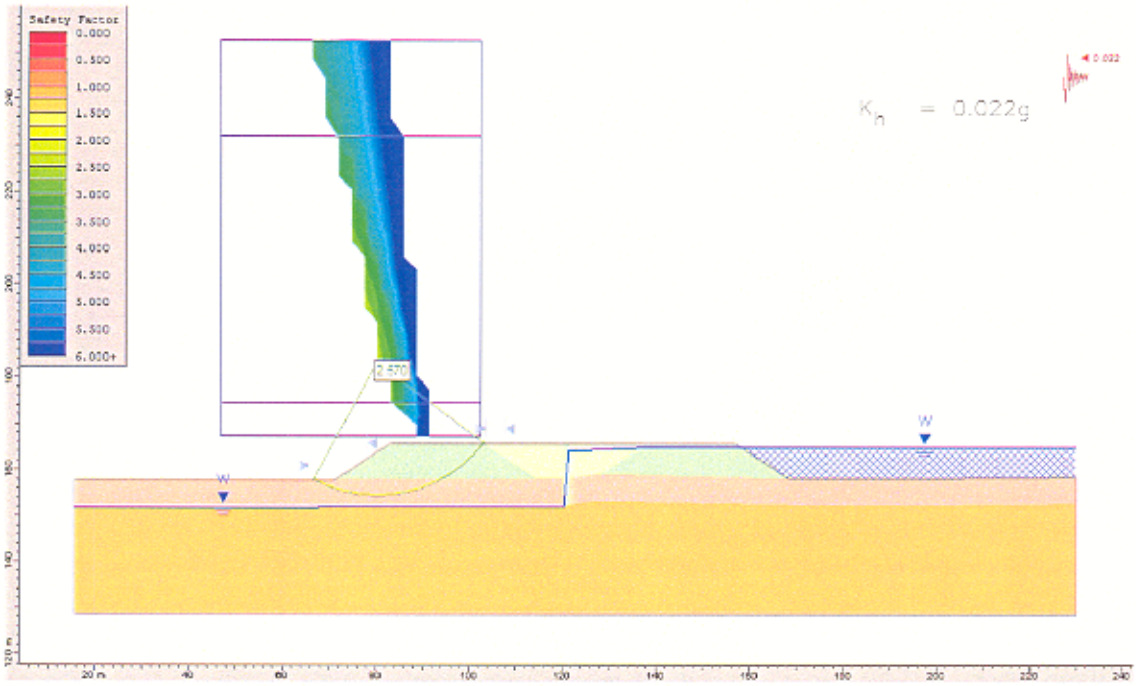
TITLE
SECTION A
CUTOFF FAILURE - BLOCK
PSEUDOSTATIC

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION A
DESIGN	DAH	16/OCT/03	SCALE N/A	REV 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-A10**	
REVIEW		23Oct03		

REVISION DATE: 03/10/17 10:31am By sreddy CADD FILE: C:\Active\2003\1413\03-1413-427 CR Feasibility\4300_DykeDesign\Slope Stability Analysis\dwg\SECTION A.dwg

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
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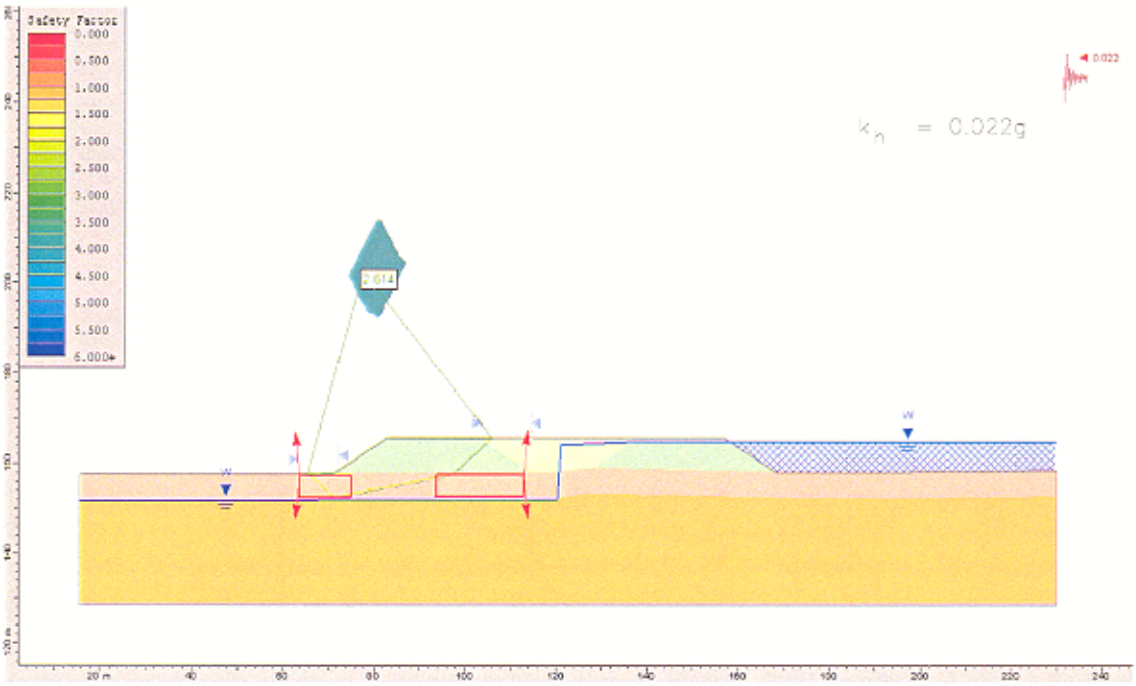
TITLE
SECTION A
ROCKFILL FAILURE - CIRCULAR
PSEUDOSTATIC

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION A
DESIGN	DAH	15/OCT/03	SCALE N/A	REV. 0
CADD	SRR	15/OCT/03		
CHECK	DAH	15/OCT/03	**FIGURE I-A11**	
REVIEW		23OCT03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT
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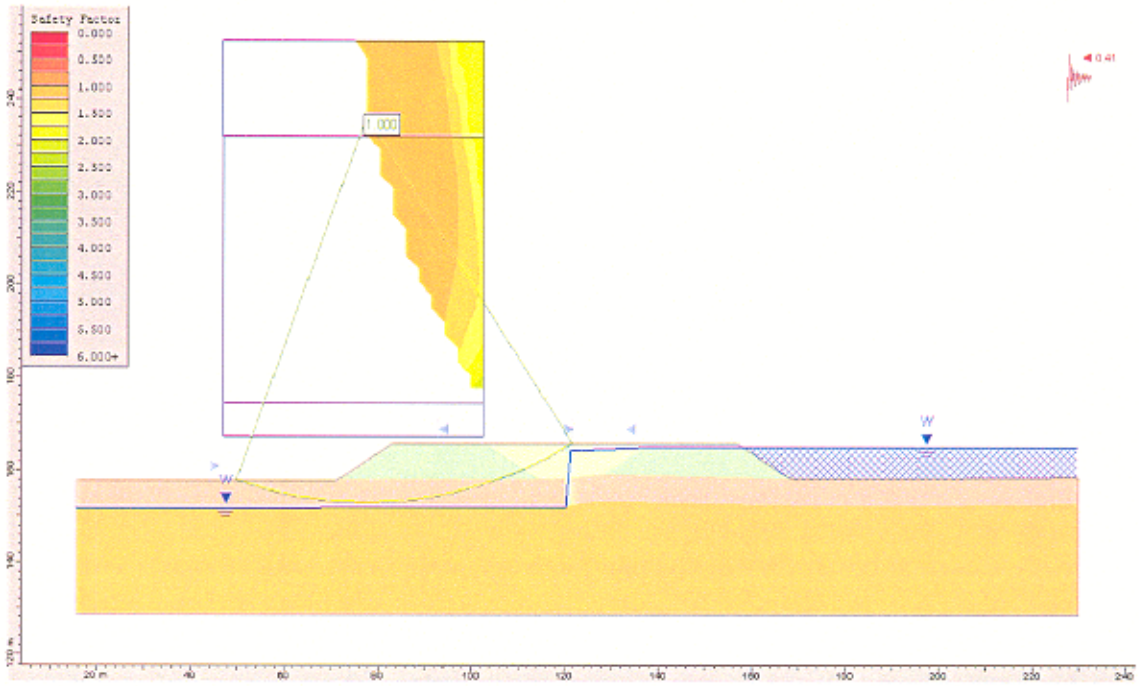
TITLE
SECTION A
ROCKFILL FAILURE - BLOCK
PSEUDOSTATIC

Golder Associates

PROJECT No.	03-1413-427		FILE No.	SECTION A
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-A12**	
REVIEW	KE	23OCT03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



YIELD ACCELERATION; ky = 0.41g

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.
3) Yield acceleration is the value of the horizontal acceleration for FOS = 1.0

PROJECT
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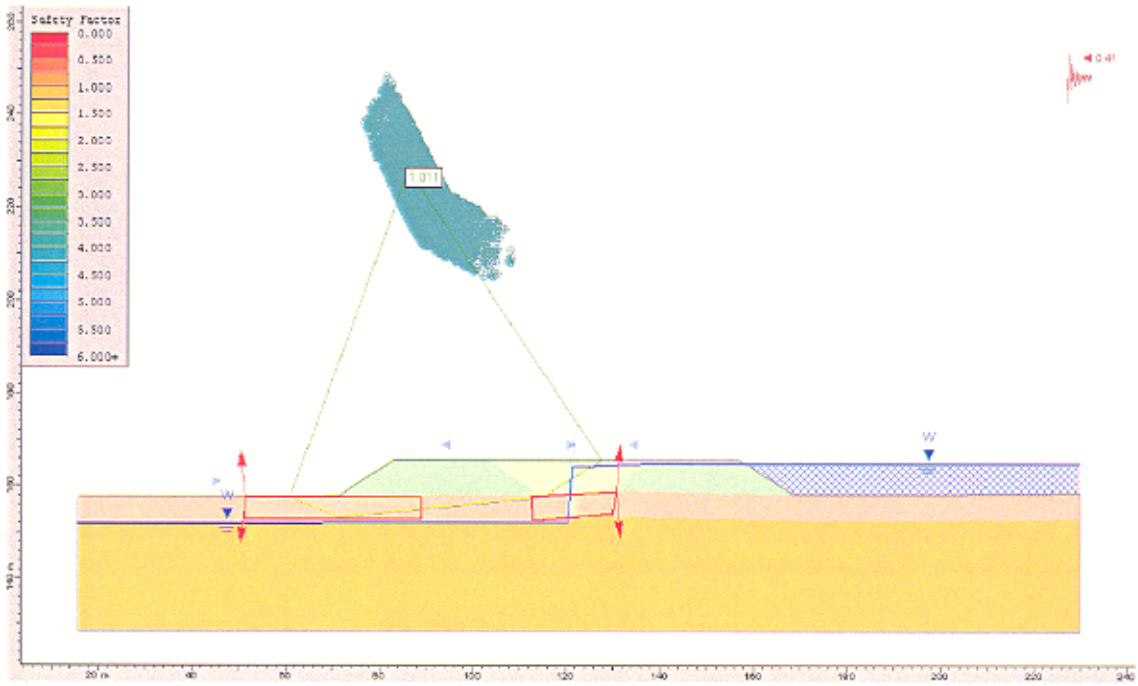
TITLE
SECTION A
CUTOFF FAILURE - CIRCULAR
YIELD ACCELERATION

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION A
DESIGN	DAH	18/OCT/03	SCALE N/A	REV. 0
CADD	SRR	18/OCT/03		
CHECK	DAH	18/OCT/03	**FIGURE I-A13**	
REVIEW		23OCT03		

REVISION DATE: 03/10/17 10:31am By: sreddy CADD FILE: G:\Active\2003\1413\03-1413-427 CRL Feasibility\4208 DykeDesign\Slope Stability Analysis\dwg\SECTION A.dwg

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



YIELD ACCELERATION; ky = 0.41g

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.
3) Yield acceleration is the value of the horizontal acceleration for FOS = 1.0

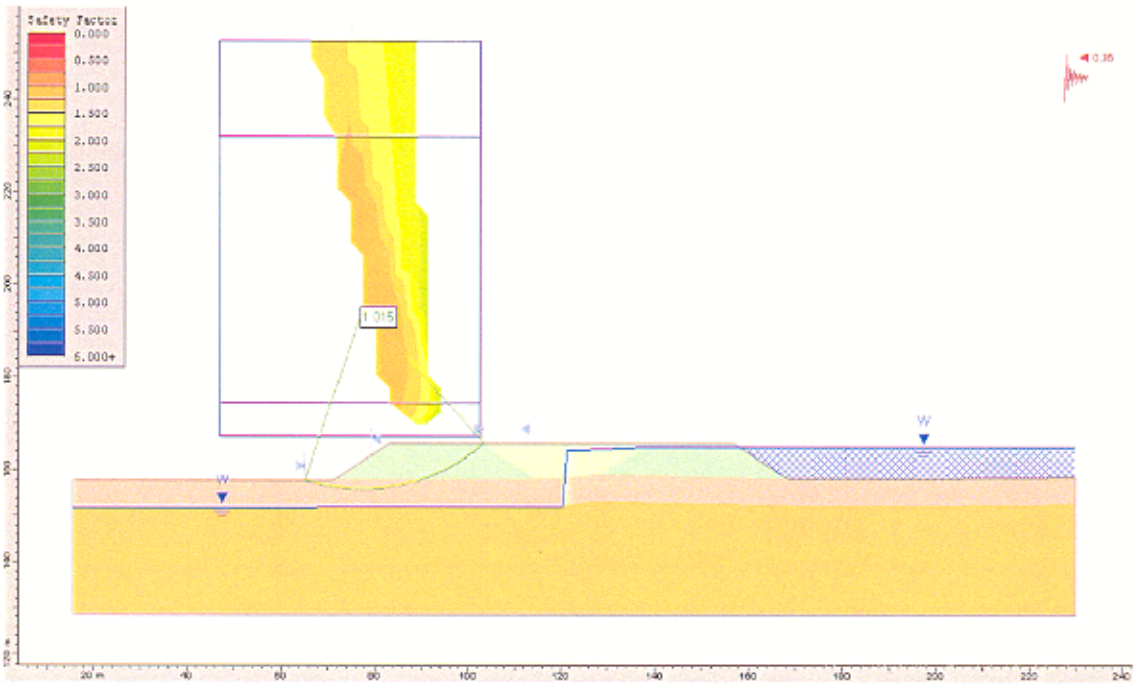
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION A
CUTOFF FAILURE - BLOCK
YIELD ACCELERATION

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION A
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-A14**	
REVIEW		23OCT03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



YIELD ACCELERATION; ky = 0.36g

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.
3) Yield acceleration is the value of the horizontal acceleration for FOS = 1.0

PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
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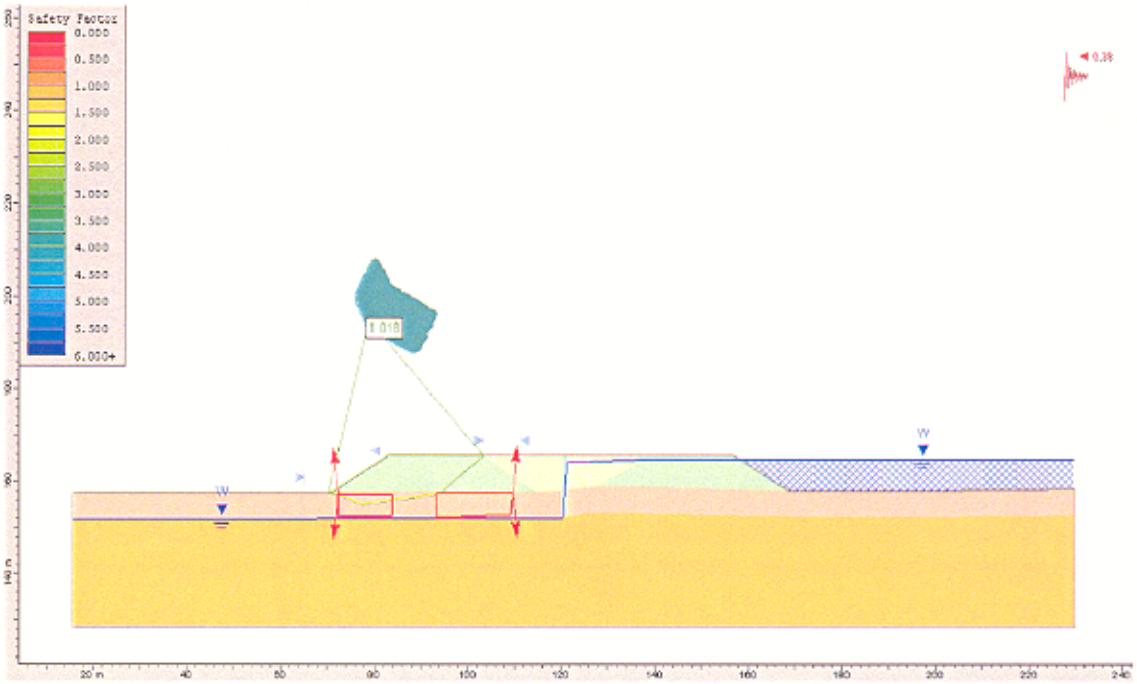
TITLE
SECTION A
ROCKFILL FAILURE - CIRCULAR
YIELD ACCELERATION

Golder Associates

PROJECT No.	03-1413-427		FILE No.	SECTION A
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03		
REVIEW		23OCT03		

FIGURE I-A15

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



YIELD ACCELERATION; ky = 0.38g

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.
3) Yield acceleration is the value of the horizontal acceleration for FOS = 1.0

PROJECT

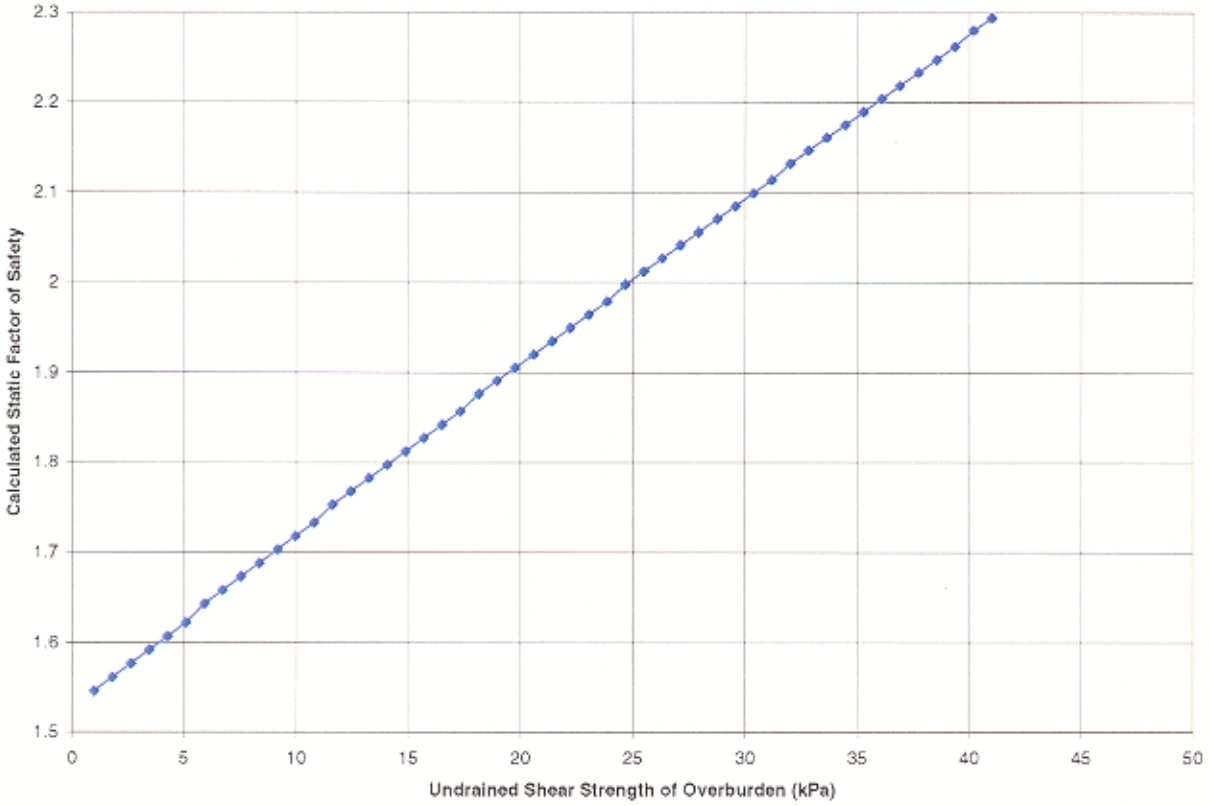
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

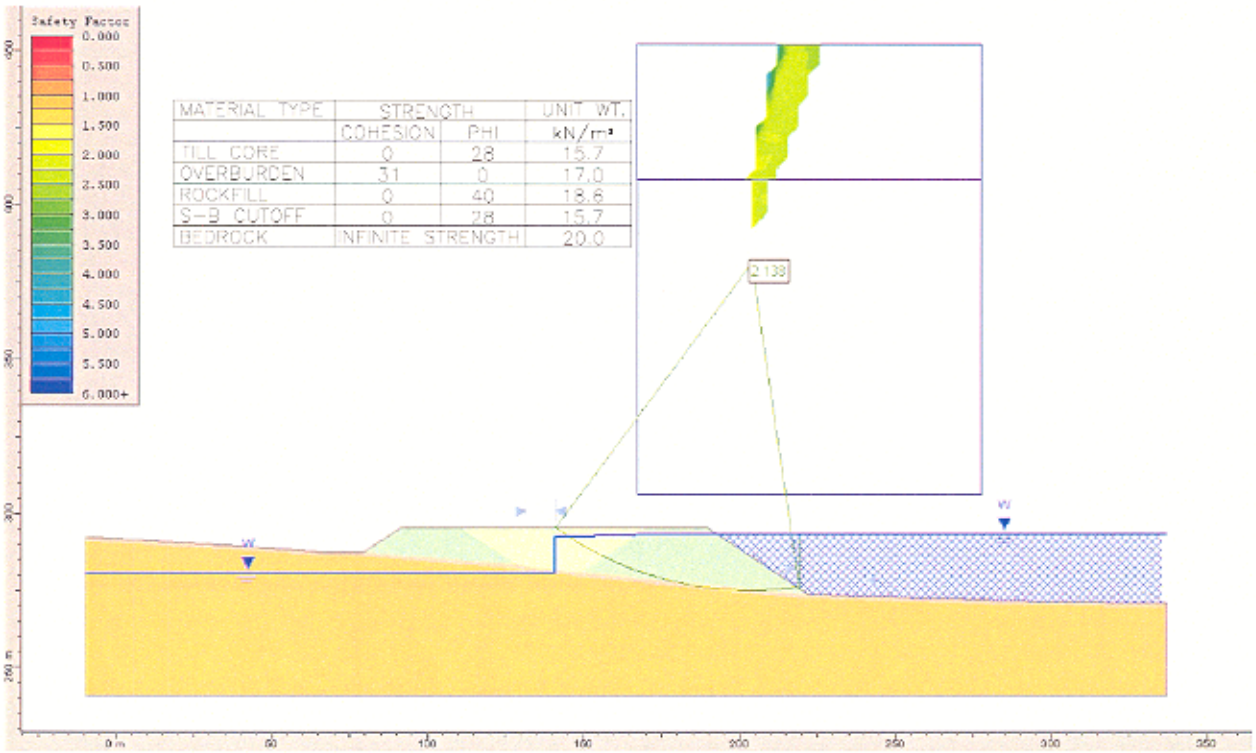
TITLE

SECTION A
ROCKFILL FAILURE - BLOCK
YIELD ACCELERATION

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION A
DESIGN	DAH	15/OCT/03	SCALE N/A	REV. 0
CADD	SRR	15/OCT/03		
CHECK	DAH	15/OCT/03	**FIGURE I-A16**	
REVIEW		23 OCT 03		





MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	31	0	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT

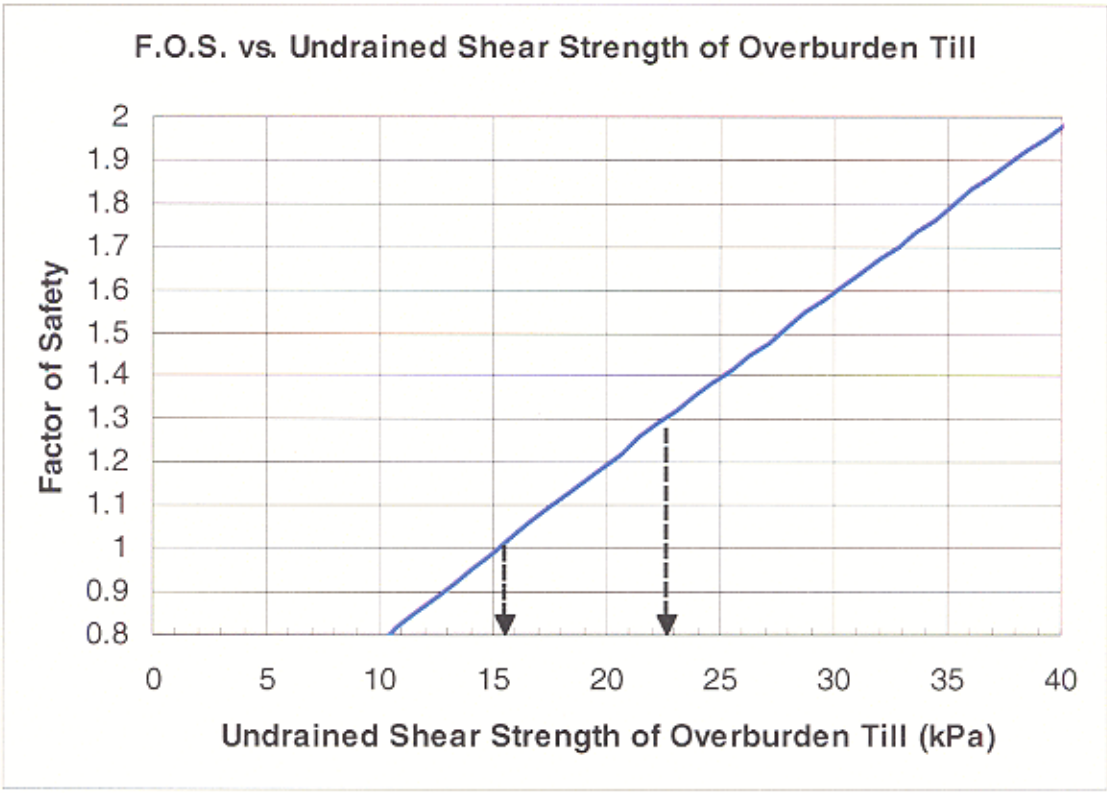
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

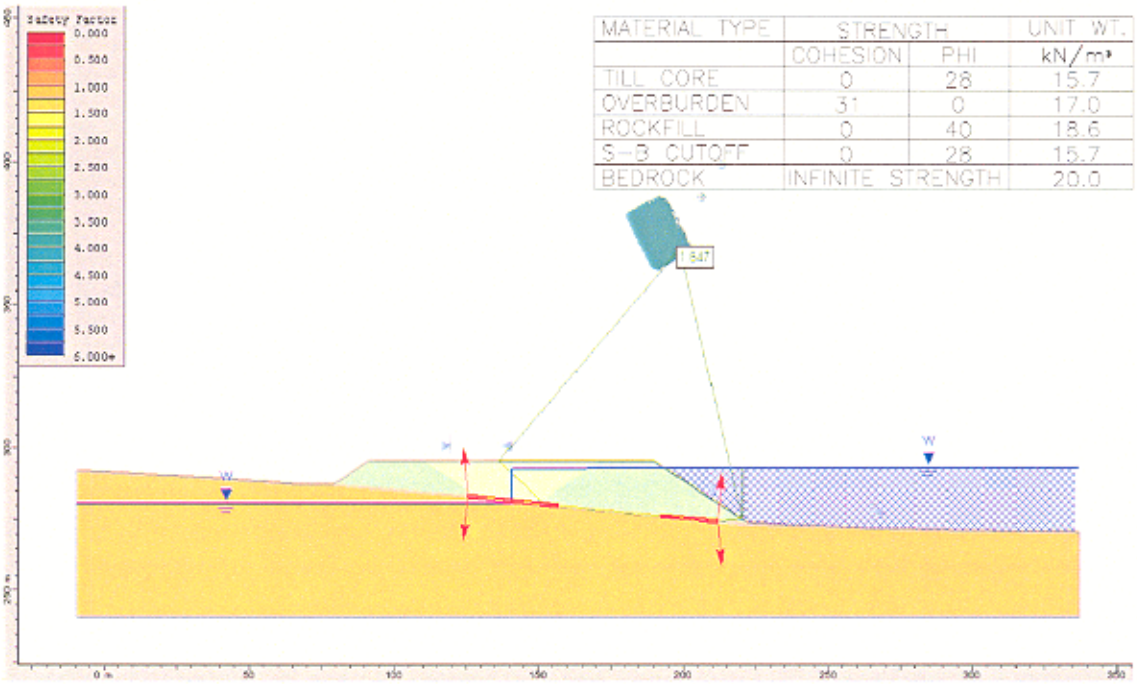
TITLE

SECTION B - END OF CONSTRUCTION CUTOFF FAILURE - CIRCULAR

Golder Associates

PROJECT No. 03-1413-427			FILE No. CumberlandFigures	
DESIGN	WSL	16/06/03	SCALE N/A	REV 0
CADD	WSL	18/06/03		
CHECK	DGH	03/09/03	**FIGURE I-B1**	
REVIEW	RE	23 OCT 03		





MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	31	0	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

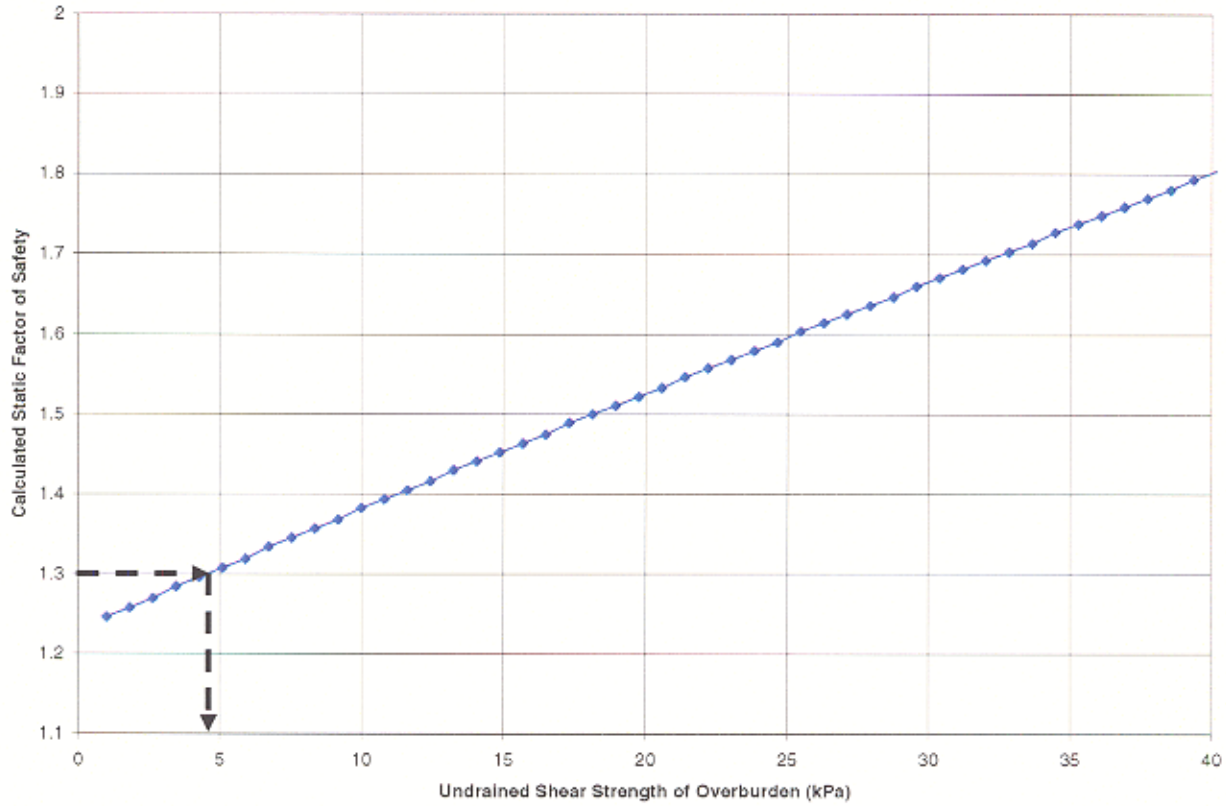
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

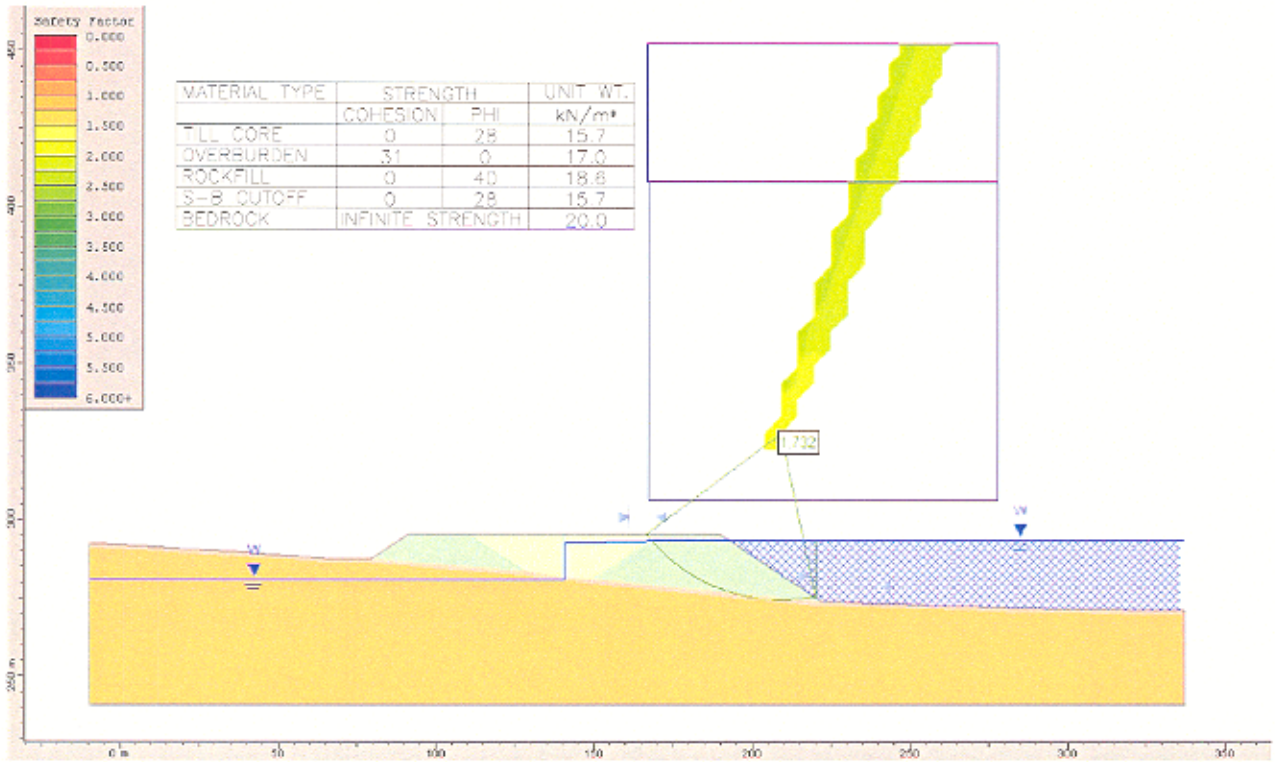
TITLE
SECTION B - END OF CONSTRUCTION CUTOFF FAILURE - BLOCK

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION B
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-B2**	
REVIEW	JRE	23 OCT 03		

REVISION DATE: 03/10/17 10:28am by: sreddy CADD FILE: O:\Active\2003\1413\03-1413-427 CRI Feasibility\4200_Pyke\design\Slope Stability Analysis\dwg\SECTION B.dwg





MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	31	0	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

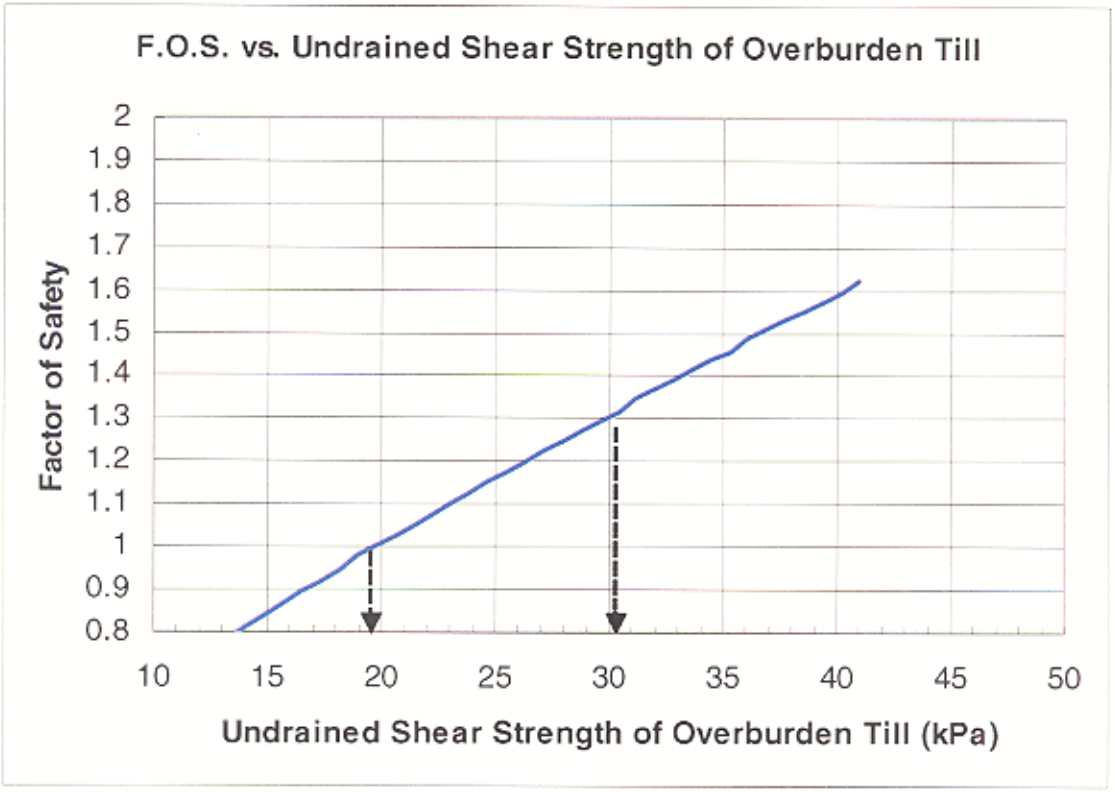
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

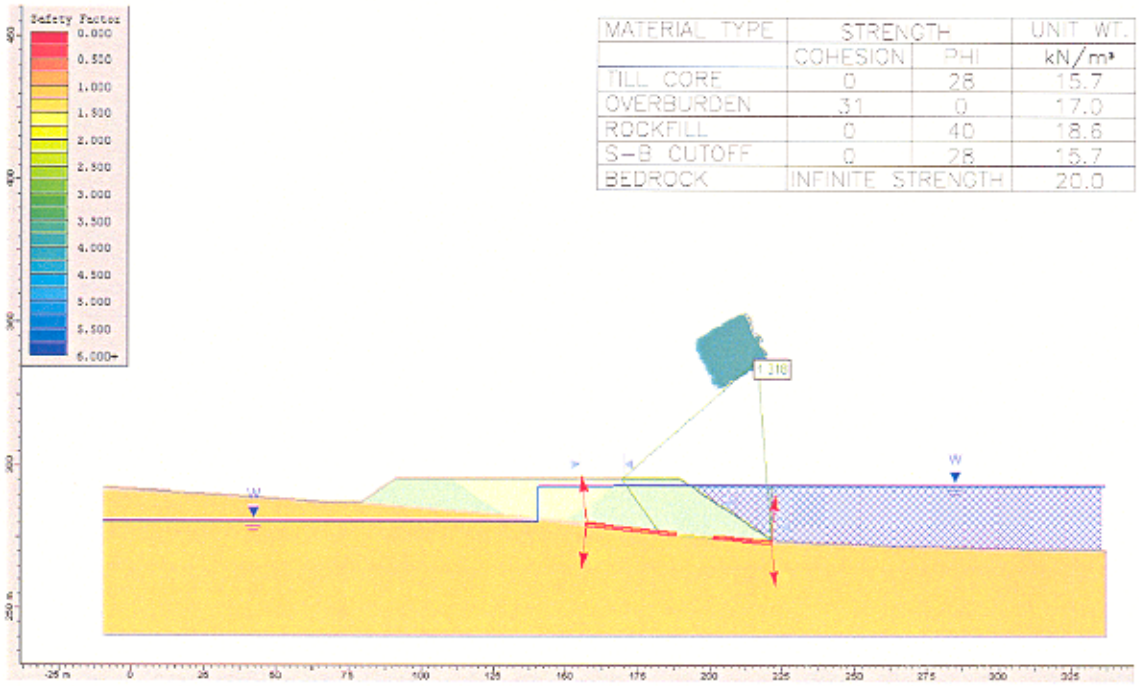
TITLE
SECTION B - END OF CONSTRUCTION ROCKFILL FAILURE - CIRCULAR

Golder Associates

PROJECT No. 03-1413-427			FILE No. CumberlandFigures	
DESIGN	WSL	18/05/03	SCALE N/A	REV. 0
CADD	WSL	18/05/03		
CHECK	DAH	03/09/03	**FIGURE I-B3**	
REVIEW	RC	2005/03		

REVISION DATE: 03/10/22 11:24am By: sreddy CADD FILE: O:\Active\2003\1413\03-1413-427 CR Feasibility\4200_DykeDesign\Slope Stability Analysis\dwg\SECTION B & C.dwg





MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	31	0	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

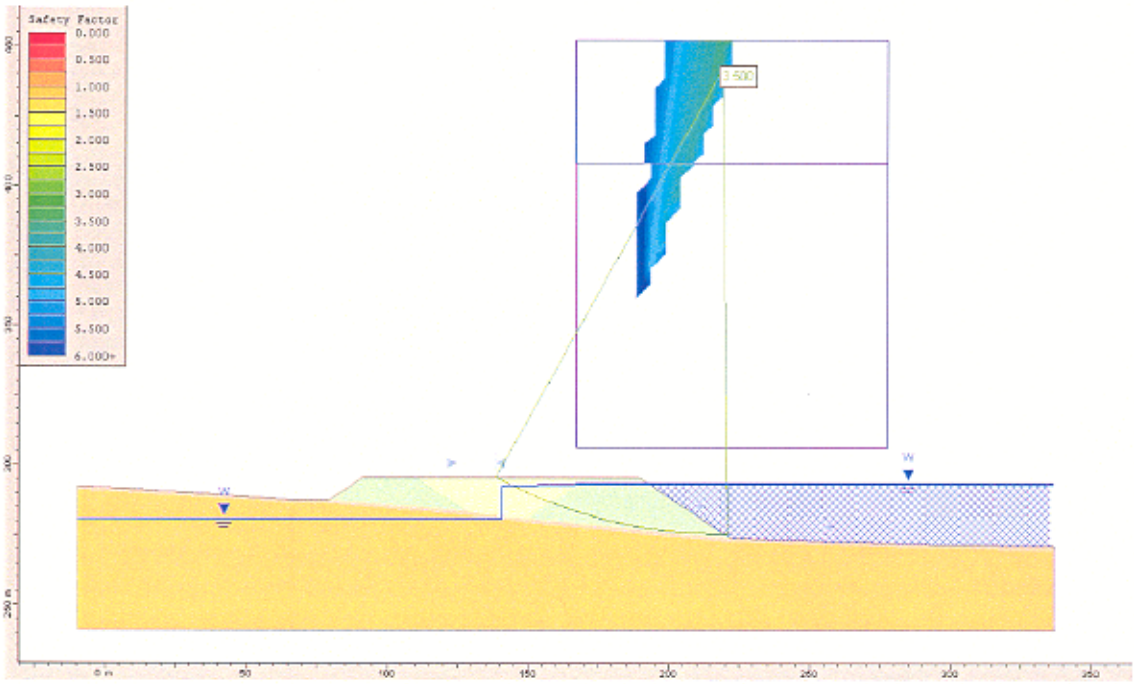
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION B - END OF CONSTRUCTION ROCKFILL FAILURE - BLOCK

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION B
DESIGN	DAH	16/OCT/03	SCALE N/A	REV 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-B4**	
REVIEW		23 OCT 03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT

CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

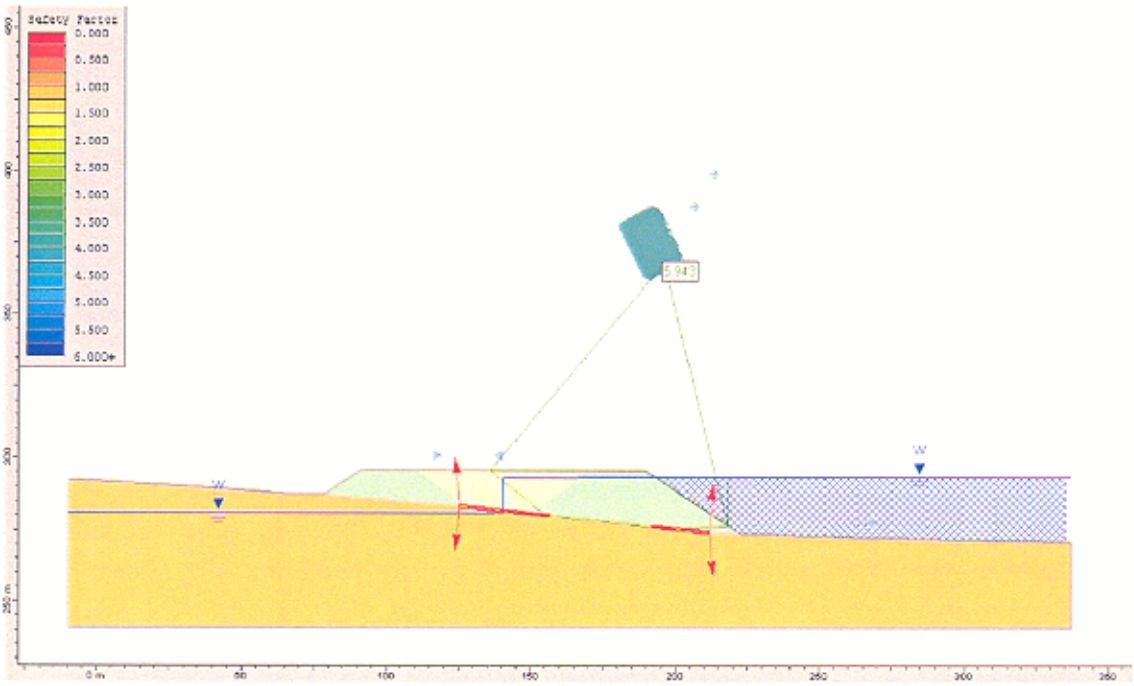
TITLE

SECTION B
CUTOFF FAILURE - CIRCULAR - STATIC

Golder Associates

PROJECT No. 03-1413-427			FILE No. CumberlandFigures	
DESIGN	WSL	18/06/03	SCALE N/A	REV. 0
CADD	WSL	18/06/03		
CHECK	DAH	03/08/03	**FIGURE I-B5**	
REVIEW	RE	13 OCT 03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT

CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

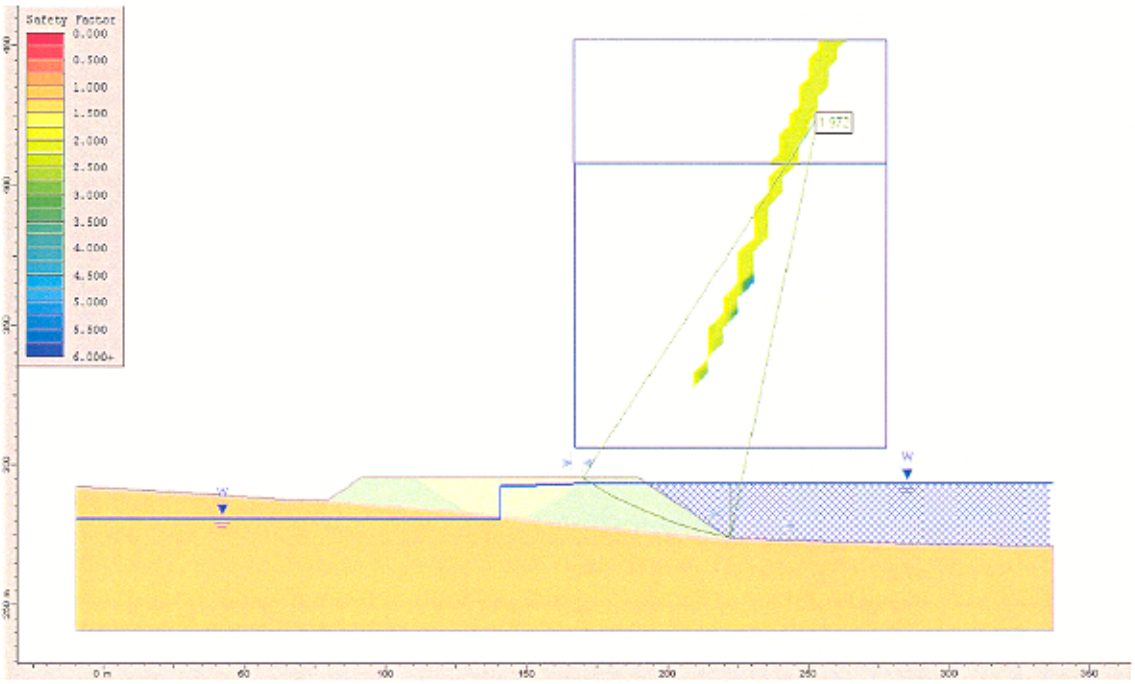
TITLE

SECTION B
CUTOFF FAILURE - BLOCK - STATIC

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION B
DESIGN	DAH	16/OCT/03	SCALE N/A	REV 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-B6**	
REVIEW	TKE	23OCT03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

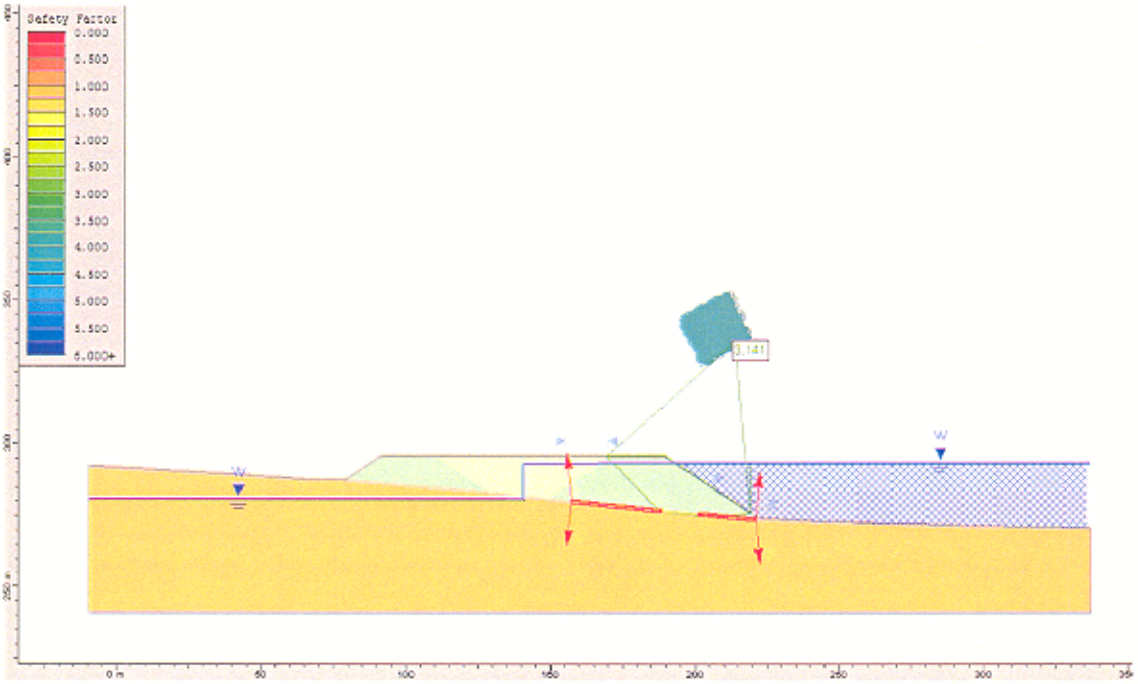
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION B
ROCKFILL FAILURE - CIRCULAR - STATIC

Golder Associates

PROJECT No. 03-1413-427			FILE No. CumberlandFigures	
DESIGN	WSL	18/06/03	SCALE N/A	REV. 0
CADD	WSL	18/06/03		
CHECK	DAH	03/09/03	**FIGURE I-B7**	
REVIEW	TCK	23OCT03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT

CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE

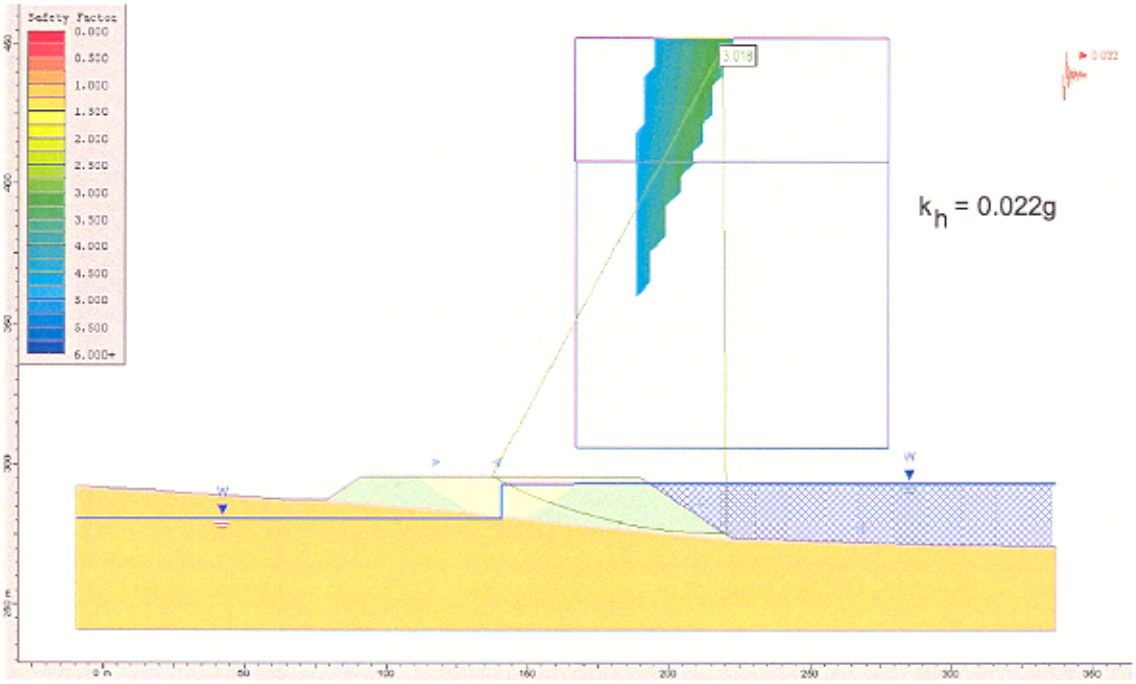
SECTION B
ROCKFILL FAILURE - BLOCK - STATIC

Golder Associates

PROJECT No.	03-1413-427		FILE No.	SECTION B
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03		
REVIEW	RK	29 OCT 03		

FIGURE I-B8

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

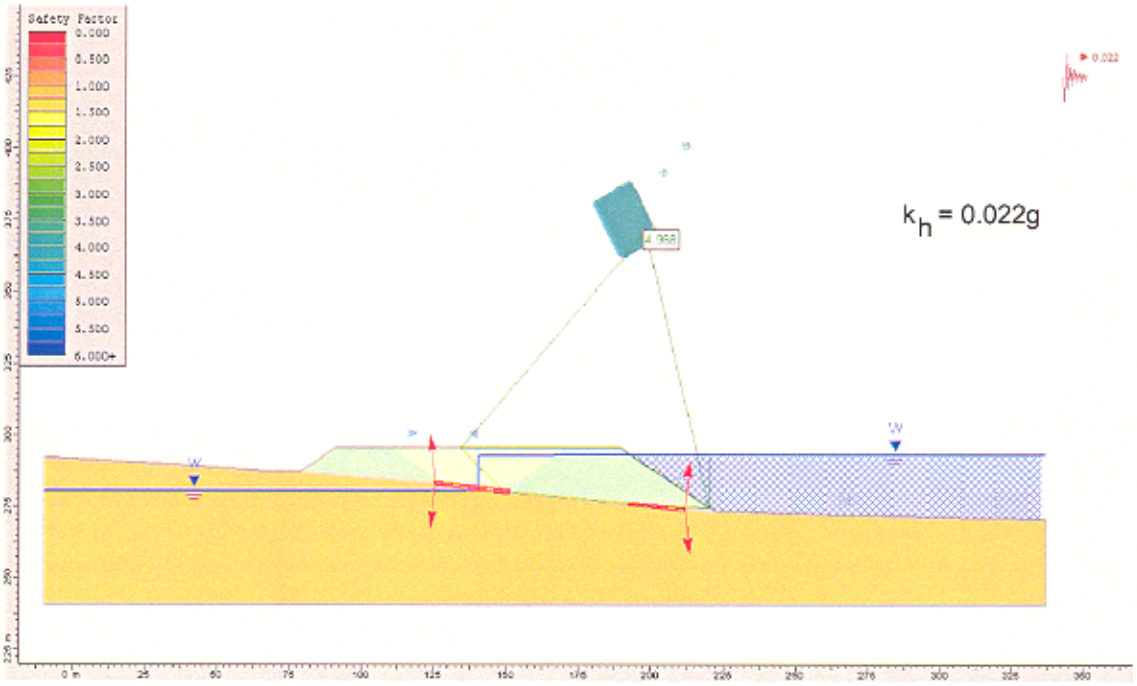
TITLE
SECTION B
CUTOFF FAILURE - CIRCULAR
PSEUDOSTATIC

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION B
DESIGN	CAH	16/OCT/03	SCALE N/A	REV 0
CADD	SRR	16/OCT/03		
CHECK	CAH	16/OCT/03		
REVIEW		23 OCT 03		

FIGURE I-B9

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

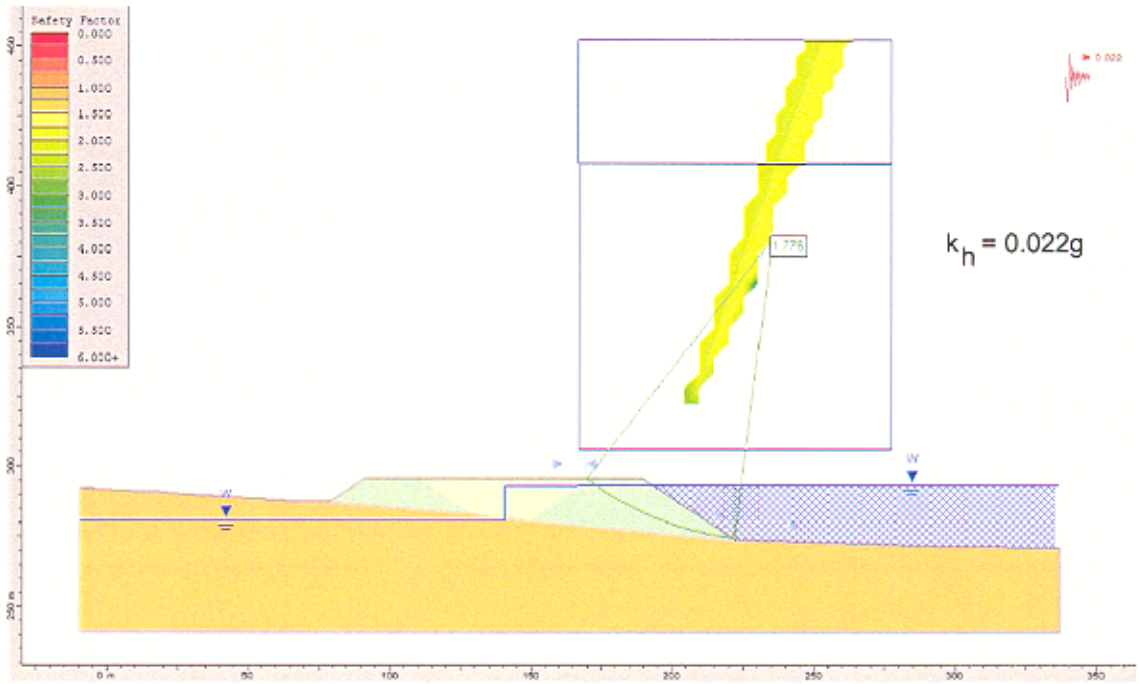
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION B
ROCKFILL FAILURE - BLOCK
PSEUDOSTATIC

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION B
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-B10**	
REVIEW		23OCT03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
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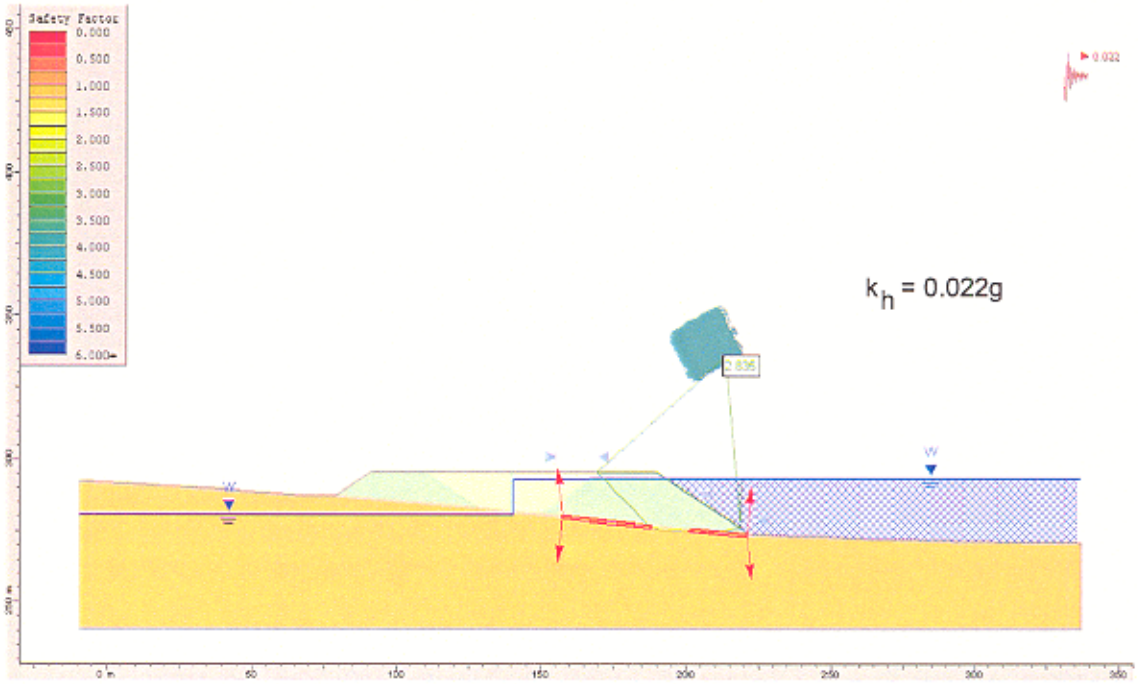
TITLE
SECTION B
ROCKFILL FAILURE - CIRCULAR
PSEUDOSTATIC

Golder Associates

PROJECT No.	03-1413-427		FILE No.	SECTION B
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03		
REVIEW	TRE	23OCT03		

FIGURE I-B11

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT

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MEADOWBANK GOLD PROJECT
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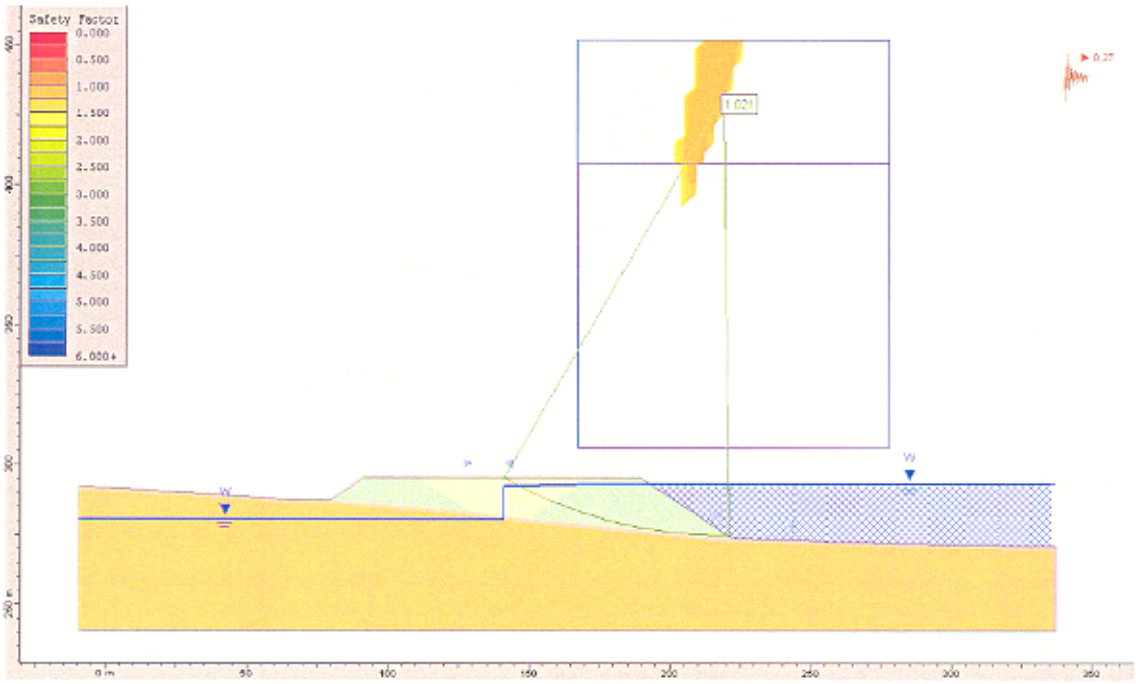
TITLE

SECTION B
ROCKFILL FAILURE - BLOCK
PSEUDOSTATIC

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION B
DESIGN	DAH	15/OCT/03	SCALE N/A	REV. 0
CADD	SRR	15/OCT/03		
CHECK	DAH	15/OCT/03	**FIGURE I-B12**	
REVIEW		23 OCT 03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



Yield Acceleration; ky = 0.27g

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.
3) Yeild acceleration is the value of the horizontal acceleration for FOS = 1.0

PROJECT
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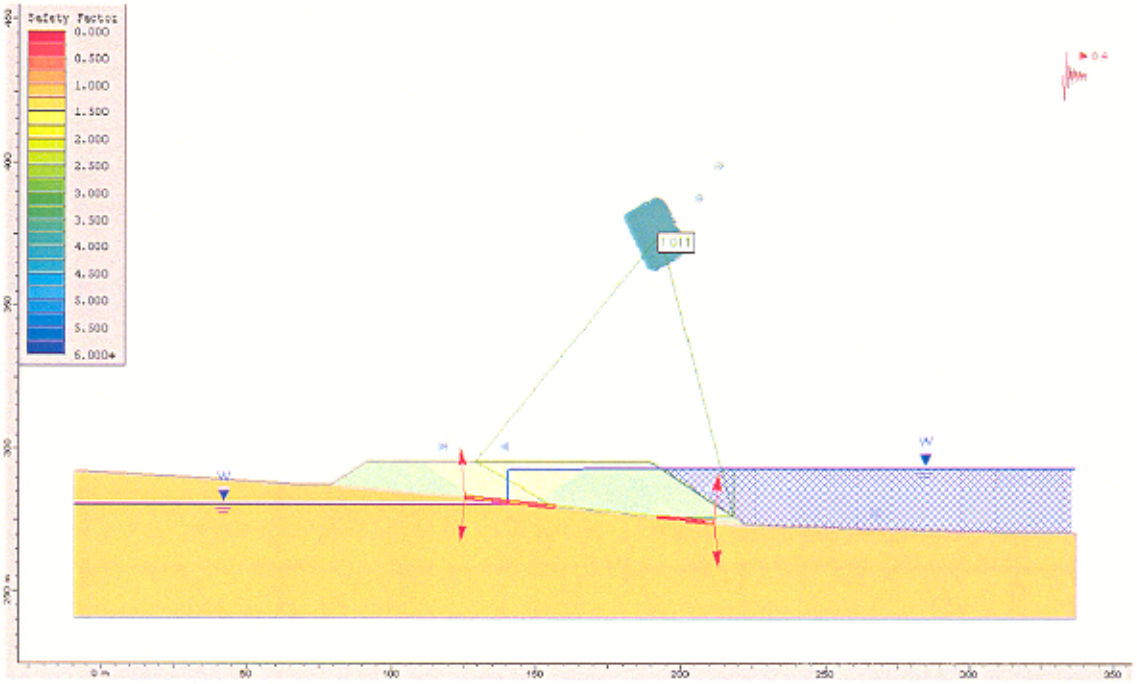
TITLE
SECTION B
CUTOFF FAILURE - CIRCULAR
YIELD ACCELERATION

Golder Associates

PROJECT No.	03-1413-427	FILE No.	CumberlandFigures
DESIGN	WSL	18/06/03	SCALE N/A REV 0
CADD	WSL	18/06/03	
CHECK	DAH	03/09/03	**FIGURE I-B13**
REVIEW	RC	23/05/03	

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



YIELD ACCELERATION; ky = 0.40g

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.
3) Yeild acceleration is the value of the horizontal acceleration for FOS = 1.0

PROJECT
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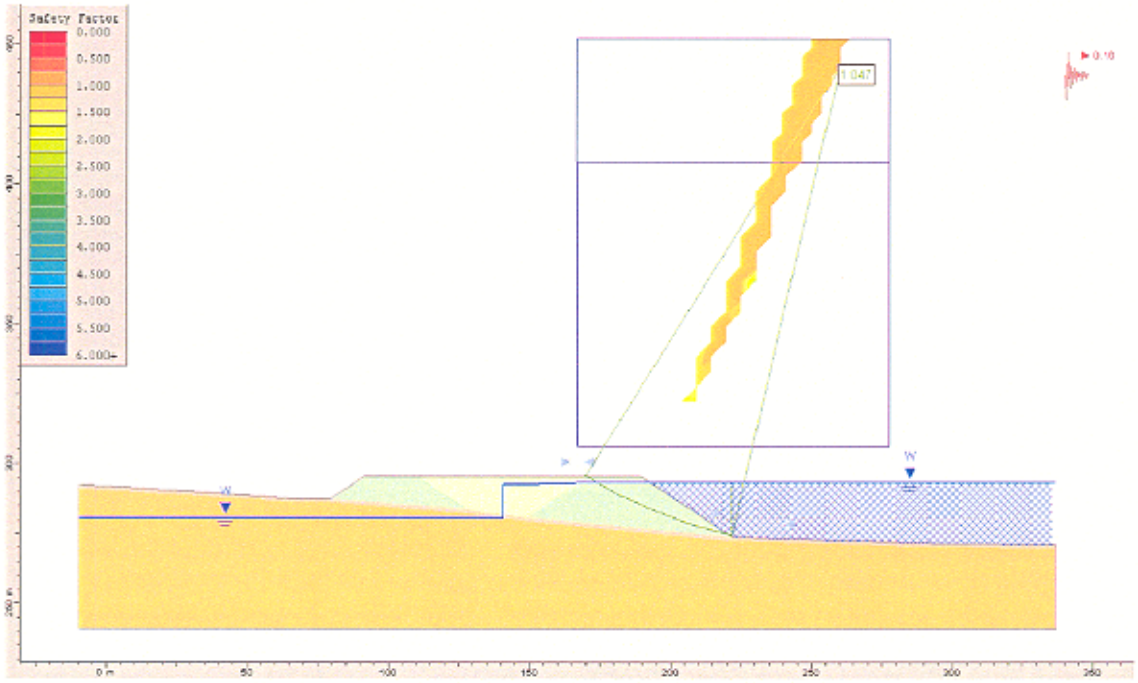
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION B
CUTOFF FAILURE - BLOCK
YIELD ACCELERATION

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION B
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-B14**	
REVIEW	RCC	23OCT03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



Yield Acceleration; ky = 0.16g

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.
3) Yeild acceleration is the value of the horizontal acceleration for FOS = 1.0

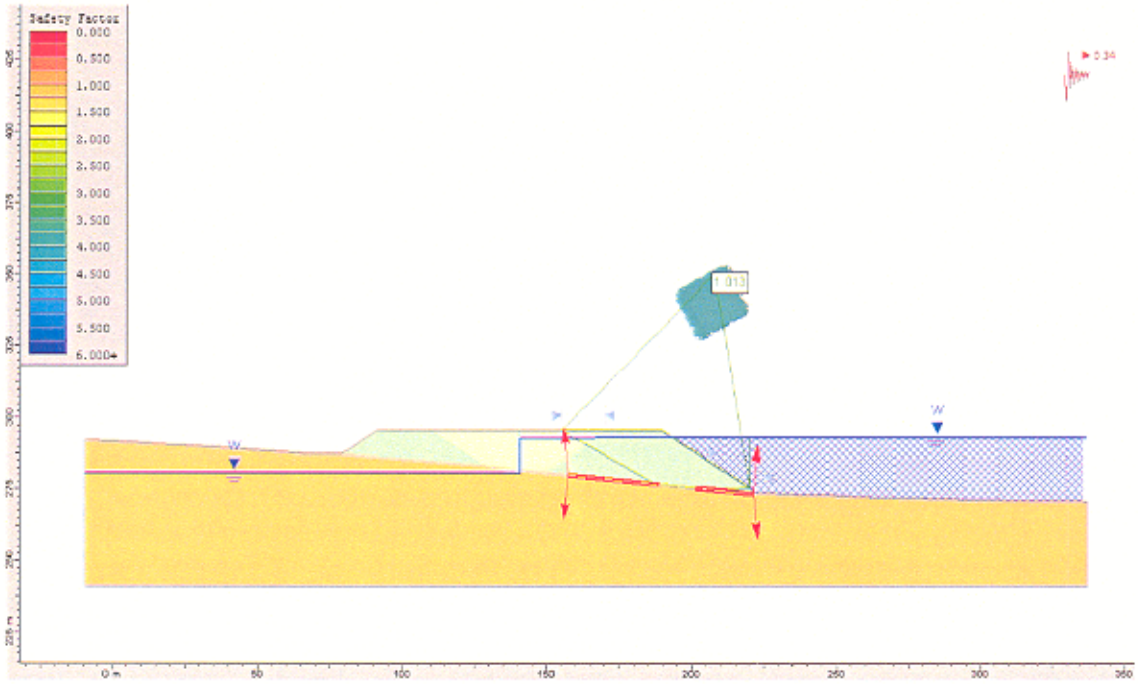
PROJECT: CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE: **SECTION B**
ROCKFILL FAILURE - CIRCULAR
YIELD ACCELERATION

Golder Associates

PROJECT No. 03-1413-427			FILE No. CumberlandFigures
DESIGN	WSL	18/06/03	SCALE N/A REV 0
CADD	WSL	18/06/03	
CHECK	DAH	03/08/03	**FIGURE I-B15**
REVIEW		23/08/03	

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



YIELD ACCELERATION; ky = 0.34g

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.
3) Yeild acceleration is the value of the horizontal acceleration for FOS = 1.0

PROJECT

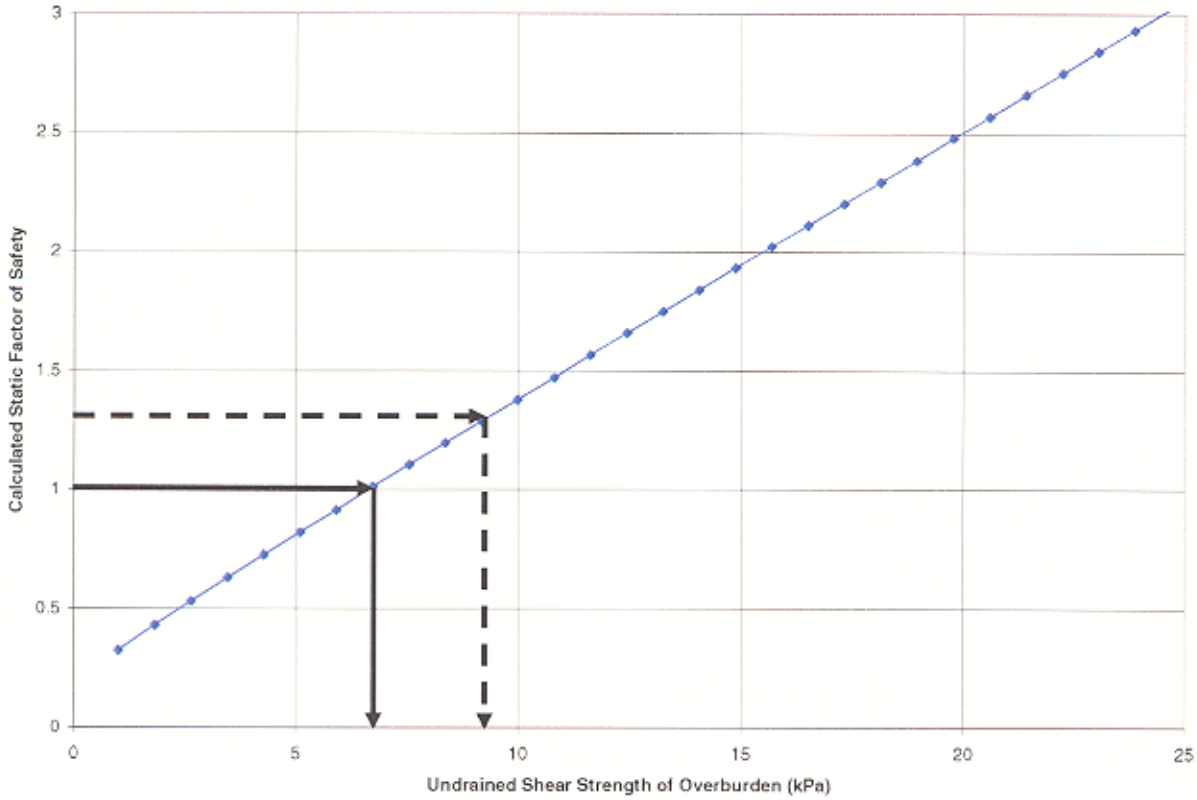
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

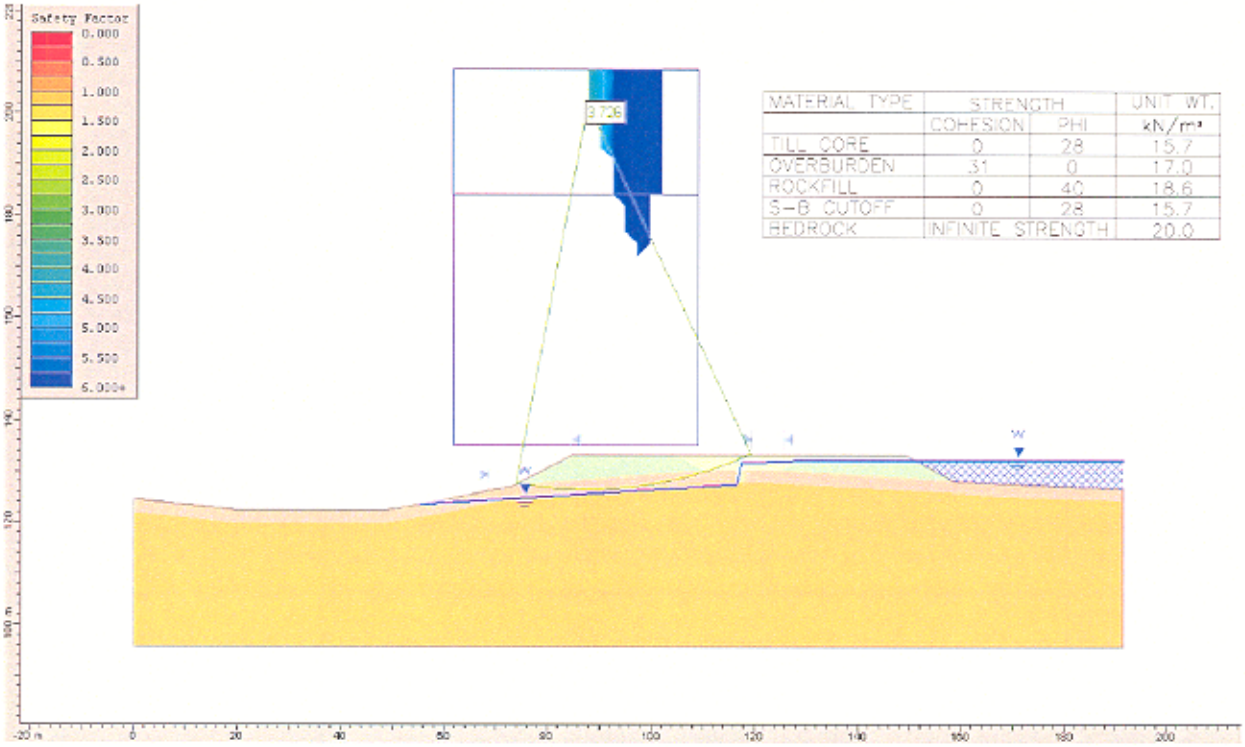
TITLE

SECTION B
ROCKFILL FAILURE - BLOCK
YIELD ACCELERATION

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION B
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-B16**	
REVIEW	JCR	23OCT03		





MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	31	0	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT

CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

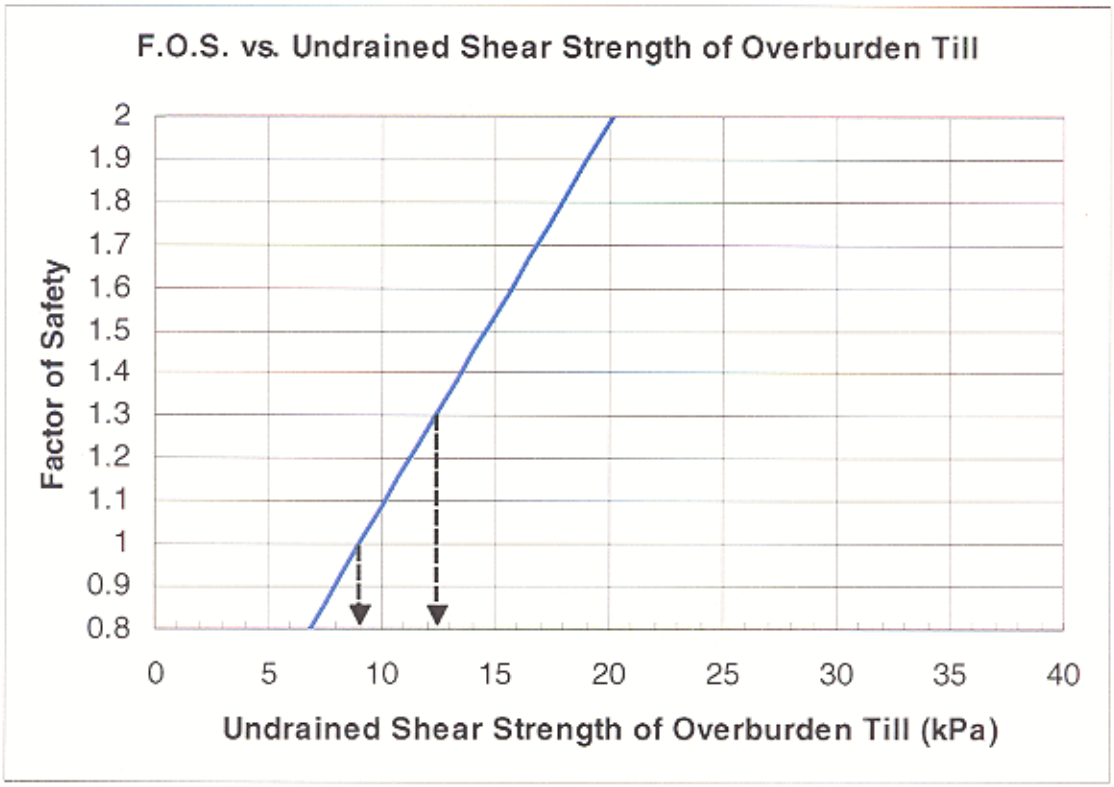
TITLE

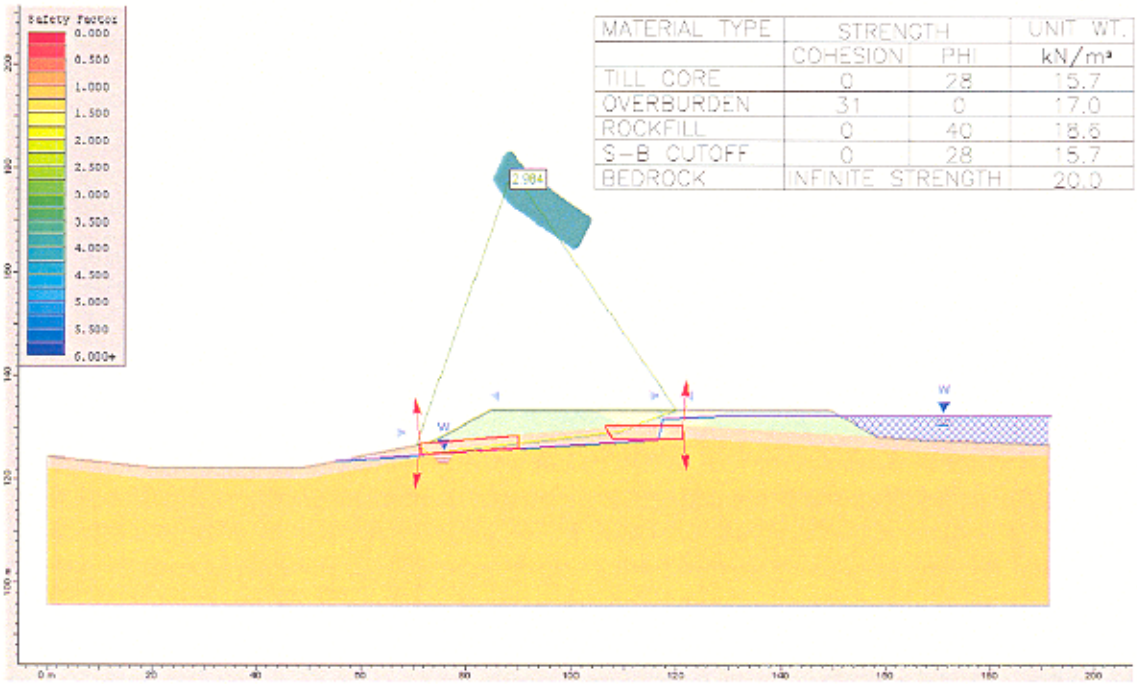
SECTION C - END OF CONSTRUCTION CUTOFF FAILURE - CIRCULAR

Golder Associates

PROJECT No. 03-1413-427			FILE No. CumberlandFigures	
DESIGN	WSL	18/06/03	SCALE N/A	REV. 0
CADD	WSL	18/06/03		
CHECK	DAH	03/09/03	**FIGURE I-C1**	
REVIEW	JCK	23OCT03		

REVISION DATE 03/10/22 11:24am By sready CADD FILE: C:\Active\2003\1413\03-1413-427 CRI Feasibility\4200_DykeDesign\Slope Stability Analysis\dwg\SECTION B & C.dwg





MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	31	0	17.0
ROCKFILL	0	40	18.5
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

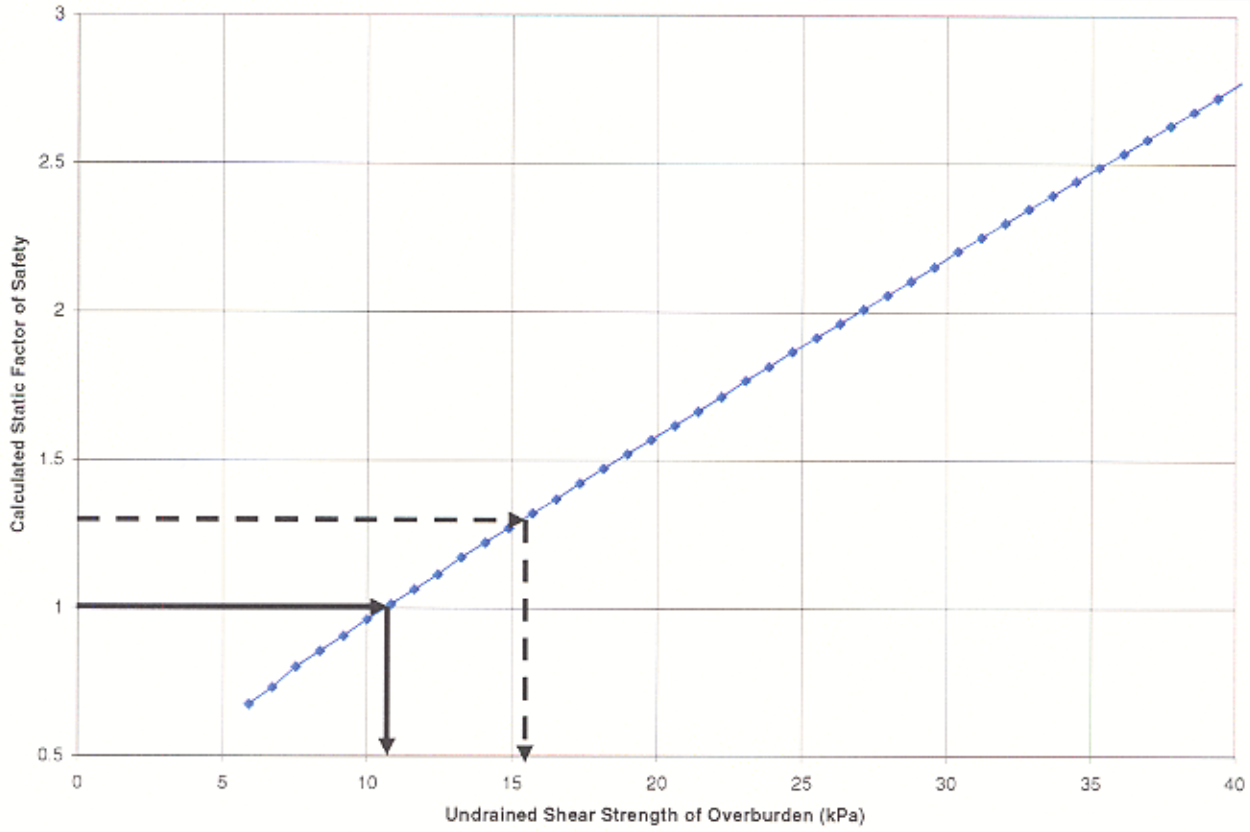
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

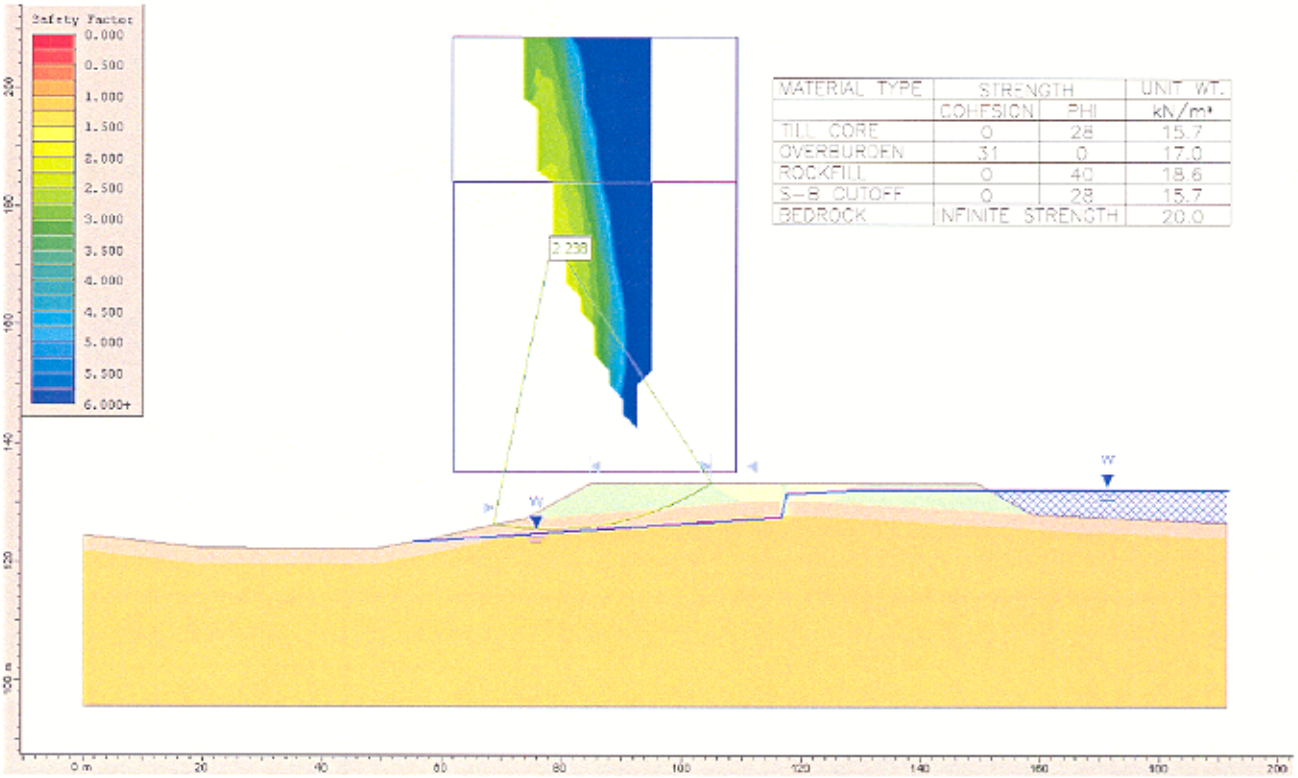
TITLE
SECTION C - END OF CONSTRUCTION CUTOFF FAILURE - BLOCK

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION C
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03		
REVIEW	TCC	23OCT03		

FIGURE I-C2





MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	31	0	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT

CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

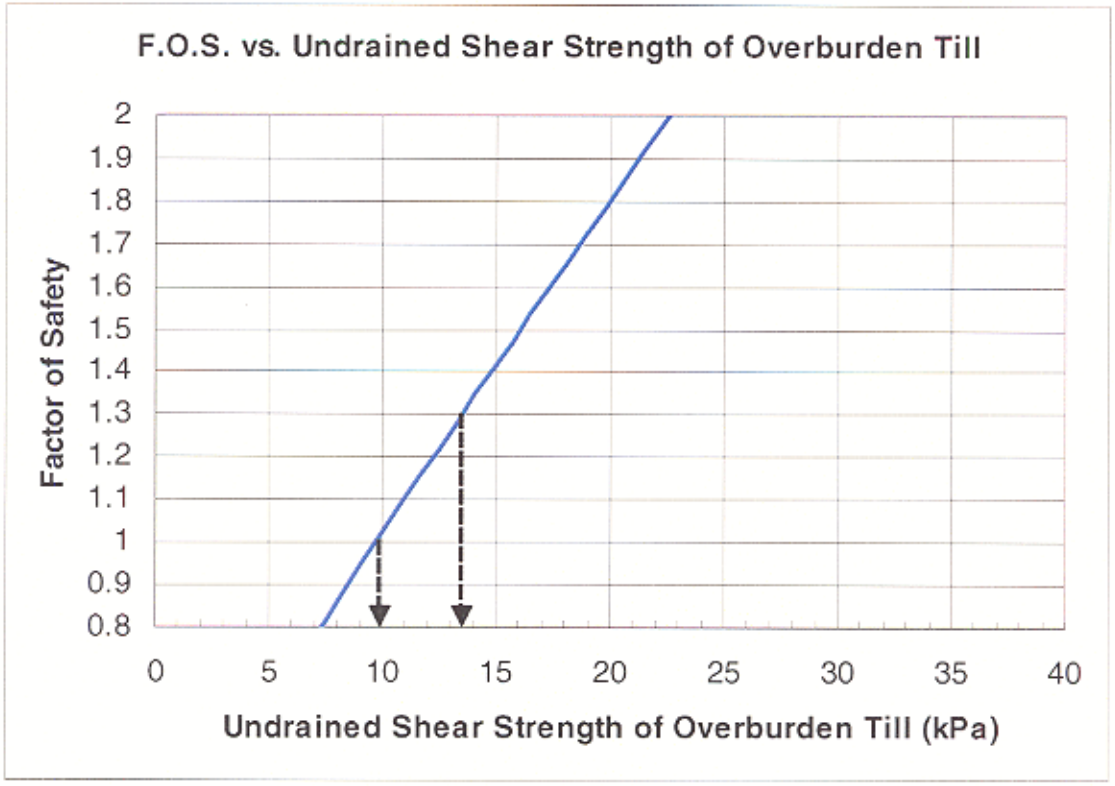
TITLE

SECTION C - END OF CONSTRUCTION ROCKFILL FAILURE - CIRCULAR

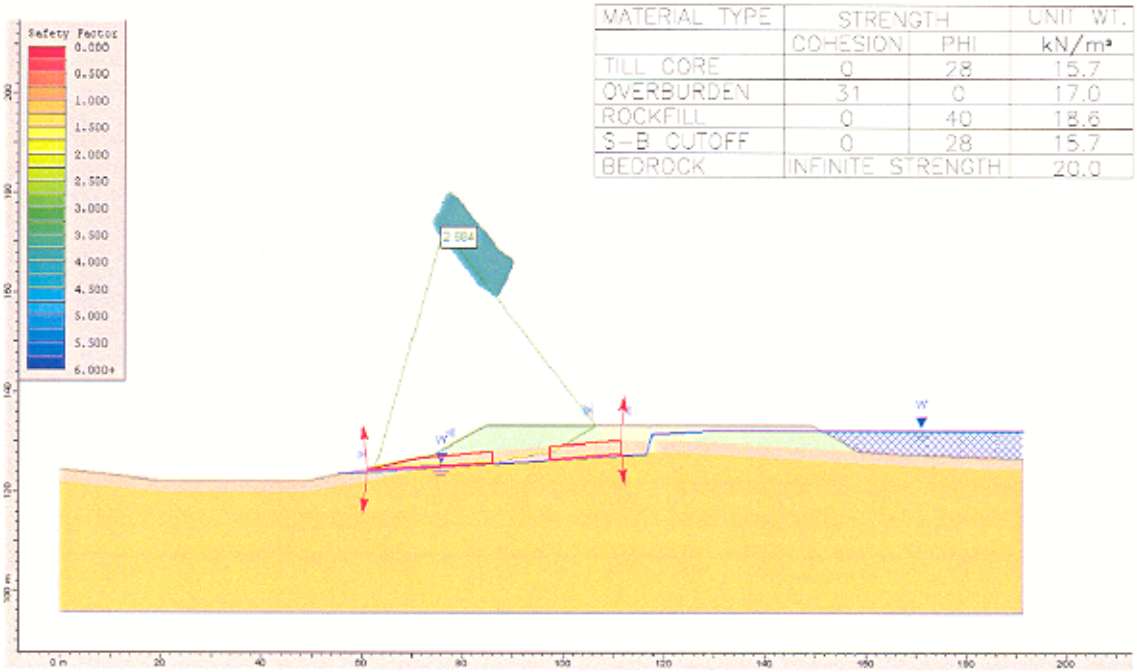
Golder Associates

PROJECT No. 03-1413-427			FILE No. CumberlandFigures	
DESIGN	WSL	18/06/03	SCALE N/A	REV. 0
CADD	WSL	18/06/03		
CHECK	DAH	03/09/03	**FIGURE I-C3**	
REVIEW	ZKE	23/09/03		

REVISION DATE: 03/10/22 11:24am By: sreddy CADD FILE: G:\Active\2003\1413\03-1413-427 CRL Feasibility\4200_DykeDesign\Slope Stability Analysis\dwg\SECTION B & C.dwg



MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	31	0	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

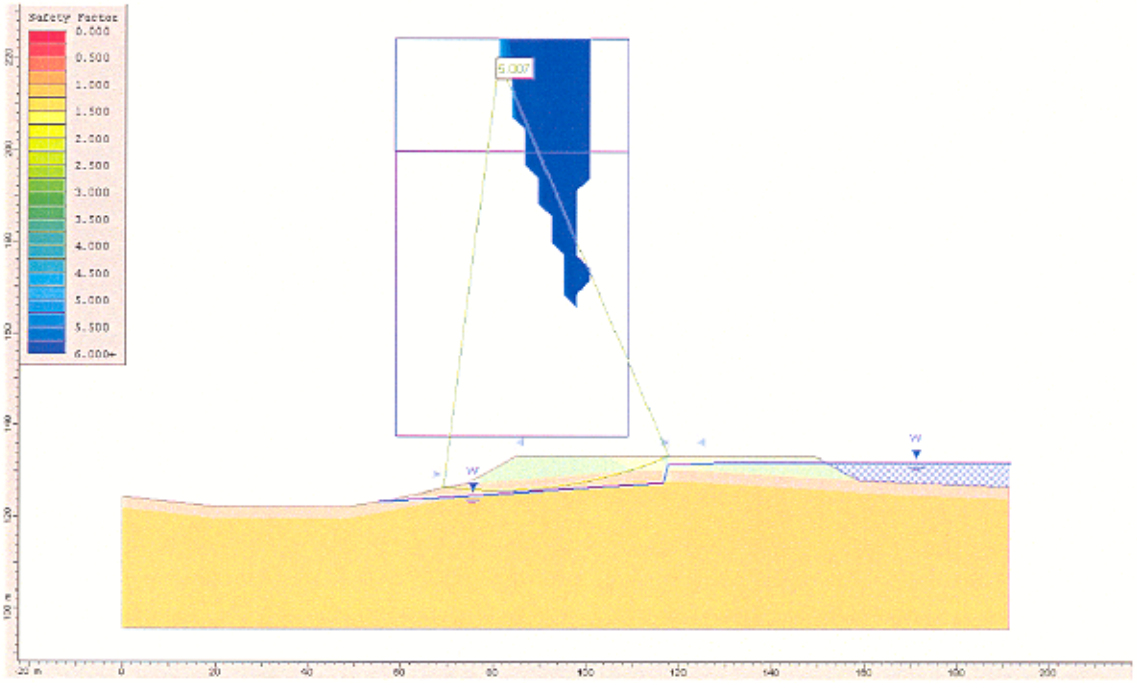
TITLE
SECTION C - END OF CONSTRUCTION ROCKFILL FAILURE - BLOCK

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION C
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03		
REVIEW		29OCT03		

FIGURE I-C4

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT

CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

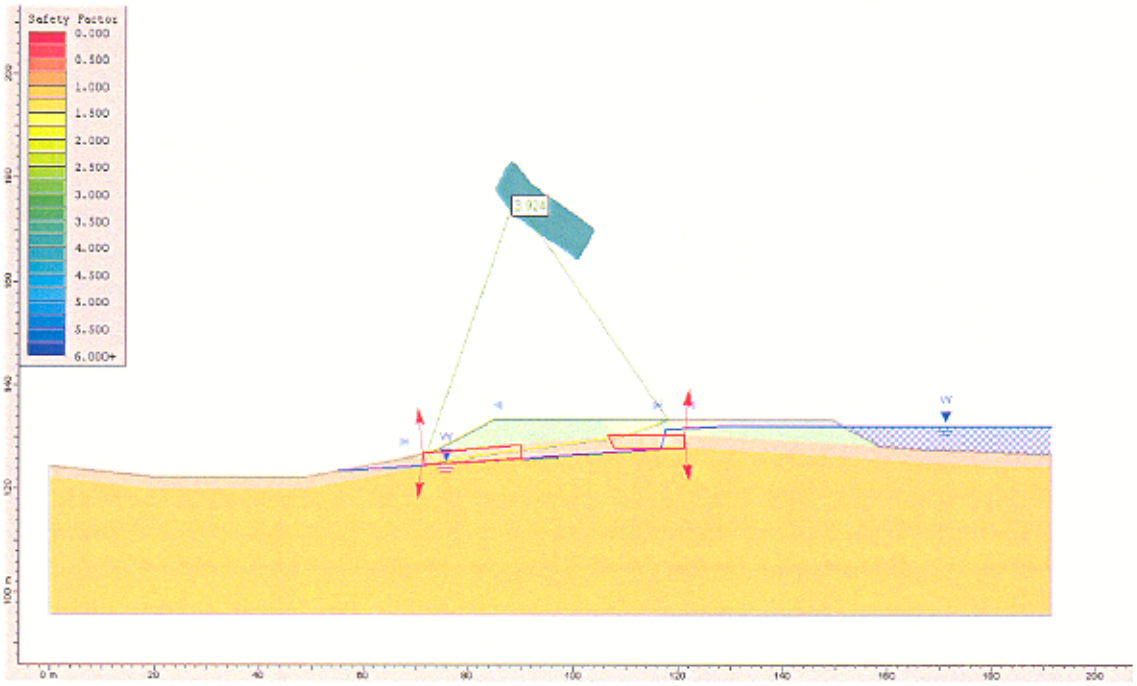
TITLE

SECTION C
CUTOFF FAILURE - CIRCULAR - STATIC

Golder Associates

PROJECT No. 03-1413-427			FILE No. CumberlandFigures	
DESIGN	WSL	18/06/03	SCALE N/A	REV. 0
CADD	WSL	18/06/03		
CHECK	DAH	03/09/03	**FIGURE I-C5**	
REVIEW	RKE	23Oct03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT
CUMBERLAND RESOURCES LTD.
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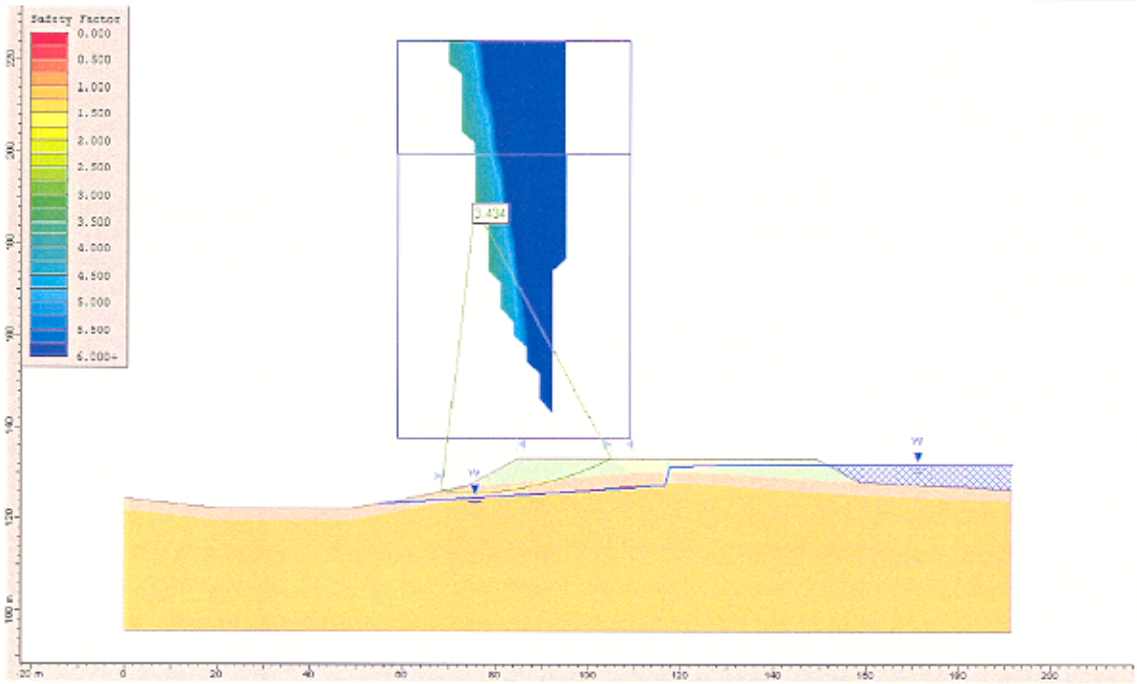
TITLE
SECTION C
CUTOFF FAILURE - BLOCK - STATIC

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION C
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-C6**	
REVIEW		23Oct03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT

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TITLE

SECTION C
ROCKFILL FAILURE - CIRCULAR - STATIC

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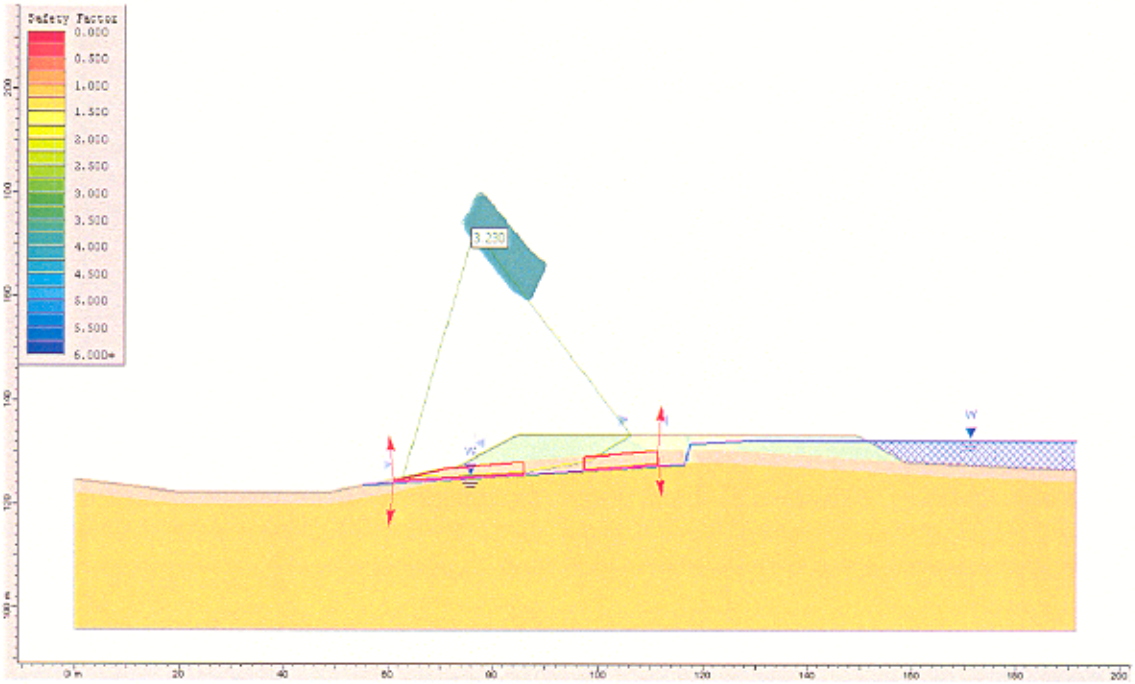
PROJECT No. 03-1413-427			FILE No. CumberandFigures	
DESIGN	WSL	18/06/03	SCALE N/A	REV 0
CADD	WSL	18/06/03		
CHECK	DAH	03/09/03	**FIGURE I-C7**	
REVIEW	JRC	23 Oct 03		

REVISION DATE: 03/10/22 11:25am By: sreedy CADD FILE: G:\Active\2003\1413\03-1413-427 CM Feasibility\4200_DykeDesign\Slope Stability Analysis\dwg\SECTION B & C.dwg

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT

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TITLE

SECTION C
ROCKFILL FAILURE - BLOCK - STATIC

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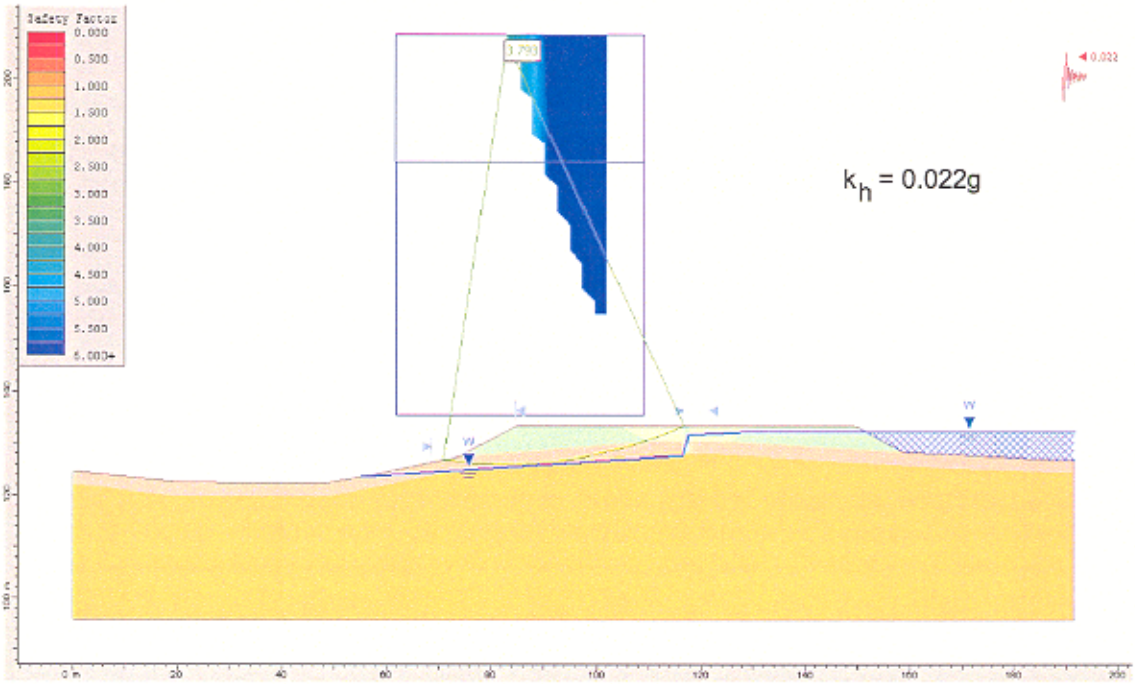
PROJECT No. 03-1413-427			FILE No.	SECTION C
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-C8**	
REVIEW		23 OCT 03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT	CUMBERLAND RESOURCES LTD. MEADOWBANK GOLD PROJECT NUNAVUT
TITLE	**SECTION C CUTOFF FAILURE - CIRCULAR PSEUDOSTATIC**

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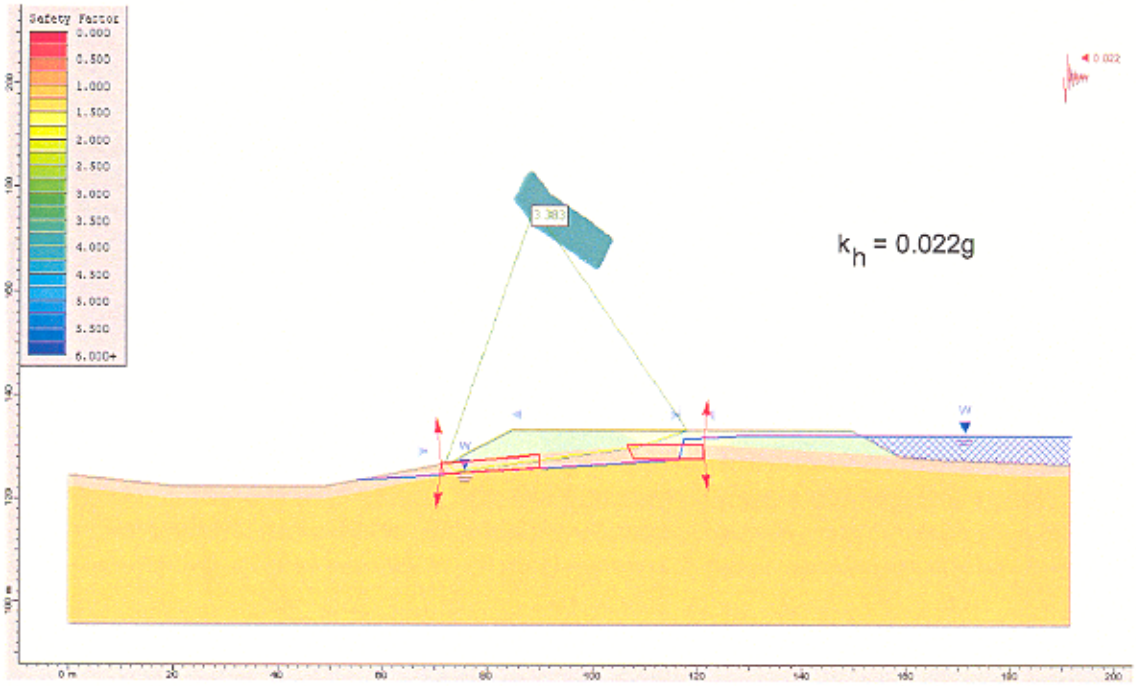
PROJECT No. 03-1413-427			FILE No.	SECTION C
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-C9**	
REVIEW	TKE	23OCT03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT
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CUTOFF FAILURE - BLOCK
PSEUDOSTATIC

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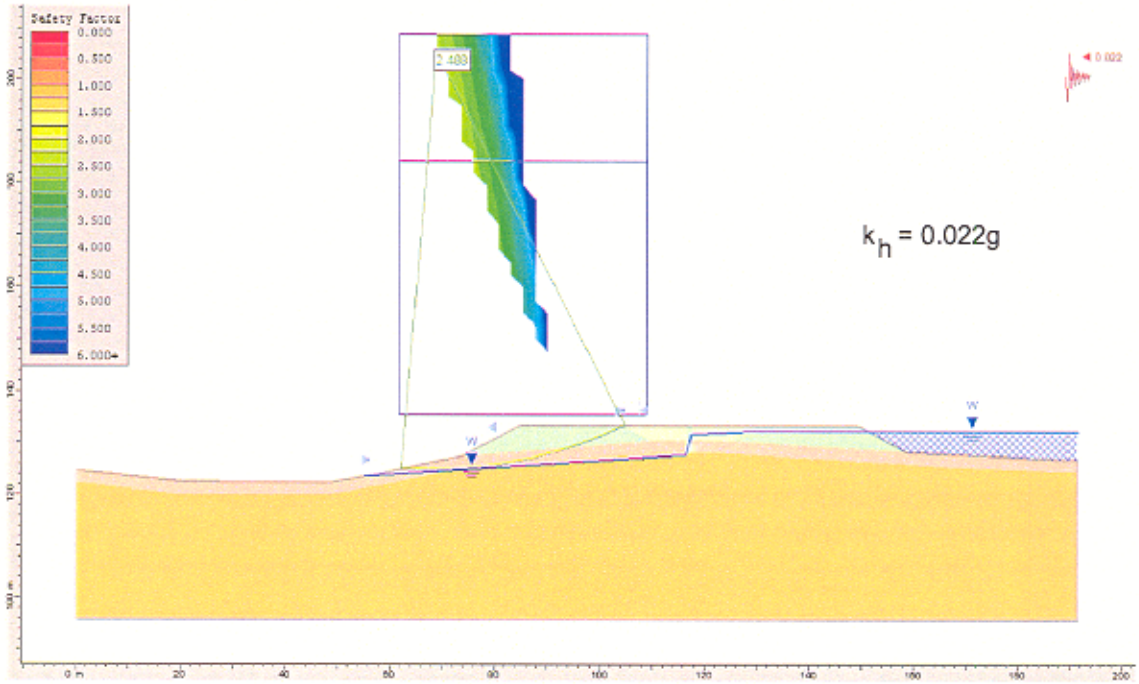
PROJECT No. 03-1413-427			FILE No.	SECTION C
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-C10**	
REVIEW	RE	23 Oct 03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

PROJECT

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TITLE

SECTION C
ROCKFILL FAILURE - CIRCULAR - STATIC

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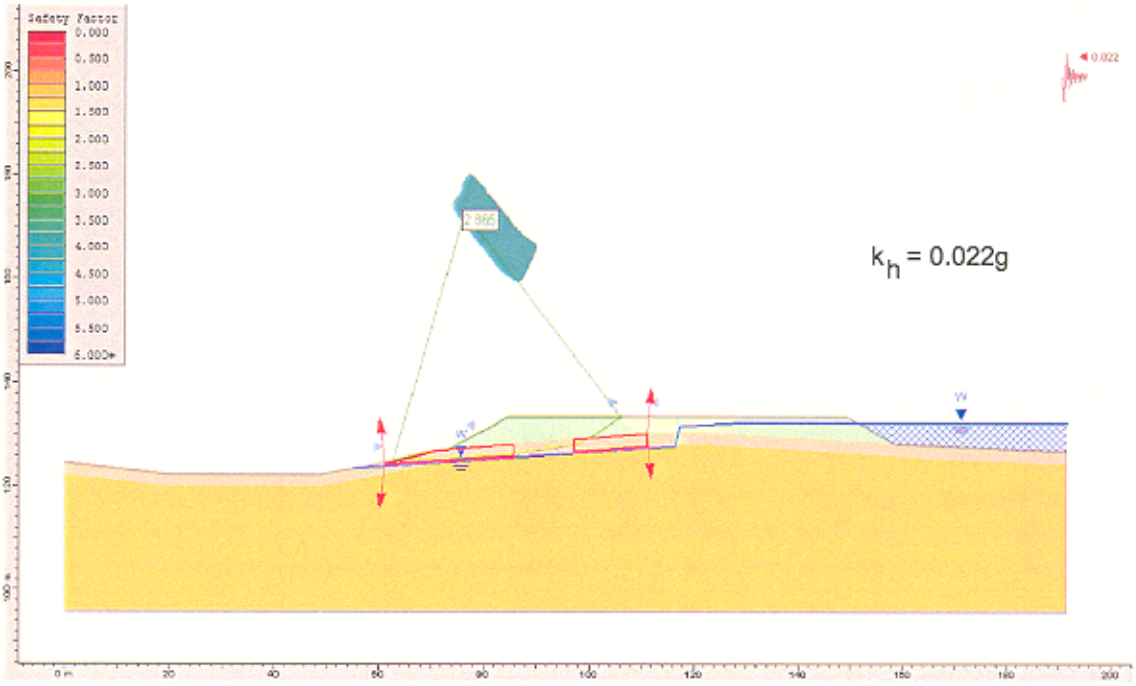
PROJECT No. 03-1413-427			FILE No.	SECTION C
DESIGN	CAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	CAH	16/OCT/03	**FIGURE I-C11**	
REVIEW	TKK	23Oct03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.

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SECTION C
ROCKFILL FAILURE - BLOCK
PSEUDOSTATIC

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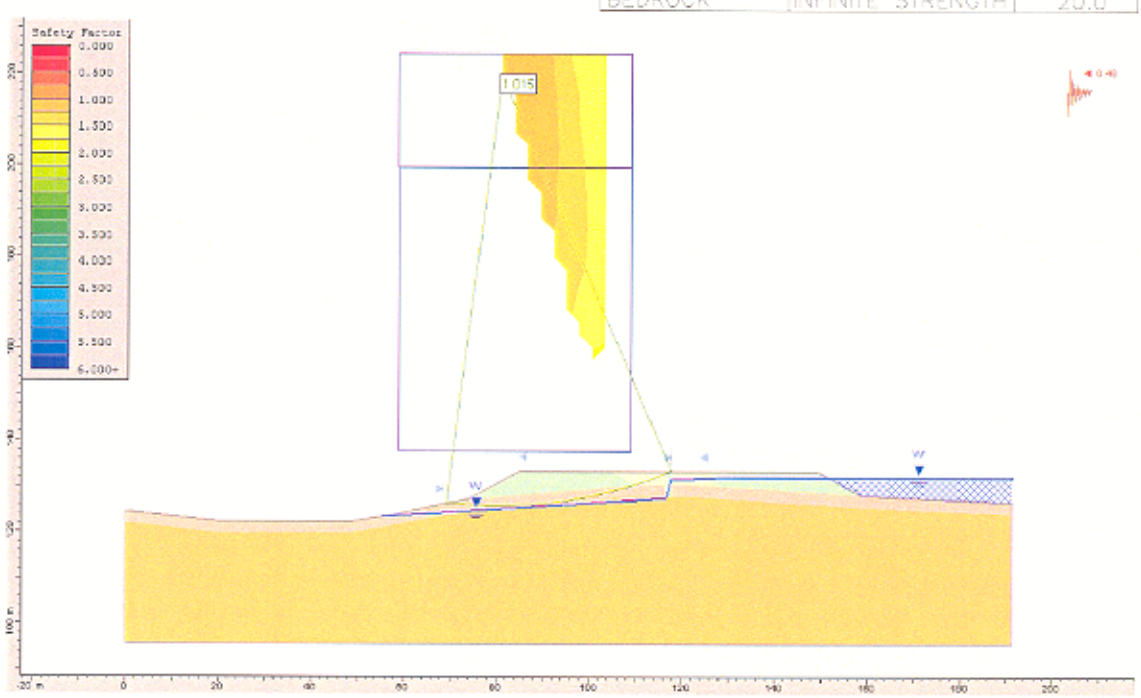
PROJECT No.	03-1413-427		FILE No.	SECTION C
DESIGN	DAH	16/OCT/03	SCALE N/A	REV. 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03		
REVIEW				

FIGURE I-C12

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



Yield Acceleration; ky = 0.48g

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.
3) Yield acceleration is the value of the horizontal acceleration for FOS = 1.0

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SECTION C
CUTOFF FAILURE - CIRCULAR
YIELD ACCELERATION

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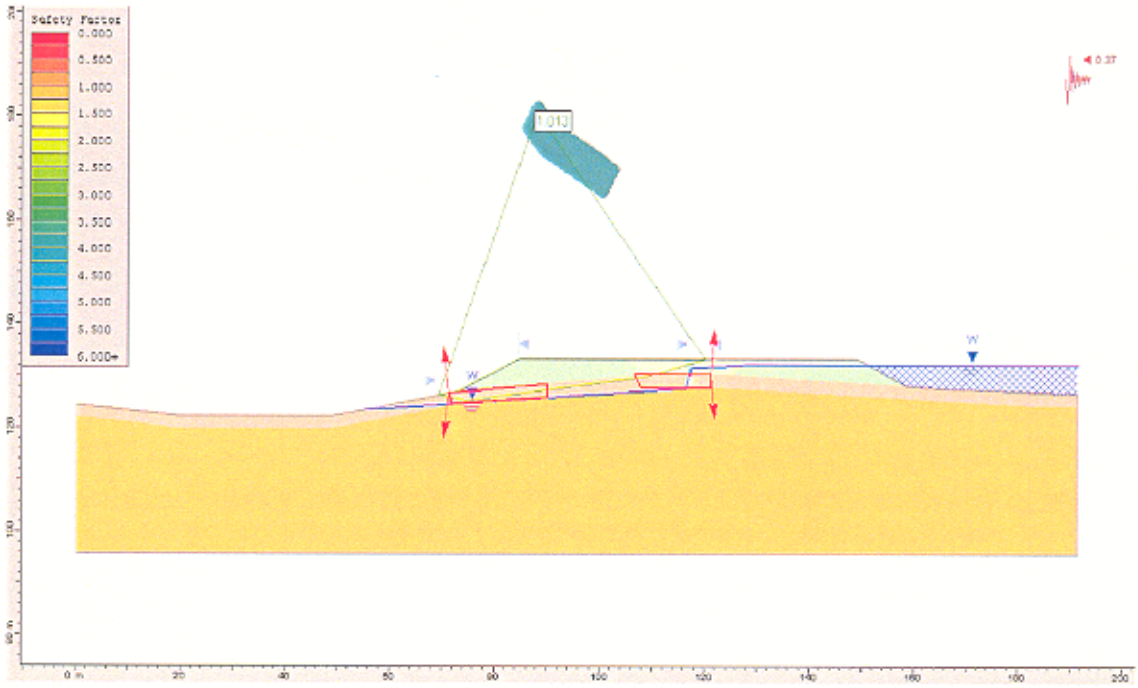
PROJECT No. 03-1413-427			FILE No. CumberlandFigures	
DESIGN	WSL	18/06/03	SCALE N/A	REV. 0
CADD	WSL	18/06/03		
CHECK	DAH	03/08/03	**FIGURE I-C13**	
REVIEW		28 Oct 03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



YIELD ACCELERATION; ky = 0.37g

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.
3) Yeild acceleration is the value of the horizontal acceleration for FOS = 1.0

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TITLE
SECTION C
CUTOFF FAILURE - BLOCK
YIELD ACCELERATION

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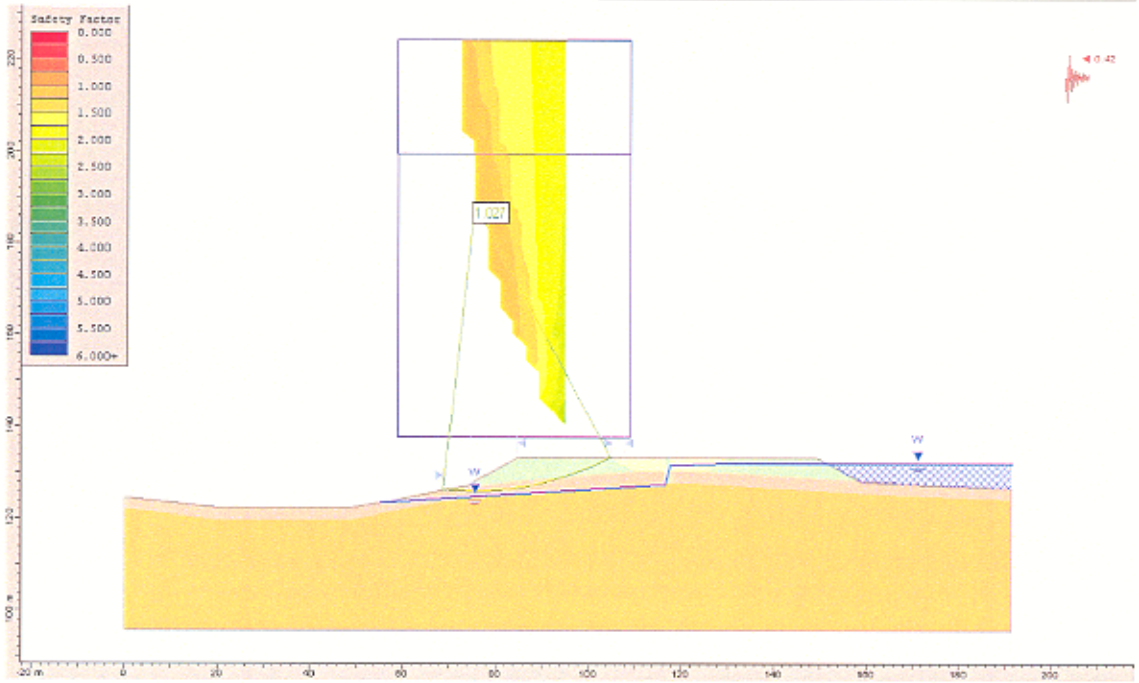
PROJECT No. 03-1413-427			FILE No.	SECTION C
DESIGN	DAH	16/OCT/03	SCALE N/A	REV 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-C14**	
REVIEW		30/10/03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



Yield Acceleration; ky = 0.42g

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.
3) Yield acceleration is the value of the horizontal acceleration for FOS = 1.0

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SECTION C
ROCKFILL FAILURE - CIRCULAR
YIELD ACCELERATION

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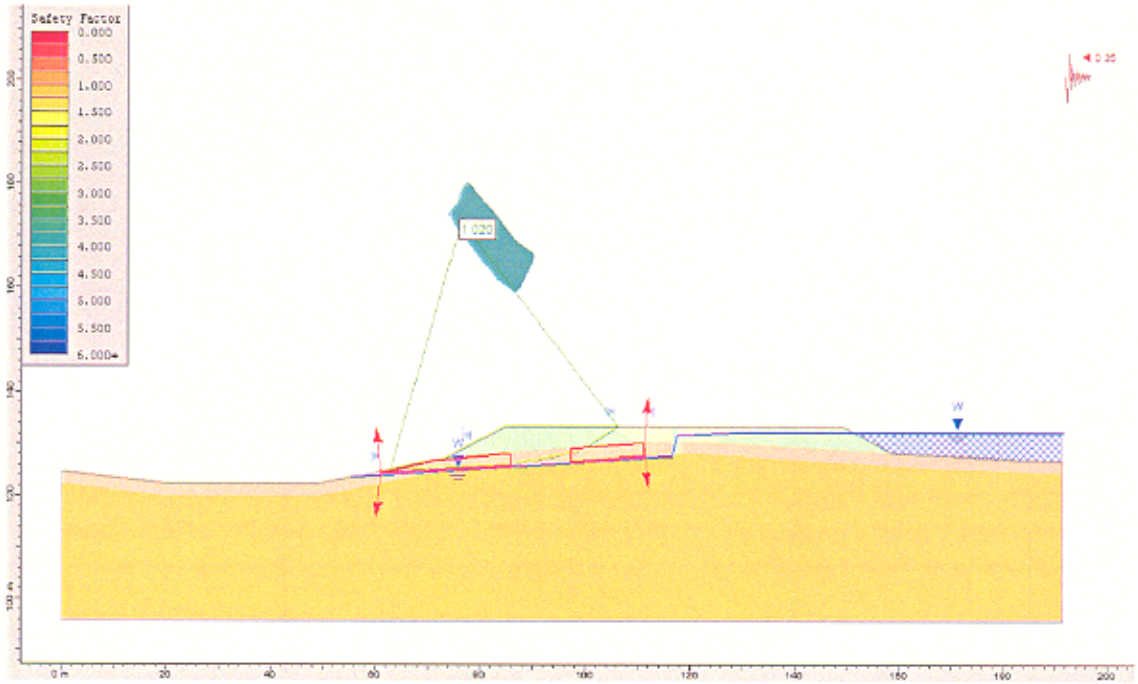
PROJECT No. 03-1413-427			FILE No. CumberlandFigures	
DESIGN	WSL	18/06/03	SCALE N/A	REV. 0
CADD	WSL	18/06/03		
CHECK	DAH	03/09/03	**FIGURE I-C15**	
REVIEW		23Oct03		

MATERIAL TYPE	STRENGTH		UNIT WT.
	COHESION	PHI	kN/m³
TILL CORE	0	28	15.7
OVERBURDEN	0	28	17.0
ROCKFILL	0	40	18.6
S-B CUTOFF	0	28	15.7
BEDROCK	INFINITE STRENGTH		20.0



YIELD ACCELERATION; ky = 0.36g

NOTES

1) All values of Phi are in degrees.
2) All values of Cohesion are in kPa.
3) Yeild acceleration is the value of the horizontal acceleration for FOS = 1.0

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TITLE
SECTION C
ROCKFILL FAILURE - BLOCK
YIELD ACCELERATION

Golder Associates

PROJECT No. 03-1413-427			FILE No.	SECTION C
DESIGN	DAH	16/OCT/03	SCALE N/A	REV 0
CADD	SRR	16/OCT/03		
CHECK	DAH	16/OCT/03	**FIGURE I-C16**	
REVIEW	PR 5230	00503		

APPENDIX II

SEEPAGE ANALYSES

Table AII-1: Summary of Seepage Analyses – Meadowbank Dikes

Figure No. (II-)	Section Analyzed	Conditions Modelled	Flux through Dike (L/s/m)
A1	A	No gap at bedrock contact; no crack in soil-bentonite wall	5.8×10^{-4}
A2		No gap at bedrock contact; crack in soil-bentonite wall within overburden till	1.5×10^{-2}
A3		No gap at bedrock contact; crack in soil-bentonite wall within till core	5.9×10^{-4}
A4		0.5 m gap at bedrock contact; no crack in soil-bentonite wall	1.9×10^{-3}
A5		0.5 m gap at bedrock contact; crack in soil-bentonite wall within overburden till	1.5×10^{-2}
A6		0.5 m gap at bedrock contact; crack in soil-bentonite wall within till core	1.9×10^{-3}
B1	B	No gap at bedrock contact; no crack in soil-bentonite wall	$5.6 \text{ X } 10^{-4}$
B2		No gap at bedrock contact; crack in soil-bentonite wall within overburden till	7.5×10^{-3}
B3		No gap at bedrock contact; crack in soil-bentonite wall within till core	5.6×10^{-3}
B4		0.5 m gap at bedrock contact; no crack in soil-bentonite wall	6.7×10^{-3}
B5		0.5 m gap at bedrock contact; crack in soil-bentonite wall within overburden till	1.2×10^{-2}
B6		0.5 m gap at bedrock contact; crack in soil-bentonite wall within till core	6.6×10^{-3}

REVISION DATE: 03/10/17 4:19pm By: sreddy CADD FILE: O:\Active\2003\1413\03-1413-427 CRLFeasibility\4200_DykeDesign\Seepage Analysis\cad\Section 3A10-8.dwg

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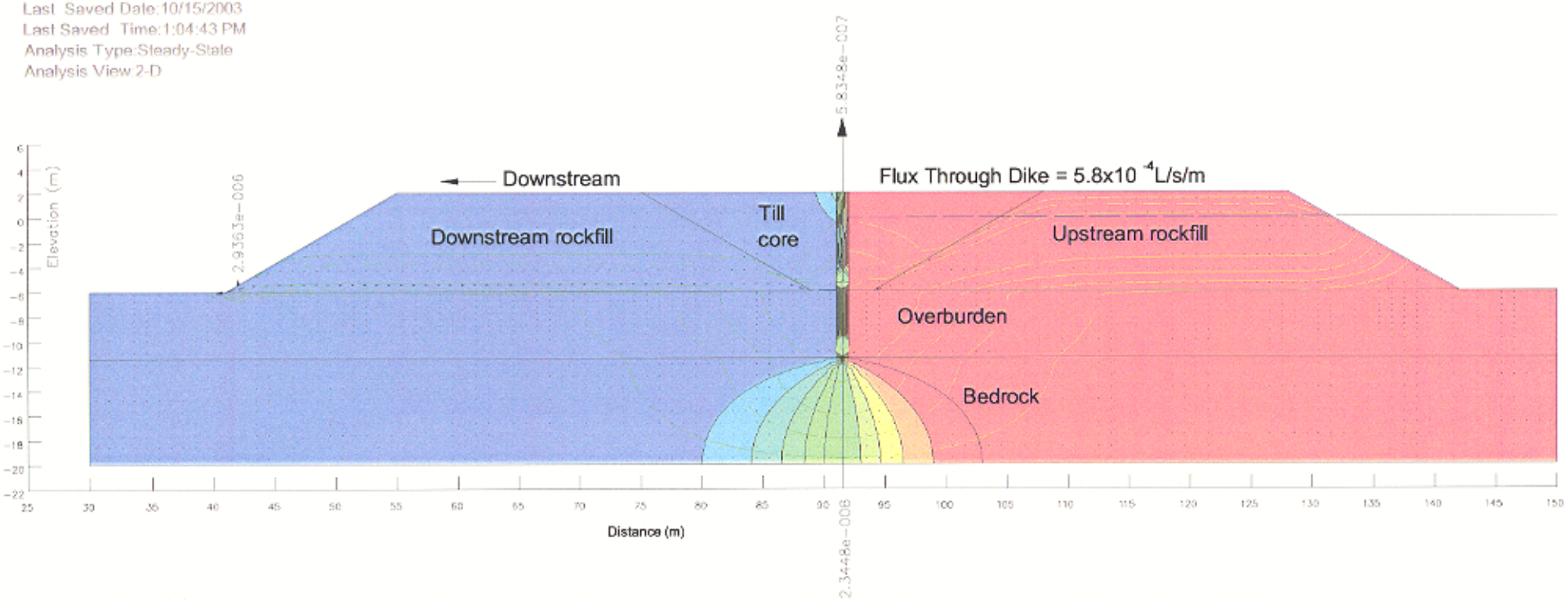
Comments:03-1413-427/4200 File
Name:Section 3A10-8_no gap, no crack.sez
Last Saved Date:10/15/2003
Last Saved Time:1:04:43 PM
Analysis Type:Steady-State
Analysis View:2-D



NOTES

1) See section A on Figure 1.3

MATERIAL HYDRAULIC CONDUCTIVITY (m/s)	
Till core	$1x10^{-5}$
Rockfill	$1x10^{-2}$
Overburden	$1x10^{-5}$
Soil-bentonite backfill	$1x10^{-8}$
Bedrock	$1x10^{-7}$

PROJECT
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TITLE
SECTION A - NO GAP OR CRACK IN SOIL-BENTONITE WALL

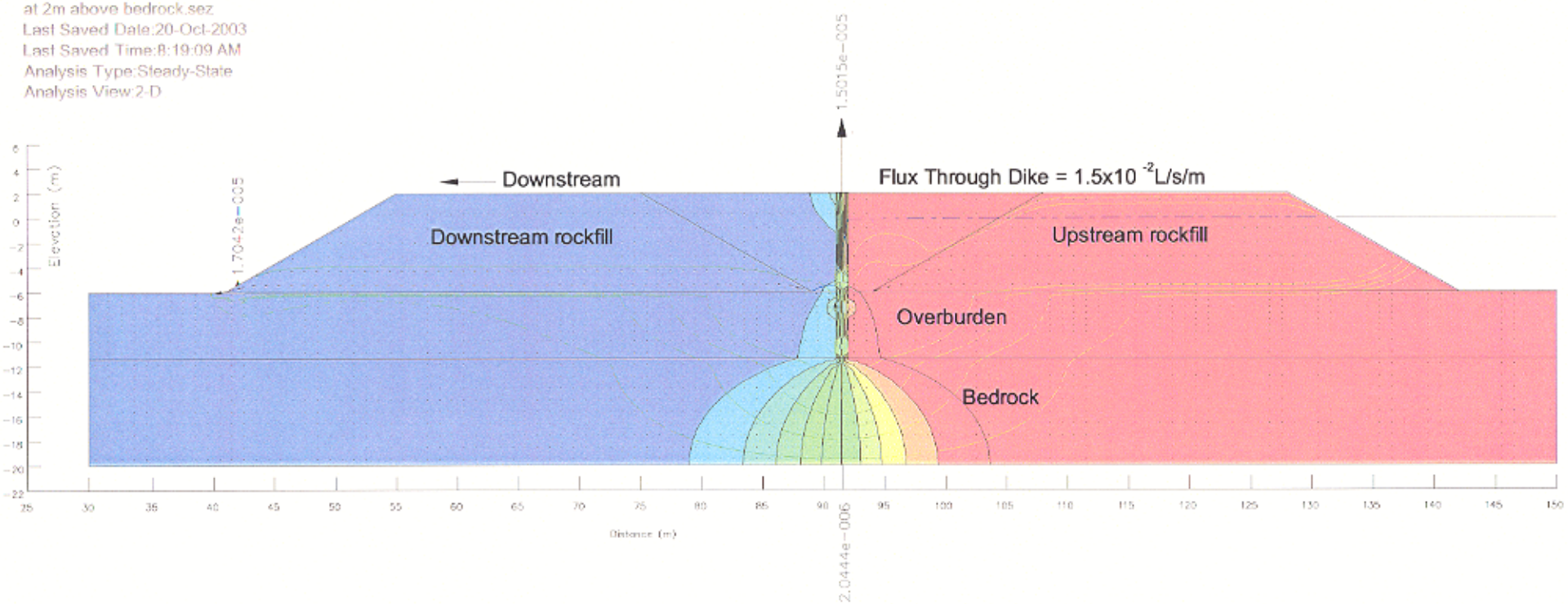
Golder Associates

PROJECT No.		03-1413-427	FILE No.	Section 3A10-8
DESIGN	DAH	06/OCT/03	SCALE N/A	REV. 0
CADD	SRR	06/OCT/03		
CHECK	DAH	06/OCT/03		
REVIEW	KE	23/OCT/03		

FIGURE II-A1

REVISION DATE: 03/10/17 4:19pm By: sreddy CADD FILE: D:\Active\2003\1413\03-1413-427 CRLFeasibility\4200_DykeDesign\Seepage Analysis\cad\Section 3A10-8.dwg

Description:Meadowbank Dike Design
Comments:03-1413-427/4200
File Name:Section 3A10-8_no gap, 0.25m crack at 2m above bedrock.sez
Last Saved Date:20-Oct-2003
Last Saved Time:8:19:09 AM
Analysis Type:Steady-State
Analysis View:2-D



NOTES

1) See section A on Figure 1.3
2) Cracks modelled as 0.25m thick.

MATERIAL HYDRAULIC CONDUCTIVITY (m/s)	
Till core	$1x10^{-5}$
Rockfill	$1x10^{-2}$
Overburden	$1x10^{-5}$
Soil-bentonite backfill	$1x10^{-8}$
Bedrock	$1x10^{-7}$

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TITLE
SECTION A - NO GAP; CRACK IN SOIL-BENTONITE WALL WITHIN OVERBURDEN

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PROJECT No.		03-1413-427	FILE No.	Section 3A10-8
DESIGN	DAH	06/OCT/03	SCALE N/A	REV. 0
CADD	SRR	06/OCT/03		
CHECK	DAH	06/OCT/03	**FIGURE II-A2**	
REVIEW	RE	23/04/03		

REVISION DATE: 03/10/17 4:19pm By: sreddy CADD FILE: O:\Active\2003\1413\03-1413-427 CRLFeasibility\4200_DykeDesign\Seepage Analysis\cad\Section 3A10-8.dwg

Description:Meadowbank Dike Design
Comments:03-1413-427/4200
File Name:Section 3A10-8_no gap, 0.25m crack at 3m above bedrock.sez
Last Saved Date:20-Oct-2003
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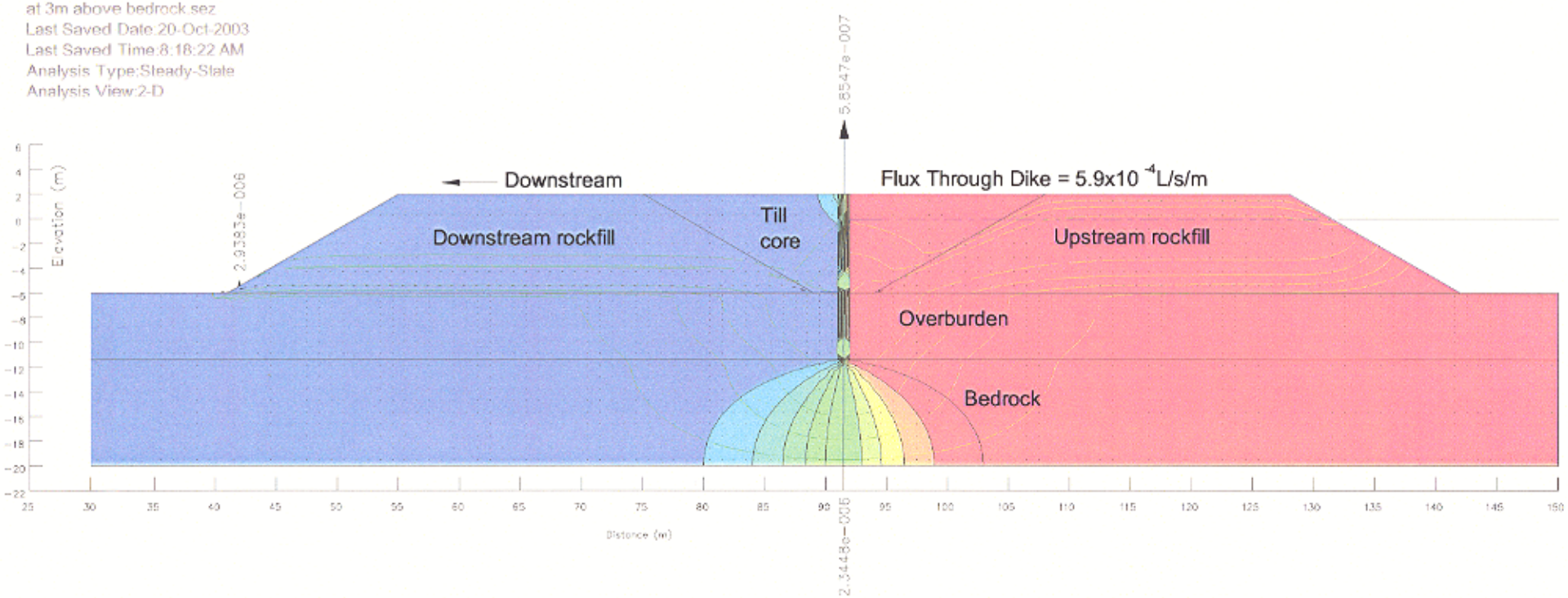
Analysis Type:Steady-State
Analysis View:2-D



NOTES

1) See section A on Figure 1.3
2) Cracks modelled as 0.25m thick.

MATERIAL HYDRAULIC CONDUCTIVITY (m/s)	
Till core	$1x10^{-5}$
Rockfill	$1x10^{-2}$
Overburden	$1x10^{-5}$
Soil-bentonite backfill	$1x10^{-8}$
Bedrock	$1x10^{-7}$

PROJECT
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TITLE
SECTION A - NO GAP; CRACK IN SOIL-BENTONITE WALL WITHIN TILL CORE

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PROJECT No.		03-1413-427	FILE No.	Section 3A10-8
DESIGN	DAH	06/OCT/03	SCALE N/A	REV. 0
CADD	SRR	06/OCT/03		
CHECK	DAH	06/OCT/03		
REVIEW	ZKE	23OCT03		

FIGURE II-A3

REVISION DATE: 03/10/17 4:19pm By: sreddy CADD FILE: O:\Active\2003\1413\03-1413-427 CRLFeasibility\4200_DykeDesign\Seepage Analysis\cad\Section 3A10-8.dwg

Description:Meadowbank Dike Design
Comments:03-1413-427/4200
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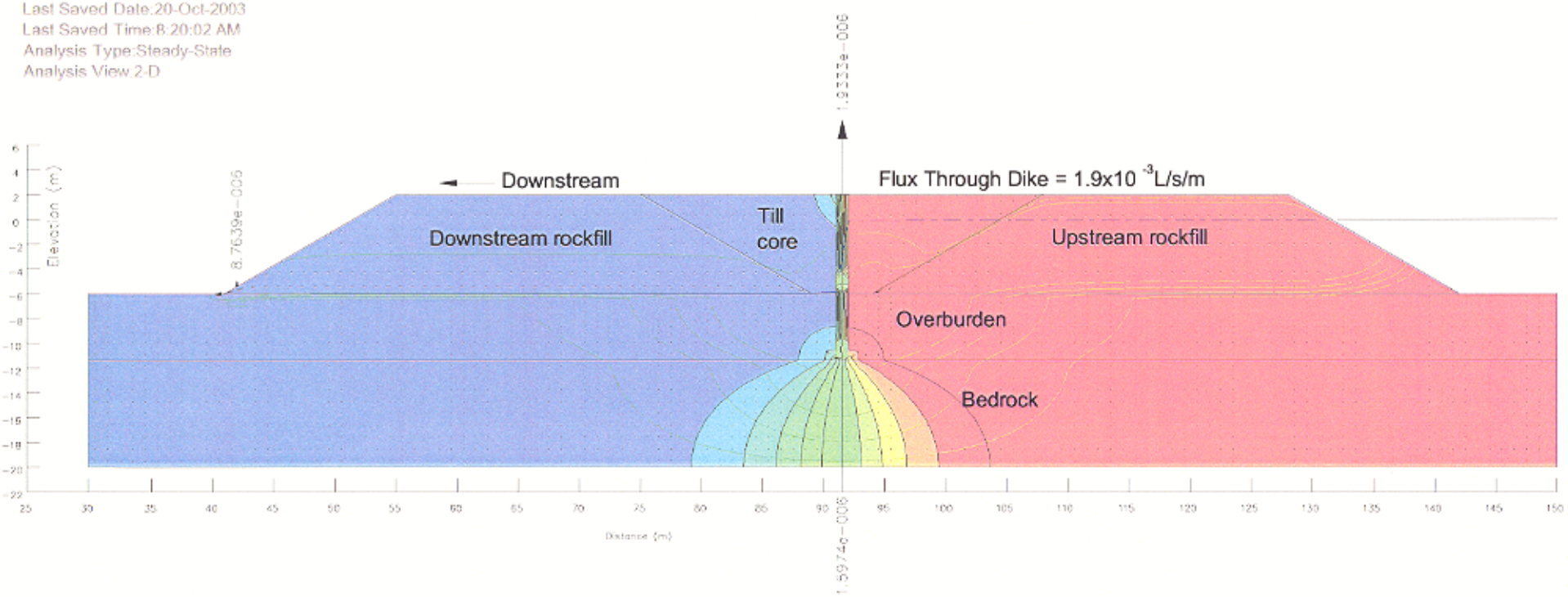
Last Saved Date:20-Oct-2003
Last Saved Time:8:20:02 AM
Analysis Type:Steady-State
Analysis View:2-D



NOTES

1) See section A on Figure 1.3

MATERIAL HYDRAULIC CONDUCTIVITY (m/s)	
Till core	$1x10^{-5}$
Rockfill	$1x10^{-2}$
Overburden	$1x10^{-5}$
Soil-bentonite backfill	$1x10^{-8}$
Bedrock	$1x10^{-7}$

PROJECT
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TITLE
SECTION A - 0.5m GAP; NO CRACK IN SOIL-BENTONITE WALL

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PROJECT No.		03-1413-427	FILE No.	Section 3A10-8
DESIGN	DAH	06/OCT/03	SCALE N/A	REV. 0
CADD	SRR	06/OCT/03		
CHECK	DAH	06/OCT/03		FIGURE II-A4
REVIEW	TLE	23 OCT 03		

REVISION DATE: 03/10/17 4:19pm By: sreddy CADD FILE: O:\Active\2003\1413\03-1413-427 CRLFeasibility\4200_DykeDesign\Seepage Analysis\cad\Section 3A10-8.dwg

Description:Meadowbank Dike Design
Comments:03-1413-427/4200
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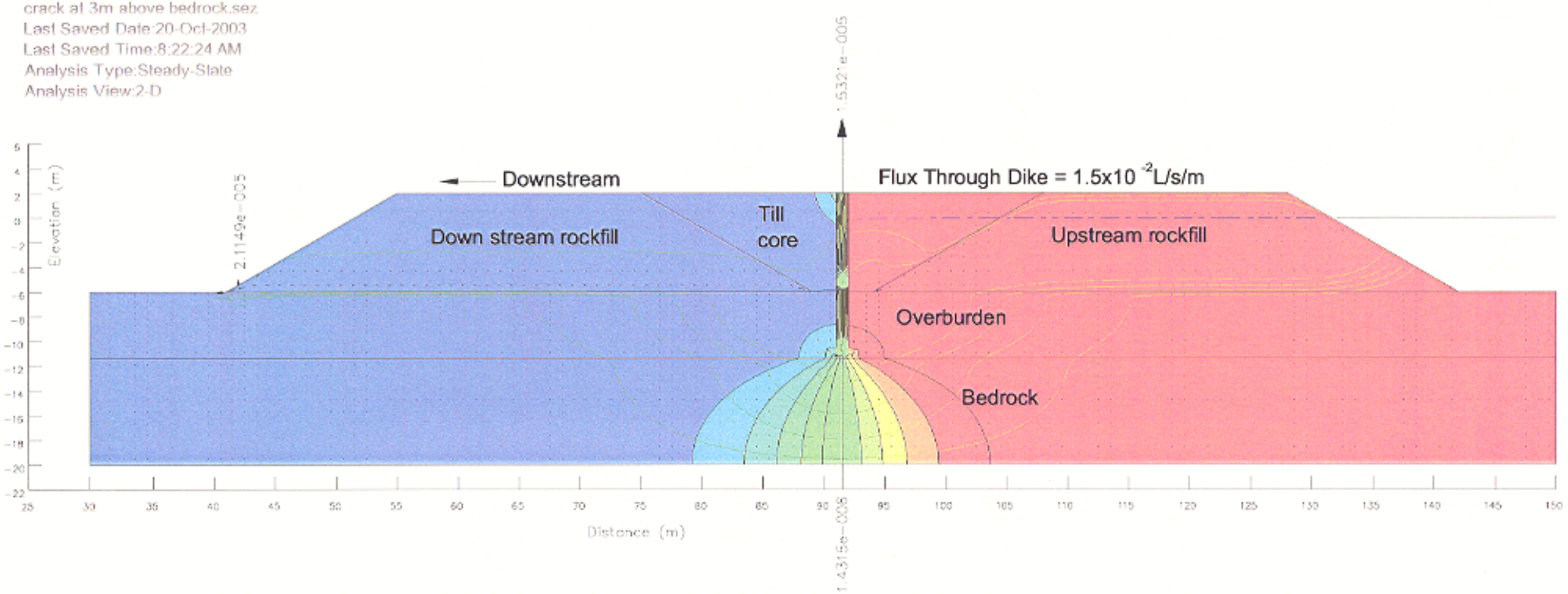
Last Saved Date:20-Oct-2003
Last Saved Time:8:22:24 AM
Analysis Type:Steady-State
Analysis View:2-D



NOTES

1) See section A on Figure 1.3
2) Cracks modelled as 0.25m thick.

MATERIAL HYDRAULIC CONDUCTIVITY (m/s)	
Till core	$1x10^{-5}$
Rockfill	$1x10^{-2}$
Overburden	$1x10^{-5}$
Soil-bentonite backfill	$1x10^{-8}$
Bedrock	$1x10^{-7}$

PROJECT
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MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION A - 0.5m GAP; CRACK IN SOIL-BENTONITE WALL WITHIN OVERBURDEN

Golder Associates

PROJECT No.		03-1413-427	FILE No.	Section 3A10-8
DESIGN	DAH	06/OCT/03	SCALE N/A	REV. 0
CADD	SRR	06/OCT/03		
CHECK	DAH	06/OCT/03		
REVIEW	KE	23 OCT 03		

FIGURE II-A5

REVISION DATE: 03/10/17 4:19pm By: sreddy CADD FILE: G:\Active\2003\1413\03-1413-427 CRLFeasibility\4200_DykeDesign\Seepage Analysis\cad\Section 3A10-8.dwg

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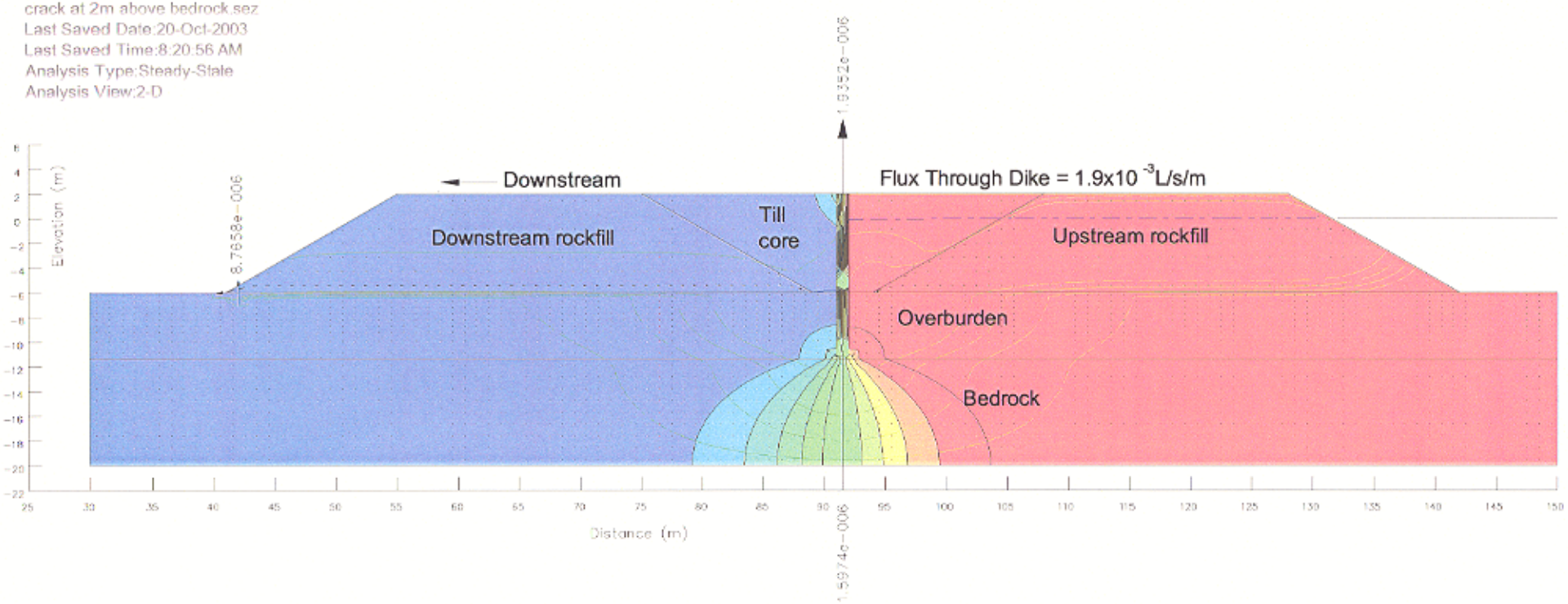
Last Saved Time:8:20:56 AM
Analysis Type:Steady-State
Analysis View:2-D



NOTES

1) See section A on Figure 1.3
2) Cracks modelled as 0.25m thick.

MATERIAL HYDRAULIC CONDUCTIVITY (m/s)	
Till core	$1x10^{-5}$
Rockfill	$1x10^{-2}$
Overburden	$1x10^{-5}$
Soil-bentonite backfill	$1x10^{-8}$
Bedrock	$1x10^{-7}$

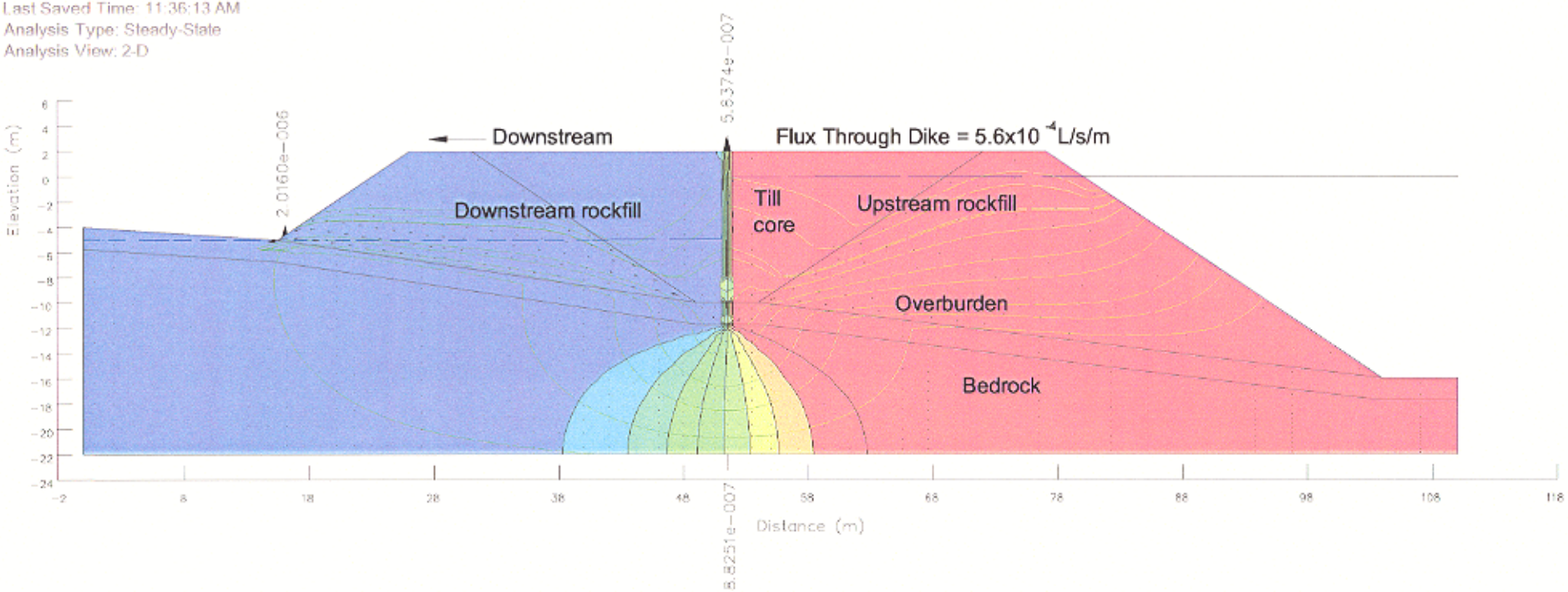
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION A - 0.5m GAP; CRACK IN SOIL-BENTONITE WALL WITHIN TILL CORE

Golder Associates

PROJECT No.		03-1413-427	FILE No.	Section 3A10-8
DESIGN	DAH	06/OCT/03	SCALE N/A	REV. 0
CADD	SRR	06/OCT/03		
CHECK	DAH	06/OCT/03	**FIGURE II-A6**	
REVIEW	RE	23OCT03		

Description: Meadowbank Dike Design
Comments: 03-1413-427/4200
File Name: Section 3B10-8_no gap, no crack.sez
Last Saved Date: 10/15/2003
Last Saved Time: 11:36:13 AM
Analysis Type: Steady-State
Analysis View: 2-D



NOTES

1) See section B on Figure 1.3

MATERIAL HYDRAULIC CONDUCTIVITY (m/s)	
Till core	$1x10^{-5}$
Rockfill	$1x10^{-2}$
Overburden	$1x10^{-5}$
Soil-bentonite backfill	$1x10^{-8}$
Bedrock	$2.2x10^{-7}$

PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

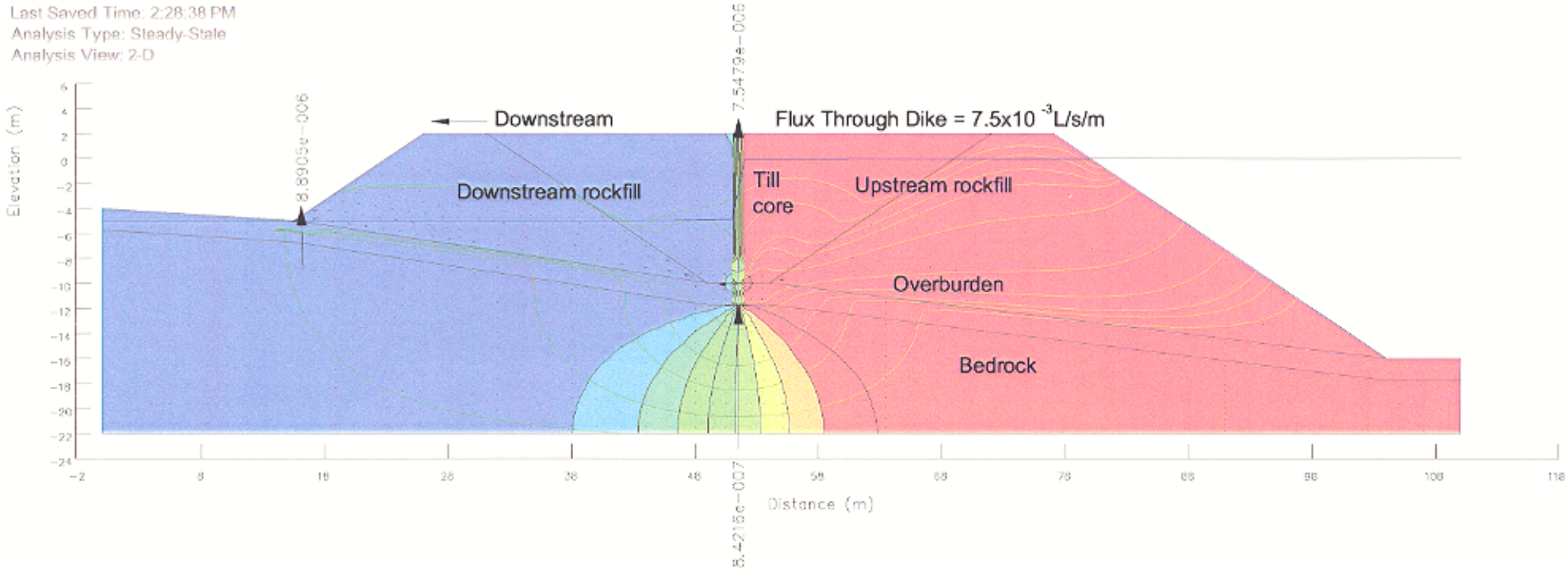
TITLE
SECTION B - NO GAP OR CRACK IN SOIL-BENTONITE WALL

Golder Associates

PROJECT No.		03-1413-427	FILE No.	Section 3B10-8
DESIGN	DAH	06/OCT/03	SCALE N/A	REV. 0
CADD	SRR	06/OCT/03		
CHECK	DAH	06/OCT/03	**FIGURE II-B1**	
REVIEW	AE	23 OCT 03		

REVISION DATE: 03/10/21 8:55am By: sreddy CADD FILE: O:\Active\2003\1413\03-1413-427 CRLFeasibility\4200_DykeDesign\Seepage Analysis\cad\Section 3B10-8.dwg

Description: Meadowbank Dike Design
Comments: 03-1413-427/4200
File Name: Section 3B10-8_no gap, 0.25m crack at 1.5m above bedrock (OB).sez
Last Saved Date: 10/16/2003
Last Saved Time: 2:28:38 PM
Analysis Type: Steady-State
Analysis View: 2-D



NOTES

1) See section B on Figure 1.3
2) Cracks modelled as 0.25m thick.

MATERIAL HYDRAULIC CONDUCTIVITY (m/s)	
Till core	$1x10^{-5}$
Rockfill	$1x10^{-2}$
Overburden	$1x10^{-5}$
Soil-bentonite backfill	$1x10^{-8}$
Bedrock	$2.2x10^{-7}$

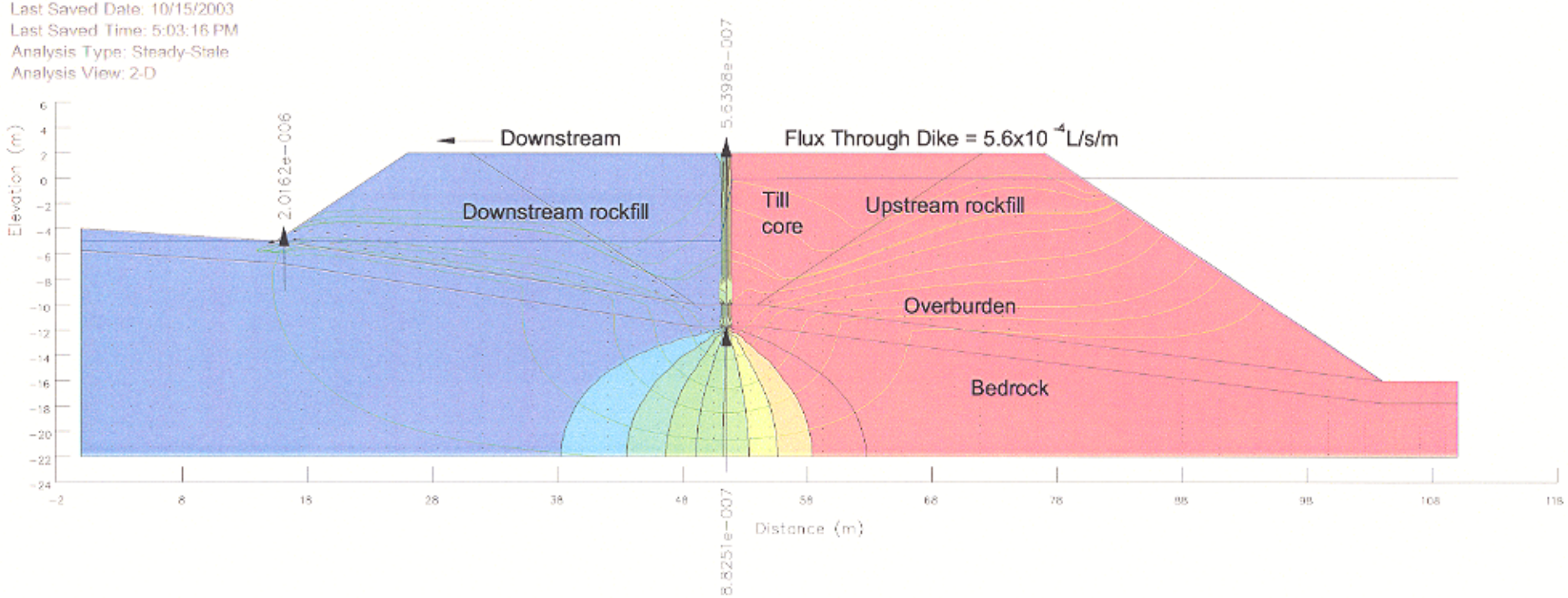
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION B - NO GAP; CRACK IN SOIL-BENTONITE WALL WITHIN OVERBURDEN

Golder Associates

PROJECT No.		03-1413-427	FILE No.	Section 3B10-8
DESIGN	DAH	06/OCT/03	SCALE N/A	REV. 0
CADD	SRR	06/OCT/03		
CHECK	DAH	06/OCT/03	**FIGURE II-B2**	
REVIEW	RC	23 oct 03		

Description: Meadowbank Dike Design
Comments: 03-1413-427/4200
File Name: Section 3B10-8_no gap, 0.25m crack at 3m above bedrock (till).sez
Last Saved Date: 10/15/2003
Last Saved Time: 5:03:16 PM
Analysis Type: Steady-State
Analysis View: 2-D



NOTES

1) See section B on Figure 1.3
2) Cracks modelled as 0.25m thick.

MATERIAL HYDRAULIC CONDUCTIVITY (m/s)	
Till core	$1x10^{-5}$
Rockfill	$1x10^{-2}$
Overburden	$1x10^{-5}$
Soil-bentonite backfill	$1x10^{-8}$
Bedrock	$2.2x10^{-7}$

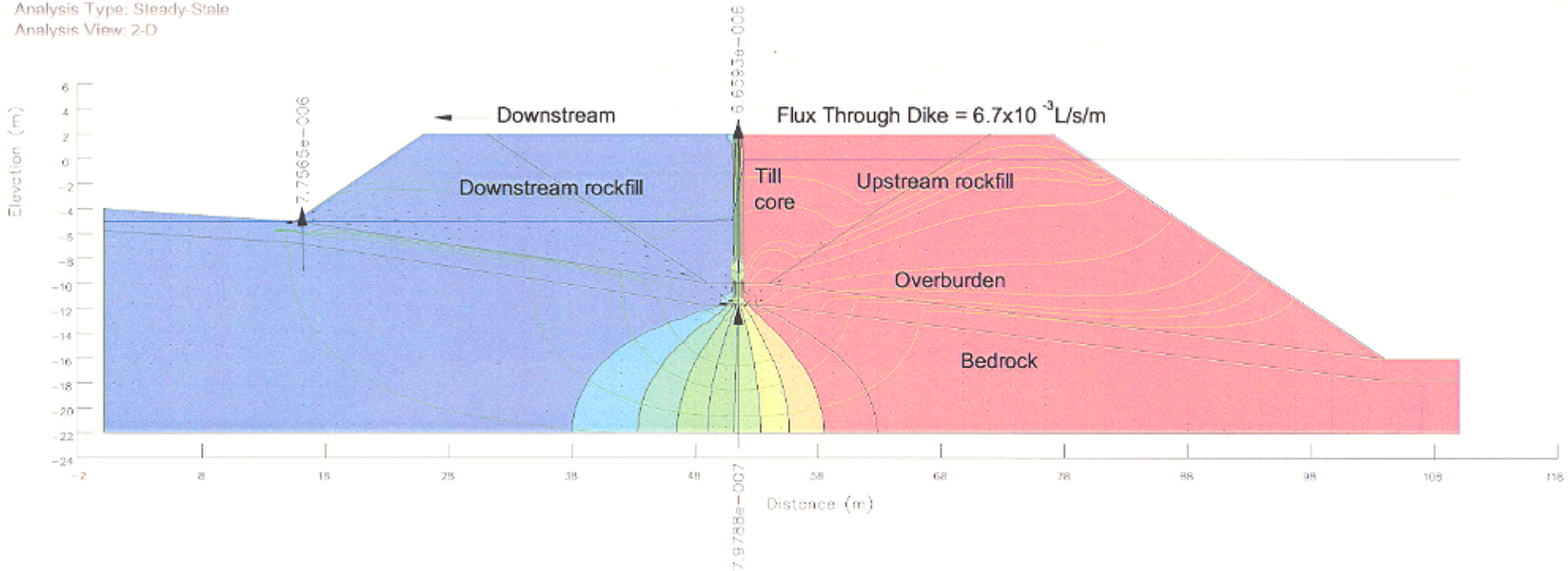
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION B - NO GAP; CRACK IN SOIL-BENTONITE WALL WITHIN TILL CORE

Golder Associates

PROJECT No.		03-1413-427	FILE No.	Section 3B10-8
DESIGN	DAH	06/OCT/03	SCALE N/A	REV. 0
CADD	SRR	06/OCT/03		
CHECK	DAH	06/OCT/03	**FIGURE II-B3**	
REVIEW	TKE	23OCT03		

Description: Meadowbank Dike Design
Comments: 03-1413-427/4200
File Name: Section 3B10-8_0.50m gap, no crack.sez
Last Saved Date: 10/15/2003
Last Saved Time: 11:57:30 AM
Analysis Type: Steady-State
Analysis View: 2-D



NOTES

1) See section B on Figure 1.3

MATERIAL HYDRAULIC CONDUCTIVITY (m/s)	
Till core	$1x10^{-5}$
Rockfill	$1x10^{-2}$
Overburden	$1x10^{-5}$
Soil-bentonite backfill	$1x10^{-8}$
Bedrock	$2.2x10^{-7}$

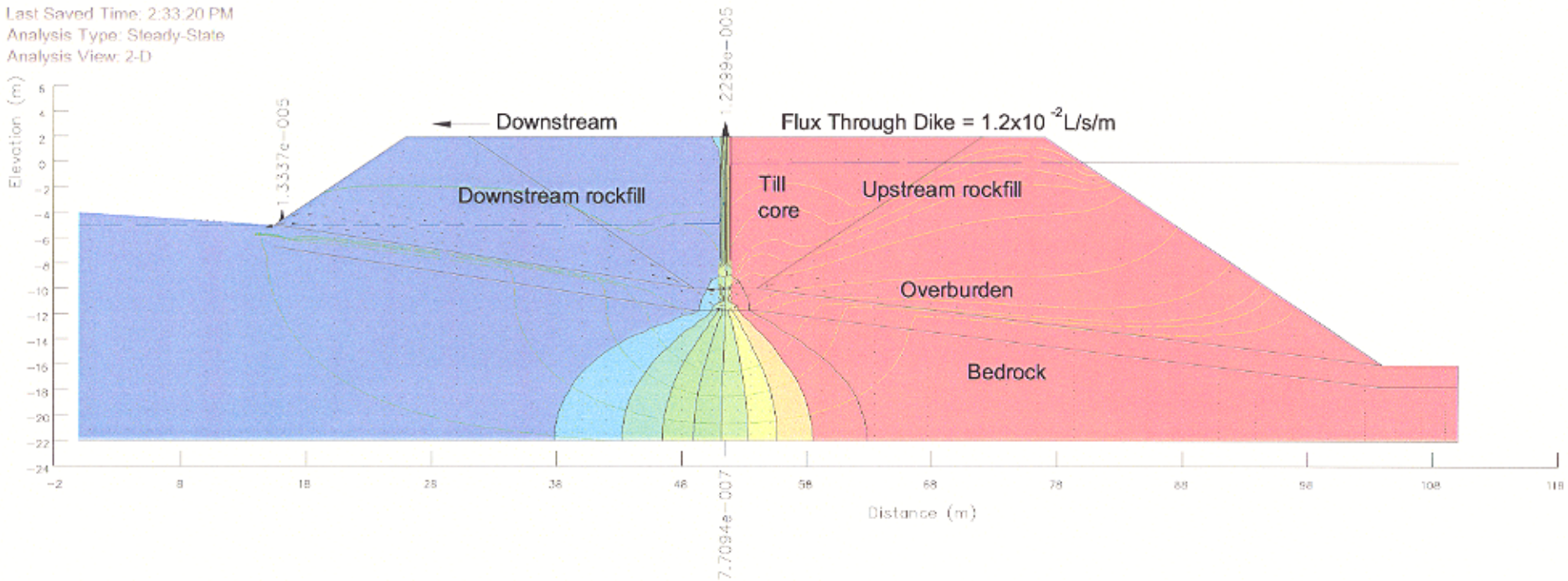
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION B - 0.5m GAP; NO CRACK IN SOIL-BENTONITE WALL

Golder Associates

PROJECT No.		03-1413-427	FILE No.	Section 3B10-8
DESIGN	DAH	06/OCT/03	SCALE N/A	REV. 0
CADD	SRR	06/OCT/03		
CHECK	DAH	06/OCT/03		FIGURE II-B4
REVIEW	KE	23 OCT 03		

Description: Meadowbank Dike Design
Comments: 03-1413-427/4200
File Name: Section 3B10-8_0.50m gap, 0.25m crack at 1.5m above bedrock (OB).sez
Last Saved Date: 10/16/2003
Last Saved Time: 2:33:20 PM
Analysis Type: Steady-State
Analysis View: 2-D



NOTES

1) See section B on Figure 1.3
2) Cracks modelled as 0.25m thick.

MATERIAL HYDRAULIC CONDUCTIVITY (m/s)	
Till core	$1x10^{-5}$
Rockfill	$1x10^{-2}$
Overburden	$1x10^{-5}$
Soil-bentonite backfill	$1x10^{-8}$
Bedrock	$2.2x10^{-7}$

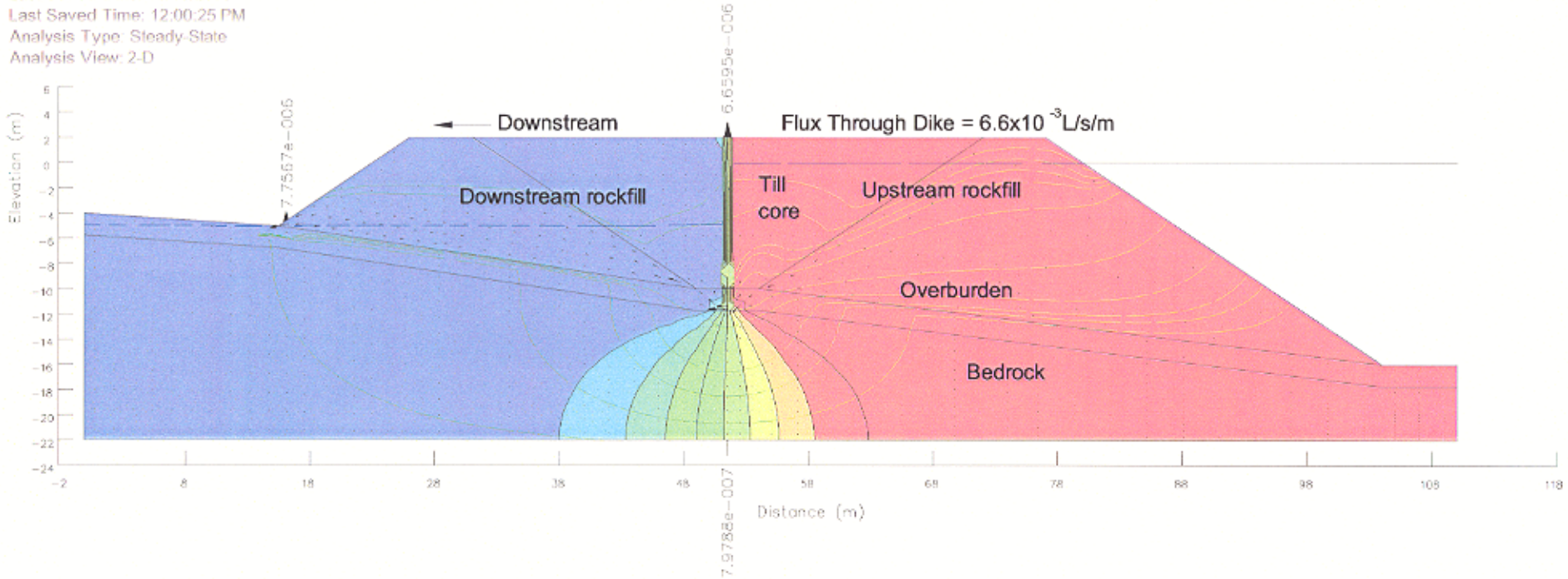
PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION B - 0.5m GAP; CRACK IN SOIL-BENTONITE WALL WITHIN OVERBURDEN

Golder Associates

PROJECT No.		03-1413-427	FILE No.	Section 3B10-8
DESIGN	DAH	06/OCT/03	SCALE N/A	REV. 0
CADD	SRR	06/OCT/03		
CHECK	DAH	06/OCT/03	**FIGURE II-B5**	
REVIEW	TCE	23-OCT-03		

Description:Meadowbank Dike Design
Comments: 03-1413-427/4200
File Name: Section 3B10-8_0.50m gap, 0.25m crack at 3m above bedrock (till).sez
Last Saved Date: 10/15/2003
Last Saved Time: 12:00:25 PM
Analysis Type: Steady-State
Analysis View: 2-D



NOTES

1) See section B on Figure 1.3
2) Cracks modelled as 0.25m thick.

MATERIAL HYDRAULIC CONDUCTIVITY (m/s)	
Till core	$1x10^{-5}$
Rockfill	$1x10^{-2}$
Overburden	$1x10^{-5}$
Soil-bentonite backfill	$1x10^{-8}$
Bedrock	$2.2x10^{-7}$

PROJECT
CUMBERLAND RESOURCES LTD.
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE
SECTION B - 0.5m GAP; CRACK IN SOIL-BENTONITE WALL WITHIN TILL CORE

Golder Associates

PROJECT No.		03-1413-427	FILE No.	Section 3B10-8
DESIGN	DAH	06/OCT/03	SCALE N/A	REV. 0
CADD	SRR	06/OCT/03		
CHECK	DAH	06/OCT/03	**FIGURE II-B6**	
REVIEW	RE	23 OCT 03		

APPENDIX III

PRELIMINARY MATERIALS BALANCE

Meadowbank Mined Tonnages and Volumes

Year			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
TONNES		Assumptions	-2	-1	1	2	3	4	5	6	7	8	9	10	11	
Mined Ore Open Pit				514492	1352183	1866975	3595715	1866975	1866975	1866975	1866975	1866975	1866975	1478244	1478244	21487703
Grade				7	5	4	4	4	4	4	4	3	4	6	6	4
Recovery	t		-	1	1	1	1	1	1	1	1	1	1	1	1	
Tailings Produced	**t**		-	514489	1352176	1866968	3595702	1866968	1866967	1866968	1866968	1866969	1866968	1478235	1478235	21487613
Portage Pit																
Overburden	t		-	915145	1181899	344052	1415052	858362	0	0	0	0	0	0	0	4714510
UM	t		-	161424	870165	2047706	2606760	4030192	2756831	2869373	4230059	2320748	2422948	680212	53835	25050256
IV	t		-	1350376	3505432	3766198	4674081	3716710	3329997	2872252	2808018	1860802	1610966	905506	312928	30713265
IF	t		-	1749376	3096487	3468825	3693520	3131945	2601659	2692840	1744856	608850	426829	127400	45150	23387736
QZ	t		-	1013	138407	161194	541603	125157	186388	16364	0	0	0	0	0	1170126
Total	t		0	4177333	8792390	9787975	12931016	11862366	8874875	8450830	8782934	4790400	4460743	1713119	411913	85035893
Goose Island Pit																
Overburden	t		-	0	0	0	0	0	0	1028930	151364	0	0	0	0	1180294
UM	t		-	0	0	0	0	0	0	494268	2632476	3196324	2391415	812413	0	9526897
IF	t		-	0	0	0	0	0	0	354271	466229	453435	626081	663942	0	2563958
IV	t		-	0	0	0	0	0	0	572477	943310	1068105	815196	232219	0	3631307
QZ	t		-	0	0	0	0	0	0	133913	484366	143185	0	0	0	761463
Total	t		0	0	0	0	0	0	0	2583859	4677745	4861049	3832692	1708575	0	17663920
Vault Pit																
Overburden	t		-	0	0	0	0	0	0	0	0	0	0	0	0	0
UM	t		-	0	0	0	0	0	0	0	0	0	0	0	0	0
IF	t		-	0	0											0
IV	t		-	0	5870425	6719315	3547203	4815741	7336539	6864792	4495692	6765350	4826036	2298941		53540034
QZ	t		-	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	t		-	0	5870425	6719315	3547203	4815741	7336539	6864792	4495692	6765350	4826036	2298941	0	53540034
ALL PITS																
Overburden	t		-	915145	1181899	344052	1415052	858362	0	1028930	151364	0	0	0	0	5894804
UM	t		-	161424	870165	2047706	2606760	4030192	2756831	3363641	6862535	5517072	4814364	1492626	53835	34577153
IF	t		-	1350376	3505432	3766198	4674081	3716710	3329997	3226523	3274247	2314237	2237047	1569448	312928	33277223
IV	t		-	1749376	8966911	10188140	7240723	7947686	9938197	10130110	7183858	8442305	6068060	2658560	45150	80559077
QZ	t		-	1013	138407	161194	541603	125157	186388	150277	484366	143185	0	0	0	1931590
Total Pit	t		-	4177333	14662815	16507291	16478219	16678107	16211414	17899481	17956370	16416799	13119471	5720635	411913	155827935
VOLUMES																
Portage and Goose Pits																
Construction Rock Required																
Overburden	**m3**		0	0	0	0	0	0	0	0	0	0	0	0	0	
UM+QZ	**m3**		0	89380	0	0	0	0	29483	0	0	0	0	0	0	118864
IF	**m3**		0	0	0	0	0	0	0	0	0	0	0	0	0	0
IV	**m3**		0	301632	0	0	0	0	0	0	0	0	0	0	0	301632
Dike Rock Required																
Overburden	**m3**		0	323101	62728	62728	62728	62728	331728	62728	62728	62728	62728	0	0	1156652
UM+QZ	**m3**		0	0	19138	0	0	0	11082	0	0	0	0	0	0	30220
IF	**m3**		0	375132	0	0	0	0	426000	0	0	0	0	0	0	801132
IV	**m3**		0	400223	62728	62728	62728	62728	488728	62728	62728	62728	62728	0	0	1390774
Capping Volume Required																
UM+QZ	**m3**		0	0	236364	676364	676364	676364	676364	676364	676364	676364	676364	676364	2576364	8900000
Portage Waste Rock Dump		1.9 t/m3														
Overburden	**m3**		0	158554	559324	118352	682036	389042	-331728	478814	16937	-62728	-62728	0	0	1945876
Overburden Cumulative	**m3**		0	158554	717878	836230	1518267	1907308	1575581	2054395	2071332	2008604	1945876	1945876	1945876	1945876
UM+QZ			0	-3887	275326	486216	980670	1510662	832134	1173067	3190426	2302719	1857512	109229	-2548029	10166044
UM+QZ Cumulative	**m3**		0	-3887	271438	757654	1738323	3248986	4081120	5254187	8444613	10747332	12604844	12714073	10166044	10166044
IF	**m3**		0	545592	1629730	1825697	1943958	1648392	943294	1603743	1163729	559098	554163	416496	23763	12857655
IV	**m3**		0	8869	1782236	1919481	2397315	1893435	1263902	1750287	1911655	1478802	1214199	598803	164699	16383684
Net Waste Rock	**m3**			863794	5235932	5943631	9260569	10597825	8364303	12314493	16798694	17033827	18113868	15784477	9752353	130063767
Cumulative Waste Rock	**m3**		0	863794	6099727	12043358	21303926	31901752	40266054	52580548	69379242	86413069	104526937	120311414	130063767	130063767
Vault Pit																
Construction and Dike Rock Required																
Overburden	**m3**		0	14557	0	0	0	0	0	0	0	0	0	0	0	14557
IV	**m3**		0	41152	0	0	0	0	0	0	0	0	0	0	0	41152
Capping UM+QZ Required	**m3**		0	0	0	440000	440000	440000	440000	440000	440000	440000	440000	440000	440000	4400000
Vault Pit Dump																
Overburden	**m3**	1.9 t/m3	0	-14557	0	0	0	0	0	0	0	0	0	0	0	-14557
IV	**m3**		0	-41152	3089697	3536482	1866949	2534600	3861336	3613048	2366153	3560710	2540019	1209969	0	28137813
Net Waste Rock	**m3**		0	-55709	3089697	3536482	1866949	2534600	3861336	3613048	2366153	3560710	2540019	1209969	0	28123256
Cumulative Waste Rock	**m3**		0	-55709	3033988	6570470	8437419	10972020	14833356	18446405	20812558	24373268	26913287	28123256	28123256	28123256
Tailings Produced	**m3**	2.2 t/m3	0	233858	614626	848622	1634410	848622	848621	848622	848622	848622	848622	671925	671925	9767097
Cumulative Tailings	**m3**		0	233858	848484	1697106	3331515	4180137	5028759	5877381	6726002	7574625	8423247	9095172	9767097	9767097

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	1	2	3	4	5	6	7	8	9
	-1								
	Portage				Vault		Goose		
	starter	lower	south	north	starter	middle	end	only	Total
ore tonnes	511,592	2,893	7	300					514,792
grade	7.08	4.72	4.72	2.89					7.07
low grade	23,652			92					23,744
grade	1.27			1.47					1.28
ovbd	442,831	242,197	96,549	136,037					917,615
IV_CHLOR									
ULT_MAF	32,886	9,126		84,642					126,654
IR_FORM	1,063,325	79,044		213,710					1,356,079
INT_VOLC	1,248,026	151,648	1,277	355,145					1,756,096
QUARTZ_V									
MAF_VOL				34,950					34,950
FEL_POR									
QTZITE				1,013					1,013
G_R									
Waste									
									4,192,406
	Portage				Vault		Goose		

	10	1	2	3	4	5	6	7	8
	1								
	Portage				Vault		Goose		
	starter	lower	south	north	starter	middle	end	only	Total
ore tonnes	857,188	124,149		15,006	355,559	281			1,352,183
grade	6.01	3.51		2.27	3.70	1.87			5.13
low grade	13,707	413		728	12,369	23			27,239
grade	1.30	1.27		1.40	1.11	1.40			1.22
ovbd		992,911		190,691					1,183,602
IV_CHLOR									
ULT_MAF	143,762	494,265		186,963					824,990
IR_FORM	1,191,834	2,079,945		265,972					3,537,750
INT_VOLC	767,868	1,818,575		531,765					3,118,208
QUARTZ_V									
MAF_VOL				49,537					49,537
FEL_POR									
QTZITE				138,448					138,448
G_R									
Waste					5,841,451	43,368			5,884,819
									14,737,355
	Portage				Vault		Goose		

	1	2	3	4	5	6	7	8
	2							
	Portage				Vault		Goose	
	starter	lower	south	north	starter	middle	end	only	Total
ore tonnes	413,189	733,823		27,038	692,925				1,866,975
grade	5.68	3.96		2.64	3.69				4.22
low grade	8,741	26,365		626	26,365				62,098
grade	1.20	1.29		1.40	1.24				1.26
ovbd		10,850		333,519					344,369
IV_CHLOR									
ULT_MAF	322,681	1,495,722		197,880					2,016,283
IR_FORM	550,597	2,779,312		457,565					3,787,474
INT_VOLC	495,886	2,449,012		542,963					3,487,861
QUARTZ_V									
MAF_VOL				43,300					43,300
FEL_POR									
QTZITE				161,325					161,325
G_R									
Waste					6,745,106				6,745,106
	3.33	9.21		64.25	9.77				16,585,718
	Portage				Vault		Goose		

DILUTED

0.075269

	1	2	3	4	5	6	7	8	9
ore tonnes	511,592	2,893	7	300					514,792
grade	7.08	4.72	4.72	2.89					7.07
dilution	38,507	218	1	23					38,748
dilution grade	1.17	1.00	1.00	1.47					1.17
LG Dilution	23,652			23					23,674
barren dilution	14,855	218	1						15,073
Feed									553,540
grade									6.65
to Waste Dump									
low grade				69					69
ovbd	440,471	242,088	96,549	136,037					915,145
IV_CHLOR									
ULT_MAF	32,711	9,122		84,642					126,474
IR_FORM	1,057,657	79,008		213,710					1,350,376
INT_VOLC	1,241,374	151,579	1,277	355,145					1,749,376
QUARTZ_V									
MAF_VOL				34,950					34,950
FEL_POR									
QTZITE				1,013					1,013
G_R									
Waste									

	10	1	2	3	4	5	6	7	8
ore tonnes	857,188	124,149		15,006	355,559	281			1,352,183
grade	6.01	3.51		2.27	3.70	1.87			5.13
dilution	64,520	9,345		1,129	26,763	21			101,777
dilution grade	1.06	1.01		1.26	1.05	1.40			1.06
LG Dilution	13,707	413		728	12,369	21			27,238
barren dilution	50,813	8,932		402	14,394				74,540
Feed									1,453,960
grade									4.84
to Waste Dump									
low grade						2			2
ovbd		991,264		190,635					1,181,899
IV_CHLOR									
ULT_MAF	140,289	493,445		186,908					820,642
IR_FORM	1,163,043	2,076,496		265,894					3,505,432
INT_VOLC	749,319	1,815,559		531,608					3,096,487
QUARTZ_V									
MAF_VOL				49,523					49,523
FEL_POR									
QTZITE				138,407					138,407
G_R									
Waste					5,827,057	43,368			5,870,425

	1	2	3	4	5	6	7	8
ore tonnes	413,189	733,823		27,038	692,925				1,866,975
grade	5.68	3.96		2.64	3.69				4.22
dilution	31,100	55,234		2,035	52,156				140,525
dilution gra	1.06	1.14		1.12	1.12				1.11
LG Dilution	8,741	26,365		626	26,365				62,098
barren dilu	22,359	28,869		1,409	25,791				78,428
Feed									2,007,500
grade									4.00
to Waste Dump									
low grade									
ovbd		10,803		333,249					344,052
IV_CHLOR									
ULT_MAF	317,412	1,489,311		197,719					2,004,442
IR_FORM	541,605	2,767,398		457,194					3,766,198
INT_VOLC	487,788	2,438,515		542,522					3,468,825
QUARTZ_V									
MAF_VOL				43,265					43,265
FEL_POR									
QTZITE				161,194					161,194
G_R									
Waste					6,719,315				6,719,315

	1	2	3	4	5	6	7	8	9
	Portage				Vault		Goose		
	starter	lower	south	north	starter	middle	end	only	
ore tonnes	1,920,204	4,572,242	670,047	2,513,295	2,625,970	3,901,463	648,293	1,532,613	7,175,726
grade	6.25	4.28	4.98	4.74	3.98	3.51	2.31	5.41	9,675,788
low grade	46,100	115,880	101,896	34,173	107,346	211,873	76,471	14,994	
grade	1.27	1.30	1.16	1.37	1.16	1.21	1.09	1.31	
ovbd	442,831	1,245,958	1,614,740	1,417,509				1,182,217	
IV_CHLOR									
ULT_MAF	565,278	10,737,468	9,194,805	4,385,841				9,582,152	
IR_FORM	2,943,346	11,003,493	7,403,762	9,549,371				2,587,024	
INT_VOLC	2,578,907	8,173,144	2,885,246	9,895,204				3,649,780	
QUARTZ_V									
MAF_VOL				315,169					
FEL_POR									
QTZITE				1,173,223				763,110	
G_R									
Waste					19,097,074	21,980,336	12,671,583		

	1	2	3	4	5	6	7	8	
	3								
		Portage				Vault		Goose	
	starter	lower	south	north	starter	middle	end	only	Total
ore tonnes	138,235	965,309	11,852	216,034	535,545				1,866,975
grade	6.39	3.66	3.86	4.06	4.04				4.02
low grade		39,445	3,407	72	30,435				73,360
grade		1.29	1.07	1.45	1.10				1.20
ovbd			737,125	679,722					1,416,847
IV_CHLOR									
ULT_MAF	65,950	1,740,999	7,935	710,297					2,525,181
IR_FORM	137,590	2,184,916	149,618	2,226,190					4,698,314
INT_VOLC	67,125	1,628,845	141,713	1,873,103					3,710,787
QUARTZ_V									
MAF_VOL				96,655					96,655
FEL_POR									
QTZITE				543,037					543,037
G_R									
Waste					3,557,078				3,557,078
	1.96	5.80	87.73	28.37	6.70				16,547,900
		Portage				Vault		Goose	

	1	2	3	4	5	6	7	8	
	4								
		Portage				Vault		Goose	
	starter	lower	south	north	starter	middle	end	only	Total
ore tonnes		1,080,258	54,527	119,051	522,444	59,944	30,751		1,866,975
grade		4.36	4.35	4.83	3.65	2.07	1.51		4.07
low grade		41,904	35,327	1,503	32,749	7,972	2,064		121,519
grade		1.32	1.04	1.44	1.19	1.66	1.24		1.23
ovbd			781,066	77,539					858,605
IV_CHLOR									
ULT_MAF		2,723,297	978,124	328,351					4,029,771
IR_FORM		1,728,094	1,044,928	958,608					3,731,630
INT_VOLC		1,259,975	1,008,522	874,876					3,143,374
QUARTZ_V									
MAF_VOL				20,300					20,300
FEL_POR									
QTZITE				125,550					125,550
G_R									
Waste					2,130,985	1,924,340	767,241		4,822,566
		5.33	70.57	20.05	4.14	32.24	25.02		16,731,796
		Portage				Vault		Goose	

	1	2	3	4	5	6	7	8	
	5								
		Portage				Vault		Goose	
	starter	lower	south	north	starter	middle	end	only	Total
ore tonnes		471,261		673,388	389,436	332,890			1,866,975
grade		4.45		5.38	4.48	2.42			4.43
low grade		7,140		18,399	5,428	51,257			82,224
grade		1.27		1.37	1.06	1.15			1.20
ovbd									
IV_CHLOR									
ULT_MAF		1,484,999		1,250,671					2,735,669
IR_FORM		605,213		2,745,498					3,350,711
INT_VOLC		302,488		2,314,172					2,616,660
QUARTZ_V									
MAF_VOL				45,140					45,140
FEL_POR									
QTZITE				187,312					187,312
G_R									
Waste					734,823	6,625,600			7,360,423
		5.09		9.74	1.90	20.06			16,295,916
		Portage				Vault		Goose	

ore tonnes	138,235	965,309	11,852	216,034	535,545				1,866,975
grade	6.39	3.66	3.86	4.06	4.04				4.02
dilution	10,405	72,658	892	16,261	40,310				140,525
dilution gra	1.00	1.16	1.07	1.00	1.08				1.10
LG Dilution		39,445	892	72	30,435				70,845
barren dilu	10,405	33,212		16,188	9,875				69,680
Feed									2,007,500
grade									3.82
to Waste Dump									
low grade			2,515						2,515
ovbd			737,125	677,927					1,415,052
IV_CHLOR									
ULT_MAF	63,414	1,730,590	7,935	708,421					2,510,360
IR_FORM	132,301	2,171,852	149,618	2,220,310					4,674,081
INT_VOLC	64,545	1,619,106	141,713	1,868,156					3,693,520
QUARTZ_V									
MAF_VOL				96,400					96,400
FEL_POR									
QTZITE				541,603					541,603
G_R									
Waste					3,547,203				3,547,203

ore tonnes		1,080,258	54,527	119,051	522,444	59,944	30,751		1,866,975
grade		4.36	4.35	4.83	3.65	2.07	1.51		4.07
dilution		81,310	4,104	8,961	39,324	4,512	2,315		140,525
dilution gra		1.16	1.04	1.07	1.16	1.66	1.22		1.17
LG Dilution		41,904	4,104	1,503	32,749	4,512	2,064		86,837
barren dilu		39,406		7,458	6,575		251		53,689
Feed									2,007,500
grade									3.87
to Waste Dump									
low grade			31,222			3,460			34,682
ovbd			781,066	77,296					858,362
IV_CHLOR									
ULT_MAF		2,704,508	978,124	327,324					4,009,955
IR_FORM		1,716,171	1,044,928	955,610					3,716,710
INT_VOLC		1,251,282	1,008,522	872,140					3,131,945
QUARTZ_V									
MAF_VOL				20,237					20,237
FEL_POR									
QTZITE				125,157					125,157
G_R									
Waste					2,124,410	1,924,340	766,990		4,815,741

ore tonnes		471,261		673,388	389,436	332,890			1,866,975
grade		4.45		5.38	4.48	2.42			4.43
dilution		35,471		50,685	29,312	25,056			140,525
dilution gra		1.05		1.13	1.01	1.15			1.09
LG Dilution		7,140		18,399	5,428	25,056			56,023
barren dilu		28,331		32,286	23,884				84,502
Feed									2,007,500
grade									4.20
to Waste Dump									
low grade						26,201			26,201
ovbd									
IV_CHLOR									
ULT_MAF		1,467,415		1,244,499					2,711,914
IR_FORM		598,047		2,731,950					3,329,997
INT_VOLC		298,906		2,302,753					2,601,659
QUARTZ_V									
MAF_VOL				44,917					44,917
FEL_POR									
QTZITE				186,388					186,388
G_R									
Waste					710,939	6,625,600			7,336,539

1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8		1
			6									7									8						
	Portage				Vault		Goose			Portage				Vault		Goose			Portage				Vault		Goose		
starter	lower	south	north	starter	middle	end	only	Total	starter	lower	south	north	starter	middle	end	only	Total	starter	lower	south	north	starter	middle	end	only	Total	starter
	142,790	40,145	875,541	130,061	565,542	28,811	84,085	1,866,975	ore tonnes	610,642	77,001	408,961		542,769	17,391	210,211	1,866,975	ore tonnes	351,992	82,637	133,415		901,437	125,549	271,945	1,866,975	ore tonnes
	4.44	3.83	4.42	5.86	2.56	1.59	2.95	3.84	grade	4.97	4.04	5.03		2.58	2.26	3.15	4.02	grade	5.29	3.23	4.63		2.55	1.98	4.52	3.49	grade
	331	6,835	12,140		44,124	934	2,171	66,536	low grade		6,893	613		30,646	9,286	7,549	54,987	low grade	281	4,137			47,620	14,199	972	67,210	low grade
	1.42	1.05	1.38		1.39	1.32	1.45	1.35	grade		1.16	1.09		1.06	0.89	1.31	1.08	grade	1.28	1.28			1.19	0.98	1.25	1.15	grade
							1,030,585	1,030,585	ovbd							151,632	151,632	ovbd									ovbd
									IV_CHLOR									IV_CHLOR									IV_CHLOR
	640,382	1,172,730	1,048,687				495,063	3,356,862	ULT_MAF	1,637,369	2,185,410	441,840				2,637,132	6,901,751	ULT_MAF	467,659	1,732,541	136,512				3,209,144	5,545,856	ULT_MAF
	232,220	808,136	1,853,670				354,841	3,248,867	IR_FORM	704,563	1,465,780	659,310				467,053	3,296,707	IR_FORM	481,356	1,239,375	156,485				455,254	2,332,470	IR_FORM
	161,385	372,584	2,183,390				573,398	3,290,757	INT_VOLC	327,754	445,550	991,489				944,978	2,709,771	INT_VOLC	64,012	350,000	200,798				1,072,389	1,687,199	INT_VOLC
									QUARTZ_V									QUARTZ_V									QUARTZ_V
			25,286					25,286	MAF_VOL									MAF_VOL									MAF_VOL
									FEL_POR									FEL_POR									FEL_POR
			16,537				134,129	150,666	QTZITE							485,222	485,222	QTZITE							143,759	143,759	QTZITE
									G_R									G_R									G_R
				87,630	4,784,542	2,003,644		6,875,816	Waste					3,201,482	1,304,417		4,505,899	Waste					3,348,022	3,437,558		6,785,580	Waste
	7.24	58.79	5.87	0.67	8.54	69.58	30.80	17,978,840		4.37	53.29	5.12		5.95	75.54	22.33	18,050,983		2.88	40.25	3.70		3.77	27.49	17.95	16,494,864	
	Portage				Vault		Goose			Portage				Vault		Goose			Portage				Vault		Goose		

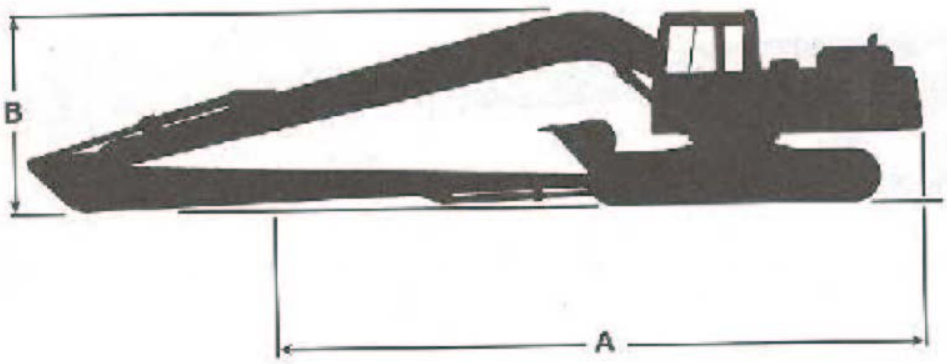
	142,790	40,145	875,541	130,061	565,542	28,811	84,085	1,866,975	ore tonnes	610,642	77,001	408,961		542,769	17,391	210,211	1,866,975	ore tonnes	351,992	82,637	133,415		901,437	125,549	271,945	1,866,975	ore tonnes
	4.44	3.83	4.42	5.86	2.56	1.59	2.95	3.84	grade	4.97	4.04	5.03		2.58	2.26	3.15	4.02	grade	5.29	3.23	4.63		2.55	1.98	4.52	3.49	grade
	10,748	3,022	65,901	9,790	42,568	2,169	6,329	140,525	dilution	45,962	5,796	30,782		40,854	1,309	15,822	140,525	dilution	26,494	6,220	10,042		67,850	9,450	20,469	140,525	dilution
	1.01	1.05	1.07	1.00	1.39	1.14	1.15	1.16	dilution gra	1.00	1.16	1.00		1.04	0.89	1.15	1.04	dilution gra	1.00	1.19	1.00		1.13	0.98	1.01	1.07	dilution gra
	331	3,022	12,140		42,568	934	2,171	61,166	LG Dilution		5,796	613		30,646	1,309	7,549	45,913	LG Dilution	281	4,137			47,620	9,450	972	62,461	LG Dilution
	10,416		53,761	9,790		1,235	4,158	79,359	barren dilu	45,962		30,169		10,207		8,274	94,613	barren dilu	26,213	2,083	10,042		20,230		19,497	78,065	barren dilu
								2,007,500	Feed								2,007,500	Feed								2,007,500	Feed
								3.65	grade								3.81	grade								3.32	grade
Dump									to Waste Dump									to Waste Dump									to Waste Dump
		3,813			1,556			5,369	low grade		1,097				7,977		9,074	low grade						4,749		4,749	low grade
							1,028,930	1,028,930	ovbd							151,364	151,364	ovbd									ovbd
									IV_CHLOR									IV_CHLOR									IV_CHLOR
	633,931	1,172,730	1,037,691				494,268	3,338,620	ULT_MAF	1,609,179	2,185,410	435,470				2,632,476	6,862,535	ULT_MAF	455,558	1,731,455	133,735				3,196,324	5,517,072	ULT_MAF
	229,880	808,136	1,834,235				354,271	3,226,523	IR_FORM	692,433	1,465,780	649,805				466,229	3,274,247	IR_FORM	468,901	1,238,598	153,303				453,435	2,314,237	IR_FORM
	159,759	372,584	2,160,497				572,477	3,265,318	INT_VOLC	322,111	445,550	977,195				943,310	2,688,166	INT_VOLC	62,355	349,781	196,714				1,068,105	1,676,955	INT_VOLC
									QUARTZ_V									QUARTZ_V									QUARTZ_V
			25,021					25,021	MAF_VOL									MAF_VOL									MAF_VOL
									FEL_POR									FEL_POR									FEL_POR
			16,364				133,913	150,277	QTZITE							484,366	484,366	QTZITE							143,185	143,185	QTZITE
									G_R									G_R									G_R
				77,841	4,784,542	2,002,409		6,864,792	Waste					3,191,275	1,304,417		4,495,692	Waste					3,327,792	3,437,558		6,765,350	Waste

2	3	4	5	6	7	8		1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8
		9									10									11				
Portage				Vault		Goose			Portage			Vault		Goose				Portage			Vault		Goose	
lower	south	north	starter	middle	end	only	Total	starter	lower	south	north	starter	middle	end	only	Total	starter	lower	south	north	starter	middle	end	only	Total
89,125	138,943	44,561		1,014,977	148,310	431,059	1,866,975	ore tonnes		161,827			483,623	297,481	535,313	1,478,244	ore tonnes		103,108						103,108
3.99	3.32	3.83		3.71	1.98	5.78	4.04	grade		6.64			7.95	2.77	6.83	6.36	grade		7.65						7.65
	4,909			29,816	7,003	2,518	44,245	low grade		29,036			415	42,985	1,784	74,221	low grade		11,352						11,352
	1.31			1.15	1.28	1.29	1.20	grade		1.30			0.86	1.13	1.19	1.20	grade		1.13						1.13
								ovbd									ovbd							
								IV_CHLOR									IV_CHLOR							
43,650	2,384,018					2,410,089	4,837,756	ULT_MAF		680,212					830,724	1,510,936	ULT_MAF		53,835						53,835
128,831	1,477,490	12,362				630,970	2,249,653	IR_FORM		905,506					678,906	1,584,412	IR_FORM		312,928						312,928
9,450	393,050	27,504				821,561	1,251,565	INT_VOLC		127,400					237,453	364,853	INT_VOLC		45,150						45,150
								QUARTZ_V									QUARTZ_V							
								MAF_VOL									MAF_VOL							
								FEL_POR									FEL_POR							
								QTZITE									QTZITE							
								G_R									G_R							
				1,861,635	3,015,142		4,876,777	Waste					191,347	2,143,581		2,334,928	Waste							
2.04	30.66	0.89		1.86	20.38	8.97	13,215,752			10.77			0.40	7.35	3.27	5,795,130			4.11						411,913
Portage				Vault		Goose			Portage			Vault		Goose				Portage			Vault		Goose	

89,125	138,943	44,561		1,014,977	148,310	431,059	1,866,975	ore tonnes		161,827			483,623	297,481	535,313	1,478,244	ore tonnes		103,108						103,108
3.99	3.32	3.83		3.71	1.98	5.78	4.04	grade		6.64			7.95	2.77	6.83	6.36	grade		7.65						7.65
6,708	10,458	3,354		76,396	11,163	32,445	140,525	dilution		12,181			36,402	22,391	40,292	111,266	dilution		7,761						7,761
1.00	1.14	1.00		1.06	1.18	1.02	1.06	dilution gra		1.30			1.00	1.13	1.01	1.06	dilution gra		1.13						1.13
	4,909			29,816	7,003	2,518	44,245	LG Dilution		12,181			415	22,391	1,784	36,771	LG Dilution		7,761						7,761
6,708	5,549	3,354		46,580	4,161	29,928	96,280	barren dilut					35,987		38,508	74,495	barren dilut								
							2,007,500	Feed								1,589,510	Feed								110,869
							3.83	grade								5.99	grade								7.19
								to Waste Dump									to Waste Dump							
								low grade		16,855				20,594		37,450	low grade		3,591						3,591
								ovbd									ovbd							
								IV_CHLOR									IV_CHLOR							
42,040	2,380,908					2,391,415	4,814,364	ULT_MAF		680,212					812,413	1,492,626	ULT_MAF		53,835						53,835
124,081	1,475,563	11,322				626,081	2,237,047	IR_FORM		905,506					663,942	1,569,448	IR_FORM		312,928						312,928
9,102	392,537	25,190				815,196	1,242,025	INT_VOLC		127,400					232,219	359,619	INT_VOLC		45,150						45,150
								QUARTZ_V									QUARTZ_V							
								MAF_VOL									MAF_VOL							
								FEL_POR									FEL_POR							
								QTZITE									QTZITE							
								G_R									G_R							
				1,815,055	3,010,981		4,826,036	Waste					155,360	2,143,581		2,298,941	Waste							

APPENDIX IV

SAMPLE EXCAVATORS



LONG REACH ATTACHMENT SHIPPING DIMENSIONS

Model	320B L m	320B L ft	320 L* m	320 L* ft	322B L m	322B L ft	317 L m	317 L ft
A Overall Transport Length (Front Folded)	12.65	41'6"	12.99	42'7"	14.24	46'9"	11.23	36'10"
B Overall Height (To Top of Boom)	3.21	10'6"	3.35	10'0"	3.17	10'5"	2.93	9'7"
Overall Width (To Widest Point)	3.18	10'5"	3.7	12'2"	3.39	11'1"	2.48	8'2"

*Belgium sourced. Extra wide gauge and 660 mm (26") track shoes.
Note: For other base machine dimensions, see section on machines with IGP attachments.

LONG REACH ATTACHMENT COMPONENT WEIGHTS

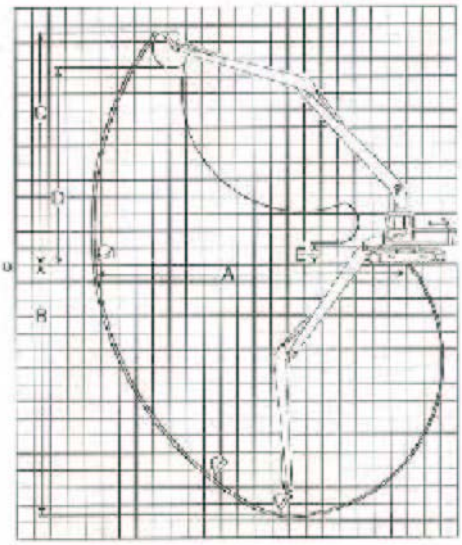
Model	320B L kg	320B L lb	320 L* kg	320 L* lb	322B L kg	322B L lb	317 L kg	317 L lb
Additional Counterweight	960	2116	1100	2426	1450	3197	—	—
Long Reach Boom: Includes boom, stick cylinder, hydraulic lines, and pins for stick, stick cylinder, and boom rod end	2185	4817	2504	5519	3130	6900	1618	3566
Long Reach Stick: Includes stick, bucket linkage and pins, bucket cylinder and pin, and hydraulic lines	1260	2778	1290	2841	1570	3461	993	2185

*Belgium sourced. Includes extra wide gauge and reinforced upperframe.

INTRODUCTION

Long reach excavators are designed specifically for those jobs requiring reach capability beyond the range of normal excavators. Applications for which long reach excavators are ideally suited include ditch cleaning, slope finishing, river conservation, and other work formerly reserved for draglines.

Caterpillar offers two hydraulic excavator models in long reach arrangements. Each model uses purpose-built booms and sticks designed by Caterpillar for maximized performance and durability.



320 L LONG REACH
325 L LONG REACH

Long Reach Front Includes: Boom, stick, linkage cylinders (boom, stick, and bucket), hydraulic lines, and additional counterweight for stability while working over the side. Dimensions include ditch cleaning bucket.

Note: All dimensions are with ditch cleaning bucket.

Long Reach Model	320B L mm	320B L ft	320 L* mm	320 L* ft	322B L mm	322B L ft	317 L mm	317 L ft
A Maximum Reach at Ground Level	16 725	51'7"	16 540	54'3"	16 430	60'6"	13 000	42'5"
B Maximum Digging Depth	11 880	39'0"	12 800	42'0"	14 720	48'4"	10 100	33'2"
C Maximum Cutting Height	13 290	43'7"	13 400	43'11"	14 230	46'8"	11 640	38'2"
D Maximum Dumping Height	11 010	36'1"	11 350	37'3"	12 005	39'5"	10 670	35'0"
E Minimum Loading Height	1970	6'6"	2300	7'6"	1360	4'6"	9580	31'5"

320B L • Long Reach • Japan/U.S. Sourced

Bucket Type	Bucket Width mm	Bucket Width in	Tip Radius mm	Tip Radius in	SAE Heaped Cap. L	SAE Heaped Cap. yd³	Bucket Weight kg	Bucket Weight lb	No. of Teeth	Bucket Curl Force kN	Bucket Curl Force lb	Stick Crowd Force kN	Stick Crowd Force lb
General Purpose	810	32	1220	48	450	0.59	365	805	5	—	—	—	—
Ditch Cleaning	1140	46	1090	43	600	0.78	200	617	0	—	—	—	—

320 L* • Long Reach • Belgium Sourced

General Purpose	—		—		—		—		—	—		—	
Ditch Cleaning	1800	70.8	790	30.7	600	0.78	400	882	—	63.25	14,231	62.82	14,134

322B L • Long Reach • Japan/U.S. Sourced

General Purpose	700	28	1220	48	380	0.50	335	739	4	—	—	—	—
Ditch Cleaning	965	38	1090	43	480	0.63	265	584	0	—	—	—	—

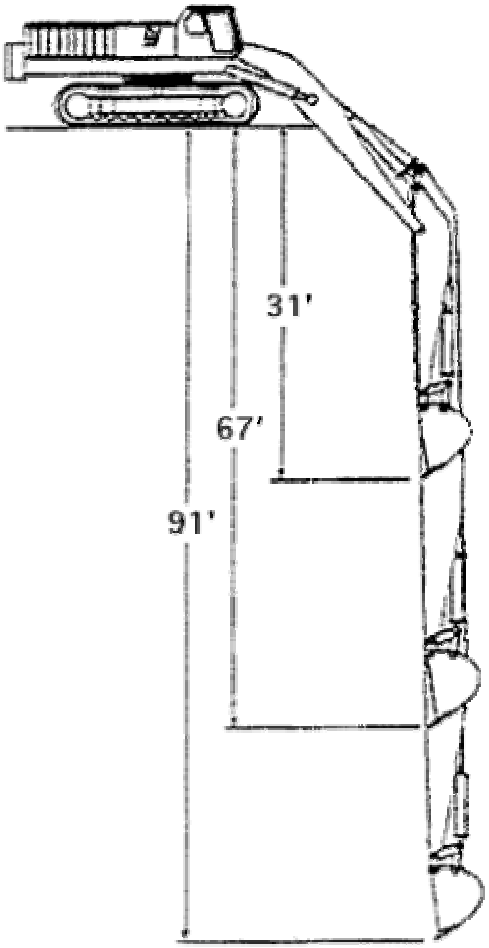
317 • Long Reach • France Sourced

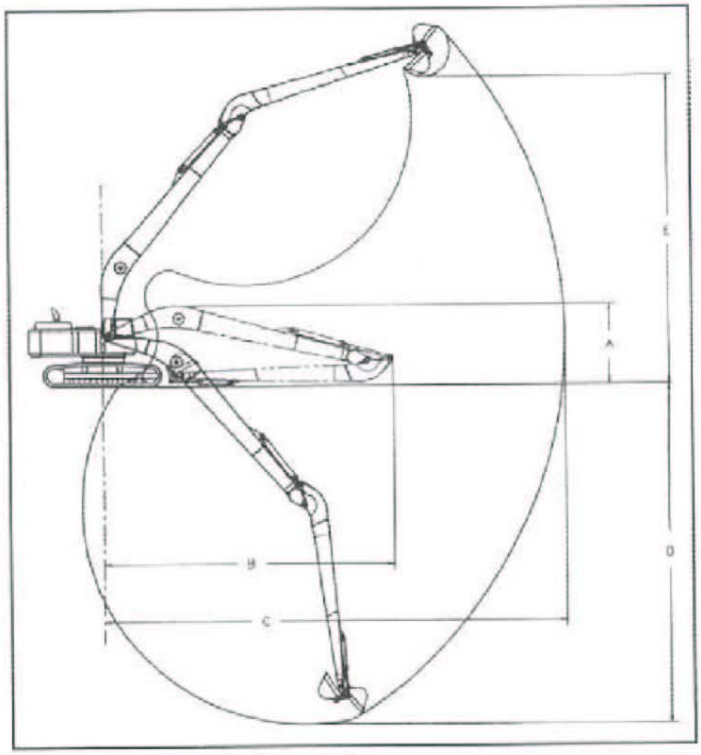
General Purpose	—	—	—	—	—	—	—	—	—	—	—	—	—
Ditch Cleaning	1010	40	1310	52	500	0.65	350	770	0	—	—	—	—

*Belgium sourced.

1266

KOEHRING	DESCRIPTION	DIG DEPTH	REACH
1266	w/ medium front (265,000#)	31 feet	50 feet
	w/ long front	39.5 feet	61 feet
	w/ extended arm - 1250	67 feet	89 feet
	w/ extended arm - 1258-2	75 feet	98 feet
	w/ extended arm - 1275-2	91 feet	114 feet
	w/ extended boom/arm - 1250-40	75 feet	98 feet
	w/ extended boom/arm - 1258-2-40	79 feet	102 feet





Long Reach Model	A	B	C	D	E
LR 2/50	10' - 1"	33' - 2"	51' - 2"	38' - 1"	36' - 8"
LR 2/60	10' - 6"	39' - 0"	60' - 2"	45' - 0"	43' - 9"
LR 3/55	10' - 11"	35' - 4"	54' - 11"	44' - 5"	40' - 2"
LR 3/60	11' - 6"	39' - 1"	60' - 6"	47' - 9"	43' - 10"
LR 4/55	12' - 9"	37' - 5"	58' - 1"	41' - 11"	36' - 9"
LR 4/60	12' - 8"	39' - 7"	60' - 10"	46' - 4"	37' - 7"
LR 4/65	12' - 11"	42' - 1"	66' - 3"	48' - 7"	37' - 7"
LR 4/75	12' - 10"	47' - 0"	75' - 0"	57' - 2"	49' - 11"
LR 5/65	12' - 10"	42' - 0"	65' - 4"	48' - 1"	47' - 8"
LR 7/60	14' - 2"	40' - 3"	62' - 2"	45' - 8"	45' - 5"
LR 7/75	14' - 9"	49' - 3"	76' - 11"	59' - 10"	44' - 4"
LR 7/80	14' - 9"	51' - 1"	81' - 10"	60' - 10"	55' - 3"
LR 11/75	NA	NA	74' - 11"	56' - 2"	37' - 2"
LR 11/85	NA	NA	85' - 0"	66' - 0"	50' - 4"
LR 11/85			85' - 0"		
LR 11/100			100' - 0"		

APPENDIX V

GEOTECHNICAL BOREHOLE LOGS

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-BZ-1

LOCATION: Bay Zone Dyke
N: 7213129.491 E: 639153.134

DRILLING DATE: 07-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	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY %	GRADATION %: GRAVEL	SAND	FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		135.78											
0	HQ3	Coarse to fine gravel of granitic rock, rounded, slightly weathered (Ground surface to top of bedrock)		0.00	1	RC		1							
1															
2				133.62											
		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
3															
4															
5															
6															
7															
8															
9															
10															

Legend: RECOVERY % scale 80, 60, 40, 20; HYDRAULIC CONDUCTIVITY scale 10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}; WATER CONTENT PERCENT Wp — W — Wl, scale 10, 20, 30, 40

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-BZ-1

LOCATION: Bay Zone Dyke
N: 7213129.491 E: 639153.134

INCLINATION: -59.59° AZIMUTH: 213°

DRILLING DATE: 07-Aug-03
DRILL RIG: LF-70
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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.		133.62													
	Boart-Longyear HQ3	Fresh to slightly weathered, colsely foliated with massive veins, grey green, medium strength, INTERMEDIATE VOLCANICS (with Quartz)		2.50 / 133.19	2												
3				3.00	3									FO,PL,SM x4			
														FO,PL,SM FE			
														JN,PL,SM FE			
														JN,PL,SM FE			
														JN,PL,SM FE			
														JN,PL,SM FE			
4														JN,PL,RO x2 FE SU			
		Fresh to slightly weathered (oxidized), closely foliated with veins, grey green, medium strength, INTERMEDIATE VOLCANICS (with Quartz)															
					4									FO,PL,SM x4 FE			
5														JN,PL,RO SU			
														VN,PL,RO QZ SU			
														FO,UN,SM QZ			
6				130.60 / 6.00													
					5									FO,PL,SM x2			
														FO,UN,SM SE			
														FO,UN,SM SE			
7														JN,UN,SM			
8					6									JN,PL,SM SU QZ			
9														JN,PL,SM			
		Fresh, closely foliated, grey green, fine grained, medium strength, INTERMEDIATE VOLCANICS			7												
10																	
														JN,PL,SM SU			
														JN,UN,SM SU			
11														JN,PL,SM SU			
					8									FO,PL,SM x2			
														JN,PL,SM			
12					9												

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-BZ-1

LOCATION: Bay Zone Dyke
N: 7213129.491 E: 639153.134

INCLINATION: -59.59° AZIMUTH: 213°

DRILLING DATE: 07-Aug-03

DRILL RIG: LF-70

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
13	Boart-Longyear HQ3	Fresh, closely foliated, grey green, fine grained, medium strength, INTERMEDIATE VOLCANICS *(continued)*			9									FO,UN,SM QZ CH FO,PL,SM SE			
14					10									JN,UN,SM SU FO,PL,SM JN,PL,SM SU JN,PL,SM JN,PL,SM			
15					11									FO,UN,SM CH SU FO,PL,SM CH JN,UN,SM CH			
16				121.55										JN,UN,SM CH FO,PL,SM CH FO,PL,SM CH			
17		Fresh, closely foliated, grey green, medium strength with short intervals of weak rock, INTERMEDIATE VOLCANICS (chloritized)		16.50	12									FO,PL,PO CH FO,PL,PO x2 CH FO,PL,PO CH			
18					13									FO,PL,SM CH FO,PL,SM CH JN,IR,RO JN,PL,SM			
19																	
20					14									JN,UN,SM FO,PL,SM JN,PL,SM			
21					15									FO,PL,SM CH JN,PL,SM CH FO,PL,SM CH FO,PL,SM CH JN,PL,SM FO,PL,SM CH			
22				116.37													

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-BZ-1

LOCATION: Bay Zone Dyke
N: 7213129.491 E: 639153.134

INCLINATION: -59.59° AZIMUTH: 213°

DRILLING DATE: 07-Aug-03
DRILL RIG: LF-70
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

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

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	ELEV. / DEPTH (m)	RUN No.	DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION
	Boart-Longyear HQ3	Fresh, closely foliated, grey green, fine grained, medium strength, INTERMEDIATE VOLCANICS	22.50	16		
23						
24				17		JN,PL,SM SU CH
						JN,PL,SM
25						
				18		JN,PL,SM
						JN,PL,SM
26						FO,PL,SM
						JN,PL,SM
						JN,PL,SM
						FO,UN,SM
27				19		JN,PL,SM
						JN,PL,SM x2 SU
28						JN,PL,SM CH
29				20		JN,PL,SM CH
						JN,PL,SM
						JN,PL,SM
30						JN,PL,SM
						JN,PL,SM
				21		JN,PL,SM
31						JN,PL,SM
32				22		JN,PL,SM x2

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NOTES
WATER LEVELS
INSTRUMENTATION

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-BZ-1

LOCATION: Bay Zone Dyke
N: 7213129.491 E: 639153.134

INCLINATION: -59.59° AZIMUTH: 213°

DRILLING DATE: 07-Aug-03
DRILL RIG: LF-70
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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	DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
	Boart-Longyear HQ3	Fresh, closely foliated, grey green, fine grained, medium strength, INTERMEDIATE VOLCANICS *(continued)*			22									FO,UN,Ro	R5 R4 R3 R2 R1	W1 W2 W3 W4	
33					23									JN,PL,SM x2			
34														JN,PL,SM			
					24									JN,PL,SM SU			
														JN,PL,SM			
35														JN,PL,SM			
														JN,PL,RO FE			
														JN,PL,SM			
36														JN,PL,SM			
														JN,PL,SM			
					25									JN,PL,SM x2			
37														JN,PL,SM CA			
														JN,PL,SM			
														JN,PL,SM			
														JN,PL,SM			
														JN,PL,SM CA			
														JN,PL,SM			
38																	
					26									JN,IR,SM			
														JN,PL,SM CA			
														JN,PL,SM CA			
														JN,PL,SM			
														JN,PL,SM			
														JN,PL,SM			
														JN,PL,SM			
39														JN,ST,SM			
														JN,ST,SM			
														JN,PL,SM			
					27												
40														JN,PL,SM			
														JN,PL,SM			
														JN,PL,SM			
														JN,PL,SM			
41														JN,PL,SM			
					28									JN,PL,SM			
														JN,PL,SM			
														JN,PL,SM			
42														JN,PL,SM CA			
					29									JN,PL,SM			

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-BZ-1

LOCATION: Bay Zone Dyke
N: 7213129.491 E: 639153.134

INCLINATION: -59.59° AZIMUTH: 213°

DRILLING DATE: 07-Aug-03
DRILL RIG: LF-70
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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	DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
43	Boart-Longyear HQ3	Fresh, closely foliated, grey green, fine grained, medium strength, INTERMEDIATE VOLCANICS *(continued)*			29									JN,PL,SM CA JN,PL,SM JN,PL,SM JN,UN,SM JN,PL,SM			
44					30									JN,PL,SM JN,PL,SM JN,PL,SM x2 JN,UN,SM JN,PL,SM			
45				96.97 45.00													
46		Fresh, closely foliated, gray, medium strength, INTERMEDIATE VOLCANICS (transition / high quartz)			31									JN,UN,RO JN,PL,SM JN,UN,SM JN,PL,SM JN,PL,RO x2			
47					32									JN,ST,SM JN,UN,SM SU JN,PL,SM JN,PL,SM JN,IR,RO			
48				94.38 48.00										JN,IR,SM CL JN,PL,SM			
49		Fresh, closely foliated, gray, medium strength, INTERMEDIATE VOLCANICS (transition / high quartz / increasing sulphides)			33									JN,ST,SM SU JN,PL,RO SU JN,PL,RO SU JN,PL,SM SU VN,PL,SM SU JN,IR,RO SU JN,UN,SM SU JN,ST,SM SU			
50				92.57 50.10										JN,PL,SM x3			
51		Fresh, closely foliated, grey and dark grey, medium strength, IRON FORMATION (EOH)		91.80 51.00	34									JN,UN,SM SU CA JN,PL,SM SU CA JN,PL,SM SU JN,UN,SM			
52		End of BOREHOLE.															

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-BZ-2

SHEET 1 OF 2

LOCATION: Bay Zone Dyke
N: 7212931 E: 639000

DRILLING DATE: 28-Apr-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local
Reference: Ice Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY % (80, 60, 40, 20)	GRADATION %: GRAVEL	SAND	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
		Ice Surface		134.00											
0	HQ3	ICE		0.00											
				132.44											
		LAKE WATER		1.56											
				128.50											
		Loose COBBLES and GRAVEL with trace sand composed of Granite		5.50											
				126.34											
		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: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-BZ-2

LOCATION: Bay Zone Dyke
N: 7212931 E: 639000

INCLINATION: -90°

DRILLING DATE: 28-Apr-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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.		126.34													
8, 9	Boart-Longyear HQ3	Fresh to slightly weathered along joints, fine grained with trace coarse fragments, weak foliation, medium green, weak to medium strength, ULTRA MAFIC with trace stringers and blebs of pyrite.		7.66 / 124.49	1									JN,UN,Ro; JN,PL,Ro; JN,PL,SM Go; JN,PL,Ro			
10		Fresh, fine grained, weak to moderate foliation, green-grey, medium strength, INTERMEDIATE VOLCANIC with trace stringers and bleb of sulphides		9.51 / 123.14	2									JN,PL,Ro Fe; FO,PL,SM; FO,PL,SM Ch; FO,PL,SM x2 Ch; FO,PL,SM Ch; FO,PL,SM Ch; FO,PL,SM Ch			
11, 12		Fresh to slightly altered, moderate foliated, grey-green, strong strength, INTERMEDIATE VOLCANICS.		10.86 / 121.64	3									FO,PL,Ro Ch; JN,PL,Ro; JN,PL,Ro Se; JN,PL,Ro Se; JN,PL,SM; JN,PL,Ro; JN,PL,SM; JN,PL,Ro Fe; JN,PL,Ro Fe; JN,PL,Ro Fe; JN,PL,Ro Fe; JN,PL,Ro Fe			10.86m to 15.36m Falling Head Packer Test k=1.3x10-4 cm/s
13, 14, 15		Fresh, moderate foliated, fine grained, medium green, strong strength, INTERMEDIATE VOLCANICS with ground lower contact.		12.36 / 118.64	4, 5									FO,PL,Ro; JN,PL,Ro x2; JN,ST,Ro Fe; JN,PL,Ro Fe; FO,PL,Ro; JN,PL,Ro; JN,PL,Ro; JN,PL,Ro; FO,PL,Ro; FO,PL,Ro; FO,PL,SM; FO,PL,Ro; FO,PL,Ro; JN,PL,Ro			
16, 17		End of BOREHOLE.		15.36													

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-BZ-3

SHEET 1 OF 2

LOCATION: Bay Zone Dyke
N: 7212991 E: 638793

DRILLING DATE: 29-Apr-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local
Reference: Ice Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY % (80, 60, 40, 20)	GRADATION %: GRAVEL	SAND	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
		Ice Surface		134.00											
0	HQ3	ICE		0.00											
1				132.78											
		LAKE WATER		1.22 / 132.55											
		GRAVEL and COBBLES		1.45											
2				131.35											
3		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
4															
5															
6															
7															
8															
9															
10															

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-BZ-3

LOCATION: Bay Zone Dyke
N: 7212991 E: 638793

INCLINATION: -90°

DRILLING DATE: 29-Apr-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

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

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	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.	131.35													
3	Boart-Longyear HQ3	Fresh to slightly weathered, light grey, fine grained/closely foliated, medium strength, INTERMEDIATE VOLCANICS with trace pyrite.	2.65	1									FO,PL,Ro JN,PL,Ro			
			130.65													
4		Fresh, fine grained, closely foliated, light grey, medium strength, INTERMEDIATE VOLCANICS.	3.35	2									FO,UN,Ro Fe JN,PL,Ro Fe JN,PL,Ro Fe FO,PL,VR Fe FO,PL,Ro Fe FO,PL,Ro Fe CJ,PL,Ro Fe CJ,PL,Ro Fe			
5				3									FO,PL,Ro JN,PL,Ro			
6			127.65													
7		Fresh, fine grained, closely foliated, light grey, medium strength, INTERMEDIATE VOLCANICS with chlorite along discontinuities.	6.35	4									FO,PL,SM Ch FO,PL,SM Ch FO,PL,SM Ch CJ,PL,			6.35m to 9.35 Falling Head Packer Test k=3.1x10-4 cm/s
			126.15													
8		Fresh, fined grained, closely foliated light to dark grey, medium strength, INTERMEDIATE VOLCANICS with trace pyrite and stringers of quartz.	7.85	5									,PL,SM FO,PL,SM FO,PL,SM Ch			
9													CJ,PL,Ro CJ,PL,Ro			
			124.65													
		End of BOREHOLE.	9.35													
10																
11																
12																

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-BZ-4

LOCATION: Bay Zone Dyke
N: 7213201.335 E: 638647.027

DRILLING DATE: 06-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	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY %	GRADATION %: GRAVEL	SAND	FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		137.31											
0	HQ3	COBBLES with trace GRAVEL of Granite and Intermediate Volcanics		0.00	1	RC		1							
1															
2				135.44											
		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
3															
4															
5															
6															
7															
8															
9															
10															

Hydraulic conductivity scale: 10^{-6} 10^{-5} 10^{-4} 10^{-3}
Water content scale: Wp — W — Wl; 10 20 30 40
Recovery scale: 80 60 40 20

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-BZ-4

LOCATION: Bay Zone Dyke
N: 7213201.335 E: 638647.027

INCLINATION: -51.39° AZIMUTH: 155°

DRILLING DATE: 06-Aug-03
DRILL RIG: LF-70
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

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.		135.44												
3	Boart-Longyear HQ3	Slightly weathered, medium to weak strength, closely foliated and vuggy, greyish green, INTERMEDIATE VOLCANICS		2.40	2								JN,PL,SM			
													JN,IR,Ro CL			
													JN,PL,SM			
													JN,PL,Ro QZ			
					3								JN,PL,Ro CA			
													JN,PL,Ro x6 SI SU			
													JN,PL,SM			
4													JN,PL,SM x3			
													FO,PL,SM x3 QZ			
				133.79												
		Slightly weathered, medium to weak strength, closely foliated and vuggy, greyish green, INTERMEDIATE VOLCANICS		4.50									FO,PL,SM x3			
													JN,IR,SM			
5					4											
6													FO,PL,SM			
													JN,UN,Ro			
													FO,PL,SM			
													JN,PL,SM QZ			
													FO,PL,SM x2 SU			
													JN,PL,SM CH			
					5								FO,PL,SM			
													FO,PL,SM CL			
													JN,PL,SM			
7													FO,PL,SM QZ CH			
													VN,IR,Ro QZ CH			
													JN,PL,SM			
													FO,PL,Ro QZ			
													FO,UN,SM			
													FO,PL,SM SI			
													VN,PL,Ro QZ			
8													JN,IR,Ro			
													FO,PL,SM			
					6								FO,PL,SM			
													FO,PL,SM			
9																
													JN,PL,Ro			
					7								JN,PL,SM			
10													FO,PL,SM			
													FO,PL,SM			
													FO,PL,SM			
													JN,PL,SM QZ			
													JN,PL,SM QZ			
				129.11												
		Slightly weathered, medium to weak strength, closely foliated and vuggy, greyish green, INTERMEDIATE VOLCANICS		10.50									FO,UN,SM			
													VN,IR,Ro QZ			
11													FO,IR,Ro QZ			
					8											
													FO,UN,SM			
													FO,PL,SM			
													JN,ST,SM			
													FO,PL,Ro			
12					9								FO,PL,SM			

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-BZ-4

LOCATION: Bay Zone Dyke
N: 7213201.335 E: 638647.027

INCLINATION: -51.39° AZIMUTH: 155°

DRILLING DATE: 06-Aug-03
DRILL RIG: LF-70
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
13	Boart-Longyear HQ3	Slightly weathered, medium to weak strength, closely foliated and vuggy, greyish green, INTERMEDIATE VOLCANICS *(continued)*			9									FO,PL,SM x4 JN,PL,SM JN,PL,SM FO,PL,SM x3			
14					10									FO,PL,SM JN,IR,Ro JN,R,SM JN,PL,SM CH FO,PL,SM x2			
15					11									JN,PL,SM FO,PL,SM JN,PL,SM x2 FO,PL,SM			
16														FO,PL,SM JN,IR,SM QZ			
17					12									FO,PL,SM JN,PL,SM CA FO,PL,SM JN,PL,SM JN,PL,SM			
18					13									JN,IR,Ro x2 QZ JN,IR,Ro SU FO,ST,SM JN,PL,Ro QZ			
19														FO,PL,SM			
20					14									FO,PL,K x7 JN,PL,SM JN,PL,SM JN,PL,SM QZ FO,PL,SM x3			
21				120.90 21.00													
22		Slightly weathered, medium to weak strength, closely foliated, grey, INTERMEDIATE VOLCANICS			15									JN,PL,SM FO,UN,SM x4 FO,PL,SM x8			

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-BZ-4

LOCATION: Bay Zone Dyke
N: 7213201.335 E: 638647.027

INCLINATION: -51.39° AZIMUTH: 155°

DRILLING DATE: 06-Aug-03
DRILL RIG: LF-70
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
	Boart-Longyear HQ3			119.73	15												
		Slightly weathered, medium strong, closely foliated, grey, INTERMEDIATE VOLCANICS		22.50	16									JN,IR,Ro QZ			
23														FO,PL,SM			
														FO,PL,SM x5			
24				118.56													
		Fresh, medium strength, closely bedded, grey with black banding, IRON FORMATION		24.00	17												
														JN,PL,SM			
25														JN,PL,SM x2			
					18									FO,PL,SM			
														FO,PL,SM HE CA			
26														JN,UN,SM HE CA			
														JN,UN,SM			
27				115.74													
		Fresh to slightly weathered, closely foliated to random flow, light grey green, fine grained, medium strength, ULTRAMAFIC		27.60	19									JN,UN,SM			
														VN,PL,Ro QZ			
28														JN,UN,SM			
														JN,PL,Ro CH SE			
				115.04													
		Fresh to slightly weathered, closely foliated to random flow, light grey green, fine grained, medium strength, ULTRAMAFIC (some iron staining on core)		28.50	20									FO,PL,SM			
29																	
														FO,UN,SM			
														FO,PL,SM FE			
				113.87													
30		Fresh to slightly weathered, closely foliated to random flow, light grey green, fine grained, medium strength, ULTRAMAFIC (transition to Iron Formation)		30.00	21									JN,UN,SM FE			
														FO,PL,SM			
				113.56													
				30.40										FO,PL,SM HE QZ			
														JN,PL,SM			
		Fresh, closely bedded, grey green with black banding, fine grained, medium strength, IRON FORMATION															
31														JN,PL,SM FE			
														JN,PL,SM FE			
				112.70										JN,PL,SM			
		Slightly weathered, closely foliated, black with grey intrusions, fine grained, medium strength, INTERMEDIATE VOLCANICSN (Vuggy in short sections)		31.50	22									FO,PL,SM			
32														JN,IR,Ro			
														JN,UN,SM			
														JN,PL,SM			
														FO,PL,SM			

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-BZ-4

LOCATION: Bay Zone Dyke
N: 7213201.335 E: 638647.027

INCLINATION: -51.39° AZIMUTH: 155°

DRILLING DATE: 06-Aug-03
DRILL RIG: LF-70
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

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

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	ELEV. / DEPTH (m)	RUN No.	TYPE AND SURFACE DESCRIPTION
	Boart-Longyear HQ3	Slightly weathered, closely foliated, black with grey intrusions, fine grained, medium strength, INTERMEDIATE VOLCANICSN (Vuggy in short sections) *(continued)*	111.52	22	JN,PL,Ro
33			33.00		FO,PL,SM; JN,IR,Ro CL; JN,IR,Ro CL; JN,PL,SM FE; JN,PL,SM; JN,IR,Ro; JN,IR,Ro x3
		Slightly weathered, closely foliated to random, dark grey, fine grained, medium to weak strength, INTERMEDIATE VOLCANICS (Vuggy sections and some iron staining parallel to foliation)	110.35	23	JN,PL,SM; FO,PL,SM CL; FO,PL,SM; FO,PL,SM x6 BR
34		Slightly weathered, closely foliated to random, dark grey, fine grained, medium to weak strength, INTERMEDIATE VOLCANICS (Vuggy sections and some iron staining parallel to foliation, TRANSITION)	109.81	24	FO,PL,SM x3 FE; JN,PL,SM CL; FO,PL,SM; FO,PL,SM; FO,PL,SM; FO,PL,SM CL; FO,PL,SM CL
35			35.20	25	JN,PL,SM CL; FO,PL,SM; FO,PL,SM; FO,PL,SM; FO,PL,SM; FO,PL,SM QZ
36				26	FO,PL,SM CH; FO,PL,SM; FO,PL,SM x2
37		Fresh, closely foliated, light gray green, fine grained, medium strength, ULTRAMAFIC (with thin quartz layering)		27	FO,PL,SM CL; FO,PL,SM; JN,IU,Ro; JN,PL,Ro; JN,PL,SM x2
38				28	JN,PL,Ro; JN,PL,Ro; JN,PL,Ro; JN,IR,SM; FO,PL,Ro CA; JN,UN,SM
39				29	JN,PL,SM
40					
41					
42					

NOTES
WATER LEVELS
INSTRUMENTATION

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-BZ-4

LOCATION: Bay Zone Dyke
N: 7213201.335 E: 638647.027

INCLINATION: -51.39° AZIMUTH: 155°

DRILLING DATE: 06-Aug-03
DRILL RIG: LF-70
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
43	Boart-Longyear HQ3	Fresh, closely foliated, light gray green, fine grained, medium strength, ULTRAMAFIC (with thin quartz layering) *(continued)*			29									FO,PL,SM FLT,I,Ro CL JN,UN,Ro FO,PL,SM JN,PL,Ro			
44					30									JN,PL,SM JN,PL,SM JN,PL,SM JN,PL,SM			
45					31									JN,PL,SM x2 JN,PL,Ro FO,PL,SM			
47					32									JN,PL,Ro FO,PL,SM x2			
48				99.80 48.00										JN,PL,Ro			
		End of BOREHOLE.															
49																	
50																	
51																	
52																	

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/MT
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-BZ-5

SHEET 1 OF 2

LOCATION: Bay Zone
N: 7213096 E: 638703

DRILLING DATE: 30-31 May 03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local
Reference: Ice Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY % (80, 60, 40, 20)	GRADATION %: GRAVEL	SAND	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
		Ice Surface		134.00											
0	HQ3	ICE		0.00											
1				132.90											
		WATER		1.10											
2															
3															
4															
5				128.33											
		COBBLES and Boulders with some gravel, trace sandy silt		5.67											
6															
7															
8				125.59											
		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
9															
10															

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/CS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-BZ-5

LOCATION: Bay Zone
N: 7213096 E: 638703

INCLINATION: -90°

DRILLING DATE: 30-31 May 03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

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.		125.59													
	Boart-Longyear HQ3	Fresh, fine grained, closely foliated, greenish grey, weak ULTRA MAFIC (soapstone) with cubic pyrite and calcium and chlorite in discontinuities (calcium banding).		8.41	1									JN,PL,SM Ch,Ca			8.57m to 16.07m Falling Head Packer Test k=5.0x10-6 cm/s
9					2									FO,PL,SM Su,Ch,Ca; JN,CU,SM Ch,Ca; JN,PL,SM Ch,Ca; FO,PL,SM; Su,Ch,Ca; JN,IR,SM Su,Ca; JN,CU,SM CH; FO,CU,SM Ch,Ca; JN,IR,SM CA; JN,ST,SM Ch,Ca; FO,PL,SM Ch,Ca; JN,ST,SM CH; JN,ST,SM SU; JN,IR,SM Ch,Ca; JN,IR,SM CH; FO,PL,SM CA; FO,ST,SM CA; FO,PL,SM Ch,Ca			
10					3									JN,PL,SM CA; JN,IR,SM Ca,Su; FO,PL,SM SU; JN,PL,SM SU			
11					4									JN,IR,SM Ch,Ca; FO,PL,SM; JN,IR,SM Su,Ca; JN,IR,SM Su,Ch,Ca; JN,PL,SM Su,Ca; JN,IR,SM; JN,PL,SM; JN,IR,SM Ch,Ca			
12					5									JN,ST,SM CH; FO,ST,SM Ch,Qz; JN,UN,SM; JN,IR,Ro; FO,PL,SM; FO,PL,SM; FO,UN,SM; FO,UN,SM; FO,PL,SM			
13					6									FO,IR,Ro; FO,ST,Ro; FO,PL,SM; FO,PL,SM; JN,IR,Ro; JN,UN,SM; JN,UN,SM; JN,PL,SM			
14																	
15																	
16				117.93													
		End of BOREHOLE.		16.07													
17																	
18																	

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/CS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-BZ-6

SHEET 1 OF 2

LOCATION: Bay Zone
N: 7212952 E: 638906

DRILLING DATE: 31 May 03 - 01 June 03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local
Reference: Ice Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY % (80, 60, 40, 20)	GRADATION %: GRAVEL	SAND	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
		Ice Surface		134.00											
0	HO3	ICE		0.00											
1				132.57											
		WATER		1.43											
2															
3															
4				129.83											
		BOULDERS and cobbles with some gravel, trace sand and silt.		4.17											
5															
6															
7															
8				125.40											
		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
9															
10															

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/CS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-BZ-6

LOCATION: Bay Zone
N: 7212952 E: 638906

INCLINATION: -90°

DRILLING DATE: 31 May 03 - 01 June 03

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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.		125.40													
				8.60													
9														JN,PL,SM CH			
														JN,PL,Ro Ch,Ca			
					1												
														JN,PL,SM CH			
														JN,PL,Ro			
														JN,IR,Ro SU			
10														JN,PL,SM			
														JN,IR,SM CA			
														JN,IR,Ro CA			
														JN,PL,SM			
														JN,IR,Ro Ca,Qz			
														JN,PL,Ro CH			
					2												
11														JN,IR,Ro CH			
														JN,PL,SM CH			
														JN,PL,SM CH			
														JN,UN,SM CH			
																	11.60m to 16.10m Falling Head Packer Test k=1.3x10-5 cm/s
12	Boart-Longyear HQ3	Fresh, closely foliated, greenish grey, weak, ULTRAMAFICS (soapstone) with calcium and chlorite in discontinuities and calcium banding with occasional cubic pyrite.												FO,PL,SM			
														Su,Ch,Ca			
														JN,IR,SM Su,Ch,Ca			
					3									FO,IR,SM CH			
														FO,PL,SM CA			
														FO,PL,SM Ch,Ca			
														JN,IR,SM CH			
														JN,PL,SM CA			
13														JN,IR,Ro CH			
														JN,UN,SM CA			
														JN,PL,SM CH			
														JN,PL,SM CA			
					4									JN,PL,SM CH			
14																	
														FO,ST,SM CH			
														FO,PL,SM CA			
														FO,PL,SM CL			
														FO,PL,SM CA			
15														FO,PL,SM CL			
														FO,PL,SM			
					5									FO,PL,SM			
16				117.90													
		End of BOREHOLE.		16.10													
17																	
18																	

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/CS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-GI-1

SHEET 1 OF 2

LOCATION: Goose Island Dyke
N: 7212775 E: 638924

DRILLING DATE: 29-Apr-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local
Reference: Ice Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY %	GRADATION %: GRAVEL	SAND	FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ice Surface		134.00											
0	HQ3	ICE		0.00											
1				132.39											
2		Single Boulder composed on INTERMEDIATE VOLCANICS.		1.61				1							
3				130.89											
4		COBBLES and GRAVEL with trace clay and sand composed of granite, quartz, and mafic volcanics.		3.11				2							
5				129.08											
		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
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: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-GI-1

LOCATION: Goose Island Dyke
N: 7212775 E: 638924

INCLINATION: -90°

DRILLING DATE: 29-Apr-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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.		129.08													
5	Boart-Longyear HQ3	Fresh, weak close foliated, fine grained, light grey, strong strength, INTERMEDIATE VOLCANICS with trace stringers of quartz.		4.92	1					80	80	2	0	JN,PL,Ro Ca	R5	W1	
													30	JN,PL,SM			
													60	JN,PL,Ro Ca			
6													30	JN,IR,Ro			
					2								60	JN,PL,Ro			
													60	FO,PL,Ro			
7													60	FO,PL,Ro Ca			
														FO,PL,SM Su			
													30	JN,PL,SM Ca			
				126.39													
		Fresh, moderate to closely foliated, fine grained, grey, strong strength, INTERMEDIATE VOLCANIC, @8.88-9.09 fragment with foliation parallel to core axis.		7.61	3					80	80	2	60	JN,CU,Ro			7.61m to 12.11m Falling Head Packer Test k=2.5x10-6 cm/s
8																	
													90	JN,IR,Ro			
9				124.89													
		Fresh, moderate to closely foliated, fine grained, grey, strong strength, INTERMEDIATE VOLCANIC, @11.0-11.25 mafic volcanic/quartz fragment/inclusion.		9.11	4					80	80	2	30	FO,PL,SM			
													90	JN,UN,Ro			
10																	
				123.39													
		Fresh, moderate to closely foliated, fine-medium grained, grey-green, INTERMEDIATE VOLCANIC.		10.61	5					80	80	2	30	JN,PL,Ro			
11													90	VN,PL,Ro Qz			
												2	30	JN,PL,Ro Ca			
12				121.89									60	FO,PL,Ro Ca			
		End of BOREHOLE.		12.11													
13																	
14																	

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-GI-2

SHEET 1 OF 2

LOCATION: Goose Island Dyke
N: 7212535 E: 638938

DRILLING DATE: 6-May-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local
Reference: Ice Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY %	GRADATION %: GRAVEL	SAND	FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ice Surface		134.00											
0	HQ3	ICE		0.00 / 133.09											
1		COBBLES and Gravel		0.91 / 132.31											
		Silty Clay with some sand and trace gravel		1.69 / 131.79				1							
2		Sandy clay with gravel		2.21 / 130.99	1	DO	40	2		17.7	47.5	34.8			
					2	SC				40.2	28.1	31.7	○		
3		Sandy clay and gravel with cobbles		3.01 / 129.49				3							
4					3	SC				35.8	30.1	34.1	○		
		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
5															
6															
7															
8															
9															
10															

Hydraulic conductivity scale: 10^{-6} 10^{-5} 10^{-4} 10^{-3}
Water content scale: Wp — W — Wl; 10 20 30 40

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-GI-2

LOCATION: Goose Island Dyke
N: 7212535 E: 638938

INCLINATION: -90°

DRILLING DATE: 6-May-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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.		129.49													
5	Boart-Longyear HQ3	Slightly weathered, fine grained, closely foliated, grey, weak to medium strong, INTERMEDIATE VOLCANICS with foliation sub parallel to core axis and iron staining present in discontinuities.		4.51	1									FO,UN,Ro Fe,Go JN,PL,Ro Fe,Go			
6					2												
7				126.49													
8		Fresh, fine grained, closely foliated to massive, grey green, medium strong INTERMEDIATE VOLCANICS.		7.51	3									JN,CU,Ro Fe JN,PL,Ro JN,PL,Ro JN,PL,Ro Su JN,PL,Ro JN,UN,Ro			7.51m to 12.01m Falling Head Packer Test k=3.7x10-7 cm/s
9					4									JN,PL,SM FO,PL,Ro JN,PL,SM Go JN,PL,Ro Go JN,PL,Ro Go			
10				123.49													
11		Fresh, fine grained, closely to moderately foliated, grey, medium strong, INTERMEDIATE VOLCANICS.		10.51	5									JN,PL,Ro JN,PL,Ro JN,PL,Ro Se JN,PL,Ro Go FO,PL,Ro Se JN,UN,Ro Go FO,PL,SM Se JN,PL,SM JN,UN,Ro FO,CU,SM			
12		End of BOREHOLE.		121.99 12.01													
13																	
14																	

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-GI-3

LOCATION: Goose Island Dyke
N: 7212073 E: 638912

DRILLING DATE: 7-May-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local
Reference: Ice Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY % (80, 60, 40, 20)	GRADATION %: GRAVEL	SAND	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
		Ice Surface		134.00											
0				0.00											
		ICE													
1															
				132.38											
				1.62											
2															
3															
4															
5	HQ3														
		LAKE WATER													
6															
7															
8															
9															
10															

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-GI-3

LOCATION: Goose Island Dyke
N: 7212073 E: 638912

DRILLING DATE: 7-May-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY % (80, 60, 40, 20)	GRADATION %: GRAVEL	SAND	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
10	HQ3	LAKE WATER *(continued)*		123.45 / 10.55											
11		Overburden - cased		122.30											
		COBBLES and Gravel (angular) - granite, trace sand, trace clay		122.20											
12		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
13															
14															
15															
16															
17															
18															
19															
20															

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-GI-3

LOCATION: Goose Island Dyke
N: 7212073 E: 638912

INCLINATION: -90°

DRILLING DATE: 7-May-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

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

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	ELEV. / DEPTH (m)	RUN No.	TYPE AND SURFACE DESCRIPTION	NOTES WATER LEVELS INSTRUMENTATION
		Continued from SOIL LOG.	122.20			
12	Boart-Longyear HQ3	Fresh, closely foliated, light grey, fine grained, medium strong, INTERMEDIATE VOLCANICS.	11.80	1	FO,PL,SM Cl	
				2	JN,IR,Ro Cl	
13					FO,PL,SM Cl FO,PL,SM Cl FO,PL,SM Cl JN,IR,Ro Cl FO,PL,SM Cl FO,PL,SM x4 Fe,Cl	
					CJ,UN,SM Fe,Su	
14				3	FO,PL,Ro Cl JN,CU,SM Fe,Cl	
					JN,CU,Ro Fe	
15			118.65		JN,PL,Ro Cl	
		Fresh to slightly weathered, closely foliated, light grey, fine grained, medium strong, INTERMEDIATE VOLCANICS.	15.35		JN,IR,Ro Cl	15.35m to 18.35m Falling Head Packer Test k=1.3x10-4 cm/s
				4	JN,IR,Ro JN,PL,Ro Fe,Cl FO,ST,Ro	
16					FO,PL,SM Cl FO,PL,Ro Cl	
17				5	FO,ST,Ro FO,CU,Ro Ch JN,PL,Ro Su	
18					FO,CU,Ro CJ,PL,Ro Ch,Qz JN,PL,Ro	
			115.65			
		End of BOREHOLE.	18.35			
19						
20						
21						

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-GI-4

SHEET 1 OF 2

LOCATION: Goose Island Dyke
N: 7211999 E: 638676

DRILLING DATE: 7-May-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local
Reference: Ice Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY %	GRADATION %: GRAVEL	SAND	FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ice Surface		134.00											
0	HQ3	ICE		0.00 / 133.39											
1, 2	HQ3	COBBLES and gravel with trace sand and clay		0.61 / 131.58											
3		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
4															
5															
6															
7															
8															
9															
10															

Scale: 80, 60, 40, 20 — 10^{-6}, 10^{-5}, 10^{-4}, 10^{-3} — Wp, W, Wl — 10, 20, 30, 40

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-GI-4

LOCATION: Goose Island Dyke
N: 7211999 E: 638676

INCLINATION: -90°

DRILLING DATE: 7-May-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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.		131.58													
3	Boart-Longyear HQ3	Fresh, weak to moderate spaced foliation, light grey, fine grained, medium strong to strong, INTERMEDIATE VOLCANICS.		2.42	1									JN,OR,PL,Ro			
														FO,PL,Ro			
					2									JN,PL,Ro			
4														JN,PL,Ro			
														JN,PL,Ro			
														JN,,			
5					3									JN,PL,Ro			
														FO,PL,Ro			
														FO,PL,Ro Ch			
														FO,PL,Ro Ch			
6				127.99													
		Fresh, weak to moderate spaced foliation, light grey, fine to medium grained, medium strong to strong, INTERMEDIATE VOLCANICS.		6.01										JN,PL,Ro			
					4									FO,PL,SM			
														JN,PL,Ro Fe			
7														JN,CU,Ro Fe			
														FO,PL,Ro Ch			
				126.49													
		Fresh, moderate spaced foliation, light grey, fine, medium strong to strong, INTERMEDIATE VOLCANICS.		7.51										JN,CU,Ro			
8					5									JN,PL,Ro			
														FO,PL,Ro			
														FO,UN,Ro			
9				124.99													
		End of BOREHOLE.		9.01													
10																	
11																	
12																	

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-GI-5

SHEET 1 OF 2

LOCATION: Goose Island Dyke
N: 7212091 E: 638502

DRILLING DATE: 8-May-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local
Reference: Ice Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY % (80, 60, 40, 20)	GRADATION %: GRAVEL	SAND	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
		Ice Surface		134.00											
0	HQ3	ICE		0.00 / 132.19											
2	HQ3	LAKE WATER		1.81 / 131.59											
3	HQ3	GRAVEL composed of granite (very little sample collected from rock coring)		2.41 / 129.74											
4		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
5															
6															
7															
8															
9															
10															

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-GI-5

LOCATION: Goose Island Dyke
N: 7212091 E: 638502

INCLINATION: -90°

DRILLING DATE: 8-May-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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.		129.74													
5, 6	Boart-Longyear HQ3	Slightly weathered, moderately banded-closely spaced, grey black, fine grained, strong to very strong, BANDED IRON FORMATION with iron staining throughout.		4.26 / 127.57	1, 2				80 60 40 20	80 60 40 20	80 60 40 20	2 4 6 8	0 30 60 90	BD,PL,Ro Ch; BD,PL,SM Fe; JN,UN,SM Mag; BD,UN,Ro x2 Fe; BD,CU,Ro x2 Fe; BD,PL,Ro; JN,PL,Ro Ch; BD,PL,Ro Mag; CO,PL,Ro	R5 R4 R3 R2 R1	W1 W2 W3 W4	
7, 8, 9	Boart-Longyear HQ3	Fresh, closely foliated, light grey, fine grained, medium to strong, INTERMEDIATE VOLCANICS with sericite alteration (10.6-10.9m Fault Zone with FE staining and gouge (drillers reported loss of water return)).		6.43 / 124.89	3, 4				80 60 40 20	80 60 40 20	80 60 40 20	2 4 6 8	0 30 60 90	FO,PL,Ro Se; JN,PL,Ro Se; FO,PL,Ro Se; FO,PL,Ro Se; JN,PL,Ro Se; FO,PL,Ro Se; FO,PL,Ro Se; FO,PL,Ro Se; FO,CU,Ro Se; JN,UN,Ro; JN,UN,Ro; FO,PL,Ro Se; FO,PL,Ro Se; FO,CU,Ro Se	R5 R4 R3 R2 R1	W1 W2 W3 W4	7.61m to 12.11m Falling Head Packer Test k=3.3x10-3 cm/s
9, 10	Boart-Longyear HQ3	Fresh, closely foliated, light grey, fine grained, medium to strong, INTERMEDIATE VOLCANICS with sericite alteration.		9.11 / 123.39	5				80 60 40 20	80 60 40 20	80 60 40 20	2 4 6 8	0 30 60 90	FO,CU,SM Se; FO,CU,Ro Se; FO,PL,Ro Se; FO,PL,Ro Se; JN,PL,Ro Su; FLT,PL,Ro; FLT,PL,Ro Go; FLT,PL,Ro Go,Fe	R5 R4 R3 R2 R1	W1 W2 W3 W4	
11, 12	Boart-Longyear HQ3	Fresh, closely foliated, light grey, fine grained, medium strong, INTERMEDIATE/FELSIC VOCANICS with sericite alteration.		10.61 / 121.89	6				80 60 40 20	80 60 40 20	80 60 40 20	2 4 6 8	0 30 60 90	JN,PL,Ro; JN,PL,Ro Fe; FO,CU,Ro Se; FO,CU,Ro Se; FLT,JN,PL,Ro Fe; JN,PL,Ro; JN,PL,Ro	R5 R4 R3 R2 R1	W1 W2 W3 W4	
13, 14		End of BOREHOLE.		12.11													

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-GI-6

SHEET 1 OF 3

LOCATION: Goose Island Dyke
N: 7212236 E: 638398

DRILLING DATE: 26-Apr-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local
Reference: Ice Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY %	GRADATION %: GRAVEL	SAND	FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ice Surface		134.00											
0	HQ3	ICE		0.00											
1															
				132.16											
2		LAKE WATER		1.84											
3															
4															
5															
6															
7				126.90											
		Loose, COBBLES and GRAVEL, composed of granite recovered with core		7.10											
8															
9															
				124.68											
		Loose, COBBLES and GRAVEL with trace sand, composed of granite and quartz		9.32											
10															

Hydraulic conductivity scale: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

Water content scale: Wp — W — Wl; 10 20 30 40

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-GI-6

LOCATION: Goose Island Dyke
N: 7212236 E: 638398

DRILLING DATE: 26-Apr-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY %	GRADATION %: GRAVEL	SAND	FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10															
11	HQ3	Loose, COBBLES and GRAVEL with trace sand, composed of granite and quartz *(continued)*			1	DO	53								
					2	DO	48								
12															
13				121.00											
		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
14															
15															
16															
17															
18															
19															
20															

Column headings: RECOVERY % 80 60 40 20; 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: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-GI-6

LOCATION: Goose Island Dyke
N: 7212236 E: 638398

INCLINATION: -90°

DRILLING DATE: 26-Apr-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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.		121.00													
13	Boart-Longyear HQ3	Fresh, weak to moderate planar to wavy foliation, light grey, QUARTZITE with sericite alteration and quartz patches, vuggs @14.78-14.9 and 15.52-15.61		13.00	1									JN,PL,SM Se			15.00m to 18.75m Falling Head Packer Test k=4.7x10-5 cm/s
														FO,PL,Ro			
														JN,UN,Ro Ca			
14																	
														FO,IR,Ro			
														JN,PL,Ro Se			
15																	
														JN,PL,Ro			
				118.50													
		Fresh to slightly weathered along joints, weak to moderate planar foliation, grey, strong, QUARTZITE strongly fractured with epidote and iron staining along discontinuities		15.50										FLT,PL,Ro Qz,Go			
16					2									JN,PL,Ro He			
														JN,PL,Ro He			
														JN,PL,Ro He			
														JN,PL,Ro He			
														FO,PL,Ro			
17														JN,PL,SM Go			
				116.75													
				17.25										FO,PL,Ro			
														FO,PL,Ro Se			
														JN,PL,Ro Ca			
														FLT,UN,Ro Se			
18					3									FLT,UN,Ro Qz,Se			
														FO,PL,Ro			
				115.25													
		End of BOREHOLE.		18.75													
19																	
20																	
21																	
22																	
23																	

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-GI-7

LOCATION: Goose Island Dyke Abut.
N: 7212245.771 E: 638251.184

DRILLING DATE: 25-26 April 2003
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local
Reference: Ground Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY %	GRADATION %: GRAVEL	SAND	FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		134.97											
0	HQ3	GRAVEL and COBBLES		0.00				1							
5		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.		130.59											

Hydraulic conductivity scale: 10^{-6} 10^{-5} 10^{-4} 10^{-3}
Water content scale: Wp — W — Wl; 10 20 30 40

DEPTH SCALE
1 : 50

LOGGED: JC/PP/CC
CHECKED: CJC

Golder Associates

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-GI-7

LOCATION: Goose Island Dyke Abut.
N: 7212245.771 E: 638251.184

INCLINATION: -61.04° AZIMUTH: 86°

DRILLING DATE: 25-26 April 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

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

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	ELEV. / DEPTH (m)	RUN No.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION
		Continued from SOIL LOG.	130.59		
5	Boart-Longyear HQ3	Fresh, thinly bedded, grey to dark grey, fine grained, very strong, IRON FORMATION	5.00 / 130.12	1	CJ,UN,Ro Fe CJ,UN,Ro Fe FO,PL,Ro Fe
6, 7		Fresh, thinly bedded/foliated, grey-green fine grained, very weak to weak, ULTRA MAFIC, interbeds of IV to 30cm at upper contact	5.54 / 127.53	2, 3	FO,PL,SM FO,PL,SM x4 Cl JN,PL,SM FO,PL,SM FO,PL,SM x5 Cl JN,UN,SM Cl
8, 9		Fresh, thinly bedded/foliated, grey-green strong to medium strong, ULTRA MAFIC	8.50 / 126.22	4	JN,UN,Ro FO,UN,SM FO,UN,SM FO,PL,Ro
10		Fresh, thinly bedded/foliated, grey-green weak to medium strong, ULTRA MAFIC, quartz calcite vuggs perpendicular to foliation @ 10.32	10.00 / 125.34	5	FO,UN,SM CJ,UN,SM Ch FO,PL,SM x2 Ch OR,PL,Ro Ca FO,PL,Ro x2
11		Fresh, thinly bedded, green-grey, strong, INTERMEDIATE VOLCANICS to MAFICS	11.00 / 124.91	6	OR,PL,Ro Sa FO,PL,Ro Sa
12, 13		Fresh, thinly bedded, greenish grey, fine grained, strong INTERMEDIATE VOLCANICS	11.50 / 123.59	7	FO,PL,Ro JN,PL,Ro FO,PL,Ro FO,PL,SM CJ,PL,Ro
14		Fresh, thinly bedded/foliated, grey, fine grained, very strong, INTERMEDIATE VOLANICS	13.00 / 122.28	8	CJ,PL,Ro FO,PL,SM OR,ST,Ro CJ,UN,Ro Ch OR,IR,Ro FO,PL,SM Ch JN,CU,Ro Qz FO,PL,Ro JN,PL,Ro FO,PL,Ro Qz JN,PL,SM Ch
15		Fresh, thinly foliated to mottled , grey, fine grained, very strong, INTERMEDIATE VOLCANICS	14.50	9	OR,ST,Ro FO,PL,SM JN,PL,SM Cl FO,PL,Ro

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NOTES
WATER LEVELS
INSTRUMENTATION

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP/CC
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-GI-7

LOCATION: Goose Island Dyke Abut.
N: 7212245.771 E: 638251.184

INCLINATION: -61.04° AZIMUTH: 86°

DRILLING DATE: 25-26 April 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
15	Boart-Longyear HQ3	Fresh, thinly foliated to mottled , grey, fine grained, very strong, INTERMEDIATE VOLCANICS *(continued)*		120.97	9									OR,UN,Ro OR,PL,Ro Qz FO,PL,SM CJ,PL,Ro Ca FO,PL,Ro			
16		Fresh, thinly foliated to mottled , grey, fine grained, very strong, INTERMEDIATE VOLCANICS, foliation commonly with quartz and silicified stringers		16.00 119.66	10									CJ,PL,Ro Ch CJ,CU,Ro Ca FO,PL,SM FO,PL,SM			
17																	
18		Fresh, thinly foliated to mottled , grey, fine grained, very strong, INTERMEDIATE VOLCANICS,		17.50 118.34	11									CJ,PL,SM Ch JN,IR,VR OR,IR,Ro FO,PL,SM FO,PL,SM			
19		Fresh, thinly foliated to mottled , grey, fine grained, very strong, INTERMEDIATE VOLCANICS, mottled texture begin to increase @19.30		19.00 117.03	12									CJ,UN,Ro FO,PL,SM OR,PL,Ro Ch CJ,PL,Ro FO,PL,Ro			
20																	
21		Fresh, mottled, green, fine to medium grained , medium strong, INTERMEDIATE VOLCANICS		20.50 115.72	13									FO,PL,SM FO,PL,Ro JN,PL,Ro			
22		Fresh, moderate foliated/mottled, fine grained, medium strong, INTERMEDIATE VOLCANICS with mottled texture ends @22.20 and increase biotite/chlorite in foliated sections		22.00 114.41	14									FO,PL,Ro JN,PL,Ro FO,PL,Ro FO,PL,SM Ch			
23																	
24		Fresh, weak foliated, fine grained medium strong, INTERMEDIATE VOLCANICS with chlorite alteration		23.50 113.10	15									JN,PL,SM Ch JN,PL,SM Ca FO,PL,SM Ch JN,PL,Ro JN,CU,Ro FO,PL,SM			
25																	

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP/CC
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-GI-7

LOCATION: Goose Island Dyke Abut.
N: 7212245.771 E: 638251.184

INCLINATION: -61.04° AZIMUTH: 86°

DRILLING DATE: 25-26 April 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
25	Boart-Longyear HQ3	Fresh, weak foliated, fine grained, strong, INTERMEDIATE VOLCANICS		25.00	16									FO,PL,SM FO,CU,SM			
26														JN,PL,Ro			
					17									JN,PL,Ro JN,PL,VR			
27														FO,PL,SM			
														JN,PL,Ro JN,PL,Ro			
28				110.19													
		Fresh, weak to moderate foliated, green, strong, INTERMEDIATE VOLCANICS with a small fold @ 28.84, trace sulphides and quartz veins and patches		28.32	18									JN,CU,Ro FO,PL,Ro FO,CU,SM FO,PL,Ro			
29														JN,PL,Ro			
				109.16										JN,IR,Ro			
		Fresh, massive to weak foliated, dark green, fine grained, strong, INTERMEDIATE VOLCANIC to ULTRA MAFIC		29.50	19									FLT,PL,SM Ch JN,UN,Ro			
30														FO,PL,Ro			
														FO,PL,SM			
														JN,PL,Ro Qz			
31					20									JN,IR,Ro Qz JN,PL,Ro Cl JN,PL,Ro Cl			
32														FO,PL,Ro			
														JN,PL,Ro Cl			
33					21									FO,PL,Ro VN,IR,Ro Ca			
														JN,PL,Ro Su FO,PL,SM			
34				105.22													
		Fresh, weak to moderate foliated, green medium to strong, INTERMEDIATE VOLCANIC to ULTRA MAFIC with strong biotite alternation in sections		34.00	22									JN,PL,Ro Su FO,PL,SM Ca			
35														CO,UN,SM			

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP/CC
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-GI-7

LOCATION: Goose Island Dyke Abut.
N: 7212245.771 E: 638251.184

INCLINATION: -61.04° AZIMUTH: 86°

DRILLING DATE: 25-26 April 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
35	Boart-Longyear HQ3	Fresh, weak to moderate foliated, green medium to strong, INTERMEDIATE VOLCANIC to ULTRA MAFIC with strong biotite alternation in sections *(continued)*		103.91	22												
				35.50													
36		Fresh, weak foliated, green, fine grained, medium INTERMEDIATE VOLCANIC to ULTRA MAFIC with talc/chlorite alteration		102.60	23									FO,PL,Ro FO,PL,SM Ch			
37		Fresh, weak to moderate foliated, green, fine grained, medium to strong, ULTRA MAFIC, foliation angle is shallow to core axis		37.00 101.28	24									FO,PL,Ro Ch FO,PL,Ro			
38																	
39		Fresh, weak to moderate wavy foliation, green, fine grained, medium to strong, ULTRA MAFIC,		38.50 99.97	25									FO,PL,Ro FO,PL,Ro			
40		Fresh, weak to moderate wavy foliation, green, fine grained, medium to strong, ULTRA MAFIC, with calcite fragments		40.00 98.66	26									FO,PL,Ro Ch FO,PL,Ro Ch FO,PL,Ro Ch FO,PL,Ro Ch			
41																	
42		Fresh, moderate to strong wavy foliation, green, fine grained, medium to strong, ULTRA MAFIC, with calcite fragments		41.50 97.35	27												
43		Fresh, moderate foliated, green, fine grained, medium, ULTRA MAFIC, fault with 3mm of gouge @43.64		43.00 96.03	28									FO,ST,SM Ch FLT,PL,Ro Go			
44																	
		Fresh, moderate planar to wavy foliation, green, fine grained, medium, ULTRA MAFIC, vugs @44.76-44.86		44.50	29												
45																	

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP/CC
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-GI-7

LOCATION: Goose Island Dyke Abut.
N: 7212245.771 E: 638251.184

INCLINATION: -61.04° AZIMUTH: 86°

DRILLING DATE: 25-26 April 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
45	Boart-Longyear HQ3																
					29									FO,PL,SM Ch SHR,PL,SM Go			
46		Fresh, moderate planar to wavy foliation, green, fine grained, medium, ULTRA MAFIC, vugs @44.76-44.86 *(continued)*															
					30												
47														SHR,PL,SM Ch			
				93.41													
				47.50													
48														FO,PL,SM x2 Ch			
					31												
49		Fresh, moderate planar to wavy foliation, green, fine grained, medium, INTREMEDIATE VOLCANIC to ULTRA MAFIC,															
					32												
50														FO,PL,SM Ch FO,PL,SM x2 Cg			
				90.78													
		End of BOREHOLE.		50.50													
51																	
52																	
53																	
54																	
55																	

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP/CC
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-GI-8

SHEET 1 OF 3

LOCATION: Goose Island
N: 7212300 E: 638967

DRILLING DATE: 2-3 June 2003
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local
Reference: Ice Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY % (80, 60, 40, 20)	GRADATION %: GRAVEL	SAND	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
		Ice Surface		134.00											
0	HO3			0.00											
1		ICE													
				132.02											
2				1.98											
3		WATER													
4															
5				128.92											
				5.08											
6															
7		COBBLES and Boulder with some gravel													
8				125.40											
		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
9															
10															

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/CS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-GI-8

LOCATION: Goose Island
N: 7212300 E: 638967

INCLINATION: -90°

DRILLING DATE: 2-3 June 2003
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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.		125.40													
9	Boart-Longyear HQ3			8.60													
10		Fresh to moderately weathered, closely foliated, greenish grey, weak, ULTRAMAFICS (soapstone), chloritization in discontinuities, highly fractured												JN,PL,SM Ch,Ca			
														JN,PL,SM SU			
					2									JN,PL,SM CH			
11				122.40													
		Fresh to moderately weathered, closely foliated, greenish grey, weak, ULTRAMAFICS (soapstone) with pyrite, fine gravel		11.60													
12					3									JN,PL,SM Ch,Su			
														JN,IR,Ro Ch,Su			
														JN,IR,Ro Ch,Su			
														JN,ST,SM Ch,Su			
13				120.90													
		Fresh, closely foliated to massive, greyish black, MAFIC (Intermediate Volcanics) with Iron Staining, Quartz veinlets, weak to medium strong, sulphide staining, medium to fine grained		13.10										JN,IR,Ro SU			
					4									JN,UN,SM SU			
														JN,PL,Ro			
														JN,PL,Ro			
14														JN,PL,Ro SU			
														JN,ST,Ro SU			
15														JN,PL,Ro x6 SU			
					5									FO,PL,Ro SU Ch			
														FO,ST,Ro SU			
16														JN,PL,Ro Su,Ca			
														FO,PL,SM			
														FO,IR,SM SU			
					6									FO,PL,SM SU			
														FO,UN,SM SU			
17														FO,PL,SM SU			
														FO,PL,SM x3			
														JN,PL,Ro x3			
														JN,PL,Ro x3 SU			
														FO,PL,SM SU			
														FO,ST,SM			
														FO,UN,SM			
18														FO,PL,SM			
					7									FO,PL,SM SU			
														FO,PL,SM			
														FO,PL,SM			

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/CS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-GI-8

LOCATION: Goose Island
N: 7212300 E: 638967

INCLINATION: -90°

DRILLING DATE: 2-3 June 2003
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
19	HQ3			114.90	7									JN,PL,SM SU			
		End of BOREHOLE.		19.10													
20																	
21																	
22																	
23																	
24																	
25																	
26																	
27																	
28																	

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TS/CS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-SE-1

LOCATION: 2nd Portage Lake
N: 7214176 E: 639458

DRILLING DATE: 17-May-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local
Reference: Ice Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY %	GRADATION %: GRAVEL	SAND	FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ice Surface		133.00											
0	HQ3	ICE		0.00											
1				131.21											
2		LAKE WATER		1.79											
3				129.25											
4		Stiff layered moist light brown and grey greasy silty clay with little gravel		3.75 / 128.79	1	DO	49			31.3	12.5	56.2			
5		Gravel and cobbles, well rounded granite with trace sand		4.21											
6															
7															
8				124.67											
		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
9															
10															

Hydraulic conductivity scale: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

Water content scale: Wp — W — Wl; 10 20 30 40

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SE-1

LOCATION: 2nd Portage Lake
N: 7214176 E: 639458

INCLINATION: -90°

DRILLING DATE: 17-May-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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.		124.67													
9	Boart-Longyear HQ3	Slightly weathered, fine to medium grained, closely foliated to massive, greyish white, medium strong to strong, highly fractured along foliation QUARTZITE.		8.33	1									JN,PL,Ro JN,UN,Ro Fe,Gr,Fe FO,PL,Ro x4 Fe,Sa	R5	W1	
10					2									FO,IR,Ro x5 Gr,Sa FO,ST,Ro Sa			
11				121.68										JN,IR,Ro Qz			
12		Slightly weathered, fine to medium grained, closely foliated to massive, greyish white, medium strong to strong, QUARTZITE with quartz vein @ 11.23 to 11.37 m		11.32	3									JN,UN,Ro Fe FO,PL,Ro x19 FO,PL,Ro x3			11.32m to 15.82m Falling Head Packer Test k=7.2x10-4 cm/s
13				120.18													
14		Slightly weathered, fine to medium grained, closely foliated to massive, greyish white, medium strong to strong, highly fractured along foliation QUARTZITE.		12.82	4									JN,PL,Ro JN,PL,Ro Fe			
15				117.18	5												
16		End of BOREHOLE.		15.82													
17																	
18																	

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-SE-2

LOCATION: 2nd Portage Lake
N: 7213945 E: 639527

DRILLING DATE: 17-May-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local
Reference: Ice Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY % (80, 60, 40, 20)	GRADATION %: GRAVEL	SAND	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
		Ice Surface		133.00											
0		ICE		0.00 / 132.70											
1	HQ3	COBBLES and GRAVEL of granite and int. volcanics		0.30 / 131.16											
2		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
3															
4															
5															
6															
7															
8															
9															
10															

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SE-2

LOCATION: 2nd Portage Lake
N: 7213945 E: 639527

INCLINATION: -90°

DRILLING DATE: 17-May-03
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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.		131.16													
2		Starter barrel used no core recovered.		1.84 / 130.16													
3	Boart-Longyear HQ3	Slightly weathered, fine grained, strong closely foliated, light grey, medium strength, INTERMEDIATE VOLCANICS with sericitic alteration.		2.84 / 128.66	1									FO,PL,Ro x6 Fe JN,PL,Ro Fe,Go FO,PL,Ro Se			
4																	
5		Fresh, fine grained, weakly foliated, light grey, medium strength, INTERMEDIATE VOLCANICS with vuggs.		4.34 / 127.16	2									JN,PL,Ro JN,PL,Ro FO,PL,Ro JN,CU,Ro			
6		Fresh to slightly weathered, fine grained, weakly foliated, light grey, medium strength, INTERMEDIATE VOLCANICS.		5.84 / 125.66	3									FO,PL,Ro FO,PL,Ro JN,PL,Ro FO,PL,Ro Ca JN,PL,Ro			5.84m to 10.34m Falling Head Packer Test k=7.9x10-6 cm/s
7														JN,PL,Ro Ca			
8		Fresh to slightly weathered, fine grained, weakly foliated, light grey, medium strength, INTERMEDIATE VOLCANICS with little vuggs.		7.34 / 122.66	4									FO,PL,Ro x2 FO,PL,Ro JN,PL,Ro Ca JN,PL,Ro Ca JN,PL,Ro FLT,CU,Ro Ca,Sa JN,CU,Ro Ca			
9					5									JN,PL,Ro JN,PL,Ro Ca JN,PL,Ro JN,PL,Ro Ca JN,PL,Ro Ca JN,PL,Ro Su			
10														JN,PL,Ro Ca FO,PL,Ro			
		End of BOREHOLE.		10.34													
11																	

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JC/PP
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF BOREHOLE: 03GT-SPEC-F2

LOCATION: 2nd Portage Lake
N: 7213853.491 E: 639415.404

DRILLING DATE: 23-28 May 2003
DRILL RIG: LY38
DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local
Reference: Ice Surface

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY % (80, 60, 40, 20)	GRADATION %: GRAVEL	SAND	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
		Ice Surface		132.20											
0	HQ3	ICE		0.00											
1															
2															
				129.79											
3		LAKE WATER		2.84											
4															
5															
				127.54											
6		COBBLES (Granite)		5.48											
7															
				125.93											
8		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
9															
10															

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SPEC-F2

LOCATION: 2nd Portage Lake
N: 7213853.491 E: 639415.404

INCLINATION: -58.19° AZIMUTH: 232°

DRILLING DATE: 23-28 May 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

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.		125.93													
8	Boart-Longyear HQ3	Fresh, fine grained, closely foliated, greenish grey, medium strong to weak, MAFIC.		7.38	1									FO,PL,Ro FO,PL,Ro FO,PL,Ro FO,PL,Ro FO,PL,Ro JN,PL,Ro FE			
9					2									FO,PL,Ro FO,PL,Ro FO,PL,Ro OR,IR,Ro Ca JN,PL,Ro FE JN,UN,Ro FE			
10					3									FO,IR,VR SU FO,CU,Ro Su,Qz JN,PL,Ro Su,Qz FO,IR,VR SU FO,CU,Ro SU FO,IR,Ro SU JN,ST,Ro FO,CU,Ro QZ JN,IR,Ro FO,IR,Ro QZ			
11				122.53													
12		Fresh, fine grained, closely foliated, greenish grey, medium strong to weak, MAFIC with chlorite banding from 13.19 to 13.35 m.		11.38	4									FO,CU,Ro Ca FO,IR,Ro Ca JN,IR,Ro Su,Fe JN,IR,Ro QZ FO,PL,Ro Ch JN,PL,Ro Ch,Fe JN,PL,Ro x2 FE FO,UN,Ro HE			
				121.52													
13		Fresh, fine grained, closely foliated with wavy banding, strong, grey with black banding, IRON FORMATION.		12.57	5									JN,ST,Ro Ch FO,PL,Ro QZ JN,PL,Ro			
				120.75													
14		Fresh, fine grained, closely foliated, grey medium strong, MAFICS with frequent bands of chloritization.		13.47	6									JN,CU,Ro Ch FO,PL,SM Ch CJ,CU,SM Ch FO,PL,Ro Ch			
				119.98													
15		Fresh, fine grained, closely foliated, grey medium strong, MAFICS with frequent bands of chloritization.		14.38	7									JN,PL,Ro JN,PL,Ro Ch FO,CU,SM JN,PL,SM JN,IR,Ro			
				119.04													
16		Fresh, fine grained, closely banded with wavy banding, greyish black, strong, IRON FORMATION with distinct foliation.		15.49	8									FO,UN,SM Ch JN,IR,Ro Ch			15.88m to 35.38m Falling Head Packer Test k=1.6x10-4 cm/s
17					9									FO,PL,SM Ch JN,PL,Ro Ch JN,IR,Ro Ch JN,PL,Ro FE JN,PL,Ro Ch JN,CU,Ro FE JN,UN,Ro FE JN,PL,Ro FE FO,IR,Ro FE FO,IR,Ro FE			
				117.43													

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SPEC-F2

LOCATION: 2nd Portage Lake
N: 7213853.491 E: 639415.404

INCLINATION: -58.19° AZIMUTH: 232°

DRILLING DATE: 23-28 May 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
	Boart-Longyear HQ3	Fresh, fine grained, closely foliated, greenish grey, medium strong to strong, MAFICS with wavy foliation.		17.38	10									FO,ST,Ro FE; FO,CU,Ro; FO,PL,SM x2 QZ; JN,ST,Ro FE; FO,PL,Ro; JN,IR,Ro; JN,PL,Ro			
		Fresh, fine grained, closely foliated to massive, greenish grey, moderately strong, MAFICS with occasional calcite stringers.		116.15 / 18.88	11									JN,IR,Ro Ch,Su; FO,ST,SM Ca; FO,IR,Ro QZ; JN,CU,Ro Ca; FO,PL,SM Ca			
					12									JN,PL,Ro QZ; JN,IR,Ro QZ			
					13									JN,PL,Ro QZ; JN,CU,Ro; JN,CU,Ro; JN,PL,Ro Cl; JN,IR,Ro Cl			
					14									FO,ST,Ro; FO,CU,VR Ch; JN,IR,Ro; JN,IR,Ro; JN,IR,Ro; JN,UN,Ro; JN,PL,SM; FO,ST,Ro			
					15									FO,IR,Ro; FO,PL,Ro; JN,IR,Ro; JN,IR,Ro; FO,PL,Ro; JN,IR,Ro; FO,PL,SM; FO,PL,SM; FO,PL,SM; FO,PL,SM; FO,PL,SM			
					16									JN,PL,SM; JN,PL,SM			

Depth scale: 18, 19, 20, 21, 22, 23, 24, 25, 26, 27

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SPEC-F2

LOCATION: 2nd Portage Lake
N: 7213853.491 E: 639415.404

INCLINATION: -58.19° AZIMUTH: 232°

DRILLING DATE: 23-28 May 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
	Boart-Longyear HQ3	Fresh, fine grained, closely foliated to massive, greenish grey, moderately strong, MAFICS with occasional calcite stringers. *(continued)*			16									JN,IR,SM; JN,UN,Ro; JN,PL,SM			
28					17									JN,PL,SM; JN,UN,SM			
29					18									FO,PL,SM; JN,PL,SM; JN,UN,SM; JN,UN,SM; JN,UN,SM; JN,PL,SM			
30																	
31					19									JN,PL,SM; FO,PL,SM; FO,PL,SM			
32														FO,UN,SM			
33					20									JN,PL,SM; JN,PL,Ro			
				103.41 / 33.88													
34		Fresh, fine grained, closely foliated, greenish white/grey, medium strong, MAFIC to ULTRA MAFIC.			21									JN,PL,Ro; JN,UN,Ro; JN,CU,SM			
35														JN,PL,Ro			
36					22									FO,PL,SM x2; FO,PL,SM; JN,UN,Ro			
37					23									JN,CU,Ro; FO,PL,Ro			

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SPEC-F2

LOCATION: 2nd Portage Lake
N: 7213853.491 E: 639415.404

INCLINATION: -58.19° AZIMUTH: 232°

DRILLING DATE: 23-28 May 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
38	Boart-Longyear HQ3	Fresh, fine grained, closely foliated, greenish white/grey, medium strong, MAFIC to ULTRA MAFIC *(continued)*			23												
39					24									JN,PL,Ro JN,PL,SM JN,CU,SM FO,PL,SM			
40					25									FO,PL,SM Bt Qz FO,PL,SM Bt Qz FO,PL,SM Bt Qz FO,PL,SM Bt Qz			
41					26									JN,PL,SM Bt Qz JN,PL,SM Bt Qz JN,PL,SM Bt Qz JN,PL,SM Bt Qz FO,PL,SM Bt Qz FO,PL,SM x2 Bt Qz JN,PL,SM Bt Qz			
42					27									JN,CU,SM Bt Qz JN,PL,SM			
43					28									JN,IR,SM FO,IR,SM			
44					29									FO,PL,SM			
45																	
46																	
47																	

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SPEC-F2

LOCATION: 2nd Portage Lake
N: 7213853.491 E: 639415.404

INCLINATION: -58.19° AZIMUTH: 232°

DRILLING DATE: 23-28 May 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
48	Boart-Longyear HQ3	Fresh, fine grained, closely foliated, greenish white/grey, medium strong, MAFIC to ULTRA MAFIC *(continued)*			30									JN,IR,Ro; JN,IR,Ro; FO,ST,Ro; FO,PL,SM; JN,PL,SM; JN,IR,Ro			51.88m to 74.38m Falling Head Packer Test k=1.3x10-4 cm/s
49					31									JN,CU,Ro; JN,PL,Ro; FO,CU,Ro			
50																	
51					32									FO,CU,SM; FO,PL,SM x4; FO,PL,SM; FO,PL,SM; FO,PL,SM			
52					33									FO,PL,SM x3; FO,PL,SM; FO,IR,Ro			
53														JN,PL,SM			
54					34									JN,ST,Ro; FO,PL,SM; FO,PL,SM; JN,CU,SM; JN,PL,SM			
55														JN,CU,Ro			
56					35									FO,PL,SM; FO,PL,SM			
57					36									FO,PL,SM; FO,IR,Ro; FO,PL,SM; JN,IR,Ro; FO,PL,SM			

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DEPTH SCALE
1 : 50

Golder Associates

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PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SPEC-F2

LOCATION: 2nd Portage Lake
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INCLINATION: -58.19° AZIMUTH: 232°

DRILLING DATE: 23-28 May 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

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
	Boart-Longyear HQ3	Fresh, fine grained, closely foliated, greenish white/grey, medium strong, MAFIC to ULTRA MAFIC *(continued)*			36									FO,PL,Ro x2 JN,CU,Ro JN,IR,Ro			
58					37									JN,PL,SM JN,PL,SM JN,PL,SM			
59				81.74										JN,CU,Ro			
		Fresh, fine grained, closely foliated to massive, greenish grey, medium strong, ULTRAMAFIC		59.38	38									FO,IR,Ro			
60														JN,IR,Ro			
61					39									JN,IR,Ro			
62														JN,IR,Ro			
					40									JN,CU,Ro JN,IR,Ro JN,PL,Ro			
63														JN,ST,Ro JN,IR,Ro			
64					41									JN,CU,Ro JN,IR,SM JN,PL,SM JN,IR,Ro			
65														JN,PL,Ro JN,ST,Ro			
		Fresh, fine grained, closely foliated to massive, grey, medium strong to strong, MAFIC with quartzite stringers.		76.64 65.38	42									FO,IR,Ro JN,ST,Ro JN,PL,Ro JN,IR,Ro FO,CU,Ro FO,ST,Ro			
66																	
67					43									JN,PL,Ro JN,PL,Ro			

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DEPTH SCALE
1 : 50

Golder Associates

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CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SPEC-F2

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INCLINATION: -58.19° AZIMUTH: 232°

DRILLING DATE: 23-28 May 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
68	Boart-Longyear HQ3	Fresh, fine grained, closely foliated to massive, grey, medium strong to strong, MAFIC with quartzite stringers. *(continued)*			43									JN,PL,Ro; JN,PL,Ro QZ; JN,PL,Ro QZ; JN,IR,Ro QZ; JN,PL,Ro QZ			
69					44									FO,PL,Ro; JN,IR,Ro QZ; JN,CU,Ro QZ; JN,IR,Ro; JN,IR,Ro x2			
70					45									FO,IR,Ro; FO,PL,SM; FO,PL,Ro; JN,PL,Ro			
71														JN,PL,SM; JN,IR,Ro; FO,ST,Ro			
72					46									JN,IR,Ro QZ; JN,PL,Ro QZ; FO,PL,SM; JN,CU,Ro; JN,IR,Ro			
73														JN,ST,Ro			
74					47									JN,IR,Ro QZ; JN,IR,Ro QZ; JN,PL,Ro QZ; JN,IR,Ro QZ			
75					48									FO,PL,SM Cl			
76		Fresh, fine grained, closely foliated, grey medium strong, MAFICS with Quartz veinlets and chlorite.		67.72 / 75.88	49									FO,PL,SM Cl; FO,PL,SM x2 Cl; JN,PL,SM Cl; FO,PL,SM x2 Cl; JN,PL,SM Cl; JN,PL,SM Cl; FO,PL,SM x2 Cl			75.88m to 104.38m Falling Head Packer Test k=2.8x10-6 cm/s
77																	

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DEPTH SCALE
1 : 50

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PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SPEC-F2

LOCATION: 2nd Portage Lake
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DRILLING DATE: 23-28 May 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
78	Boart-Longyear HQ3	Fresh, fine grained, closely foliated, grey medium strong, MAFICS with Quartz veinlets and chlorite.*(continued)*			50												
79					51												
80																	
					52									JN,UN,Ro			
														JN,UN,Ro			
														JN,UN,Ro			
														JN,IR,Ro			
81																	
														JN,UN,Ro			
														JN,UN,Ro x2			
82					53									JN,UN,SM			
														JN,UN,Ro			
														FO,PL,SM Cl			
														FO,PL,SM			
83																	
					54									FO,UN,SM			
														JN,UN,SM			
84																	
														JN,UN,Ro			
85					55									JN,IR,Ro			
														FO,PL,SM			
														FO,CU,SM			
														FO,IR,SM			
														FO,PL,SM			
86																	
					56									JN,IR,Ro			
														JN,IR,Ro			
87														FO,ST,Ro			
														JN,PL,Ro			

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DEPTH SCALE
1 : 50

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PROJECT No.: 03-1413-427

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DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
88	Boart-Longyear HQ3	Fresh, fine grained, closely foliated, grey medium strong, MAFICS with Quartz veinlets and chlorite.*(continued)*			56									JN,CU,Ro JN,IR,Ro JN,PL,Ro			
89					57									JN,PL,SM JN,IR,Ro JN,PL,Ro FO,PL,SM			
90					58									FO,PL,SM FO,PL,Ro JN,PL,SM JN,PL,Ro JN,IR,Ro			
91					59									JN,PL,Ro JN,PL,Ro JN,PL,SM FO,IR,Ro			
92				53.69													
93		Fresh, fine grained, chlorite bands, blackish grey, weak, SOAPSTONE with frequent quartz and chlorite veinlets.		92.38	60									JN,PL,SM FO,PL,SM FO,PL,SM FO,PL,Ro			
94					61									JN,IR,Ro FO,PL,Ro FO,PL,SM			
95														FO,PL,SM FO,PL,SM FO,ST,Ro JN,IR,Ro JN,PL,Ro			
96					62									JN,CU,SM JN,IR,Ro FO,PL,SM FO,CU,SM FO,PL,SM x2 FO,PL,SM JN,IR,Ro FO,PL,SM			
97					63									JN,UN,Ro			

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DEPTH SCALE
1 : 50

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DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
98	Boart-Longyear HQ3	Fresh, fine grained, chlorite bands, blackish grey, weak, SOAPSTONE with frequent quartz and chlorite veinlets. *(continued)*			63									FO,PL,SM; FO,PL,SM; FO,CU,SM; JN,CU,Ro	R5 R4 R3 R2 R1	W1 W2 W3 W4	
99					64									FO,PL,Ro; FO,CU,SM; FO,PL,Ro; JN,IR,Ro; JN,IR,Ro; JN,PL,SM			
100					65									JN,PL,Ro; JN,CU,Ro; JN,IR,Ro; JN,PL,SM			
101														JN,PL,SM; JN,PL,SM			
102					66									FO,UN,Ro; JN,PL,Ro; JN,PL,SM			
103					67									JN,PL,Ro; JN,CU,Ro; JN,IR,SM			
104				43.50										JN,PL,SM			
105		Fresh, fine grained, greyish white, strong, MAFICS with quartz veinlets.		104.38	68									JN,ST,Ro; JN,ST,Ro; FO,PL,SM; FO,PL,SM; JN,PL,SM; JN,PL,SM			
106					69									JN,UN,Ro; JN,UN,Ro; JN,UN,Ro			
107														FO,PL,Ro; FO,PL,Ro			

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DEPTH SCALE
1 : 50

Golder Associates

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CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SPEC-F2

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DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
108	Boart-Longyear HQ3	Fresh, fine grained, greyish white, strong, MAFICS with quartz veinlets. *(continued)*			70									FO,PL,SM FO,PL,Ro FO,ST,SM FO,CU,SM VN,IR,Ro JN,CU,SM JN,CU,SM JN,CU,SM			111.88m to 135.38m Falling Head Packer Test k=6.3x10-7 cm/s
109					71									FO,PL,SM JN,IR,Ro CH			
110																	
111					72									JN,PL,SM VN,ST,Ro FO,PL,SM VN,IR,Ro			
112					73									JN,CU,Ro FO,PL,Ro			
113																	
114					74									JN,PL,Ro JN,PL,Ro CH JN,ST,Ro			
115					75									FO,PL,Ro FO,PL,Ro FO,IR,Ro JN,ST,Ro			
116																	
117					76									JN,IR,Ro JN,ST,Ro JN,ST,Ro JN,IR,Ro			

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DEPTH SCALE
1 : 50

Golder Associates

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PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SPEC-F2

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DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
118	Boart-Longyear HQ3	Fresh, fine grained, greyish white, strong, MAFICS with quartz veinlets. *(continued)*			76									JN,IR,Ro; FO,PL,Ro; FO,PL,Ro			
119					77									JN,PL,Ro; JN,ST,Ro; FO,PL,Ro; FO,PL,SM; JN,PL,Ro			
120					78									FO,PL,Ro; FO,PL,SM; JN,IR,Ro; JN,IR,Ro; JN,CU,Ro; FO,PL,Ro			
121					79									FO,PL,Ro; JN,ST,Ro; JN,CU,Ro; FO,PL,Ro; JN,CU,Ro			
122					80									FO,PL,Ro; FO,PL,Ro; FO,PL,Ro; FO,PL,Ro; JN,IR,Ro			
123					81									JN,CU,Ro; JN,UN,Ro			
124					82									JN,ST,Ro; FO,PL,Ro			
125					83												
126																	
127																	

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DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
128	Boart-Longyear HQ3	Fresh, fine grained, greyish white, strong, MAFICS with quartz veinlets. *(continued)*			83												
129					84									JN,CU,Ro JN,IR,Ro			
														JN,CU,Ro			
130														JN,IR,Ro JN,UN,Ro			
131					85												
132					86												
133					87									JN,PL,SM CH			
134																	
135					88												
136					89												
137																	136.88m to 174.38m Falling Head Packer Test k=4.3x10-7 cm/s

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SPEC-F2

LOCATION: 2nd Portage Lake
N: 7213853.491 E: 639415.404

INCLINATION: -58.19° AZIMUTH: 232°

DRILLING DATE: 23-28 May 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
138	Boart-Longyear HQ3	Fresh, fine grained, greyish white, strong, MAFICS with quartz veinlets. *(continued)*			90								JN,PL,Ro SU JN,CU,Ro CA			
139					91								JN,PL,Ro Ch,Su JN,IR,Ro Ch JN,PL,Ro JN,ST,Ro			138.88m to 147.38m Falling Head Packer Test k=2.1x10-6 cm/s
140				12.90									JN,ST,Ro QZ JN,IR,Ro Ch,Qz			
141		Fresh, fine grained, closely banded with wavy banding, strong, greenish black, IRON FORMATION with distinct foliation and chlorite in joints.		140.38 11.63	92								JN,PL,SM Ch,Cl JN,PL,Ro JN,IR,Ro CH JN,PL,SM CH			
142				141.88	93											
143		Fresh, fine grained, closely banded with wavy banding, strong, greenish black, IRON FORMATION.														
144					94								JN,PL,SM JN,PL,SM JN,UN,Ro			
145				9.08 144.88	95											
146		Fresh, fine grained, massive to moderately jointed, grey green, medium strong, IRON FORMATION with pyrite and iron staining in core.														
147					96								JN,PL,SM JN,PL,SM FO,UN,SM			

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SPEC-F2

LOCATION: 2nd Portage Lake
N: 7213853.491 E: 639415.404

INCLINATION: -58.19° AZIMUTH: 232°

DRILLING DATE: 23-28 May 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
148	Boart-Longyear HQ3	Fresh, fine grained, massive to moderately jointed, grey green, medium strong, IRON FORMATION with pyrite and iron staining in core *(continued)*			96									JN,PL,SM Fe,Su JN,PL,SM Fe,Su FO,PL,SM SU			
149					97									JN,IR,Ro			
150				5.26 149.38	98									JN,PL,Ro			
151					99									JN,PL,SM JN,IR,Ro			
152														JN,PL,SM JN,PL,SM JN,PL,SM			
153		Fresh, fine grained, closely foliated to massive, greenish grey, medium strong to strong, INTERMEDIATE VOLCANICS with occasional calcite stringers.			100									JN,PL,Ro JN,IR,Ro JN,PL,Ro			
154					101									JN,PL,SM JN,PL,Ro JN,ST,Ro JN,PL,SM			
155																	154.88m to 174.38m Falling Head Packer Test k=1.5x10-6 cm/s
156					102									JN,CU,Ro JN,IR,Ro JN,PL,SM JN,PL,Ro JN,PL,SM			
157				-1.12 156.88	103									JN,PL,Ro FO,PL,Ro FO,PL,Ro			

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SPEC-F2

LOCATION: 2nd Portage Lake
N: 7213853.491 E: 639415.404

INCLINATION: -58.19° AZIMUTH: 232°

DRILLING DATE: 23-28 May 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
158	Boart-Longyear HQ3	Fresh, fine grained, closely foliated to massive, greenish grey, medium strong to strong, INTERMEDIATE VOLCANICS with quartz banding and trace clay and chlorite in discontinuities *(continued)*			103									FO,PL,Ro			
														JN,PL,SM			
					104									FO,PL,Ro			
159														JN,PL,SM			
														JN,PL,Ro			
														JN,PL,Ro			
160					105									JN,PL,Ro			
161																	
162					106									JN,PL,Ro			
														JN,PL,SM CL			
														JN,PL,SM CL			
														JN,PL,SM CL			
														JN,PL,SM CL			
163					107									JN,PL,SM CL			
														JN,PL,SM CL			
														JN,ST,Ro CL			
164																	
					108									JN,PL,SM CL			
														JN,PL,Ro CL			
														JN,PL,Ro CL			
165														JN,CU,SM CL			
														JN,ST,Ro CL			
				-8.77										JN,PL,Ro CL			
166		Fresh, fine grained, closely foliated to massive, greenish grey, medium strong to strong, INTERMEDIATE VOLCANICS with chloritization in discontinuities.		165.88	109									JN,PL,Ro CL			
														JN,CU,Ro			
														FO,PL,SM SU			
167																	

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS
CHECKED: CJC

PROJECT No.: 03-1413-427

RECORD OF DRILLHOLE: 03GT-SPEC-F2

LOCATION: 2nd Portage Lake
N: 7213853.491 E: 639415.404

INCLINATION: -58.19° AZIMUTH: 232°

DRILLING DATE: 23-28 May 2003

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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
168	Boart-Longyear HQ3	Fresh, fine grained, closely foliated to massive, greenish grey, medium strong to strong, INTERMEDIATE VOLCANICS with chloritization in discontinuities. *(continued)*			110									JN,PL,Ro CA JN,PL,Ro CH JN,PL,Ro Ca,Ch JN,CU,Ro CH JN,ST,Ro Ch,Ca,Qz JN,IR,Ro QZ	R5	W1	
				-11.32 168.88													
169		Fresh, medium grained, reddish brown, strong, FELSIC VOLCANICS.			111									JN,IR,Ro CA JN,UN,Ro CA JN,CU,Ro CA JN,PL,SM JN,ST,Ro			
170														JN,PL,SM			
171					112									CJ,IR,Ro QZ JN,PL,Ro JN,IR,Ro			
172					113									JN,PL,Ro JN,PL,Ro			
173																	
174					114									JN,PL,Ro FE JN,PL,Ro FE JN,IR,Ro FE			
				-15.99 174.38													
175		End of BOREHOLE.															
176																	
177																	

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CS/TS
CHECKED: CJC

PROJECT No.: 022-1427A Task 2000

RECORD OF DRILLHOLE: 02GT-01

LOCATION: East Dyke

DRILLING DATE: 7 May, 2002

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)
		Ice Surface		
0	Boart-Longyear LY38 - HQ3	Grounded Ice.		0.00
		At 0.5-3.5m depth cobbles and gravel recovered. Very poor recovery even with triple tube. - No soil material recovered. - Fresh cobbles and gravel of variable origin; Granite, intermediate volcanics, quartz [OVERBURDEN].		0.50
		At 3.5-5.6m depth cobbles and gravel. - No soil material recovered. - Fresh cobbles and gravel of variable origin; Granite, intermediate volcanics, quartz, [OVERBURDEN].		3.50
		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.		

SAMPLES: NUMBER, TYPE, BLOWS/0.3m

CORE: RUN No., RECOVERY % (80, 60, 40, 20)

GRADATION %: GRAVEL, SAND, FINES

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-5}, 10^{-4}, 10^{-3}, 10^{-2}

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

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: CJC/JRT

CHECKED:

PROJECT No.: 022-1427A Task 2000

RECORD OF DRILLHOLE: 02GT-01

LOCATION: East Dyke

DRILLING DATE: 7 May, 2002

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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 0.3	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.															
6	Boart-Longyear LY38 - HQ3	Fresh, green to grey, massive fine to medium grained (serpentinized) weak to medium strong [INTERMEDIATE VOLCANICS]. 7.70m to 7.97m Quartz Vein. - Core is fractured along foliation surfaces. - Core recovery improves down hole.		5.60	1									J,PL,P J,PL,R J,PL,R G J,PL,SM			4.5m to 6.5m Constant Head Packer Test no flow
7					2									J,UE,SM FO,PL,R BC,, J,I,R J,I,R J,I,R BC,,			7.36m - 7.45m Sample Taken 7.5m to 9.5m Falling Head Test k=1.7x10-4 cm/s
8														J,PL,SM J,PL,SM FO,UE,R Fe FO,PL,SM Fe FO,PL,SM x10x			Constant Head Test k=4.0x10-5 cm/s
9														FO,PL,SM FO,PL,SM FO,PL,SM J,I,VR			9.10m - 9.22m Sample Taken
		End of DRILLHOLE.		9.50													
10																	
11																	
12																	
13																	
14																	
15																	

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: CJC/JRT

CHECKED:

PROJECT No.: 022-1427A Task 2000

RECORD OF DRILLHOLE: 02GT-02A

LOCATION: East Dyke

DRILLING DATE: 8 May, 2002

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY %	GRADATION %: GRAVEL	SAND	FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ice Surface													
0	LY38 - HQ3	Ice.		0.00											
2.40		Water.													
3.90		Loose, homogenous, wet, dark grey, well graded, clean SAND (lake bottom). [OVERBURDEN]													
		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

RECOVERY %: 80, 60, 40, 20

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-5}, 10^{-4}, 10^{-3}, 10^{-2}

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

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: CJC/JRT

CHECKED:

PROJECT No.: 022-1427A Task 2000

RECORD OF DRILLHOLE: 02GT-02A

LOCATION: East Dyke

DRILLING DATE: 8 May, 2002

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

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 0.3	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.															
7	Boart-Longyear LY38 - HQ/HW	Fresh, grey, laminated, fine to medium grained, strong, INTERMEDIATE VOLCANICS.		6.60										J,PL,R			
8		- Rock very competent, very few material breaks, remainder are mechanical.			1									J,PL,R			
		- Interbeds of silicified material, up to 10cm thick.												J,ST,R			
		- Broken core zones due to re-drill of hole.												FO,PL,R			
9														J,PL,R J,PL,R			
		End of DRILLHOLE.		9.50										FO,PL,R			
10																	
11																	
12																	
13																	
14																	
15																	
16																	

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CJC/JRT
CHECKED:

PROJECT No.: 022-1427A Task 2000

RECORD OF DRILLHOLE: 02GT-02B

LOCATION: East Dyke

DRILLING DATE: 8 May, 2002

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY %	GRADATION %: GRAVEL	SAND	FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ice Surface													
0	LY38 - HQ3	Ice.		0.00											
2.40		Water.													
3.90		Loose, homogenous, wet, dark grey, well graded, clean SAND (lake bottom). [OVERBURDEN]			1	WS									
7		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Hydraulic conductivity scale: 10^{-5}, 10^{-4}, 10^{-3}, 10^{-2}

Water content scale: Wp, W, Wl; 10, 20, 30, 40

Recovery scale: 80, 60, 40, 20

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: CJC/JRT

CHECKED:

PROJECT No.: 022-1427A Task 2000

RECORD OF DRILLHOLE: 02GT-02B

LOCATION: East Dyke

DRILLING DATE: 8 May, 2002

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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 0.3	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.															
7	Boart-Longyear LY38 - HQ/HW	Fresh, grey, laminated, fine to medium grained, strong, INTERMEDIATE VOLCANICS. - Rock very competent, very few natural breaks, remainder are mechanical. - Interbeds of silicified material, up to 10cm thick. - Broken core zones due to re-drill of hole.		7.00	1									FO,PL,R; FO,U,VR; FO,PL,R; FO,PL,R; BC,,			7.0m to 7.2m Sample Taken; 7.5m to 9.5m Falling Head and Constant Head Packer Test attempted. Data unreliable. 8.06m to 8.20m Sample Taken 8.5m to 12.5m Falling Head Test Data unreliable
8																	
9																	
10														BC,,			
11		Fresh, grey-green, thinly foliated, chloritic, fine grained, weak to medium strong, chloritic, sericitic INTERMEDIATE VOLCANICS. - Interbeds of silicified material, up to 10cm thick.		10.30	2									J,I,VR; FR,C,SM; FO,C,SM; J,PL,R; J,I,VR; J,C,SM			10.5m to 12.5m Falling Head Packer Test k=3.5x10-5 cm/s
12																	
		End of DRILLHOLE.		12.50													
13																	
14																	
15																	
16																	
17																	

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: CJC/JRT

CHECKED:

PROJECT No.: 022-1427A Task 2000

RECORD OF DRILLHOLE: 02GT-04

LOCATION: East Dyke

DRILLING DATE: 10 May, 2002

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY % (80, 60, 40, 20)	GRADATION %: GRAVEL	SAND	FINES	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-5}, 10^{-4}, 10^{-3}, 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl; 10, 20, 30, 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface													
0	LY38 - HQ3	Loose homogeneous, moist, subbrounded to rounded cobbles, coarse gravel, some sand (TILL) [OVERBURDEN].		0.00											
1															
2															
3		Loose homogeneous, moist, subangular to subrounded bolders and cobbles, coarse gravel, trace sand (TILL) [OVERBURDEN].		2.75											3.5m to 8.5m Packer Test #1 Test Data Unreliable.
4		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													
5															
6															
7															
8															
9															
10															

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: CJC/JRT

CHECKED:

PROJECT No.: 022-1427A Task 2000

RECORD OF DRILLHOLE: 02GT-04

LOCATION: East Dyke

DRILLING DATE: 10 May, 2002

DATUM: Local

DRILL RIG: LY38

INCLINATION: -50.304° AZIMUTH: 22°

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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 0.3	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.															
4	Boart-Longyear LY38 - HQ/HW			3.85										BC,, BC,,			
														J,PL,R			Thermistor TC-1 installed from ground surface to 30.0m depth. 4.36m to 4.60m Sample Taken
					1									J,PL,SM			
														BC,,			Nodal Down Hole Depths
5		- Pervasive silicification and potassic alteration.												BC,, J,PL,SM			
														BC,,			1 0.5m 2 1.0m 3 3.0m 4 5.0m 5 10.0m 6 15.0m 7 20.0m 8 30.0m
		- Foliation approx. 15 degrees TCA.												BC,,			
														J,C,R			
6														J,PL,SM			
		Fresh, grey, foliated, medium grained, strong to very strong, INTERMEDIATE VOLCANICS.															6.30m to 6.55m Sample Taken 6.5m to 8.5m Constant Head Test k=2.2x10-6 cm/s
														J,PL,R			
7					2												
8														FO,PL,R J,PL,R			
														,, Contact Healed			
				8.77													
9														FO,PL,R			
		- Small shear zone, pitting of core. - Chloritic margins.												SH,I,VR BC,,			
														BC,, SH,PL,R			9.5m to 17.50m Falling Head Packer Test k=3.2x10-5 cm/s
														J,U,R			
10		- Matrix is soapy to the touch; Sericite visible on surfaces.			3									BC,,			
														BC,, J,PL,SM K BC,, F,,			
														J,U,VR			
11		- 11.0m Iron Staining on foliation surfaces.												FO,U,R			
		- 11.27m Iron Staining on foliation surfaces.												FO,PL,SM Fe			
		Fresh, grey-green, foliated, fine grained, chloritic, weak to medium strong, INTERMEDIATE VOLCANICS.												FO,PL,SM			
		- 11.5m to 12.07m Iron Staining along foliation surfaces.															
12		- 12.07m Increase in rock strength.												FO,PL,R x13x Fe			
					4									FO,PL,SM			
13														FO,PL,SM			13.12m to 13.33m Sample Taken.
														FO,C,SM FO,U,SM			

CONTINUED NEXT PAGE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: CJC/JRT

CHECKED:

PROJECT No.: 022-1427A Task 2000

RECORD OF DRILLHOLE: 02GT-04

LOCATION: East Dyke

DRILLING DATE: 10 May, 2002

DATUM: Local

DRILL RIG: LY38

INCLINATION: -50.304° AZIMUTH: 22°

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
14	Boart-Longyear, LY38 - HQ/HW	- 15.64m Iron staining on foliation. Fresh, grey-green, foliated, fine grained, chloritic, weak to medium strong, INTERMEDIATE VOLCANICS. *(continued)*			4				80 60 40 20	80 60 40 20	80 60 40 20	5 10 15 20	0 30 60 90	FO,PL,SM FO,PL,SM	R5 R4 R3 R2 R1	W1 W2 W3 W4	
														BC,,			
														BC,,			
15														FO,PL,SM			
														FO,PL,SM Fe			
16					5												
														J,U,SM BC,,			
														BC,, J,U,SM			
17														J,U,R			
				17.50													
														BC,,			
18														BC,, J,U,R J,U,R			
														J,U,R			18.5m to 29.5m Falling Head Packer Test k=2.2x10-6 cm/s
19		Fresh, grey-green, massive in some foliated zones, fine grained to medium grained, strong, INTERMEDIATE VOLCANICS.			6									J,U,R			
														J,U,R Fe			
														J,U,R			
20														J,U,R			
														J,U,R			
				20.50										J,U,R			
														J,U,R			
														J,U,R J,U,R			
21														BC,,			
		Fresh, grey, massive with some foliation, fine grained to medium grained, strong, INTERMEDIATE VOLCANICS. - at 21.5m to 22.0m Possible Fault Zone.															
22					7									BC,, J,U,R Fe			
														J,U,R Fe			
														J,PL,R			
23														J,PL,R J,PL,R Fe			
														J,U,R Fe			
				23.50	8												

CONTINUED NEXT PAGE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: CJC/JRT

CHECKED:

PROJECT No.: 022-1427A Task 2000

RECORD OF DRILLHOLE: 02GT-04

LOCATION: East Dyke

DRILLING DATE: 10 May, 2002

DATUM: Local

DRILL RIG: LY38

INCLINATION: -50.304° AZIMUTH: 22°

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	ROCK STRENGTH INDEX	WEATHERING INDEX	NOTES WATER LEVELS INSTRUMENTATION
24	Boart-Longyear LY38 - HQ/HW	Fresh, grey, massive with some foliation, fine to medium grained, strong, INTERMEDIATE VOLCANICS. *(continued)*												J,PL,R			
														J,PL,R			
														J,PL,R			
25					8									J,U,R			
26																	
				26.50													
27		Fresh, grey-green, massive with zones of foliation, fine to medium grained, strong, INTERMEDIATE VOLCANICS.												J,U,R			
														J,U,R			
														BC,,			
28					9									BC,,			
														BC,,			
														BC,,			
29														BC,,			
														BC,,			
														FO,U,R			
30					10												
		End of DRILLHOLE.		30.10													
31																	
32																	
33																	

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: CJC/JRT

CHECKED:

PROJECT No.: 022-1427A Task 2000

RECORD OF DRILLHOLE: 02GT-03

LOCATION: East Dyke

DRILLING DATE: 11 May, 2002

DRILL RIG: LY38

DRILLING CONTRACTOR: Boart-Longyear

DATUM: Local

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	CORE: RUN No.	RECOVERY %	GRADATION %: GRAVEL	SAND	FINES	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface													
0	LY38 - HQ3	Boulder TILL. [OVERBURDEN] - Attemped SPT's with borehole oriented vertically but could not drive.		0.00	1	50 DO	>50								1.8m to 3.1m Falling Head Test.
3		Bedrock Encountered. Refer to ROCK LOG for continuation of rock description.													

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-5} 10^{-4} 10^{-3} 10^{-2}

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

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: CJC/JRT

CHECKED:

PROJECT No.: 022-1427A Task 2000

RECORD OF DRILLHOLE: 02GT-03

LOCATION: East Dyke

DRILLING DATE: 11 May, 2002

DATUM: Local

DRILL RIG: LY38

INCLINATION: -50.879° AZIMUTH: 175°

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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 0.3	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.															
3	Boart-Longyear, LY38 - HQ3	Slightly weathered, green-grey, foliated, fine to medium grained, medium strong INTERMEDIATE VOLCANICS.		3.00	1									J,PL,R J,PL,R Fe BC,, BC,, FO,PL,R G J,PL,R G BC,, BC,, FO,PL,R Fe J,PL,R Fe J,PL,R J,PL,R BC,,			Thermistor TC-2 installed from ground surface to 29.50m depth. Nodal Down Hole Depths 1 0m 2 0.5m 3 2.5m 4 4.5m 5 9.5m 6 14.5m 7 19.5m 8 29.5m
4																	
5																	
6		Fresh, green-grey, foliated, fine to medium grained, medium strong, INTERMEDIATE VOLCANICS.		5.50	2									BC,, J,PL,R J,PL,R J,PL,R J,PL,R BC,, FR,, J,PL,R			
7																	
8																	
9		Fresh, grey, foliated, small to medium grained, strong, INTERMEDIATE VOLCANICS.		8.50	3									FO,PL,R FO,PL,R F,PL,R ,, MB ,, MB BC,, BC,,			9.5m to 14.5m Falling Head Packer Test. No recovery.
10																	
11																	
12		Fresh, grey, foliated, small to medium grained, strong, INTERMEDIATE VOLCANICS.		11.50	4									FO,PL,R FO,PL,R FO,PL,R FO,PL,R			
13																	

CONTINUED NEXT PAGE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: CJC/JRT

CHECKED:

PROJECT No.: 022-1427A Task 2000

RECORD OF DRILLHOLE: 02GT-03

LOCATION: East Dyke

DRILLING DATE: 11 May, 2002

DATUM: Local

DRILL RIG: LY38

INCLINATION: -50.879° AZIMUTH: 175°

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 0.3 (5 10 15 20)	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 LY38 - HQ3	Fresh, grey, foliated, small to medium grained, strong, INTERMEDIATE VOLCANICS.*(continued)*			4									BC,, BC,, FO,PL,R FO,PL,R FO,PL,R			
14																	
				14.50													
15														FO,PL,R F,PL,R BC,,			
16		Fresh, grey, foliated, small to medium grained, strong, INTERMEDIATE VOLCANICS.			5									BC,, FO,PL,R FO,PL,R FO,PL,R			16m to 30m Falling Head Packer Test #3. No recovery.
17														J,U,R			
				17.50													
18														J,U,R J,U,R FO,PL,SM ,, ,,			
19		Fresh, grey, foliated, small to medium grained, strong, INTERMEDIATE VOLCANICS.			6									J,PL,R FO,PL,R			
20														FO,U,R			
				20.50													
21														FO,U,R FO,PL,R			
22		Fresh, green-grey, foliated, fine to medium grained, strong, INTERMEDIATE VOLCANICS. - Fe staining on joint surface, with some clay infill.			7									J,U,R Fe CL FO,PL,R J,C,R J,U,R J,PL,R			22.26m to 22.45m Sample Taken
23																	

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DEPTH SCALE

1 : 50

Golder Associates

LOGGED: CJC/JRT

CHECKED:

PROJECT No.: 022-1427A Task 2000

RECORD OF DRILLHOLE: 02GT-03

LOCATION: East Dyke

DRILLING DATE: 11 May, 2002

DATUM: Local

DRILL RIG: LY38

INCLINATION: -50.879° AZIMUTH: 175°

DRILLING CONTRACTOR: Boart-Longyear

FR-FRACTURE, CL-CLEAVAGE, SH-SHEAR, VN-VEIN, F-FAULT, J-JOINT, P-POLISHED, S-SLICKENSIDED, SM-SMOOTH, R-ROUGH, ST-STEPPED, PL-PLANAR, FL-FLEXURED, UE-UNEVEN, W-WAVY, C-CURVED, BC-BROKEN CORE, MB-MECH. BREAK, B-BEDDING, 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 0.3 (5 10 15 20)	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
23	Boart-Longyear LY38 - HQ3				7									J,I,VR			
														FO,W,R J,PL,SM			
24		- Conjugate joint with Iron staining and polished surfaces. - Orthogonal joint with Iron staining and clay. - 24.75m to 24.85m Broken core with iron staining on the surface.												J,PL,SM Fe K J,PL,SM Fe Ch, Orthogonal J,W,R Fe Ch BC,, BC,,			
25					8									J,W,VR Fe J,PL,R Ch FO,PL,R			
														FO,W,VR			
26		- Conjugate joint with Iron staining. Fresh, green-grey, foliated, fine to medium grained, strong, INTERMEDIATE VOLCANICS. *(continued)* - Orthogonal joints with Iron staining.												J,PL,SM Fe Ch FO,PL,SM J,W,VR Fe Orthogonal FO,U,SM			26.72m to 26.96m Sample Taken
27														FO,PL,SM FO,C,SM J,PL,SM FO,PL,R			
28					9									J,PL,SM Orthogonal			
		- Iron staining on conjugate joint surface.												J,I,VR Fe			
29		- Iron staining and clay coating of conjugate surface.												FO,PL,R J,PL,R Fe Cl FO,PL,SM			
		End of DRILLHOLE.		29.50													
30																	
31																	
32																	
33																	

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: CJC/JRT

CHECKED:

APPENDIX VI

SEISMIC RISK CALCULATION FOR MEADOWBANK SITE

NATURAL RESOURCES CANADA RESSOURCES NATURELLES CANADA
GEOLOGICAL SURVEY OF CANADA COMMISSION GEOLOGIQUE DU CANADA

SEISMIC RISK CALCULATION * CALCUL DE RISQUE SEISMIQUE *

REQUESTED BY/ DEMANDE PAR Don Hickson, Golder Assoc., Vancouver

SITE Tenek Lake, Nunavut

LOCATED AT/ SITUE AU 65.00 NORTH/NORD 96.05 WEST/OUEST

PROBABILITY OF EXCEEDENCE PER ANNUM/ PROBABILITE DE DEPASSEMENT PAR ANNEE	0.010	0.005	0.0021	0.001
PROBABILITY OF EXCEEDENCE IN 50 YEARS/ PROBABILITE DE DEPASSEMENT EN 50 ANS	40 %	22 %	10 %	5 %
PEAK HORIZONTAL GROUND ACCELERATION (G) / ACCELERATION HORIZONTALE MAXIMALE DU SOL (G)	0.018	0.025	0.034	0.044
PEAK HORIZONTAL GROUND VELOCITY (M/SEC) / VITESSE HORIZONTALE MAXIMALE DU SOL (M/SEC)	0.011	0.017	0.029	0.039

* REFERENCES

1. NEW PROBABILISTIC STRONG SEISMIC GROUND MOTION MAPS OF CANADA: A COMPILATION OF EARTHQUAKE SOURCE ZONES, METHODS AND RESULTS. P.W. BASHAM, D.H. WEICHERT, F.M. ANGLIN, AND M.J. BERRY EARTH PHYSICS BRANCH OPEN FILE NUMBER 82-33, OTTAWA, CANADA 1982.

2. ENGINEERING APPLICATIONS OF NEW PROBABILISTIC SEISMIC GROUND-MOTION MAPS OF CANADA. A.C. HEIDEBRECHT, P.W. BASHAM, J.H. RAINER, AND M.J. BERRY CANADIAN JOURNAL OF CIVIL ENGINEERING, VOL. 10, NO. 4, P. 670-680, 1983.

3. NEW PROBABILISTIC STRONG GROUND MOTION MAPS OF CANADA. P.W. BASHAM, D.H. WEICHERT, F.M. ANGLIN, AND M.J. BERRY, BULLETIN OF THE SEISMOLOGICAL SOCIETY OF AMERICA, VOL. 75, NO. 2, P. 563-595, 1985.

4A. SUPPLEMENT TO THE NATIONAL BUILDING CODE OF CANADA 1990, NRCC NO. 30629. CHAPTER 1: CLIMATIC INFORMATION FOR BUILDING DESIGN IN CANADA. CHAPTER 4: COMMENTARY J: EFFECTS OF EARTHQUAKES.

4B. SUPPLEMENT DU CODE NATIONAL DU BATIMENT DU CANADA 1990, CNRC NO 30629F. CHAPITRE 1: DONNEES CLIMATIQUES POUR LE CALCUL DES BATIMENTS AU CANADA. CHAPITRE 4: COMMENTAIRE J: EFFETS DES SEISMES.

Tenek Lake, Nunavut

ZONING FOR ABOVE SITE/ ZONAGE DU SITE CI-DESSUS

1990 NBCC/CNBC: ZA = 0; ZV = 0; V = 0.00 M/S

ACCELERATION ZONE/ ZONE D'ACCELERATION ZA=0
ZONAL ACCELERATION/ ACCELERATION ZONALE 0.00 G

VELOCITY ZONE/ ZONE DE VITESSE ZV=0
ZONAL VELOCITY/ VITESSE ZONALE 0.00 M/S

1990 NBCC/CNBC **
SEISMIC ZONING MAPS/ CARTES DU ZONAGE SEISMIQUE

PROBABILITY LEVEL: 10% IN 50 YEARS
NIVEAU DE PROBABILITE: 10% EN 50 ANNEES

G OR M/S	ZONE	ZONAL VALUE/ VALEUR ZONALE
0.00		
	0	0.00
0.04		
	1	0.05
0.08		
	2	0.10
0.11		
	3	0.15
0.16		
	4	0.20
0.23		
	5	0.30
0.32		
	6*	0.40

* ZONE 6: NOMINAL VALUE/ VALEUR NOMINALE 0.40;
SITE-SPECIFIC STUDIES SUGGESTED FOR IMPORTANT PROJECTS/
ETUDES COMPLEMENTAIRES SUGGEREES POUR DES PROJETS D'IMPORTANCE.

** FOR NBCC APPLICATIONS, CALCULATED ZONE VALUES AT A SITE SHOULD BE
REPLACED BY EFFECTIVE ZONE VALUES [ZA(EFF) OR ZV(EFF)] AS SHOWN BELOW/
POUR APPLICATIONS SELON LE CNBC, ON DOIT REMPLACER LES VALEURS ZONALES
CALCULEES POUR UN SITE PAR LES VALEURS EFFECTIVES [ZA(EFF) OU ZV(EFF)]
COMME MONTRE CI-DESSOUS:

1. IF/SI (ZA - ZV) > 1, ===> ZA(EFF) = ZV + 1.
OR/OU
2. IF/SI (ZA - ZV) < 1, ===> ZA(EFF) = ZV - 1.
OR/OU
3. IF/SI ZV=0 AND/ET ZA > 0, ===> ZV(EFF) = 1.

(SEE REFERENCE 2 CITED ABOVE, PAGE 677)
(VOIR PAGE 677 DE LA REFERENCE 2 CI-DESSUS) Jul 9 2003 12:44