Attachment 8.7

Milne Port Factual Geotechnical Report

(536 Pages)

Baffinland Iron Mines Corporation
Mary River Expansion Project

2016-2017-2018 Milne Port Geotechnical Investigation Factual Data Report

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2018-09-11	0	Approved for Use	M Yang	W Hoyle	D Stanger	R Stefan
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						Client

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Document Number Explanation

This report was Approved for Use as Rev. 2 on October 4th, 2017 under the following document number: H352034-1000-229-230-0002. The current revised version of this report was supplemented with the new information associated with the 22 boreholes drilled in 2017 and 4 boreholes drilled in 2018. As a result of this additional information, the document number was revised to H353004-40000-229-230-0009. Although the current project number (H353004) was used to report the new data (borehole reports, test reports, etc.), the former project number (H352034) is still shown on the borehole reports/data sheets from previous investigations.

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This report contains the expression of the professional opinion of Hatch exercising reasonable care, skill and judgment and based upon information available at the time of preparation. Hatch has conducted this investigation in accordance with the methodology outlined herein. It is important to note that the methods of evaluation employed, while aimed at minimizing the risk of unidentified problems, cannot guarantee their absence. The quality of the information, conclusions and estimates contained herein is consistent with the intended level of accuracy as set out in this report, as well as the circumstances and constraints under which this report was prepared.

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1. Introduction

Baffinland Iron Mines Corporation (BIM) currently operates the Mary River iron ore mine in Nunavut, Canada. BIM plans to increase the production to 12 Mtpa, shipping the output through Milne Port. This will be achieved by upgrading the mine fleet, constructing a 110 km long rail line from the mine site to the port, building a new crushing and screening facility at the port, construction of larger ore stockpiles and building a second ore dock for ship loading.

Hatch Ltd. (Hatch) was retained by BIM to conduct geotechnical drilling investigations for the design of a railway alignment spanning from Milne Port to the Mine Site, and infrastructures at Milne Port. The drilling program included four phases; the first phase was executed in the Fall of 2016, while the second, third, and fourth phases were, completed in Summer 2017, Fall 2017, and Spring 2018, respectively.

This report summarizes the factual data result of the geotechnical investigation for the port infrastructure, including rail unloading, tanks, crusher, screening, tail pulley, reclaimer berm, reclaim tunnel, conveyors, and module delivery route. The site program, borehole log reports, photographs and laboratory testing results are detailed in the following sections.

1.1 Previous Investigations

Geotechnical investigation programs have previously been conducted at the Mary River mine site, Steensby Inlet port structure, and the Milne Inlet port site, the Tote Road, as well as offshore investigations at Milne Port.

These previous programs were conducted in 2006, 2007, and 2008 by Knight Piésold Consulting Ltd. (Knight Piésold), in 2010 by AMEC Earth and Environmental (AMEC), and in 2011 and 2013-2014 by Hatch. Relevant information from these investigations has been included in this report.

1.2 Local Topology and Geology

The site of the proposed Milne Port facilities is located at the southern extent of Milne Inlet. The area where the stockpiles, and the crusher and screener will be located is in the delta of Phillips Creek. The geology of this area is generally mapped as deltaic sediments including clay, silt, sand and gravel. Closer to the water, and comprising the northern extent of the stacker reclaimer foundation, the area is mapped as beach sediments, specifically sand.

The rail unloading area is located on a bedrock ridge which is mapped as undifferentiated gneiss and granitic rock. The ridge rises above the surrounding delta and forms the rock outcrop ridge. The area along the base of the ridge is mapped as glacial end moraine, comprised of or matted by till. The tank farm location is near the boundary between the deltaic sediments and the glacial end moraine provinces.

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2. Geotechnical Investigation

2.1 General

This report provides geotechnical investigation information for the Milne Port area. The information associated with the rail alignment is provided in a report entitled, “2016-2017-2018 Rail Geotechnical Investigation Factual Data Report, H353004-10000-229-230-0005”.

2.2 Borehole Locations

A summary of the as-drilled borehole locations for Milne Port infrastructure is provided in Table 2-1. All coordinates are located within Zone 17 of the Universal Transverse Mercator (UTM) Grid. The horizontal datum for this project is the North American Datum 1983 (NAD 83). The as-drilled borehole location plan is provided in Appendix A.

Table 2-1: Milne Port Borehole Locations

Borehole Number	Easting (m)	Northing (m)	Depth (m)
BH16-M001	503,504	7,976,237	15.2
BH16-M002	503,757	7,975,894	15.2
BH16-M003	503,714	7,975,892	15.2
BH16-M004	503,302	7,975,591	15.2
BH16-M005	503,270	7,975,606	15.2
BH16-M006	503,136	7,975,081	15.2
BH16-M007	503,822	7,974,945	9.1
BH16-M008	503,771	7,974,959	21.3
BH16-M009	503,904	7,974,935	5.3
BH16-M010	503,394	7,974,877	15.2
BH16-M011	503,339	7,974,868	15.2
BH16-M012	503,268	7,974,848	15.2
BH16-M013	503,140	7,974,820	15.2
BH16-M014	503,052	7,974,782	15.2
BH16-M015	503,007	7,974,799	15.2
BH17-RD-1	504,095	7,976,552	6.1
BH17-RD-1A	504,090	7,976,463	4.6
BH17-RD-1B	504,100	7,976,358	4.9
BH17-RD-1C	504,075	7,976,302	6.1
BH17-RD-2	503,872	7,976,162	4.6
BH17-RD-3	503,599	7,975,985	4.6
BH17-RD-4	503,594	7,975,136	4.6
BH17-RD-5	503,596	7,974,811	2.65
BH17-RD-6	503,922	7,974,286	6.1
BH17-RD-7	503,896	7,974,423	3.7
BH17-EBC-8	503,535	7,976,327	39.5
BH17-EBC-9	503,548	7,976,371	39.5
BH17-10	503,476	7,974,905	16.7
BH17-11	503,268	7,976,025	15.2
BH17-12	503,180	7,975,752	15.2
BH17-13	503,159	7,975,912	6.1
BH17-14	503,187	7,975,913	6.1
BH17-15	503,222	7,975,913	6.1
BH17-CAMP-1	503,961	7,976,147	6.1
BH17-M008-R	503,772	7,974,960	22.0

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Borehole Number	Easting (m)	Northing (m)	Depth (m)
BH17-EBC-1	503,783	7,974,921	21.7
BH17-EBC-2	503,791	7,974,895	21.8
BH18-M001	503,423	7,974,892	25.9
BH18-M002	503,328	7,974,867	39.6
BH18-M003	503,055	7,974,868	50.3
BH18-004	563,499	7,975,260	77.7

2.3 Drilling and Sampling Methodology

The geotechnical boreholes were developed using a BL100 Mini Sonic Drilling rig manufactured and operated by Boart Longyear, shown in Figure 1. The boreholes were advanced by vibration of the drill string at a high frequency in addition to rotary motion, and pressure by the drilling head (vibracore). Casing, size H, was advanced with the vibracore to keep the hole open between runs. Sonic drilling does not require water at shallow depths in the overburden.

When using vibracore drilling in overburden, a 3 m drilling rod was advanced 1.5 m into the ground for each run. The bottom 1.5 m was collected into a 4 inch split PVC pipe as shown in Figure 2. Soil collected above the bottom 1.5 m, if encountered, was disposed to ensure the collected sample was not contaminated by surface soil “fall in” accumulated at the bottom of the drilled hole. Soil sample were photographed in the PVC split. Once the material in the split was photographed and sampled, the splits were secured using caps and aluminum tape, and stored in a shipping container at the Milne Port site.

Where encountered, bedrock was cored using an HQ-3 triple tube wireline core barrel, which required the use of water and casing. In addition, rock coring required the installation of a high-speed rotary head on the drilling rig every time there was a switch from sonic drilling in soil to rock coring.



Figure 1: Boart Longyear Mini Sonic Drilling Rig

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Figure 2: Sample Collected in a PVC Split using a Mini Sonic Drilling Rig

The Hatch field supervisor documented the materials encountered, and determined in situ testing and sampling requirements. When ice was encountered in the borehole, it was documented and classified according to ASTM D4083. The description of soils as detailed in the geotechnical borehole reports are based on field visual classification and confirmatory laboratory testing in accordance with the explanatory notes included with these reports.

The detailed geotechnical borehole drilling reports are contained in the attached Appendix B and should be referenced for a complete description of soil materials and the in situ testing and sampling performed. Appendix B also contains a set of explanatory notes detailing terminology used in the borehole reports. Additional observations such as testing and sampling procedures, percent recovery, water loss/gain, and mechanical heating of samples were recorded, along with time of observation. Photographs of samples collected during the drilling investigation are contained in Appendix C.

2.4 Safety Management Plan

Safety management was a key consideration during the planning process for the geotechnical investigations. A safety management plan was prepared by Hatch and reviewed by BIM and Boart Longyear. A Job Hazard Analysis (JHA), identifying the hazards associated with the work and the controls that were to be used, was developed by Hatch and BIM and reviewed by Boart Longyear. This JHA was reviewed on a periodic basis and when work conditions changed and updated accordingly. A notification procedure was prepared by BIM specifically for the drilling activities in remote areas. A copy of both the final JHA and the notification procedure is presented in Appendix H.

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2.5 Laboratory Testing

2.5.1 Soil Testing

All samples were shipped to the Hatch geotechnical laboratory in Niagara Falls, a Canadian Council of Independent Laboratories (CCIL) certified laboratory (see Appendix G for the certification document). Representative samples were selected for testing including moisture content, particle size distribution, pore water salinity, rock strength tests in accordance with the standard listed in Table 2-2. Full laboratory test results are presented in Appendix D and laboratory results are summarized in Appendix F. 1

Table 2-2: Standards Used for the 2016, 2017, and 2018 Geotechnical Investigation 1

Name	Standard
Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classifications	ASTM D5731
Standard Test Methods for Laboratory Determination of Water Content of Soil and Rock by Mass	ASTM D2216
Standard Test Methods for Particle-Size Distribution of Soils using Sieve Analysis	ASTM D6913
Standard Test Method for Particle Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis	ASTM D7928
Standard Test Methods for Pore Water Extraction and Determination of the Soluble Salt Content of Soils by Refractometer	ASTM D4542
Uniaxial Compressive Strength of Intact Rock Core Specimens	ASTM D7012

2.6 Geophysics

GPR Inc. was contracted to undertake a Ground Penetrating Radar (GPR) survey to identify ground ice and ice rich soil in proximity of the proposed area for drive station, dumper, conical stockpile, crushing building, screening building and south end of stacker reclaimer berm. The survey required towing of a GPR unit (Figure 3) in a line over the area to be surveyed. Readings were recorded using a handheld output device, which can be seen in Figure 4. A detailed description of the GPR survey technique can be found in Appendix I.

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Figure 3: Ground Penetrating Radar Survey Unit



Figure 4: GPR Survey in Progress

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3. Results of Field Investigations

3.1 Milne Port Infrastructure Boreholes

A total of 15 boreholes were drilled in 2016 geotechnical investigation program at Milne Port Site. In 2017, 22 boreholes were drilled to support design of the proposed infrastructure including rail unloading dumper, module delivery routes (MDR), crushing plant, screening plant, stacker/reclaimer berm, stockpile reclaim load-out tunnel. Another 4 boreholes were drilled in 2018 to support design of the proposed conical stockpile, crusher pads, and the stocker / reclaimer berm. Fence diagrams have been made for select areas and are presented in Appendix E.

3.1.1 Stacker/Reclaimer Berm and Tail Pulley

Eight (8) boreholes (BH16-M001, BH16-M004, BH16-M005, BH16-M006, BH16-M014, BH16-M015, BH18-M003, BH18-004) were drilled along the longitudinal alignment of the berm from north (near shoreline) to south. The tail pulley is located near the south end of the berm. The overall site is relatively flat over the footprint of the berm.

The subsurface conditions encountered at the site are highlighted as follows:

- Near the south end of the berm, the deposit consists of a sandy layer (sand to sand and gravel) with a thickness of 6 m to 9 m, overlying a silt deposit extending to the borehole termination depths of about 15.2 m (BH16-M006, BH16-M014 and BH16-M015, BH18-M003). BH18-M003 extends to a termination depth of about 50 m and encountered the same silt deposit (silt with sand) extending to a depth of about 46 m. Below 46 m to the termination of BH18-M003 was a deposit of till.
- In the middle of the berm, the sandy deposit dominates the encountered overburden (BH16-M004 and BH16-M005). A 1.5 m silt layer was encountered in BH16-M004 from a depth of 10.6 m to 12.1 m.
- Near the north end of the berm, a sandy deposit (sand to sand and gravel) was encountered in BH16-M001 down to the termination of the borehole (at about 15 m depth) and in BH18-004 down to about 42 m depth. Below 42 m in BH18-004, some silt layers between 0.7 m and 2.5 m in thickness were encountered between layers of sandy deposits (sand to silty sand). A silty deposit (sandy silty to silty clay) was encountered in BH18-004 below about 68 m to the termination of the borehole.
- No bedrock was encountered during the investigation.

Table 3-1 presents the depth of soil/ice encountered in the boreholes. The following summarizes the soils encountered during investigation. Typical samples for sandy deposit and silty deposits are presented in Figure 5, Figure 6 and Figure 7.

- The sandy deposit contains sand (silty sand to sand and gravel), with a varying amount of gravel and silt. Ice content in this layer typically ranges from 10% to 20% by weight.

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- The silty deposit contains predominantly silt (silt to sandy silt), trace to some sand, trace gravel, trace organics. This layer was likely formed from a delta sediment deposit. The silt is generally well bonded and contains thin ice lenses with a typical ice content ranging from 20% to 40% by weight.
- Ground ice was not encountered in the boreholes listed above. However, the presence of occasional ground ice layer is likely in the Milne Inlet Port area, particularly near the depth of the active zone.

3.1.2 Stockpile Reclaim Tunnel, Crushing and Screening Plants

Seven (7) boreholes (BH17-10, BH 16-M010, BH 16-M011, BH 16-M012, and BH16-M013, BH18-M002, BH18-M001) were drilled in the vicinity of the stockpile reclaim tunnel and crushing/screening plants. In particular, the stockpile tunnel is located close to BH18-M001. The crusher plant is close to BH16-M011 and the screening plant is near BH16-M013. Table 3-1 summarizes the depth of soil/ice encountered in the boreholes.

The subsurface conditions encountered are highlighted as follows:

- The deposit at the site comprise a thin sandy layer overlying a thick silt deposit. Below this is likely a till layer which was encountered in BH17-10, BH18-M001, and BH18-M002.
- The sandy layer contains sand, with a varying amount of gravel, trace to some silt and trace cobbles. The thickness of the sandy layer varies from zero to about 3.5 m.
- The silt layer contains predominantly silt, trace to some fine sand, trace gravel, trace organics, with a thickness of about 12 m to 24 m (BH17-10, BH18-M001, BH18-M002). This layer is likely a deltaic sediment sequence deposit. The frozen silt is general well bonded and contains trace thin ice lenses with a typical ice content from 20% to 40% by weight.
- A 1.4 m thick layer of ground ice was encountered from 1.0 m to 2.4 m depth in BH16-M010. A 5.4 m thick layer of ground ice was also encountered in BH18-M001 from about 0.8 m to 6.2 m. All other boreholes in this area did not encounter ground ice.
- A till layer (sand till with some silt and some gravel) was encountered in BH17-10, BH18-M001, BH18-M002 at a depth of 13.7 m to 29.5 m underlying the silt deposit. The till layer is well graded and has a relatively low ice content of about 8%.
- Bedrock was not encountered in all of the drilled boreholes (to their end of holes up to 39.6 m depth).

The boreholes for this infrastructure are summarized in Table 3-1.

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Table 3-1: Summary of Boreholes in Stacker/Reclaimer, Crusher and Screener Areas

Borehole ID (Infrastructure)	Depth Material Encountered			
	Sandy Deposit (Sandy Gravel to Gravelly Sand)	Sandy Deposit (Sand to Silty Sand)	Silty Deposit (Sandy Silt to Silt)	Ice / Till with low ice content
BH16-M001 (Reclaimer)	0 – 15.2*			
BH16-M004 (Reclaimer)	6.1 – 10.6	0 – 6.1; 12.1 – 15.2*	10.6 – 12.1	
BH16-M005 (Reclaimer)	0 – 3.0; 10.4 – 15.2*	3.0 – 10.4		
BH16-M006 (Reclaimer)	0 – 3.0	3.0 – 9.1	9.1 – 15.2*	
BH16-M010 (Stockpile reclaim load-out tunnel)	2.4 – 3.0	3.0 – 4.0	0 – 1.0; 4.0 – 15.2*	1.0– 2.4 (Ice)
BH17-10 (Stockpile reclaim load-out tunnel)	-	-	0-13.7	13.7-16.7* (Low Ice Content Till)
BH16-M011 (Crusher)	3.0 – 3.7	0 – 3.0	3.7 – 15.2*	
BH16-M012 (Conveyor)	0 – 1.5	-	1.5 – 15.2*	
BH16-M013 (Screener)	0.3 – 3.0	-	3.0 – 15.2*	
BH16-M014 (Tail Pulley)	0 – 2.4	2.4 – 7.6	7.6 – 15.2*	
BH16-M015 (Tail Pulley)	0 – 3.0	3.0 – 6.1	6.1 – 15.2*	
BH18-M001 (Conical Stockpile)			0 – 0.7 6.2 – 18.3	0.7 – 6.2 (Ice) 18.3 – 25.9* (Low Ice Content Till)
BH18-M002 (Crusher Pads)	0 – 3.7	4.6 – 4.9 29.0 – 29.5	3.7 – 4.6 4.9 – 29.0	29.5 – 39.6* (Low Ice Content Till)
BH18-M003 (Reclaimer)	0 – 1.5	1.5 – 11.1	11.1 – 46.0	46.0 – 50.3* (Low Ice Content Till)
BH18-004 (Reclaimer)	0 – 3.0 13.6 – 18.3 21.3 – 42.7	3.0 – 13.6 18.3 – 21.3 43.5 – 62.5 65.0 – 68.6	42.7 – 43.5 62.5 – 65.0 68.6 – 77.7*	

* Indicates termination depth

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Figure 5: Typical Sandy Deposit at The Northern End of the Berm (BH16-M001)



Figure 6: Typical Silty Deposit found at the Crusher Location (BH16-M011)



Figure 7: Typical Sandy Deposit at the Middle of the Berm (BH16-M004)

In the crusher, generator and screener areas and the southern end of the reclaimer, the stratigraphy followed a consistent pattern of silt underlying coarser sand and gravel layers. In BH16-M004 and BH16-M005 coarser material also underlies finer material, which may be indicative of paleo channels.

3.1.3 Tank Area

Two additional tanks are proposed for the Milne Port, south of the existing tank farm. Two boreholes, BH16-M002 and BH16-M003 were drilled at the proposed locations for the east tank and west tank, respectively. The results of the boreholes are summarized in Table 3-2.

Table 3-2: Summary of Boreholes in Tank Area

Borehole ID (Infrastructure)	Depth Material was Encountered		
	Sand and Silt	Silt	Gravelly Sand to Sandy Gravel
BH16-M002 (East Tank)	0 – 3.8	4.6 – 7.6	3.8 – 4.6; 7.6 – 15.2*
BH16-M003 (West Tank)	0 – 2.5	2.5 – 12.1	12.1 – 15.2*

* Denotes termination depth

3.1.3.1 Silt and Sand

In both boreholes the uppermost soil encountered contained approximately equal parts of silt and sand with trace to some gravel. In BH16-M002 from 3.0 m to 3.8 m, the silt and sand was highly organic. This material is likely a fill.

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3.1.3.2 Silt

A layer of silt with trace to some sand and with organics was encountered in both boreholes. In BH16-M003, the silt was noted to contain ice inclusions including randomly/irregularly oriented ice formations.

3.1.3.3 Gravelly Sand to Sandy Gravel

In BH16-M002, a gravelly sand was encountered between the silt and sand strata, and also below the silt. This layer was described as light brown to grey with rounded to subangular gravel, similar to the deltaic sediments noted above. In BH16-M003, the sandy gravel layer was found to be angular and reddish brown to grey, which may indicate a different origin for this material, possibly as a glacial end moraine.

3.1.4 Dumper (Rail Unloading) Area

A total of six boreholes (BH16-M007, BH16-M008, and BH17-M008R, BH16-M009, BH17-EBC-1, and BH17-EBC-2) were drilled in the vicinity of the dumper (rail unloading area). BH17-M008R was drilled at the same location but slightly offset from BH16-M008 to obtain more detailed bedrock information at this location.

The subsurface conditions encountered at the site are highlighted as follows:

- The deposit at the hill crest comprises of a layer of sandy deposit described as silty sand, sand, or sand and gravel overlying till and then bedrock. A cobble and gravel layer was encountered right above bedrock in BH BH17-EBC-1 and BH17-EBC-2. The presence of cobbles and boulders were also inferred within the overburden in BH16-M008 and BH16-M009.
- Ground ice was encountered in borehole BH17-EBC-1. About 6 m of thick ground ice was encountered close to the surface of the native deposit. BH17- EBC-1 is located on the slope near the crest of the hill. A 3 m thick fill was placed to allow the access of the drilling rig. Under a 0.4 m thick surficial native gravel, the ground ice was encountered from el. 48.2 m to el. 42.2 m, with a 0.3 m thick interbedded sand layer from el. 46.5 m to el. 46.2 m. Below this interbedded sequence is a sand layer and a till deposit overlying a cobble and gravel layer and then bedrock. No ground ice was found at the corresponding elevations in the two nearby boreholes located approximately 30 m north (BH16-M-008) and 40 m south (BH17-EBC-002) of BH17-EBC-001. It is possible that the ground ice found in BH17-EBC-1 formed from a run-off stream.
- The bedrock at the site generally dips from east to west down the hill. The bedrock is granitic gneiss with RQD values varying from 64% to 68% as encountered in BH17-M-008R, which is the most close to the dumper. The unconfined compressive strength of the bedrock ranges from 23.6 MPa to 100.7 MPa with an average of about 60 MPa, classifying the rock as weak to very strong.

The overburden layers from the abovementioned boreholes are summarized in Table 3-3.

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Table 3-3 Summary of Boreholes at the Rail Unloading Area

Borehole ID (Infrastructure)	Depth Material was Encountered				
	Fill	Ice	Sand and Gravel	Sand to Silty Sand	Granitic Gneiss Bedrock
BH16-M007 (Rail Unloading)			0 – 1.5	1.5 – 6.1	6.1 – 9.14*
BH16-M008 (Rail Unloading)			0 – 1.5; 4.6 – 10.6	1.5 – 4.6; 10.6 – 18.8	18.8 – 21.3*
BH16-M009 (Rail Workshop)			0.5 – 3.0	3.0 – 3.7	3.7 – 5.2*
BH17-M008R (Rail Unloading)**	-	-	-	-	17.42-22*
BH17-EBC-1 (Rail Unloading)	0.0-3.0	3.4-5.1 5.4-9.4	3.0-3.4 10.2-14	5.1-5.4 9.5-10.2	14-21.7*
BH17-EBC-2 (Rail Unloading)	-	-	0.0-1.52 3.55-13.3	1.52-3.55	13.3-21.8*

Notes: *Denotes termination depth. **BH17-M008R was drilled to only confirm bedrock condition. No sample was collected from overburden.

3.1.5 Module Delivery Routes (MDR)

A total of ten (10) boreholes have been drilled along the proposed MDR; the borehole logs and test reports are presented in Appendix B and Appendix D, respectively. The subsurface conditions reported along the road alignments are highlighted as follows:

- The boreholes drilled south of the existing barge off loading area (BH17-RD-1, BH17-RD-1A, and BH17-RD-1B), showed a layer of sand and gravel as road topping overlying a layer of rockfill of up to 4.5 m thick. This fill layer is underlain by a sandy layer which contains sand, with a varying amount of gravel, trace to no silt.
- In the area between the new permanent accommodation camp and the existing camp, three (3) new boreholes (BH17-RD-1C, BH17-RD-2, and BH17-RD-3) were drilled. A layer of sand and gravel of up to 0.5 m as road topping was encountered overlying a layer of sand with various gravel content. The thickness of the sand layers varies between 1 to 1.5 m. Below this sand layer, a layer of “silt and sand” to “sand trace silt” was recorded to the target depth of the boreholes (4.6 m to 6.1 m below existing ground surface).
- On the portion of the MDR alignment overlapping the existing haul road, four (4) boreholes (BH17-RD-4, BH17-RD-5, BH17-RD-6 and BH17-RD-7) were drilled. All boreholes showed a sand and gravel road topping of approximately 0.3 m thick, overlying a layer of rockfill with varying thickness of 1 to 3 m. Below this rockfill layer, a layer of “silt and sand” to “sand with silt” was reported. A layer of ice-rich soil (approximately 60% ice content) was observed in BH17-RD-4 between 1.4 m and the termination depth of the borehole at 4.6 m below existing ground surface. Also, a layer of ice (trace silt/sand) was reported in BH17-RD-6 between depths of 2.4 and 6 m.

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- On the portion of the MDR alignment running along the proposed stacker/reclaimer berm, the subsurface condition was extracted from the boreholes drilled in that area in 2016 (BH16-M004, -M005, and -M006). In general, the material encountered ranged from “silt trace to some sand” to “sand and gravel”.
- In the area in vicinity of the stockpile reclaim tunnel and crusher/screening plants, seven (7) boreholes (BH17-10, BH16-M010, BH16-M011, BH16-M012, BH16-M013, BH18-M001, and BH18-M002) were drilled. The deposit at this area comprise a thin sandy layer overlying a thick silt deposit. Below this layer is likely a till deposit as inferred from the findings in BH17-10, BH18-M001, and BH18-M002. The sandy layer contains sand, with a varying amount of gravel, trace to some silt and trace cobbles. The thickness of the sandy layer varies from zero to about 3.5 m. The silt layer also contains trace to some fine sand, trace gravel, trace organics. The frozen silt is generally well bonded and contains trace of thin ice lenses with a typical ice content from 20% to 40% by weight. A till layer (sand till with some silt and some gravel) was encountered at a starting depth of 13.7 m to 29.5 m underlying the silt deposit. The till layer is well graded and has a relatively low ice content of about 8%. A 1.4 m thick layer of ground ice was encountered from 1.0 m to 2.4 m depth in BH16-M010, and a 5.2 m thick layer was encountered from 0.8 m to 6.2 m depth in BH18-M001. All other boreholes in this area did not encounter ground ice.
- During the site investigations carried out in 2016, 2017, and 2018, bedrock was encountered at depth of 3.7 m at the proposed Rail Workshop area, and at the depth ranging between 6.1 m and 18.8 m at the proposed Dumper area. Bedrock was not encountered at other drilling locations within the port area.

The overburden layers encountered in the boreholes drilled for the MDR are summarized in Table 3-4.

Table 3-4: Summary of Boreholes for Module Delivery Routes (MDR)

Borehole ID (Infrastructure)	Depth Material was Encountered					
	Fill	Rock Fill	Ice	Sand and Gravel	Sand to Silty Sand	Gravel some Sand
BH17-RD-1	0.0-0.3	0.3-3.8	-	3.8-6.1	-	-
BH17-RD-1A	-	0.0-0.6	-	0.6-4.57	-	-
BH17-RD-1B	0.0-0.3	0.3-4.9	-	-	-	-
BH17-RD-1C	0.0-0.5	-	-	0.5-0.8	0.8-6.1	-
BH17-RD-2	0.0-0.3	0.3-1.1	-	1.5-2.5	1.1-1.5 2.5-4.57	-
BH17-RD-3	0.0-0.15	0.15-0.4	-	0.4-4.57	-	-
BH17-RD-4	0.0-0.3	0.3-1.1	1.3-4.57	1.1-1.3	-	-
BH17-RD-5	0.0-0.3	0.3-1.2	-	-	1.7-2.4	1.2-1.7 2.4-2.7
BH17-RD-6	0.0-0.2	0.2-2.9	3.4-6.1	3.3-3.4	2.9-3.3	-
BH17-RD-7	0.0-0.3	0.3-1.7	-	1.7-3.65	-	-

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3.1.6 *Fines Stockpile*

Five boreholes (BH 17-11 to BH17-15) were drilled near the fines stockpiles. In general, the deposit consists of a surficial layer of iron ore and rockfill with a depth from 0 to 0.8 m. Underlying that, the deposits are silt and sand, silty sand, sand to sand and gravel, trace organics, containing ice content ranging from 6% to 32%. BH 17-12 encountered a sand and ice from 0.7 to 1.7m and ice from 1.7 m to 3.4 m. Table 3-5 summaries the soil layers encountered in this area.

3.1.7 *New Accommodation Camp*

One borehole (BH 17-Camp-1) was drilled at the proposed new accommodation camp. The deposit consists of 0.15 m road topping fill, overlying a sand and gravel layer to a depth of 1.8 m. Below that is a silt and sand deposit with trace clay and trace organics. No ground ice was encountered. Table 3-5 summaries the soil layers encountered at the proposed location for the new accommodation camp.

Table 3-5: Summary of Milne Port Supplementary Boreholes

Borehole ID (Infrastructure)	Depth Material was Encountered					
	Iron Ore	Rock Fill	Ice	Sand and Gravel	Sand to Silty Sand	Granitic Gneiss Bedrock
BH17-11 (fines stockpile)	0.0-0.76	0.76-1.52	-	1.52-8.60 10.7-15.20	8.60-10.70	-
BH17-12 (fines stockpile	0.0-0.5	0.5-0.7	0.7-3.4	3.6-4.6 6.1-15.2	4.6-6.1	-
BH17-13 (fines stockpile	0.0-0.4	0.4-0.8	-	0.8-6.09	-	-
BH17-14 (fines stockpile	0.0-0.3	0.3-0.4	-	0.4-6.1	-	-
BH17-15 (fines stockpile	0.0-0.7	-	-	0.7-6.1	-	-
BH17-CAMP-1 (Camp)	-	-	-	0.0-1.6	1.6-6.1	-

3.1.8 *New Drive House*

Two boreholes (BH17-EBC-8 and BH17-EBC-9) were drilled near the proposed new drive house. The deposit mainly consists of sand to sand and gravel, trace silt, trace to some organic interbedded layers. The ice content typically ranges from 10% to 20%. It is noted that unfrozen samples were retrieved from 14.5 m to 15.7 m in BH17-EBC-9 (a high salinity of 88 parts per thousand (ppt) was measured from the sample at a depth of 15.2 m). In BH17-EBC-8, the unfrozen samples were retrieved from 12.15 m to 12.76 m and from 13.68 m to 15.20

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m. In BH17-EBC-8, the corresponding salinity measurement range from 14 ppt to 13 ppt for the samples at 12 m and 15 m depths. Table 3-6 summaries the soil layers encountered in the above boreholes.

Table 3-6: Summary of Boreholes for New Drive House

Borehole ID (Infrastructure)	Depth Material was Encountered		
	Sand and Gravel	Sand to Silty Sand	Granitic Gneiss Bedrock
BH17-EBC-8	0.0-16.7 23.0-25.2	16.7-23.0 25.2-39.52	-
BH17-EBC-9	0.0-8.4 11.0-39.52	8.4-11.0	-

3.2 Laboratory Testing

Select soil samples collected during the investigations were tested to confirm the field classification of the soil (completed by Hatch in a laboratory located in Niagara Falls, Ontario). These test results have been included in the borehole reports contained in Appendix B. Full test results are included in Appendix D. Appendix F also summarized the results of the moist test, grain size tests, salinity tests, rock strength tests (UCS and point load tests).

Samples of the granitic gneiss were taken from the rock core recovered in BH16-M007 as representative of the bedrock at the train unloading area. The rock test results from physical testing on the samples can be found in the 2016-2017-2018 Rail Geotechnical Investigation Factual Data Report. 1

3.3 Geophysics Results

The GPR (ground penetration radar) investigations were undertaken in proximity of the proposed area for drive station, dumper, conical stockpile, crushing building, screening building and south end of stacker reclaimer berm in order to investigate ice rich soil zones. The results of the geophysics investigation are presented in Appendix I.

In general, the GPR survey lines didn't identify any ground ice. Georadar penetration of the surface appeared shallow with poor signal attenuation, possibly due to the soil in the subsurface in the port area as per the GPR report in Appendix I. It is noted that the encountered ice in BH16-M010 was not identified in the GPR investigation. As such, the application of GPR may not be suitable to investigate ground ice at the Milne Inlet site.

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4. References

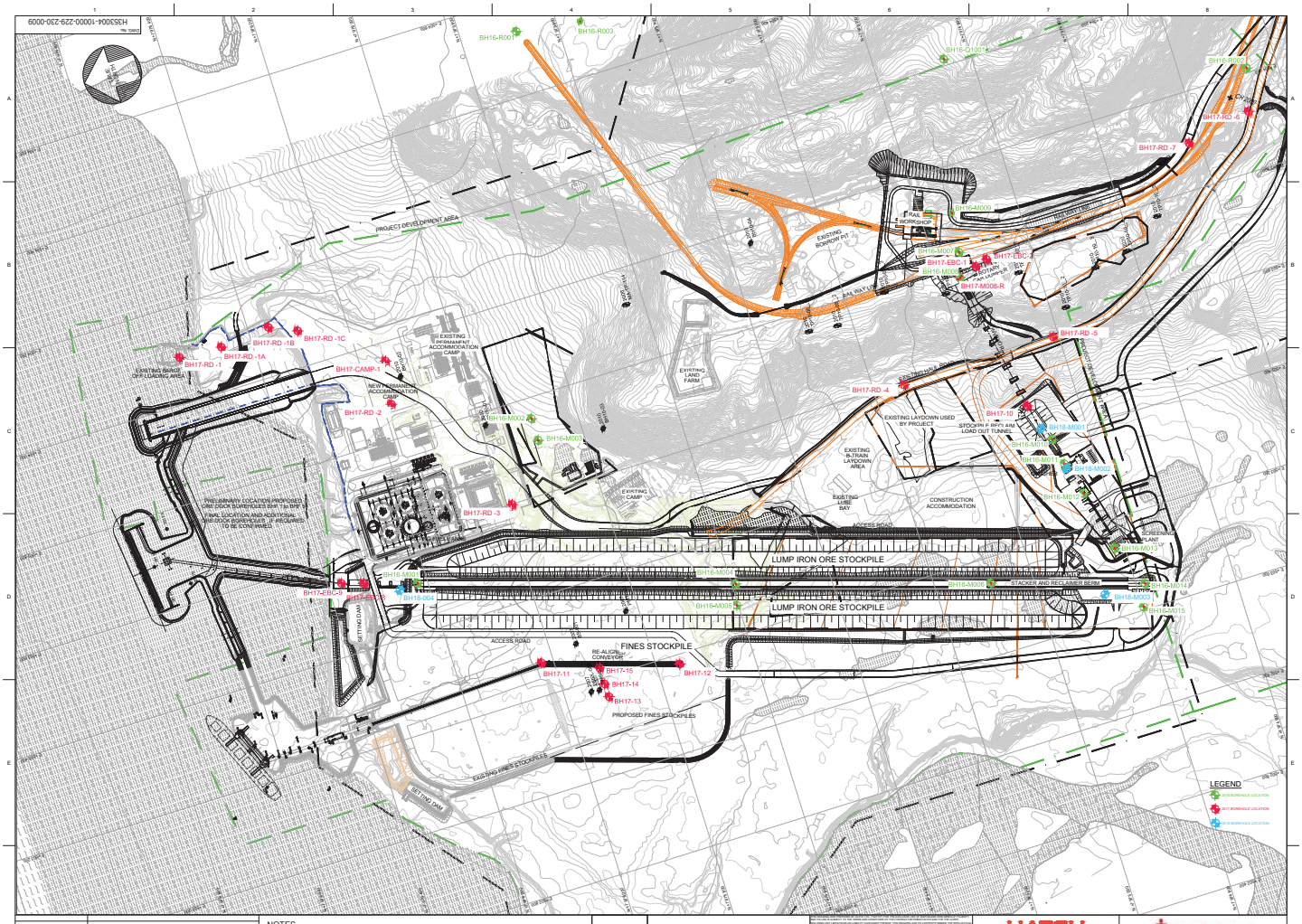
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Appendix A

Borehole Location Plan

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NOTES

1. CO-ORDINATE GRID IS UTM (NAD 83) ZONE 17 AND IS IN METRES.
2. INFORMATION FOR BATHYMETRY IS A COMBINATION OF LOGISTEC STEVEDORING INC. AND MMG. TWO POINTS WERE COMBINED TO CREATE THE BATHYMETRY LINES USED.
3. THE CHART DATUM HAS BEEN ASSIGNED TO BE 1.2 m BELOW CGVD 28 (0.0 m CD= 1.2 m GD).
4. ELEVATIONS ARE BASED ON CHART DATUM (CD).
5. DIMENSIONS ARE SHOWN IN MILLIMETERS AND ELEVATIONS ARE SHOWN IN METRES.
6. ELEVATIONS ARE MEASURED AT THE TIME OF BOREHOLE COMPLETION.

SCALE 1:5 000

REFERENCE DRAWINGS

DRAWING No.	DRAWING TITLE

No.	DESCRIPTION	BY	CHKD	DATE
A	ISSUED WITH GEOTECHNICAL REPORT	BP		

	NAME	SIGNATURE	DATE
DRAWING APPROVAL STATUS: Internal Review			
DRAFT SUPERVISOR	R FILLAZZ	NR	09/08/2018
DESIGNER	M YANG	NR	09/08/2018
CHECKER	N GHANE		09/08/2018
DESIGN COORD	M YANG		09/08/2018
RESP. ENGR.	R HALIM		09/08/2018
LEAD DISC. ENG.	N GHANE		09/08/2018
AREA MANAGER	P LAVERC		09/08/2018
PROJ. MANAGER	S. PERRY		30/08/2018

HATCH

Baffinland

BAFFINLAND IRON MINES LP
MARY RIVER EXPANSION PROJECT

PORT SITE
BOREHOLES SETTING OUT
OVERALL LAYOUT

SCALE	DWG. No.	REV
1:2000 (22"x34")	H353004-10000-229-230-0009	A

SHEET SIZE: E

KNWL
SIGNATURE
ENG REG NUMBER
REVISION DATE
ORIGINAL DATE
REG. PROFESSIONAL

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Appendix B

Borehole Reports

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List of Abbreviations and Terms Used in the Borehole Reports

(Sheet 1)

General

Elevations
Elevations are referenced to datum indicated.

Depth
All depths are given in meters (feet) measured from the ground surface unless otherwise noted.

Sample Recovery
Indicates the length retained in millimeters (inches) in a split spoon sampler or percentage recovery of sample retained in the core barrel sampler.

Sample Number
Samples are numbered consecutively in the order in which they were obtained or attempted in the borehole.

Sample Type
The first letter describes the sampling method and the second, the shipping container.

Sampling Method

A – Split Tube	E – Auger
B – Thin Wall Tube	F – Wash
C – Piston Sampler	G – Shovel Grab Sample
D – Core Barrel	K – Slotted Sampler

Shipping Container

O – Tube	U – Not Recovered
P – Water Content Tin	X – Plastic & PVC Sleeve (Sonic)
Q – Jar	Y – Core Box
S – Plastic Bag	Z – Discarded

Abbreviations
N/A – Not applicable
N/E – Not encountered
N/O – Not observed

Soil

Soil Description, Label and Symbol
Soil description under the "Description" column conforms generally, but not rigorously, to the Unified Soils Classification System. For a given soil unit, defined by depth boundaries, the descriptive text constitutes the definitive soil unit description and takes precedence over both the brief label and the symbol used to graphically represent the soil unit.

Grain Size

Clay		<0.002 mm
Silt	0.002 –	0.075 mm
Sand	0.075 –	4.75 mm
Fine	0.075 –	0.42 mm
Medium	0.42 –	2.00 mm
Course	2.00 –	4.75 mm
Gravel	4.75 –	75 mm
Fine	4.75 –	19.00 mm
Coarse	19.00 –	75.00mm
Cobbles	75 –	300 mm
Boulder		>300 mm

Relative Quantities

Term	*Example*	*(%)*
Trace	Trace sand	1 – 10
Some	Some sand	10 – 20
With (adjective)	With Sand (Sandy)	20 – 35
And	And sand	>35
Noun	Sand	>50

Standard Penetration Test (SPT)
The test is carried out in accordance with ASTM D-1586 and the 'N' value corresponds to the sum of the number of blows required by a 63.5-kg (140-lb) hammer, dropped 760 mm (30 in.), to drive a 50-mm (2-in.) diameter split tube sampler the second and third 150 mm (6 in.) of penetration.

Density (Granular Soils)

	N(SPT)
Very loose	0 – 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very dense	>50

Consistency (Cohesive Soils)

	N(SPT)
Very soft	<2
Soft	2 – 4
Firm	4 – 8
Stiff	8 – 15
Very stiff	15 – 30
Hard	>30

Plasticity/Compressibility

		Liquid Limit (%)
Low plasticity clays	Low compressibility silts	<30
Medium plasticity clays	Medium compressibility silts	30 – 50
High plasticity clays	High compressibility silts	>50

Dilatancy
None - No visible change, during shaking or squeezing
Slow - Water appears slowly on surface of specimen during shaking and does not disappear or disappears slowly upon squeezing.
Rapid - Water appears quickly on the surface of specimen during shaking and disappears quickly upon squeezing.

Sensitivity

Insensitive	<2
Low	2 – 4
Medium	4 – 8
High	8 – 16
Quick	>16

HATCH™ List of Abbreviations and Terms Used in the Borehole Reports

(Sheet 2)

Rock

Core Recovery
Sum of lengths of rock core recovered from a core run, divided by the length of the core run and expressed as a percentage.

RQD (Rock Quality Designation)
Sum of lengths of hard, sound pieces of rock core equal to or greater than 100 mm from a core run, divided by the length of the core run and expressed as a percentage. Measured along centerline of core. Core fractured by drilling is considered intact. RQD normally quoted for N-size core.

RQD (%) Rock Quality

90	-	100	Excellent
75	-	90	Good
50	-	75	Fair
25	-	50	Poor
0	-	25	Very Poor

Grain Size

Term	*Grain Size*
Very coarse-grained	>60 mm
Coarse-grained	2 mm - 60 mm
Medium-grained	60 μm - 2 mm
Fine-grained	2 μm - 60 μm
Very fine-grained	< 2 μm

Bedding

Term	*Bed Thickness*			
Very thickly bedded		>2 m		>6.50 ft
Thickly bedded	600 mm -	2 m	2.00 -	6.50 ft
Medium bedded	200 mm -	600 mm	0.65 -	2.00 ft
Thinly bedded	60 mm -	200 mm	0.20 -	0.65 ft
Very thinly bedded	20 mm -	60 mm	0.06 -	0.20 ft
Laminated	6 mm -	20 mm	0.02 -	0.06 ft
Thinly laminated		<6 mm		<0.02 ft

Discontinuity Frequency
Expressed as the number of discontinuities per meter or discontinuities per foot. Excludes drill-induced fractures and fragmented zones.

Discontinuity Spacing

Term	*Average Spacing*			
Extremely widely spaced		>6 m		>20.00 ft
Very widely spaced	2 m -	6 m	6.50 -	20.00 ft
Widely spaced	600 mm -	2 m	2.00 -	6.50 ft
Moderately spaced	200 mm -	600 mm	0.65 -	2.00 ft
Closely spaced	60 mm -	200 mm	0.20 -	0.65 ft
Very closely spaced	20 mm -	60 mm	0.06 -	0.20 ft
Extremely closely spaced		<20 mm		<0.06 ft

Note: Excludes drill-induced fractures and fragmented rock.

Broken Zone
Zone of full diameter core of very low RQD which may include some drill-induced fractures.

Fragmented Zone
Zone where core is less than full diameter and RQD = 0.

Strength

Term	*Description*	*Unconfined Compressive Strength (MPa)*	*(psi)*
Extremely weak rock	Indented by thumbnail	0.25 – 1.0	36 – 145
Very weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	1.0 – 5.0	145 – 725
Weak rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	5.0 – 25	725 – 3625
Medium strong rock	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer to facture it	25 – 50	3625 –7250
Strong rock	Specimen requires more than one blow of geological hammer to fracture it	50 – 100	7250 – 14500
Very strong rock	Specimen requires many blows of geological hammer to fracture it	100 – 250	14500 – 36250
Extremely strong rock	Specimen can only be chipped with geological hammer	>250	>36250

Weathering

Term	*Description*
Fresh	No Visible sign of rock material weathering
Faintly weathered	Discoloration on major discontinuity surfaces.
Slightly weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker than in its fresh condition.
Moderately weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
Highly weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Residual soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

BASIS FOR SOIL DESCRIPTION

(Based on AS1726-1993 - Geotechnical Site Investigations, with modifications)

GRAPHIC SYMBOLS FOR SOILS

GRAVEL – poorly graded – 

well graded – 

SAND – poorly graded – 

well graded – 

SILT – of low plasticity – 

of high plasticity – 

CLAY – of low plasticity – 

of high plasticity – 

ICE – 

COBBLES AND BOULDERS – 

ORGANIC/ PEATY SOIL – 

FILL/ MADE GROUND – 

Composite soil types are presented using combined symbols, eg. **Gravelly Sandy CLAY** 

GROUNDWATER OBSERVATIONS

Permanent Water Level 

Temporary Water Level 

Inflow into Pit or Borehole

Outflow/ Water Loss in Borehole 

Slow Inflow/ Seepage into Pit or Borehole 

SAMPLE TYPES

Disturbed bag sample 

Bulk Disturbed (>20kg) 

Hollow Stem Auger Core 

Auger Flight Cuttings 

Standard Penetration Test (SPT), with Disturbed Split-Spoon Sample 

SPT (no recovery) 

Thin walled "undisturbed" push tube sample eg. U60, U100 etc 

Sample attempted with no recovery 

HATCHCANADA2015.DRAFT.GLB GrfcText SOIL DESCRIPTION - 3 BAFFINLAND BOREHOLES 2016 - TJ.GPJ <<DrawingFile>> 17/02/2017 15:13

BASIS FOR ROCK DESCRIPTION

(Based on AS1726-1993 - Geotechnical Site Investigations, with modifications)

GRAPHIC SYMBOLS FOR SOILS

GRAVEL – poorly graded - 

well graded - 

SAND – poorly graded - 

well graded - 

SILT – of low plasticity - 

of high plasticity - 

CLAY – of low plasticity - 

of high plasticity - 

FINE GRAINED TAILINGS - 

COBBLES AND BOULDERS - 

ORGANIC/ PEATY SOIL - 

FILL/ MADE GROUND - 

Composite soil types are presented using combined symbols, eg. **Gravelly Sandy CLAY** 

GRAPHIC SYMBOLS FOR ROCKS

SEDIMENTARY

SHALE 

CLAYSTONE 

SILTSTONE 

SANDSTONE 

CONGLOMERATE 

BRECCIA 

CORE LOSS 

CARBONATE

LIMESTONE 

Calcareous CLAYSTONE 

Calcareous SILTSTONE 

CALCARENITE 

CALCIRUDITE 

CALCRETE 

EVAPORITES

GYPSUM 

IGNEOUS

COARSE GRAINED 

MEDIUM GRAINED 

FINE GRAINED 

DOLERITE 

METAMORPHIC

COARSE GRAINED 

MEDIUM GRAINED 

FINE GRAINED 

Additional rock graphics may be added for specific projects.

GROUNDWATER OBSERVATIONS

Permanent Water Level 

Temporary Water Level 

Inflow into Pit or Borehole 

Outflow/ Water Loss in Borehole 

Slow Inflow/ Seepage into Pit or Borehole 

SAMPLE TYPES

Disturbed bag sample 

Bulk Disturbed (>20kg) 

Hollow Stem Auger Core 

Auger Flight Cuttings 

Standard Penetration Test (SPT), with Disturbed Split-Spoon Sample 

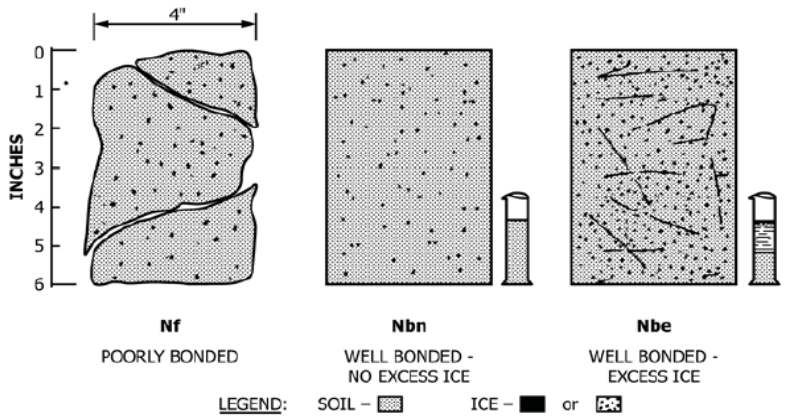
SPT (no recovery) 

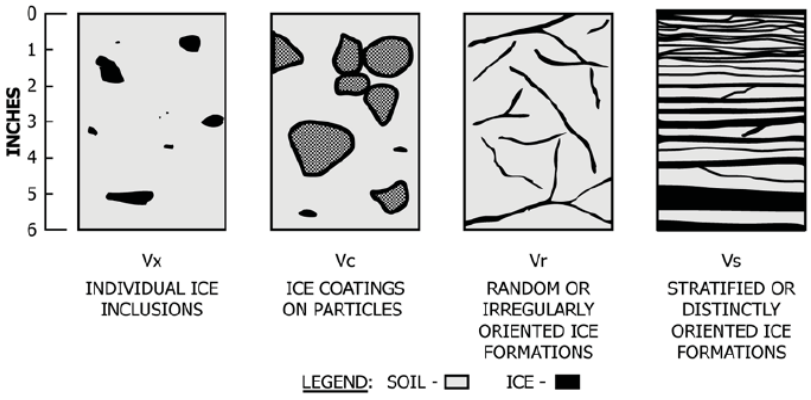
Thin walled "undisturbed" push tube sample eg. U60, U100 etc 

Sample attempted with no recovery 

HATCH LIBRARY DEVELOPMENT COPY.GLB GrfcText ROCK SYMBOLS GINT LOGS MR 2018 GEOTECHNICAL INVESTIGATION - V7.GPJ <<DrawingFile>> 29/08/2018 12:00

Symbol	Description
Nf	Poorly bonded with no visible excess ice
Nbn	Well bonded with no visible excess ice
Nbe	Well bonded with excess cie
Vx	Individual ice inclusions
Vc	Ice coatings on particles
Vr	Random or Irregularly oriented ice formations
Vs	Stratified or distrinctly oriented ice formations





HATCH BOREHOLE REPORT

BH16-M001

Sheet 1 of 1

Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: Milne Inlet (Reclaimer Berm)

Project No.: H352034
Datum: NAD83
Platform: Ground

Easting: 503,504.0 m
Northing: 7,976,237.0 m
Surface Elevation: 12.75 m
Bottom Elevation: -2.45 m
Total Depth: 15.2 m
Logged By: MR
Reviewed By: SH/WH

Contractor: Boart Longyear
Driller: Michael Scott
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 96
Date Logged: 12/8/2016
Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Moisture Condition	Consistency/ Density	Sample Type	Recovery %	Blows	Moisture Content Profile (0 50 100)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
Unobserved due to Permafrost	10.8	2.0	Vibracore	H-Casing		GRAVELLY SAND, trace COBBLES: Light brown to grey, fine to medium grained sand, rounded to subangular gravel	D												
						1.50 m to 2.00 m: Trace gravel and silt, rounded gravel	M						18						
	8.8	4.0											18						
						4.60 m to 6.10 m: Trace silt													
	6.8	6.0				6.10 m to 9.10 m: Some silt, fine to coarse grained sand							19	0	82	17			
													16						
	4.8	8.0											16						
						9.10 m to 10.60 m: Some gravel													
	2.8	10.0											16						
						10.60 m to 12.10 m: With gravel, trace excess ice							16						
	0.8	12.0				12.10 m to 13.70 m: Trace gravel and silt, rounded to subangular gravel							18						
	-1.3	14.0				13.70 m to 15.20 m: Some silt, some gravel													
				[15.2]									16						
	-3.3	16.0				To Target Depth. **Drillhole BH16-M001 terminated at 15.2m.**													
	-5.3	18.0																	
	-7.3	20.0																	

Notes:

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BOREHOLE REPORT

BH16-M002

Sheet 1 of 1

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Milne Port Tank 1

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,757.0 m

Northing: 7,975,894.0 m

Surface Elevation: 12.50 m

Bottom Elevation: -2.70 m

Total Depth: 15.2 m

Logged By: MR

Reviewed By: SH/WH

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 12/4/2016

Driller: Michael Scott

Hole Diameter (mm): 96

Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Moisture Condition	Consistency/ Density	Sample Type	Recovery %	Blows	Moisture Content Profile (0 – 50 – 100)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
Unobserved due to permafrost	10.5	2.0	Vibracore	H-Casing		SILT and SAND, trace GRAVEL: Light brown, fine to medium grained sand, subangular to angular gravel 1.20 m to 1.50 m: Light brown, medium to coarse grained sand 1.50 m to 3.00 m: Some gravel, light brown to grey and white, medium to coarse grained	M					>>	100						
	8.5	4.0				ORGANIC SILT and SAND GRAVELLY SAND, some SILT: Light brown, fine to medium grained sand, subrounded gravel							21 11	6 27	37 61	57 12			
	6.5	6.0				SILT, some SAND: Organic, dark brown, coarse grained sand with fine organic material													
	4.5	8.0				GRAVELLY SAND, some SILT: Light brown to grey, medium to coarse grained sand, rounded to subangular gravel							19						
	2.5	10.0											14						
	0.5	12.0											14						
	-1.5	14.0			[15.2]								16						
	-3.5	16.0				To Target Depth. **Drillhole BH16-M002 terminated at 15.2m.**							18						
	-5.5	18.0																	
	-7.5	20.0																	

Notes:

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BOREHOLE REPORT

BH16-M003
Sheet 1 of 1

Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: Milne Port Tank 2

Project No.: H352034
Datum: NAD83
Platform: Ground

Easting: 503,714.0 m
Northing: 7,975,892.0 m
Surface Elevation: 10.50 m
Bottom Elevation: -4.70 m
Total Depth: 15.2 m
Logged By: UK
Reviewed By: SH/WH

Contractor: Boart Longyear
Driller: E.Beachamp
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 96
Date Logged: 12/4/2016
Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Moisture Condition	Consistency/ Density	Sample Type	Recovery %	Blows	Moisture Content Profile (0 50 100)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
Unobserved due to permafrost	8.5	2.0	Vibracore	H-Casing		SAND and SILT, some GRAVEL: Grey, angular gravel, coarse grained sand							18	17	63	20			
	6.5	4.0				SILT, trace SAND: Organic, dark grey, fine grained sand							33	0	4	96			
	4.5	6.0																	
	2.5	8.0																	
	0.5	10.0																	
	-1.5	12.0																	
	-3.5	14.0				SANDY GRAVEL, some SILT: Reddish brown to grey, coarse grained sand, angular gravel													
		[15.2]																	
	-5.5	16.0				To Target Depth. **Drillhole BH16-M003 terminated at 15.2m.**													
	-7.5	18.0																	
	-9.5	20.0																	

Notes:

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BOREHOLE REPORT

BH16-M004

Sheet 1 of 1

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Milne Port Reclaimer Berm

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,302.0 m

Northing: 7,975,591.0 m

Surface Elevation: 10.20 m

Bottom Elevation: -5.00 m

Total Depth: 15.2 m

Logged By: UK

Reviewed By: SH/WH

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 12/8/2016

Driller: E.Beachamp

Hole Diameter (mm): 96

Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Moisture Condition	Consistency/ Density	Sample Type	Recovery %	Blows	Moisture Content Profile (0 50 100)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
Unobserved due to Permafrost	8.2	2.0	Vibracore	H-Casing		SILTY SAND with GRAVEL: Grey, coarse grained sand, angular gravel							19						
	6.2	4.0				SAND, trace SILT: Coarse grained sand								0	95	4			
	4.2	6.0				5.50 m to 6.10 m: Trace to some SILT													
	2.2	8.0				SAND and GRAVEL, some SILT: Grey, coarse grained sand, angular gravel							14						
	0.2	10.0																	
	-1.8	12.0				SANDY SILT: Dark grey, mottled black, fine organic material													
	-3.8	14.0				SAND, some SILT: Grey, coarse grained sand													
		[15.2]																	
	-5.8	16.0				To Target Depth. **Drillhole BH16-M004 terminated at 15.2m.**													
	-7.8	18.0																	
	-9.8	20.0																	

Notes:

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BOREHOLE REPORT

BH16-M005

Sheet 1 of 1

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Milne Port Reclaimer Berm

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,270.0 m

Northing: 7,975,606.0 m

Surface Elevation: 10.00 m

Bottom Elevation: -5.20 m

Total Depth: 15.2 m

Logged By: UK

Reviewed By: SH/WH

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 12/8/2016

Driller: E.Beachamp

Hole Diameter (mm): 96

Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Moisture Condition	Consistency/ Density	Sample Type	Recovery %	Blows	Moisture Content Profile (0 50 100)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
Unobserved due to permafrost	8.0	2.0	Vibracore	H-Casing		SAND and GRAVEL, Some SILT: Grey, angular to rounded gravel													
						SAND, some SILT: Grey, fine to coarse grained sand							13	35	53	12			
	6.0	4.0																	
	4.0	6.0											20						
	2.0	8.0																	
	0.0	10.0											16						
	-2.0	12.0				GRAVELLY SAND, Trace SILT: Grey, subangular gravel, coarse grained sand													
	-4.0	14.0				SANDY GRAVEL: Grey, angular to sub-angular and well graded gravel													
					[15.2]														
	-6.0	16.0				To Target Depth. **Drillhole BH16-M005 terminated at 15.2m.**													
	-8.0	18.0																	
	-10.0	20.0																	

Notes:

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BOREHOLE REPORT

BH16-M006

Sheet 1 of 1

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Milne Port Reclaimer Berm

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,136.0 m

Northing: 7,975,081.0 m

Surface Elevation: 10.00 m

Bottom Elevation: -5.20 m

Total Depth: 15.2 m

Logged By: MR

Reviewed By: SH/WH

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 12/8/2016

Driller: Michael Scott

Hole Diameter (mm): 96

Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Moisture Condition	Consistency/ Density	Sample Type	Recovery %	Blows	Moisture Content Profile (0 50 100)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	8.0	2.0	Vibracore	H-Casing		GRAVELLY SAND, some SILT, some COBBLES: Grey to light brown, subangluar to rounded gravel						●	9	32	55	13			
	6.0	4.0				SILTY SAND: Brown, coarse grained						●	18						
	4.0	6.0				4.90 m to 5.80 m: Some GRAVEL													
	2.0	8.0																	
	0.0	10.0				SILT, some SAND, trace GRAVEL: Grey, coarse grained and angular gravel													
	-2.0	12.0																	
	-4.0	14.0		[15.2]		SILT, trace to some SAND													
	-6.0	16.0				To Target Depth. **Drillhole BH16-M006 terminated at 15.2m.**													
	-8.0	18.0																	
	-10.0	20.0																	

Notes:

BAFFINLAND GINT LIBRARY.GLB Log SOIL BOREHOLE RAIL ALIGNMENT ALL_WITH ICE LOG_REV 3.GPJ <<DrawingFile>> 02/10/2017 17:43

HATCH BOREHOLE REPORT

BH16-M007

Sheet 1 of 2

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Milne Port Train Unloading

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,822.0 m

Northing: 7,974,945.0 m

Surface Elevation: 54.00 m

Bottom Elevation: 44.86 m

Total Depth: 9.1 m

Logged By: UK

Reviewed By: SH/WH

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 10/3/2016

Driller: E.Beachamp

Hole Diameter (mm): 96

Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Moisture Condition	Consistency/ Density	Sample Type	Recovery %	Blows	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
Unobserved due to Permafrost	52.0	2.0	Vibracore	H-Casing		SAND and GRAVEL: Grey, coarse grained sand, angular to sub-angular gravel		L				22						
	50.0	4.0				SAND: Grey, coarse grained						19	0	100	0			
						4.70 m to 6.10 m: Some GRAVEL		L										
	48.0	6.0		[6.1]		***Start of Coring at 6.1m.*** ***Continued on Rock Core Log sheet.***												
	46.0	8.0																
	44.0	10.0																
	42.0	12.0																
	40.0	14.0																
	38.0	16.0																
	36.0	18.0																
	34.0	20.0																

Notes:

BAFFINLAND GINT LIBRARY.GLB Log SOIL BOREHOLE RAIL ALIGNMENT ALL_WITH ICE LOG_REV 3.GPJ <<DrawingFile>> 02/10/2017 17:43

BOREHOLE LOG

ROCK CORE FORMAT

BH16-M007

Sheet 2 of 2

Client: Baffinland Iron Mines

Project: Mary River Expansion

Location: Milne Port Train Unloading

Project No.: H352034

Datum: NAD83

Platform:

Easting: 503,822.0 m

Northing: 7,974,945.0 m

Surface Elevation: 54.00 m

Bottom Elevation: 44.86 m

Total Depth: 9.1 m

Logged By: UK

Reviewed By: SH/WH

Contractor: Boart Longyear **Rig Type/ Mounting:** MiniSonic Rig **Bearing:** N/A **Date Logged:** 10/3/2016

Driller: E.Beachamp **Hole Diameter (mm):** 96 **Plunge:** Vertical **Date Checked:** 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Run #/TCR	Graphic Log	Geological Unit	Rock Description (ROCK TYPE; Grain size, texture and fabric, colour, general defect conditions, minor constituents.)	Weathering/ Cementation	Estimated Strength (EH VH H M L VL EL)	$Is_{(50)}$ [UCS] MPa	Defect Spacing mm (2000 600 200 [100] 60 20)	RQD %
	52.0	2.0										
	50.0	4.0										
	48.0	6.0					***Resuming in Rock Core Format 6.1m.***					
			NQ-3 Coring	/			GRANITE: Pink to dark pink, coarse grained, thickly banded gneiss in part, weakly fractured in part, faintly weathered	SW-Fr				
	46.0	8.0		/			7.70 m to 9.10 m: Dark pink, dark green, minor medium grained					
	44.0	10.0					To Target Depth. **Drillhole BH16-M007 terminated at 9.1m.**					
	42.0	12.0										
	40.0	14.0										
	38.0	16.0										
	36.0	18.0										
	34.0	20.0										

Notes:

Defect Description Legend

Planarity		Type				Roughness		Infill Amount	
Pl	Planar	Dl	Drilling Induced	Sm	Seam	Ro	Rough	cn	Clean
Ir	Irregular	Jt	Joint	Cz	Crushed Zone	Sm	Smooth	sn	Stained
Cu	Curved	Pt	Parting on Contact	Fz	Fractured Zone	Po	Polished	vn	Veneer
Un	Undulose	Sh	Shear Seam	Band	Weak Band	Sl	Slickenside	cg	Coating
St	Stepped	Cs	Crushed Seam						

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BOREHOLE REPORT

BH16-M008

Sheet 1 of 3

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Milne Port Train Unloading

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,771.0 m

Northing: 7,974,959.0 m

Surface Elevation: 52.00 m

Bottom Elevation: 30.66 m

Total Depth: 21.3 m

Logged By: UK

Reviewed By: SH/WH

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 10/4/2016

Driller: E.Beachamp

Hole Diameter (mm): 96

Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Moisture Condition	Consistency/ Density	Sample Type	Recovery %	Blows	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
Unobserved due to Permafrost	50.0	2.0	Vibracore	H-Casing		SANDY GRAVEL: Rounded to sub angular gravel, coarse grained sand, well graded												
						SAND: Coarse to fine grained 3.00 m to 4.60 m: Some SILT						18	0	73	27			
	48.0	4.0																
	46.0	6.0				SAND and GRAVEL: Coarse grained sand 6.90 m to 7.60 m: Zone of inferred cobbles						20						
	44.0	8.0																
	42.0	10.0				SILTY SAND, some GRAVEL: TILL, fine to coarse, subangular gravel 12.20 m to 12.60 m: GRAVELLY SILTY SAND 13.80 m to 15.40 m: SILTY SAND						9 12						
	40.0	12.0																
	38.0	14.0																
	36.0	16.0																
	34.0	18.0			[18.8]													
Notes:	32.0	20.0				***Start of Coring at 18.8m.*** ***Continued on Rock Core Log sheet.***												

HATCH LIBRARY V1.10.GLB Log SOIL BOREHOLE JIA_CYN_RAIL ALIGNMENT ALL_WITH ICE LOG_REV 5.GPJ <<DrawingFile>> 28/05/2018 16:04

BOREHOLE LOG

ROCK CORE FORMAT

BH16-M008

Client: Baffinland Iron Mines

Project: Mary River Expansion

Location: Milne Port Train Unloading

Project No.: H352034

Datum: NAD83

Platform:

Easting: 503,771.0 m

Northing: 7,974,959.0 m

Surface Elevation: 52.00 m

Bottom Elevation: 30.66 m

Total Depth: 21.3 m

Logged By: UK

Reviewed By: SH/WH

Contractor: Boart Longyear **Rig Type/ Mounting:** MiniSonic Rig **Bearing:** N/A **Date Logged:** 10/4/2016

Driller: E.Beachamp **Hole Diameter (mm):** 96 **Plunge:** Vertical **Date Checked:** 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Run #/TCR	Graphic Log	Geological Unit	Rock Description ROCK TYPE; Grain size, texture and fabric, colour, general defect conditions, minor constituents.	Weathering/ Cementation	Estimated Strength EH VH H M L VL EL	$Is_{(50)}$ [UCS] MPa	Defect Spacing mm 2000 600 200 [100] 60 20	RQD %
	50.0	2.0										
	48.0	4.0										
	46.0	6.0										
	44.0	8.0										
	42.0	10.0										
	40.0	12.0										
	38.0	14.0										
	36.0	16.0										
	34.0	18.0					***Resuming in Rock Core Format 18.8m.***					
	32.0	20.0					GRANITE: Pink, weathered					

Notes:

Defect Description Legend

Planarity		Type				Roughness		Infill Amount	
Pl	Planar	Dl	Drilling Induced	Sm	Seam	Ro	Rough	cn	Clean
Ir	Irregular	Jt	Joint	Cz	Crushed Zone	Sm	Smooth	sn	Stained
Cu	Curved	Pt	Parting on Contact	Fz	Fractured Zone	Po	Polished	vn	Veneer
Un	Undulose	Sh	Shear Seam	Band	Weak Band	Sl	Slickenside	cg	Coating
St	Stepped	Cs	Crushed Seam						

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BOREHOLE LOG

ROCK CORE FORMAT

BH16-M008

Sheet 3 of 3

Client: Baffinland Iron Mines

Project: Mary River Expansion

Location: Milne Port Train Unloading

Project No.: H352034

Datum: NAD83

Platform:

Easting: 503,771.0 m

Northing: 7,974,959.0 m

Surface Elevation: 52.00 m

Bottom Elevation: 30.66 m

Total Depth: 21.3 m

Logged By: UK

Reviewed By: SH/WH

Contractor: Boart Longyear **Rig Type/ Mounting:** MiniSonic Rig **Bearing:** N/A **Date Logged:** 10/4/2016

Driller: E.Beachamp **Hole Diameter (mm):** 96 **Plunge:** Vertical **Date Checked:** 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Run #/TCR	Graphic Log	Geological Unit	Rock Description ROCK TYPE; Grain size, texture and fabric, colour, general defect conditions, minor constituents.	Weathering/ Cementation	Estimated Strength EH VH H M L VL EL	$Is_{(50)}$ [UCS] MPa	Defect Spacing mm 2000 600 200 [100] 60 20	RQD %
			NQ-3 Coring				GRANITE: Pink, bedrock, angular, broken *(Continued)*					
	30.0	22.0					To Target Depth. **Drillhole BH16-M008 terminated at 21.3m.**					
	28.0	24.0										
	26.0	26.0										
	24.0	28.0										
	22.0	30.0										
	20.0	32.0										
	18.0	34.0										
	16.0	36.0										
	14.0	38.0										
	12.0	40.0										

Notes:

Defect Description Legend

Planarity		Type				Roughness		Infill Amount	
Pl	Planar	Dl	Drilling Induced	Sm	Seam	Ro	Rough	cn	Clean
Ir	Irregular	Jt	Joint	Cz	Crushed Zone	Sm	Smooth	sn	Stained
Cu	Curved	Pt	Parting on Contact	Fz	Fractured Zone	Po	Polished	vn	Veneer
Un	Undulose	Sh	Shear Seam	Band	Weak Band	Sl	Slickenside	cg	Coating
St	Stepped	Cs	Crushed Seam						

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BOREHOLE REPORT

BH16-M009

Sheet 1 of 2

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Milne Port Train Unloading

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,904.0 m

Northing: 7,974,935.0 m

Surface Elevation: 57.50 m

Bottom Elevation: 52.32 m

Total Depth: 5.2 m

Logged By: MR

Reviewed By: SH/WH

Contractor: Boart Longyear

Driller: Samuel Flynn

Rig Type/ Mounting: MiniSonic Rig

Hole Diameter (mm): 96

Date Logged: 10/4/2016

Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Moisture Condition	Consistency/ Density	Sample Type	Recovery %	Blows	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
Unobserved due to Permafrost	55.5	2.0	Vibracore	H-Casing		ORGANICS: Organic soil												
						GRAVELLY SAND: Light brown to grey, angular to subgranular gravel, medium to coarse grained sand												
						SAND and GRAVEL: Grey to light brown, Fine to coarse grained sand, angular to subangular gravel												
				[3.7]		Inferred BOULDERS with SAND: Coarse to fine grained sand												
	53.5	4.0				***Start of Coring at 3.7m.*** ***Continued on Rock Core Log sheet.***												
	51.5	6.0																
	49.5	8.0																
	47.5	10.0																
	45.5	12.0																
	43.5	14.0																
	41.5	16.0																
	39.5	18.0																
	37.5	20.0																

Notes:

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BOREHOLE LOG

ROCK CORE FORMAT

BH16-M009

Sheet 2 of 2

Client: Baffinland Iron Mines

Project: Mary River Expansion

Location: Milne Port Train Unloading

Project No.: H352034

Datum: NAD83

Platform:

Easting: 503,904.0 m

Northing: 7,974,935.0 m

Surface Elevation: 57.50 m

Bottom Elevation: 52.32 m

Total Depth: 5.2 m

Logged By: MR

Reviewed By: SH/WH

Contractor: Boart Longyear **Rig Type/ Mounting:** MiniSonic Rig **Bearing:** N/A **Date Logged:** 10/4/2016

Driller: Samuel Flynn **Hole Diameter (mm):** 96 **Plunge:** Vertical **Date Checked:** 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Run #/TCR	Graphic Log	Geological Unit	Rock Description ROCK TYPE; Grain size, texture and fabric, colour, general defect conditions, minor constituents.	Weathering/ Cementation	Estimated Strength (EH VH H M L VL EL)	$Is_{(50)}$ [UCS] MPa	Defect Spacing mm (2000 600 200 [100] 60 20)	RQD %
	55.5	2.0					***Resuming in Rock Core Format 3.7m.***					
	53.5	4.0	HQ-3 Coring				GRANITE: Pink, fractured, darker streaks, coarse grained, banded					
	51.5	6.0					To Target Depth. **Drillhole BH16-M009 terminated at 5.2m.**					
	49.5	8.0										
	47.5	10.0										
	45.5	12.0										
	43.5	14.0										
	41.5	16.0										
	39.5	18.0										
	37.5	20.0										

Notes:

Defect Description Legend

Planarity		Type				Roughness		Infill Amount	
Pl	Planar	Dl	Drilling Induced	Sm	Seam	Ro	Rough	cn	Clean
Ir	Irregular	Jt	Joint	Cz	Crushed Zone	Sm	Smooth	sn	Stained
Cu	Curved	Pt	Parting on Contact	Fz	Fractured Zone	Po	Polished	vn	Veneer
Un	Undulose	Sh	Shear Seam	Band	Weak Band	Sl	Slickenside	cg	Coating
St	Stepped	Cs	Crushed Seam						

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BOREHOLE REPORT

BH16-M010
Sheet 1 of 1

Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: Milne Port Crusher

Project No.: H352034
Datum: NAD83
Platform: Ground

Easting: 503,394.0 m
Northing: 7,974,877.0 m
Surface Elevation: 13.30 m
Bottom Elevation: -1.90 m
Total Depth: 15.2 m
Logged By: MR
Reviewed By: SH/WH

Contractor: Boart Longyear
Driller: Michael Scott
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 96
Date Logged: 12/9/2016
Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Moisture Condition	Consistency/ Density	Sample Type	Recovery %	Blows	Moisture Content Profile (0 50 100)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	11.3	2.0	Vibrocore	H-Casing		SILT, some SAND: Brown, moist							28	0	16	84			
						ICE: Soft, white, cloudy texture													
	9.3	4.0				GRAVELLY SILTY SAND: Light brown and grey							100	0	4	96			
						SILT and SAND: Organic silt, brown, moist													
	7.3	6.0				SILT, trace SAND: Organic, dark grey to brown, moist							32						
	5.3	8.0																	
	3.3	10.0																	
	1.3	12.0																	
	-0.7	14.0		[15.2]															
	-2.7	16.0				To Target Depth. **Drillhole BH16-M010 terminated at 15.2m.**													
	-4.7	18.0																	
	-6.7	20.0																	

Notes:

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BOREHOLE REPORT

BH16-M011

Sheet 1 of 1

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Milne Port Crusher

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,339.0 m

Northing: 7,974,868.0 m

Surface Elevation: 12.00 m

Bottom Elevation: -3.20 m

Total Depth: 15.2 m

Logged By: MR

Reviewed By: SH/WH

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 12/4/2016

Driller: Michael Scott

Hole Diameter (mm): 96

Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Moisture Condition	Consistency/ Density	Sample Type	Recovery %	Blows	Moisture Content Profile (0 – 50 – 100)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	10.0	2.0	Vibrocore	H-Casing		SILTY SAND: Light brown, moist							16	0	68	32			
	8.0	4.0				SAND and GRAVEL: Light brown, moist, subangular gravel							10						
	6.0	6.0				SILT, trace SAND: Dark grey, moist													
	4.0	8.0																	
	2.0	10.0																	
	0.0	12.0																	
	-2.0	14.0		[15.2]															
	-4.0	16.0				To Target Depth. **Drillhole BH16-M011 terminated at 15.2m.**													
	-6.0	18.0																	
	-8.0	20.0																	

Notes:

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BOREHOLE REPORT

BH16-M012

Sheet 1 of 1

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Milne Port Generator

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,268.0 m

Northing: 7,974,848.0 m

Surface Elevation: 12.00 m

Bottom Elevation: -3.20 m

Total Depth: 15.2 m

Logged By: MR

Reviewed By: SH/WH

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 12/8/2016

Driller: Michael Scott

Hole Diameter (mm): 96

Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Moisture Condition	Consistency/ Density	Sample Type	Recovery %	Blows	Moisture Content Profile (0 50 100)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	10.0	2.0	Vibrocore	H-Casing		SAND and GRAVEL, some SILT, trace COBBLES: Light brown, rounded							6	39	45	17			
	8.0	4.0				SILT, some SAND: Dark grey							21	0	16	84			
	6.0	6.0																	
	4.0	8.0																	
	2.0	10.0																	
	0.0	12.0																	
	-2.0	14.0		[15.2]															
	-4.0	16.0				To Target Depth. **Drillhole BH16-M012 terminated at 15.2m.**													
	-6.0	18.0																	
	-8.0	20.0																	

Notes:

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BOREHOLE REPORT

BH16-M013

Sheet 1 of 1

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Milne Port Screening

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,140.0 m

Northing: 7,974,820.0 m

Surface Elevation: 11.00 m

Bottom Elevation: -4.20 m

Total Depth: 15.2 m

Logged By: MR

Reviewed By: SH/WH

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 12/5/2016

Driller: Michael Scott

Hole Diameter (mm): 96

Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Moisture Condition	Consistency/ Density	Sample Type	Recovery %	Blows	Moisture Content Profile (0 – 50 – 100)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	9.0	2.0	Vibrocore	H-Casing		Organic soil and GRAVEL GRAVELLY SAND, some SILT: Light brown, medium to coarse grained sand, rounded to subangular gravel							25	32	48	20			
	7.0	4.0				SILT, some SAND: Dark grey							21	5	33	61			
	5.0	6.0																	
	3.0	8.0																	
	1.0	10.0																	
	-1.0	12.0																	
	-3.0	14.0																	
		[15.2]																	
	-5.0	16.0				To Target Depth. **Drillhole BH16-M013 terminated at 15.2m.**													
	-7.0	18.0																	
	-9.0	20.0																	

Notes:

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BOREHOLE REPORT

BH16-M014
Sheet 1 of 1

Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: Milne Port Tail Pulley

Project No.: H352034
Datum: NAD83
Platform: Ground

Easting: 503,052.0 m
Northing: 7,974,782.0 m
Surface Elevation: 11.00 m
Bottom Elevation: -4.20 m
Total Depth: 15.2 m
Logged By: MR
Reviewed By: SH/WH

Contractor: Boart Longyear
Driller: Michael Scott
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 96
Date Logged: 12/5/2016
Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Moisture Condition	Consistency/ Density	Sample Type	Recovery %	Blows	Moisture Content Profile (0 50 100)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	9.0	2.0	Vibrocore	H-Casing		GRAVELLY SILTY SAND: Grey to brown, angular to subangular gravel							6	22	52	26			
	7.0	4.0				SILTY SAND: Grey							21	0	78	22			
	5.0	6.0																	
	3.0	8.0				SILT, some SAND: Dark grey, fine grained sand													
	1.0	10.0																	
	-1.0	12.0																	
	-3.0	14.0																	
		[15.2]																	
	-5.0	16.0				To Target Depth. **Drillhole BH16-M014 terminated at 15.2m.**													
	-7.0	18.0																	
	-9.0	20.0																	

Notes:

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BOREHOLE REPORT

BH16-M015

Sheet 1 of 1

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Milne Port Tail Pulley Alt.

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,007.0 m

Northing: 7,974,799.0 m

Surface Elevation: 11.00 m

Bottom Elevation: -4.20 m

Total Depth: 15.2 m

Logged By: MR

Reviewed By: SH/WH

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged:

Driller: Michael Scott

Hole Diameter (mm): 96

Date Reviewed: 2/10/2017

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Moisture Condition	Consistency/ Density	Sample Type	Recovery %	Blows	Moisture Content Profile (0 50 100)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	9.0	2.0	Vibrocore	H-Casing		SAND and GRAVEL, trace SILT, trace COBBLES: Light brown to grey, fine to coarse grained sand, rounded gravel							1	32	59	10			
	7.0	4.0				SAND, trace SILT: Light brown, fine to coarse grained sand,							14	15	71	14			
	5.0	6.0				SILT, some SAND: Dark grey to brown													
	3.0	8.0																	
	1.0	10.0																	
	-1.0	12.0											24						
	-3.0	14.0																	
				[15.2]									27						
	-5.0	16.0				To Target Depth. **Drillhole BH16-M015 terminated at 15.2m.**													
	-7.0	18.0																	
	-9.0	20.0																	

Notes:

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BOREHOLE REPORT

BH17-10

Sheet 1 of 2

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Transfer Conveyor

Project No.: H353004

Datum: NAD 83

Platform: Ground

Easting: 503,476.0 m

Northing: 7,974,905.0 m

Surface Elevation: 17.00 m

Bottom Elevation: 0.28 m

Total Depth: 16.7 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 10/29/2017

Driller: Brent McAndrew

Hole Diameter (mm): 100 mm

Date Reviewed: 1/18/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 – 25 – 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	16.0	1.0				SILT with SAND, trace Gravel trace Ice: Brown, particles up to 80 mm. Unfrozen to 1.6 m, frozen beyond 1.6 m with ice lenses up to 4 mm thick. Ice poor soil.	Nbe - Vs				26	10	42	48			
	15.0	2.0															
	14.0	3.0															
	13.0	4.0															
	12.0	5.0									19	10	35	55			
	11.0	6.0															
	10.0	7.0															
	9.0	8.0				SILT, trace Sand, trace Organics trace Ice: Brown and dark grey with ocasional thin black seams of organics and ice lenses. Ice poor soil	Nbn trace Vs				9	8	36	56			
	8.0	9.0									37	0	1	99			
	7.0	10.0															

Notes: BH colar elevation is estimated fro Lidar information.

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HATCH BOREHOLE REPORT

BH17-10

Sheet 2 of 2

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Transfer Conveyor

Project No.: H353004

Datum: NAD 83

Platform: Ground

Easting: 503,476.0 m

Northing: 7,974,905.0 m

Surface Elevation: 17.00 m

Bottom Elevation: 0.28 m

Total Depth: 16.7 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 10/29/2017

Driller: Brent McAndrew

Hole Diameter (mm): 100 mm

Date Reviewed: 1/18/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	6.0	11.0				SILT, trace Sand, trace Organics trace Ice: Brown and dark grey with ocasional thin black seams of organics and ice lenses. Ice poor soil *(Continued)* 10.3 m to 10.6 m: Some thin ice lenses.	Nbn trace Vs *(Continued)*				21	0	2	98			
	5.0	12.0									18	0	30	70			
	4.0	13.0															
	3.0	14.0				SAND, some SILT, some GRAVEL: TILL, beige, well graded. Ice poor soil.	Nbn				8	15	69	16			
	2.0	15.0															
	1.0	16.0									8	13	60	27			
	0.0	17.0				To Target Depth. **Drillhole BH17-10 terminated at 16.7m.**											
	-1.0	18.0															
	-2.0	19.0															
	-3.0	20.0															

Notes: BH colar elevation is estimated fro Lidar information.

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BOREHOLE REPORT

BH17-11

Sheet 1 of 2

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: New Transfer Tower

Project No.: H353004

Datum: NAD 83

Platform: Ground

Easting: 503,268.0 m

Northing: 7,976,025.0 m

Surface Elevation: m

Bottom Elevation: m

Total Depth: 15.2 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged:

Driller: Brent McAndrew

Hole Diameter (mm): 100 mm

Date Reviewed: 3/21/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
		0				Iron Ore (from stockplie base)	Unfrozen										
		1.0				Rockfill (base material)	unfrozen										
		2.0				GRAVEL and SAND with Silt: Grey. Ice poor soil.	Nbn										
		3.0									6						
		4.0				SAND and GRAVEL: Brown, particles up to 80 mm. Ice poor soil	Nbn										
		5.0															
		6.0									29						
		7.0															
		8.0				SAND: Beige, poorly graded. Ice poor soil.	Nbn				18						
		9.0				SAND, trace Silt: Brown, fine, unfrozen. Ice poor soil,	Unfrozen				18						
		10.0															

Notes: BH colar elevation is estimated fro Lidar information.

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BOREHOLE REPORT

BH17-11
Sheet 2 of 2

Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: New Transfer Tower

Project No.: H353004
Datum: NAD 83
Platform: Ground

Easting: 503,268.0 m
Northing: 7,976,025.0 m
Surface Elevation: m
Bottom Elevation: m
Total Depth: 15.2 m
Logged By: R.S
Reviewed By: G.Q

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged:
Date Reviewed: 3/21/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 / 25 / 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
						SILTY SAND some Gravel and Organis: Dark brown to black.	Nbn				16						
		11.0				SAND: Brown, well graded. Ice poor soil. 11.1 m: Trace gravel. 11.34 m to 11.35 m: Trace orgaics, dark grey. 12.16 m to 12.66 m: Trace gravel. loose, dry and unfrozen.	Nbn				19						
		15.0				To Target Depth. **Drillhole BH17-11 terminated at 15.2m.**											
		20.0															

Notes: BH colar elevation is estimated fro Lidar information.

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BOREHOLE REPORT

BH17-12

Sheet 1 of 2

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: New Tail of Conveyor

Project No.: H353004

Datum: NAD 83

Platform: Ground

Easting: 503,180.0 m

Northing: 7,975,752.0 m

Surface Elevation: m

Bottom Elevation: m

Total Depth: 15.2 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged:

Driller: Brent McAndrew

Hole Diameter (mm): 100 mm

Date Reviewed: 3/21/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
		0				Iron Ore (from stockplie base)	Unfrozen										
						Rockfill (base material)	unfrozen										
						SAND and ICE. Soil rich ice.	ICE										
		1.0									13						
						ICE, trace Sand. Soil poor ice.	ICE										
		2.0															
		3.0															
						SAND: Brown, poorly graded. Ice poor soil.	Nbn										
		4.0									32						
						SILT and fine SAND: Beige and brown to blackish-grey, thinly bedded layers with occasional organics. Ice poor soil.	Nbn										
		5.0									27						
		6.0									22						
						SAND: Biege and brown, poorly graded. Ice poor soil.	Nbn										
		7.0															
		8.0															
		9.0									24						
		10.0															

Notes: BH colar elevation is estimated fro Lidar information.

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BOREHOLE REPORT

BH17-12
Sheet 2 of 2

Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: New Tail of Conveyor

Project No.: H353004
Datum: NAD 83
Platform: Ground

Easting: 503,180.0 m
Northing: 7,975,752.0 m
Surface Elevation: m
Bottom Elevation: m
Total Depth: 15.2 m
Logged By: R.S
Reviewed By: G.Q

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged:
Date Reviewed: 3/21/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 – 25 – 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
		11.0				SAND: Biege and brown, poorly graded. Ice poor soil. *(Continued)*	Nbn *(Continued)*				25						
		12.0															
		13.0															
		14.0															
		15.0															
		16.0				To Target Depth. **Drillhole BH17-12 terminated at 15.2m.**											
		17.0															
		18.0															
		19.0															
		20.0															

Notes: BH colar elevation is estimated fro Lidar information.

HATCH LIBRARY DEVELOPMENT COPY.GLB Log ICE BOREHOLE MILNE PORT SUPPLIMENTARY BOREHOLES 2017.GPJ <<DrawingFile>> 04/04/2018 15:28

BOREHOLE REPORT

BH17-13

Sheet 1 of 1

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Center of Ore Pile

Project No.: H353004

Datum: NAD 83

Platform: Ground

Easting: 503,158.8 m

Northing: 7,975,912.1 m

Surface Elevation: 10.52 m

Bottom Elevation: 4.42 m

Total Depth: 6.1 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear

Driller: Brent McAndrew

Rig Type/ Mounting: MiniSonic Rig

Hole Diameter (mm): 100 mm

Date Logged: 10/8/2017

Date Reviewed: 3/21/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile 0 25 50	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
						Iron Ore (from stockplie base)	Unfrozen										
						Rockfill (base material)	Unfrozen										
	9.5	1.0				SAND and GRAVEL: Brown, particles up to 50 mm. Ice poor soil	Unfrozen										
	8.5	2.0				SAND some GRAVEL some SILT: Brown to beige, particles up to 20 mm, rounded. Ice poor soil.	Nbn										
	7.5	3.0															
	6.5	4.0															
	5.5	5.0															
	4.5	6.0				To Target Depth. **Drillhole BH17-13 terminated at 6.1m.**											
	3.5	7.0															
	2.5	8.0															
	1.5	9.0															
	0.5	10.0															

Notes: BH colar elevation is estimated fro Lidar information.

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BOREHOLE REPORT

BH17-14

Sheet 1 of 1

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Mid-Slope of Ore Pile

Project No.: H353004

Datum: NAD 83

Platform: Ground

Easting: 503,187.2 m

Northing: 7,975,912.6 m

Surface Elevation: 10.63 m

Bottom Elevation: 4.53 m

Total Depth: 6.1 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear

Driller: Brent McAndrew

Rig Type/ Mounting: MiniSonic Rig

Hole Diameter (mm): 100 mm

Date Logged: 10/8/2017

Date Reviewed: 3/21/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
						Iron Ore (from stockplie base)	Unfrozen										
						Rockfill (base material)	Unfrozen										
	9.6	1.0				SAND and GRAVEL trace Silt: Brown, frozen beyond 1.5. Ice poor soil.	Unfrozen to Nbn										
						0.60 m to 4.00 m: Colour changes to biege, particles up to 20 mm.	Nbn										
	8.6	2.0															
	7.6	3.0															
	6.6	4.0				SAND: Grey, well graded with thin brown silt lenses. Ice poor soil.	Nbn										
						4.15 m: Thin seam of black organics.											
	5.6	5.0				SAND and GRAVEL trace SILT: Biege. Ice poor soil	Nbn										
	4.6	6.0															
						To Target Depth. **Drillhole BH17-14 terminated at 6.1m.**											
	3.6	7.0															
	2.6	8.0															
	1.6	9.0															
	0.6	10.0															

Notes: BH colar elevation is estimated fro Lidar information.

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BOREHOLE REPORT

BH17-15

Sheet 1 of 1

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Toe of Ore Pile

Project No.: H353004

Datum: NAD 83

Platform: Ground

Easting: 503,222.0 m

Northing: 7,975,913.4 m

Surface Elevation: 10.25 m

Bottom Elevation: 4.15 m

Total Depth: 6.1 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 10/8/2017

Driller: Brent McAndrew

Hole Diameter (mm): 100 mm

Date Reviewed: 3/21/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
						Iron Ore (from stockplie base)	Unfrozen										
	9.2	1.0				SAND and GRAVEL some Silt: Brown. Ice poor soil. Frozen below 1.5 m.	Unfrozen to Nbn										
	8.2	2.0				1.50 mto 4.20: Colour changes to beige. Particles up to 80 mm. m	Nbn										
	7.2	3.0															
	6.2	4.0				SAND: Grey, well graded with thin brown silt lenses. Ice poor soil.	Nbn										
	5.2	5.0				SAND and GRAVEL trace SILT: Biege. Ice poor soil	Nbn										
	4.2	6.0															
						To Target Depth. **Drillhole BH17-15 terminated at 6.1m.**											
	3.2	7.0															
	2.2	8.0															
	1.2	9.0															
	0.2	10.0															

Notes: BH colar elevation is estimated fro Lidar information.

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BOREHOLE REPORT

BH17-Camp-1

Sheet 1 of 1

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Proposed Camp Extension Area

Project No.: H353004

Datum: NAD 83

Platform: Ground

Easting: 503,961.0 m

Northing: 7,976,147.0 m

Surface Elevation: m

Bottom Elevation: m

Total Depth: 6.1 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear

Driller: Brent McAndrew

Rig Type/ Mounting: MiniSonic Rig

Hole Diameter (mm): 100 mm

Date Logged:

Date Reviewed: 3/21/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 – 25 – 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
		0				SAND and GRAVEL: Brown, road topping / fill.											
		1.0				SAND and GRAVEL trace Silt: Biege, particles up to 80 mm, round. Ice poor soil.											
		2.0				SILT and SAND trace Clay trace Organics: Brown, fine grained, thin layers of orgaics. Ice poor soil.											
		3.0															
		4.0				3.50 m to 6.10 m: Colour changes from brown to grey.											
		5.0															
		6.0															
		7.0				To Target Depth. **Drillhole BH17-Camp-1 terminated at 6.1m.**											
		8.0															
		9.0															
		10.0															

Notes: BH colar elevation is estimated fro Lidar information.

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HATCH BOREHOLE REPORT

BH17-EBC-1

Sheet 1 of 4

Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: Rail Indexer Foundation

Project No.: H352034
Datum: NAD83
Platform: Ground

Easting: 503,783.4 m
Northing: 7,974,920.8 m
Surface Elevation: 51.59 m
Bottom Elevation: 29.92 m
Total Depth: 21.7 m
Logged By: R.S
Reviewed By: G.Q

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged: 9/19/2017
Date Reviewed: 1/26/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Frozen Soil Description	Consistency/ Density	Sample Type	Additional Observations	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	50.6	1.0				SAND and GRAVEL (FILL): Brown. Material placed to create level drilling platform.	Unfrozen										
	49.6	2.0															
	48.6	3.0				SAND and GRAVEL with Silt: Brown and grey, frozen.	Nbn			DQ1 taken from 3.20-3.30m.							
						ICE, trace Silt: Grey to white.	ICE										
	47.6	4.0								DQ2 taken from 4.60-4.70m.							
	46.6	5.0				SAND, trace Silt: Brown, frozen. Ice poor soil.	Nbn			DQ3 taken from 5.10-5.20m.							
						ICE, trace Silt: White/clear.	ICE										
	45.6	6.0								DQ4 taken from 6.20-6.30m.							
	44.6	7.0															
	43.6	8.0								DQ5 taken from 8.30-8.40m.							
	42.6	9.0															
						SAND, trace Silt: Light brown, occasional thin ice lenses. Ice poor soil.	Nbn-Vs			DQ6 taken from 9.70-9.80m.							
	41.6	10.0															

Notes:

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BOREHOLE REPORT

BH17-EBC-1
Sheet 2 of 4

Client: Baffinland Iron Mines
Project: Mary River Expansion Study Stage 2
Location: Rail Indexer Foundation

Project No.: H352034
Datum: NAD83
Platform: Ground

Easting: 503,783.4 m
Northing: 7,974,920.8 m
Surface Elevation: 51.59 m
Bottom Elevation: 29.92 m
Total Depth: 21.7 m
Logged By: R.S
Reviewed By: G.Q

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged: 9/19/2017
Date Reviewed: 1/26/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Consistency/ Density	Sample Type	Additional Observations	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	40.6	11.0				SAND and GRAVEL some Silt: TILL, brown. Ice poor soil.	Nbn			DQ7 taken from 11.20-11.30m.							
	39.6	12.0								DQ8 taken from 12.50-12.60m.							
	38.6	13.0								DQ9 taken from 13.40-13.50m.							
	37.6	14.0				COBBLES and BEDROCK: Biege and brown, pulverized cobbles and bedrock, dry powdery, with layers of brown silty sand and gravel, moist. Top of poor quality bedrock, 14.04 m.				DQ10 taken from 14.00-14.10m.							
	36.6	15.0				***Start of Coring at 14.0m.*** ***Continued on Rock Core Log sheet.***											
	35.6	16.0															
	34.6	17.0															
	33.6	18.0															
	32.6	19.0															
	31.6	20.0															

Notes:

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BOREHOLE LOG

ROCK CORE FORMAT

BH17-EBC-1

Sheet 3 of 4

Client: Baffinland Iron Mines Corporation

Project: Mary River Expansion Project

Location: Rail Indexer Foundation

Project No.: H353004

Datum: NAD 83

Platform: Ground

Easting: 503,783.4 m

Northing: 7,974,920.8 m

Surface Elevation: 51.59 m

Bottom Elevation: 29.92 m

Total Depth: 21.7 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear **Rig Type/ Mounting:** MiniSonic Rig **Bearing:** N/A **Date Logged:** 9/19/2017

Driller: Brent McAndrew **Hole Diameter (mm):** 100 mm **Plunge:** Vertical **Date Checked:** 1/26/2018

Water	Elevation (m)	Depth (m)	Method	Run #/TCR	Graphic Log	Geological Unit	Rock Description: ROCK TYPE; Grain size, texture and fabric, colour, general defect conditions, minor constituents.	Weathering/ Cementation	Estimated Strength (EH VH H M L VL EL)	$Is_{(50)}$ [UCS] MPa	Defect Spacing mm (2000 600 200 [100] 60 20)	RQD %	Defect Log	Defect Description: Inclination, type, infill, amount, aperture, planarity, roughness, frequency (Specific / General)
	40.6	11.0												
	39.6	12.0												
	38.6	13.0												
	37.6	14.0					***Resuming in Rock Core Format 14.0m.***							
				2 / 100			BEDROCK: Granitic Gneiss, medium to coarse grained, hard to very hard, pinkish-grey colour. Fractures are generally vertical, between 0 to 15 degrees and horizontal, from 70 to 90 degrees. Numerous joints and fractures infilled with clayey-silt and fine sand throughout.					0		Cz
														70° Jt Pl Sm Silt sn
														Cz
	36.6	15.0		3 / 96						Dia 75.5		44		80° Jt Pl Sm sn
														Cz
														Jt
														10° Dl Ir Ro
														75° Jt Pl Sm 1 -2 mm clay sn
														0° Dl Ir Ro
														10° Dl Ir Ro
	35.6	16.0		4 / 88						Dia 182.5		6		Cz
	34.6	17.0												60° Jt Pl Sm 1 -2 mm clay sn
														Fz
														20° Jt Pl Sm 1 mm clay sn
														40° Jt Pl Sm 1 mm clay sn
														10° Dl Ir Ro
														0° Dl Ir Ro
	33.6	18.0		5 / 106								56		70° Jt Pl Sm 1 -2 mm clay sn
														60° Jt Pl Sm 1 mm clay cn
														90° Dl Ir Ro
														0° Dl Ir Ro
														0° Dl Ir Ro
														0° Dl Ir Ro
														0° Dl Ir Ro
														0° Dl Ir Ro
	32.6	19.0		6 / 99						Dia 151.7 [164]		62		60° Jt Pl Sm 1 mm clay sn
														10° Jt Pl Sm sn
														Jt
														10° Jt Pl Sm 5mm Clay sn
										Dia 119.6				10° Jt Pl Sm Silt sn
	31.6	20.0												10° Jt Pl Sm Silt sn

Notes:

Defect Description Legend

Planarity		Type				Roughness		Infill Amount	
Pl	Planar	Dl	Drilling Induced	Sm	Seam	Ro	Rough	cn	Clean
Ir	Irregular	Jt	Joint	Cz	Crushed Zone	Sm	Smooth	sn	Stained
Cu	Curved	Pt	Parting on Contact	Fz	Fractured Zone	Po	Polished	vn	Veneer
Un	Undulose	Sh	Shear Seam	Band	Weak Band	Sl	Slickenside	cg	Coating
St	Stepped	Cs	Crushed Seam						

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BOREHOLE LOG

ROCK CORE FORMAT

BH17-EBC-1

Sheet 4 of 4

Client: Baffinland Iron Mines Corporation

Project: Mary River Expansion Project

Location: Rail Indexer Foundation

Project No.: H353004

Datum: NAD 83

Platform: Ground

Easting: 503,783.4 m

Northing: 7,974,920.8 m

Surface Elevation: 51.59 m

Bottom Elevation: 29.92 m

Total Depth: 21.7 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear **Rig Type/ Mounting:** MiniSonic Rig **Bearing:** N/A **Date Logged:** 9/19/2017

Driller: Brent McAndrew **Hole Diameter (mm):** 100 mm **Plunge:** Vertical **Date Checked:** 1/26/2018

Water	Elevation (m)	Depth (m)	Method	Run #/TCR	Graphic Log	Geological Unit	Rock Description (ROCK TYPE; Grain size, texture and fabric, colour, general defect conditions, minor constituents.)	Weathering/ Cementation	Estimated Strength (EH VH H M L VL EL)	$Is_{(50)}$ [UCS] MPa	Defect Spacing mm (2000 600 200 60 20) [100]	RQD %	Defect Log	Defect Description (Inclination, type, infill, amount, aperture, planarity, roughness, frequency) Specific / General
	30.6	21.0		7 / 100			BEDROCK: Granitic Gneiss, medium to coarse grained, hard to very hard, pinkish-grey colour. Fractures are generally vertical, between 0 to 15 degrees and horizontal, from 70 to 90 degrees. *(Continued)*			Dia 147.9		66		85° Jt Pl Sm Silt sn 85° Jt Pl Sm Silt sn 85° Jt Pl Sm Silt sn 85° Jt Pl Sm Silt sn 85° Jt Pl Sm 1 mm clay sn 85° Jt Pl Sm Silt sn 85° Jt Pl Sm Silt sn 85° Jt Pl Sm Silt sn 85° Jt Pl Sm Silt sn 85° Jt Pl Sm Silt sn 85° Jt Pl Sm Silt sn 10° Cz Ir Ro Silt 10° Dl Ir Ro Silt 10° Dl Ir Ro Silt 10° Dl Ir Ro Silt 10° Dl Ir Ro Silt
	29.6	22.0					To Target Depth. **Drillhole BH17-EBC-1 terminated at 21.7m.**							
	28.6	23.0												
	27.6	24.0												
	26.6	25.0												
	25.6	26.0												
	24.6	27.0												
	23.6	28.0												
	22.6	29.0												
	21.6	30.0												

Notes:

Defect Description Legend

Planarity		Type				Roughness		Infill Amount	
Pl	Planar	Dl	Drilling Induced	Sm	Seam	Ro	Rough	cn	Clean
Ir	Irregular	Jt	Joint	Cz	Crushed Zone	Sm	Smooth	sn	Stained
Cu	Curved	Pt	Parting on Contact	Fz	Fractured Zone	Po	Polished	vn	Veneer
Un	Undulose	Sh	Shear Seam	Band	Weak Band	Sl	Slickenside	cg	Coating
St	Stepped	Cs	Crushed Seam						

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BOREHOLE REPORT

BH17-EBC-2

Sheet 1 of 4

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Rail Indexer Foundation

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,790.9 m

Northing: 7,974,895.2 m

Surface Elevation: 54.05 m

Bottom Elevation: 32.21 m

Total Depth: 21.8 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear

Driller: Brent McAndrew

Rig Type/ Mounting: MiniSonic Rig

Hole Diameter (mm): 100 mm

Date Logged: 9/24/2017

Date Reviewed: 1/26/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Consistency/ Density	Sample Type	Additional Observations	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	53.1	1.0				SAND and GRAVEL trace Cobbles: Brown, well graded up to 75 mm. Cobbles recovered are partially pulverisized to dry, beige rock flour. Ice poor soil.	Unfrozen			DQ1 taken from 1.00-1.10m.							
	52.1	2.0				SAND trace Silt: Brown, well graded. Ice poor soil.	Nbn			DQ2 taken from 1.52-1.62m. DQ3 taken from 2.00-2.10m.							
	51.1	3.0								DQ4 taken from 3.05-3.15m.							
	50.1	4.0				SAND and GRAVEL trace Silt: Brown, wet, well graded. Ice poor soil. GRAVEL with SAND, trace Silt. Brown, well graded. Ice poor soil.	Nbn Nbn			DQ5 taken from 4.30-4.40m.							
	49.1	5.0								DQ6 taken from 5.00-5.10m.							
	48.1	6.0								DQ7 taken from 5.80-5.90m.							
	47.1	7.0								DQ8 taken from 6.90-7.00m.							
	46.1	8.0								DQ9 taken from 8.10-8.20m.							
	45.1	9.0				GRAVEL and SAND, some SILT: TILL, brown and grey. Recovery by HQ core barrel. Silt and sand content is estimated from wash water recovery.											
	44.1	10.0															

Notes:

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BOREHOLE REPORT

BH17-EBC-2

Sheet 2 of 4

Client: Baffinland Iron Mines

Project: Mary River Expansion Study Stage 2

Location: Rail Indexer Foundation

Project No.: H352034

Datum: NAD83

Platform: Ground

Easting: 503,790.9 m

Northing: 7,974,895.2 m

Surface Elevation: 54.05 m

Bottom Elevation: 32.21 m

Total Depth: 21.8 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear

Driller: Brent McAndrew

Rig Type/ Mounting: MiniSonic Rig

Hole Diameter (mm): 100 mm

Date Logged: 9/24/2017

Date Reviewed: 1/26/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Consistency/ Density	Sample Type	Additional Observations	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	43.1	11.0				GRAVEL and SAND, some SILT: TILL, brown and grey. Recovery by HQ core barrel. Silt and sand content is estimated from wash water recovery. *(Continued)*											
	42.1	12.0															
	41.1	13.0				***Start of Coring at 13.3m.*** ***Continued on Rock Core Log sheet.***											
	40.1	14.0															
	39.1	15.0															
	38.1	16.0															
	37.1	17.0															
	36.1	18.0															
	35.1	19.0															
	34.1	20.0															

Notes:

HATCHCANADA2015 DRAFT REV3_MY.GLB Log ICE BOREHOLE JIA_CYN_RAIL ALIGNMENT ALL_WITH ICE LOG_REV 5.GPJ <<DrawingFile>> 29/05/2018 10:30

BOREHOLE LOG

ROCK CORE FORMAT

BH17-EBC-2

Sheet 3 of 4

Client: Baffinland Iron Mines Corporation

Project: Mary River Expansion Project

Location: Rail Indexer Foundation

Project No.: H353004

Datum: NAD 83

Platform: Ground

Easting: 503,790.9 m

Northing: 7,974,895.2 m

Surface Elevation: 54.05 m

Bottom Elevation: 32.21 m

Total Depth: 21.8 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear **Rig Type/ Mounting:** MiniSonic Rig **Bearing:** N/A **Date Logged:** 9/24/2017

Driller: Brent McAndrew **Hole Diameter (mm):** 100 mm **Plunge:** Vertical **Date Checked:** 1/26/2018

Water	Elevation (m)	Depth (m)	Method	Run #/TCR	Graphic Log	Geological Unit	Rock Description (ROCK TYPE; Grain size, texture and fabric, colour, general defect conditions, minor constituents.)	Weathering/ Cementation	Estimated Strength (EH VH H M L VL EL)	$Is_{(50)}$ [UCS] MPa	Defect Spacing mm (2000 600 200 60 20) [100]	RQD %	Defect Log	Defect Description (Specific / General)
	43.1	11.0												
	42.1	12.0												
	41.1	13.0					***Resuming in Rock Core Format 13.3m.***							
	40.1	14.0		9 / 107			BEDROCK: Granitic Gneiss, medium to coarse grained, hard to very hard, pinkish-grey colour. Fractures are generally vertical, between 0 to 15 degrees and horizontal, from 70 to 90 degrees. Numerous joints and fractures infilled with clayey-silt and fine sand throughout.			Dia 100.7 Dia 157.4		48		Dl 10° Dl Ir Ro 10° Cz Ir Ro Silt 10° Jt Pl Ro 3 mm clay sn 10° Jt Pl Ro Silt sn 10° Cz Ir Ro 65° Jt Pl Sm Silt Cz
	39.1	15.0		10 / 103								74		10° Jt Pl Sm Silt 10° Jt Pl Sm Silt 10° Dl Ir Ro Silt 10° Dl Ir Ro Silt 10° Dl Ir Ro Silt 10° Dl Ir Ro Silt 10° Dl Ir Ro Silt 10° Dl Ir Ro Silt Cz 75° Jt Pl Sm 4mm Clayey sn
	38.1	16.0		11 / 130								39		10° Jt Pl Sm Silt 10° Jt Pl Sm Silt sn Cz
	37.1	17.0		12 / 105						[161.5]		59		75° Jt Pl Ro sn 10° Jt Pl Sm Silt sn 10° Jt Pl Sm Silt sn 5° Jt Pl Sm Silt sn 0° Jt Pl Sm Silt sn 0° Dl Ir Ro 60° Jt Pl Sm Silt cg 0° Dl Ir Ro 15° Jt Pl Sm Silt sn 20° Jt Pl Sm Silt sn 20° Dl Ir Ro 85° Jt Pl Sm Silt sn 20° Jt Pl Dl
	36.1	18.0												
	35.1	19.0		13 / 97						Dia 133.8 Dia 70.81		42		20° Jt Pl Sm Silt sn 10° Jt Pl Sm Silt sn Cz 85° Jt Pl Sm Silt sn Dl
	34.1	20.0												

Notes:

Defect Description Legend

Planarity		Type				Roughness		Infill Amount	
Pl	Planar	Dl	Drilling Induced	Sm	Seam	Ro	Rough	cn	Clean
Ir	Irregular	Jt	Joint	Cz	Crushed Zone	Sm	Smooth	sn	Stained
Cu	Curved	Pt	Parting on Contact	Fz	Fractured Zone	Po	Polished	vn	Veneer
Un	Undulose	Sh	Shear Seam	Band	Weak Band	Sl	Slickenside	cg	Coating
St	Stepped	Cs	Crushed Seam						

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BOREHOLE LOG

ROCK CORE FORMAT

BH17-EBC-2

Sheet 4 of 4

Client: Baffinland Iron Mines Corporation

Project: Mary River Expansion Project

Location: Rail Indexer Foundation

Project No.: H353004

Datum: NAD 83

Platform: Ground

Easting: 503,790.9 m

Northing: 7,974,895.2 m

Surface Elevation: 54.05 m

Bottom Elevation: 32.21 m

Total Depth: 21.8 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear **Rig Type/ Mounting:** MiniSonic Rig **Bearing:** N/A **Date Logged:** 9/24/2017

Driller: Brent McAndrew **Hole Diameter (mm):** 100 mm **Plunge:** Vertical **Date Checked:** 1/26/2018

Water	Elevation (m)	Depth (m)	Method	Run #/TCR	Graphic Log	Geological Unit	Rock Description (ROCK TYPE; Grain size, texture and fabric, colour, general defect conditions, minor constituents.)	Weathering/ Cementation	Estimated Strength (EH VH H M L VL EL)	$Is_{(50)}$ [UCS] MPa	Defect Spacing mm (2000 600 200 [100] 60 20)	RQD %	Defect Log	Defect Description (Inclination, type, infill, amount, aperture, planarity, roughness, frequency) Specific / General
	33.1	21.0		14 / 100			BEDROCK: Granitic Gneiss, medium to coarse grained, hard to very hard, pinkish-grey colour. Fractures are generally vertical, between 0 to 15 degrees and horizontal, from 70 to 90 degrees. *(Continued)*					42	42	85° Jt Pl Sm Silt sn 20° Jt Pl Sm Silt sn 15° Jt Pl Sm Silt sn 30° Jt Pl Sm Silt sn 0° Dl Ir Ro 85° Jt Pl Sm Silt sn 0° Dl Ir Ro 20° Jt Pl Sm Silt sn 15° Jt Pl Sm Silt sn 25° Dl Ir Ro 10° Jt Pl Sm Silt sn Cz 5° Jt Pl Sl vn Cz 0° Dl Ir Ro
	32.1	22.0					To Target Depth. **Drillhole BH17-EBC-2 terminated at 21.8m.**							0° Dl Ir Ro 0° Dl Ir Ro 0° Dl Ir Ro 0° Dl Ir Ro 0° Jt Pl Ro Silt sn 0° Jt Pl Ro Silt sn 0° Jt Pl Ro Silt sn 0° Jt Pl Ro Silt sn 0° Dl Ir Ro
	31.1	23.0												
	30.1	24.0												
	29.1	25.0												
	28.1	26.0												
	27.1	27.0												
	26.1	28.0												
	25.1	29.0												
	24.1	30.0												

Notes:

Defect Description Legend

Planarity		Type				Roughness		Infill Amount	
Pl	Planar	Dl	Drilling Induced	Sm	Seam	Ro	Rough	cn	Clean
Ir	Irregular	Jt	Joint	Cz	Crushed Zone	Sm	Smooth	sn	Stained
Cu	Curved	Pt	Parting on Contact	Fz	Fractured Zone	Po	Polished	vn	Veneer
Un	Undulose	Sh	Shear Seam	Band	Weak Band	Sl	Slickenside	cg	Coating
St	Stepped	Cs	Crushed Seam						

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BOREHOLE REPORT

BH17-M008-R

Client: Baffinland Iron Mines Corporation

Project: Mary River Expansion Project

Location: Rail Indexer Foundation

Project No.: H353004

Datum: NAD 83

Platform: Ground

Easting: 503,772.0 m

Northing: 7,974,960.0 m

Surface Elevation: 52.00 m

Bottom Elevation: 30.01 m

Total Depth: 22.0 m

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 9/17/2017

Logged By: R.S

Driller: Brent McAndrew

Hole Diameter (mm): 100 mm

Date Reviewed: 1/26/2018

Reviewed By: G.Q

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile 0 50 100	Other Tests
	52.0	0.0				NO SAMPLES TAKEN IN OVERBURDEN. Advanced sonic tube to refusal and began diamond coring bedrock.					
	51.0	1.0									
	50.0	2.0									
	49.0	3.0									
	48.0	4.0									
	47.0	5.0									
	46.0	6.0									
	45.0	7.0									
	44.0	8.0									
	43.0	9.0									
	42.0	10.0									

Notes: Redrill of BH16-M008. Elevation is approximate.

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BOREHOLE REPORT

BH17-M008-R
Sheet 2 of 4

Client: Baffinland Iron Mines Corporation
Project: Mary River Expansion Project
Location: Rail Indexer Foundation

Project No.: H353004
Datum: NAD 83
Platform: Ground

Easting: 503,772.0 m
Northing: 7,974,960.0 m
Surface Elevation: 52.00 m
Bottom Elevation: 30.01 m
Total Depth: 22.0 m
Logged By: R.S
Reviewed By: G.Q

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged: 9/17/2017
Date Reviewed: 1/26/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile 0 50 100	Other Tests
	41.0	11.0				NO SAMPLES TAKEN IN OVERBURDEN. Advanced sonic tube to refusal and began diamond coring bedrock. *(Continued)*					
	40.0	12.0									
	39.0	13.0									
	38.0	14.0									
	37.0	15.0									
	36.0	16.0									
	35.0	17.0									
	34.0	18.0				***Start of Coring at 17.4m.*** ***Continued on Rock Core Log sheet.***					
	33.0	19.0									
	32.0	20.0									

Notes: Redrill of BH16-M008. Elevation is approximate.

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BOREHOLE LOG

ROCK CORE FORMAT

BH17-M008-R

Sheet 3 of 4

Client: Baffinland Iron Mines Corporation

Project: Mary River Expansion Project

Location: Rail Indexer Foundation

Project No.: H353004

Datum: NAD 83

Platform: Ground

Easting: 503,772.0 m

Northing: 7,974,960.0 m

Surface Elevation: 52.00 m

Bottom Elevation: 30.01 m

Total Depth: 22.0 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear **Rig Type/ Mounting:** MiniSonic Rig **Bearing:** N/A **Date Logged:** 9/17/2017

Driller: Brent McAndrew **Hole Diameter (mm):** 100 mm **Plunge:** Vertical **Date Checked:** 1/26/2018

Water	Elevation (m)	Depth (m)	Method	Run #/TCR	Graphic Log	Geological Unit	Rock Description: ROCK TYPE; Grain size, texture and fabric, colour, general defect conditions, minor constituents.	Weathering/ Cementation	Estimated Strength (EH VH H M L VL EL)	$Is_{(50)}$ [UCS] MPa	Defect Spacing mm (2000 600 200 60 20) [100]	RQD %	Defect Log	Defect Description: Inclination, type, infill, amount, aperture, planarity, roughness, frequency (Specific / General)
	41.0	11.0												
	40.0	12.0												
	39.0	13.0												
	38.0	14.0												
	37.0	15.0												
	36.0	16.0												
	35.0	17.0					***Resuming in Rock Core Format 17.4m.***							Fz
	34.0	18.0		1 / 101			BEDROCK: Granitic Gneiss, medium to coarse grained, hard to very hard, pinkish-grey colour. Fractures are generally vertical, between 0 to 15 degrees and horizontal, from 70 to 90 degrees.					0		
	33.0	19.0		2 / 98			Numerous joints and fractures infilled with clayey-silt and fine sand throughout.			Dia 70.8 Dia 47.2 Dia 23.6		64		10° Dl Ir Ro 10° Jt Ir Sm Clay infill 40mm sn Dl Dl Fz 10° Jt Pl Sm Silt sn
	32.0	20.0												

Notes: Redrill of BH16-M008. Elevation is approximate.

Defect Description Legend

Planarity		Type				Roughness		Infill Amount	
Pl	Planar	Dl	Drilling Induced	Sm	Seam	Ro	Rough	cn	Clean
Ir	Irregular	Jt	Joint	Cz	Crushed Zone	Sm	Smooth	sn	Stained
Cu	Curved	Pt	Parting on Contact	Fz	Fractured Zone	Po	Polished	vn	Veneer
Un	Undulose	Sh	Shear Seam	Band	Weak Band	Sl	Slickenside	cg	Coating
St	Stepped	Cs	Crushed Seam						

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BOREHOLE LOG

ROCK CORE FORMAT

BH17-M008-R

Sheet 4 of 4

Client: Baffinland Iron Mines Corporation

Project: Mary River Expansion Project

Location: Rail Indexer Foundation

Project No.: H353004

Datum: NAD 83

Platform: Ground

Easting: 503,772.0 m

Northing: 7,974,960.0 m

Surface Elevation: 52.00 m

Bottom Elevation: 30.01 m

Total Depth: 22.0 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear **Rig Type/ Mounting:** MiniSonic Rig **Bearing:** N/A **Date Logged:** 9/17/2017

Driller: Brent McAndrew **Hole Diameter (mm):** 100 mm **Plunge:** Vertical **Date Checked:** 1/26/2018

Water	Elevation (m)	Depth (m)	Method	Run #/TCR	Graphic Log	Geological Unit	Rock Description (ROCK TYPE; Grain size, texture and fabric, colour, general defect conditions, minor constituents.)	Weathering/ Cementation	Estimated Strength (EH VH H M L VL EL)	$Is_{(50)}$ [UCS] MPa	Defect Spacing mm (2000 600 200 [100] 60 20)	RQD %	Defect Log	Defect Description (Inclination, type, infill, amount, aperture, planarity, roughness, frequency) Specific / General
	31.0	21.0		2 / 98 3 / 97			BEDROCK: Granitic Gneiss, medium to coarse grained, hard to very hard, pinkish-grey colour. Fractures are generally vertical, between 0 to 15 degrees and horizontal, from 70 to 90 degrees. *(Continued)*			Dia 94.4 [57.9] [46.1] [94.8] Dia 100.7		64 68		10° Dl Ir Ro 10° Dl Ir Ro 10° Dl Ir Ro 10° Dl Ir Ro 30° Jt Pl Sm Silt sn 10° Dl Ir Ro 10° Dl Ir Ro 10° Jt Cu Sm Silt sn 45° Dl Ir Ro 0° Dl Ir Ro 10° Jt Ir Ro Silt sn 50° Jt Ir Ro Silt sn 0° Dl Ir Ro 0° Jt Ir Sm Silt sn 10° Dl Ir Ro
	30.0	22.0					To Target Depth. **Drillhole BH17-M008-R terminated at 22.0m.**							
	29.0	23.0												
	28.0	24.0												
	27.0	25.0												
	26.0	26.0												
	25.0	27.0												
	24.0	28.0												
	23.0	29.0												
	22.0	30.0												

Notes: Redrill of BH16-M008. Elevation is approximate.

Defect Description Legend

Planarity		Type				Roughness		Infill Amount	
Pl	Planar	Dl	Drilling Induced	Sm	Seam	Ro	Rough	cn	Clean
Ir	Irregular	Jt	Joint	Cz	Crushed Zone	Sm	Smooth	sn	Stained
Cu	Curved	Pt	Parting on Contact	Fz	Fractured Zone	Po	Polished	vn	Veneer
Un	Undulose	Sh	Shear Seam	Band	Weak Band	Sl	Slickenside	cg	Coating
St	Stepped	Cs	Crushed Seam						

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BOREHOLE REPORT

BH17-EBC-8

Sheet 1 of 4

Client: Baffinland Iron Mines Corporation

Project: Mary River Expansion Project

Location: Drive House-South End

Project No.: H353004

Datum: Ground

Platform: 0

Easting: 503,534.5 m

Northing: 7,976,327.5 m

Surface Elevation: 7.66 m

Bottom Elevation: -31.86 m

Total Depth: 39.5 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 8/26/2017

Driller: Brent McAndrew

Hole Diameter (mm): 100 mm

Date Reviewed: 4/5/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 – 25 – 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	6.7	1.0				SAND, some GRAVEL, trace Silt: Brown, particles up to 50 mm. Unfrozen to 1.2 m otherwise frozen. Ice poor soil.	Unfrozen to Nf				3	15	72	13			
	5.7	2.0															
	4.7	3.0															
	3.7	4.0									11	15	76	10			
	2.7	5.0															
	1.7	6.0				SAND: Brown, medium to coarse. Ice poor soil.	Nf				21	7	88	5			
	0.7	7.0				SAND and GRAVEL trace Silt: Brown, well graded. Ice poor soil.	Nf				15	2	93	5			
	-0.3	8.0															
	-1.3	9.0									10	33	55	11			
	-2.3	10.0															
	-3.3	11.0									8	42	53	4			

Notes:

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BOREHOLE REPORT

BH17-EBC-8

Client: Baffinland Iron Mines Corporation
Project: Mary River Expansion Project
Location: Drive House-South End

Project No.: H353004
Datum: Ground
Platform: 0

Easting: 503,534.5 m
Northing: 7,976,327.5 m
Surface Elevation: 7.66 m
Bottom Elevation: -31.86 m
Total Depth: 39.5 m
Logged By: R.S
Reviewed By: G.Q

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged: 8/26/2017
Date Reviewed: 4/5/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	-4.3	12.0				SAND and GRAVEL trace Silt: Brown, well graded. Ice poor soil. *(Continued)*	Nf *(Continued)*				23						
											6	46	45	9			
						12.16 m to 12.76 m: Recovered wet / unfrozen sample.											
	-5.3	13.0															
	-6.3	14.0															
						13.68 m to 15.20 m: Recovered wet / unfrozen sample.											
	-7.3	15.0									9	29	61	10			
	-8.3	16.0															
	-9.3	17.0				SAND, trace Gravel trace Silt: Brown. Ice poor soil	Nf to Unfrozen										
						17.32 to 19.8: Material is wet and unfrozen.					17	0	89	11			
	-10.3	18.0									17	2	85	13			
	-11.3	19.0															
	-12.3	20.0															
	-13.3	21.0									20	2	98	0			
	-14.3	22.0															

Notes:

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BOREHOLE REPORT

BH17-EBC-8

Sheet 3 of 4

Client: Baffinland Iron Mines Corporation
Project: Mary River Expansion Project
Location: Drive House-South End

Project No.: H353004
Datum: Ground
Platform: 0

Easting: 503,534.5 m
Northing: 7,976,327.5 m
Surface Elevation: 7.66 m
Bottom Elevation: -31.86 m
Total Depth: 39.5 m
Logged By: R.S
Reviewed By: G.Q

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged: 8/26/2017
Date Reviewed: 4/5/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 / 25 / 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
						SAND, trace Gravel trace Silt: Brown. Ice poor soil *(Continued)*	Nf to Unfrozen *(Continued)*										
	-15.3	23.0				SAND with GRAVEL trace SIlt: Brown. Ice poor soil.	Nf				11	25	63	12			
	-16.3	24.0															
	-17.3	25.0															
	-18.3	26.0				SAND trace Silt : Brown, well graded. Occasionl layers of thinly bedded, dark grey and black organics as noted. Ice poor soil. 25.8 m to 26.7 m: Trace organics, greyish-black.	Nf				17	2	86	12			
	-19.3	27.0															
	-20.3	28.0				27.7 m: Trace organics, black.											
	-21.3	29.0				28.8 m to 29.0 m: Trace organics, greyish-black.											
	-22.3	30.0									23	0	95	5			
	-23.3	31.0															
	-24.3	32.0															
	-25.3	33.0															

Notes:

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BOREHOLE REPORT

BH17-EBC-8
Sheet 4 of 4

Client: Baffinland Iron Mines Corporation
Project: Mary River Expansion Project
Location: Drive House-South End

Project No.: H353004
Datum: Ground
Platform: 0

Easting: 503,534.5 m
Northing: 7,976,327.5 m
Surface Elevation: 7.66 m
Bottom Elevation: -31.86 m
Total Depth: 39.5 m
Logged By: R.S
Reviewed By: G.Q

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged: 8/26/2017
Date Reviewed: 4/5/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	-26.3	34.0				SAND trace Silt : Brown, well graded. Occasionl layers of thinly bedded, dark grey and black organics as noted. Ice poor soil. *(Continued)* 33.2 m to 33.5 m: Some silty organics, greyish-black.	Nf *(Continued)*				22	0	92	8			
	-27.3	35.0				35.4 m to 35.5 m: Some organics, black.											
	-28.3	36.0				36.4 m to 36.5 m: Trace organics, greyish-black.											
	-29.3	37.0									21	0	92	8			
	-30.3	38.0				38.3 m to 38.4 m: Some organics, greyish-black.											
	-31.3	39.0									13 19	0	93	7			
	-32.3	40.0				To Target Depth. **Drillhole BH17-EBC-8 terminated at 39.5m.**											
	-33.3	41.0															
	-34.3	42.0															
	-35.3	43.0															
	-36.3	44.0															

Notes:

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BOREHOLE REPORT

BH17-EBC-9

Sheet 1 of 4

Client: Baffinland Iron Mines Corporation
Project No.: H353004
Project: Mary River Expansion Project
Datum: Ground
Location: Drive House-North End
Platform: 0

Contractor: Boart Longyear
Rig Type/ Mounting: MiniSonic Rig
Date Logged: 8/28/2017
Driller: Brent McAndrew
Hole Diameter (mm): 100 mm
Date Reviewed: 4/5/2018

Easting: 503,548.5 m
Northing: 7,976,371.4 m
Surface Elevation: 7.44 m
Bottom Elevation: -32.08 m
Total Depth: 39.5 m
Logged By: R.S
Reviewed By: G.Q

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	6.4	1.0				SAND with GRAVEL, trace Silt: Brown. Unfrozen to 1.4 m, otherwise frozen. Ice poor soil.	Unfrozen to Nf										
	5.4	2.0															
	4.4	3.0									11	23	73	5			
	3.4	4.0									10	33	59	8			
	2.4	5.0															
	1.4	6.0									13	17	73	10			
	0.4	7.0															
	-0.6	8.0															
	-1.6	9.0				SAND, trace Silt: Brown, fine grained. Ice poor soil.	Nf				23	0	88	12			
											20	0	90	10			
	-2.6	10.0															
	-3.6	11.0															

Notes:

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HATCH BOREHOLE REPORT

BH17-EBC-9

Sheet 2 of 4

Client: Baffinland Iron Mines Corporation
Project: Mary River Expansion Project
Location: Drive House-North End

Project No.: H353004
Datum: Ground
Platform: 0

Easting: 503,548.5 m
Northing: 7,976,371.4 m
Surface Elevation: 7.44 m
Bottom Elevation: -32.08 m
Total Depth: 39.5 m
Logged By: R.S
Reviewed By: G.Q

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged: 8/28/2017
Date Reviewed: 4/5/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	-4.6	12.0				SAND, some Gravel: Brown, Ice poor soil.	Nf				11	16	78	6			
	-5.6	13.0															
	-6.6	14.0				SAND: Brown, fine to medium. Ice poor soil.	Nf										
						14.0 m to 14.5 m: Some rganics: Dark brown, .Ice poor soil.					18	3	88	10			
	-7.6	15.0				** 14.5 m to 15.7 m: Material is unfrozen, damp with oily texture. Salty.	UNFROZEN				13						
	-8.6	16.0															
	-9.6	17.0				17.0 m to 17.5 m: Organics and Sand, dark grey, distinct organic odour.					21	0	89	11			
	-10.6	18.0				SAND, some GRAVEL trace Silt: Brown. Ice poor soil.	Nf				22	0	93	7			
	-11.6	19.0															
	-12.6	20.0				SAND: Brown to greyish-brown, well graded. Ice poor soil	Nf				12	9	82	9			
	-13.6	21.0															
	-14.6	22.0															

Notes:

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HATCH BOREHOLE REPORT

BH17-EBC-9

Sheet 3 of 4

Client: Baffinland Iron Mines Corporation
Project No.: H353004
Project: Mary River Expansion Project
Datum: Ground
Location: Drive House-North End
Platform: 0

Contractor: Boart Longyear
Rig Type/ Mounting: MiniSonic Rig
Date Logged: 8/28/2017
Driller: Brent McAndrew
Hole Diameter (mm): 100 mm
Date Reviewed: 4/5/2018

Easting: 503,548.5 m
Northing: 7,976,371.4 m
Surface Elevation: 7.44 m
Bottom Elevation: -32.08 m
Total Depth: 39.5 m
Logged By: R.S
Reviewed By: G.Q

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	-15.6	23.0				SAND: Brown to greyish-brown, well graded. Ice poor soil *(Continued)*	Nf *(Continued)*				21	0	95	5			
	-16.6	24.0									24	0	92	8			
	-17.6	25.0															
	-18.6	26.0															
	-19.6	27.0									19	7	86	8			
						27.3 m to 27.6 m: Organics and Sand, black, distinct organic odour.					19	0	84	16			
	-20.6	28.0															
	-21.6	29.0									26	0	97	3			
	-22.6	30.0															
	-23.6	31.0															
	-24.6	32.0									20	0	94	6			
	-25.6	33.0															

Notes:

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BOREHOLE REPORT

BH17-EBC-9

Sheet 4 of 4

Client: Baffinland Iron Mines Corporation

Project: Mary River Expansion Project

Location: Drive House-North End

Project No.: H353004

Datum: Ground

Platform: 0

Easting: 503,548.5 m

Northing: 7,976,371.4 m

Surface Elevation: 7.44 m

Bottom Elevation: -32.08 m

Total Depth: 39.5 m

Logged By: R.S

Reviewed By: G.Q

Contractor: Boart Longyear

Rig Type/ Mounting: MiniSonic Rig

Date Logged: 8/28/2017

Driller: Brent McAndrew

Hole Diameter (mm): 100 mm

Date Reviewed: 4/5/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile 0 25 50	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	-26.6	34.0				SAND: Brown to greyish-brown, well graded. Ice poor soil *(Continued)*	Nf *(Continued)*										
	-27.6	35.0															
	-28.6	36.0															
	-29.6	37.0				36.8 m to 37.0 m: Silty-Organics, black, distinct organic odour.											
	-30.6	38.0															
	-31.6	39.0									22	0	98	2			
	-32.6	40.0				To Target Depth. **Drillhole BH17-EBC-9 terminated at 39.5m.**											
	-33.6	41.0															
	-34.6	42.0															
	-35.6	43.0															
	-36.6	44.0															

Notes:

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BOREHOLE REPORT

BH17-RD-1

Sheet 1 of 1

Client: Baffinland Iron Mines Corporation
Project: SPMT Road Investigation
Location: Milne Port Area

Project No.: H/353004
Datum: NAD 83
Platform: Ground

Easting: 504,095.0 m
Northing: 7,976,552.0 m
Surface Elevation: 2.10 m
Bottom Elevation: -4.00 m
Total Depth: 6.1 m
Logged By: R.S
Reviewed By: H.G

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged: 10/17/2017
Date Reviewed: 1/30/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	1.1	1.0				SAND and GRAVEL: Brown, well graded (Road Topping)	Unfrozen										
						ROCK FILL: Beige, dry, pulverized by sonic motion, fragments up to 100mm. Source material is Granitic Gneiss.	Unfrozen										
	0.1	2.0															
	-0.9	3.0															
	-1.9	4.0				SAND and GRAVEL with Organics: Grey, wet, fine sand to fine gravel, rounded.	Unfrozen										
						SAND, some GRAVEL, trace Silt: Brown, moist to wet, medium sand to medium gravel, rounded.	Unfrozen										
	-2.9	5.0									11	15	80	5			
	-3.9	6.0															
						To Target Depth. **Drillhole BH17-RD-1 terminated at 6.1m.**											
	-4.9	7.0															
	-5.9	8.0															

Notes: BH colar elevation is estimated from Lidar survey

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BOREHOLE REPORT

BH17-RD-1A

Sheet 1 of 1

Client: Baffinland Iron Mines Corporation

Project: SPMT Road Investigation

Location: Milne Port Area

Project No.: H/353004

Datum: NAD 83

Platform: Ground

Easting: 504,090.0 m

Northing: 7,976,463.0 m

Surface Elevation: 3.50 m

Bottom Elevation: -1.07 m

Total Depth: 4.6 m

Logged By: R.S

Reviewed By: H.G

Contractor: Boart Longyear

Driller: Brent McAndrew

Rig Type/ Mounting: MiniSonic Rig

Hole Diameter (mm): 100 mm

Date Logged: 10/17/2017

Date Reviewed: 1/30/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
						ROCK FILL: Beige, dry, pulverized by sonic motion, fragments up to 100mm. Source material is Granitic Gneiss.	Unfrozen										
	2.5	1.0				SAND with GRAVEL, trace Silt: Brown, moist to wet, medium to coarse. Frozen beyond 1.6 m.	Nbn										
	1.5	2.0															
	0.5	3.0															
	-0.5	4.0															
	-1.5	5.0				To Target Depth. **Drillhole BH17-RD-1A terminated at 4.6m.**											
	-2.5	6.0															
	-3.5	7.0															
	-4.5	8.0															

Notes: BH colar elevation is estimated from Lidar survey

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BOREHOLE REPORT

BH17-RD-1B

Sheet 1 of 1

Client: Baffinland Iron Mines Corporation

Project: SPMT Road Investigation

Location: Milne Port Area

Project No.: H/353004

Datum: NAD 83

Platform: Ground

Easting: 504,100.0 m

Northing: 7,976,358.0 m

Surface Elevation: 9.00 m

Bottom Elevation: 4.10 m

Total Depth: 4.9 m

Logged By: R.S

Reviewed By: H.G

Contractor: Boart Longyear

Driller: Brent McAndrew

Rig Type/ Mounting: MiniSonic Rig

Hole Diameter (mm): 100 mm

Date Logged: 10/17/2017

Date Reviewed: 1/30/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	8.0	1.0				SAND and GRAVEL: Brown, well graded (Road Topping)	Unfrozen										
						ROCK FILL: Beige, dry, pulverized by sonic motion, fragments up to 100mm. Source material is Granitic Gneiss.	Frozen										
	7.0	2.0															
	6.0	3.0				With ICE from 3.05 m to 4.90 m.											
	5.0	4.0															
	4.0	5.0				To Target Depth. **Drillhole BH17-RD-1B terminated at 4.9m.**											
	3.0	6.0															
	2.0	7.0															
	1.0	8.0															

Notes: BH colar elevation is estimated from Lidar survey

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BOREHOLE REPORT

BH17-RD-1C
Sheet 1 of 1

Client: Baffinland Iron Mines Corporation
Project: SPMT Road Investigation
Location: Milne Port Area

Project No.: H/353004
Datum: NAD 83
Platform: Ground

Easting: 504,075.0 m
Northing: 7,976,302.0 m
Surface Elevation: 10.00 m
Bottom Elevation: 3.90 m
Total Depth: 6.1 m
Logged By: R.S
Reviewed By: H.G

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged: 10/17/2017
Date Reviewed: 1/30/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	10.0	0.0				SAND and GRAVEL: Brown, well graded (Road Topping)	Unfrozen										
						SAND, trace Gravel, trace Silt: Brown. Frozen beyond 1.5 m.	Nbn										
	9.0	1.0				SAND, some Silt, some Gravel, trace Organics: Dark grey.	Nbn				10	14	71	15			
	8.0	2.0				SAND with Silt, trace to some Organics: Brown and brown with black layers (varved), fine grained.	Nbn				25	0	68	32			
	7.0	3.0															
	6.0	4.0				SILT with Sand,..					21	1	23	76			
	5.0	5.0															
	4.0	6.0				SAND: Brown, fine to medium grained.	Nbn										
						To Target Depth. **Drillhole BH17-RD-1C terminated at 6.1m.**											
	3.0	7.0															
	2.0	8.0															

Notes: BH colar elevation is estimated from Lidar survey

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BOREHOLE REPORT

BH17-RD-2

Sheet 1 of 1

Client: Baffinland Iron Mines Corporation
Project: SPMT Road Investigation
Location: Milne Port Area

Project No.: H/353004
Datum: NAD 83
Platform: Ground

Easting: 503,872.0 m
Northing: 7,976,162.0 m
Surface Elevation: 10.00 m
Bottom Elevation: 5.43 m
Total Depth: 4.6 m
Logged By: R.S
Reviewed By: H.G

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged: 10/5/2017
Date Reviewed: 1/30/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	10.0	0.0				SAND and GRAVEL: Brown, well graded (Road Topping)	Unfrozen										
						SAND, some Gravel, trace Silt: Brown, moist. **Thin seam of PEAT at 0.80 m	Unfrozen				9	18	73	9			
	9.0	1.0				SILT with SAND, trace Gravel: Greyish-black. Thin layers of orgaincs throughout, black. Distinct organic odour.Unfrozen to 1.4 m.	Nbn				22	7	30	63			
						SAND some Gravel, trace Silt: Light brown.	Nbn				12	15	74	11			
	7.0	3.0				SILT and SAND, trace Organics: Blackish-brown, distinct organic odour, fine grained.	Nbn				23	0	44	56			
	5.0	5.0				To Target Depth. **Drillhole BH17-RD-2 terminated at 4.6m.**											

Notes: BH colar elevation is estimated from Lidar survey

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BOREHOLE REPORT

BH17-RD-3

Sheet 1 of 1

Client: Baffinland Iron Mines Corporation
Project No.: H/353004
Project: SPMT Road Investigation
Datum: NAD 83
Location: Milne Port Area
Platform: Ground

Easting: 503,599.0 m
Northing: 7,975,985.0 m
Surface Elevation: 12.00 m
Bottom Elevation: 7.43 m
Total Depth: 4.6 m
Logged By: R.S
Reviewed By: H.G

Contractor: Boart Longyear
Rig Type/ Mounting: MiniSonic Rig
Date Logged: 10/5/2017
Driller: Brent McAndrew
Hole Diameter (mm): 100 mm
Date Reviewed: 1/30/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 / 25 / 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	12.0	0.0				SAND and GRAVEL: Brown, well graded (Road Topping)	Unfrozen										
						ROCK FILL: Beige, dry, pulverized by sonic motion, fragments up to 100mm. Source material is Granitic Gneiss.	Unfrozen										
	11.0	1.0				SAND and GRAVEL: Brown, particles up to 25 mm.											
						SAND and COBBLES: Brown, particles up to 100 mm.	Unfrozen										
	10.0	2.0				SAND, trace Silt, trace Gravel: Brown, gravel rounded up to 20 mm.	Nbn										
	9.0	3.0															
	8.0	4.0									12	5	86	10			
	7.0	5.0				To Target Depth. **Drillhole BH17-RD-3 terminated at 4.6m.**											
	6.0	6.0															
	5.0	7.0															
	4.0	8.0															

Notes: BH colar elevation is estimated from Lidar survey

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BOREHOLE REPORT

BH17-RD-4

Sheet 1 of 1

Client: Baffinland Iron Mines Corporation
Project: SPMT Road Investigation
Location: Milne Port Area

Project No.: H/353004
Datum: NAD 83
Platform: Ground

Easting: 503,594.0 m
Northing: 7,975,136.0 m
Surface Elevation: 20.00 m
Bottom Elevation: 15.43 m
Total Depth: 4.6 m
Logged By: R.S
Reviewed By: H.G

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged: 10/5/2017
Date Reviewed: 1/30/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
						SAND and GRAVEL: Brown, well graded (Road Topping)	Unfrozen										
						ROCK FILL: Beige, dry, pulverized by sonic motion, fragments up to 100mm. Source material is Granitic Gneiss.	Unfrozen										
	19.0	1.0				GRAVEL, some Sand, some Silt: brown, frozen.	Nbn Vs										
						ICE, with SILT, with SAND, trace Gravel: Brown. Ice lenses up to 20 mm thick throughout. Approximately 60% ice content. Ice rich soil.											
	18.0	2.0								>>	72	4	29	67			
	17.0	3.0															
	16.0	4.0															
	15.0	5.0				To Target Depth. **Drillhole BH17-RD-4 terminated at 4.6m.**											
	14.0	6.0															
	13.0	7.0															
	12.0	8.0															

Notes: BH colar elevation is estimated from Lidar survey

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BOREHOLE REPORT

BH17-RD-5

Sheet 1 of 1

Client: Baffinland Iron Mines Corporation
Project: SPMT Road Investigation
Location: Milne Port Area

Project No.: H/353004
Datum: NAD 83
Platform: Ground

Easting: 503,596.0 m
Northing: 7,974,811.0 m
Surface Elevation: 30.00 m
Bottom Elevation: 27.35 m
Total Depth: 2.7 m
Logged By: R.S
Reviewed By: H.G

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged: 10/5/2017
Date Reviewed: 1/30/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 / 25 / 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	30.0	0.0				SAND and GRAVEL: Brown, well graded (Road Topping)	Unfrozen										
						ROCK FILL: Beige, dry, pulverized by sonic motion, fragments up to 100mm. Source material is Granitic Gneiss.	Unfrozen										
	29.0	1.0				GRAVEL, some SAND trace Silt: Brownish-grey. (Till)	Unfrozen										
	28.0	2.0				SILT and SAND, trace Gravel, brown.	Nbn										
						GRAVEL, some SAND trace Silt: Brownish-grey. (Till)	Nbn			●	17	3	42	55			
	27.0	3.0				Drilling Refusal. **Drillhole BH17-RD-5 terminated at 2.7m.**											
	26.0	4.0															
	25.0	5.0															
	24.0	6.0															
	23.0	7.0															
	22.0	8.0															

Notes: BH colar elevation is estimated from Lidar survey

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BOREHOLE REPORT

BH17-RD-6

Sheet 1 of 1

Client: Baffinland Iron Mines Corporation
Project: SPMT Road Investigation
Location: Milne Port Area

Project No.: H/353004
Datum: NAD 83
Platform: Ground

Easting: 503,922.0 m
Northing: 7,974,286.0 m
Surface Elevation: 30.50 m
Bottom Elevation: 24.40 m
Total Depth: 6.1 m
Logged By: R.S
Reviewed By: H.G

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged: 10/5/2017
Date Reviewed: 1/30/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	30.5	0.0				SAND and GRAVEL: Brown, well graded (Road Topping)	Unfrozen										
						ROCK FILL: Beige, dry, pulverized by sonic motion, fragments up to 100mm. Source material is Granitic Gneiss.	Unfrozen										
	29.5	1.0															
	28.5	2.0															
	27.5	3.0				SILT and SAND, with GRAVEL: Grey. particles are rounded, up to 75 mm.	Nbn										
						SAND: Brown, coarse grained.	Nbn										
						ICE, trace Silt: White/clear.	ICE										
	26.5	4.0															
						GRAVEL and SAND, trace Silt: Grey,	Nbn										
	25.5	5.0				ICE, trace Silt, trace Sand: Grey. Soil poor ice.	ICE										
	24.5	6.0															
						To Target Depth. **Drillhole BH17-RD-6 terminated at 6.1m.**											
	23.5	7.0															
	22.5	8.0															

Notes: BH colar elevation is estimated from Lidar survey

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BOREHOLE REPORT

BH17-RD-7

Sheet 1 of 1

Client: Baffinland Iron Mines Corporation
Project: SPMT Road Investigation
Location: Milne Port Area

Project No.: H/353004
Datum: NAD 83
Platform: Ground

Easting: 503,896.0 m
Northing: 7,974,423.0 m
Surface Elevation: 56.00 m
Bottom Elevation: 52.35 m
Total Depth: 3.7 m
Logged By: R.S
Reviewed By: H.G

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: MiniSonic Rig
Hole Diameter (mm): 100 mm
Date Logged: 10/5/2017
Date Reviewed: 1/30/2018

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	56.0	0.0				SAND and GRAVEL: Brown, well graded (Road Topping)	Unfrozen										
						ROCK FILL: Beige, dry, pulverized by sonic motion, fragments up to 100mm. Source material is Granitic Gneiss.	Unfrozen										
	55.0	1.0															
	54.0	2.0				SAND with SILT, some Gravel: Brown, well graded. (Till)	Nbn				7	13	59	28			
	53.0	3.0				SAND with GRAVEL with SILT: Grey, well graded. (Till)	Nbn				5	31	49	20			
	52.0	4.0				Drilling Refusal. **Drillhole BH17-RD-7 terminated at 3.7m.**											
	51.0	5.0															
	50.0	6.0															
	49.0	7.0															
	48.0	8.0															

Notes: BH colar elevation is estimated from Lidar survey

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BOREHOLE REPORT

BH18-004

Sheet 1 of 8

Client: Baffinland Iron Mine

Project: Mary River Expansion Study

Location: Milne Port

Project No.: H353004

Datum: NAD83

Platform:

Easting: 563,499.0 m

Northing: 7,975,260.0 m

Surface Elevation: 11.50 m

Bottom Elevation: -66.20 m

Total Depth: 77.7 m

Logged By: YF/MY

Contractor: Boart Longyear

Rig Type/ Mounting: Sonic Drill Rig

Date Logged: 4/1/2018

Driller: Brent McAndrew

Hole Diameter (mm): 100

Date Reviewed:

Reviewed By:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 – 25 – 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	11.5	0.0				SANDY SNOW: Road area.	Nf inferred										
	10.5	1.0				GRAVELLY SAND, trace COBBLES, trace SILT: Coarse grained sand, brown.	Nf inferred										
	9.5	2.0					Nbn - Nbe				21 14	0 6	86 77	14 17			
	8.5	3.0				SAND, some GRAVEL, trace SILT: Coarse grained, greyish brown, subrounded.	Nbe - Vc										
	7.5	4.0															
	6.5	5.0															
	5.5	6.0															
	4.5	7.0															
	3.5	8.0					Nbn										
	2.5	9.0					Vbe										
	1.5	10.0															

Notes:

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BOREHOLE REPORT

BH18-004
Sheet 2 of 8

Client: Baffinland Iron Mine
Project: Mary River Expansion Study
Location: Milne Port

Project No.: H353004
Datum: NAD83
Platform:

Easting: 563,499.0 m
Northing: 7,975,260.0 m
Surface Elevation: 11.50 m
Bottom Elevation: -66.20 m
Total Depth: 77.7 m
Logged By: YF/MY
Reviewed By:

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: Sonic Drill Rig
Hole Diameter (mm): 100
Date Logged: 4/1/2018
Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 – 25 – 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	0.5	11.0				SAND, some GRAVEL, trace SILT: Coarse grained, greyish brown, subrounded. *(Continued)*	Nbe - Vc *(Continued)* I+S										
	-0.5	12.0				SAND, some SILT: Fine to coarse grained, light brown.	Nf inferred				9	14	70	16			
	-1.5	13.0				GRAVELLY SAND, trace SILT: Fine to coarse grained, light brown.	Nf inferred										
	-2.5	14.0															
	-3.5	15.0															
	-4.5	16.0															
	-5.5	17.0				17.70 m - 18.20 m: Trace silt.					7	34	52	14			
	-6.5	18.0				SAND, trace GRAVEL, trace SILT: Fine to medium grained, light brown. 18.75 m: Organic layer.	Nbn to Vx										
	-7.5	19.0															
	-8.5	20.0															

Notes:

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BOREHOLE REPORT

BH18-004
Sheet 3 of 8

Client: Baffinland Iron Mine
Project: Mary River Expansion Study
Location: Milne Port

Project No.: H353004
Datum: NAD83
Platform:

Easting: 563,499.0 m
Northing: 7,975,260.0 m
Surface Elevation: 11.50 m
Bottom Elevation: -66.20 m
Total Depth: 77.7 m
Logged By: YF/MY
Reviewed By:

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: Sonic Drill Rig
Hole Diameter (mm): 100
Date Logged: 4/1/2018
Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 – 25 – 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	-9.5	21.0				SAND, trace GRAVEL, trace SILT: Fine to medium grained, light brown. *(Continued)*	Nbn to Vx *(Continued)*										
						20.80 m: Black organics.					22	0	59	41			
	-10.5	22.0				GRAVELLY SAND, trace SILT: Fine to coarse grained, brown to red.	Nf inferred										
	-11.5	23.0															
	-12.5	24.0					Nbn - Vx										
	-13.5	25.0					Nbn - Nf										
	-14.5	26.0															
	-15.5	27.0					Nf inferred				14	11	81	8			
	-16.5	28.0				27.70 m - 30.20 m: Water, soft packed.											
	-17.5	29.0															
	-18.5	30.0															

Notes:

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BOREHOLE REPORT

BH18-004
Sheet 4 of 8

Client: Baffinland Iron Mine
Project: Mary River Expansion Study
Location: Milne Port

Project No.: H353004
Datum: NAD83
Platform:

Easting: 563,499.0 m
Northing: 7,975,260.0 m
Surface Elevation: 11.50 m
Bottom Elevation: -66.20 m
Total Depth: 77.7 m
Logged By: YF/MY
Reviewed By:

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: Sonic Drill Rig
Hole Diameter (mm): 100
Date Logged: 4/1/2018
Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	-19.5	31.0				GRAVELLY SAND, trace SILT: Fine to coarse grained, brown to red. *(Continued)* 30.10 m - 30.20 m: Organics in dark fine sand. 31.50 m - 31.60 m: Wet.	Nf inferred *(Continued)*										
	-20.5	32.0					Nf										
	-21.5	33.0					Nf inferred										
	-22.5	34.0					Nbn - Vx										
	-23.5	35.0					Nf inferred										
							Nbn - Vx										
							Nf										
	-24.5	36.0					Nbn										
	-25.5	37.0					Nf										
	-26.5	38.0															
	-27.5	39.0															
	-28.5	40.0					Nf inferred										

Notes:

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BOREHOLE REPORT

BH18-004
Sheet 5 of 8

Client: Baffinland Iron Mine
Project: Mary River Expansion Study
Location: Milne Port

Project No.: H353004
Datum: NAD83
Platform:

Easting: 563,499.0 m
Northing: 7,975,260.0 m
Surface Elevation: 11.50 m
Bottom Elevation: -66.20 m
Total Depth: 77.7 m
Logged By: YF/MY
Reviewed By:

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: Sonic Drill Rig
Hole Diameter (mm): 100
Date Logged: 4/1/2018
Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
						GRAVEL, some SAND, some SILT, trace COBBLES: Highly disturbed, centre of much of core is hollow, wet rounded gravel. *(Continued)*	Nf inferred *(Continued)*				7	32	45	23			
	-29.5	41.0															
	-30.5	42.0															
						CLAYEY SILT, ORGANIC: Brown black.	Nb				20	0	12	88			
	-31.5	43.0				SILT with SAND: grey with fine sand.	Nb										
						SAND, some SILT: Grey brown, fine to medium grained sand.	Nb										
	-32.5	44.0															
	-33.5	45.0															
						SAND with SILT: Beige fine sand.	Nb										
	-34.5	46.0				SAND, trace SILT: Meidum grained, grey brown.	Nb										
	-35.5	47.0										0	98	2			
	-36.5	48.0															
	-37.5	49.0				49.00 m: Silt lenses below, fine, <2 mm.											
	-38.5	50.0															

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BOREHOLE REPORT

BH18-004
Sheet 6 of 8

Client: Baffinland Iron Mine
Project: Mary River Expansion Study
Location: Milne Port

Project No.: H353004
Datum: NAD83
Platform:

Easting: 563,499.0 m
Northing: 7,975,260.0 m
Surface Elevation: 11.50 m
Bottom Elevation: -66.20 m
Total Depth: 77.7 m
Logged By: YF/MY
Reviewed By:

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: Sonic Drill Rig
Hole Diameter (mm): 100
Date Logged: 4/1/2018
Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 – 25 – 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	-39.5	51.0				SAND, trace SILT: Meidum grained, grey brown. *(Continued)*	Nb *(Continued)*										
	-40.5	52.0				51.80 m: Many silt lenses, 3 mm, wet.	Unfrozen										
	-41.5	53.0															
	-42.5	54.0				SAND, some SILT: Fine, light brown.											
	-43.5	55.0				SAND, trace SILT: Medium to coarse grained, light brown, wet, silt lenses.	Nb assumed										
	-44.5	56.0															
	-45.5	57.0															
	-46.5	58.0				NO RECOVERY											
	-47.5	59.0															
	-48.5	60.0				SILTY SAND: Fine to medium grained, greyish brown, wet.	Possibly non-frozen										

Notes:

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BOREHOLE REPORT

BH18-004
Sheet 7 of 8

Client: Baffinland Iron Mine
Project: Mary River Expansion Study
Location: Milne Port

Project No.: H353004
Datum: NAD83
Platform:

Easting: 563,499.0 m
Northing: 7,975,260.0 m
Surface Elevation: 11.50 m
Bottom Elevation: -66.20 m
Total Depth: 77.7 m
Logged By: YF/MY
Reviewed By:

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: Sonic Drill Rig
Hole Diameter (mm): 100
Date Logged: 4/1/2018
Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 – 25 – 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	-49.5	61.0				SILTY SAND: Fine to medium grained, greyish brown, wet. *(Continued)*	Possibly non-frozen *(Continued)*										
						61.00 m: Reddish brown and grey layers, stratified, fine sand, with organic layers.											
	-50.5	62.0				SAND, trace SILT: Brown, fine to medium grained sand.					18	0	23	77			
						SILT, some SAND: Reddish brown to brown, low plasticity, organic layers.	Nf inferred										
	-51.5	63.0									18	0	6	94			
	-52.5	64.0															
	-53.5	65.0				SILTY SAND: Fine to medium grained, light brown.											
	-54.5	66.0					Nbn										
	-55.5	67.0															
	-56.5	68.0					Vx										
						SANDY SILT: Light grey to reddish brown, layered dark organics.	Vs										
	-57.5	69.0									20	0	1	99			
	-58.5	70.0															

Notes:

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HATCH BOREHOLE REPORT

BH18-004
Sheet 8 of 8

Client: Baffinland Iron Mine
Project: Mary River Expansion Study
Location: Milne Port

Project No.: H353004
Datum: NAD83
Platform:

Easting: 563,499.0 m
Northing: 7,975,260.0 m
Surface Elevation: 11.50 m
Bottom Elevation: -66.20 m
Total Depth: 77.7 m
Logged By: YF/MY
Reviewed By:

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: Sonic Drill Rig
Hole Diameter (mm): 100
Date Logged: 4/1/2018
Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	-59.5	71.0				SILT, some SAND: Light brownish grey, layered dark organics.	Nbn					0	1	99			
	-60.5	72.0				SILTY CLAY: Brown, layered black organics, iron smelling.	Nbn				20	0	1	99	33	13	
	-61.5	73.0															
	-62.5	74.0															
	-63.5	75.0				74.80 m - 75.00 m: Ice lense, with banding of black silt.	Nbn										
	-64.5	76.0															
	-65.5	77.0				77.50 m - 77.60 m: Ice lense.	Nbn										
	-66.5	78.0				To Target Depth. **Drillhole BH18-004 terminated at 77.7m.**											
	-67.5	79.0															
	-68.5	80.0															

Notes:

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HATCH BOREHOLE REPORT

BH18-M001
Sheet 1 of 3

Client: Baffinland Iron Mine
Project: Mary River Expansion Study
Location: Milne Port

Project No.: H353004
Datum: NAD83
Platform:

Easting: 503,423.0 m
Northing: 7,974,892.0 m
Surface Elevation: 15.00 m
Bottom Elevation: -10.90 m
Total Depth: 25.9 m
Logged By: MY/PS
Reviewed By:

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: Sonic Drill Rig
Hole Diameter (mm): 100
Date Logged: 3/5/2018
Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 – 25 – 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	15.0	0.0				SANDY SILT: Poorly graded, reddish brown.	Nf inferred										
	14.0	1.0				ICE and SOIL: Sandy silt inclusions.	ICE				20	2	23	75			
						1.25 m: Layered sand particles in ice, multicoloured, subangular, frosted large ice crystals coating gravel / sand pieces.	I+S										
	13.0	2.0				1.50 m: Inclusions becoming sandy gravel, some silt, brownish grey, subangular.					17	2	19	79			
	12.0	3.0				3.00 m: Becoming gravel to ice matrix with soil, 30% soil, subrounded to subangular gravel.											
	11.0	4.0															
	10.0	5.0															
	9.0	6.0															
						SILT, trace SAND: Ice lenses, with stratified organics, brownish grey	Vs										
	8.0	7.0					Vx				27	0	1	99			
	7.0	8.0				8.40 m, 8.50 m, and 8.60 m: Ice lense.											
	6.0	9.0															
	5.0	10.0				9.70 m - 9.75 m: Sand layer bounded by											

Notes:

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HATCH BOREHOLE REPORT

BH18-M001
Sheet 2 of 3

Client: Baffinland Iron Mine
Project: Mary River Expansion Study
Location: Milne Port

Project No.: H353004
Datum: NAD83
Platform:

Easting: 503,423.0 m
Northing: 7,974,892.0 m
Surface Elevation: 15.00 m
Bottom Elevation: -10.90 m
Total Depth: 25.9 m
Logged By: MY/PS
Reviewed By:

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: Sonic Drill Rig
Hole Diameter (mm): 100
Date Logged: 3/5/2018
Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 / 25 / 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
						ice lense, reddish brown to grey.	Vs										
						SILT, trace SAND: Ice lenses, with stratified organics, brownish grey *(Continued)*	*(Continued)*				23	0	3	97			
	4.0	11.0				11.00 m: Sand pockets, reddish brown.											
	3.0	12.0				12.20 m: Increase in organic bands, increase in ice lense thickness (1 mm-1 cm).	Vr Nbn										
	2.0	13.0															
						13.70 m: Thicker banding of organics (up to 2 mm).	Vx Vr Vc										
	1.0	14.0															
	0.0	15.0															
	-1.0	16.0					Nbn with Vs lenses Nbn										
	-2.0	17.0															
	-3.0	18.0															
	-4.0	19.0				TILL: Sand and silt, with gravel, well graded, coarse gravel (10 mm - 75 mm), reddish brown.	Nbn				1	21	41	38			
	-5.0	20.0				19.70 m: Grey, subangular cobbles,											

Notes:

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BOREHOLE REPORT

BH18-M001

Sheet 3 of 3

Client: Baffinland Iron Mine

Project: Mary River Expansion Study

Location: Milne Port

Project No.: H353004

Datum: NAD83

Platform:

Easting: 503,423.0 m

Northing: 7,974,892.0 m

Surface Elevation: 15.00 m

Bottom Elevation: -10.90 m

Total Depth: 25.9 m

Logged By: MY/PS

Reviewed By:

Contractor: Boart Longyear

Rig Type/ Mounting: Sonic Drill Rig

Date Logged: 3/5/2018

Driller: Brent McAndrew

Hole Diameter (mm): 100

Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
						white.	Nbn										
						19.80 m: Silty sand, greyish, subrounded to subangular.	*(Continued)*										
						TILL: Sand and silt, with gravel, well graded, coarse gravel (10 mm - 75 mm), reddish brown. *(Continued)*											
	-6.0	21.0				21.40 m - 21.60 m: Boulders.											
	-7.0	22.0									6	21	41	38			
						22.70 m - 22.90 m: Boulders.											
	-8.0	23.0									6	22	42	36			
						23.60 m - 23.70 m: Boulder, subangular.	Nbn										
	-9.0	24.0															
						24.40 m: Boulders, becomes brownish red.											
	-10.0	25.0									7	13	52	35			
	-11.0	26.0				To Target Depth.											
						Drillhole BH18-M001 terminated at 25.9m.											
	-12.0	27.0															
	-13.0	28.0															
	-14.0	29.0															
	-15.0	30.0															

Notes:

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BOREHOLE REPORT

BH18-M002

Sheet 1 of 4

Client: Baffinland Iron Mine

Project: Mary River Expansion Study

Location: Milne Port

Project No.: H353004

Datum: NAD83

Platform:

Easting: 503,328.0 m

Northing: 7,974,867.0 m

Surface Elevation: 12.00 m

Bottom Elevation: -27.60 m

Total Depth: 39.6 m

Logged By: MY/PS

Reviewed By:

Contractor: Boart Longyear

Rig Type/ Mounting: Sonic Drill Rig

Date Logged: 3/5/2018

Driller: Brent McAndrew

Hole Diameter (mm): 100

Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 – 25 – 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	12.0	0.0				GRAVELLY SAND: Light grey with red, dry.	No ice										
	11.0	1.0				0.90 m: Inferred cobbles, brownish grey, subrounded multicoloured gravel.	Nf to Nbn				9	25	63	12			
	10.0	2.0															
	9.0	3.0				SAND and GRAVEL: Light grey	Melted										
	8.0	4.0				SANDY SILT: Thinly bedded to laminated, grey, black organic bands.	Nbn				20	0	2	98			
											20	0	13	87			
						SILTY SAND: Light grey.	Nbn										
	7.0	5.0				SILT, trace to some SAND: Grey, trace organics, with thin silt beds (1 cm thick).	Nbn										
											21	0	17	83			
	6.0	6.0															
	5.0	7.0															
	4.0	8.0									20	0	4	96			
	3.0	9.0				9.40 m: Organic silt layer, 2.6 mm thick.	Nbn										
	2.0	10.0															

Notes:

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BOREHOLE REPORT

BH18-M002
Sheet 2 of 4

Client: Baffinland Iron Mine
Project: Mary River Expansion Study
Location: Milne Port

Project No.: H353004
Datum: NAD83
Platform:

Easting: 503,328.0 m
Northing: 7,974,867.0 m
Surface Elevation: 12.00 m
Bottom Elevation: -27.60 m
Total Depth: 39.6 m
Logged By: MY/PS
Reviewed By:

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: Sonic Drill Rig
Hole Diameter (mm): 100
Date Logged: 3/5/2018
Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	1.0	11.0				SILT, trace to some SAND: Grey, trace organics, with thin silt beds (1 cm thick). *(Continued)*	Nbn *(Continued)*										
						10.85 m: Solid ice (5x2x2 cm)	Nbn										
	0.0	12.0				11.30 m: Solid ice lense 0.5 cm thick across core diameter.					25	0	0	100			
	-1.0	13.0															
	-2.0	14.0															
	-3.0	15.0															
	-4.0	16.0															
	-5.0	17.0					Vx										
							Nbn										
	-6.0	18.0															
	-7.0	19.0															
	-8.0	20.0					Vc Vs Vc										

Notes:

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BOREHOLE REPORT

BH18-M002
Sheet 3 of 4

Client: Baffinland Iron Mine
Project: Mary River Expansion Study
Location: Milne Port

Project No.: H353004
Datum: NAD83
Platform:

Easting: 503,328.0 m
Northing: 7,974,867.0 m
Surface Elevation: 12.00 m
Bottom Elevation: -27.60 m
Total Depth: 39.6 m
Logged By: MY/PS
Reviewed By:

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: Sonic Drill Rig
Hole Diameter (mm): 100
Date Logged: 3/5/2018
Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
						SILT, trace to some SAND: Grey, trace organics, with thin silt beds (1 cm thick). *(Continued)*	Nbn Nbn *(Continued)*										
	-9.0	21.0					Vc Nbn										
	-10.0	22.0				22.40 m - 22.90 m: Increase in organic bands.	Nbe										
	-11.0	23.0					Nbn										
	-12.0	24.0					Vx										
	-13.0	25.0					Vs Vx										
	-14.0	26.0															
	-15.0	27.0					Vs Nbn				23	0	0	100	31	12	
	-16.0	28.0															
	-17.0	29.0				SANDY SILT to SILTY SAND, some GRAVEL: Reddish brown.	Vx										
	-18.0	30.0				TILL: Sandy gravel, some silt, light brown, angular to subrounded gravel.	Nf				5 5	10 16	48 44	42 40			

Notes:

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BOREHOLE REPORT

BH18-M002

Sheet 4 of 4

Client: Baffinland Iron Mine

Project: Mary River Expansion Study

Location: Milne Port

Project No.: H353004

Datum: NAD83

Platform:

Easting: 503,328.0 m

Northing: 7,974,867.0 m

Surface Elevation: 12.00 m

Bottom Elevation: -27.60 m

Total Depth: 39.6 m

Logged By: MY/PS

Reviewed By:

Contractor: Boart Longyear

Rig Type/ Mounting: Sonic Drill Rig

Date Logged: 3/5/2018

Driller: Brent McAndrew

Hole Diameter (mm): 100

Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
						TILL: Sandy gravel, some silt, light brown, angular to subrounded gravel. *(Continued)*	Nf *(Continued)*										
	-19.0	31.0															
	-20.0	32.0				32.60 m - 32.90 m: Cobbles, grey, subrounded.											
	-21.0	33.0															
	-22.0	34.0															
	-23.0	35.0					Nbn										
	-24.0	36.0				35.90 m: Boulder.											
						36.40 m: Boulder.	Nf				2						
	-25.0	37.0															
	-26.0	38.0															
	-27.0	39.0									3	45	26	29			
	-28.0	40.0				To Target Depth. **Drillhole BH18-M002 terminated at 39.6m.**											

Notes:

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BOREHOLE REPORT

BH18-M003

Sheet 1 of 6

Client: Baffinland Iron Mine

Project: Mary River Expansion Study

Location: Milne Port

Project No.: H353004

Datum: NAD83

Platform:

Easting: 503,055.0 m

Northing: 7,974,868.0 m

Surface Elevation: 11.00 m

Bottom Elevation: -40.80 m

Total Depth: 51.8 m

Logged By: MY/PS

Reviewed By:

Contractor: Boart Longyear

Rig Type/ Mounting: Sonic Drill Rig

Date Logged: 3/6/2018

Driller: Brent McAndrew

Hole Diameter (mm): 100

Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description: TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 – 25 – 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	10.0	1.0				SANDY GRAVEL, trace SILT: Brownish grey, subangular to subrounded.	Nf Vx				8	37	43	20			
	9.0	2.0				SAND and SILT: Medium to fine grained, stratified sand and silt layers, reddish grey.	Nbn Vr				27	0	10	90			
	8.0	3.0				2.75 m: Organic layer.											
	7.0	4.0									21	0	13	87			
	6.0	5.0				5.00 m: Organic layer.											
	5.0	6.0				SILTY SAND: Stratified, fine to medium grained, reddish grey.	Nbn										
	4.0	7.0									24	0	40	60			
	3.0	8.0															
	2.0	9.0															
	1.0	10.0															

Notes:

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BOREHOLE REPORT

BH18-M003
Sheet 2 of 6

Client: Baffinland Iron Mine
Project: Mary River Expansion Study
Location: Milne Port

Project No.: H353004
Datum: NAD83
Platform:

Easting: 503,055.0 m
Northing: 7,974,868.0 m
Surface Elevation: 11.00 m
Bottom Elevation: -40.80 m
Total Depth: 51.8 m
Logged By: MY/PS
Reviewed By:

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: Sonic Drill Rig
Hole Diameter (mm): 100
Date Logged: 3/6/2018
Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 – 25 – 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	0.0	11.0				SILTY SAND: Stratified, fine to medium grained, reddish grey. *(Continued)*	Nbn *(Continued)*										
	-1.0	12.0				SANDY SILT: Stratified silt and fine sand, grey.	Nbn										
	-2.0	13.0				13.30 m: Organic layer.					22	0	1	99			
	-3.0	14.0															
	-4.0	15.0				15.20 m - 16.45 m: Sand with organic layer interbeds.	Nbn - Nf										
	-5.0	16.0															
	-6.0	17.0															
	-7.0	18.0				17.65 m, 17.90 m, 18.05 m, 18.20 m: Interbedded sand and silt with organics, fine sand grains, reddish grey. 18.30 m: Return to silt with sand, interbedded with organics and sand, brownish grey.											
	-8.0	19.0									21	0	15	85			
	-9.0	20.0															

Notes:

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BOREHOLE REPORT

BH18-M003
Sheet 3 of 6

Client: Baffinland Iron Mine
Project: Mary River Expansion Study
Location: Milne Port

Project No.: H353004
Datum: NAD83
Platform:

Easting: 503,055.0 m
Northing: 7,974,868.0 m
Surface Elevation: 11.00 m
Bottom Elevation: -40.80 m
Total Depth: 51.8 m
Logged By: MY/PS
Reviewed By:

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: Sonic Drill Rig
Hole Diameter (mm): 100
Date Logged: 3/6/2018
Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 / 25 / 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	-10.0	21.0				SANDY SILT: Stratified silt and fine sand, grey. *(Continued)*	Nbn *(Continued)*										
						21.05 m - 21.30 m: Sand layers, medium grained, bounded by organic layer.											
	-11.0	22.0				21.78 m - 22.00 m: Sand layers, medium grained, bounded by organic layer.											
						22.45 m: Organic layer.	Vs-Vc										
	-12.0	23.0															
	-13.0	24.0									25	0	1	99			
						24.40 m: Silty sand with organic banding.											
	-14.0	25.0															
	-15.0	26.0					Vr										
							Nbn										
	-16.0	27.0				27.10 m - 29.0 m: Interbedded organic bands in silt and sand.					20	0	14	86			
	-17.0	28.0															
	-18.0	29.0															
	-19.0	30.0															

Notes:

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BOREHOLE REPORT

BH18-M003
Sheet 4 of 6

Client: Baffinland Iron Mine
Project: Mary River Expansion Study
Location: Milne Port

Project No.: H353004
Datum: NAD83
Platform:

Easting: 503,055.0 m
Northing: 7,974,868.0 m
Surface Elevation: 11.00 m
Bottom Elevation: -40.80 m
Total Depth: 51.8 m
Logged By: MY/PS
Reviewed By:

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: Sonic Drill Rig
Hole Diameter (mm): 100
Date Logged: 3/6/2018
Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 / 25 / 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	-20.0	31.0				SANDY SILT: Stratified silt and fine sand, grey. *(Continued)*	Nbn *(Continued)*										
	-21.0	32.0															
	-22.0	33.0															
	-23.0	34.0				33.50 m: Mottled organic layers, brownish grey, organic layers at 34.75 m, 33.85 m, and 34.10 m.											
	-24.0	35.0				34.95 m - 35.10 m: More sand present. 35.30 m, and 36.06 m: Organic layers.											
	-25.0	36.0															
	-26.0	37.0															
	-27.0	38.0				37.55 m: Brownish grey dipping organic layer (10 cm).											
	-28.0	39.0				38.50 m, 38.80 m, 39.40 m: Organic layering.	Vs										
	-29.0	40.0															

Notes:

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BOREHOLE REPORT

BH18-M003
Sheet 5 of 6

Client: Baffinland Iron Mine
Project: Mary River Expansion Study
Location: Milne Port

Project No.: H353004
Datum: NAD83
Platform:

Easting: 503,055.0 m
Northing: 7,974,868.0 m
Surface Elevation: 11.00 m
Bottom Elevation: -40.80 m
Total Depth: 51.8 m
Logged By: MY/PS
Reviewed By:

Contractor: Boart Longyear
Driller: Brent McAndrew
Rig Type/ Mounting: Sonic Drill Rig
Hole Diameter (mm): 100
Date Logged: 3/6/2018
Date Reviewed:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	-30.0	41.0				SANDY SILT: Stratified silt and fine sand, grey. *(Continued)* 40.20 m: Interbedded horizontal organic layer, reddish brown (possible grey). 41.40 m - 42.60 m: Interbedded sand and organics approximately every 20cm.	Nbn *(Continued)* Nbn										
	-31.0	42.0															
	-32.0	43.0					Vx Vr										
	-33.0	44.0					Vx Vs										
	-34.0	45.0															
	-35.0	46.0															
	-36.0	47.0				TILL: Sand and gravel to sandy gravel, fine to coarse grained, grey, subangular to subrounded.	Nf										
	-37.0	48.0									6 7	25	45	30			
	-38.0	49.0					Nbn										
	-39.0	50.0															

Notes:

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BOREHOLE REPORT

BH18-M003

Sheet 6 of 6

Client: Baffinland Iron Mine

Project: Mary River Expansion Study

Location: Milne Port

Project No.: H353004

Datum: NAD83

Platform:

Easting: 503,055.0 m

Northing: 7,974,868.0 m

Surface Elevation: 11.00 m

Bottom Elevation: -40.80 m

Total Depth: 51.8 m

Logged By: MY/PS

Contractor: Boart Longyear

Rig Type/ Mounting: Sonic Drill Rig

Date Logged: 3/6/2018

Driller: Brent McAndrew

Hole Diameter (mm): 100

Date Reviewed:

Reviewed By:

Water	Elevation (m)	Depth (m)	Method	Casing	Graphic Log	Soil Description TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.	Frozen Soil Description	Recovery	Sample Type	Moisture Content Profile (0 25 50)	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
	-40.0	51.0				TILL: Sand and gravel to sandy gravel, fine to coarse grained, grey, subangular to subrounded. *(Continued)*	Nf *(Continued)*										
	-41.0	52.0				To Target Depth. **Drillhole BH18-M003 terminated at 51.8m.**											
	-42.0	53.0															
	-43.0	54.0															
	-44.0	55.0															
	-45.0	56.0															
	-46.0	57.0															
	-47.0	58.0															
	-48.0	59.0															
	-49.0	60.0															

Notes:

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Appendix C

Sample Photographs

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HATCH

Sample Photographs

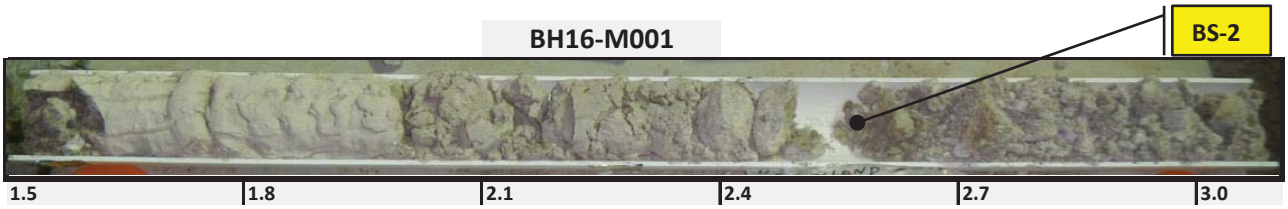
Borehole Name:	BH16-M001	Mary River 12 MTPA Mine Expansion
Location:	17 W 503504 7976237	Pre-feasibility Study
Completion Date:	8/12/2016	Baffinland Iron Mines

BH16-M001



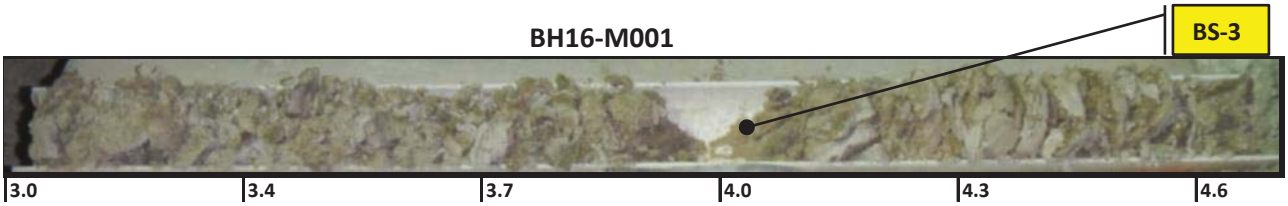
0	0.3	0.6	0.9	1.2	1.5

BH16-M001



1.5	1.8	2.1	2.4	2.7	3.0

BH16-M001



3.0	3.4	3.7	4.0	4.3	4.6

BH16-M001



4.6	4.9	5.2	5.5	5.8	6.1

BH16-M001



6.1	6.4	6.7	7.0	7.3	7.6

BH16-M001



7.6	7.9	8.2	8.5	8.8	9.1

BH16-M001



9.1	9.4	9.8	10.1	10.4	10.7

BH16-M001



10.7	11.0	11.3	11.6	11.9	12.2

BH16-M001



12.2	12.5	12.8	13.1	13.4	13.7

BH16-M001



13.7	14.0	14.3	14.6	14.9	15.2

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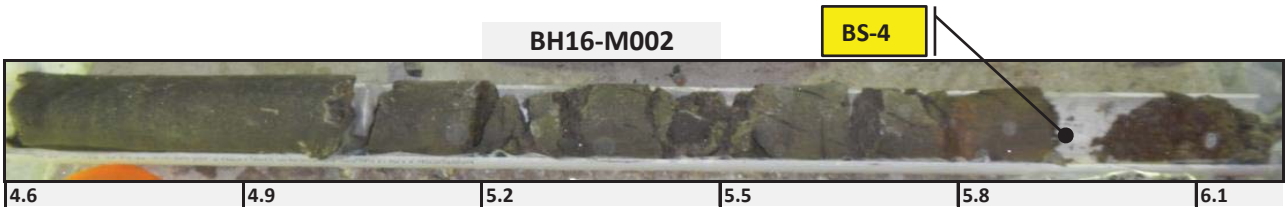
Sample Photographs

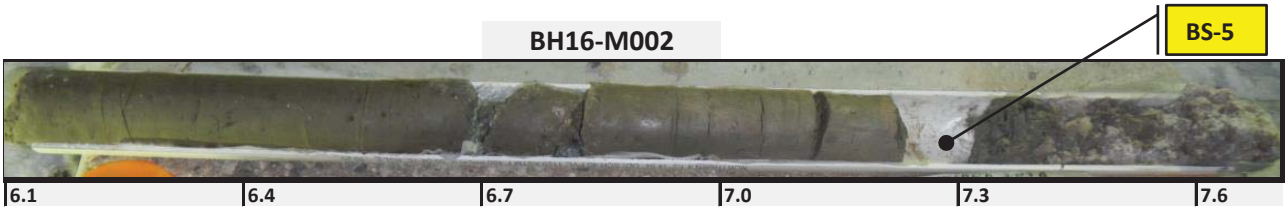
Borehole Name:	BH16-M002	Mary River 12 MTPA Mine Expansion
Location:	17 W 503757 7975894	Pre-feasibility Study
Completion Date:	4/12/2016	Baffinland Iron Mines













BH16-M002



9.1	9.4	9.8	10.1	10.4	10.7

BH16-M002



10.7	11.0	11.3	11.6	11.9	12.2

BH16-M002



12.2	12.5	12.8	13.1	13.4	13.7

BH16-M002

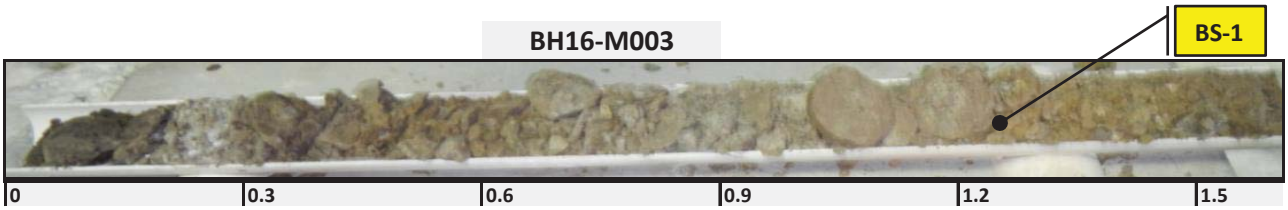


13.7	14.0	14.3	14.6	14.9	15.2

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Sample Photographs

Borehole Name:	BH16-M003	Mary River 12 MTPA Mine Expansion
Location:	17 W 503714 7975892	Pre-feasibility Study
Completion Date:	4/12/2016	Baffinland Iron Mines













BH16-M003



9.1	9.4	9.8	10.1	10.4	10.7

BH16-M003



10.7	11.0	11.3	11.6	11.9	12.2

BH16-M003



12.2	12.5	12.8	13.1	13.4	13.7

BH16-M003



13.7	14.0	14.3	14.6	14.9	15.2

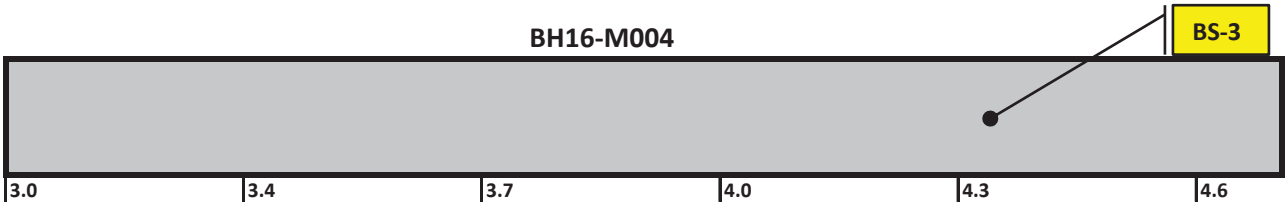
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Sample Photographs

Borehole Name:	BH16-M004	Mary River 12 MTPA Mine Expansion
Location:	17 W 503302 7975591	Pre-feasibility Study
Completion Date:	8/12/2016	Baffinland Iron Mines













BH16-M004



9.1	9.4	9.8	10.1	10.4	10.7

BH16-M004



10.7	11.0	11.3	11.6	11.9	12.2

BH16-M004



12.2	12.5	12.8	13.1	13.4	13.7

BH16-M004



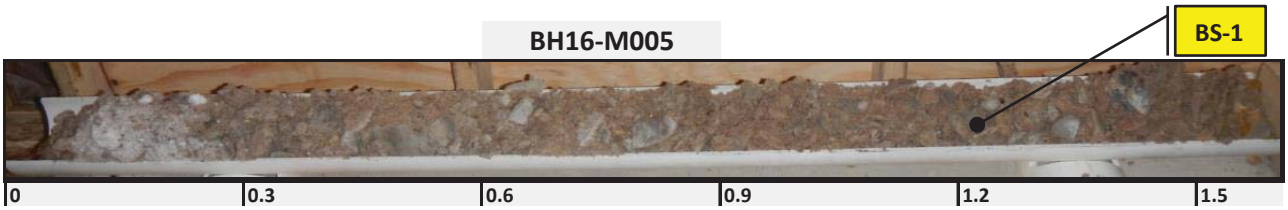
13.7	14.0	14.3	14.6	14.9	15.2

HATCH

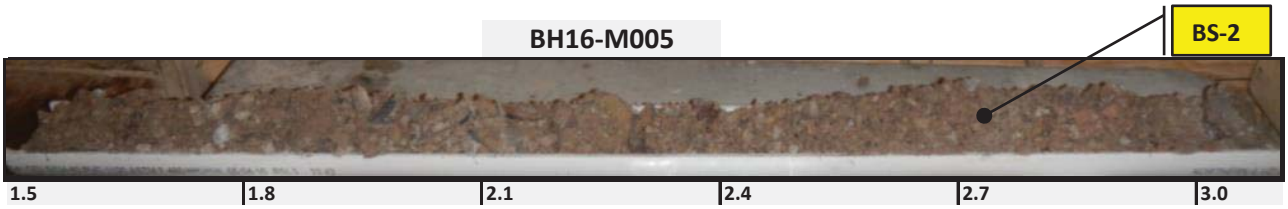
Sample Photographs

Borehole Name:	BH16-M005	Mary River 12 MTPA Mine Expansion
Location:	17 W 503270 7975606	Pre-feasibility Study
Completion Date:	8/12/2016	Baffinland Iron Mines

BH16-M005



BH16-M005



BH16-M005



BH16-M005



BH16-M005



BH16-M005



BH16-M005



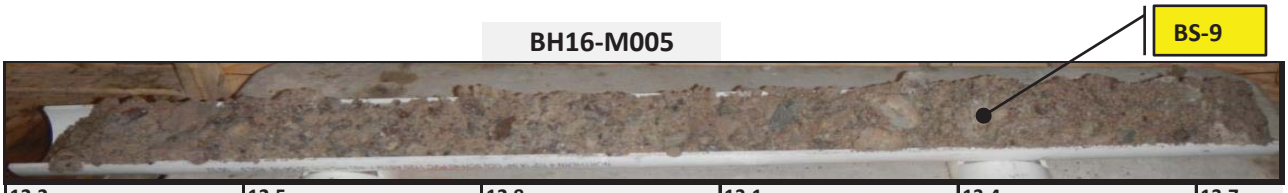
9.1	9.4	9.8	10.1	10.4	10.7

BH16-M005



10.7	11.0	11.3	11.6	11.9	12.2

BH16-M005



12.2	12.5	12.8	13.1	13.4	13.7

BH16-M005



13.7	14.0	14.3	14.6	14.9	15.2

HATCH

Sample Photographs

Borehole Name:	BH16-M006	Mary River 12 MTPA Mine Expansion
Location:	17 W 503136 7975081	Pre-feasibility Study
Completion Date:	8/12/2016	Baffinland Iron Mines

BH16-M006



BH16-M006



BH16-M006



BH16-M006



BH16-M006



BH16-M006



HATCH

BH16-M006



9.1	9.4	9.8	10.1	10.4	10.7

BH16-M006



10.7	11.0	11.3	11.6	11.9	12.2

BH16-M006



12.2	12.5	12.8	13.1	13.4	13.7

BH16-M006



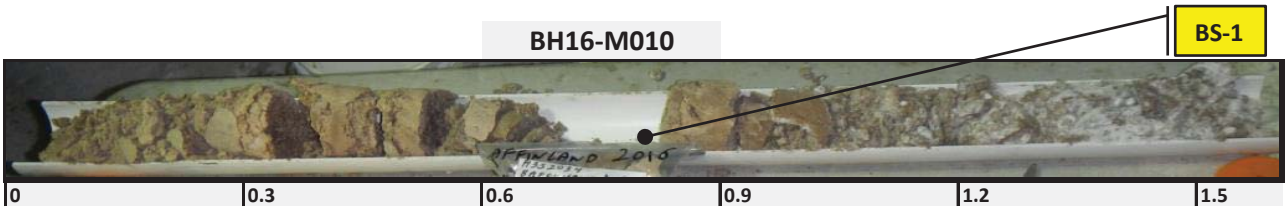
13.7	14.0	14.3	14.6	14.9	15.2

HATCH

Sample Photographs

Borehole Name:	BH16-M010	Mary River 12 MTPA Mine Expansion
Location:	17 W 503394 7974877	Pre-feasibility Study
Completion Date:	9/12/2016	Baffinland Iron Mines

BH16-M010



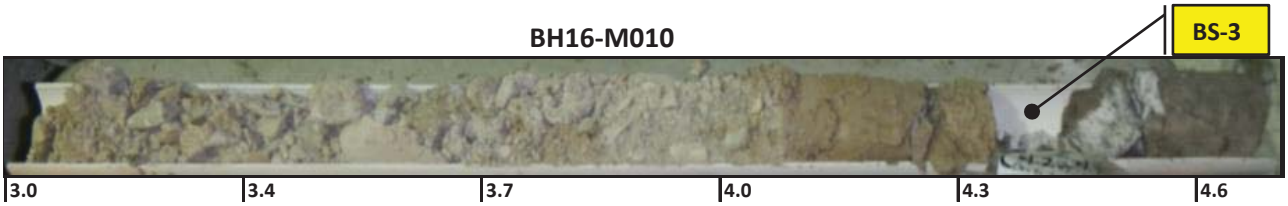
0 | 0.3 | 0.6 | 0.9 | 1.2 | 1.5

BH16-M010



1.5 | 1.8 | 2.1 | 2.4 | 2.7 | 3.0

BH16-M010



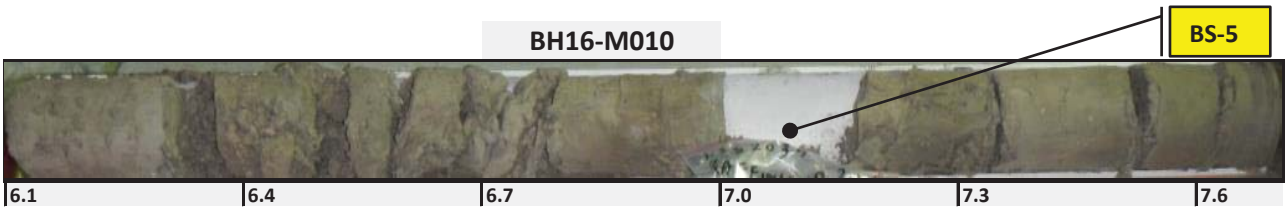
3.0 | 3.4 | 3.7 | 4.0 | 4.3 | 4.6

BH16-M010



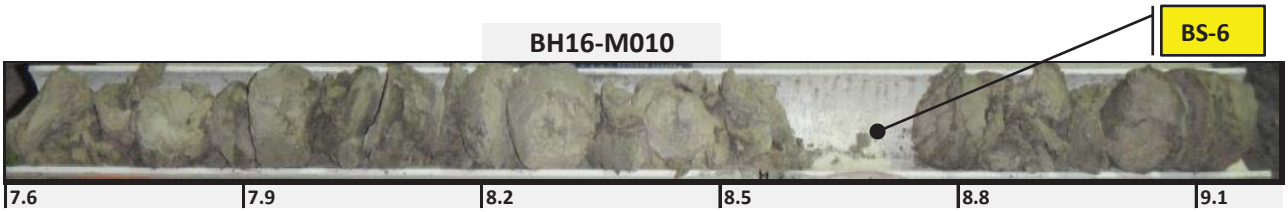
4.6 | 4.9 | 5.2 | 5.5 | 5.8 | 6.1

BH16-M010



6.1 | 6.4 | 6.7 | 7.0 | 7.3 | 7.6

BH16-M010



7.6 | 7.9 | 8.2 | 8.5 | 8.8 | 9.1

BH16-M010



9.1	9.4	9.8	10.1	10.4	10.7

BH16-M010



10.7	11.0	11.3	11.6	11.9	12.2

BH16-M010



12.2	12.5	12.8	13.1	13.4	13.7

BH16-M010

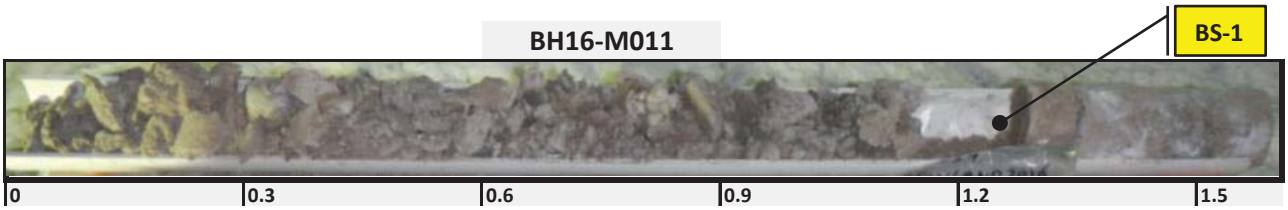


13.7	14.0	14.3	14.6	14.9	15.2

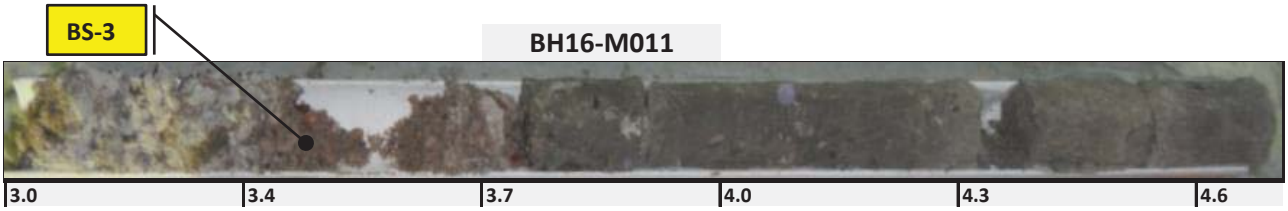
HATCH

Sample Photographs

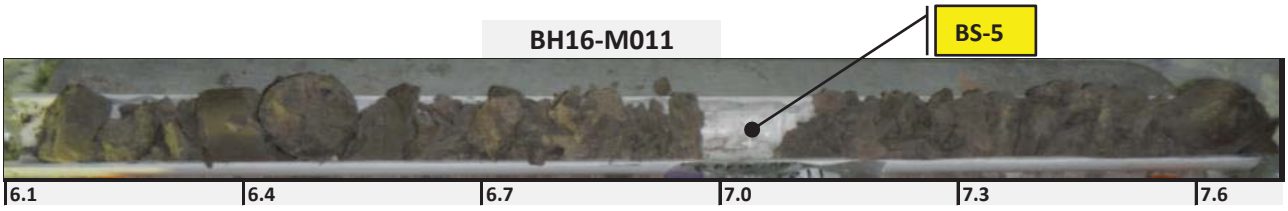
Borehole Name:	BH16-M011	Mary River 12 MTPA Mine Expansion
Location:	17 W 503339 7974868	Pre-feasibility Study
Completion Date:	4/12/2016	Baffinland Iron Mines

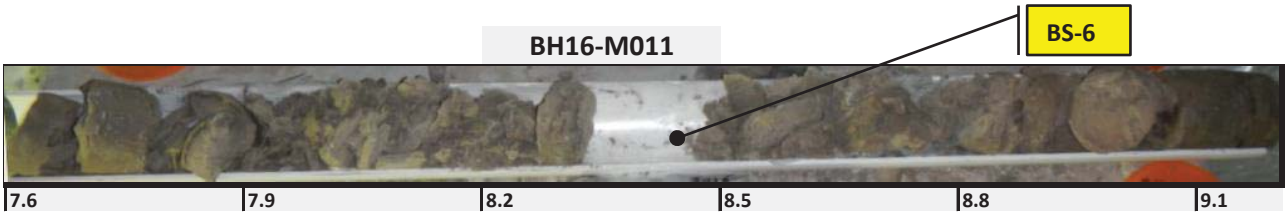












HATCH

BH16-M011



9.1	9.4	9.8	10.1	10.4	10.7

BH16-M011



10.7	11.0	11.3	11.6	11.9	12.2

BH16-M011



12.2	12.5	12.8	13.1	13.4	13.7

BH16-M011



13.7	14.0	14.3	14.6	14.9	15.2

HATCH

Sample Photographs

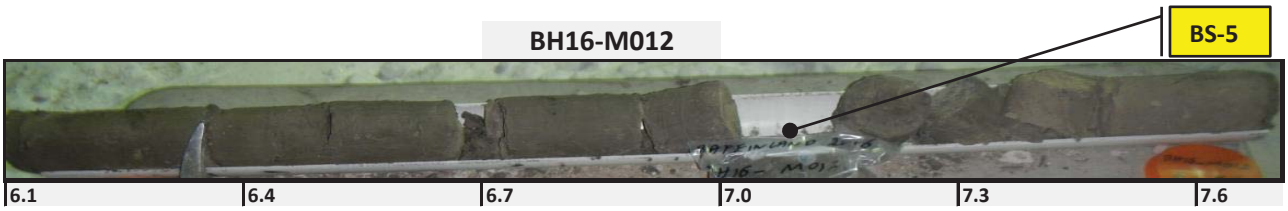
Borehole Name:	BH16-M012	Mary River 12 MTPA Mine Expansion
Location:	17 W 503268 7974848	Pre-feasibility Study
Completion Date:	9/12/2016	Baffinland Iron Mines













BH16-M012



9.1	9.4	9.8	10.1	10.4	10.7

BH16-M012



10.7	11.0	11.3	11.6	11.9	12.2

BH16-M012



12.2	12.5	12.8	13.1	13.4	13.7

BH16-M012

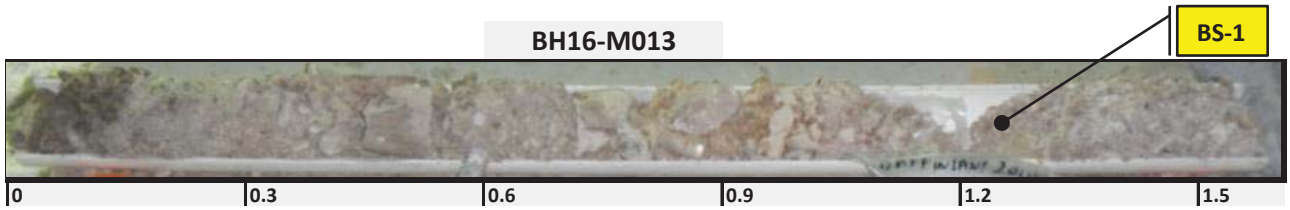


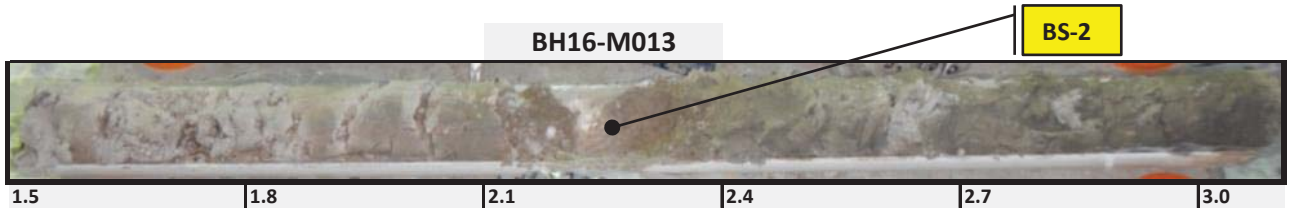
13.7	14.0	14.3	14.6	14.9	15.2

HATCH

Sample Photographs

Borehole Name:	BH16-M013	Mary River 12 MTPA Mine Expansion
Location:	17 W 503140 7974820	Pre-feasibility Study
Completion Date:	5/12/2016	Baffinland Iron Mines













BH16-M013



9.1	9.4	9.8	10.1	10.4	10.7

BH16-M013



10.7	11.0	11.3	11.6	11.9	12.2

BH16-M013



12.2	12.5	12.8	13.1	13.4	13.7

BH16-M013

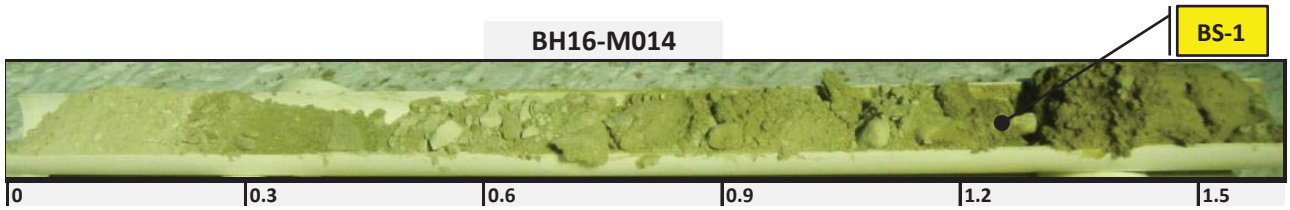


13.7	14.0	14.3	14.6	14.9	15.2

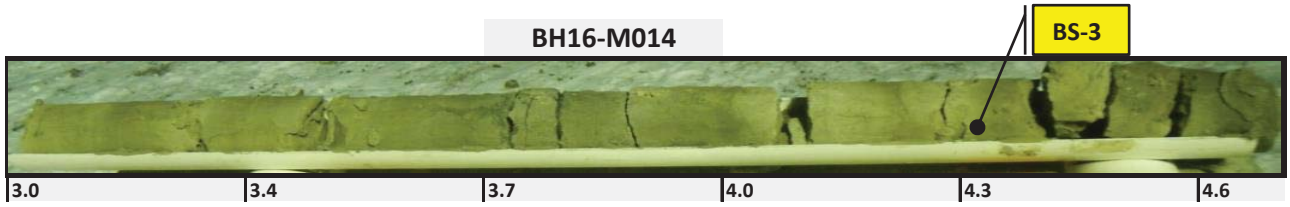
HATCH

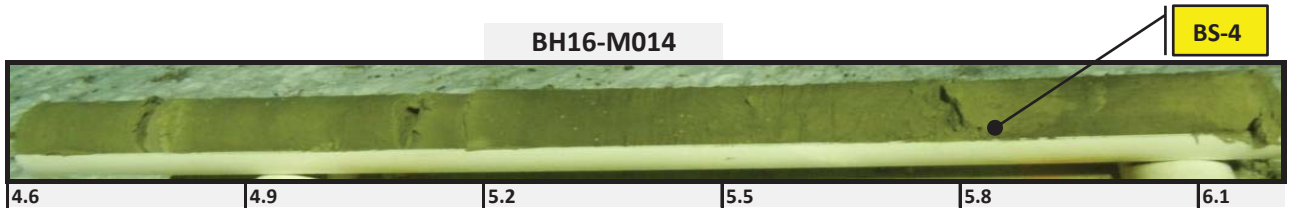
Sample Photographs

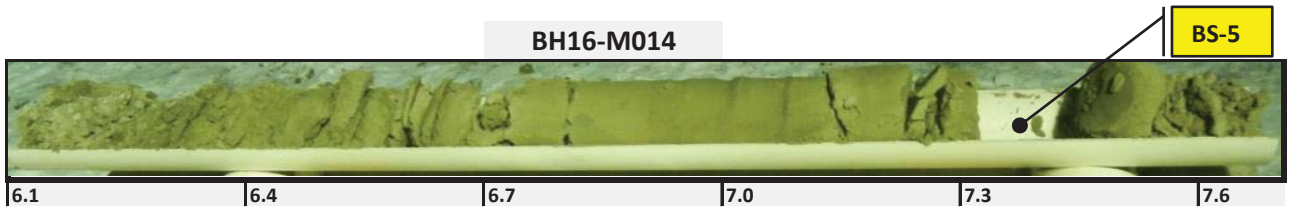
Borehole Name:	BH16-M014	Mary River 12 MTPA Mine Expansion
Location:	17 W 503052 7974782	Pre-feasibility Study
Completion Date:	5/12/2016	Baffinland Iron Mines

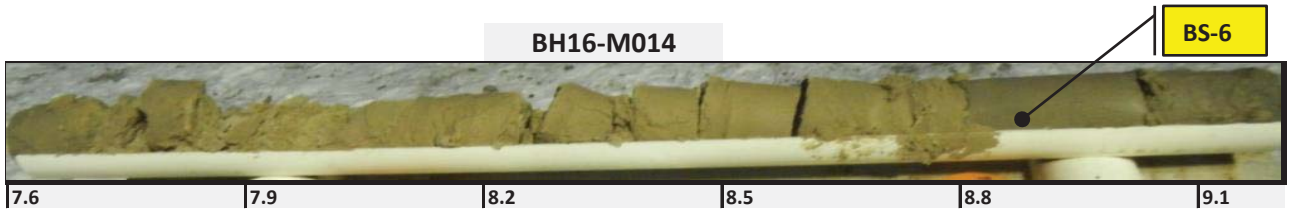












HATCH

BH16-M014



9.1	9.4	9.8	10.1	10.4	10.7

BH16-M014



10.7	11.0	11.3	11.6	11.9	12.2

BH16-M014



12.2	12.5	12.8	13.1	13.4	13.7

BH16-M014



13.7	14.0	14.3	14.6	14.9	15.2

HATCH

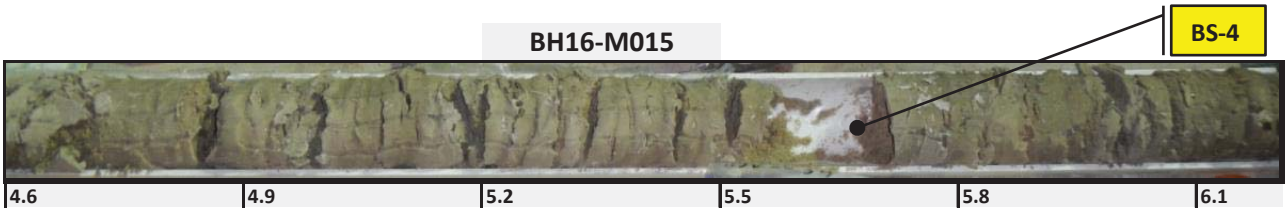
Sample Photographs

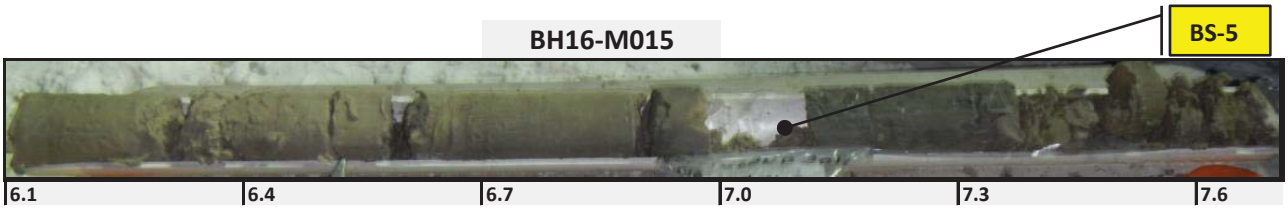
Borehole Name:	BH16-M015	Mary River 12 MTPA Mine Expansion
Location:	17 W 503007 7974799	Pre-feasibility Study
Completion Date:	5/12/2016	Baffinland Iron Mines













BS-7

BH16-M015



9.1	9.4	9.8	10.1	10.4	10.7

BH16-M015

BS-8



10.7	11.0	11.3	11.6	11.9	12.2

BH16-M015

BS-9



12.2	12.5	12.8	13.1	13.4	13.7

BH16-M015

BS-10

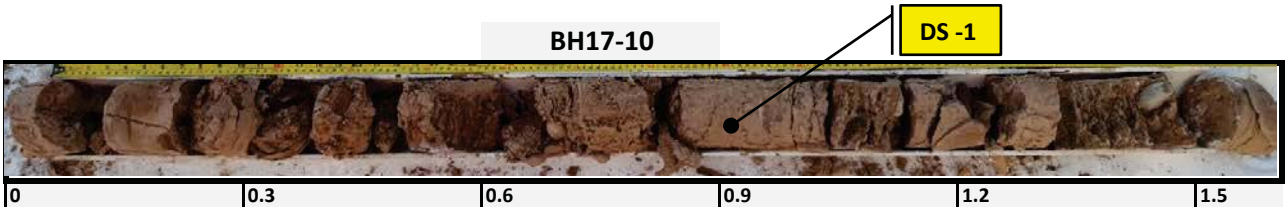


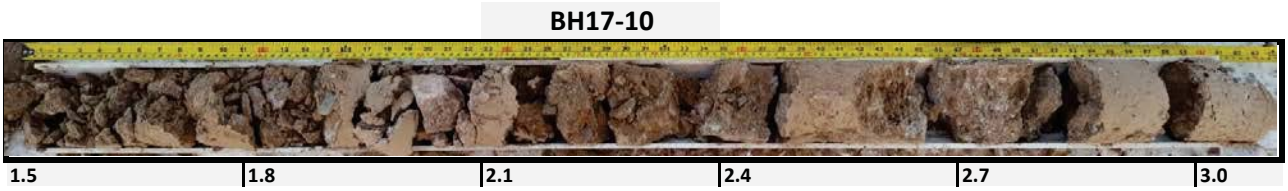
13.7	14.0	14.3	14.6	14.9	15.2

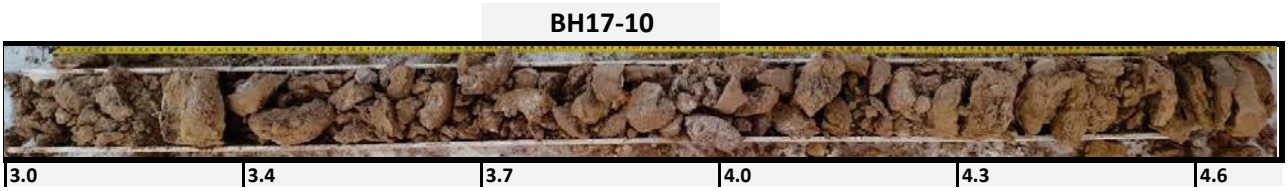
HATCH

Sample Photographs

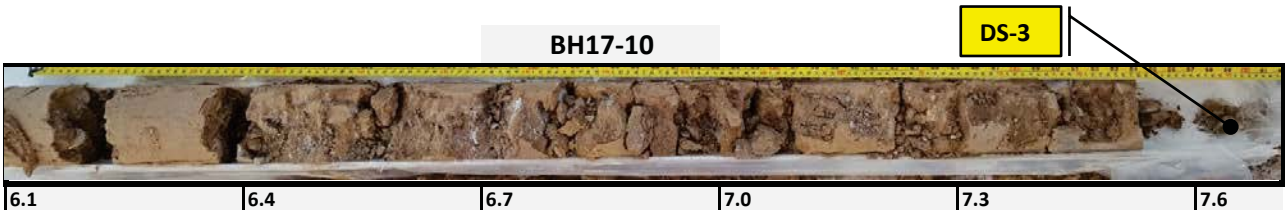
Borehole Name:	BH17-10	Mary River Expansion Study Stage 2
Location:	17 W 503476 7974905	2017 Geotechnical Investigation
Completion Date:	October 29, 2017	Baffinland Iron Mines













Sample Photographs

Borehole Name:	BH17-10	Mary River Expansion Study Stage 2
Location:	17 W 503476 7974905	
Completion Date:	October 29, 2017	Baffinland Iron Mines

BH17-10



9.1 | 9.4 | 9.8 | 10.1 | 10.4 | 10.7

BH17-10



10.7 | 11.0 | 11.3 | 11.6 | 11.9 | 12.2

BH17-10



12.2 | 12.5 | 12.8 | 13.1 | 13.4 | 13.7

BH17-10



13.7 | 14.0 | 14.3 | 14.6 | 14.9 | 15.2

BH17-10



15.2 | 15.5 | 15.8 | 16.2 | 16.5 | 16.8

HATCH

Sample Photographs

Borehole Name:	BH17-11	Mary River Expansion Study Stage 2
Location:	17 W 503268 7976025	2017 Geotechnical Investigation
Completion Date:	October 30, 2017	Baffinland Iron Mines

BH17-11



BH17-11

DS-1



BH17-11



BH17-11

DS-2



BH17-11



DS-3

BH17-11

DS-4



HATCH

Sample Photographs

Borehole Name:	BH17-11	Mary River Expansion Study Stage 2
Location:	17 W 503268 7976025	
Completion Date:	October 30, 2017	Baffinland Iron Mines

BH17-11



9.1	9.4	9.8	10.1	10.4	10.7

BH17-11



10.7	11.0	11.3	11.6	11.9	12.2

BH17-11



12.2	12.5	12.8	13.1	13.4	13.7

BH17-11



13.7	14.0	14.3	14.6	14.9	15.2

HATCH

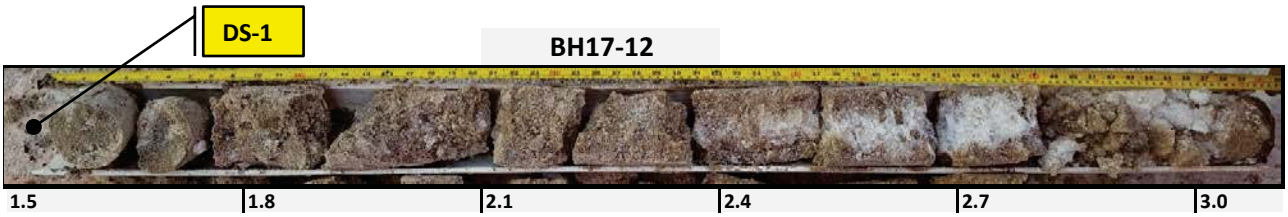
Sample Photographs

Borehole Name:	BH17-12	Mary River Expansion Study Stage 2
Location:	17 W 503180 7975752	2017 Geotechnical Investigation
Completion Date:	October 30, 2017	Baffinland Iron Mines

BH17-12



BH17-12



BH17-12



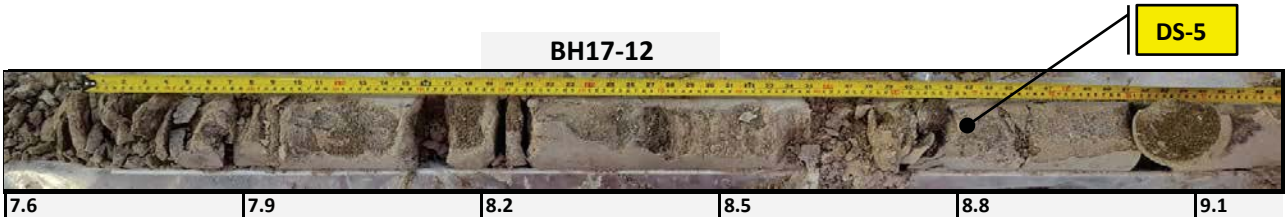
BH17-12



BH17-12



BH17-12



HATCH

Sample Photographs

Borehole Name:	BH17-12	Mary River Expansion Study Stage 2
Location:	17 W 503180 7975752	
Completion Date:	October 30, 2017	Baffinland Iron Mines

BH17-12



9.1	9.4	9.8	10.1	10.4	10.7

BH17-12



10.7	11.0	11.3	11.6	11.9	12.2

BH17-12



12.2	12.5	12.8	13.1	13.4	13.7

BH17-12



13.7	14.0	14.3	14.6	14.9	15.2

HATCH

Sample Photographs

Borehole Name:	BH17-13	Mary River Expansion Study Stage 2
Location:	17 W 503159 7975912	2017 Geotechnical Investigation
Completion Date:	October 8, 2017	Baffinland Iron Mines

BH17-13



0 | 0.3 | 0.6 | 0.9 | 1.2 | 1.5

BH17-13



1.5 | 1.8 | 2.1 | 2.4 | 2.7 | 3.0

BH17-13



3.0 | 3.4 | 3.7 | 4.0 | 4.3 | 4.6

BH17-13



4.6 | 4.9 | 5.2 | 5.5 | 5.8 | 6.1

HATCH

Sample Photographs

Borehole Name:	BH17-14	Mary River Expansion Study Stage 2
Location:	17 W 503187 7975913	2017 Geotechnical Investigation
Completion Date:	October 8, 2017	Baffinland Iron Mines

BH17-14



0 | 0.3 | 0.6 | 0.9 | 1.2 | 1.5

BH17-14



1.5 | 1.8 | 2.1 | 2.4 | 2.7 | 3.0

BH17-14



3.0 | 3.4 | 3.7 | 4.0 | 4.3 | 4.6

BH17-14



4.6 | 4.9 | 5.2 | 5.5 | 5.8 | 6.1

Sample Photographs

Borehole Name:	BH17-15	Mary River Expansion Study Stage 2
Location:	17 W 50322 7975913	2017 Geotechnical Investigation
Completion Date:	October 8, 2017	Baffinland Iron Mines

BH17-15



BH17-15



BH17-15



BH17-15



HATCH

Sample Photographs

Borehole Name:	BH17-CAMP-1	Mary River Expansion Study Stage 2
Location:	17 W 529031 7976147	2017 Geotechnical Investigation
Completion Date:	October 7, 2017	Baffinland Iron Mines

BH17-CAMP-1

DS-1



0 | 0.3 | 0.6 | 0.9 | 1.2 | 1.5

DS-3

BH17-CAMP-1



1.5 | 1.8 | 2.1 | 2.4 | 2.7 | 3.0

BH17-CAMP-1

DS-3



3.0 | 3.4 | 3.7 | 4.0 | 4.3 | 4.6

BH17-CAMP-1



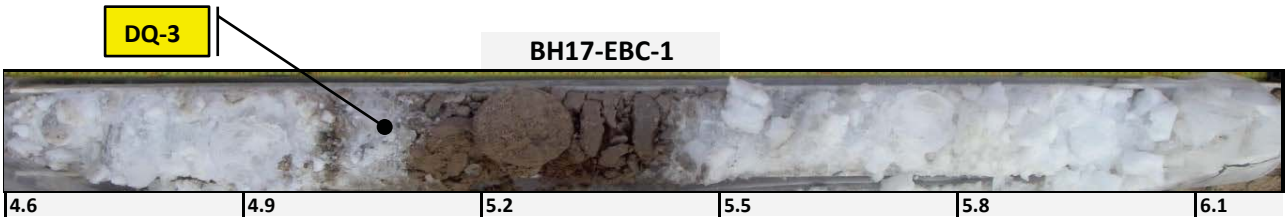
4.6 | 4.9 | 5.2 | 5.5 | 5.8 | 6.1

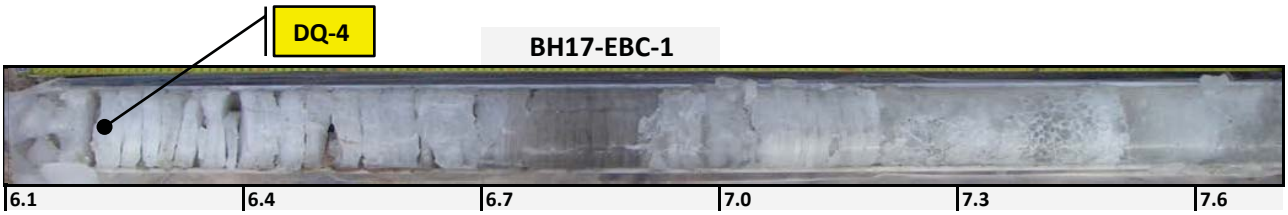
HATCH

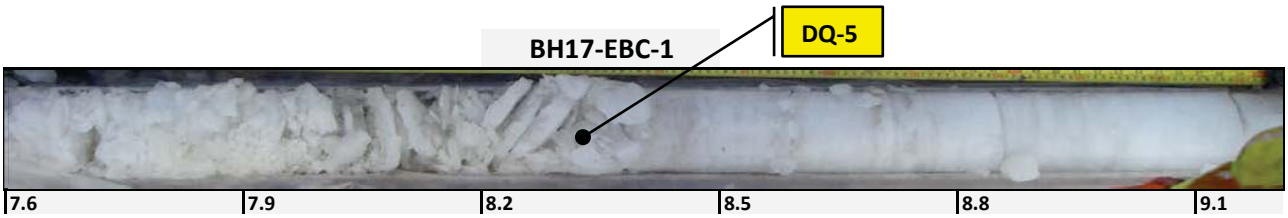
Sample Photographs

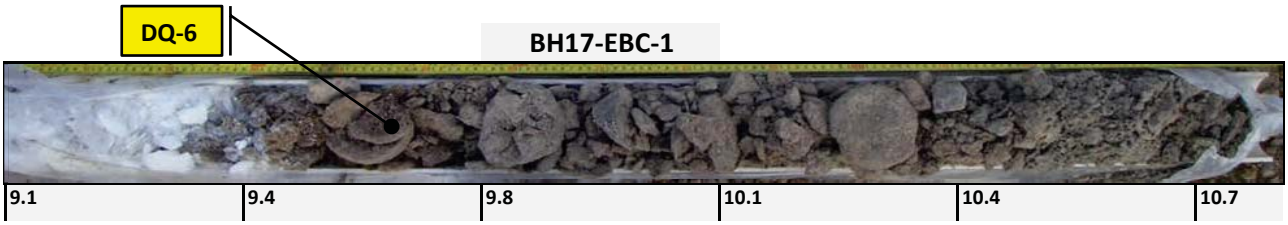
Borehole Name:	BH17-EBC-1	Mary River Expansion Study Stage 2
Location:	17 W 503783.38 7974920.79	2017 Geotechnical Investigation
Completion Date:	September 20, 2017	Baffinland Iron Mines

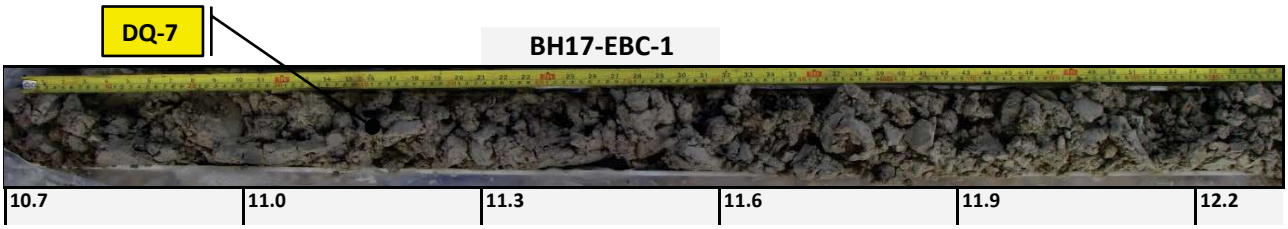








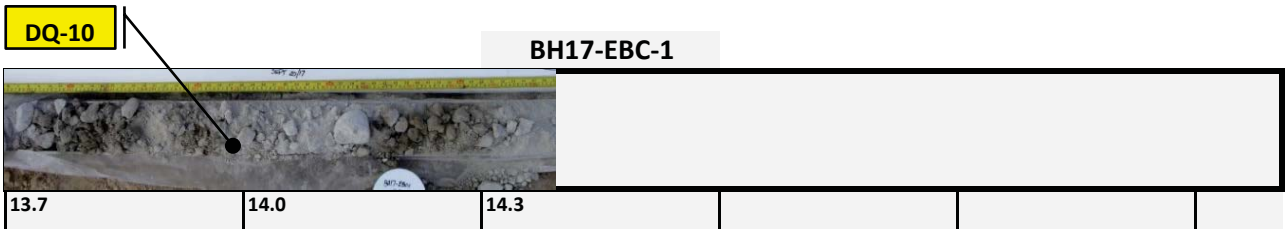




Sample Photographs

Borehole Name:	BH17-EBC-1	Mary River Expansion Study Stage 2
Location:	17 W 503779 7974925	2017 Geotechnical Investigation
Completion Date:	September 20, 2017	Baffinland Iron Mines



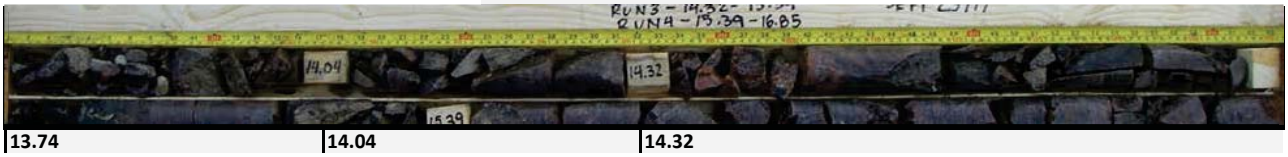


HATCH

Sample Photographs

Borehole Name:	BH17-EBC-1A	Mary River Expansion Study Stage 2
Location:	17 W 503783.38 7974920.79	2017 Geotechnical Investigation
Completion Date:	September 23, 2017	Baffinland Iron Mines

BH17-EBC-1A



13.74 | 14.04 | 14.32

BH17-EBC-1A



15.39

BH17-EBC-1A



16.99

BH17-EBC-1A



18.59

BH17-EBC-1A



20.10

BH17-EBC-1A



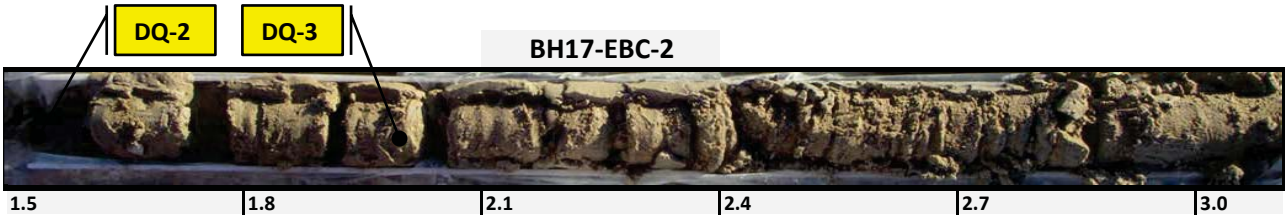
21.67

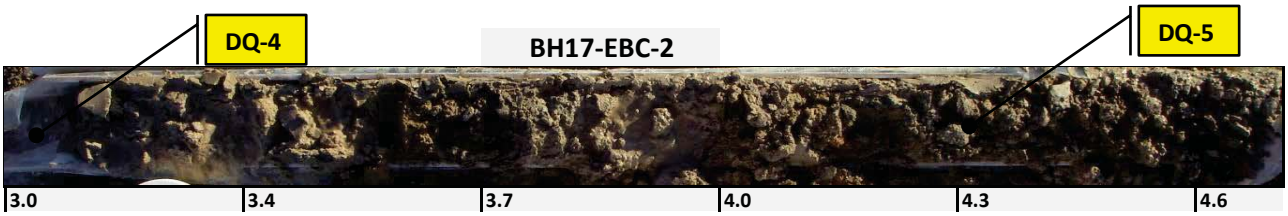
HATCH

Sample Photographs

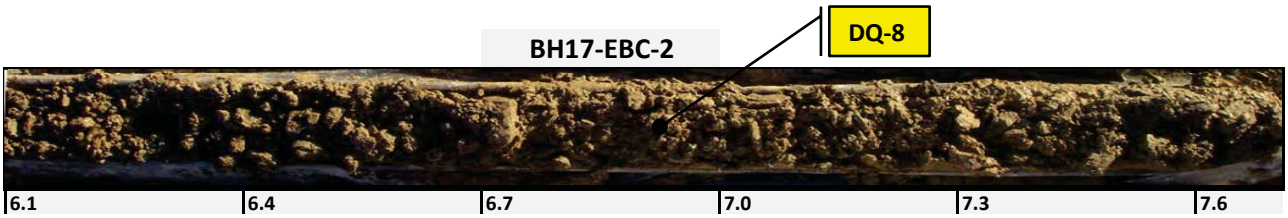
Borehole Name:	BH17-EBC-2	Mary River Expansion Study Stage 2
Location:	17 W 503790.94 7974895.17	2017 Geotechnical Investigation
Completion Date:	September 25, 2017	Baffinland Iron Mines

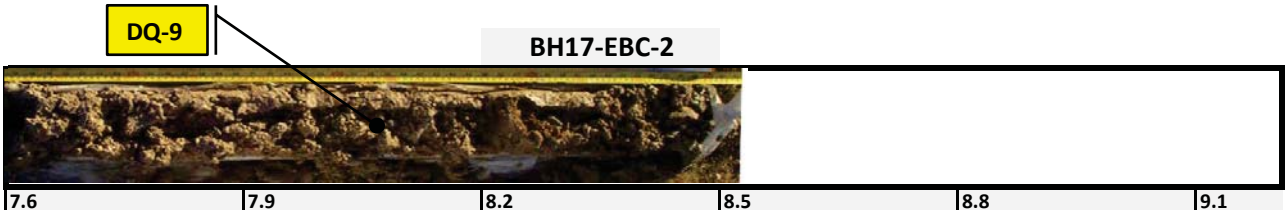












HATCH

Sample Photographs

Borehole Name:	BH17-EBC-2	Mary River Expansion Study Stage 2
Location:	17 W 503790.94 7974895.17	
Completion Date:	September 25, 2017	Baffinland Iron Mines

BH17-EBC-2



8.4 | 9.1 | 9.9

BH17-EBC-2



10.4 | 11.1 | 11.6

BH17-EBC-2



12.3 | 12.7

BH17-EBC-2



13.3

BH17-EBC-2



14.575

BH17-EBC-2

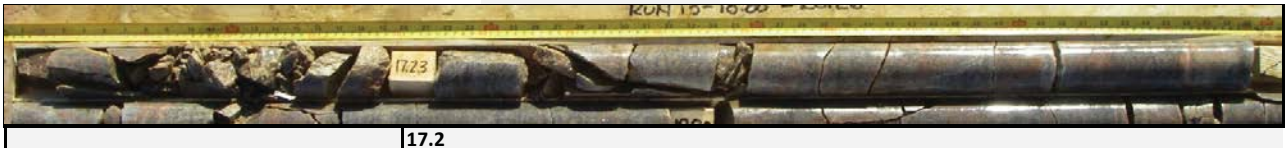


16.2

Sample Photographs

Borehole Name:	BH17-EBC-2	Mary River Expansion Study Stage 2
Location:	17 W 503790.94 7974895.17	
Completion Date:	September 25, 2017	Baffinland Iron Mines

BH17-EBC-2



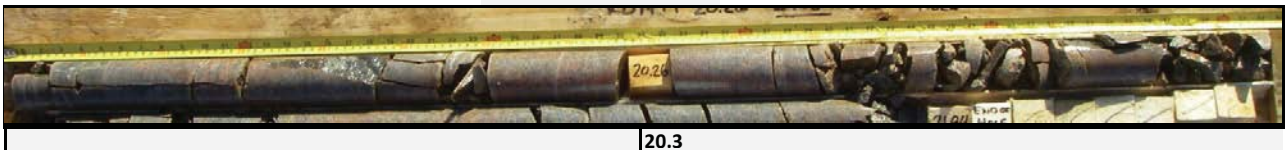
17.2

BH17-EBC-2



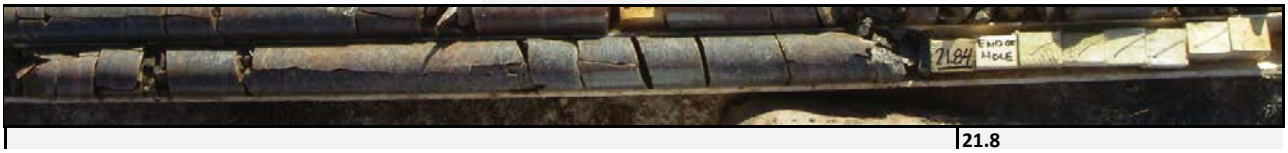
18.8

BH17-EBC-2



20.3

BH17-EBC-2

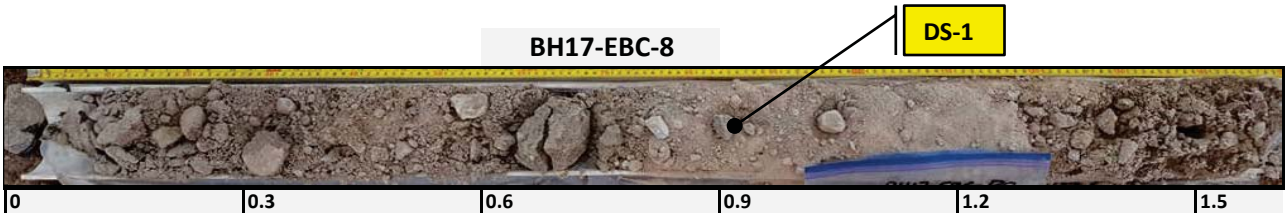


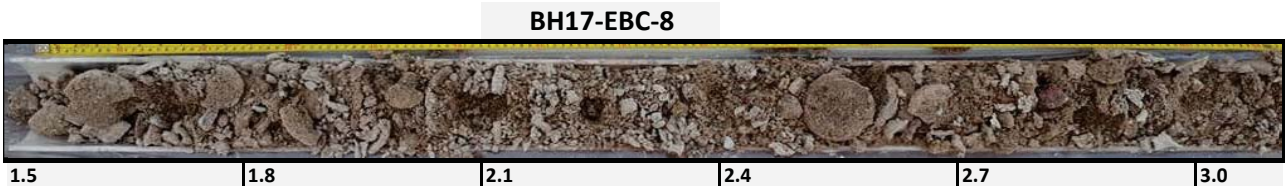
21.8

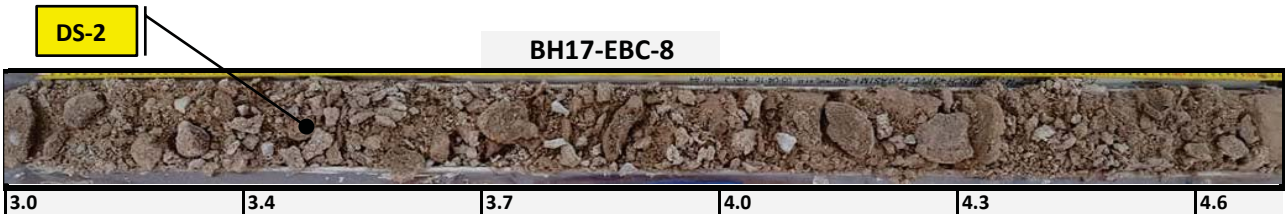
HATCH

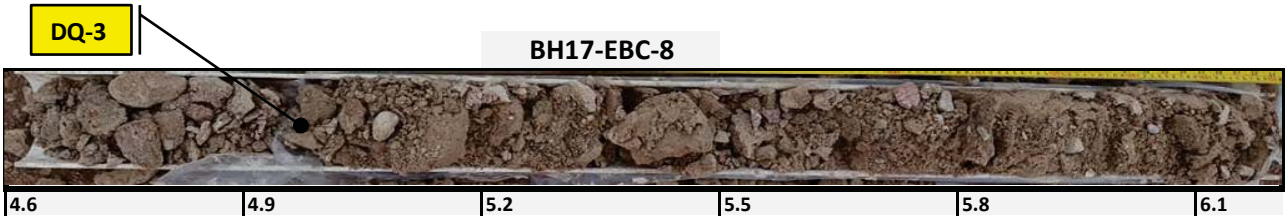
Sample Photographs

Borehole Name:	BH17-EBC-8	Mary River Expansion Study Stage 2
Location:	17 W 503534.503 7976327.453	2017 Geotechnical Investigation
Completion Date:	September 27, 2017	Baffinland Iron Mines

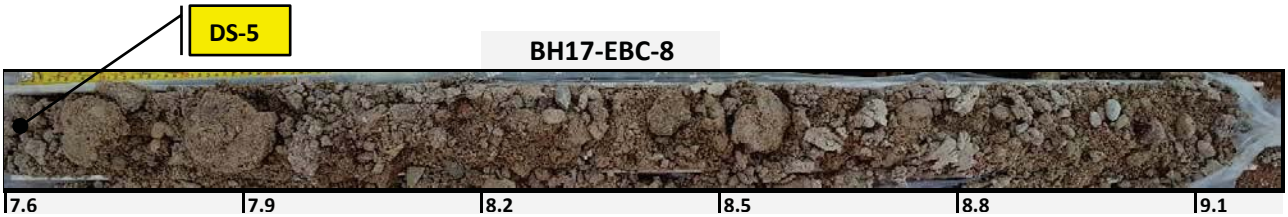












HATCH

Sample Photographs

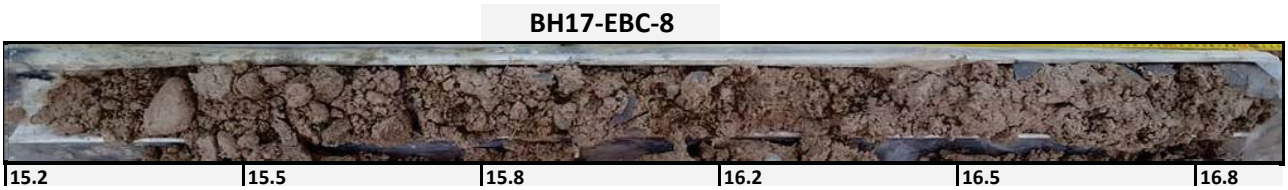
Borehole Name:	BH17-EBC-8	Mary River Expansion Study Stage 2
Location:	17 W 503534.503 7976327.453	
Completion Date:	September 27, 2017	Baffinland Iron Mines

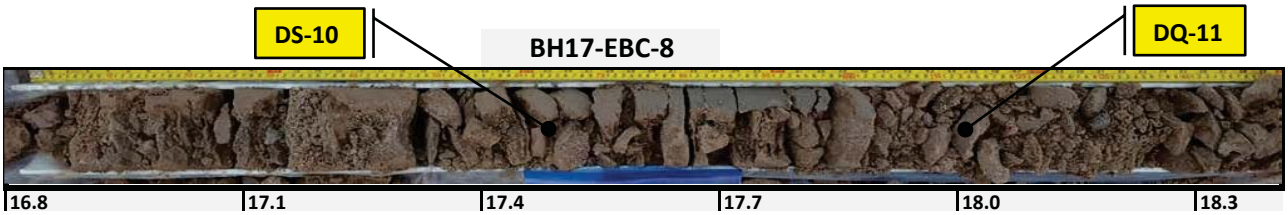








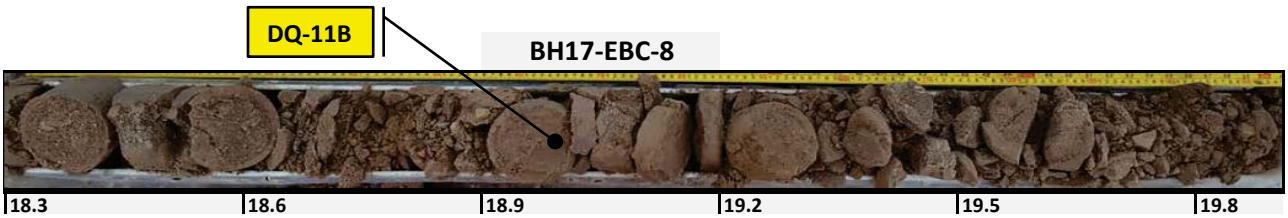


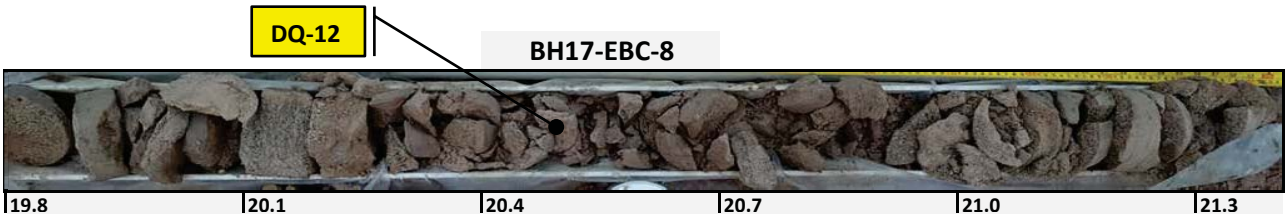


HATCH

Sample Photographs

Borehole Name:	BH17-EBC-8	Mary River Expansion Study Stage 2
Location:	17 W 503534.503 7976327.453	
Completion Date:	September 27, 2017	Baffinland Iron Mines













HATCH

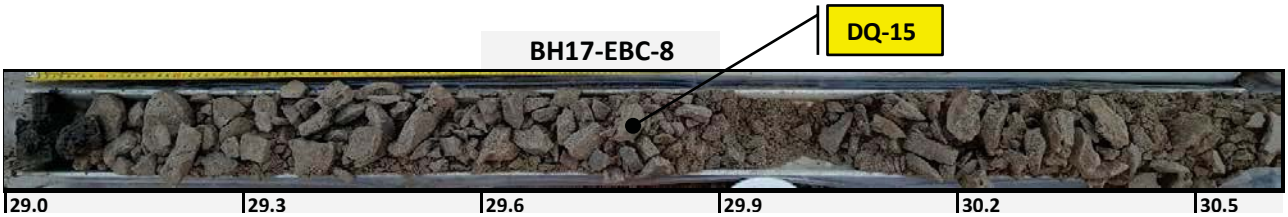
Sample Photographs

Borehole Name:	BH17-EBC-8	Mary River Expansion Study Stage 2
Location:	17 W 503534.503 7976327.453	
Completion Date:	September 27, 2017	Baffinland Iron Mines

BH17-EBC-8



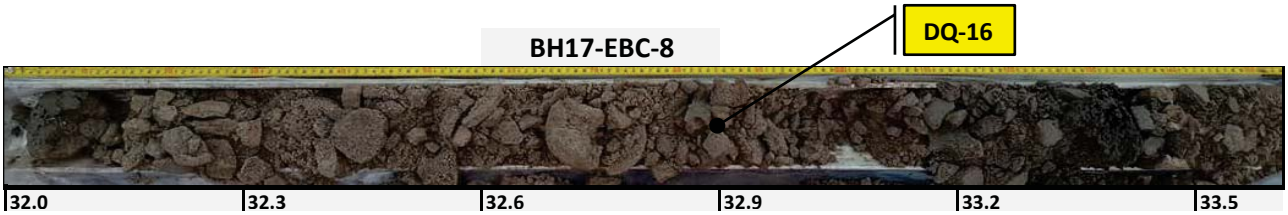
BH17-EBC-8



BH17-EBC-8



BH17-EBC-8



BH17-EBC-8

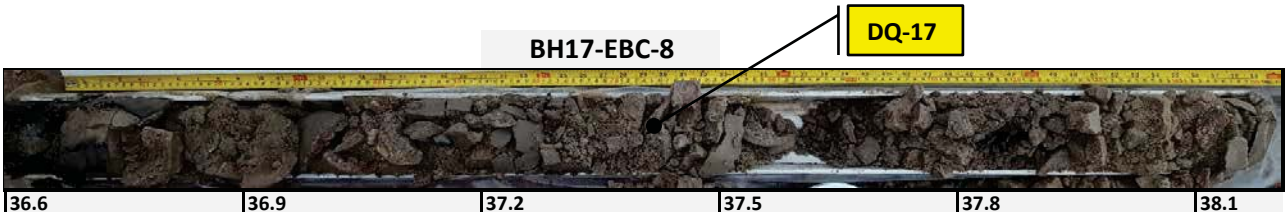


BH17-EBC-8



Sample Photographs

Borehole Name:	BH17-EBC-8	Mary River Expansion Study Stage 2
Location:	17 W 503534.503 7976327.453	
Completion Date:	September 27, 2017	Baffinland Iron Mines





HATCH

Sample Photographs

Borehole Name:	BH17-EBC-9	Mary River Expansion Study Stage 2
Location:	17 W 503548.47 7976371.396	2017 Geotechnical Investigation
Completion Date:	October 29, 2017	Baffinland Iron Mines

BH17-EBC-9



BH17-EBC-9



BH17-EBC-9



BH17-EBC-9



BH17-EBC-9



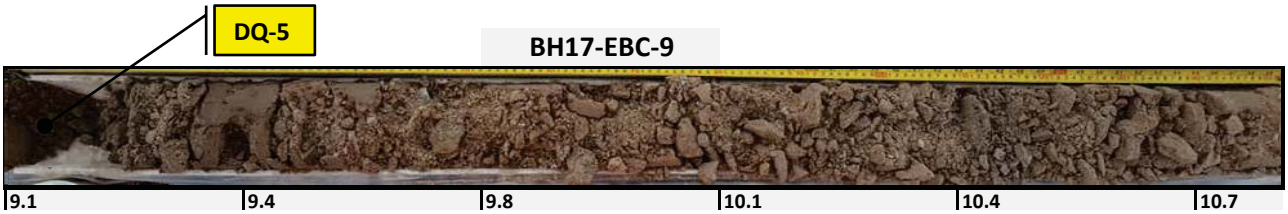
BH17-EBC-9

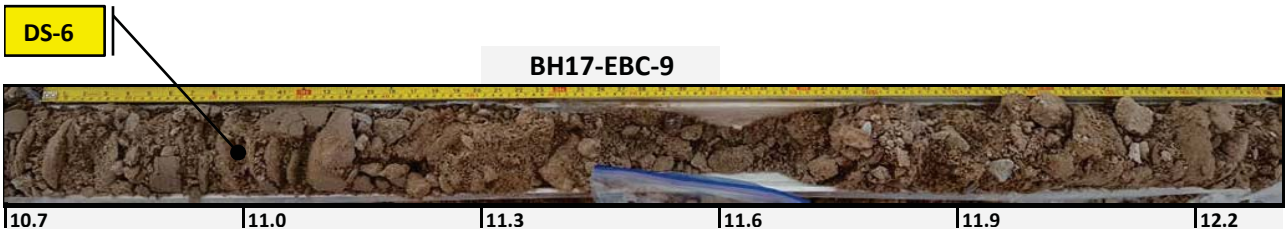


HATCH

Sample Photographs

Borehole Name:	BH17-EBC-9	Mary River Expansion Study Stage 2
Location:	17 W 503548.47 7976371.396	
Completion Date:	October 29, 2017	Baffinland Iron Mines













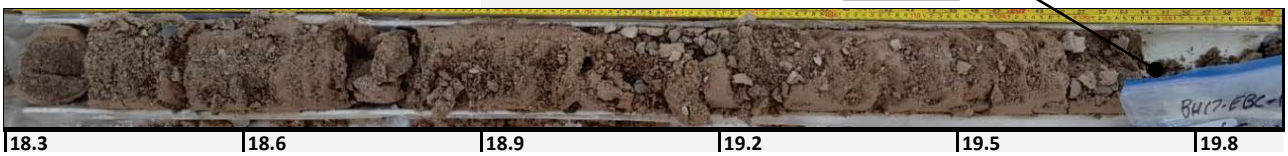
HATCH

Sample Photographs

Borehole Name:	BH17-EBC-9	Mary River Expansion Study Stage 2
Location:	17 W 503548.47 7976371.396	
Completion Date:	October 29, 2017	Baffinland Iron Mines

BH17-EBC-9

DS-11



18.3 | 18.6 | 18.9 | 19.2 | 19.5 | 19.8

BH17-EBC-9



19.8 | 20.1 | 20.4 | 20.7 | 21.0 | 21.3

BH17-EBC-9

DQ-12



21.3 | 21.6 | 21.9 | 22.3 | 22.6 | 22.9

BH17-EBC-9

DQ-13



22.9 | 23.2 | 23.5 | 23.8 | 24.1 | 24.4

BH17-EBC-9



24.4 | 24.7 | 25.0 | 25.3 | 25.6 | 25.9

BH17-EBC-9

DQ-14



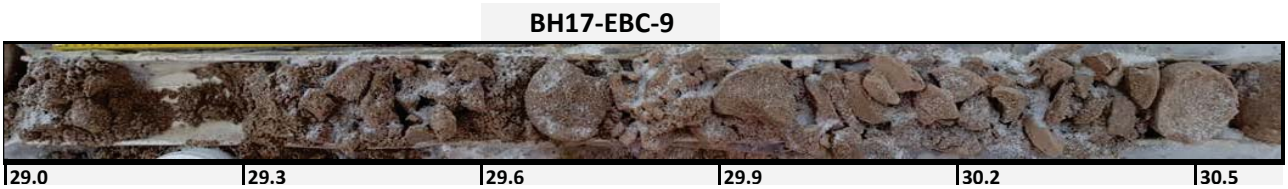
25.9 | 26.2 | 26.5 | 26.8 | 27.1 | 27.4

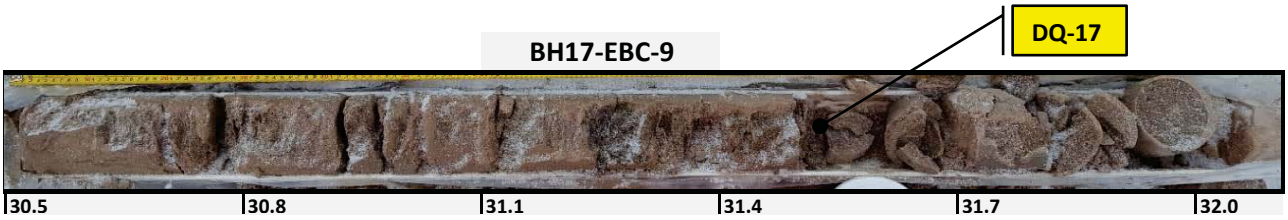
HATCH

Sample Photographs

Borehole Name:	BH17-EBC-9	Mary River Expansion Study Stage 2
Location:	17 W 503548.47 7976371.396	
Completion Date:	October 29, 2017	Baffinland Iron Mines













HATCH

Sample Photographs

Borehole Name:	BH17-EBC-9	Mary River Expansion Study Stage 2
Location:	17 W 503548.47 7976371.396	
Completion Date:	October 29, 2017	Baffinland Iron Mines

BH17-EBC-9



BH17-EBC-9



Sample Photographs

Borehole Name:	BH17-M008-R	Mary River Expansion Study Stage 2
Location:	17 W 503772 7974960	2017 Geotechnical Investigation
Completion Date:	September 18, 2017	Baffinland Iron Mines

BH17-M008-R



17.420 | 18.935

BH17-M008-R



18.935 | 20.430

BH17-M008-R



20.430

BH17-M008-R



21.990

HATCH

Sample Photographs

Borehole Name:	BH17-RD-1	Mary River Expansion Study Stage 2
Location:	17 W 504095 7976552	2017 Geotechnical Investigation
Completion Date:	October 31, 2017	Baffinland Iron Mines

BH17-RD-1



BH17-RD-1



BH17-RD-1



DS-1

BH17-RD-1



HATCH

Sample Photographs

Borehole Name:	BH17-RD-1A	Mary River Expansion Study Stage 2
Location:	17 W 504090 7976463	2017 Geotechnical Investigation
Completion Date:	October 31, 2017	Baffinland Iron Mines

BH17-RD-1A



0 | 0.3 | 0.6 | 0.9 | 1.2 | 1.5

BH17-RD-1A



1.5 | 1.8 | 2.1 | 2.4 | 2.7 | 3.0

BH17-RD-1A



3.0 | 3.4 | 3.7 | 4.0 | 4.3 | 4.6

HATCH

Sample Photographs

Borehole Name:	BH17-RD-1B	Mary River Expansion Study Stage 2
Location:	17 W 504100 7976358	2017 Geotechnical Investigation
Completion Date:	October 31, 2017	Baffinland Iron Mines

BH17-RD-1B



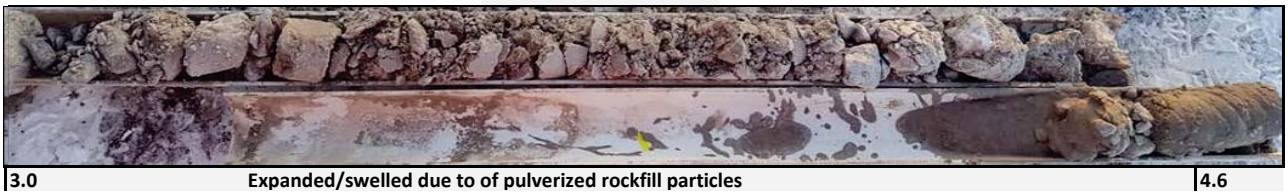
0	Expanded/swelled due to of pulverized rockfill particles	1.5

BH17-RD-1B



1.5	1.8	2.1	2.4	2.7	3.0

BH17-RD-1B

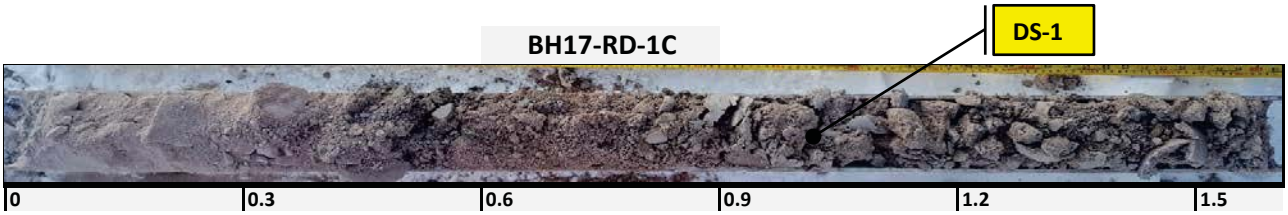


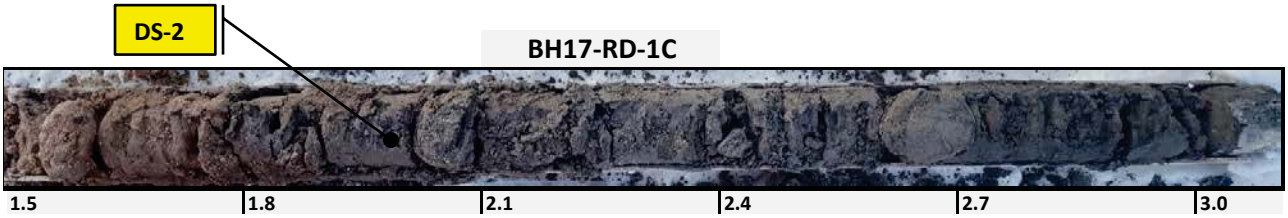
3.0	Expanded/swelled due to of pulverized rockfill particles	4.6

HATCH

Sample Photographs

Borehole Name:	BH17-RD-1C	Mary River Expansion Study Stage 2
Location:	17 W 504075 7976302	2017 Geotechnical Investigation
Completion Date:	October 31, 2017	Baffinland Iron Mines





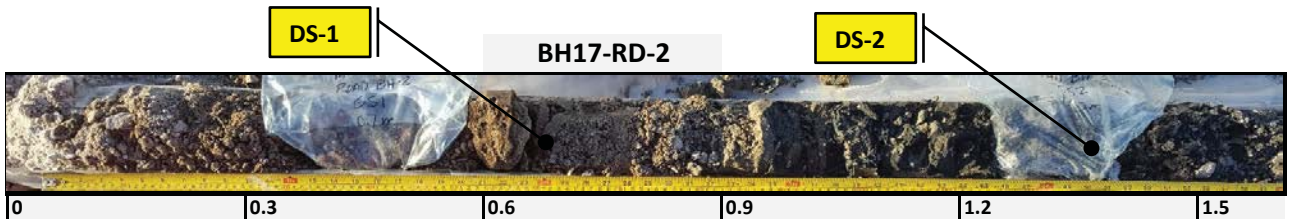




HATCH

Sample Photographs

Borehole Name:	BH17-RD-2	Mary River Expansion Study Stage 2
Location:	17 W 503872 7976162	2017 Geotechnical Investigation
Completion Date:	October 6, 2017	Baffinland Iron Mines







Sample Photographs

Borehole Name:	BH17-RD-3	Mary River Expansion Study Stage 2
Location:	17 W 503599 7975985	2017 Geotechnical Investigation
Completion Date:		Baffinland Iron Mines

BH17-RD-3



BH17-RD-3



DS-1

BH17-RD-3



Sample Photographs

Borehole Name:	BH17-RD-4	Mary River Expansion Study Stage 2
Location:	17 W 503594 7975136	2017 Geotechnical Investigation
Completion Date:	October 5, 2017	Baffinland Iron Mines

BH17-RD-4



0 | 0.3 | 0.6 | 0.9 | 1.2 | 1.5

DQ-1

BH17-RD-4



1.5 | 1.8 | 2.1 | 2.4 | 2.7 | 3.0

BH17-RD-4



3.0 | 3.4 | 3.7 | 4.0 | 4.3 | 4.6

HATCH

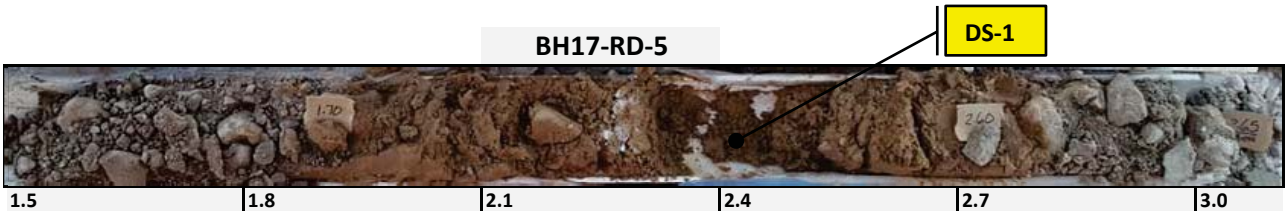
Sample Photographs

Borehole Name:	BH17-RD-5	Mary River Expansion Study Stage 2
Location:	17 W 503596 7974811	2017 Geotechnical Investigation
Completion Date:	October 5, 2017	Baffinland Iron Mines

BH17-RD-5



BH17-RD-5



HATCH

Sample Photographs

Borehole Name:	BH17-RD-6	Mary River Expansion Study Stage 2
Location:	17 W 503922 7974286	2017 Geotechnical Investigation
Completion Date:	October 5, 2017	Baffinland Iron Mines

BH17-RD-6



BH17-RD-6



BH17-RD-6



BH17-RD-6

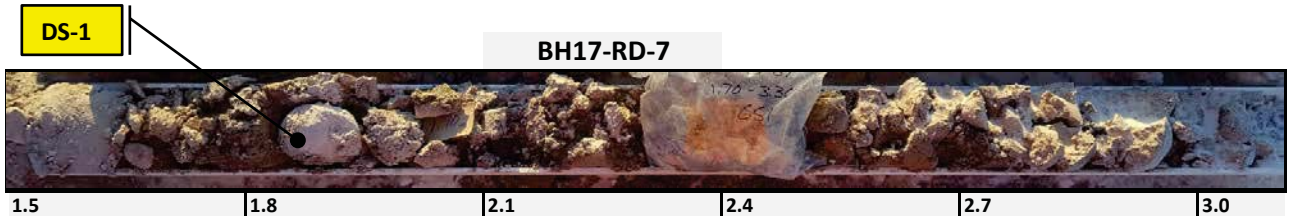


HATCH

Sample Photographs

Borehole Name:	BH17-RD-7	Mary River Expansion Study Stage 2
Location:	17 W 503896 7974423	2017 Geotechnical Investigation
Completion Date:	October 5, 2017	Baffinland Iron Mines



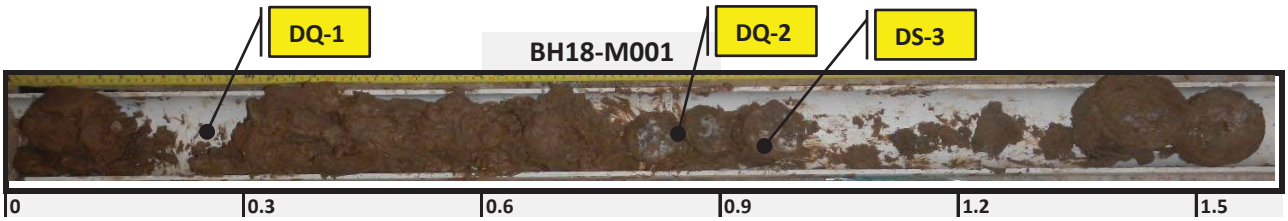




HATCH

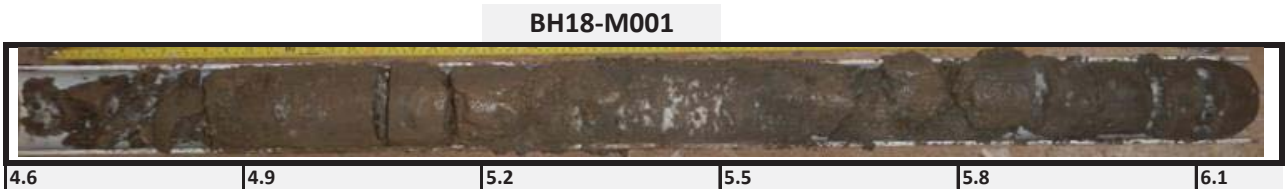
Sample Photographs

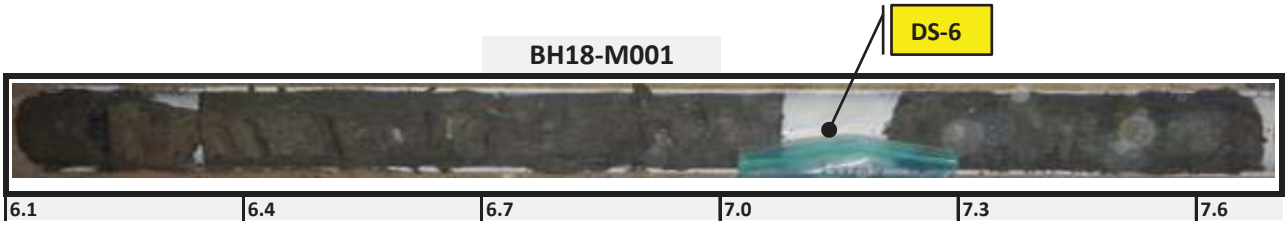
Borehole Name:	BH18-M001	Mary River Expansion Study Stage 2
Location:	17 W 503423 7974892	2018 Geotechnical Investigation
Completion Date:	March 5, 2018	Baffinland Iron Mines













HATCH

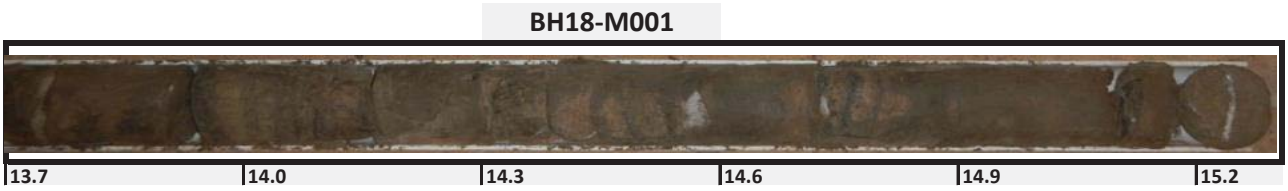
Sample Photographs

Borehole Name:	BH18-M001	Mary River Expansion Study Stage 2
Location:	17 W 503423 7974892	
Completion Date:	March 5, 2018	Baffinland Iron Mines

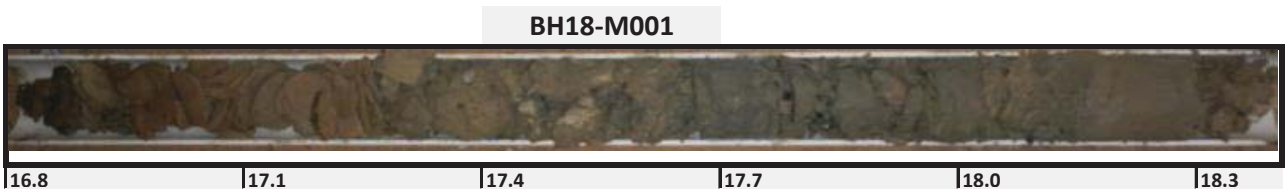








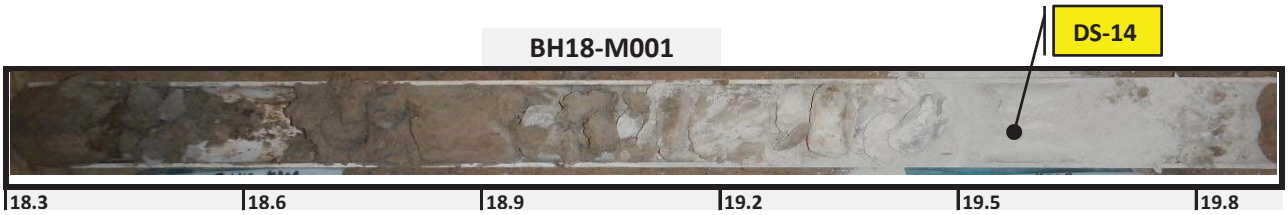


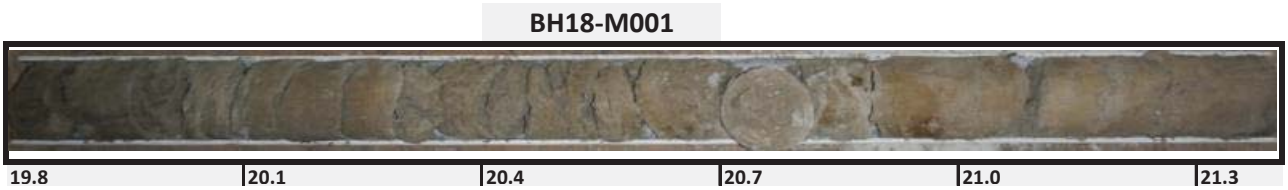


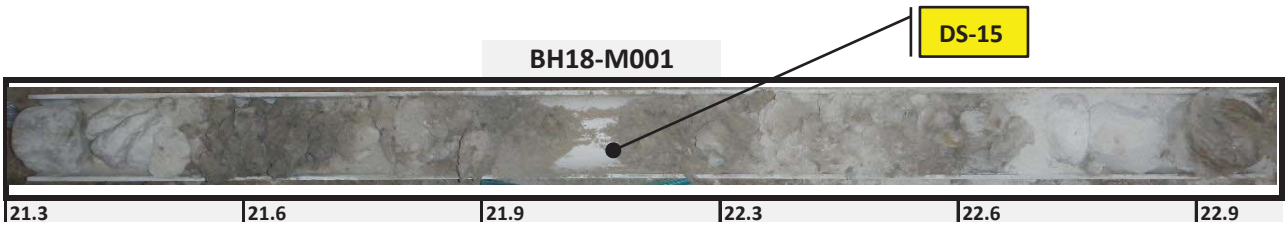
HATCH

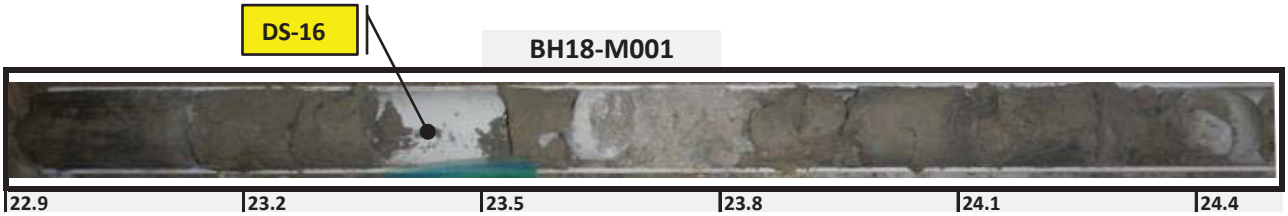
Sample Photographs

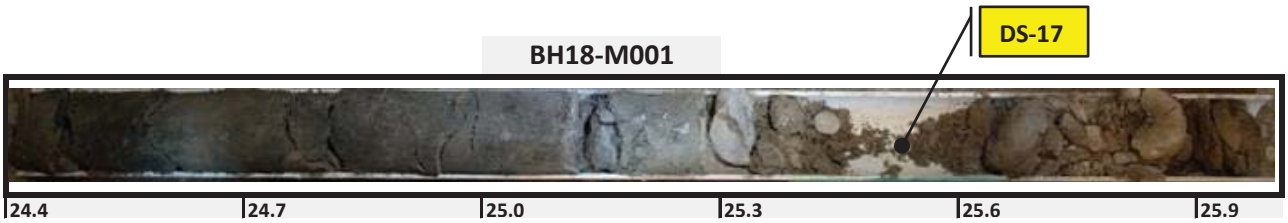
Borehole Name:	BH18-M001	Mary River Expansion Study Stage 2
Location:	17 W 503423 7974892	
Completion Date:	March 5, 2018	Baffinland Iron Mines









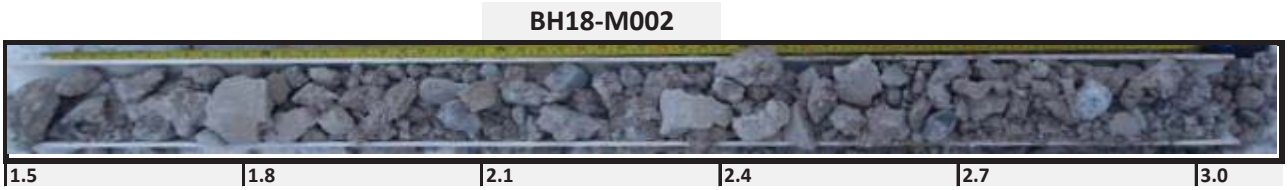


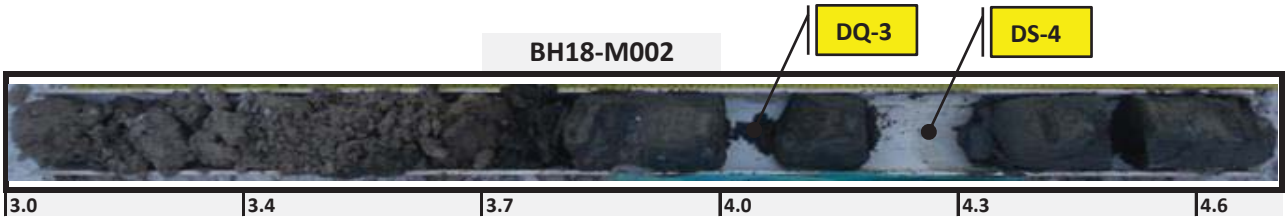
HATCH

Sample Photographs

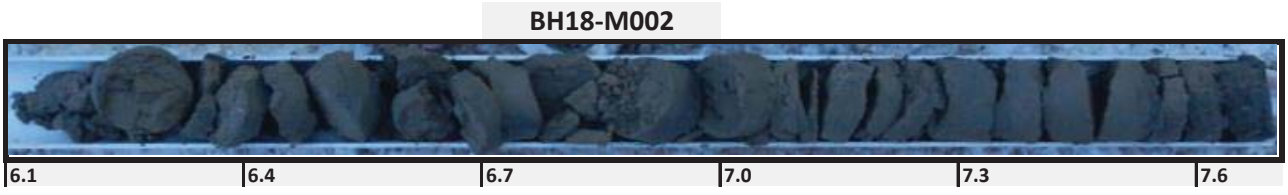
Borehole Name:	BH18-M002	Mary River Expansion Study Stage 2
Location:	17 W 503328 7974867	2018 Geotechnical Investigation
Completion Date:	March 5, 2018	Baffinland Iron Mines













HATCH

Sample Photographs

Borehole Name:	BH18-M002	Mary River Expansion Study Stage 2
Location:	17 W 503328 7974867	
Completion Date:	March 5, 2018	Baffinland Iron Mines

BH18-M002



9.1 | 9.4 | 9.8 | 10.1 | 10.4 | 10.7

BH18-M002



10.7 | 11.0 | 11.3 | 11.6 | 11.9 | 12.2

BH18-M002



12.2 | 12.5 | 12.8 | 13.1 | 13.4 | 13.7

BH18-M002



13.7 | 14.0 | 14.3 | 14.6 | 14.9 | 15.2

BH18-M002



15.2 | 15.5 | 15.8 | 16.2 | 16.5 | 16.8

BH18-M002



16.8 | 17.1 | 17.4 | 17.7 | 18.0 | 18.3

HATCH

Sample Photographs

Borehole Name:	BH18-M002	Mary River Expansion Study Stage 2
Location:	17 W 503328 7974867	
Completion Date:	March 5, 2018	Baffinland Iron Mines

BH18-M002



18.3 | 18.6 | 18.9 | 19.2 | 19.5 | 19.8

BH18-M002



19.8 | 20.1 | 20.4 | 20.7 | 21.0 | 21.3

DS-13 DQ-14

BH18-M002



21.3 | 21.6 | 21.9 | 22.3 | 22.6 | 22.9

BH18-M002



22.9 | 23.2 | 23.5 | 23.8 | 24.1 | 24.4

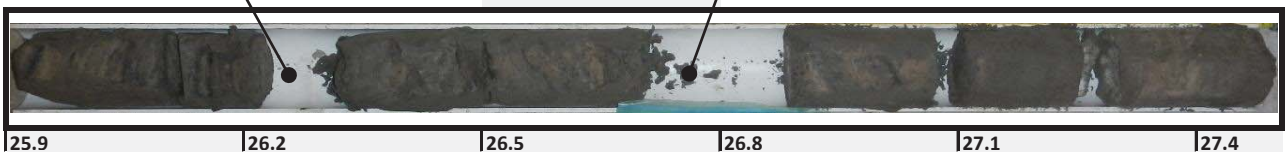
BH18-M002



24.4 | 24.7 | 25.0 | 25.3 | 25.6 | 25.9

DQ-15 DS-16

BH18-M002



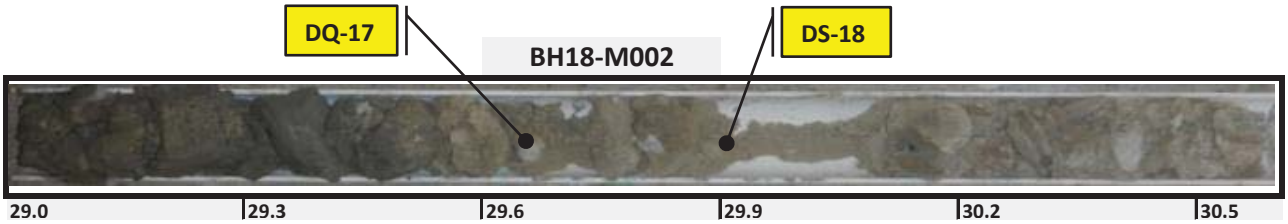
25.9 | 26.2 | 26.5 | 26.8 | 27.1 | 27.4

HATCH

Sample Photographs

Borehole Name:	BH18-M002	Mary River Expansion Study Stage 2
Location:	17 W 503328 7974867	
Completion Date:	March 5, 2018	Baffinland Iron Mines













Sample Photographs

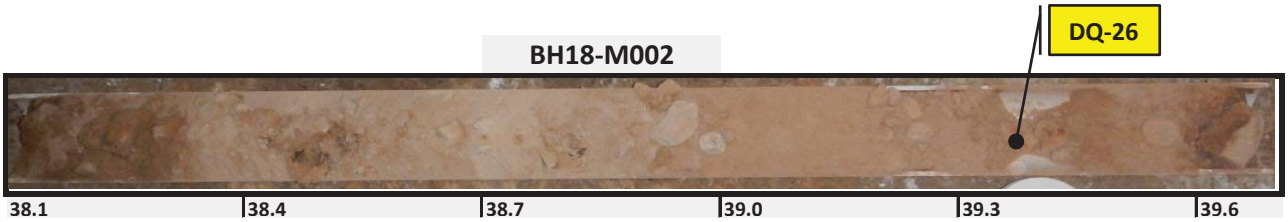
Borehole Name:	BH18-M002	Mary River Expansion Study Stage 2
Location:	17 W 503328 7974867	
Completion Date:	March 5, 2018	Baffinland Iron Mines

BH18-M002



36.6 | 36.9 | 37.2 | 37.5 | 37.8 | 38.1

BH18-M002

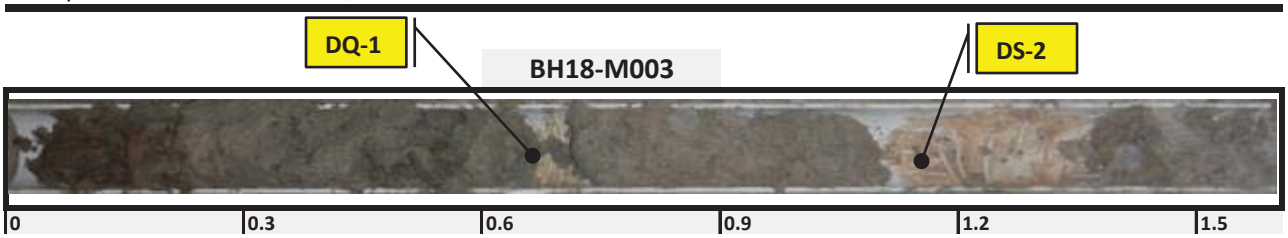


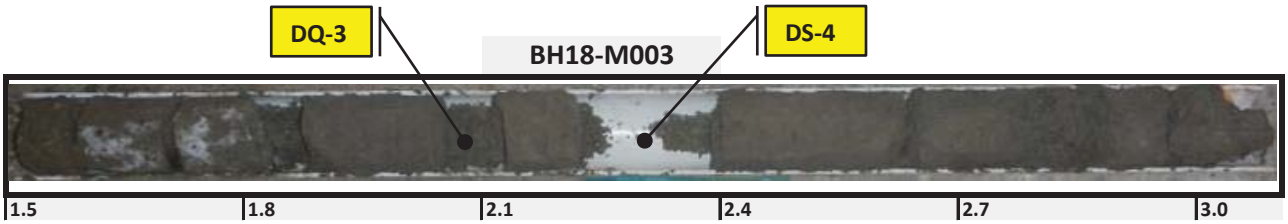
38.1 | 38.4 | 38.7 | 39.0 | 39.3 | 39.6

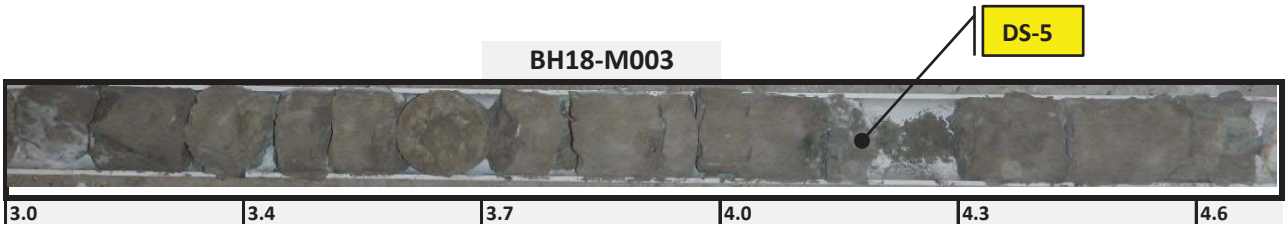
HATCH

Sample Photographs

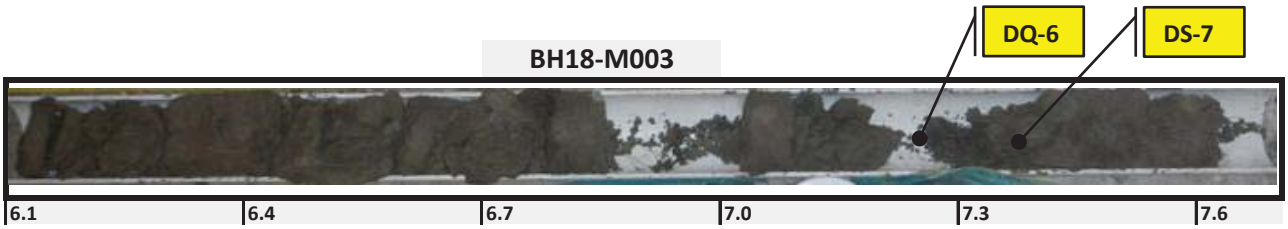
Borehole Name:	BH18-M003	Mary River Expansion Study Stage 2
Location:	17 W 503055 7974868	2018 Geotechnical Investigation
Completion Date:	March 6, 2018	Baffinland Iron Mines













HATCH

Sample Photographs

Borehole Name:	BH18-M003	Mary River Expansion Study Stage 2
Location:	17 W 503055 7974868	
Completion Date:	March 6, 2018	Baffinland Iron Mines

BH18-M003



9.1 | 9.4 | 9.8 | 10.1 | 10.4 | 10.7

BH18-M003



10.7 | 11.0 | 11.3 | 11.6 | 11.9 | 12.2

BH18-M003



12.2 | 12.5 | 12.8 | 13.1 | 13.4 | 13.7

BH18-M003



13.7 | 14.0 | 14.3 | 14.6 | 14.9 | 15.2

BH18-M003



15.2 | 15.5 | 15.8 | 16.2 | 16.5 | 16.8

BH18-M003

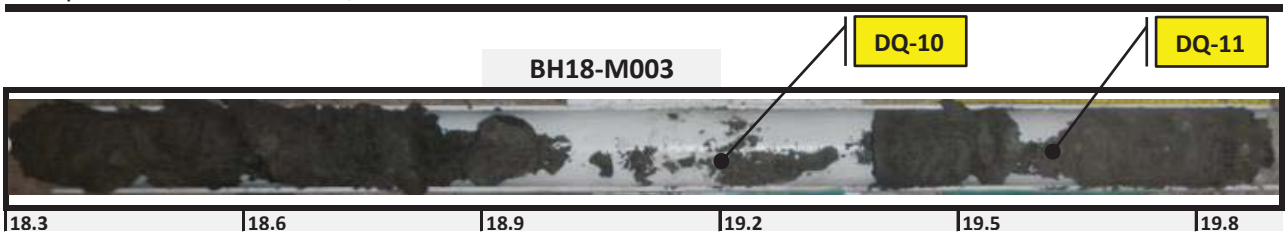


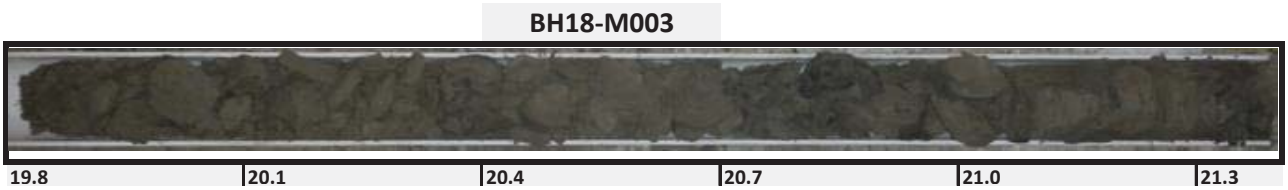
16.8 | 17.1 | 17.4 | 17.7 | 18.0 | 18.3

HATCH

Sample Photographs

Borehole Name:	BH18-M003	Mary River Expansion Study Stage 2
Location:	17 W 503055 7974868	
Completion Date:	March 6, 2018	Baffinland Iron Mines

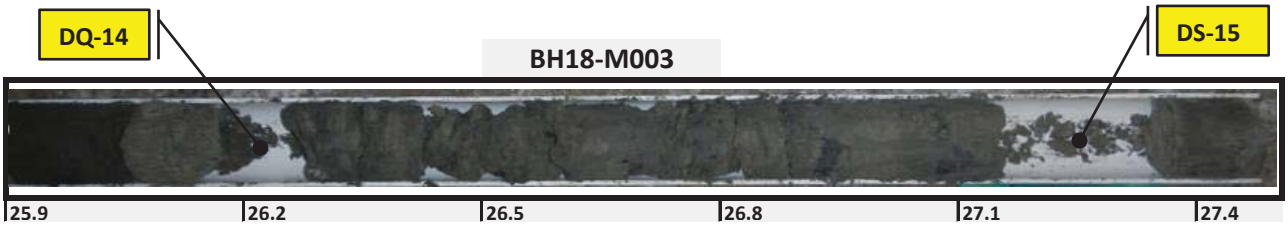












HATCH

Sample Photographs

Borehole Name:	BH18-M003	Mary River Expansion Study Stage 2
Location:	17 W 503055 7974868	
Completion Date:	March 6, 2018	Baffinland Iron Mines













HATCH

Sample Photographs

Borehole Name:	BH18-M003	Mary River Expansion Study Stage 2
Location:	17 W 503055 7974868	
Completion Date:	March 6, 2018	Baffinland Iron Mines

BH18-M003



36.6 | 36.9 | 37.2 | 37.5 | 37.8 | 38.1

DS-20

BH18-M003



38.1 | 38.4 | 38.7 | 39.0 | 39.3 | 39.6

BH18-M003



39.6 | 39.9 | 40.2 | 40.5 | 40.8 | 41.1

BH18-M003



41.1 | 41.5 | 41.8 | 42.1 | 42.4 | 42.7

DQ-23

DQ-22

BH18-M003



42.7 | 43.0 | 43.3 | 43.6 | 43.9 | 44.2

BH18-M003



44.2 | 44.5 | 44.8 | 45.1 | 45.4 | 45.7

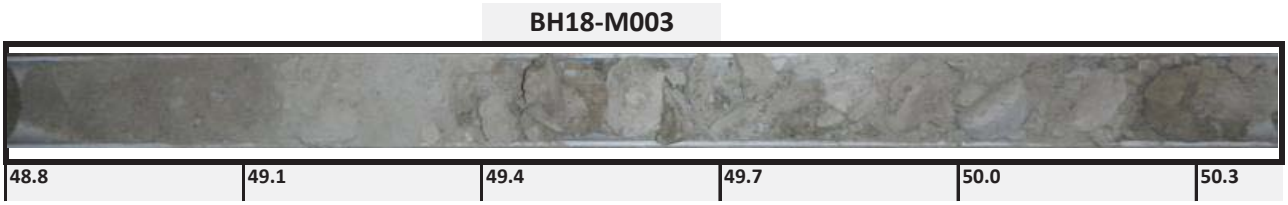
HATCH

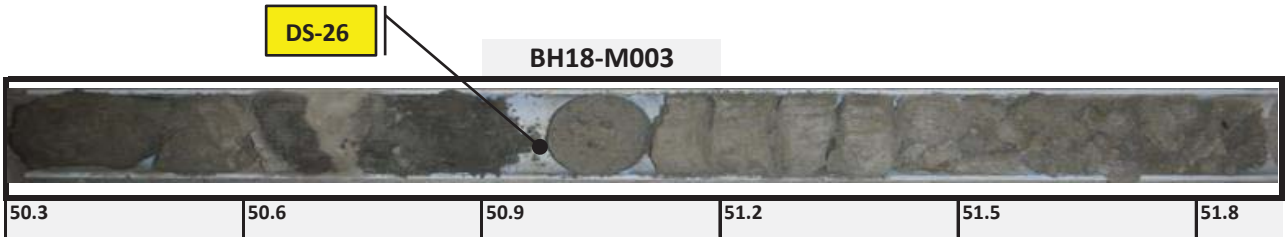
Sample Photographs

Borehole Name:	BH18-M003	Mary River Expansion Study Stage 2
Location:	17 W 503055 7974868	
Completion Date:	March 6, 2018	Baffinland Iron Mines









HATCH

Sample Photographs

Borehole Name:	BH18-004
Location:	17 W 563499 7976260
Completion Date:	April 1, 2018

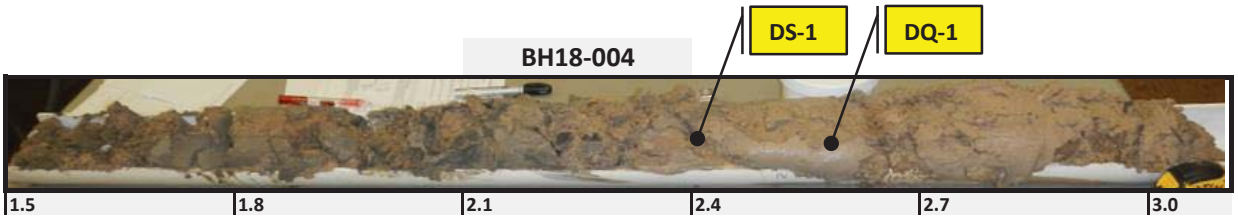
Mary River Expansion Study Stage 2
2018 Geotechnical Investigation
Baffinland Iron Mines

BH18-004



0 | 0.3 | 0.6 | 0.9 | 1.2 | 1.5

BH18-004



1.5 | 1.8 | 2.1 | 2.4 | 2.7 | 3.0

BH18-004



3.0 | 3.4 | 3.7 | 4.0 | 4.3 | 4.6

BH18-004



4.6 | 4.9 | 5.2 | 5.5 | 5.8 | 6.1

BH18-004



6.1 | 6.4 | 6.7 | 7.0 | 7.3 | 7.6

BH18-004



7.6 | 7.9 | 8.2 | 8.5 | 8.8 | 9.1

HATCH

Sample Photographs

Borehole Name:	BH18-004	Mary River Expansion Study Stage 2
Location:	17 W 563499 7976260	
Completion Date:	April 1, 2018	Baffinland Iron Mines

BH18-004

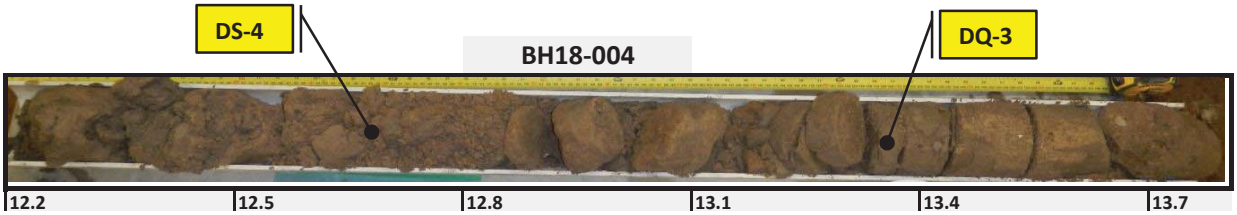


9.1 | 9.4 | 9.8 | 10.1 | 10.4 | 10.7

BH18-004



10.7 | 11.0 | 11.3 | 11.6 | 11.9 | 12.2



12.2 | 12.5 | 12.8 | 13.1 | 13.4 | 13.7

BH18-004

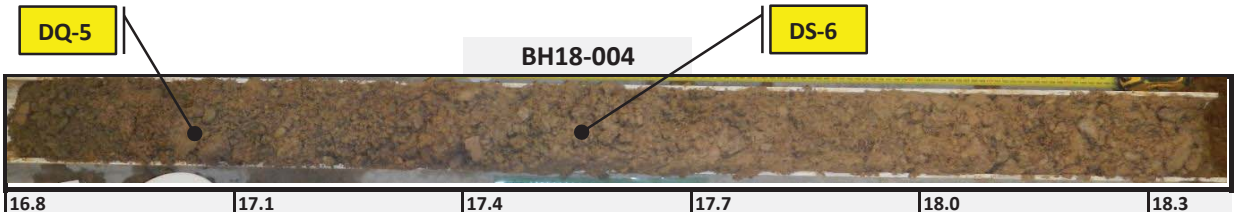


13.7 | 14.0 | 14.3 | 14.6 | 14.9 | 15.2

BH18-004



15.2 | 15.5 | 15.8 | 16.2 | 16.5 | 16.8

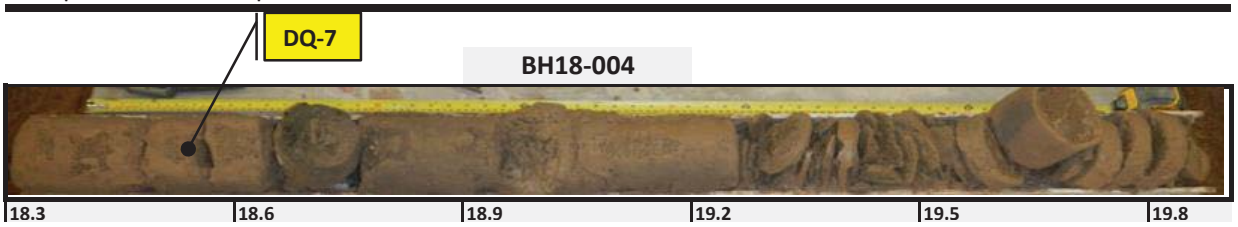


16.8 | 17.1 | 17.4 | 17.7 | 18.0 | 18.3

HATCH

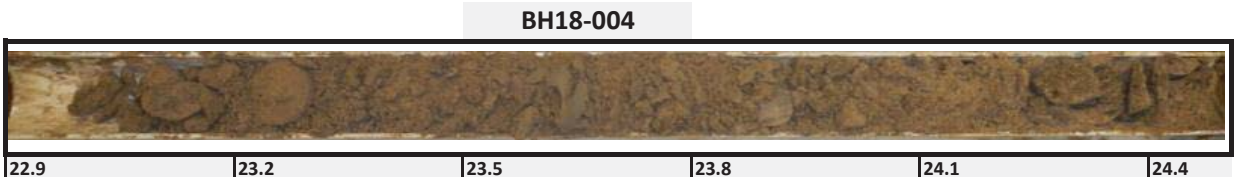
Sample Photographs

Borehole Name:	BH18-004	Mary River Expansion Study Stage 2
Location:	17 W 563499 7976260	
Completion Date:	April 1, 2018	Baffinland Iron Mines

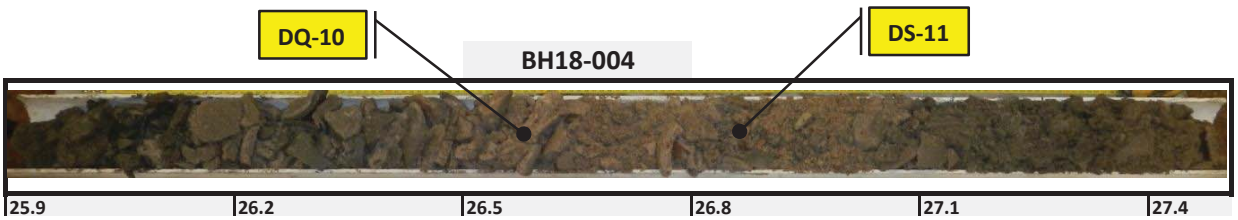












HATCH

Sample Photographs

Borehole Name:	BH18-004	Mary River Expansion Study Stage 2
Location:	17 W 563499 7976260	
Completion Date:	April 1, 2018	Baffinland Iron Mines

BH18-004



27.4 | 27.7 | 28.0 | 28.3 | 28.7 | 29.0

BH18-004



29.0 | 29.3 | 29.6 | 29.9 | 30.2 | 30.5

DQ-12

BH18-004



30.5 | 30.8 | 31.1 | 31.4 | 31.7 | 32.0

BH18-004



32.0 | 32.3 | 32.6 | 32.9 | 33.2 | 33.5

BH18-004



33.5 | 33.8 | 34.1 | 34.4 | 34.7 | 35.1

DQ-13

BH18-004



35.1 | 35.4 | 35.7 | 36.0 | 36.3 | 36.6

HATCH

Sample Photographs

Borehole Name:	BH18-004	Mary River Expansion Study Stage 2
Location:	17 W 563499 7976260	
Completion Date:	April 1, 2018	Baffinland Iron Mines

BH18-004



36.6 | 36.9 | 37.2 | 37.5 | 37.8 | 38.1

BH18-004



38.1 | 38.4 | 38.7 | 39.0 | 39.3 | 39.6

DS-14

BH18-004



39.6 | 39.9 | 40.2 | 40.5 | 40.8 | 41.1

DQ-15

BH18-004



41.1 | 41.5 | 41.8 | 42.1 | 42.4 | 42.7

DS-17

BH18-004



42.7 | 43.0 | 43.3 | 43.6 | 43.9 | 44.2

BH18-004



44.2 | 44.5 | 44.8 | 45.1 | 45.4 | 45.7

HATCH

Sample Photographs

Borehole Name:	BH18-004	Mary River Expansion Study Stage 2
Location:	17 W 563499 7976260	
Completion Date:	April 1, 2018	Baffinland Iron Mines

BH18-004



45.7	46.0	46.3	46.6	46.9	47.2

BH18-004



47.2	47.5	47.9	48.2	48.5	48.8

BH18-004



48.8	49.1	49.4	49.7	50.0	50.3

BH18-004



50.3	50.6	50.9	51.2	51.5	51.8

BH18-004



51.8	52.1	52.4	52.7	53.0	53.3

BH18-004



53.3	53.6	53.9	54.3	54.6	54.9

HATCH

Sample Photographs

Borehole Name:	BH18-004	Mary River Expansion Study Stage 2
Location:	17 W 563499 7976260	
Completion Date:	April 1, 2018	Baffinland Iron Mines

DQ-20

BH18-004



54.9	55.2	55.5	55.8	56.1	56.4

BH18-004



56.4	56.7	57.0	57.3	57.6	57.9

BH18-004

Run not recovered

57.9	58.2	58.5	58.8	59.1	59.4

BH18-004



59.4	59.7	60.0	60.4	60.7	61.0

DQ-23

DS-24

BH18-004



61.0	61.3	61.6	61.9	62.2	62.5

DQ-25

DS-26

BH18-004



62.5	62.8	63.1	63.4	63.7	64.0

HATCH

Sample Photographs

Borehole Name:	BH18-004	Mary River Expansion Study Stage 2
Location:	17 W 563499 7976260	
Completion Date:	April 1, 2018	Baffinland Iron Mines

DQ-27

BH18-004



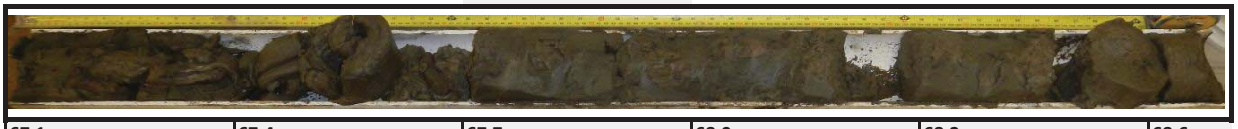
64.0	64.3	64.6	64.9	65.2	65.5

BH18-004



65.5	65.8	66.1	66.4	66.8	67.1

BH18-004



67.1	67.4	67.7	68.0	68.3	68.6

DQ-28

BH18-004



68.6	68.9	69.2	69.5	69.8	70.1

DS-29

BH18-004



70.1	70.4	70.7	71.0	71.3	71.6

DS-30

BH18-004



71.6	71.9	72.2	72.5	72.8	73.2

Sample Photographs

Borehole Name:	BH18-004	Mary River Expansion Study Stage 2
Location:	17 W 563499 7976260	
Completion Date:	April 1, 2018	Baffinland Iron Mines

BH18-004



73.2	73.5	73.8	74.1	74.4	74.7

BH18-004



74.7	75.0	75.3	75.6	75.9	76.2

BH18-004

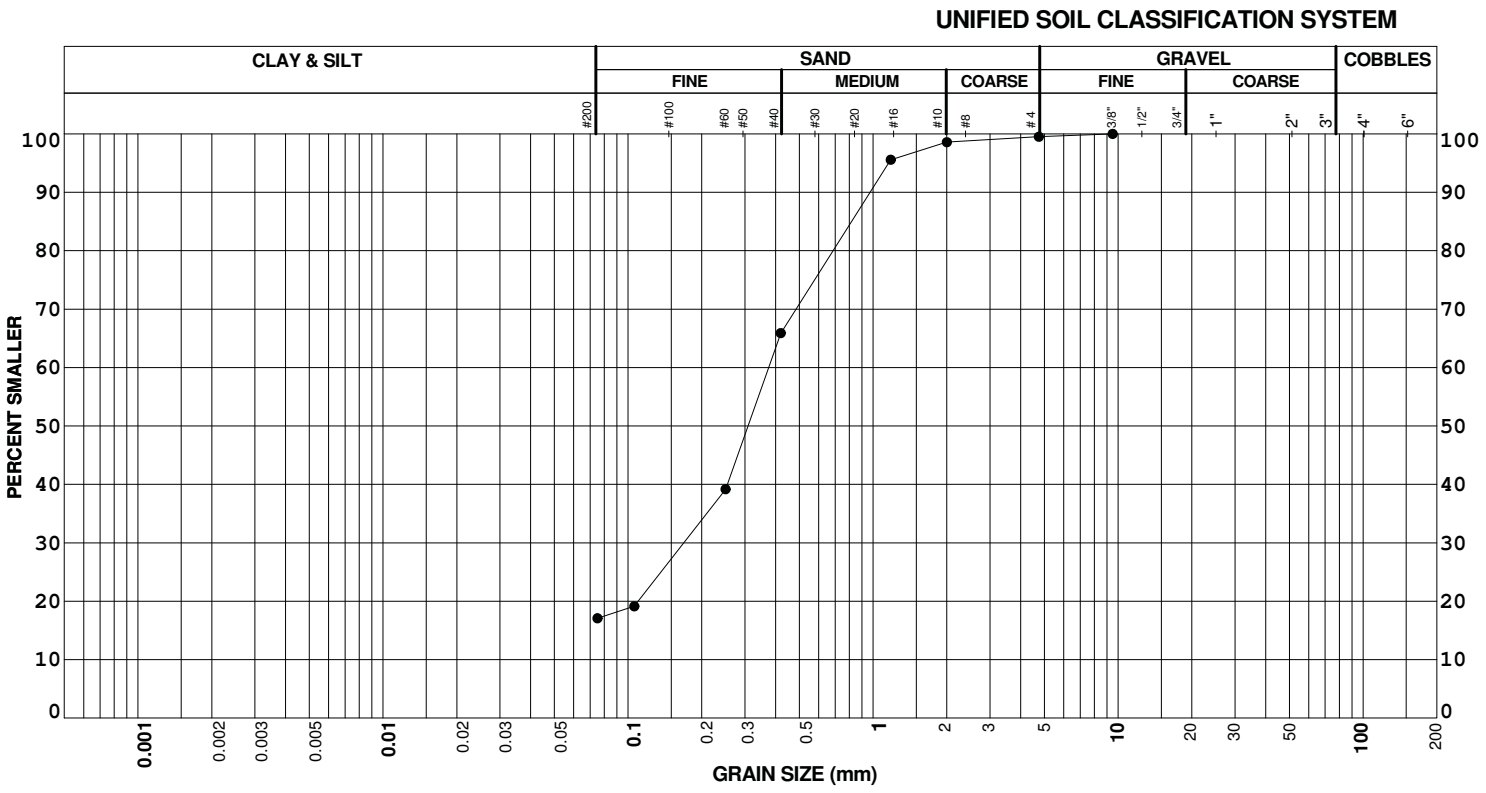


76.2	76.5	76.8	77.1	77.4	77.7

Appendix D

Laboratory Test Reports

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M001	BS4	5.90	0	82	17		

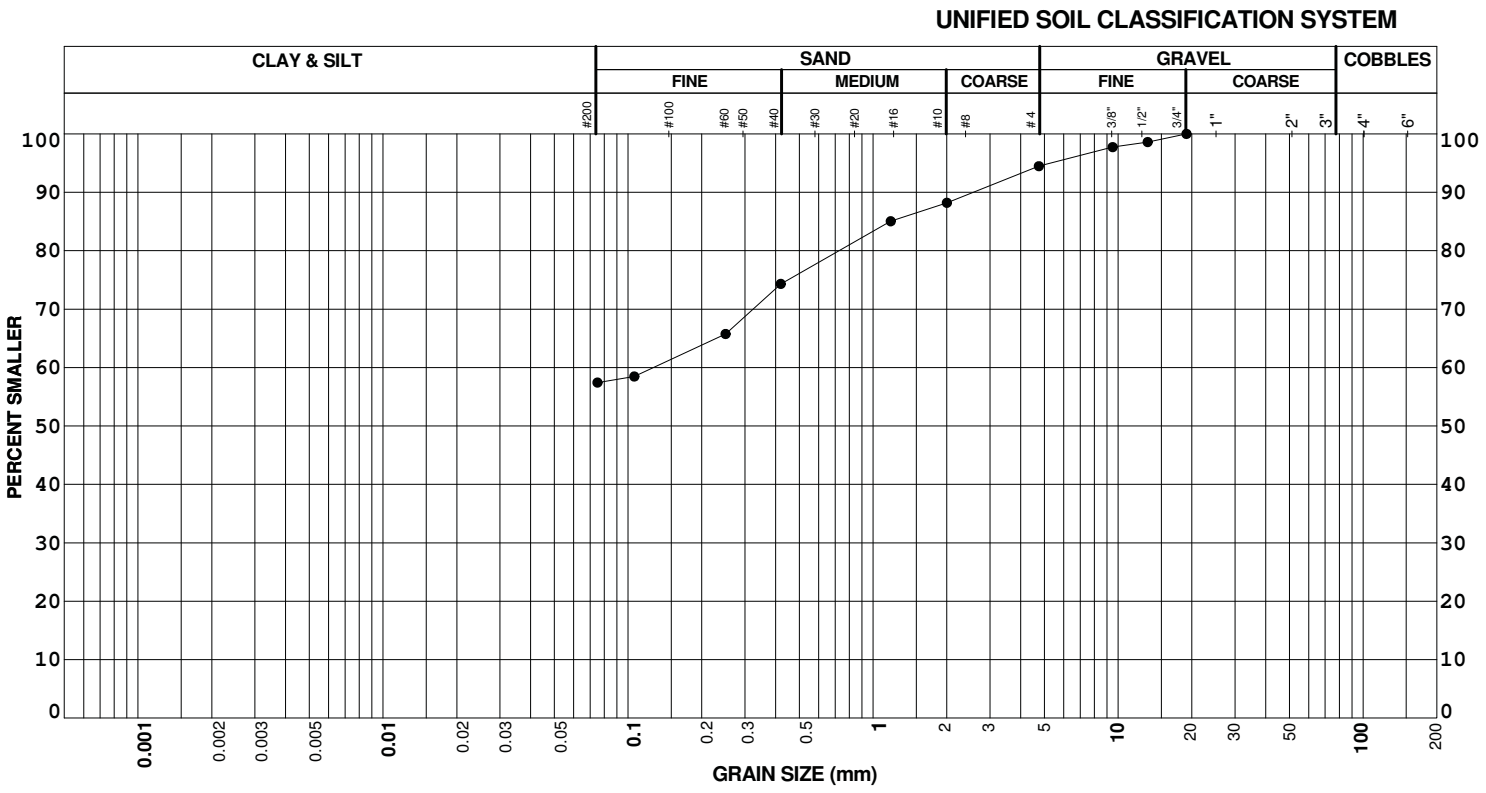
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M002	BS2	2.70	6	37	57		

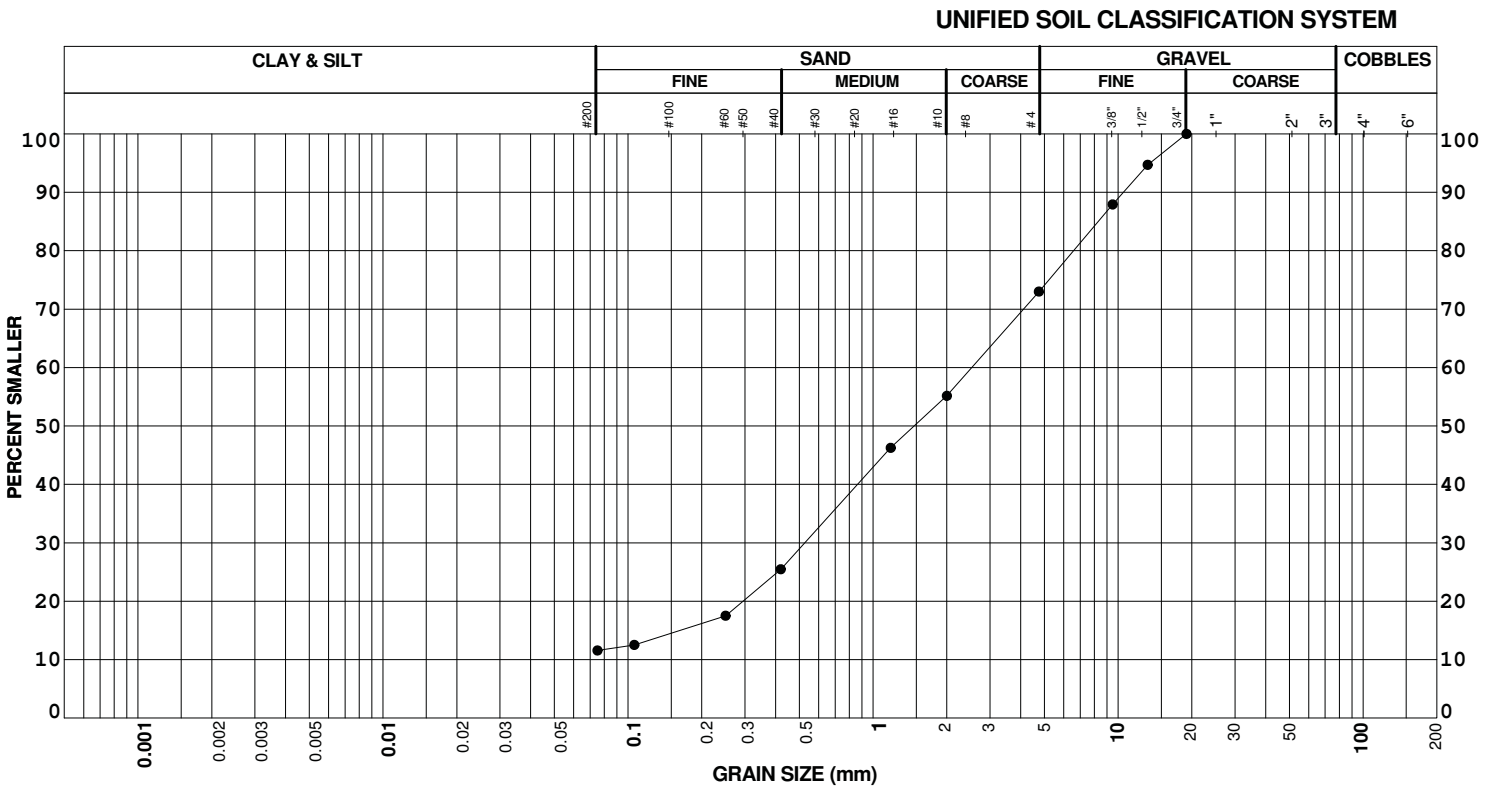
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M002	BS3	4.00	27	61	12		

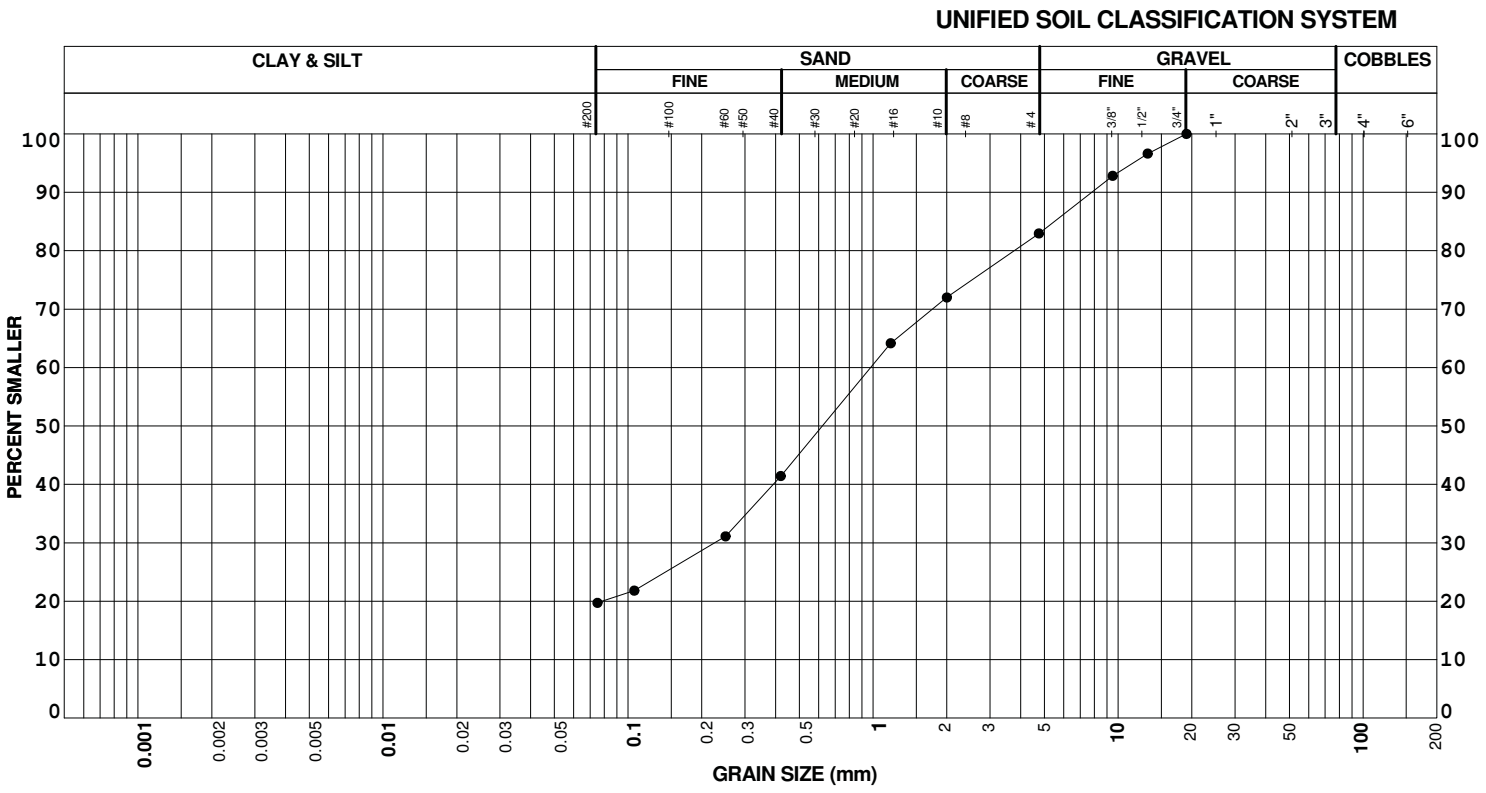
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M003	BS1	1.20	17	63	20		

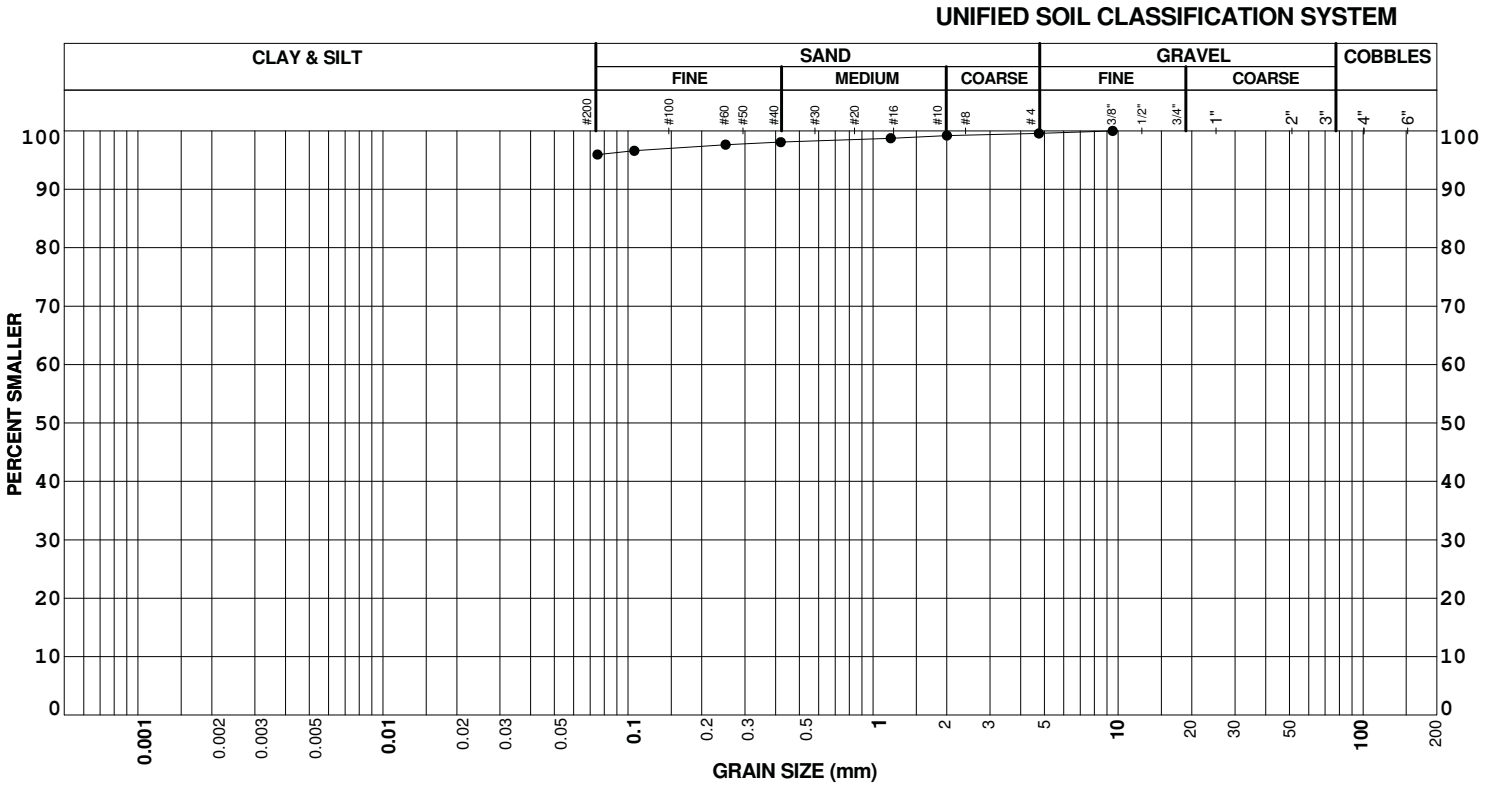
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M003	BS2	2.70	0	4	96		

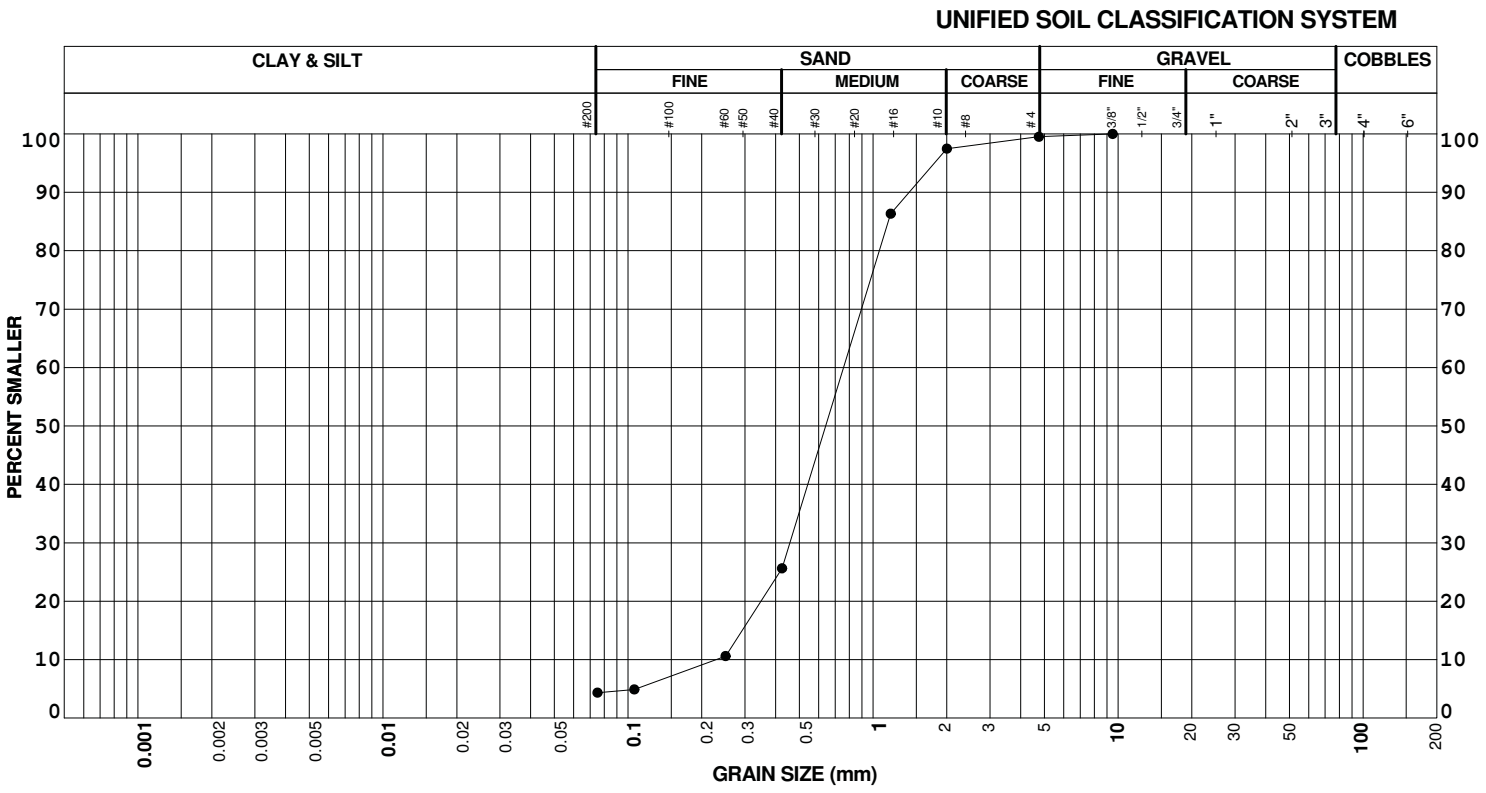
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M004	BS2	2.70	0	95	4		

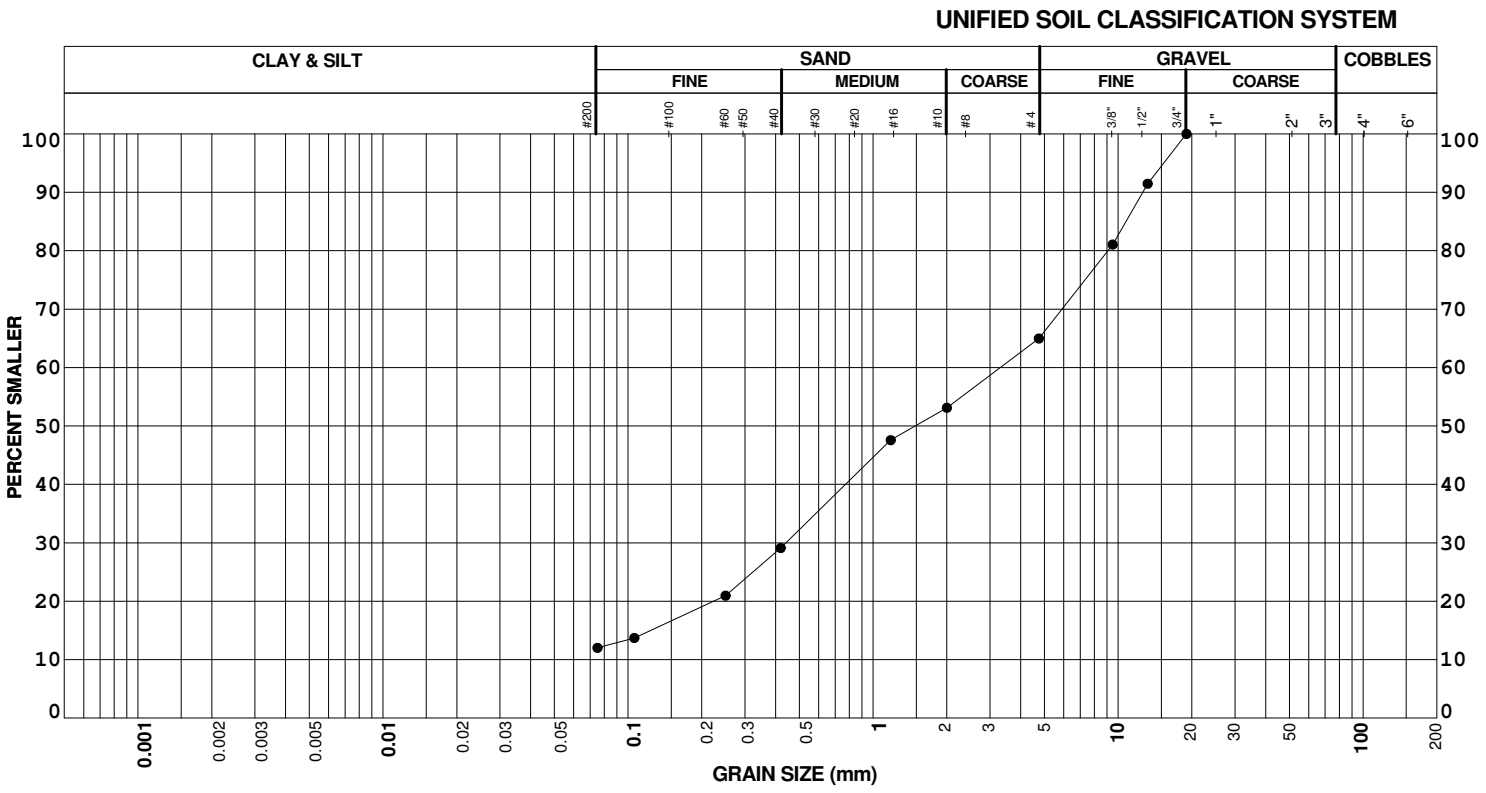
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M005	BS2	2.70	35	53	12		

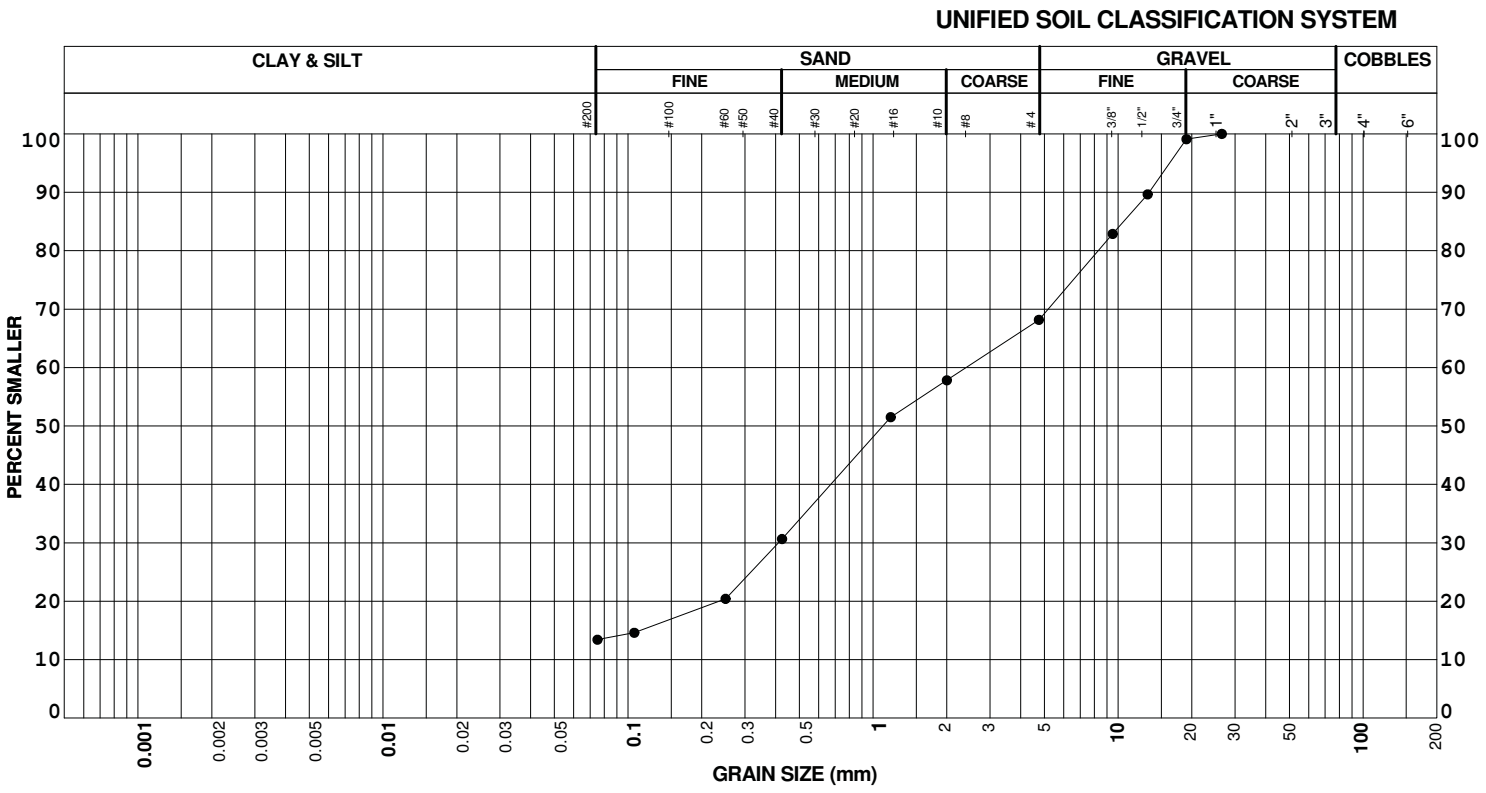
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M006	BS1	0.90	32	55	13		

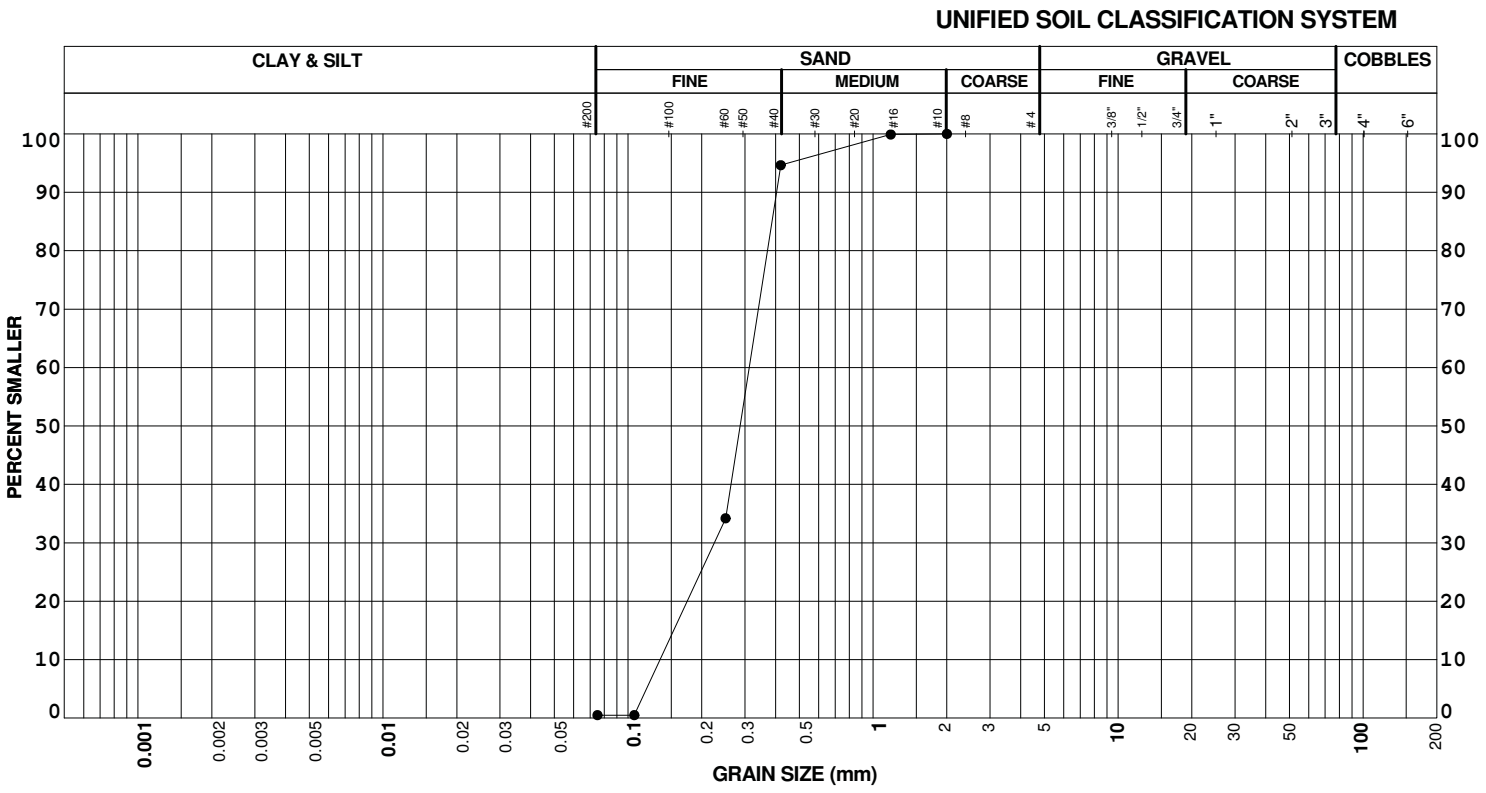
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M007	BS3	3.05	0	100	0		

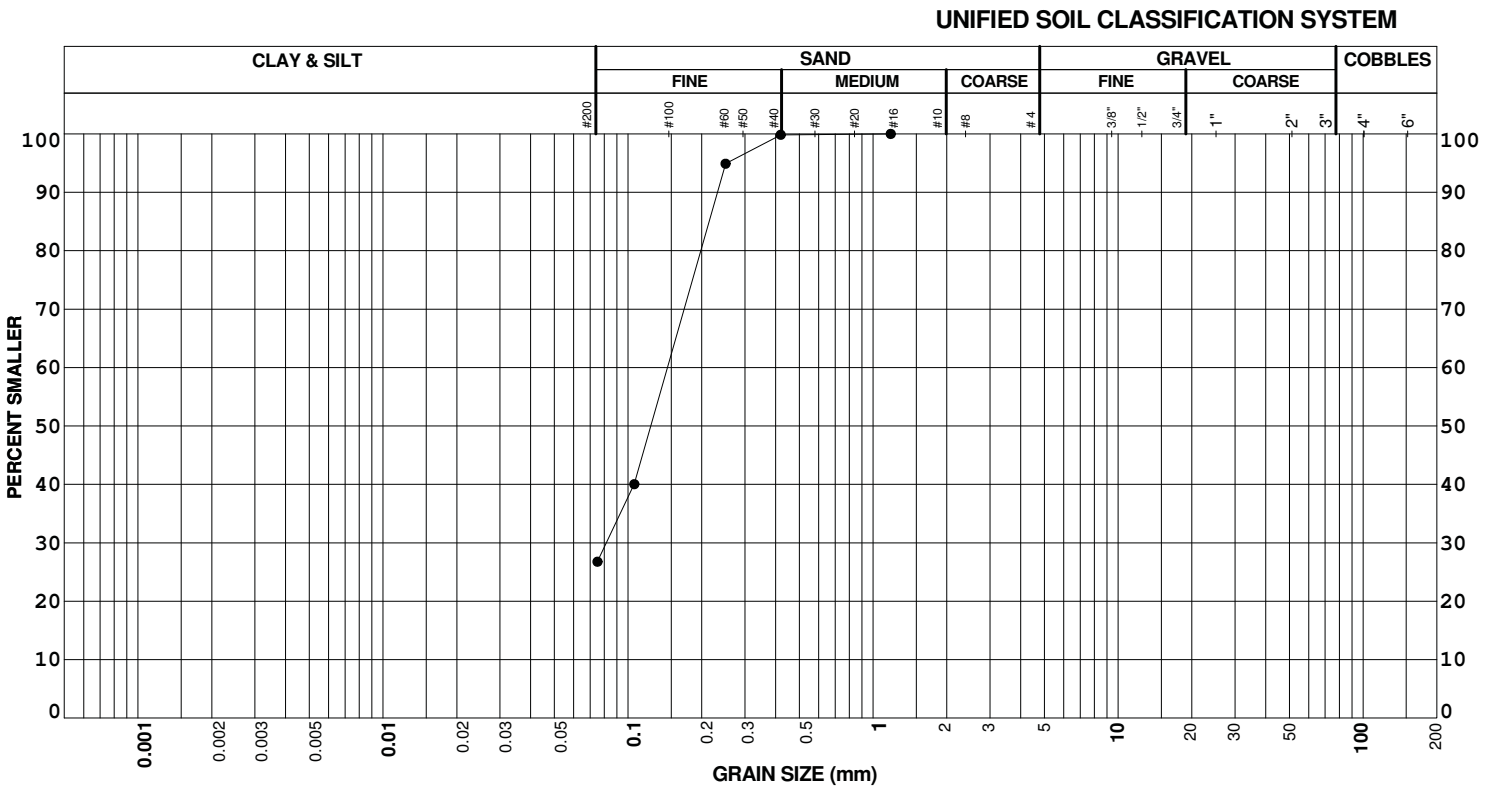
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M008	BS3	3.05	0	73	27		

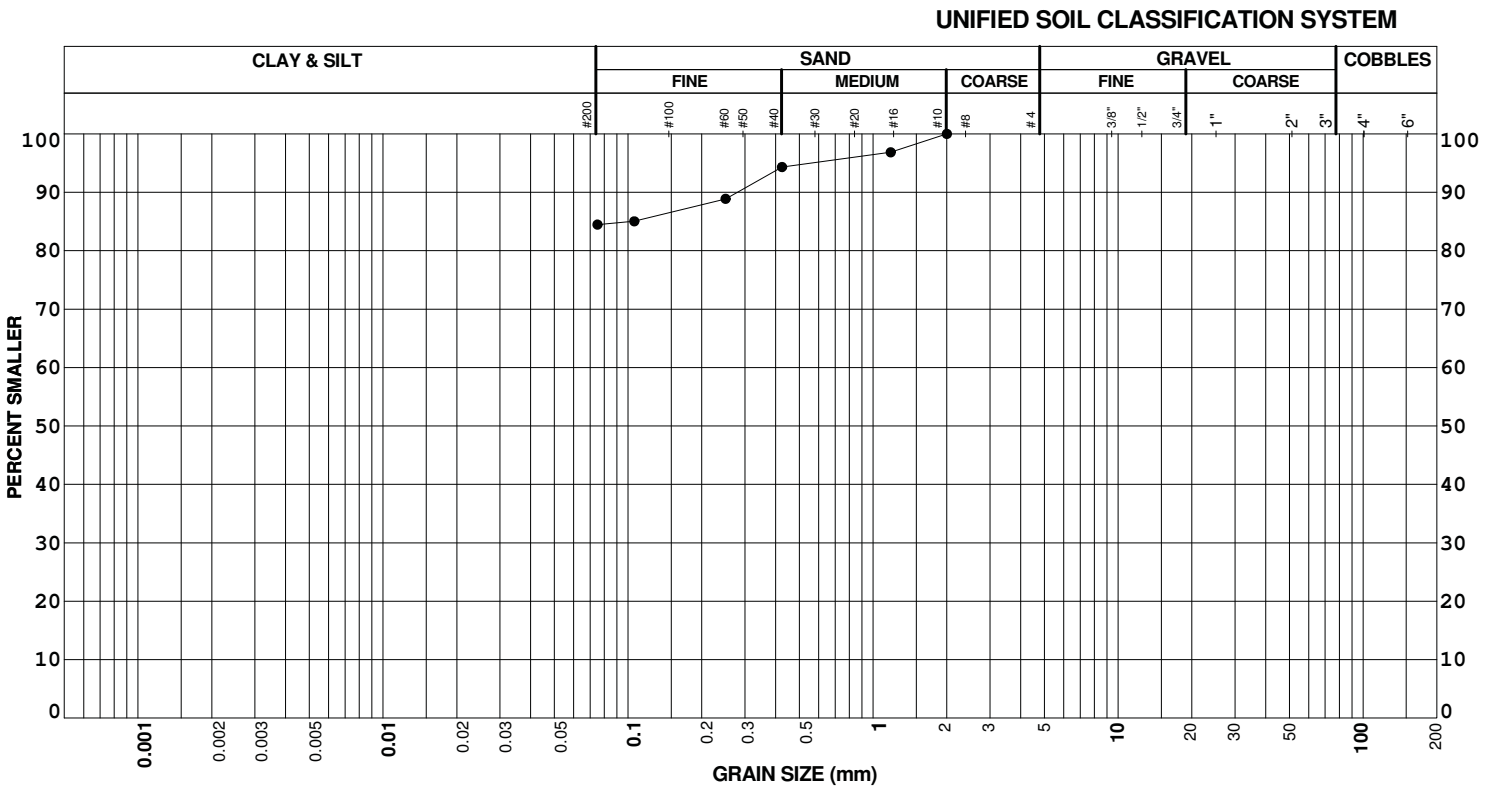
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M010	BS1	0.90	0	16	84		

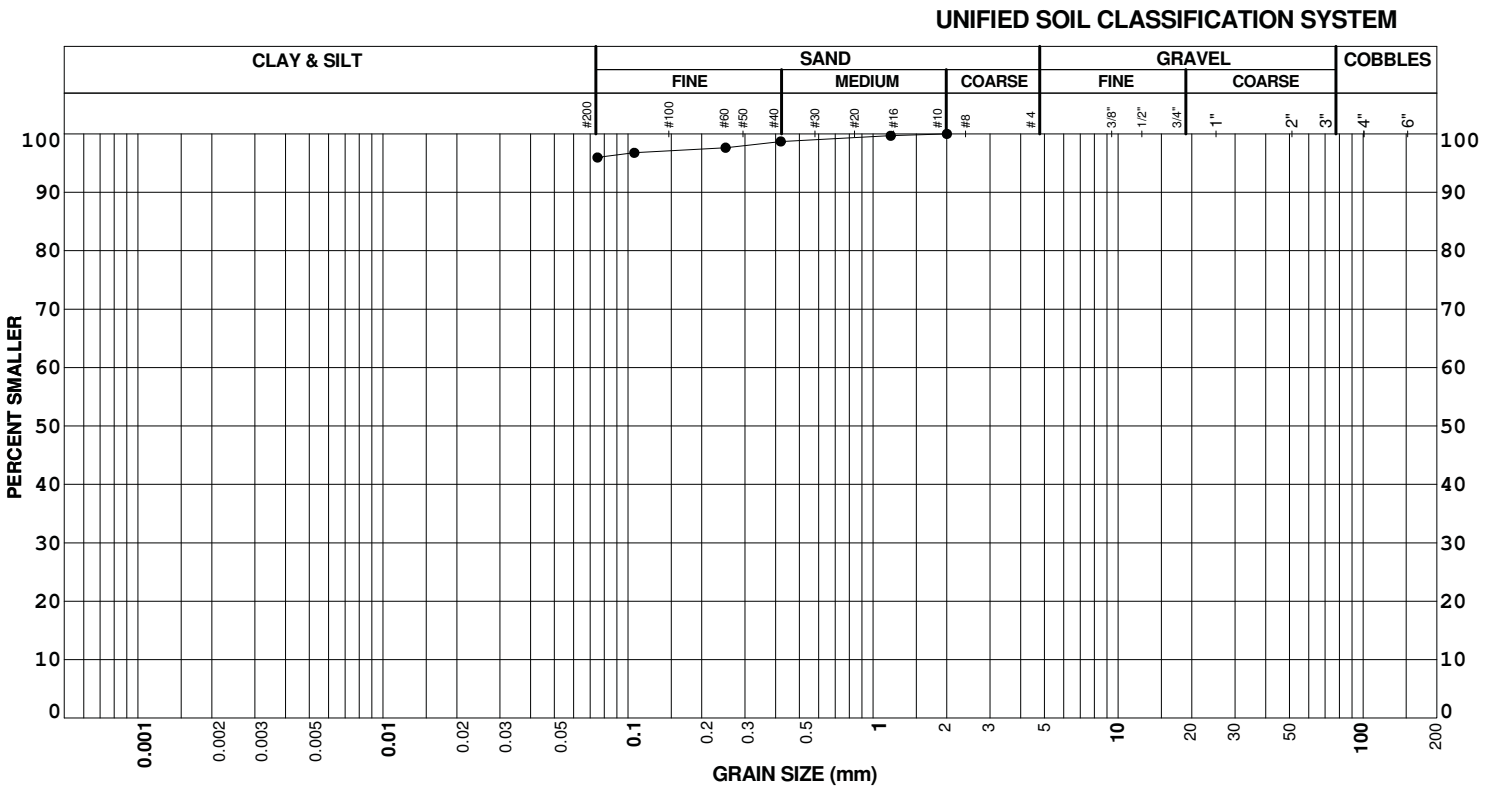
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M010	BS3	4.20	0	4	96		

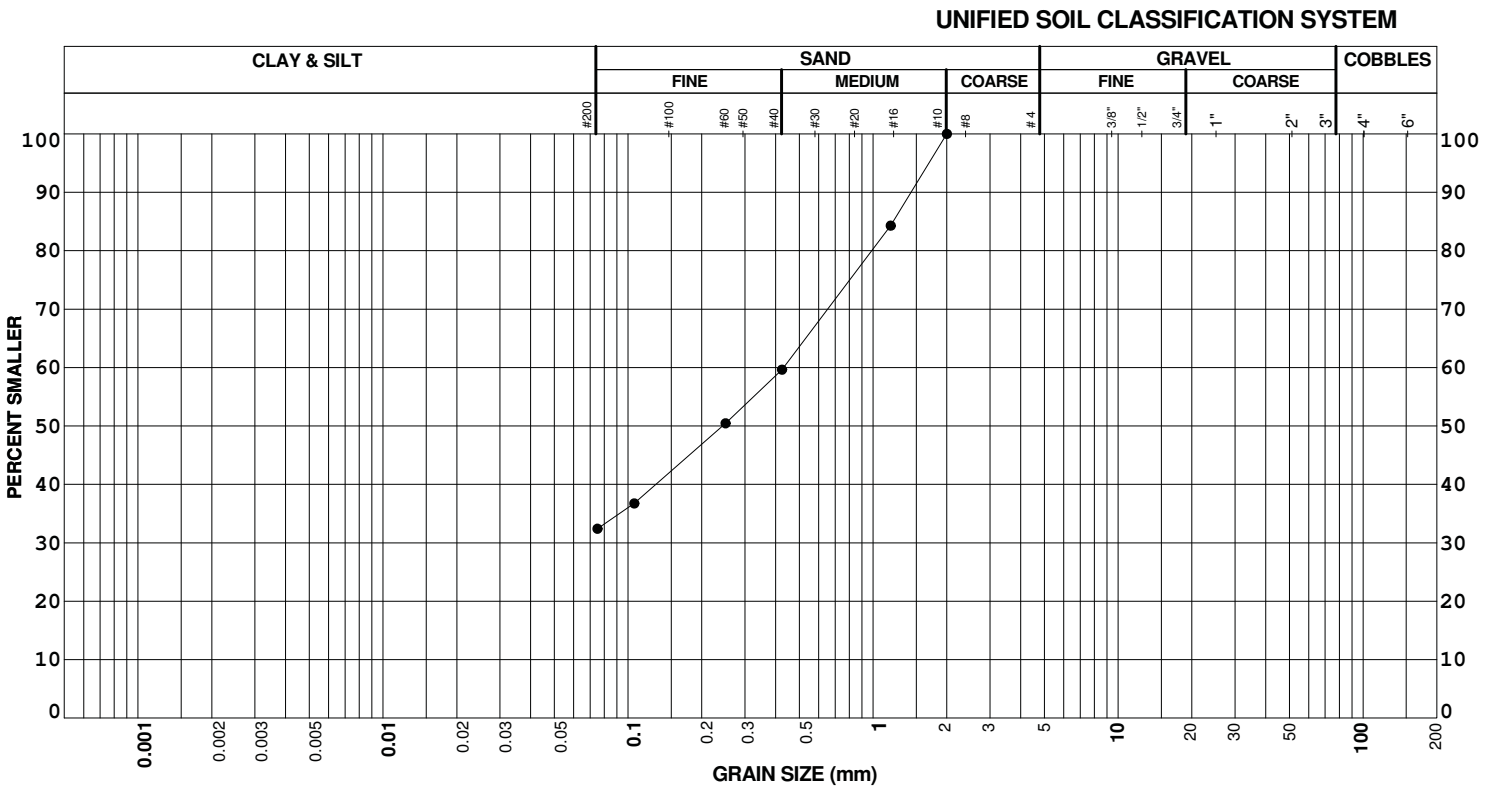
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M011	BS1	1.20	0	68	32		

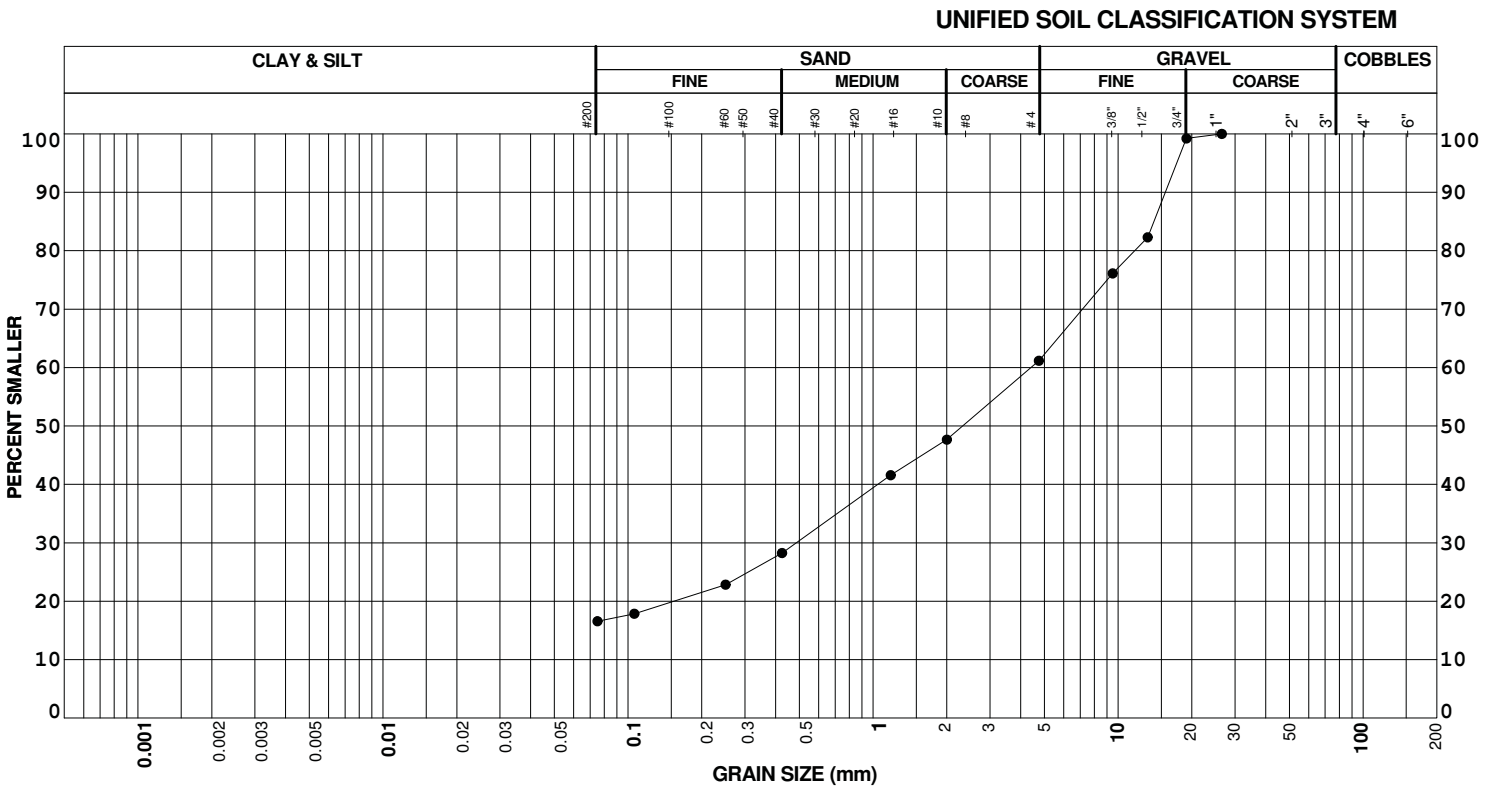
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M012	BS1	0.90	39	45	17		

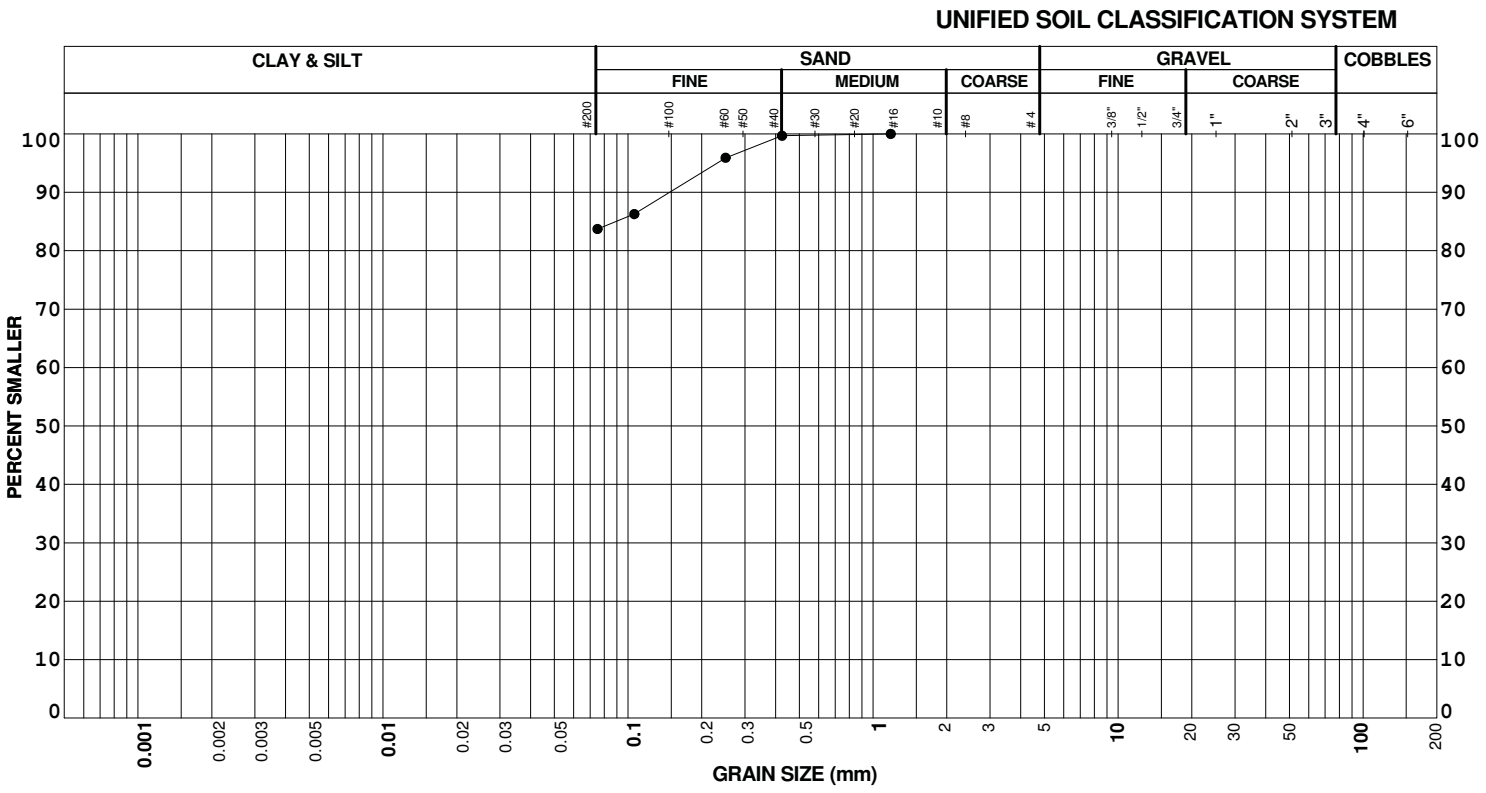
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M012	BS3	4.10	0	16	84		

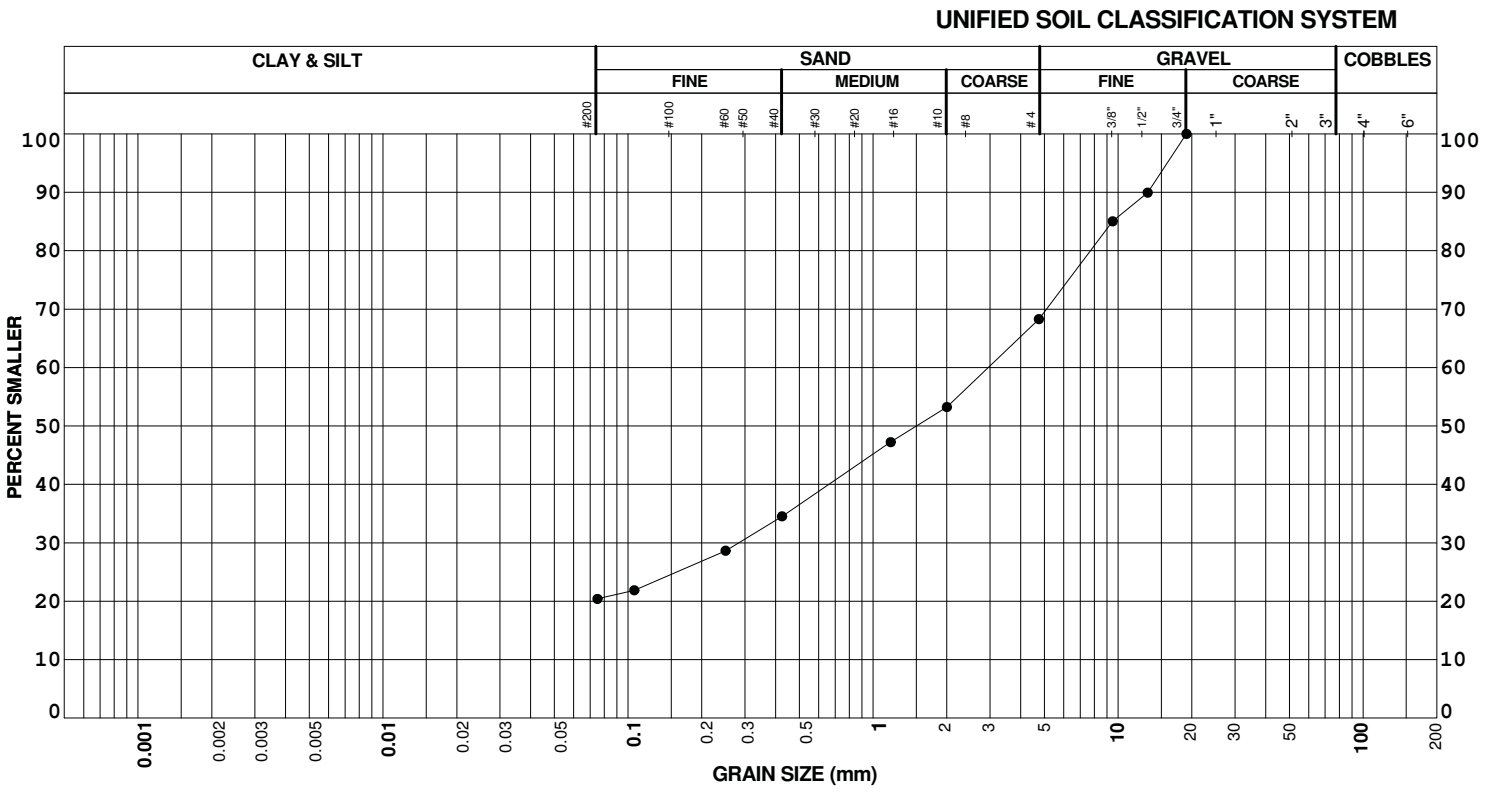
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M013	BS1	1.20	32	48	20		

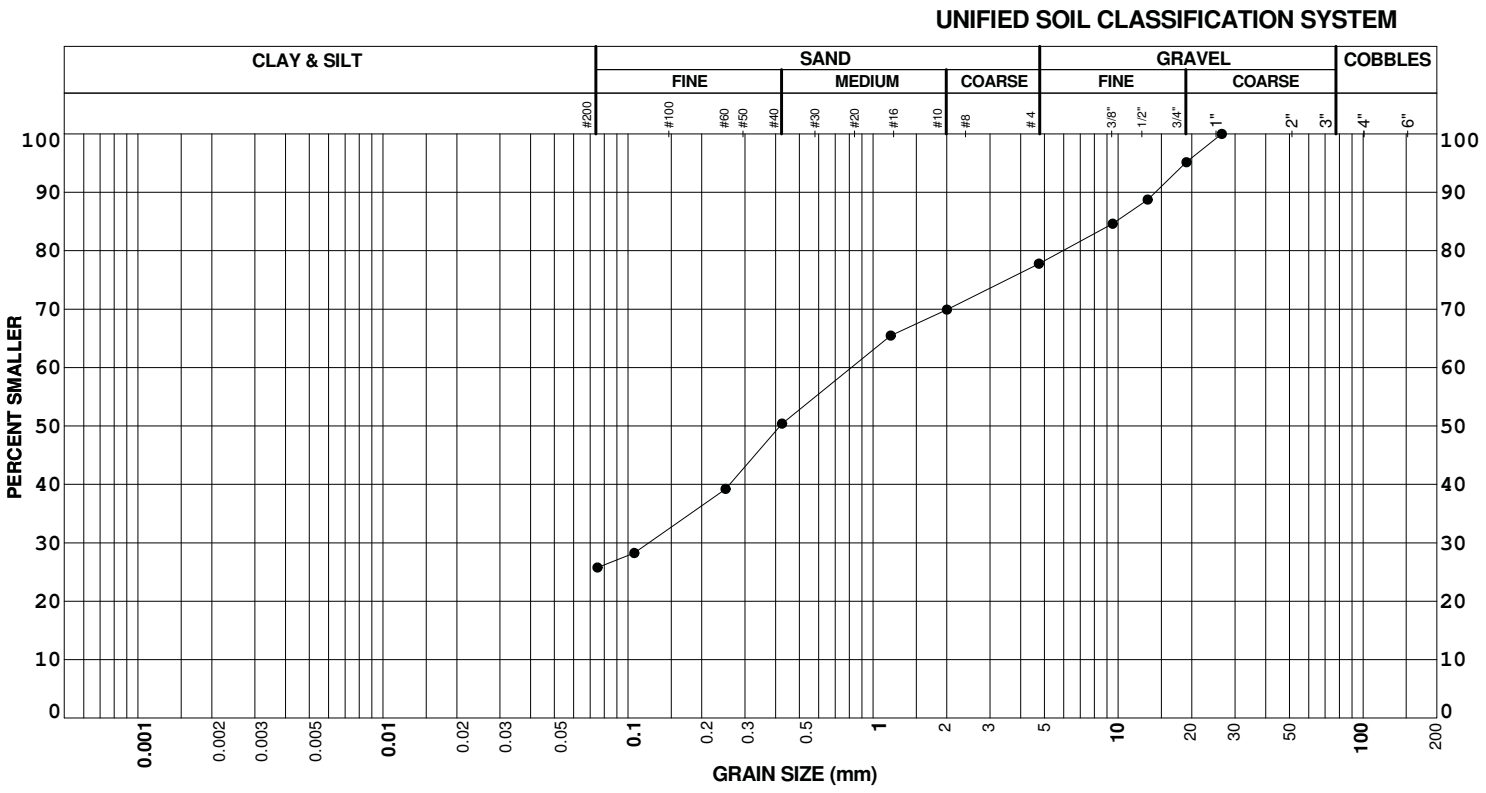
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M014	BS1	1.20	22	52	26		

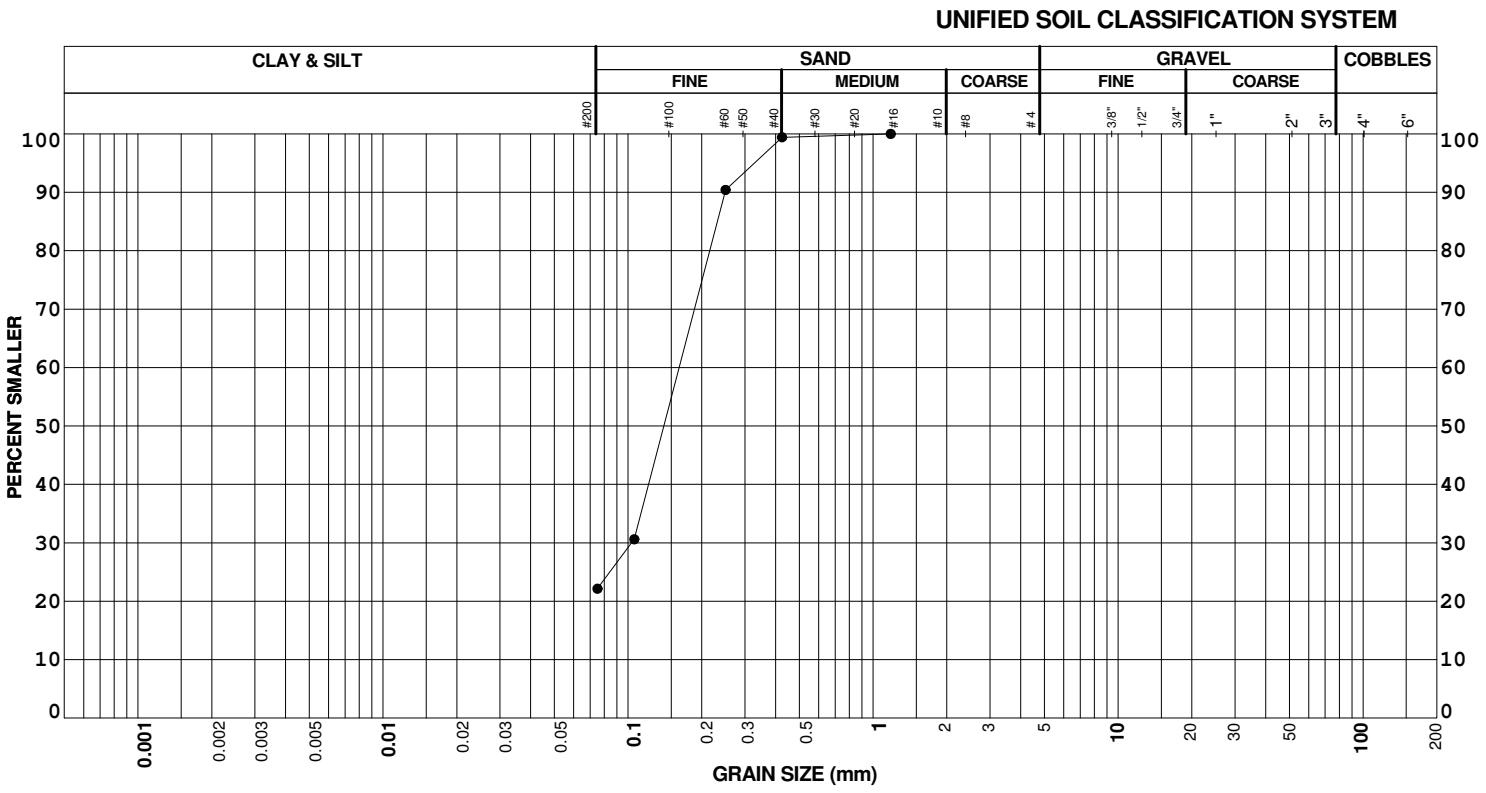
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M014	BS3	4.30	0	78	22		

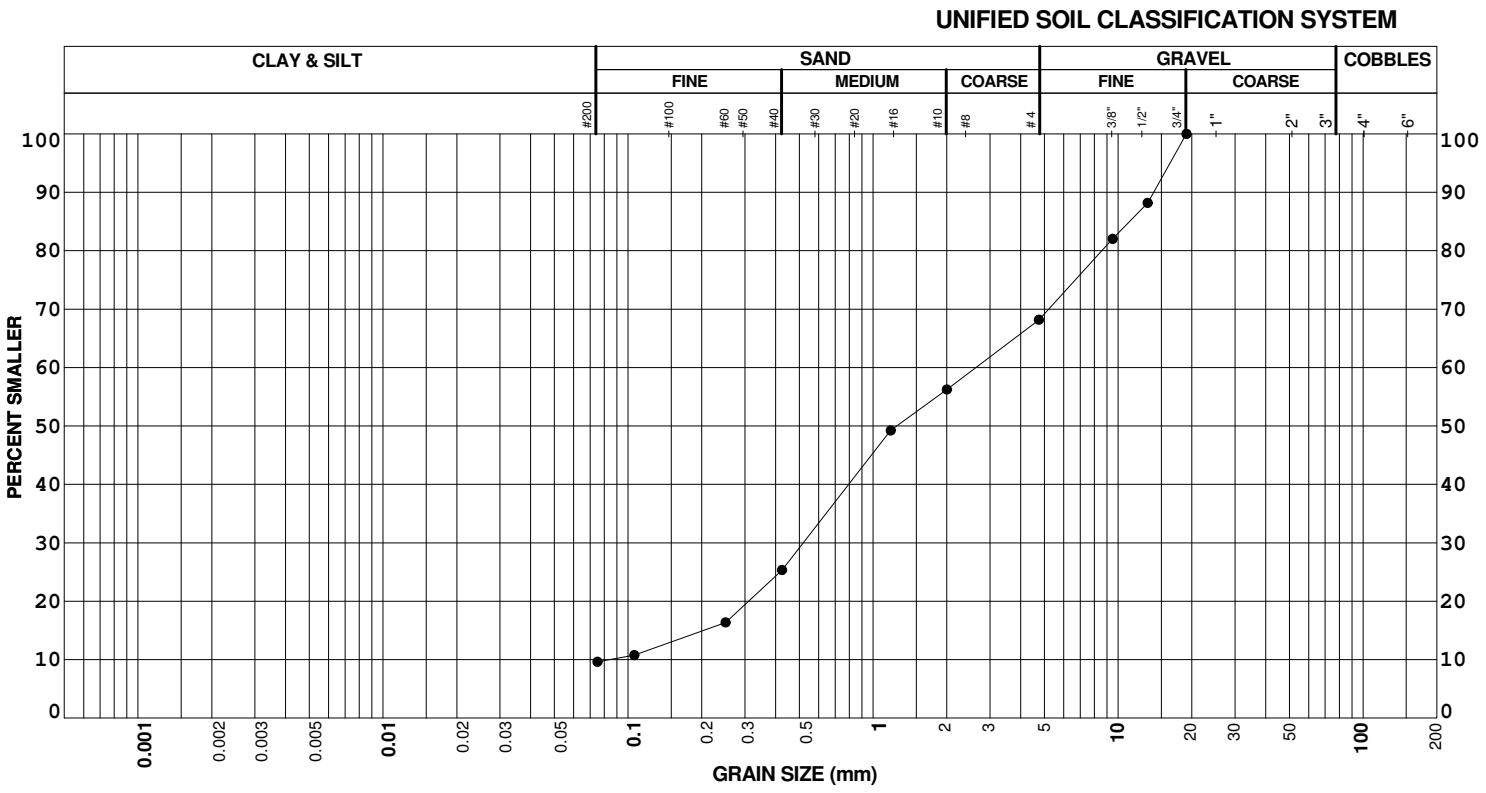
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M015	BS1	1.00	32	59	10		

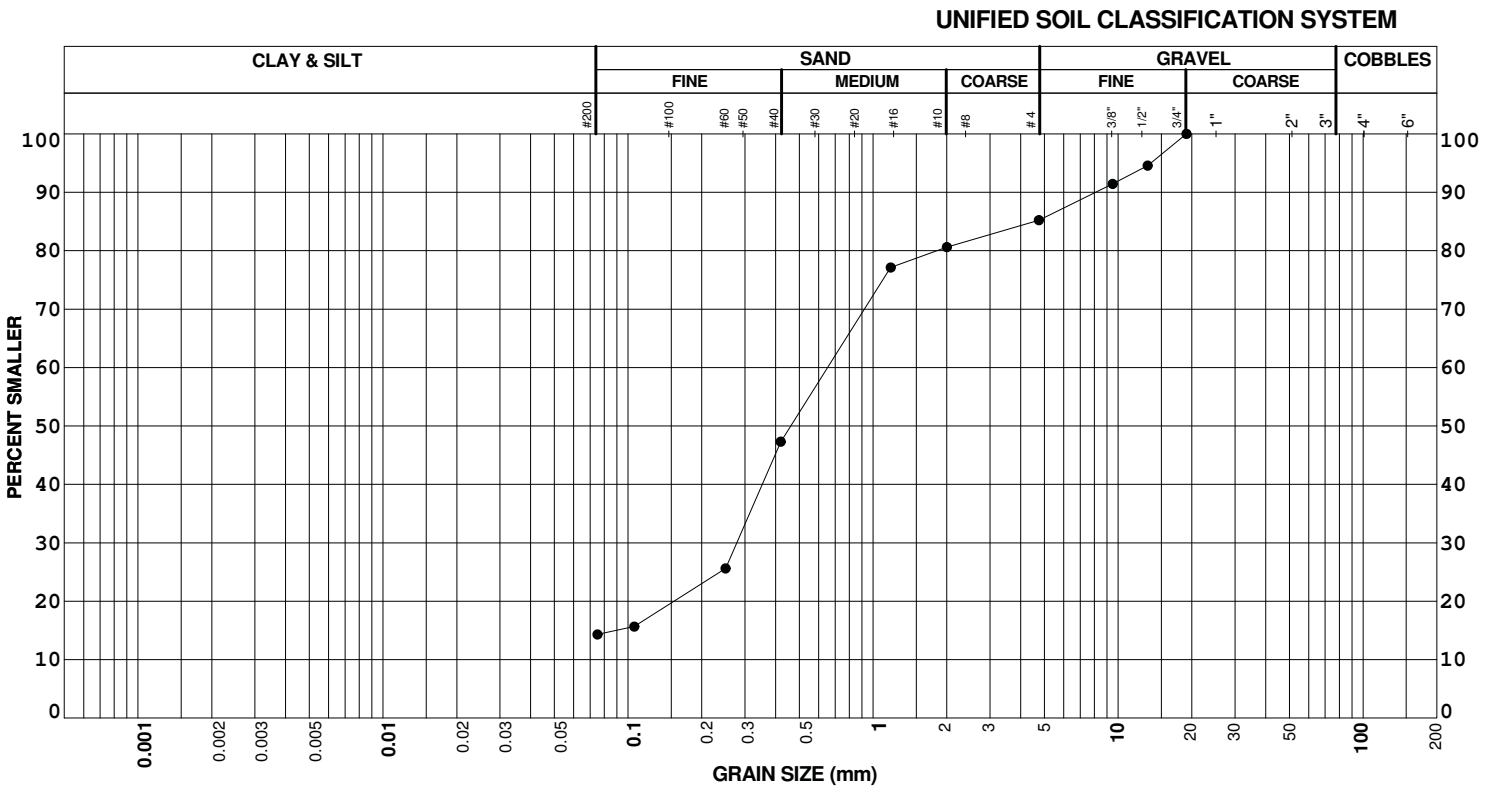
REMARKS:

GRAIN SIZE DISTRIBUTION

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Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH16-M015	BS3	3.90	15	71	14		

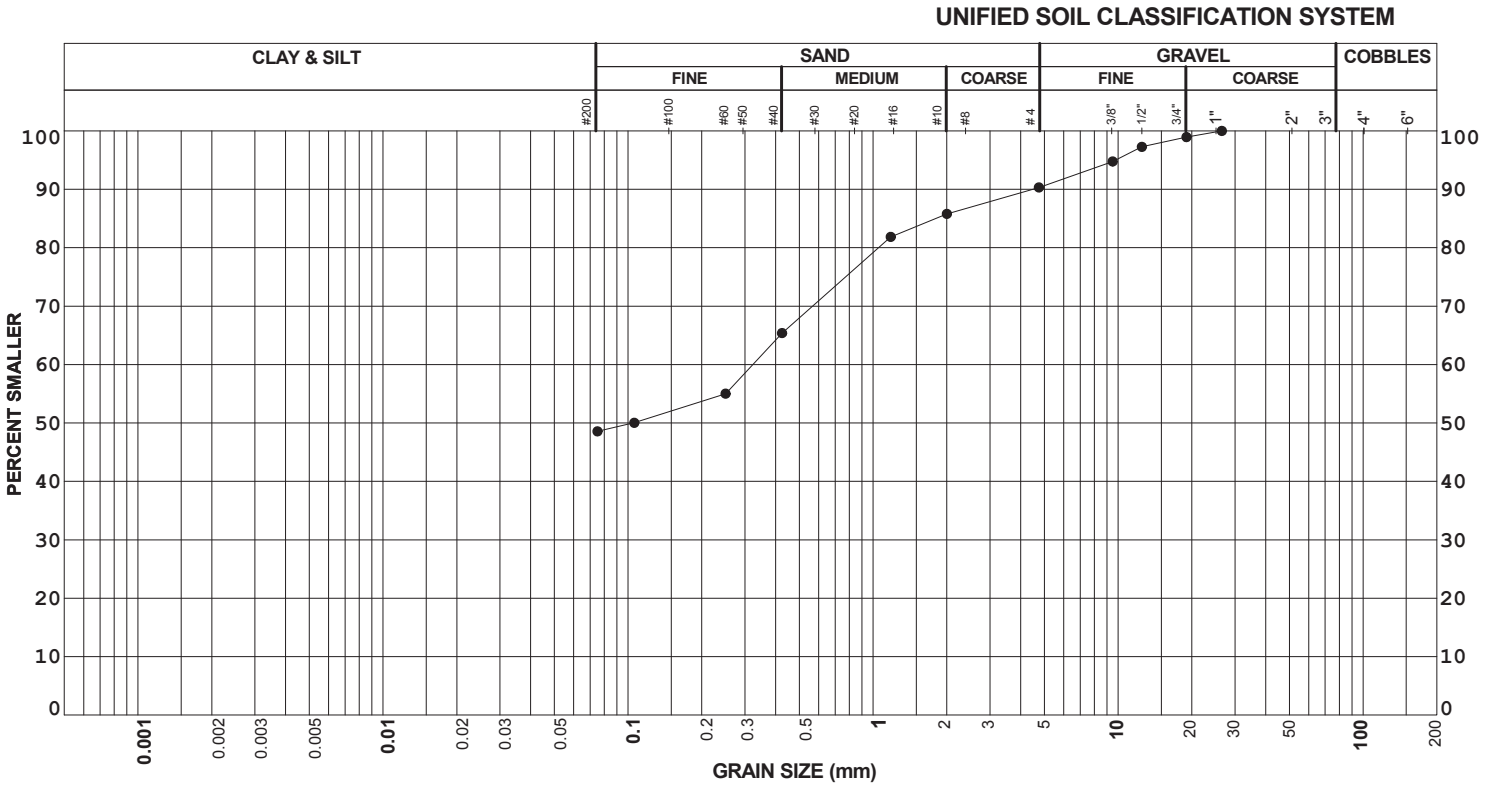
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

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Project



	BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
●	BH17-10	DS1	0.90	10	42	49		

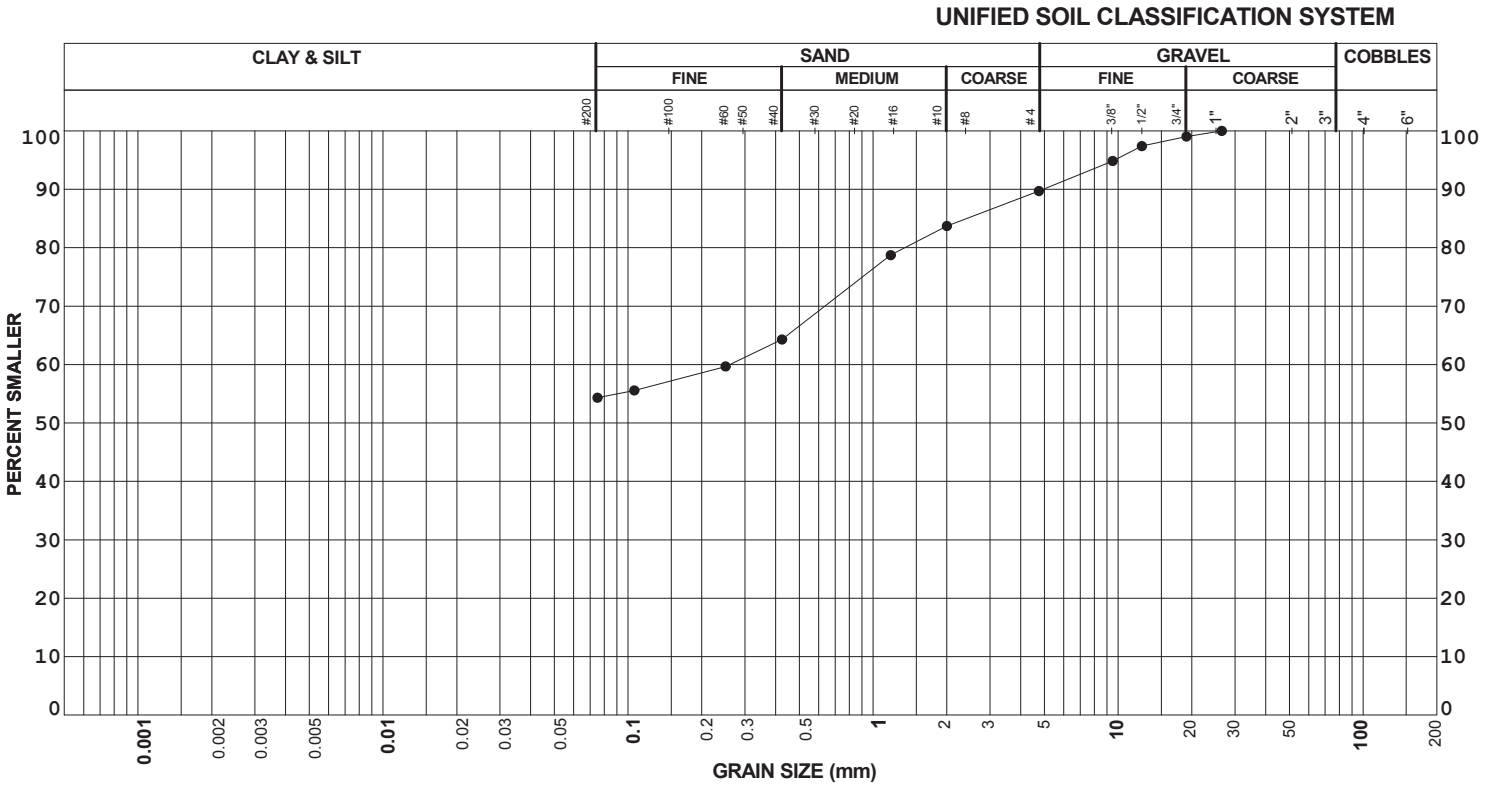
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

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Project



	BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
●	BH17-10	DS2	5.00	10	35	54		

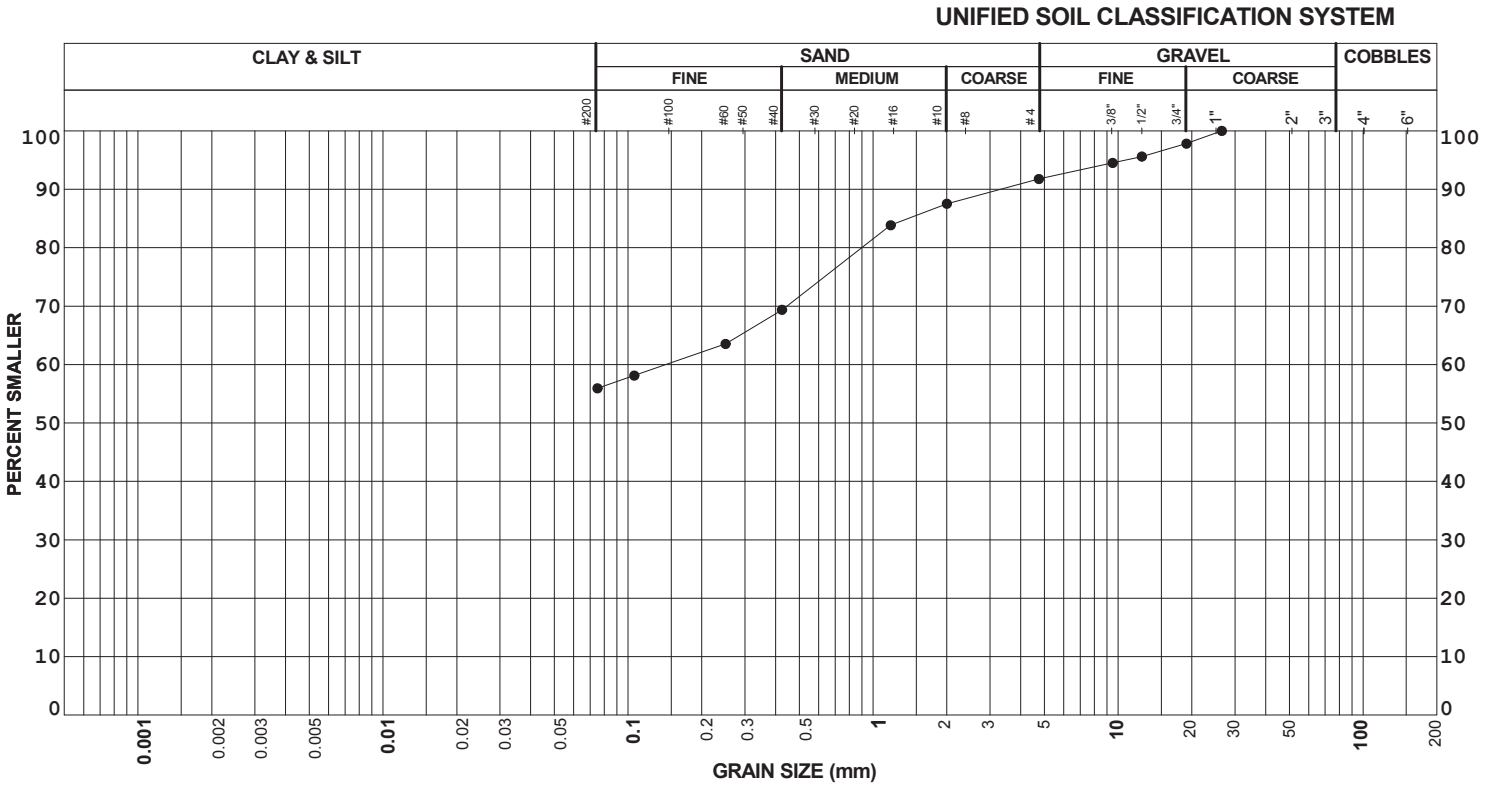
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

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Project



	BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
●	BH17-10	DS3	7.62	8	36	56		

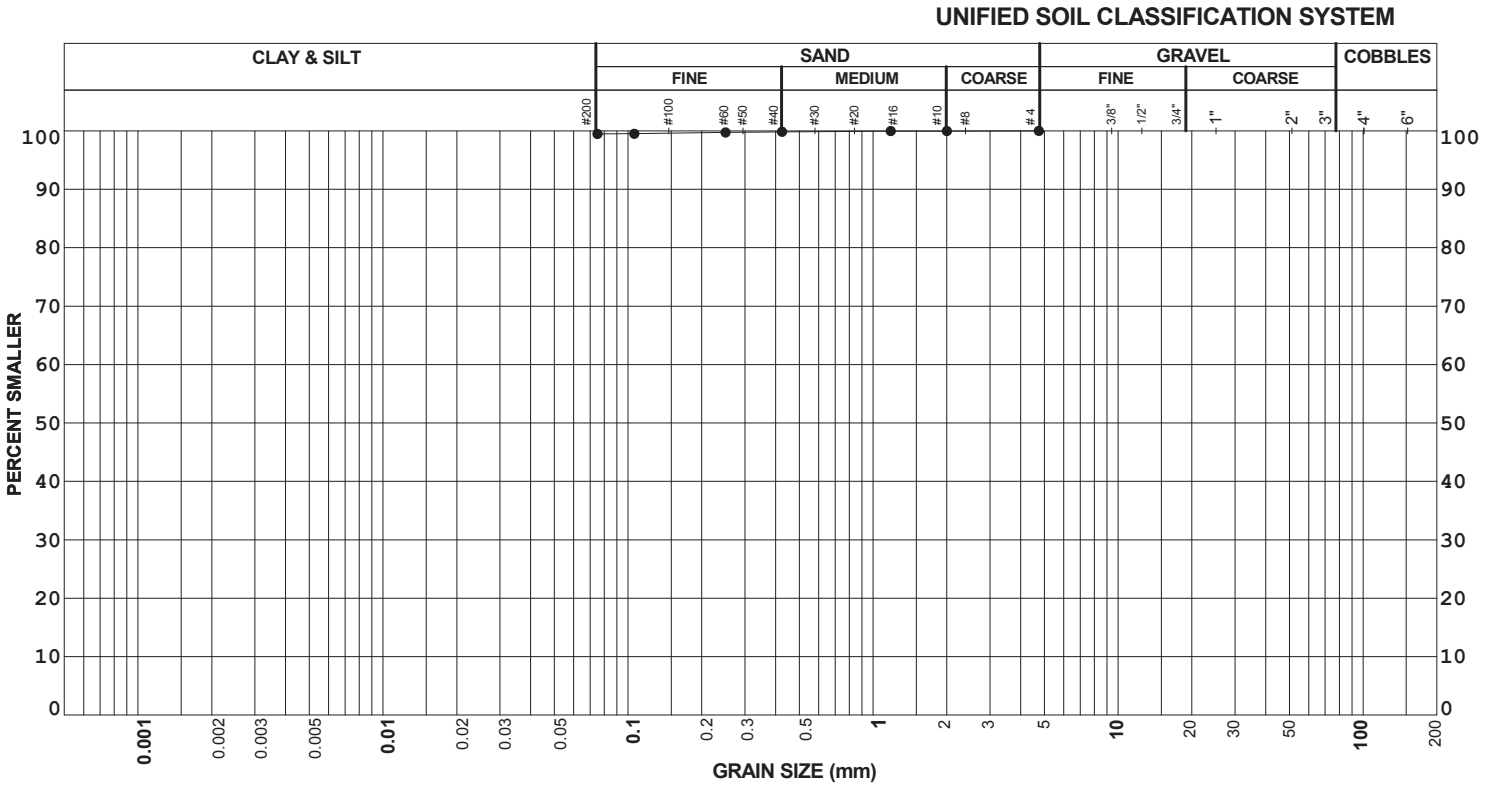
REMARKS:

GRAIN SIZE DISTRIBUTION

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	BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
●	BH17-10	DS4	8.70	0	1	99		

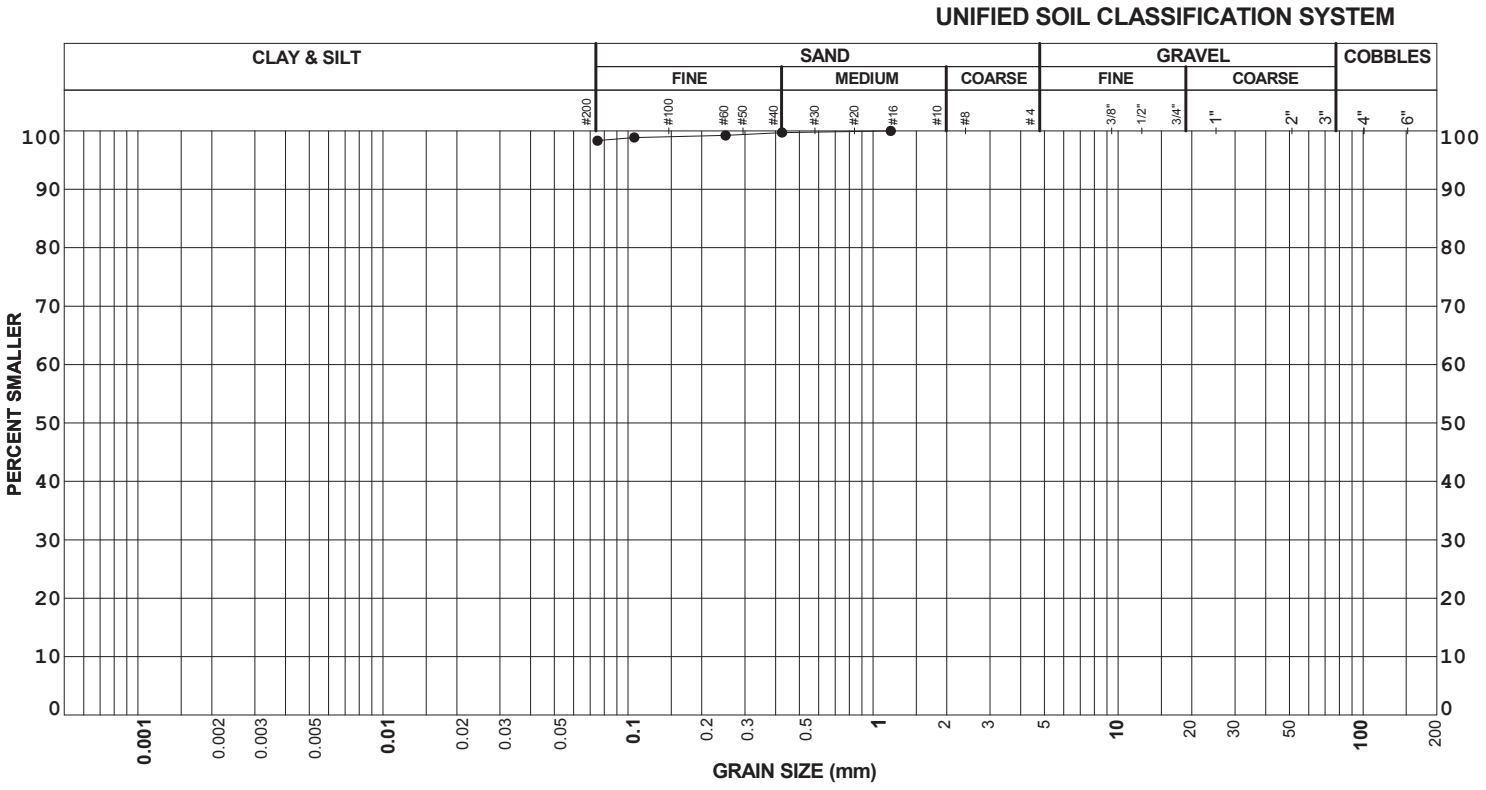
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-10	DS5	11.40	0	2	98		

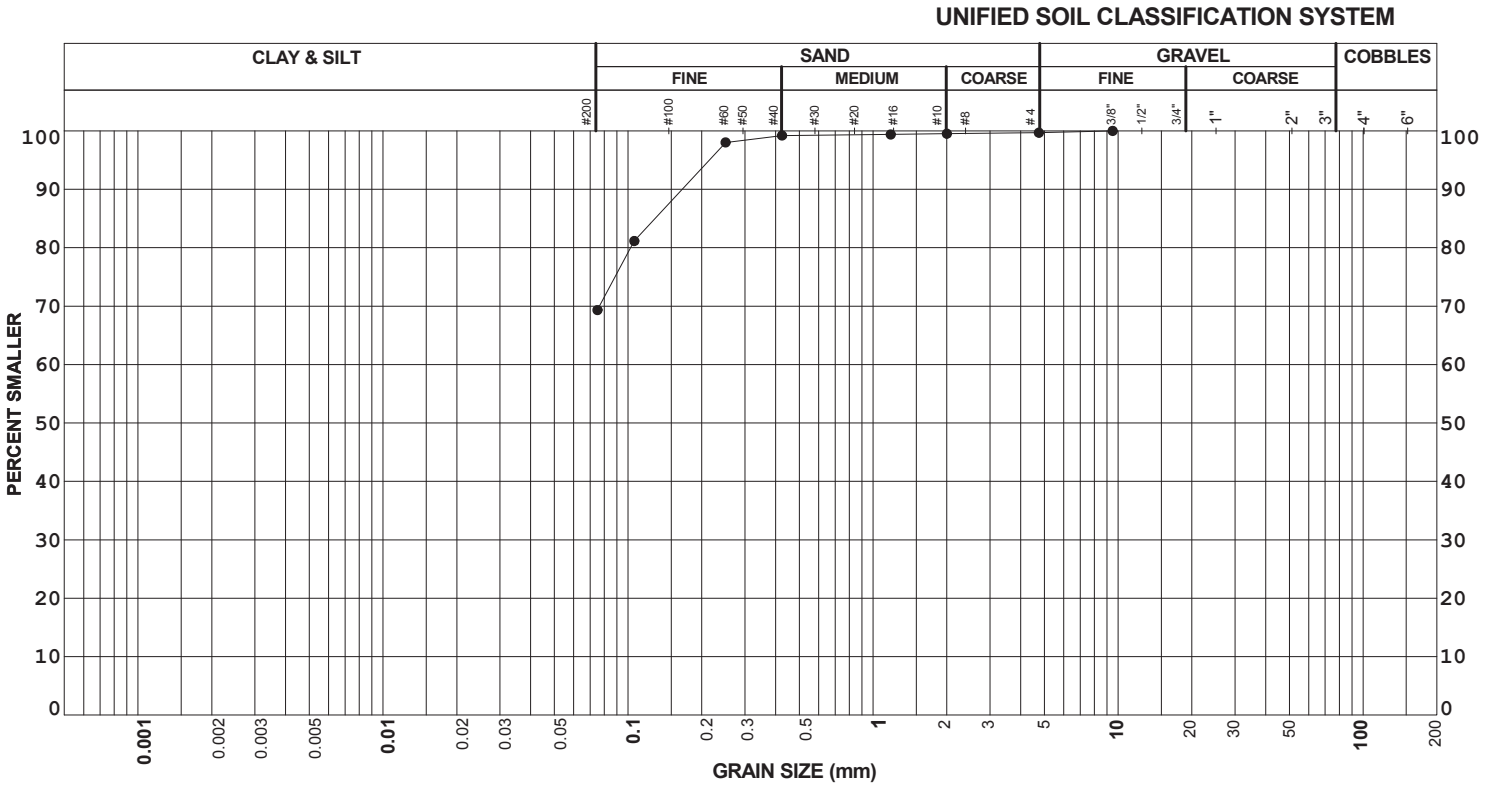
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

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Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-10	DS6	12.50	0	30	69		

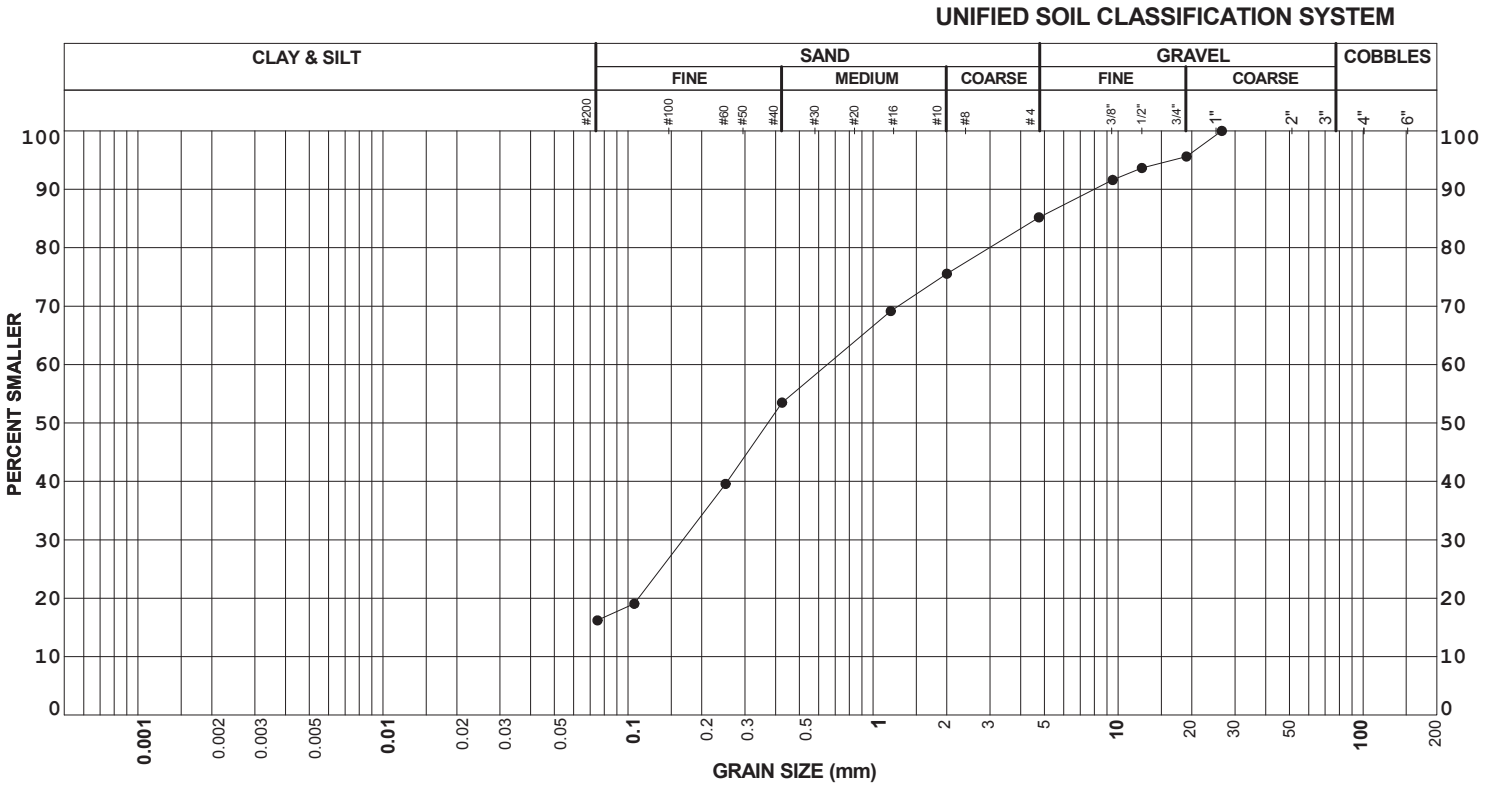
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

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Project



	BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
●	BH17-10	DS7	14.30	15	69	16		

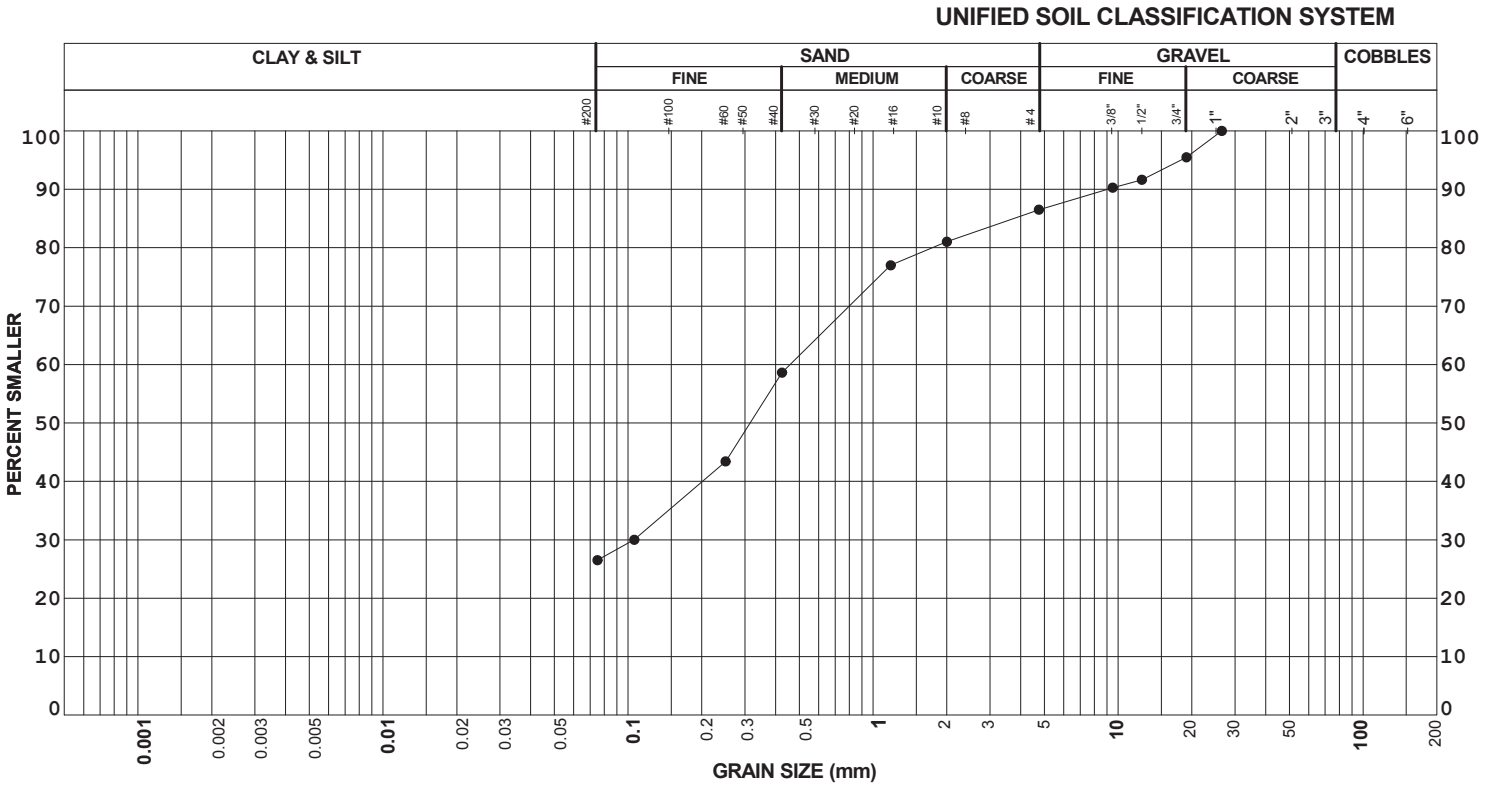
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

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	BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
●	BH17-10	DS8	16.20	13	60	27		

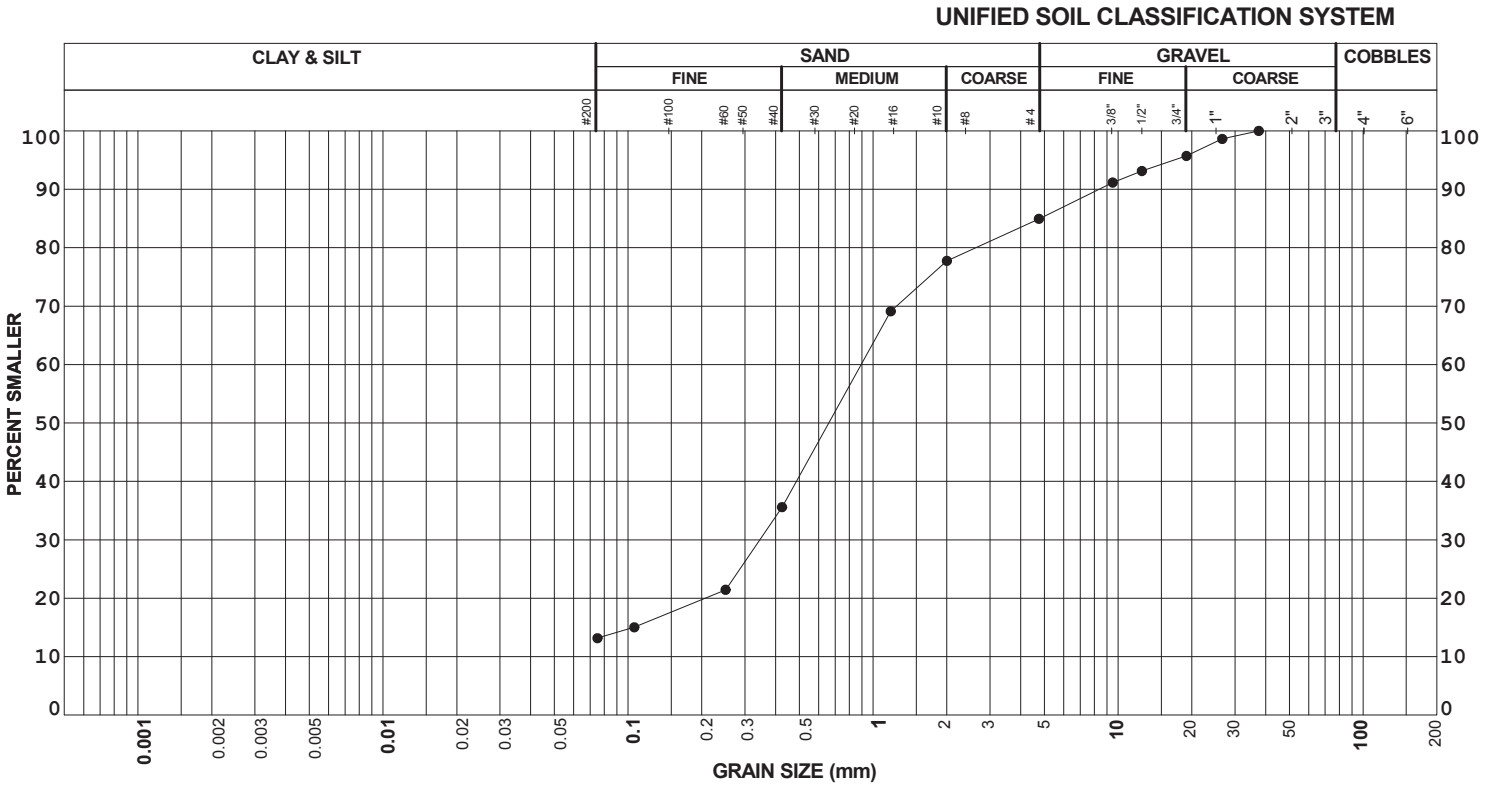
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DS1	0.90	15	72	13		

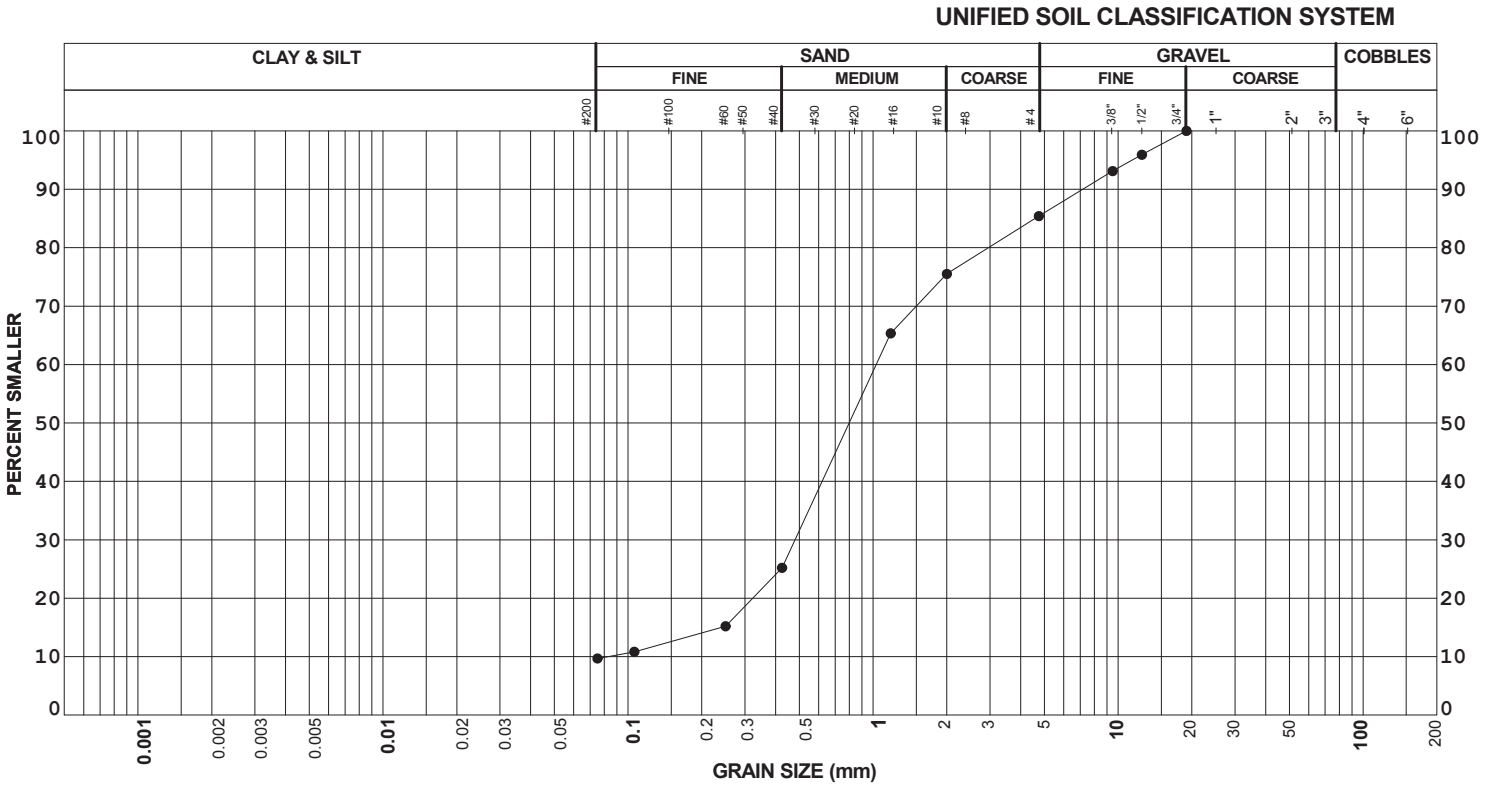
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DS2	3.50	15	76	10		

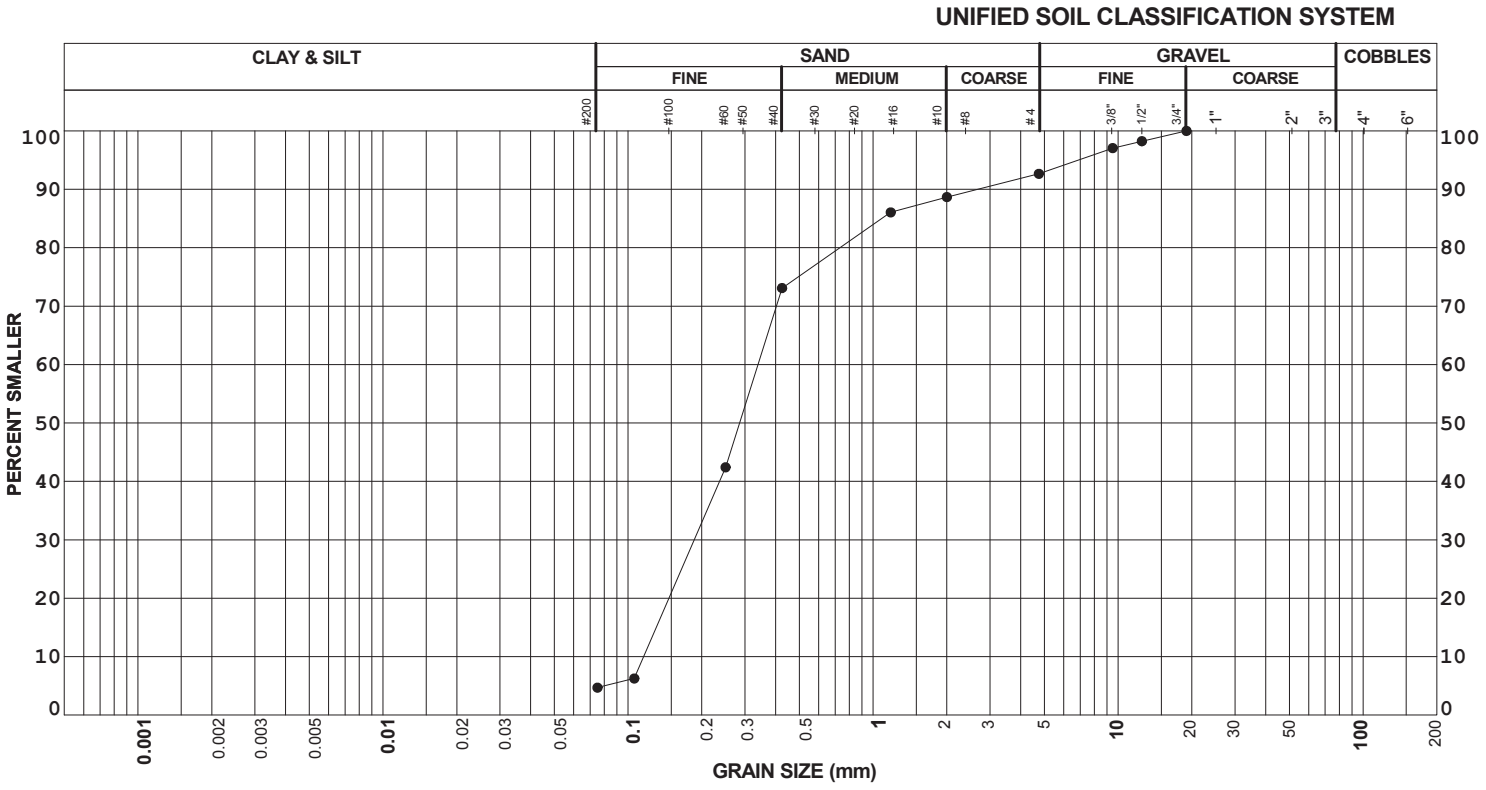
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DQ3	5.00	7	88	5		

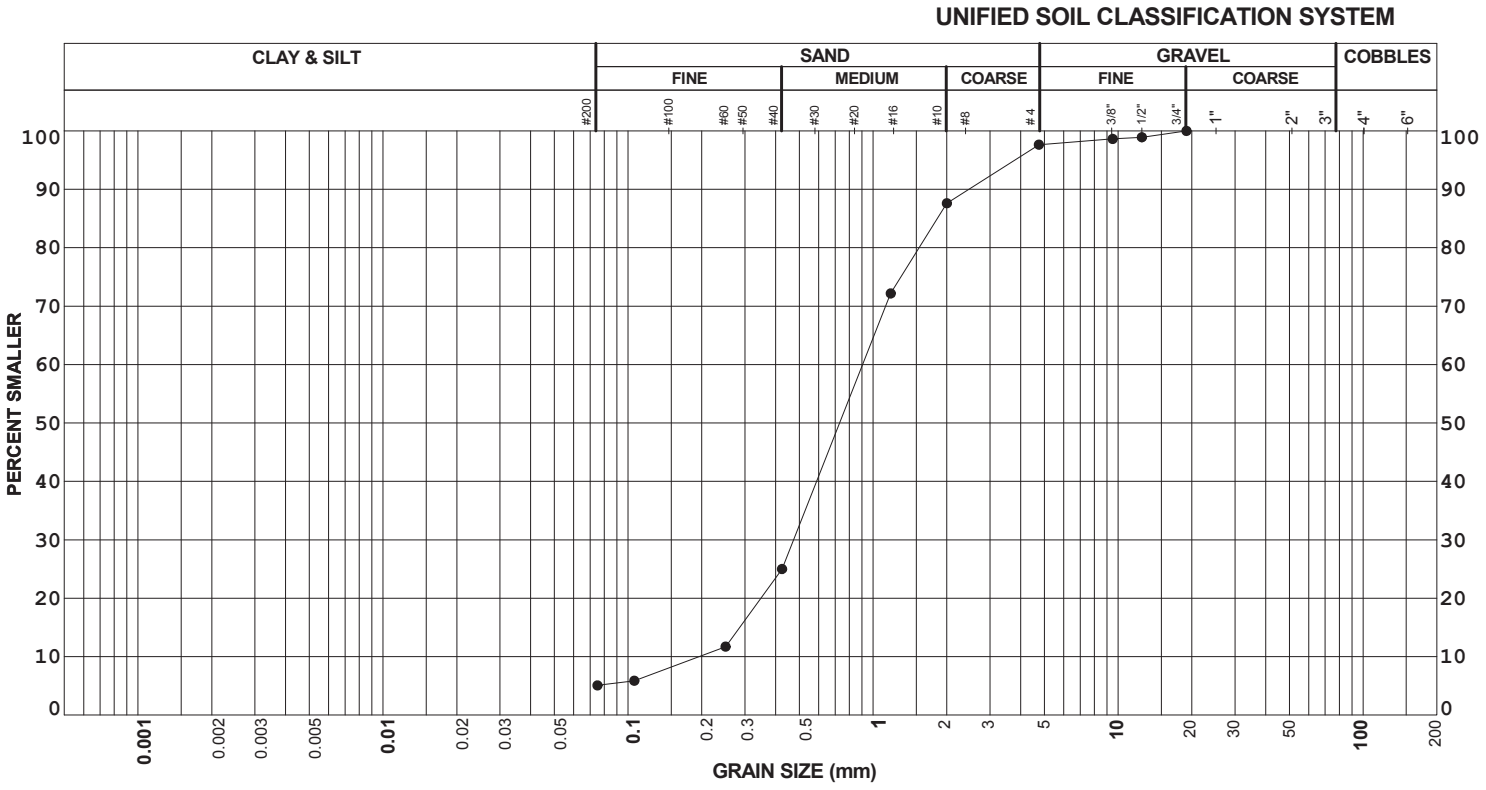
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DS4	6.30	2	93	5		

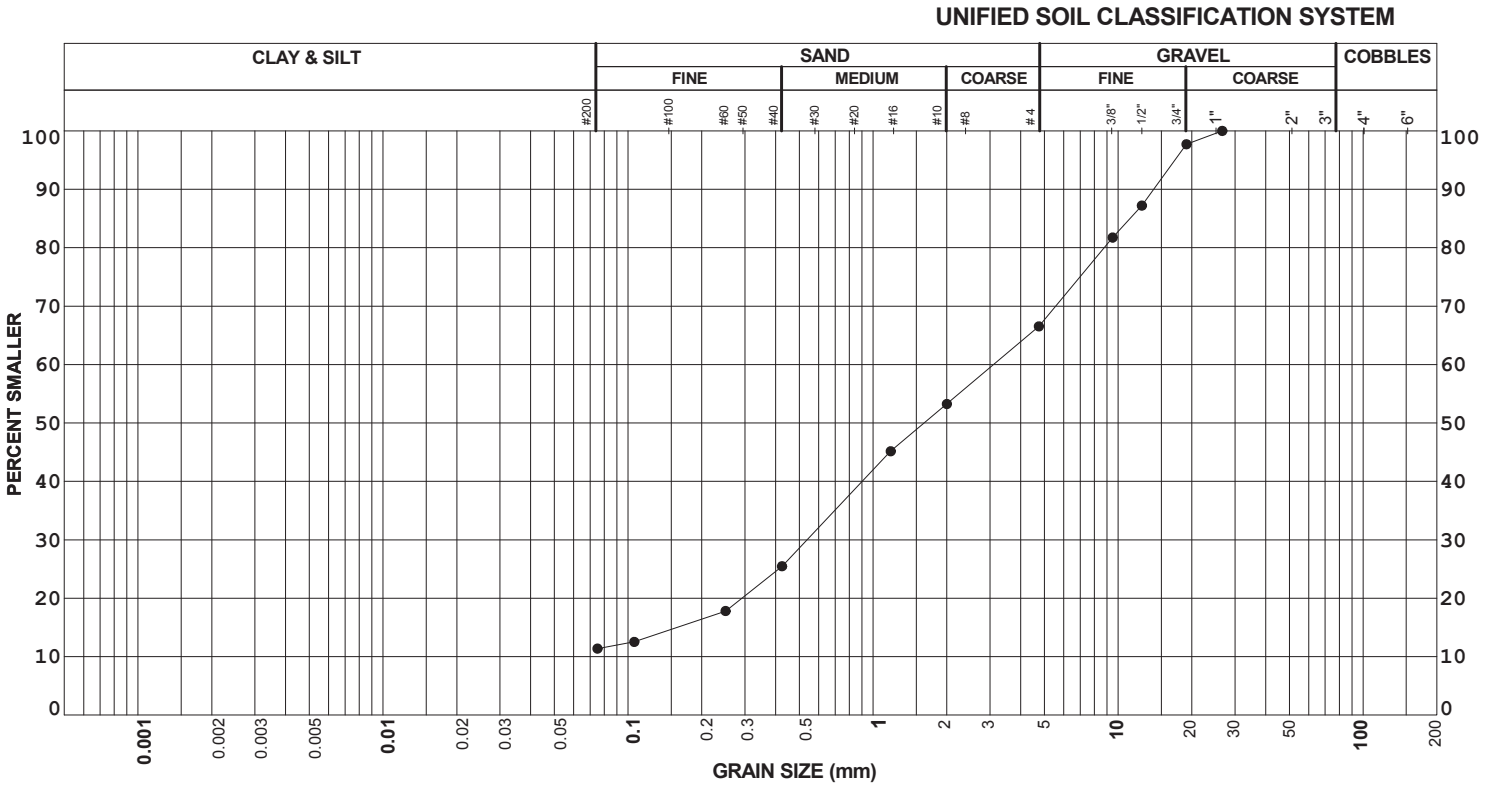
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DS5	7.60	33	55	11		

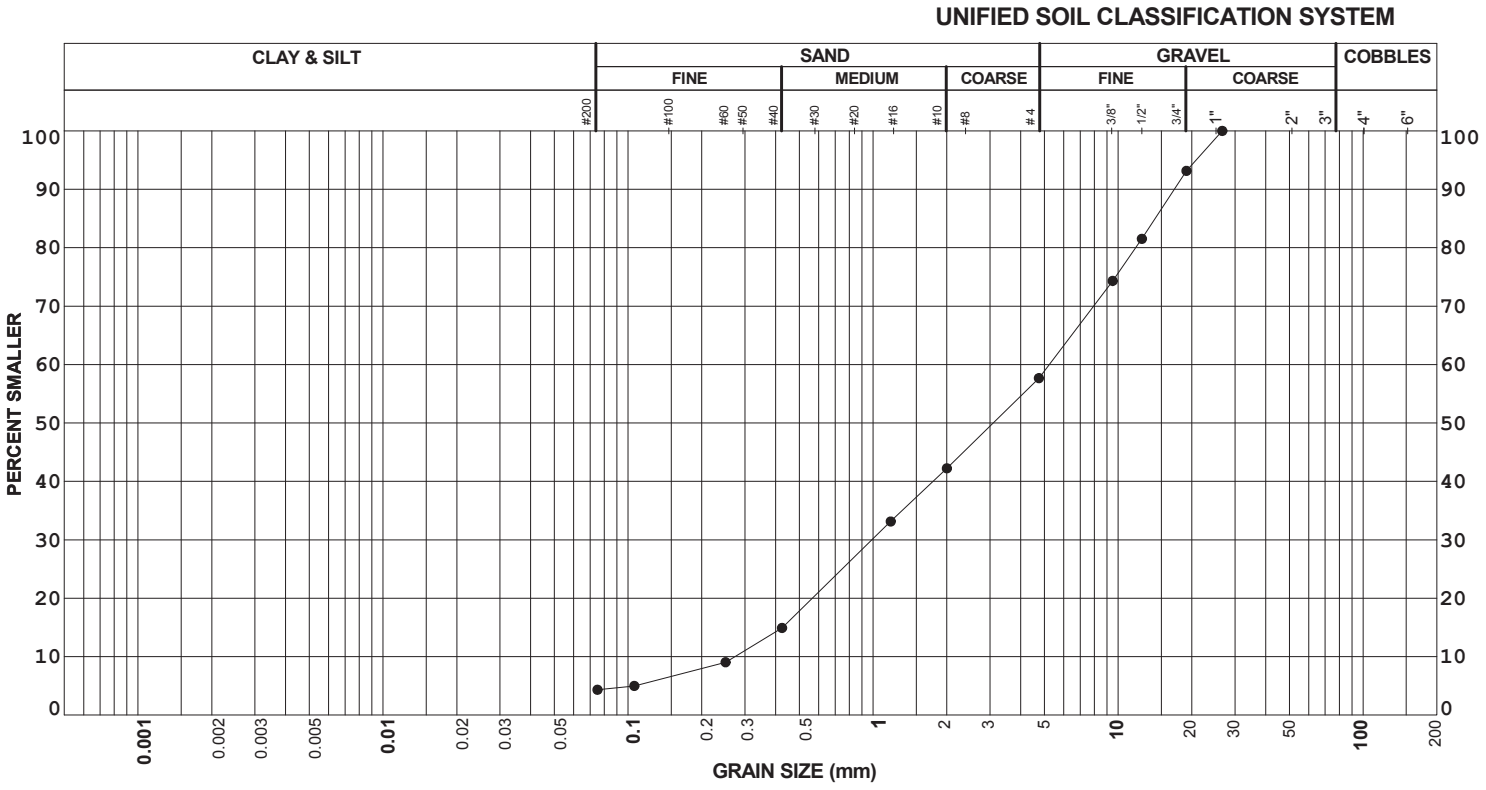
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DS6	9.30	42	53	4		

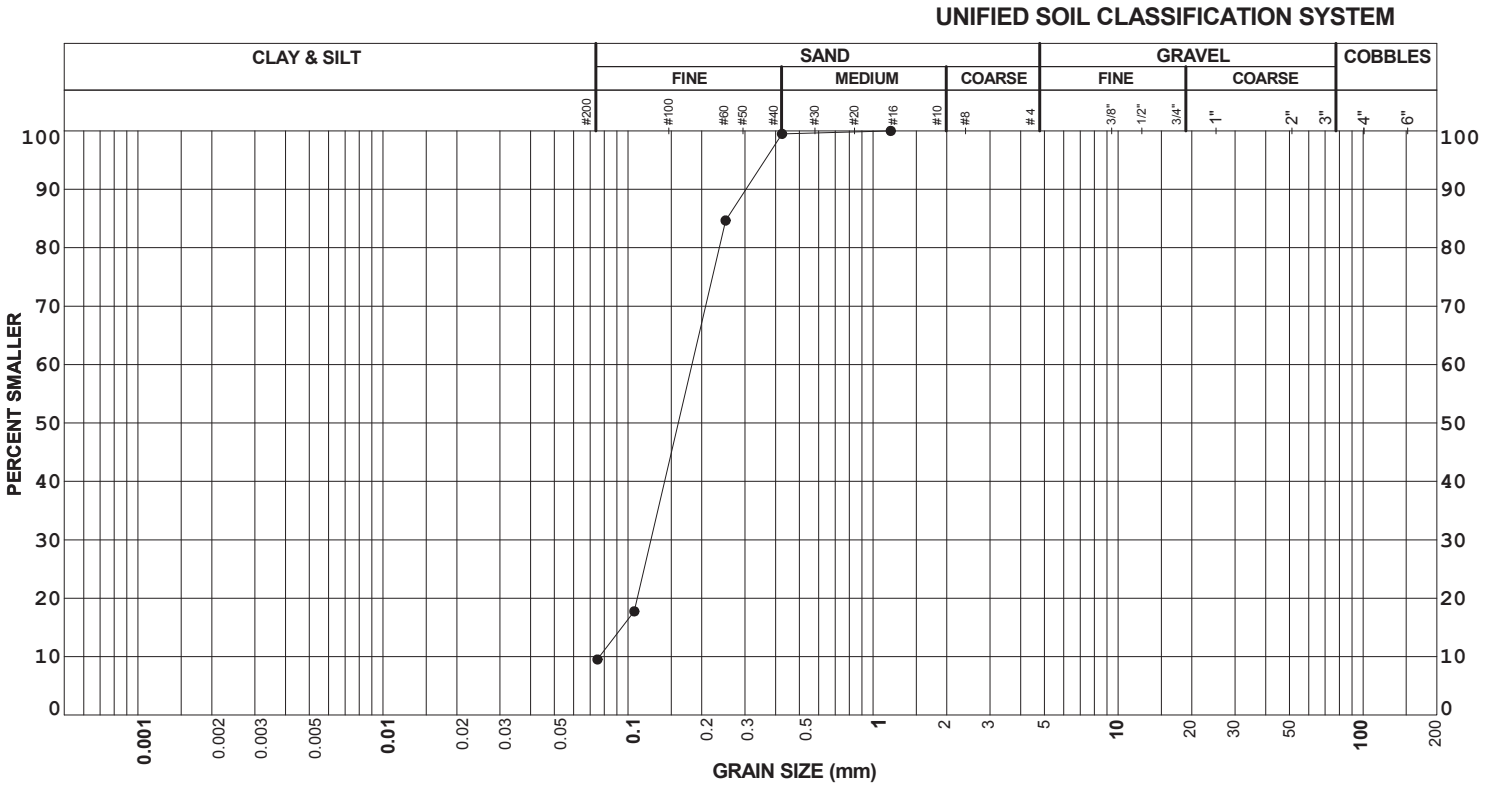
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DQ7	12.00	0	90	10		

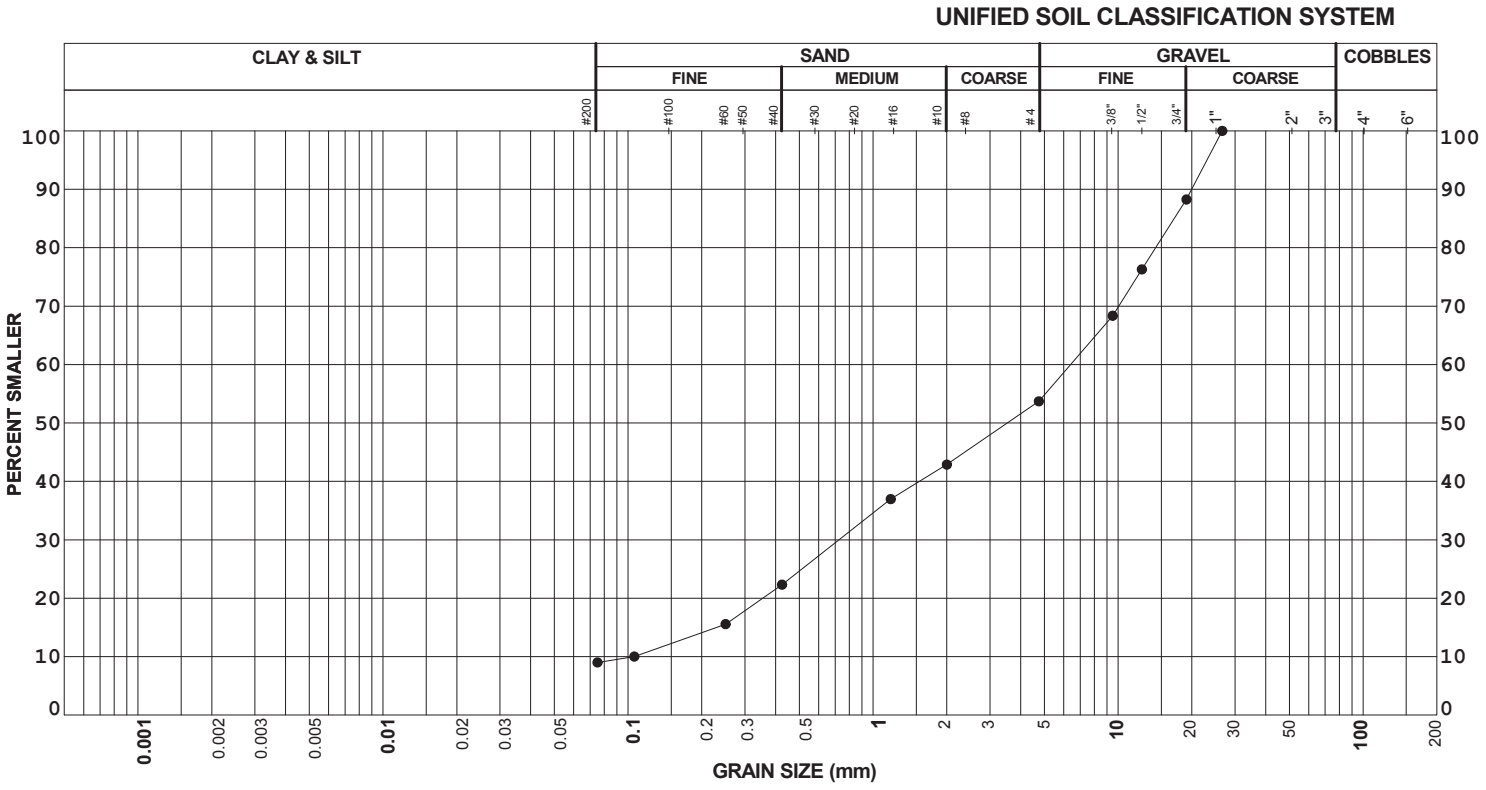
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DS8	12.20	46	45	9		

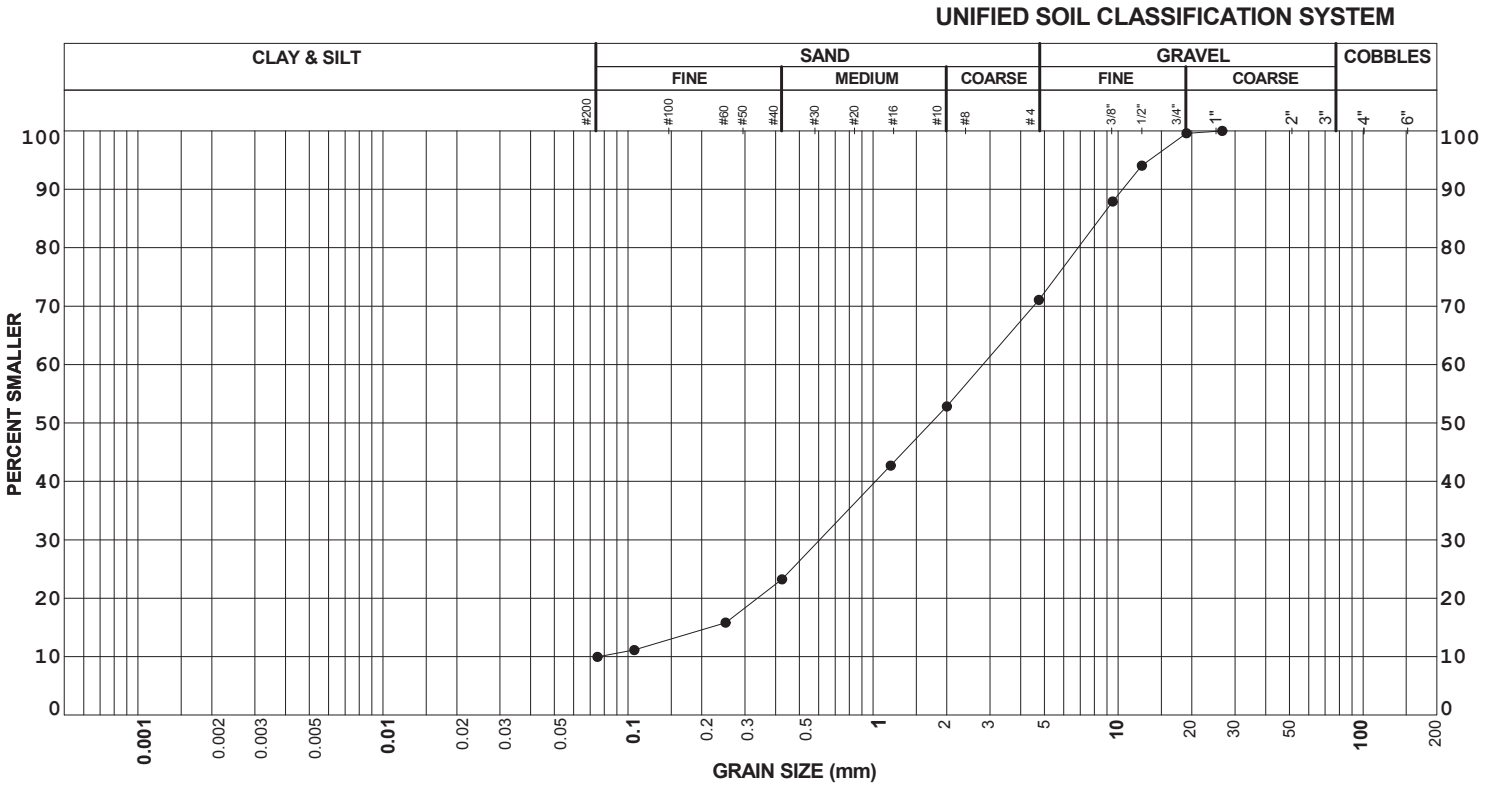
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DS9	15.00	29	61	10		

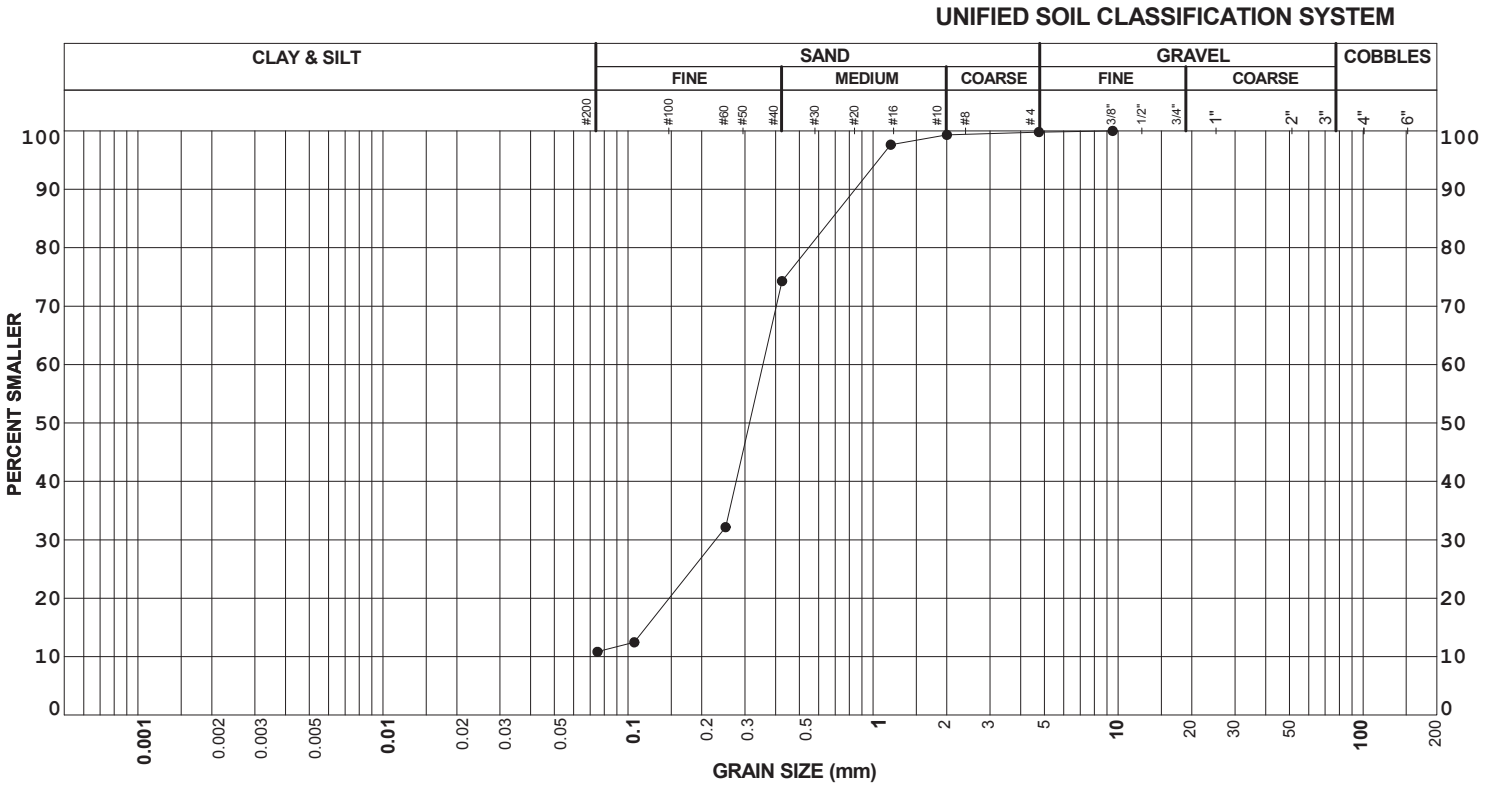
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DS10	17.50	0	89	11		

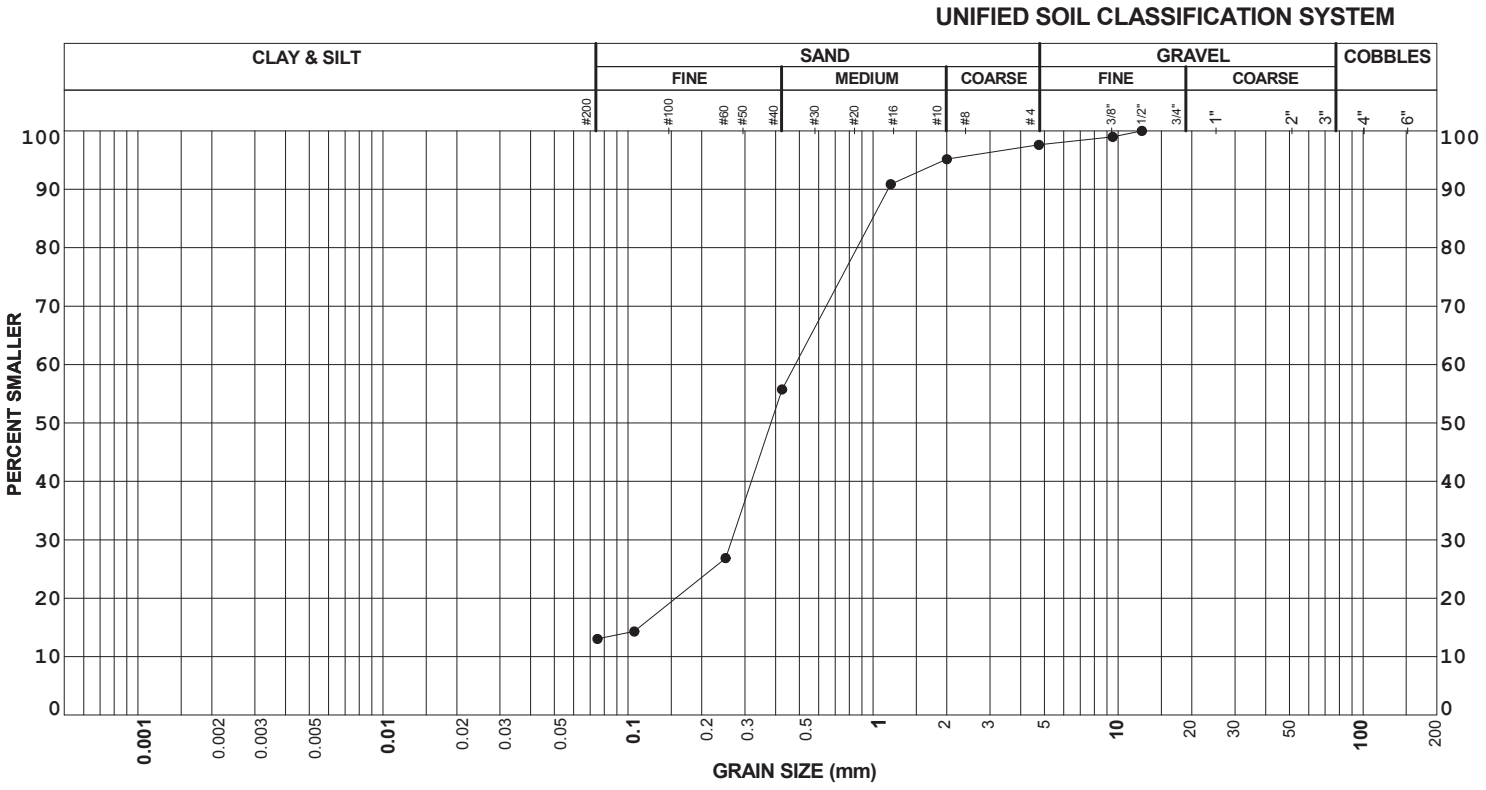
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DQ11	18.00	2	85	13		

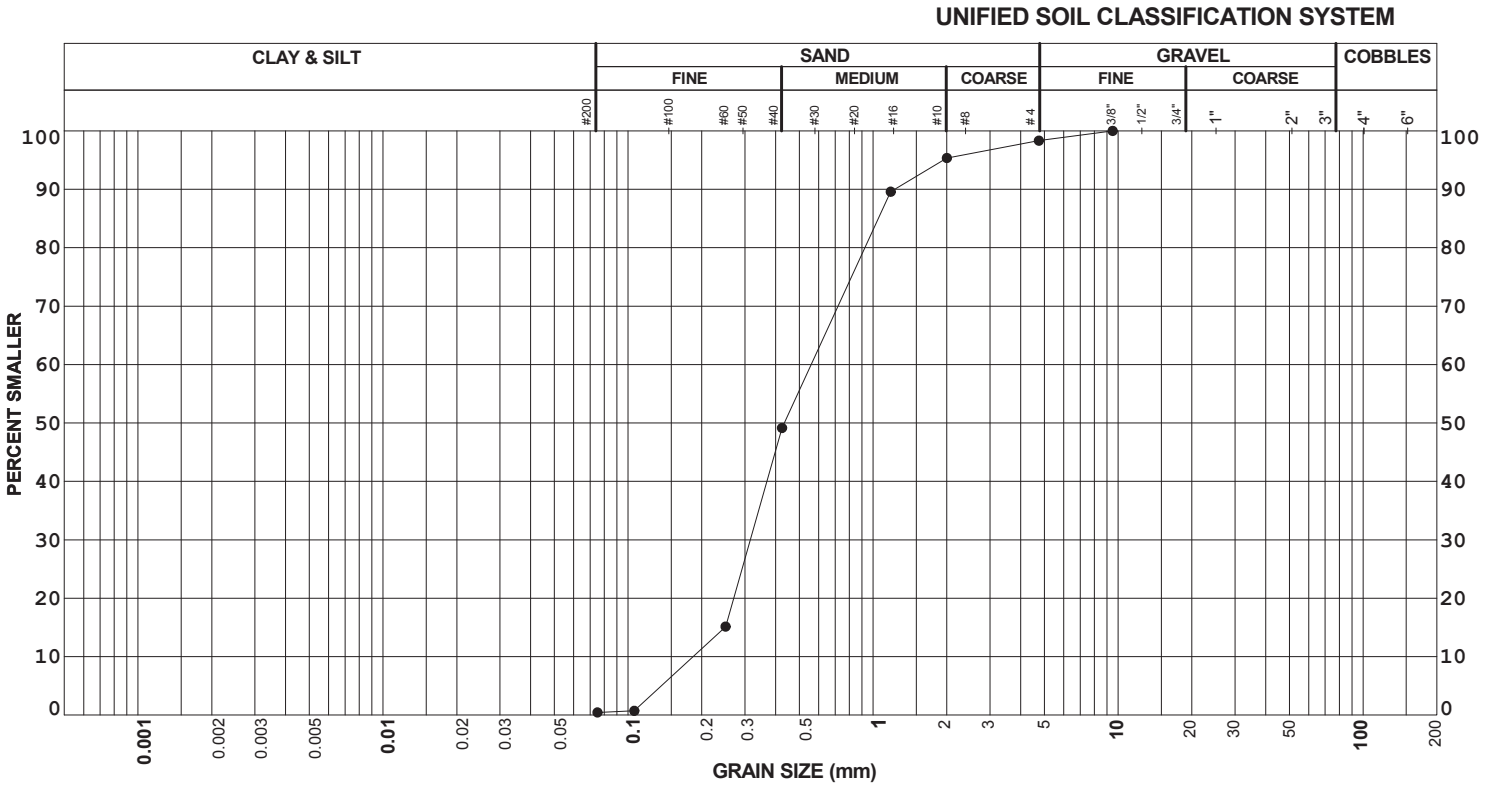
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DQ12	20.51	2	98	0		

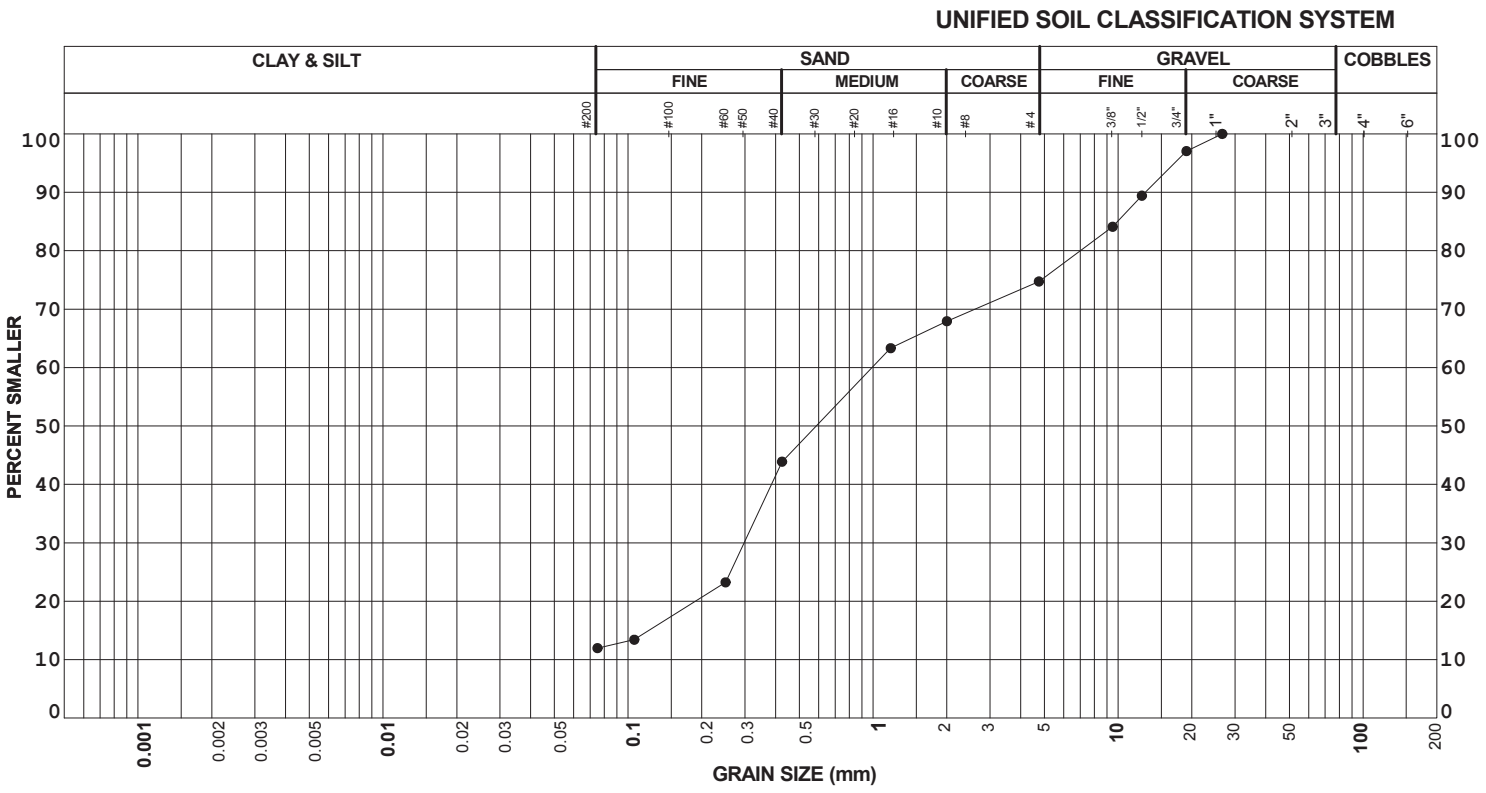
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DS13	23.60	25	63	12		

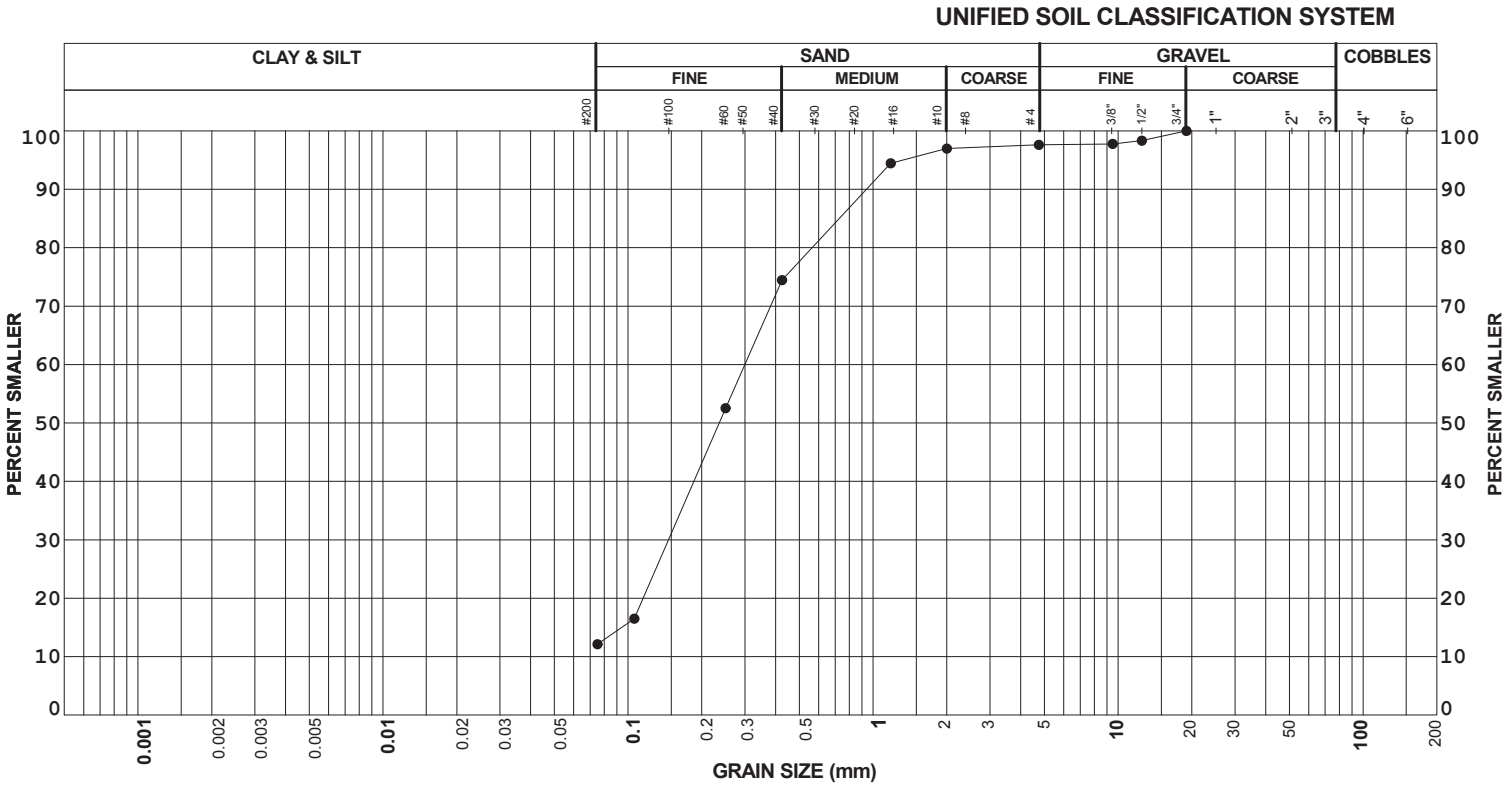
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DS14	26.60	2	86	12		

REMARKS:

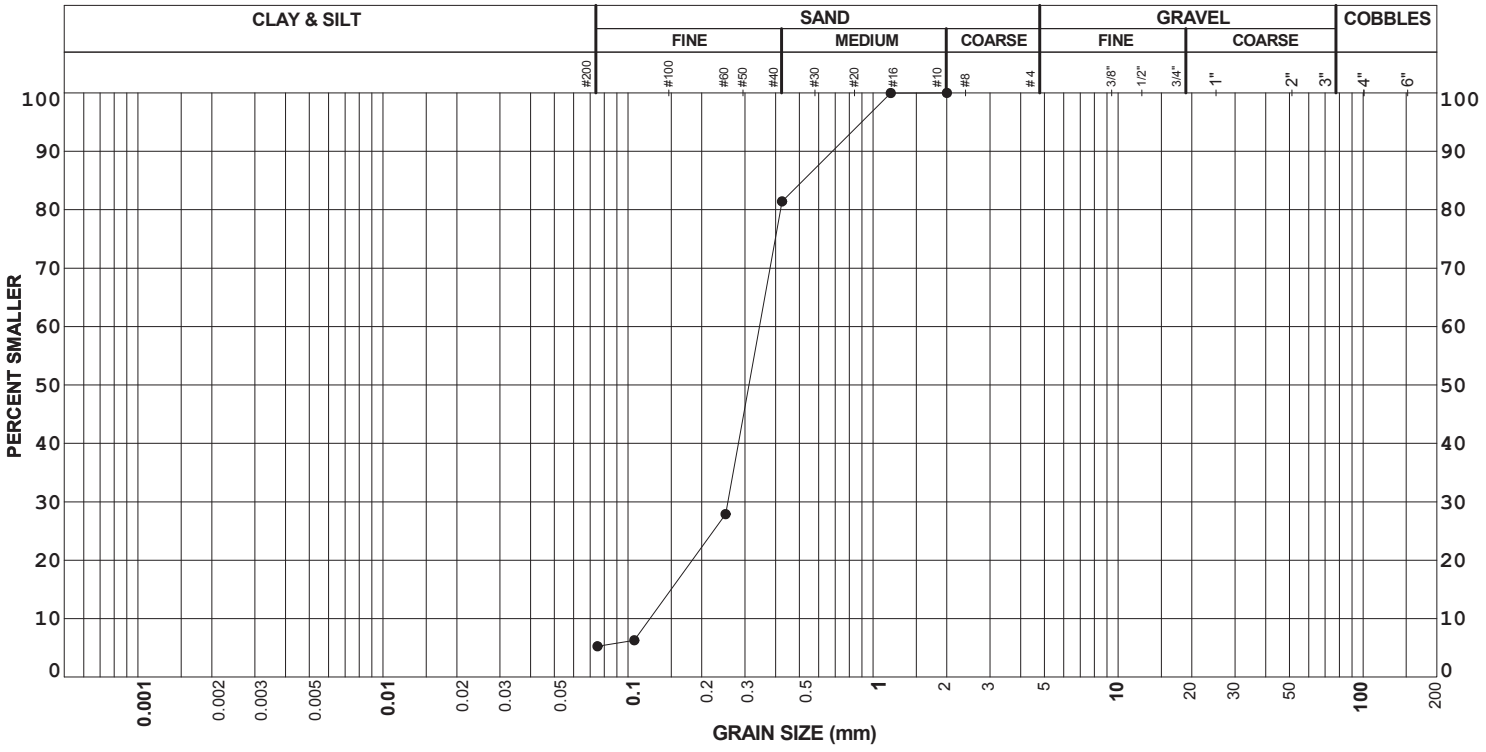
GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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UNIFIED SOIL CLASSIFICATION SYSTEM



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DQ15	29.80	0	95	5		

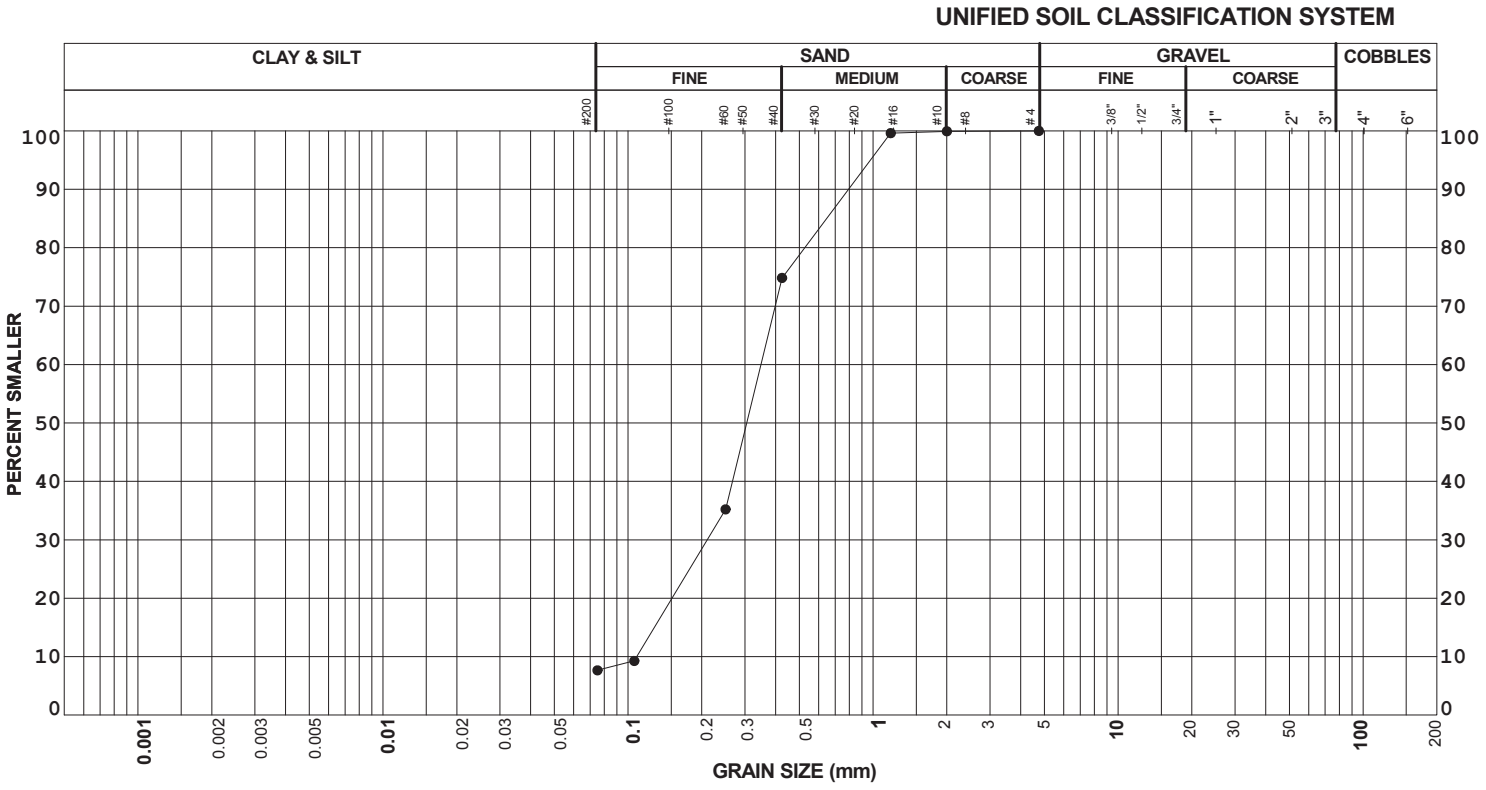
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DQ16	32.90	0	92	8		

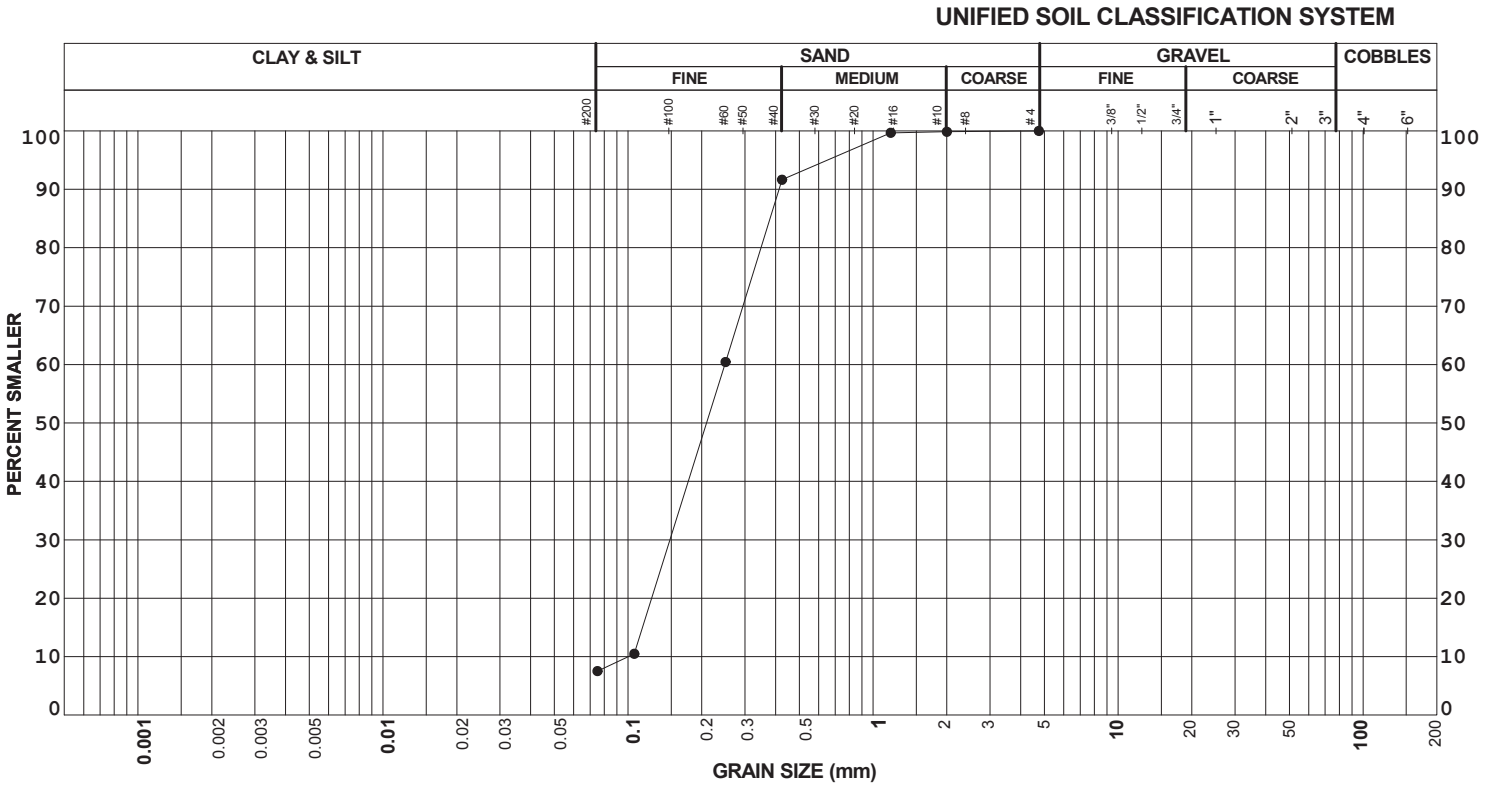
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DQ17	37.40	0	92	8		

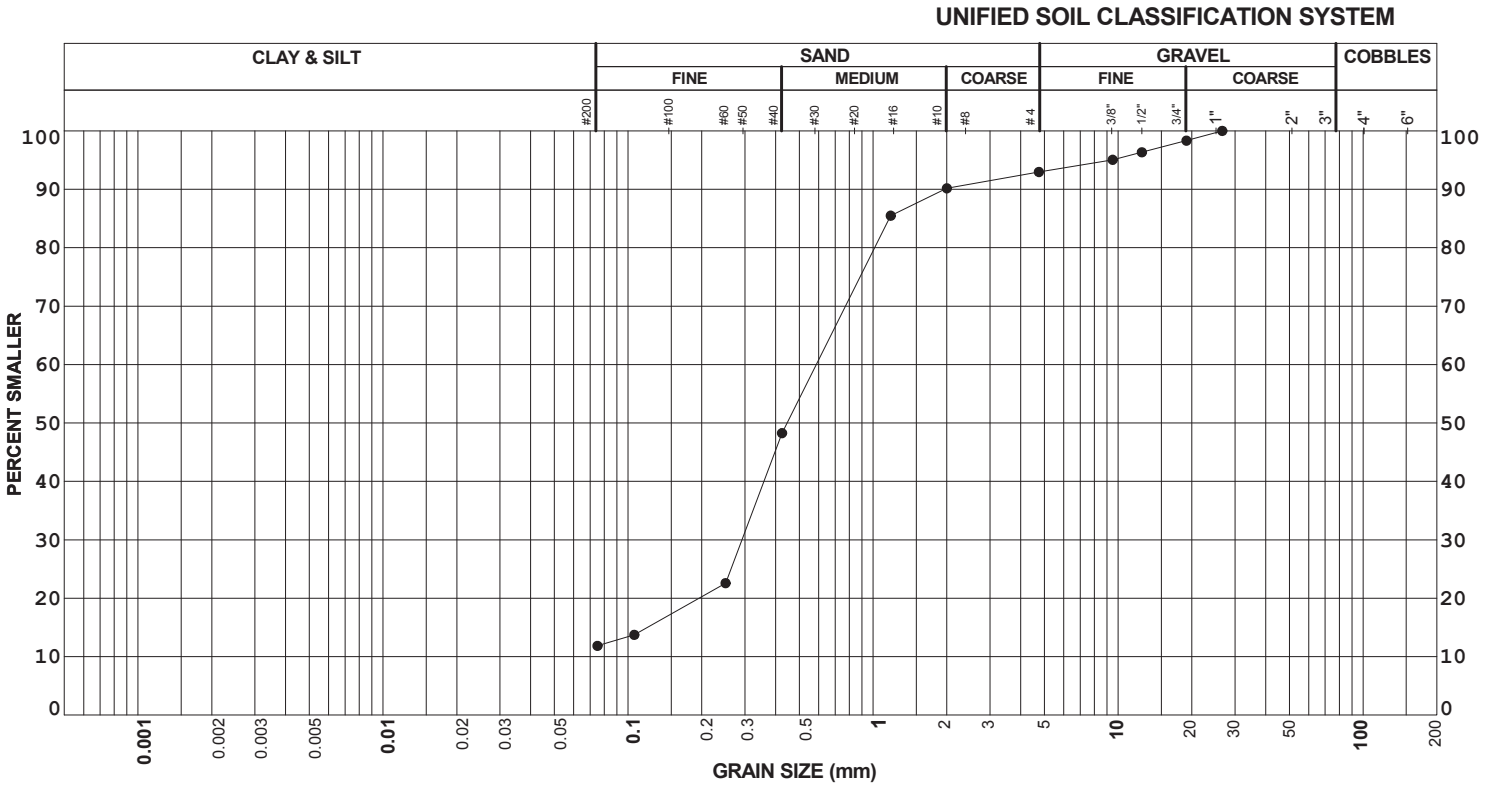
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DS18	39.30	7	81	12		

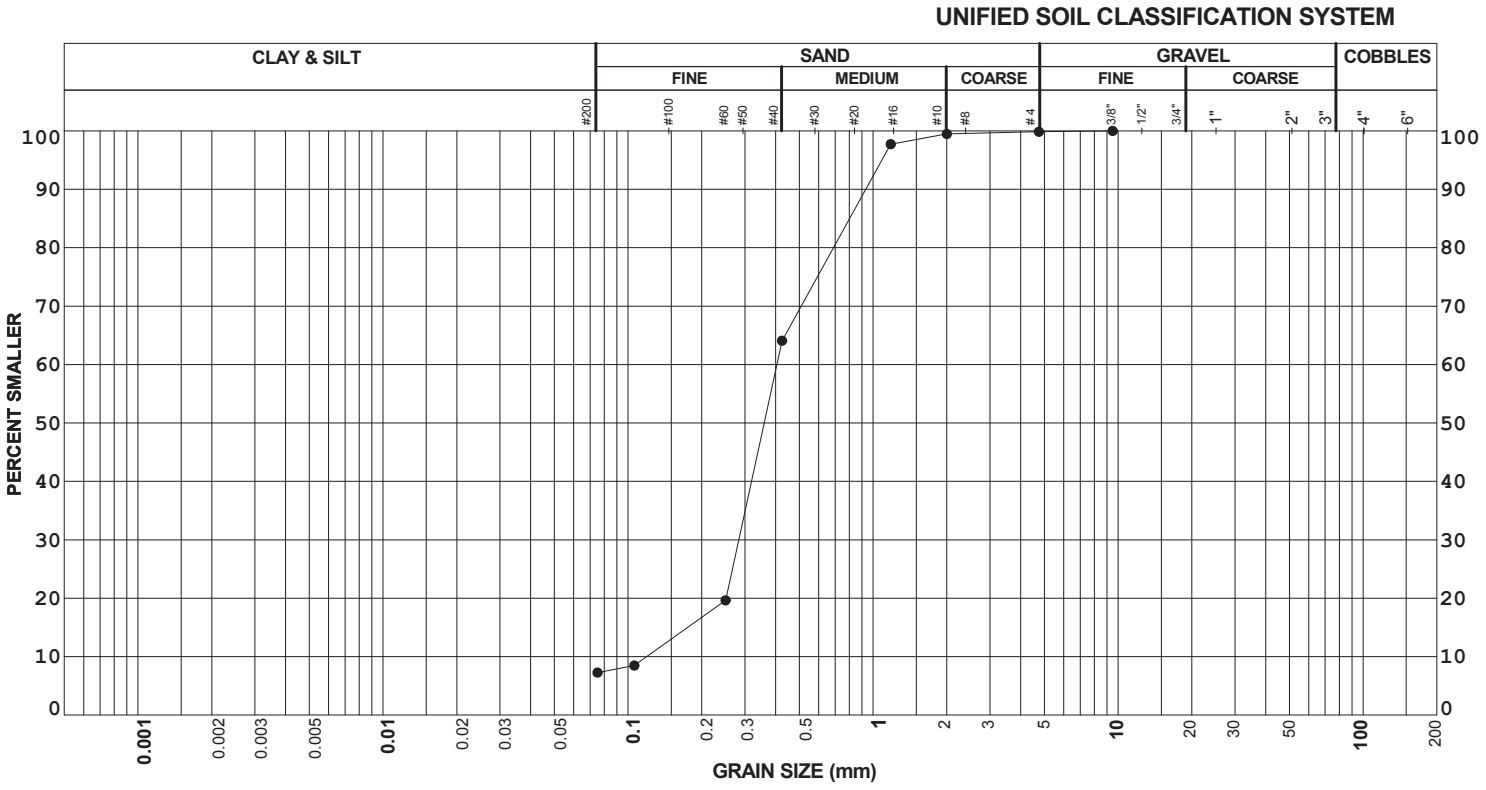
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-8	DQ19	39.40	0	93	7		

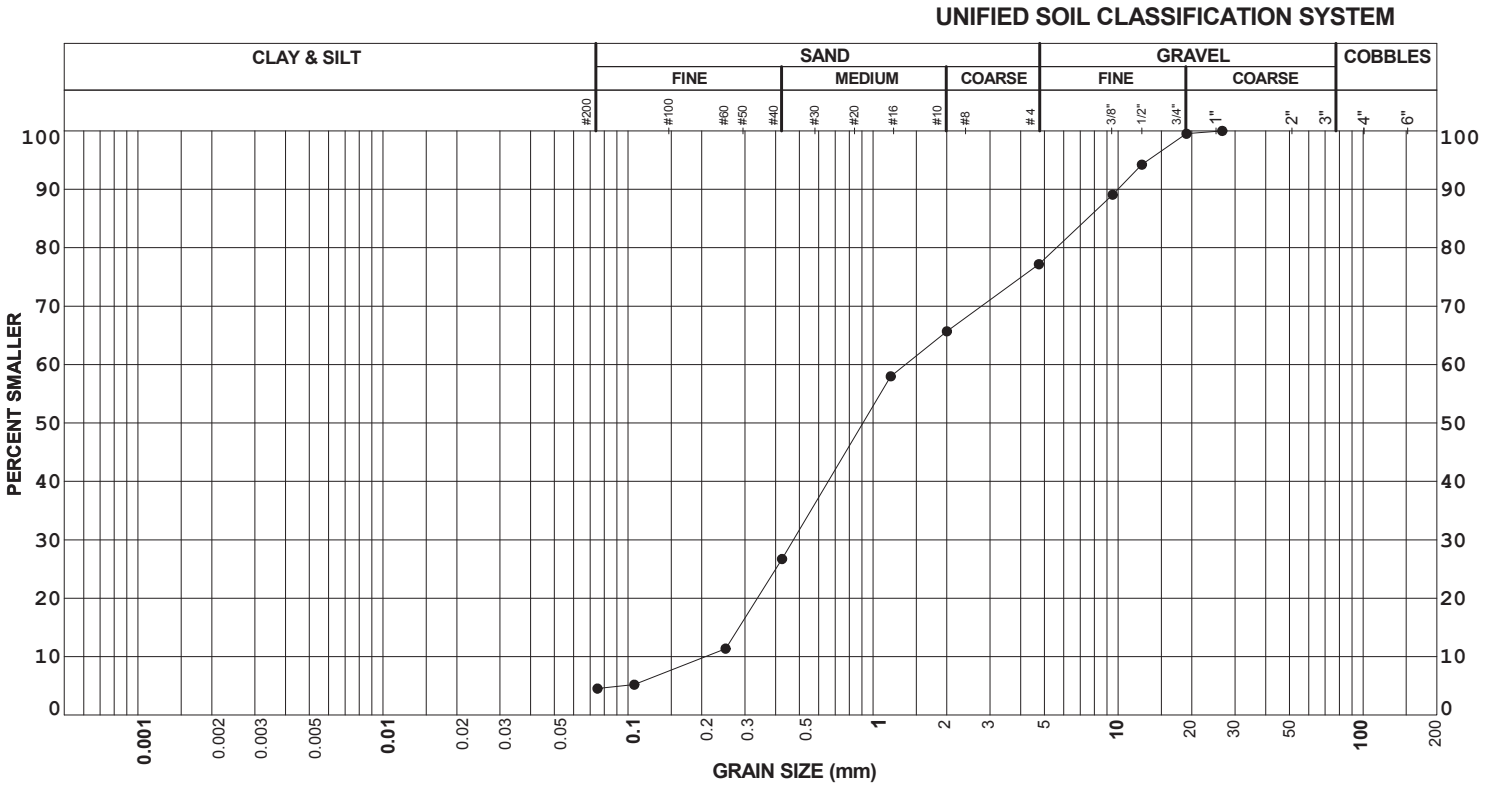
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DS1	3.05	23	73	5		

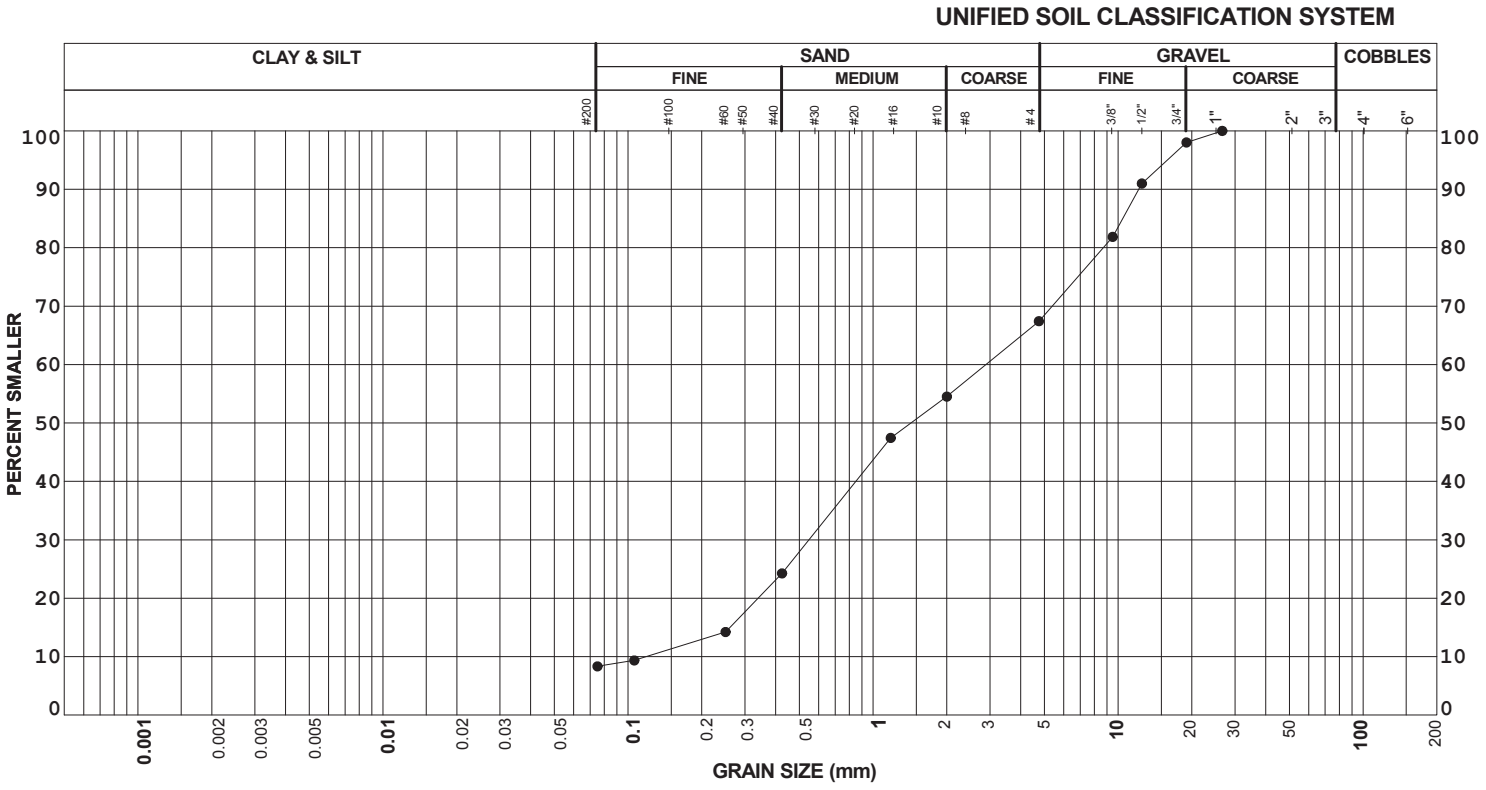
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DQ2	4.40	33	59	8		

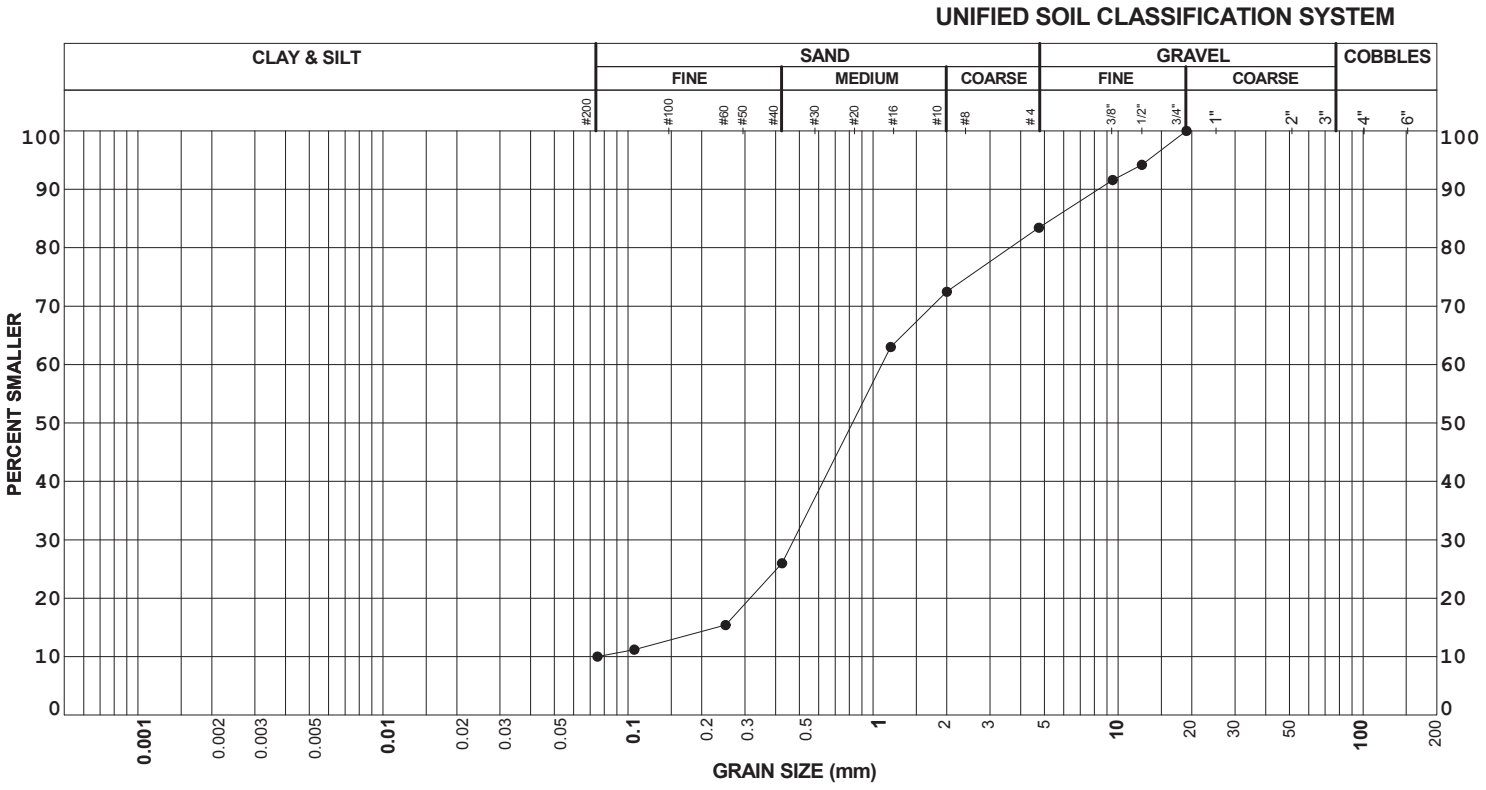
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DS3	6.00	17	73	10		

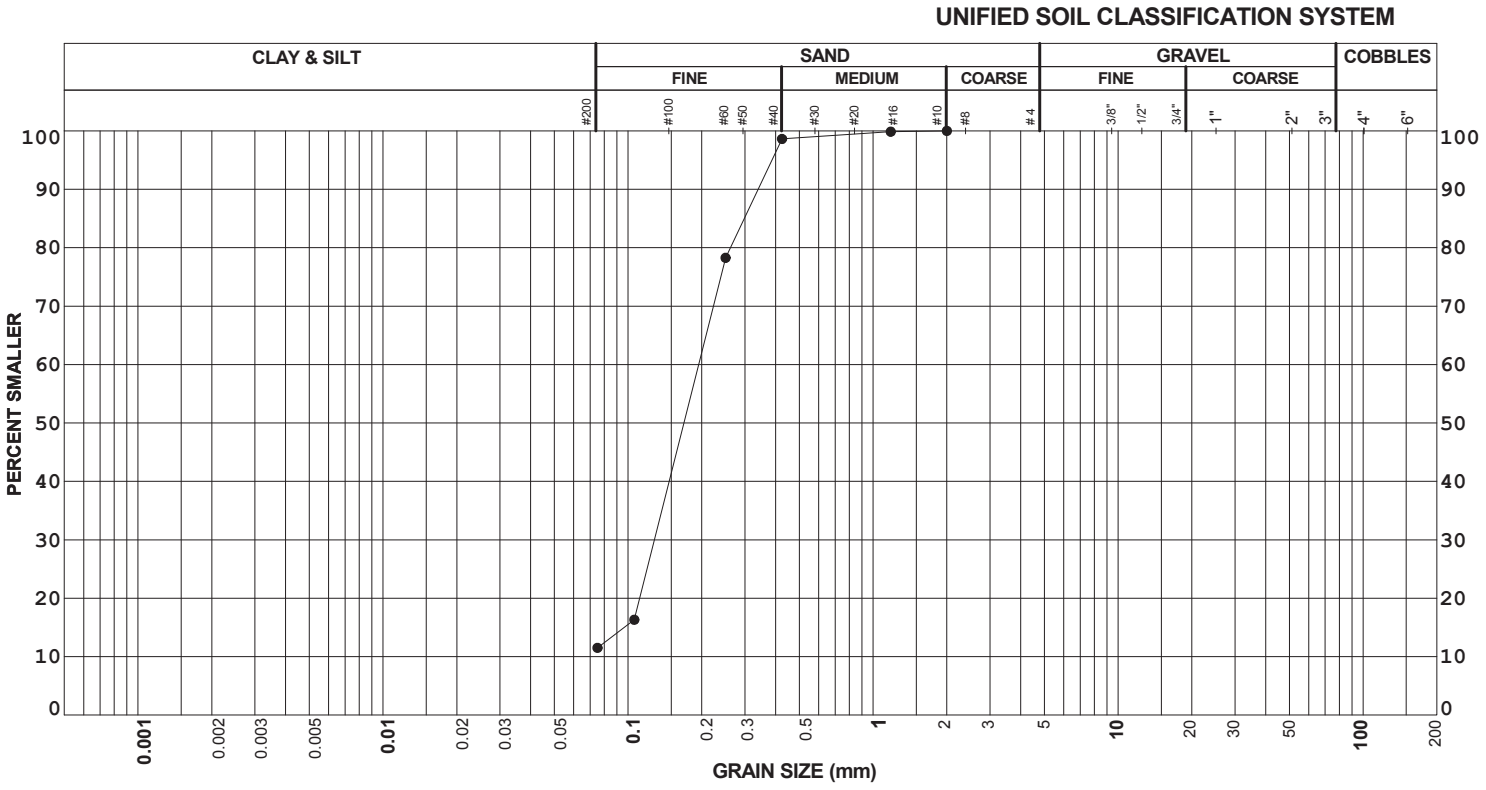
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DQ4	8.80	0	88	12		

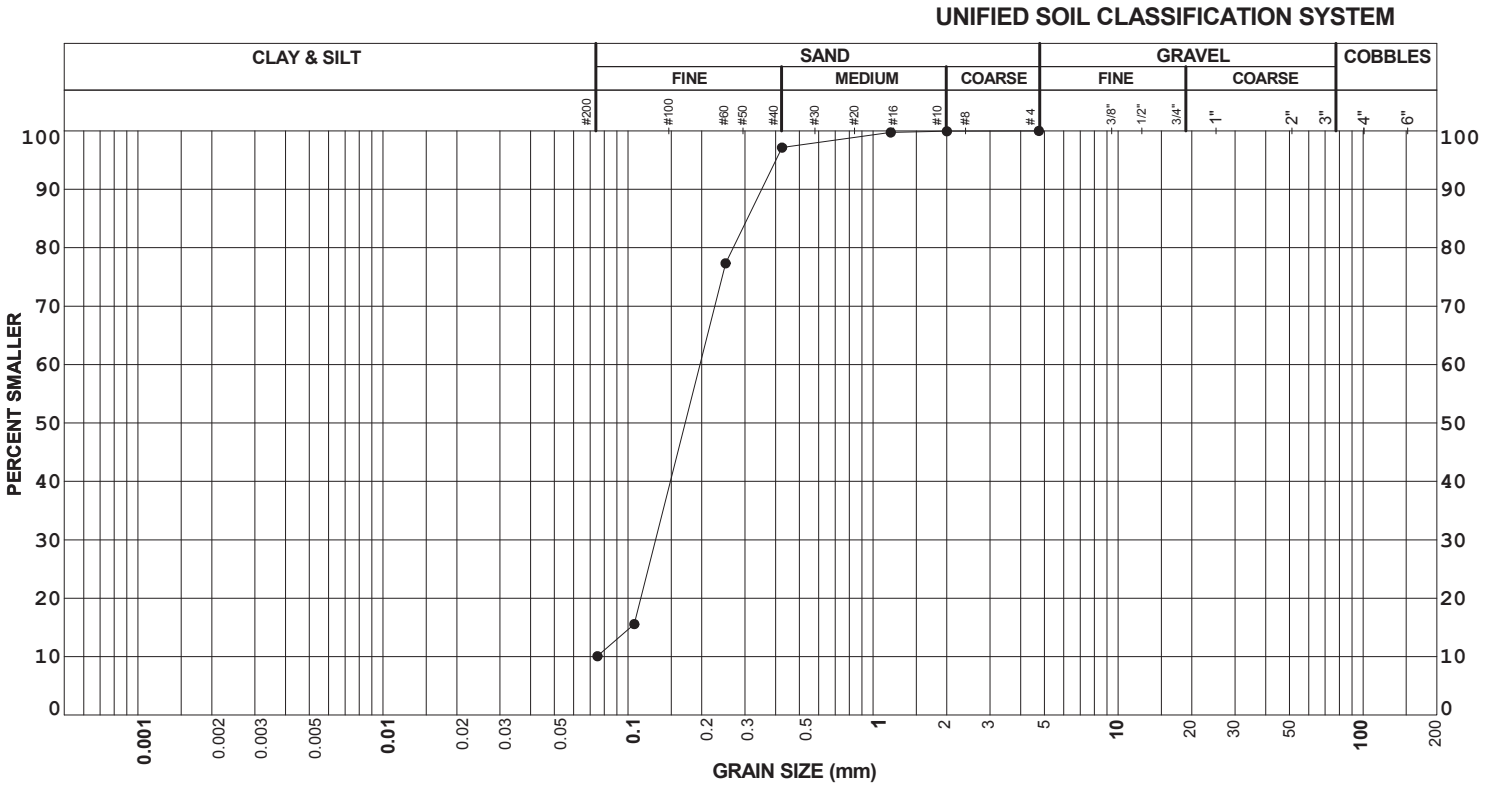
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DQ5	9.12	0	90	10		

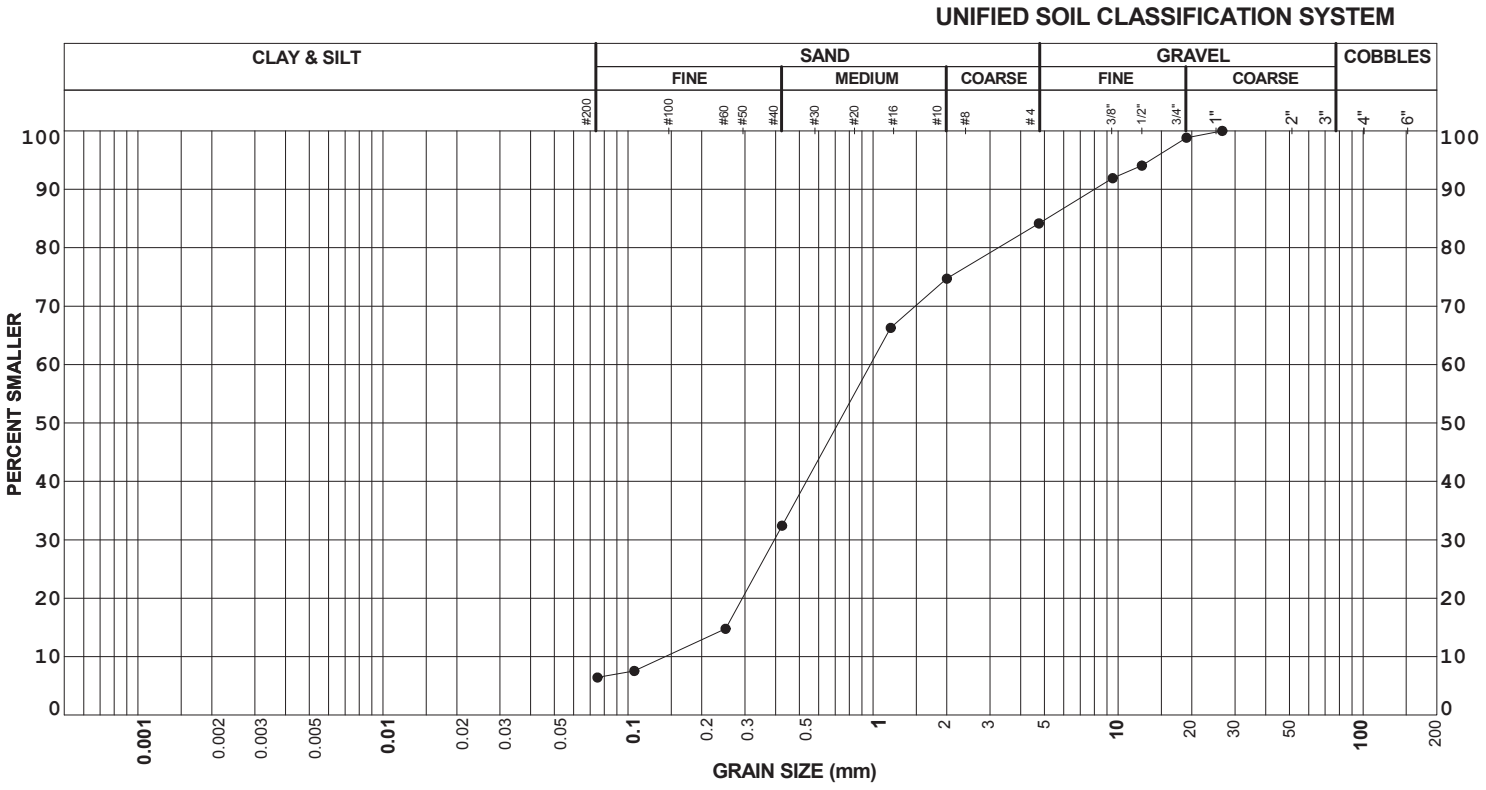
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DS6	11.00	16	78	6		

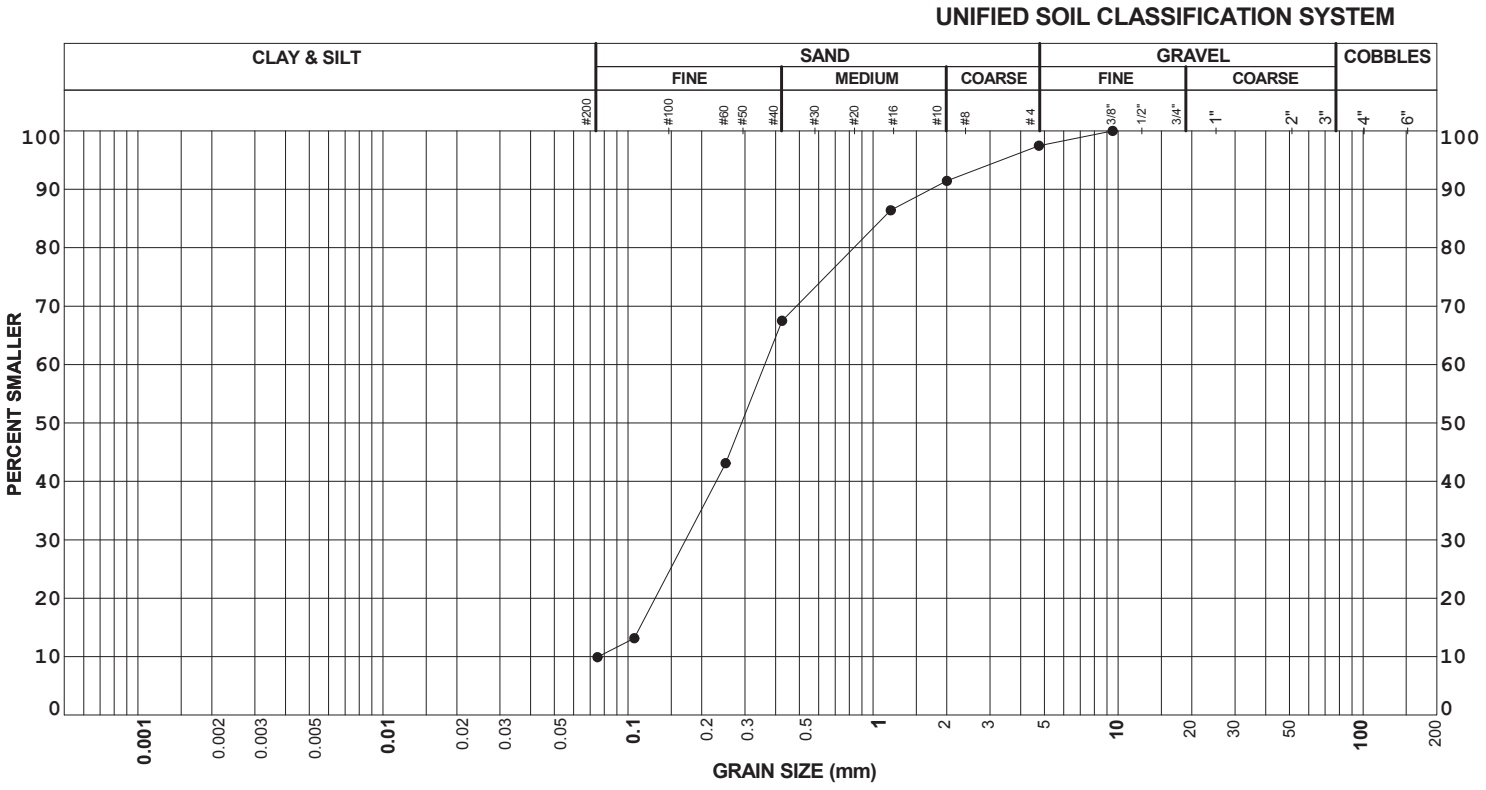
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DQ7	14.30	3	88	10		

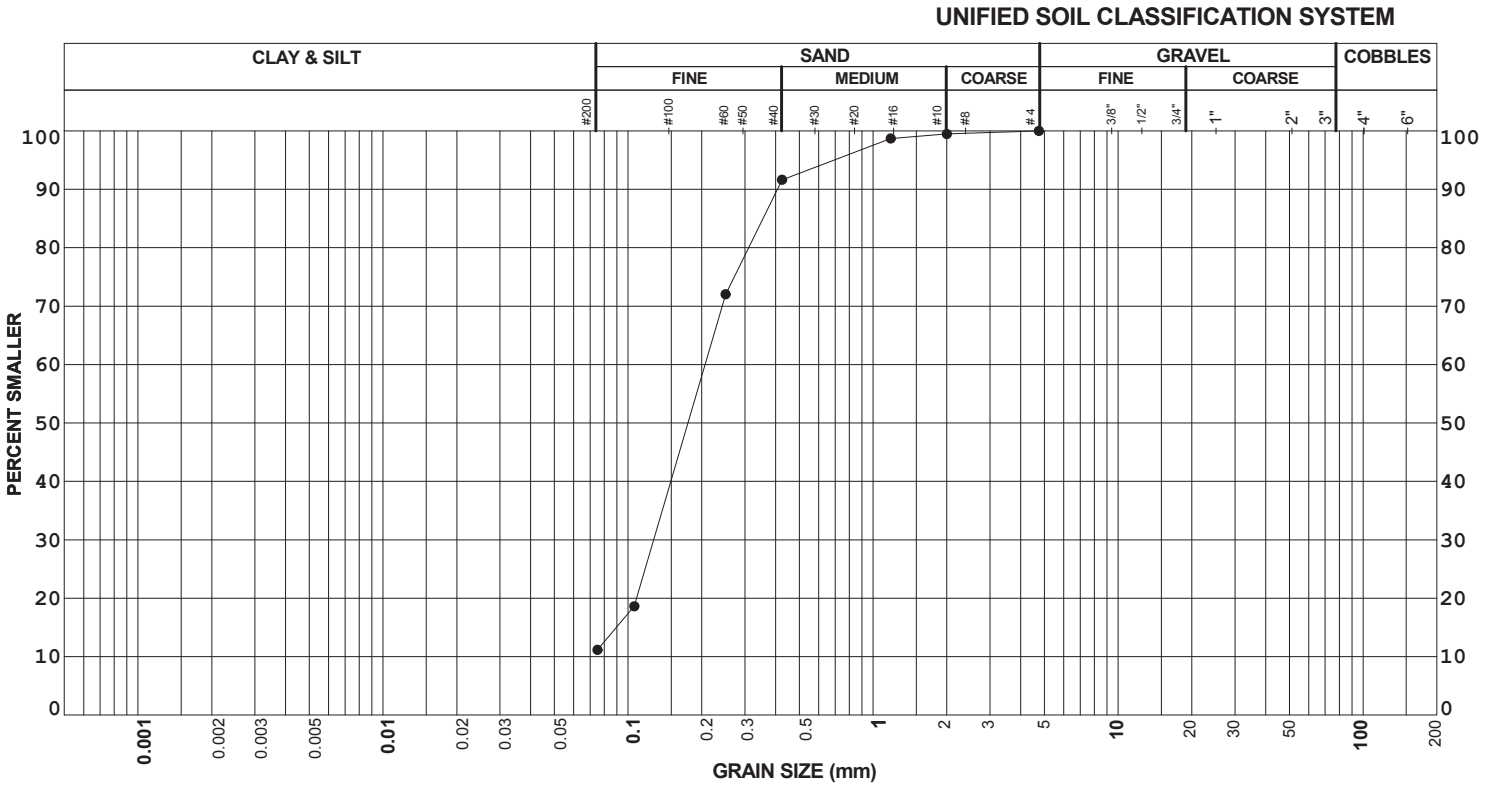
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DQ9	17.25	0	89	11		

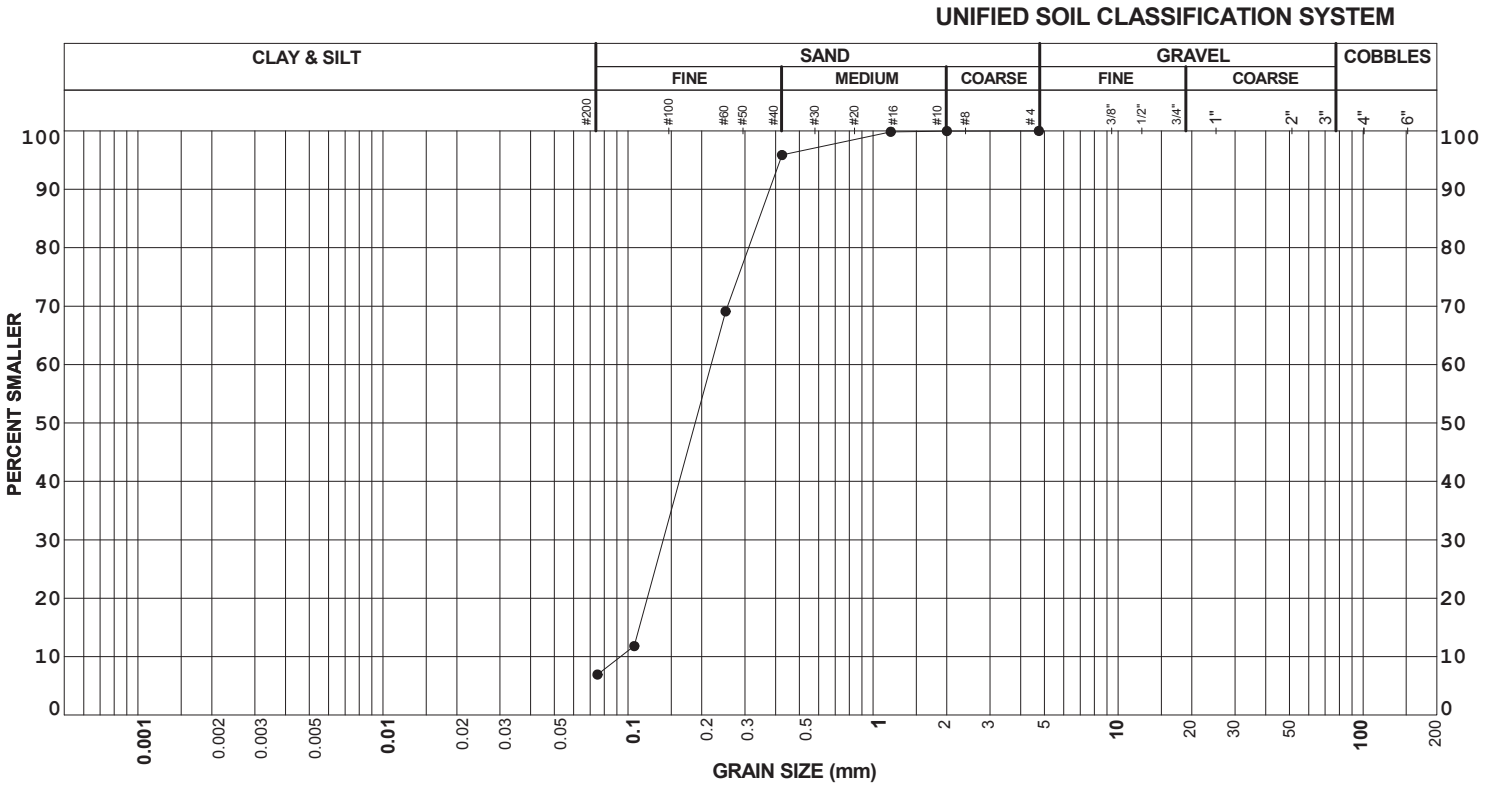
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DQ10	18.00	0	93	7		

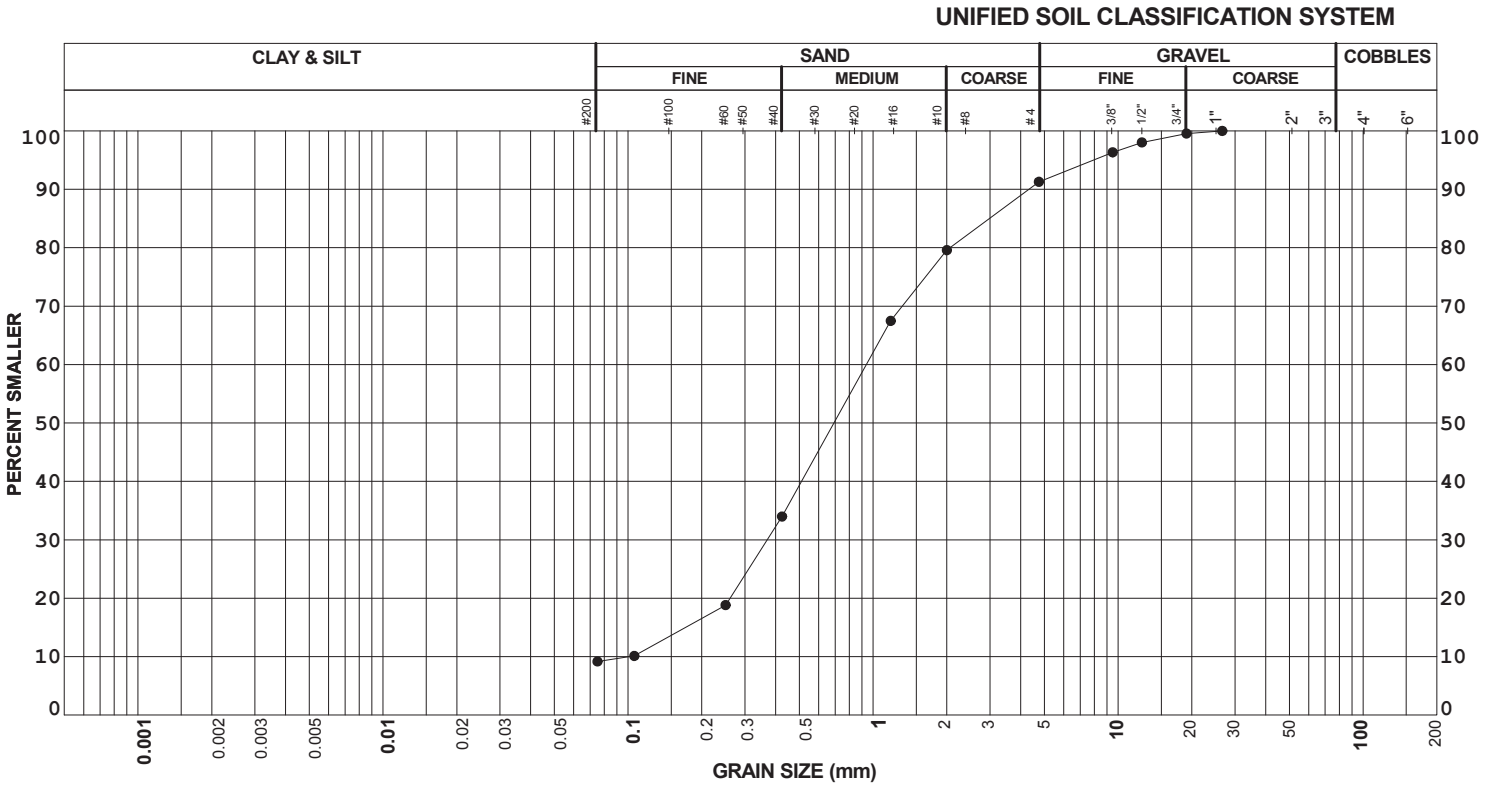
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DS11	19.76	9	82	9		

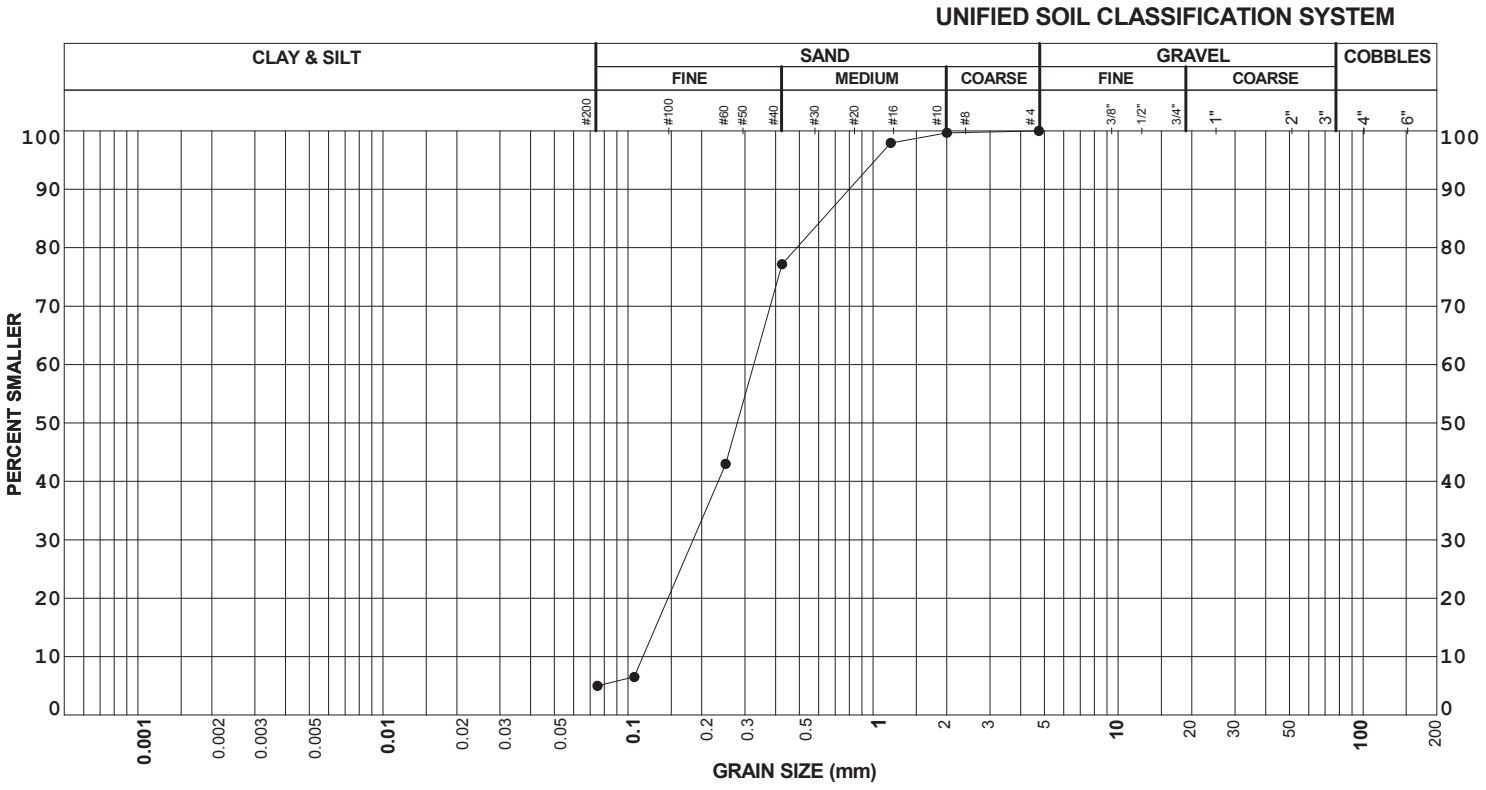
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DQ12	22.50	0	95	5		

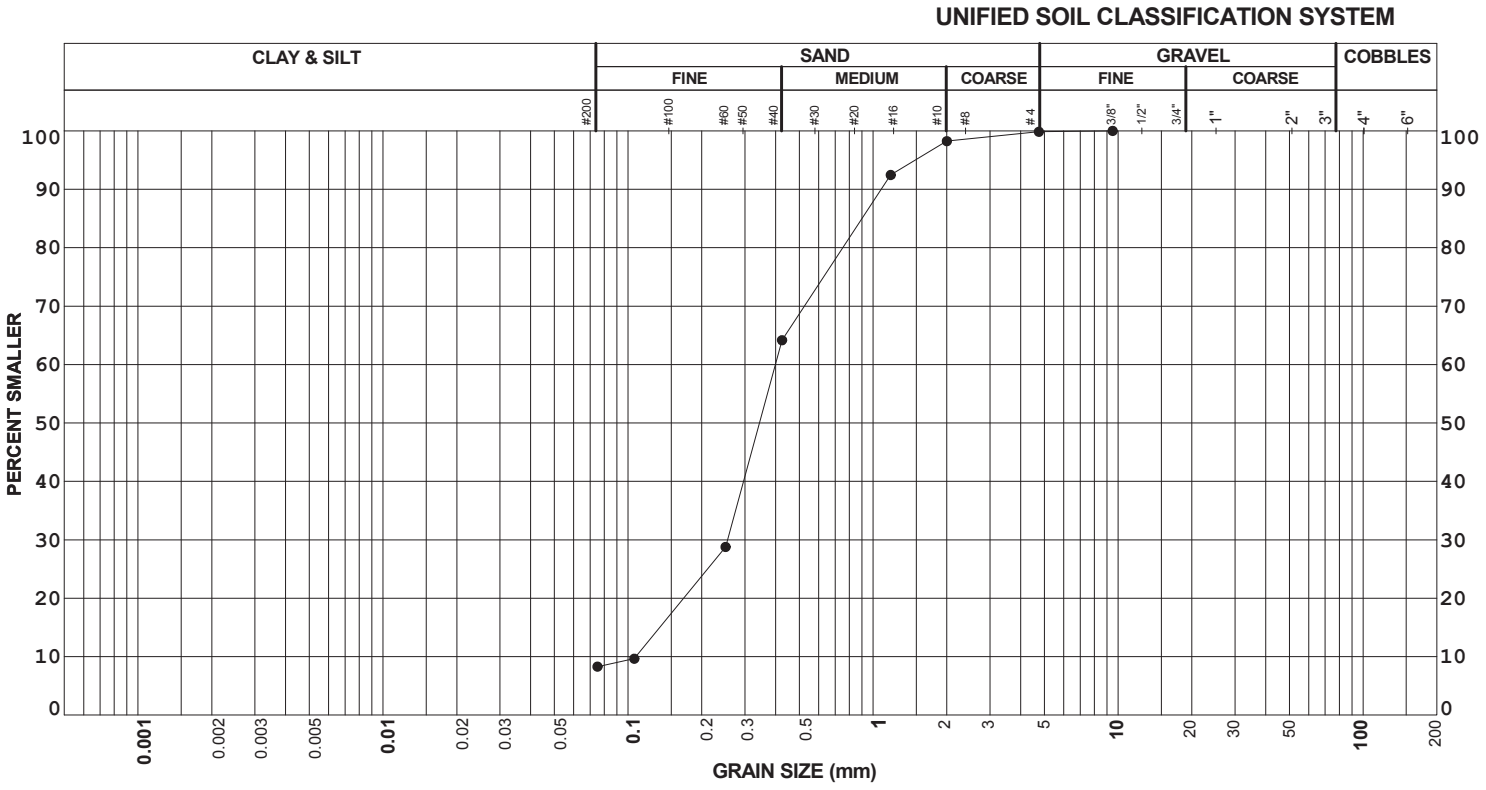
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DQ13	24.00	0	92	8		

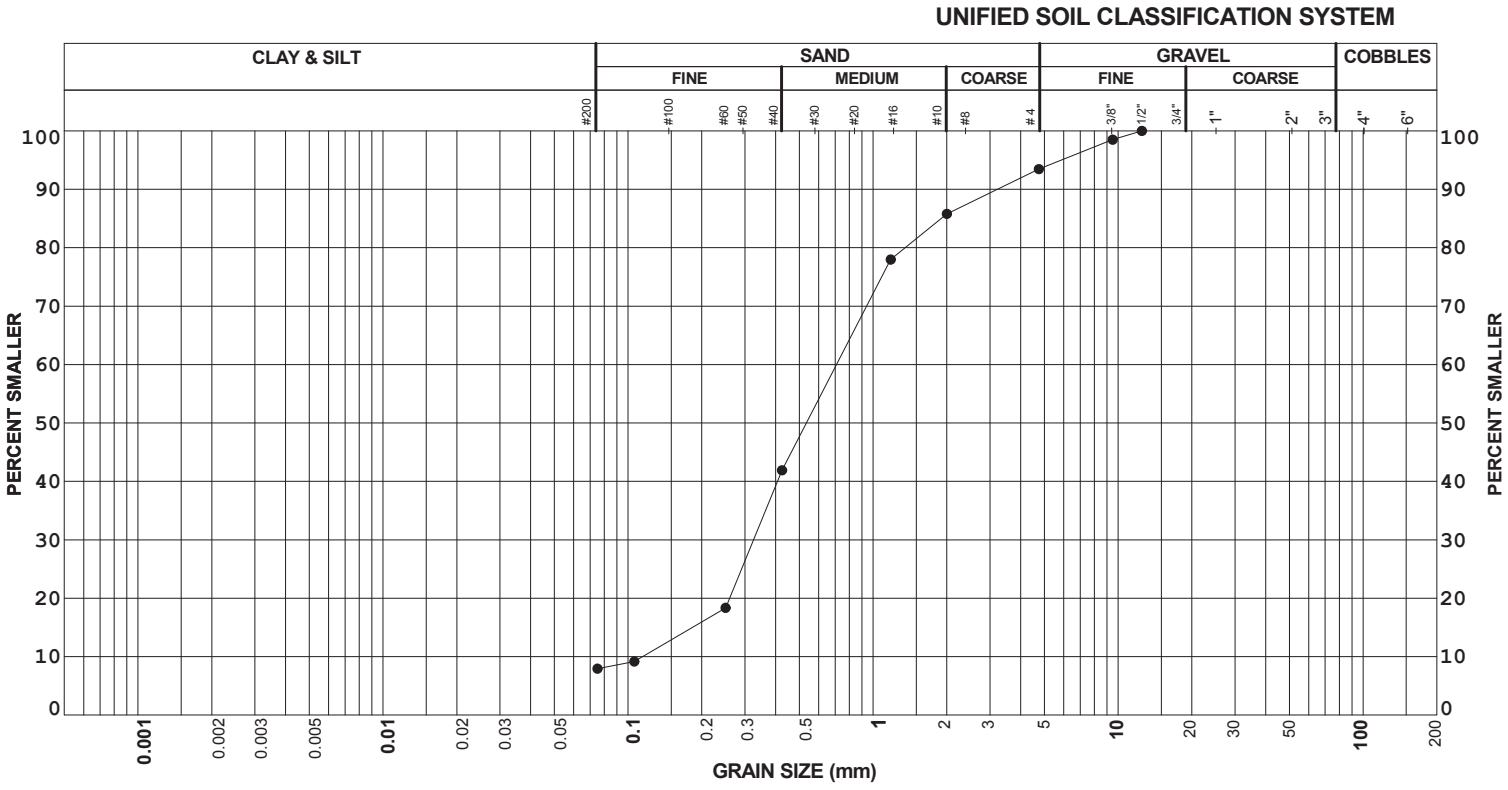
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DQ14	27.00	7	86	8		

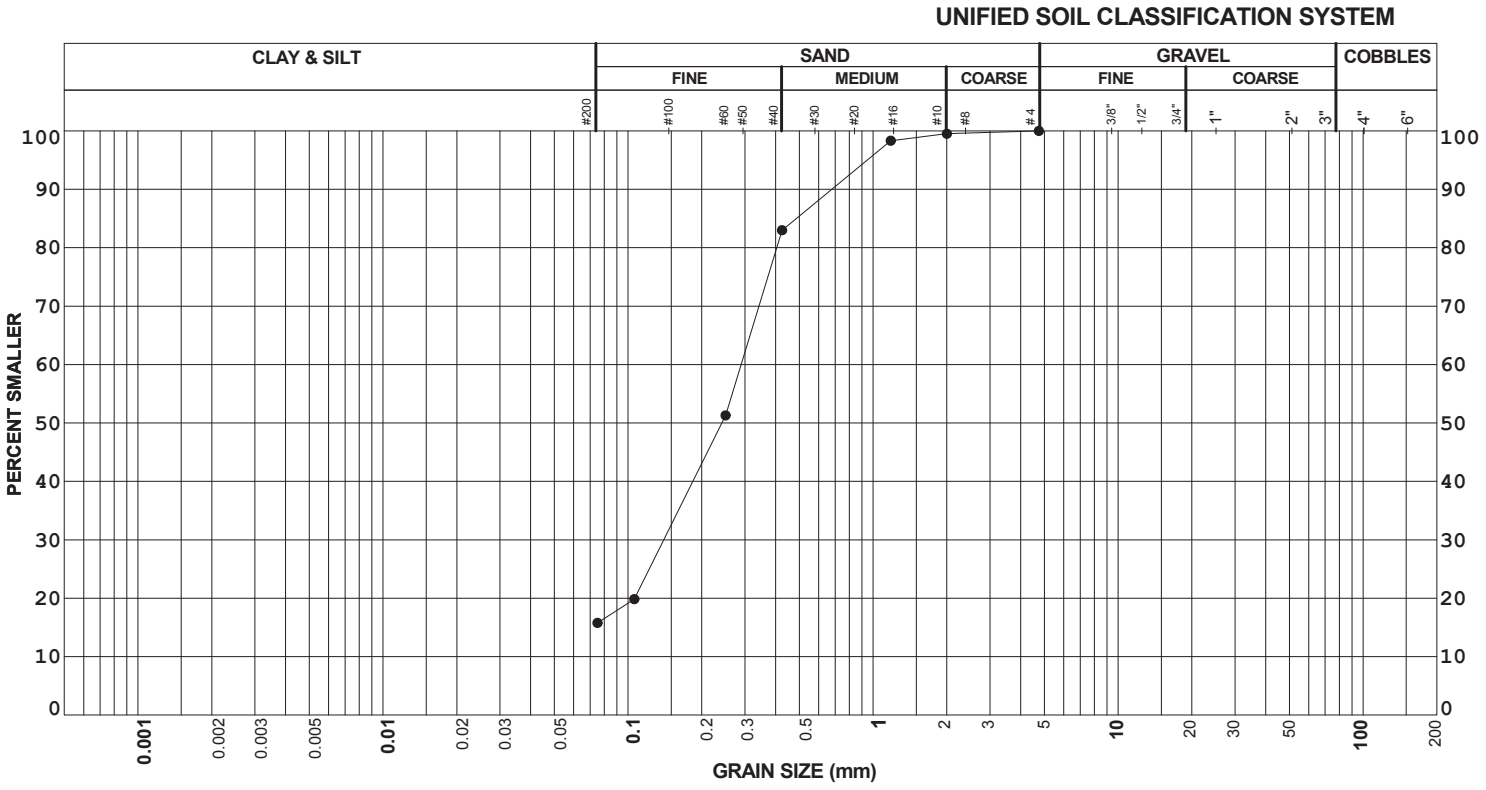
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DQ15	27.40	0	84	16		

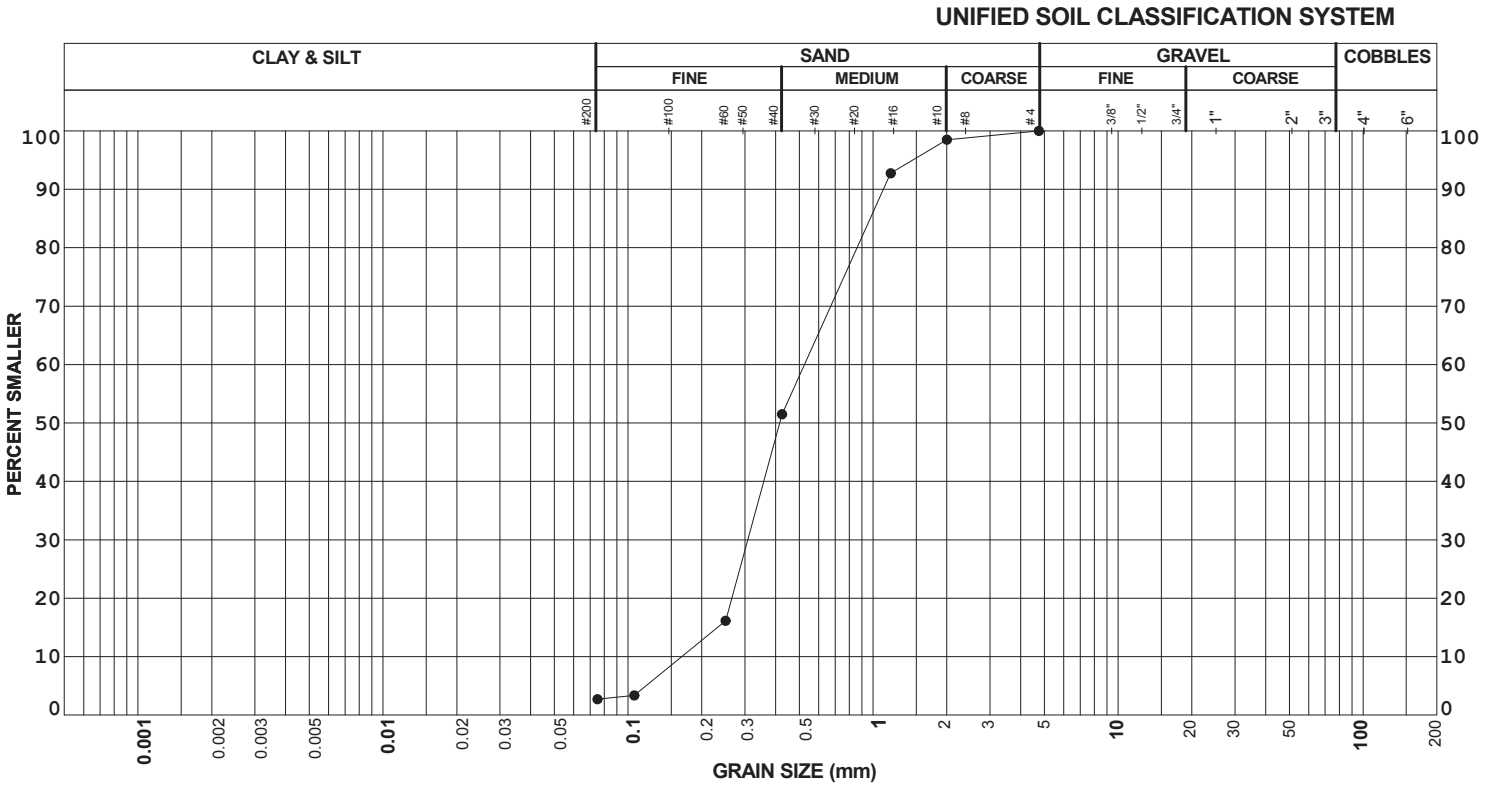
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DQ16	28.88	0	97	3		

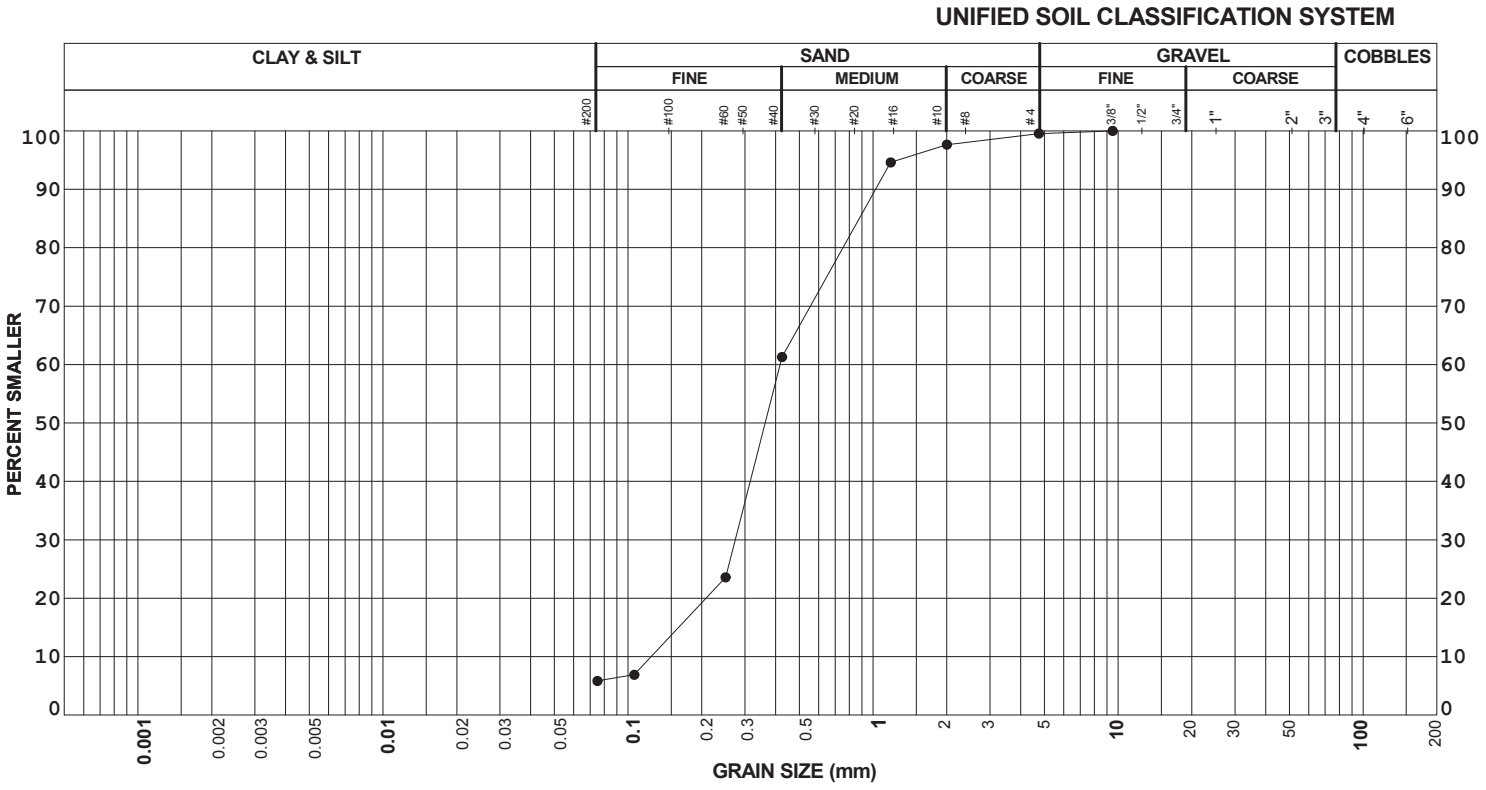
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DQ17	31.50	0	94	6		

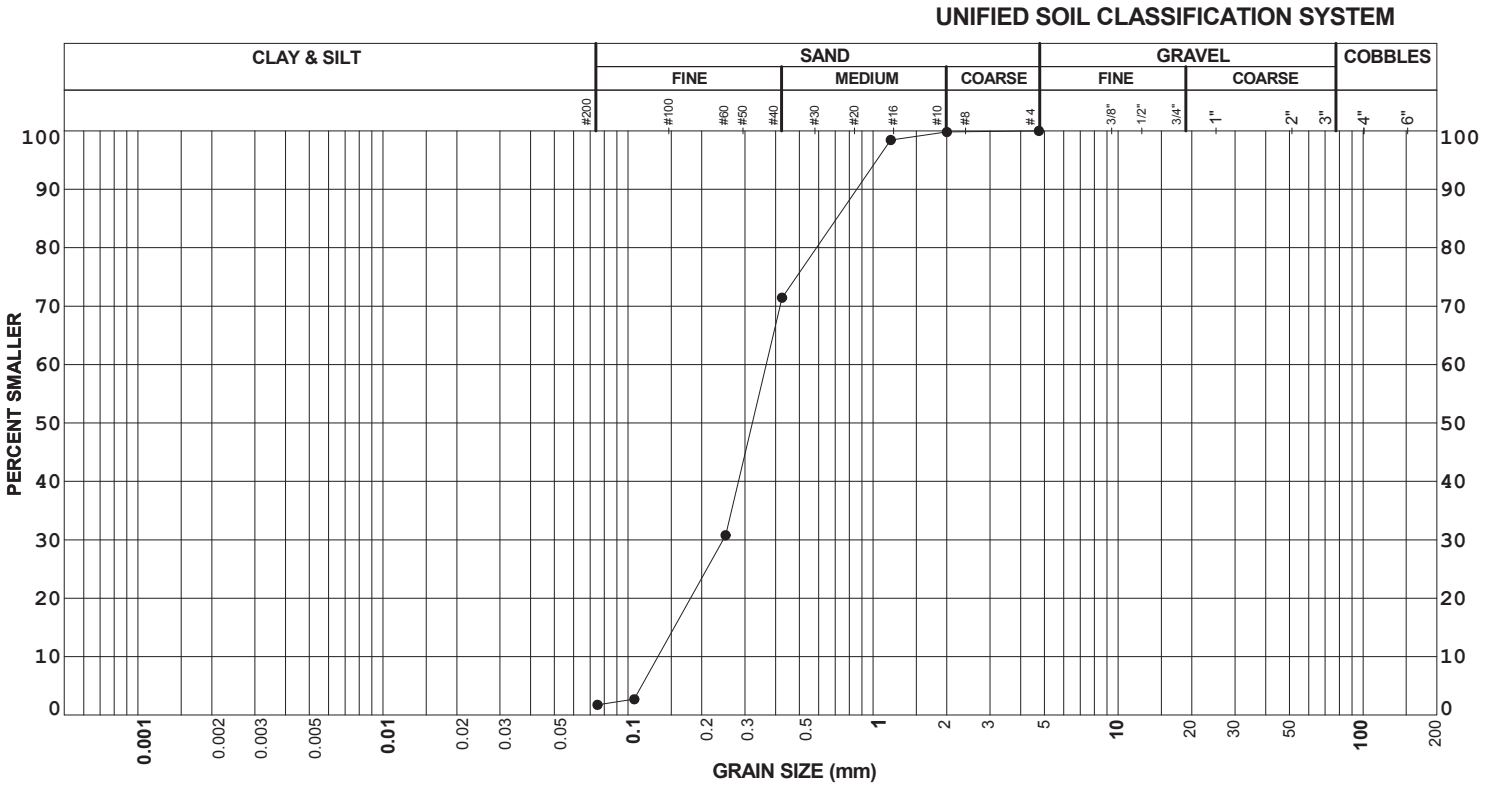
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-EBC-9	DQ19	39.00	0	98	2		

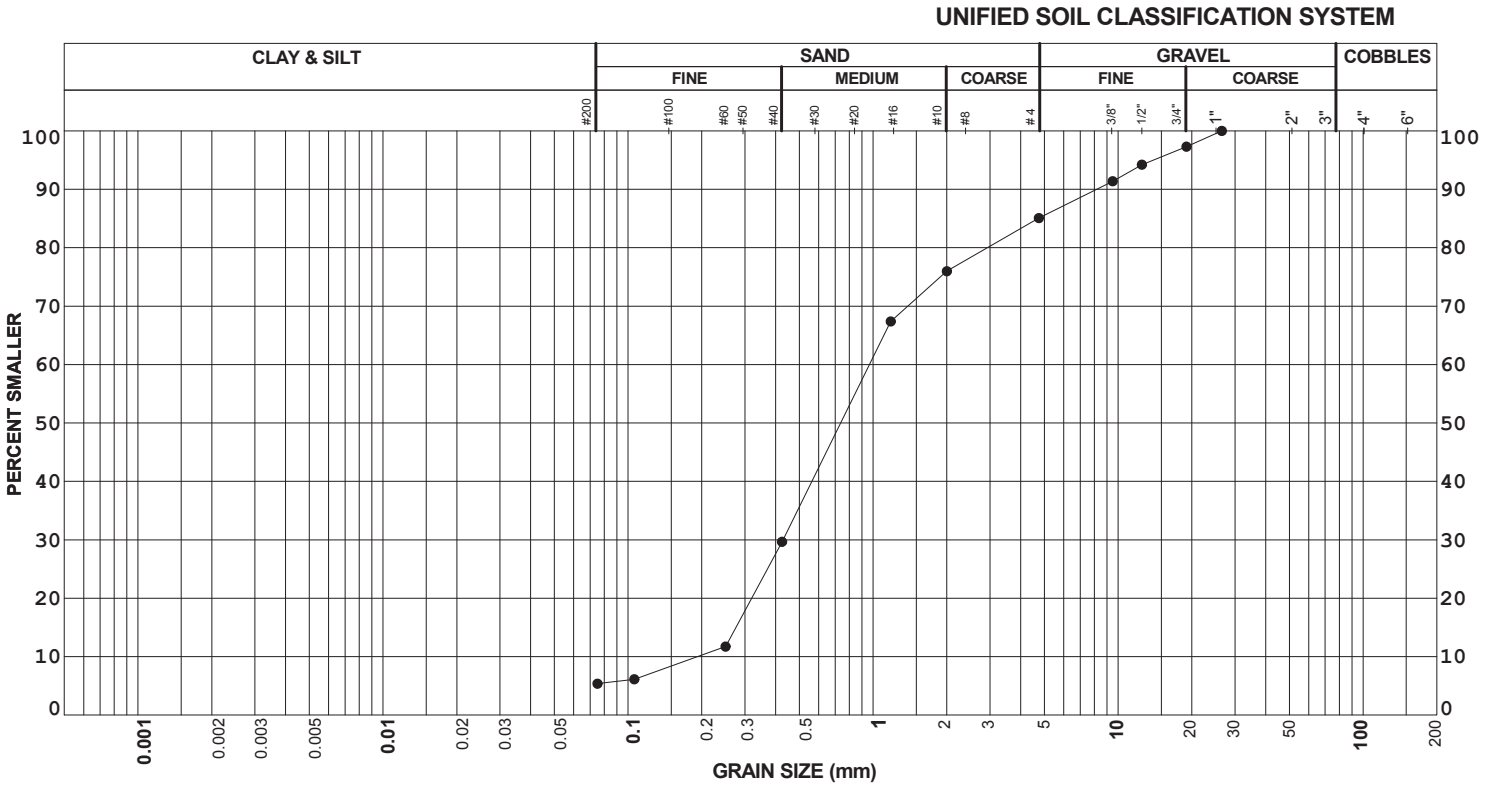
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-RD-1	DS1	5.00	15	80	5		

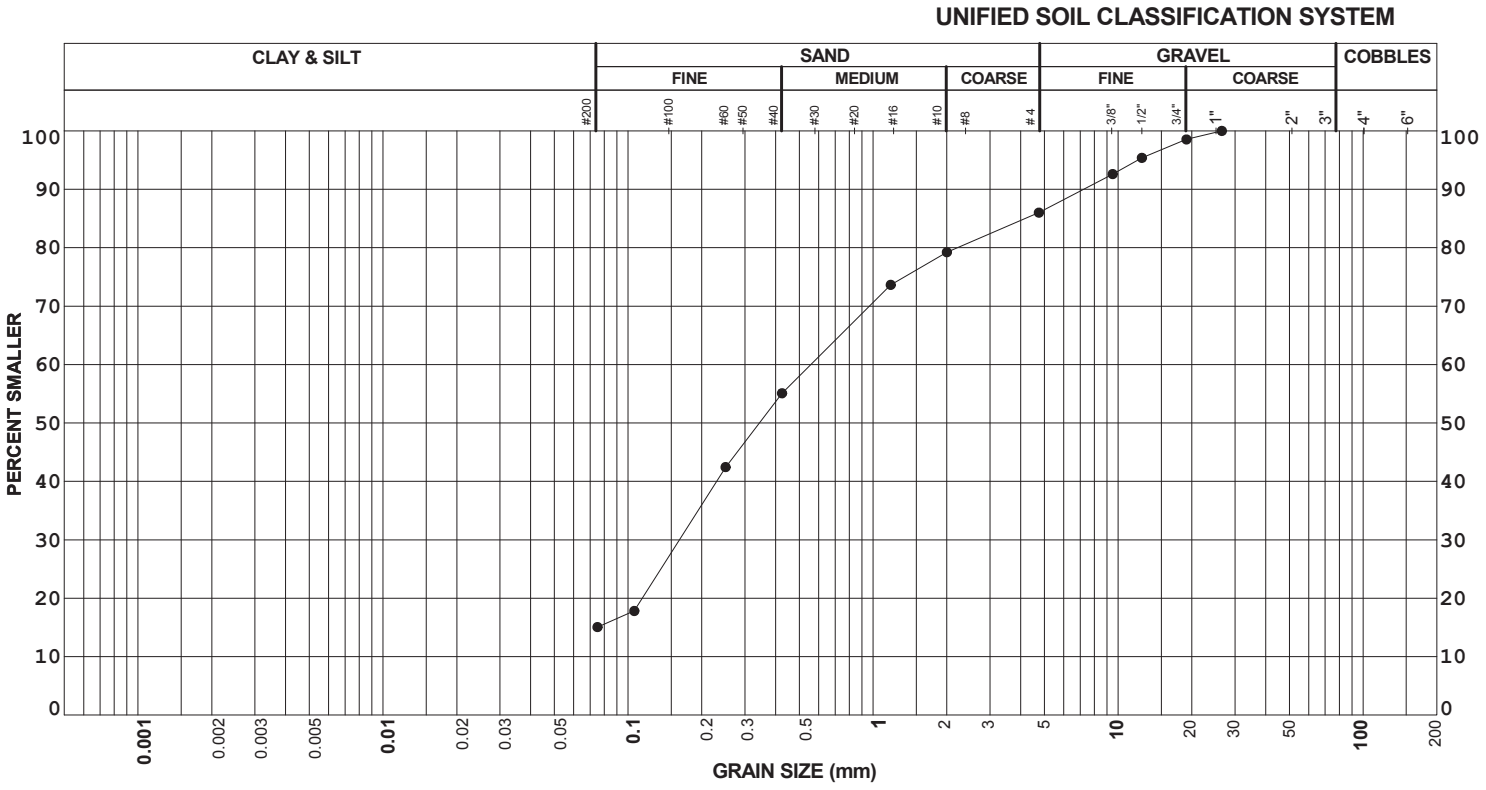
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-RD-1C	DS1	1.00	14	71	15		

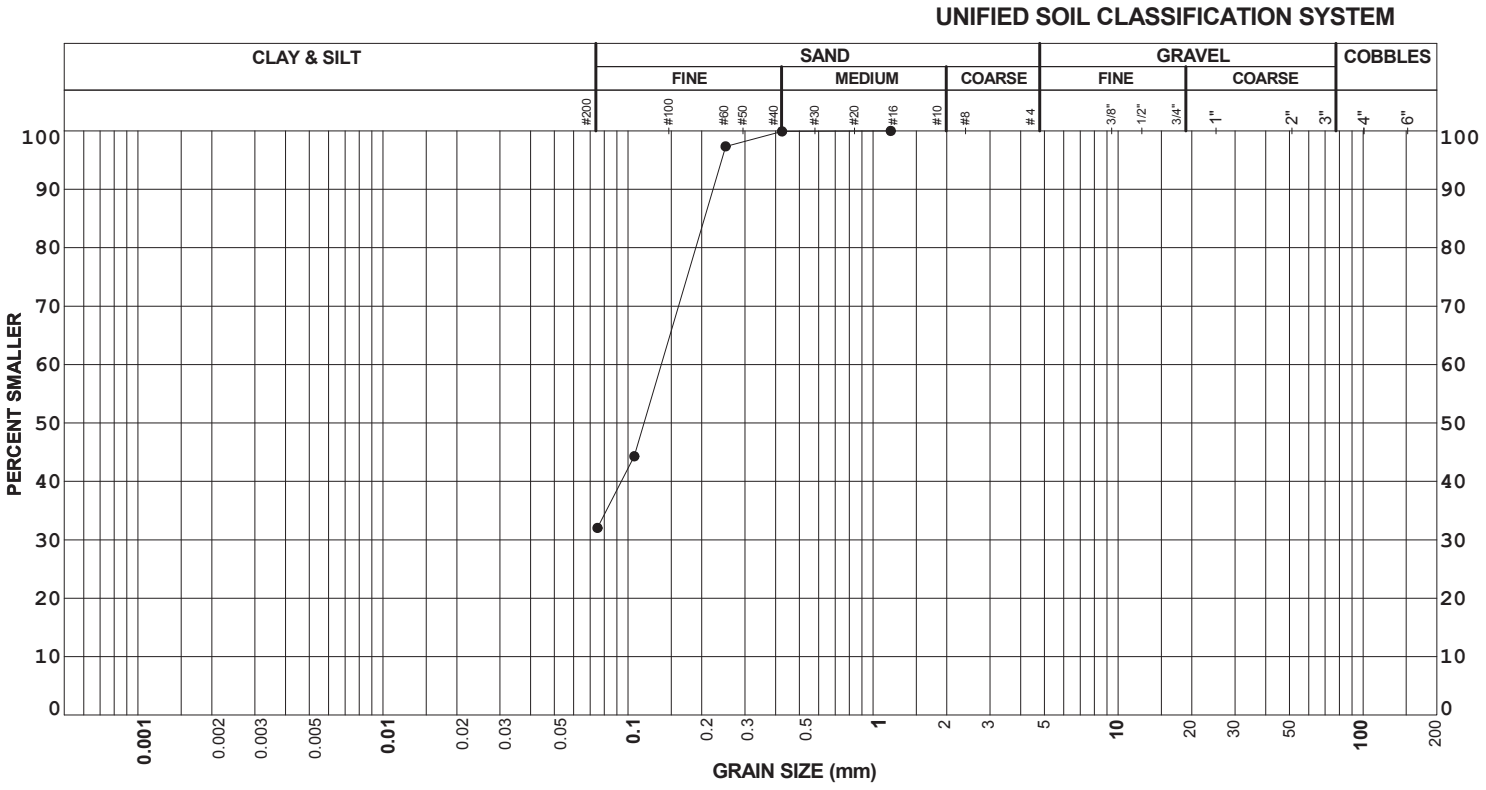
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-RD-1C	DS2	2.00	0	68	32		

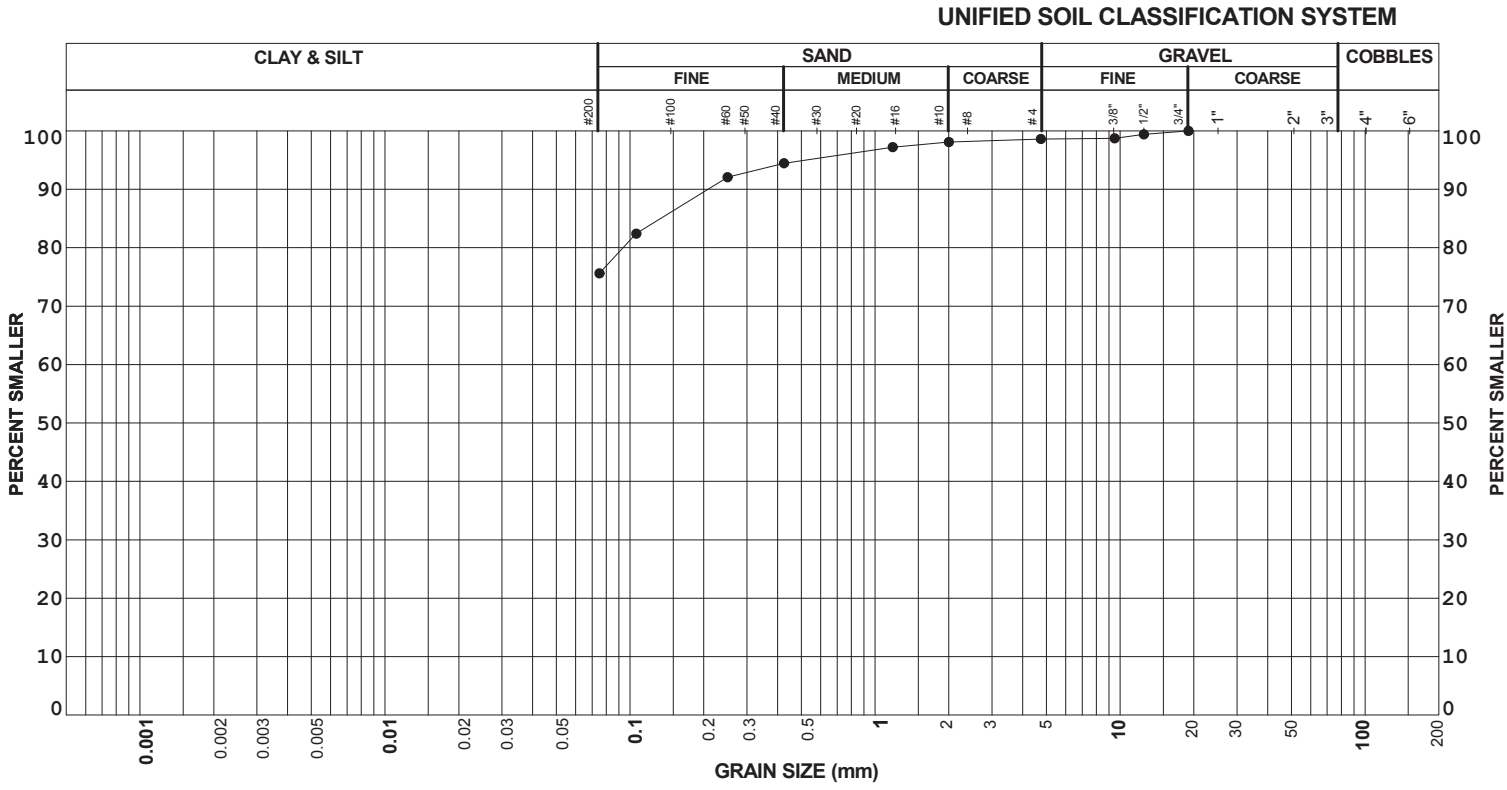
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-RD-1C	DS3	4.00	1	23	76		

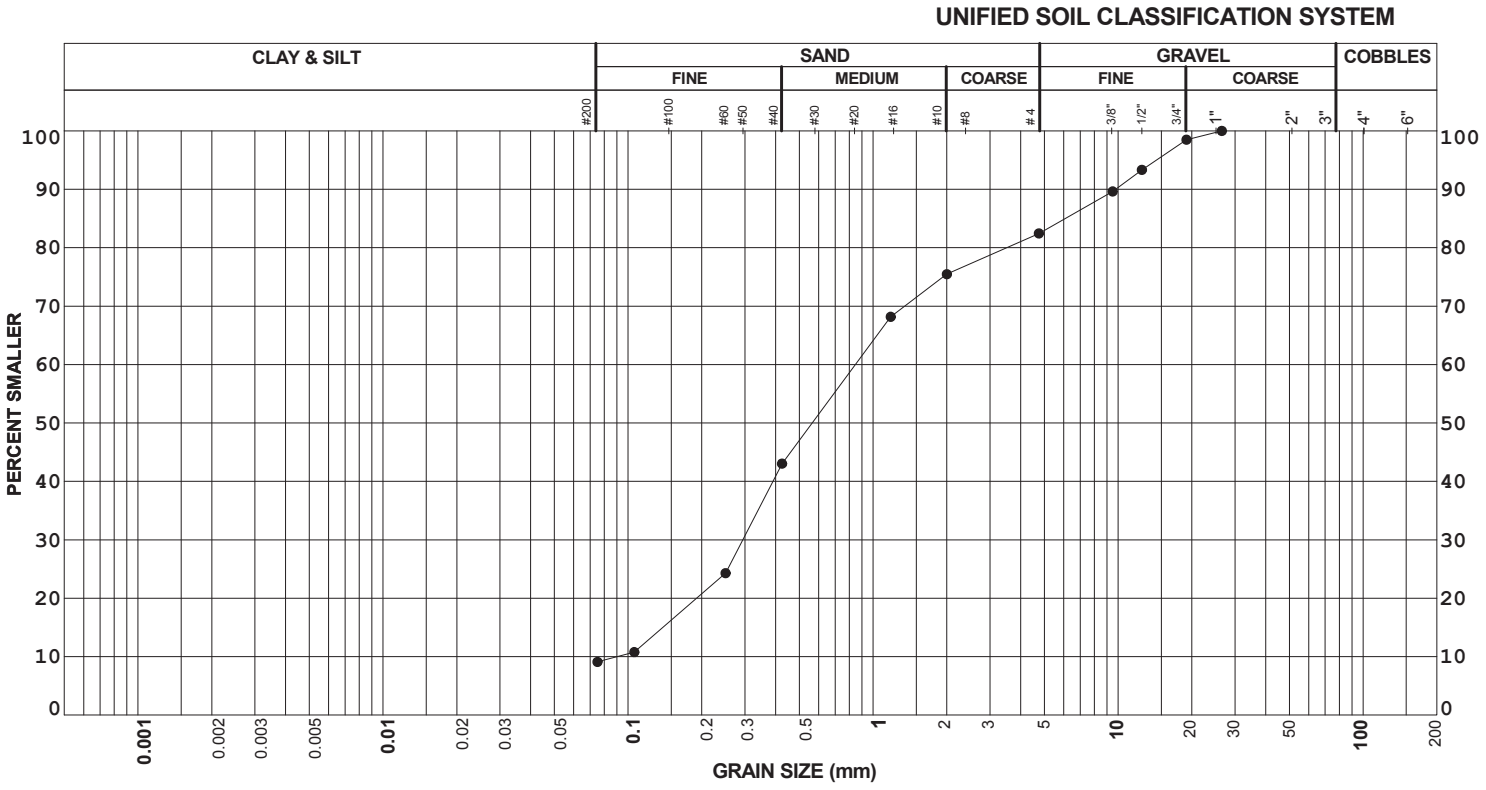
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-RD-2	DS1	0.70	18	73	9		

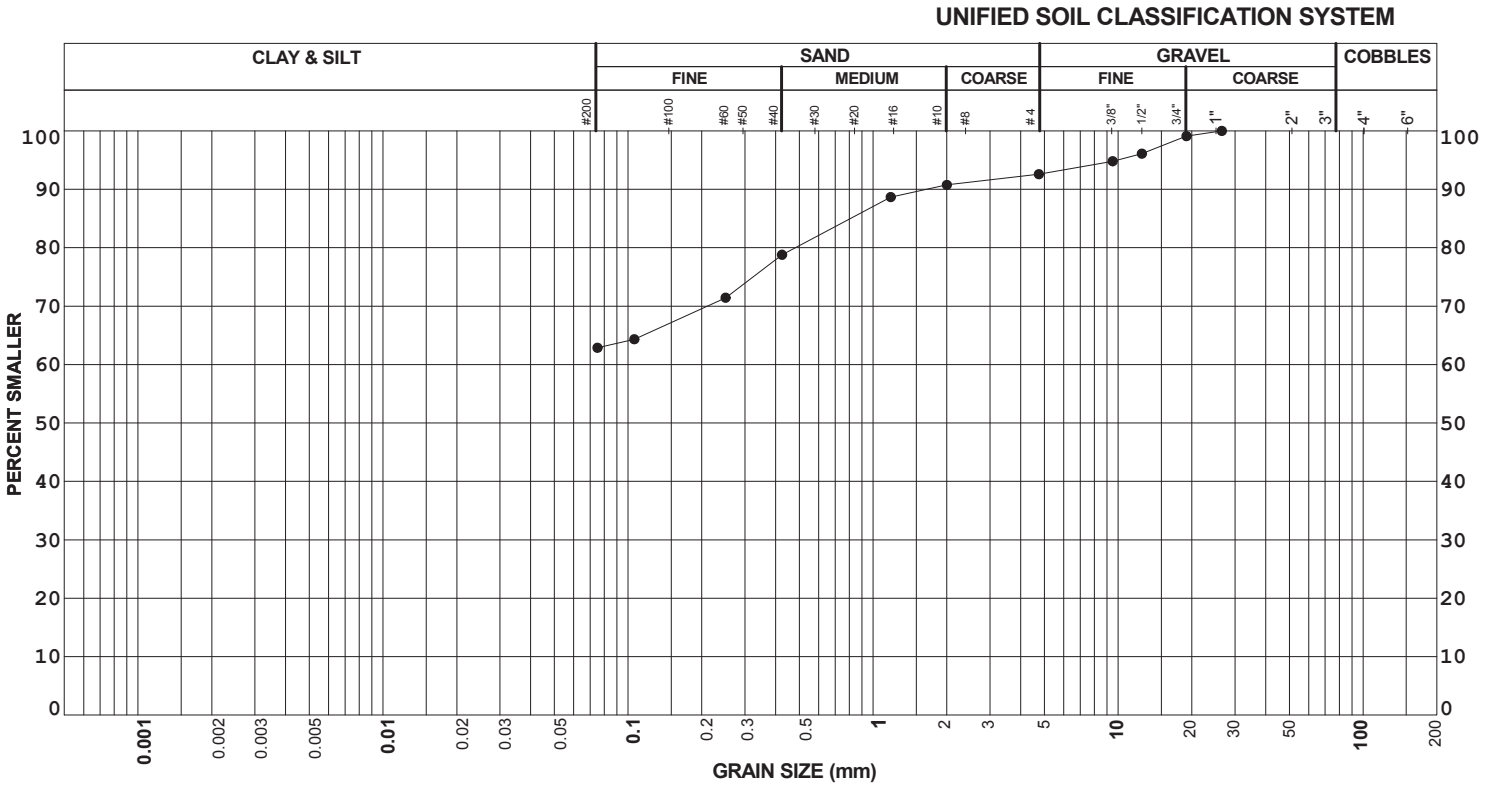
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-RD-2	DS2	1.40	7	30	63		

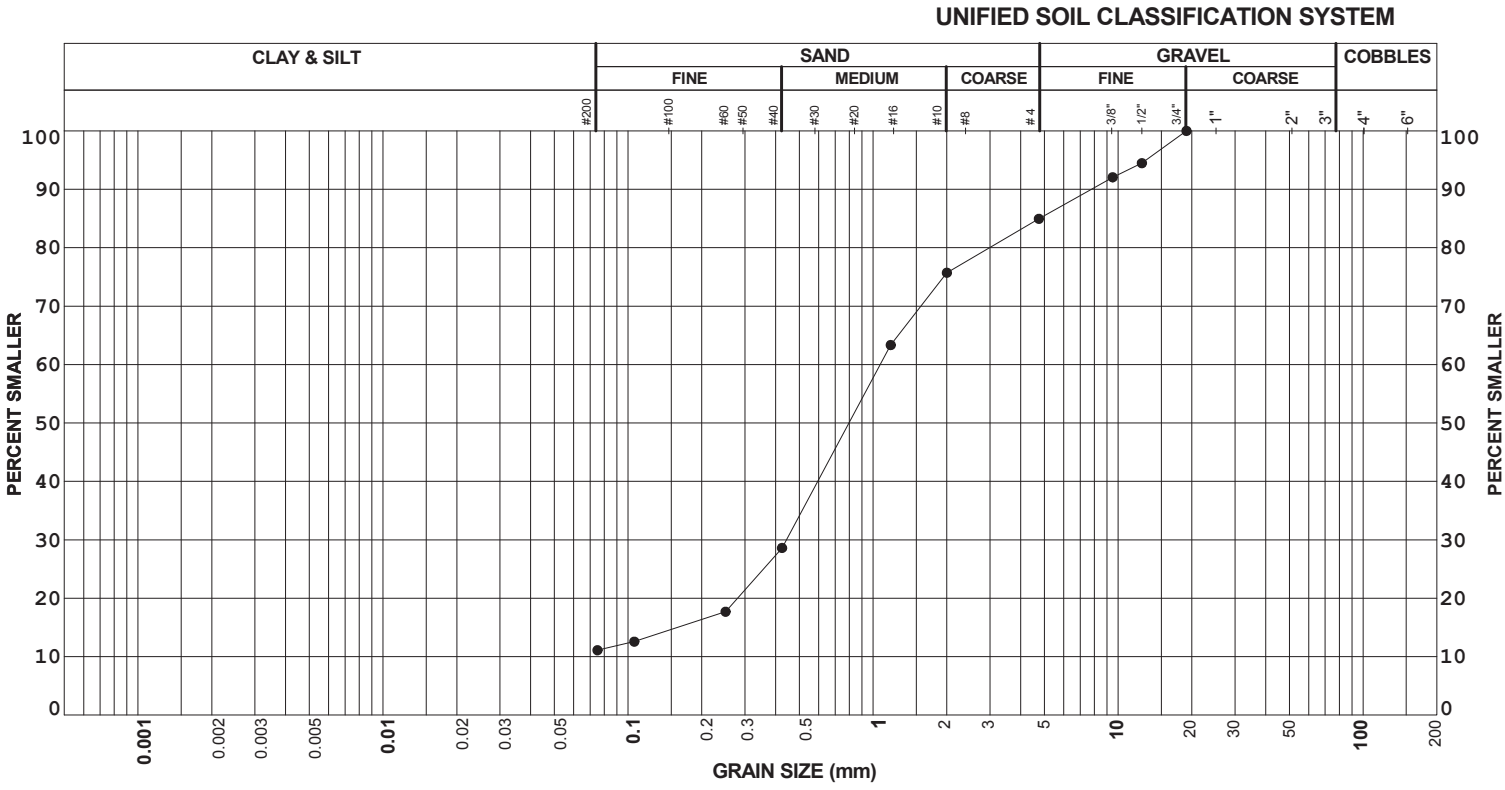
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-RD-2	DS3	2.20	15	74	11		

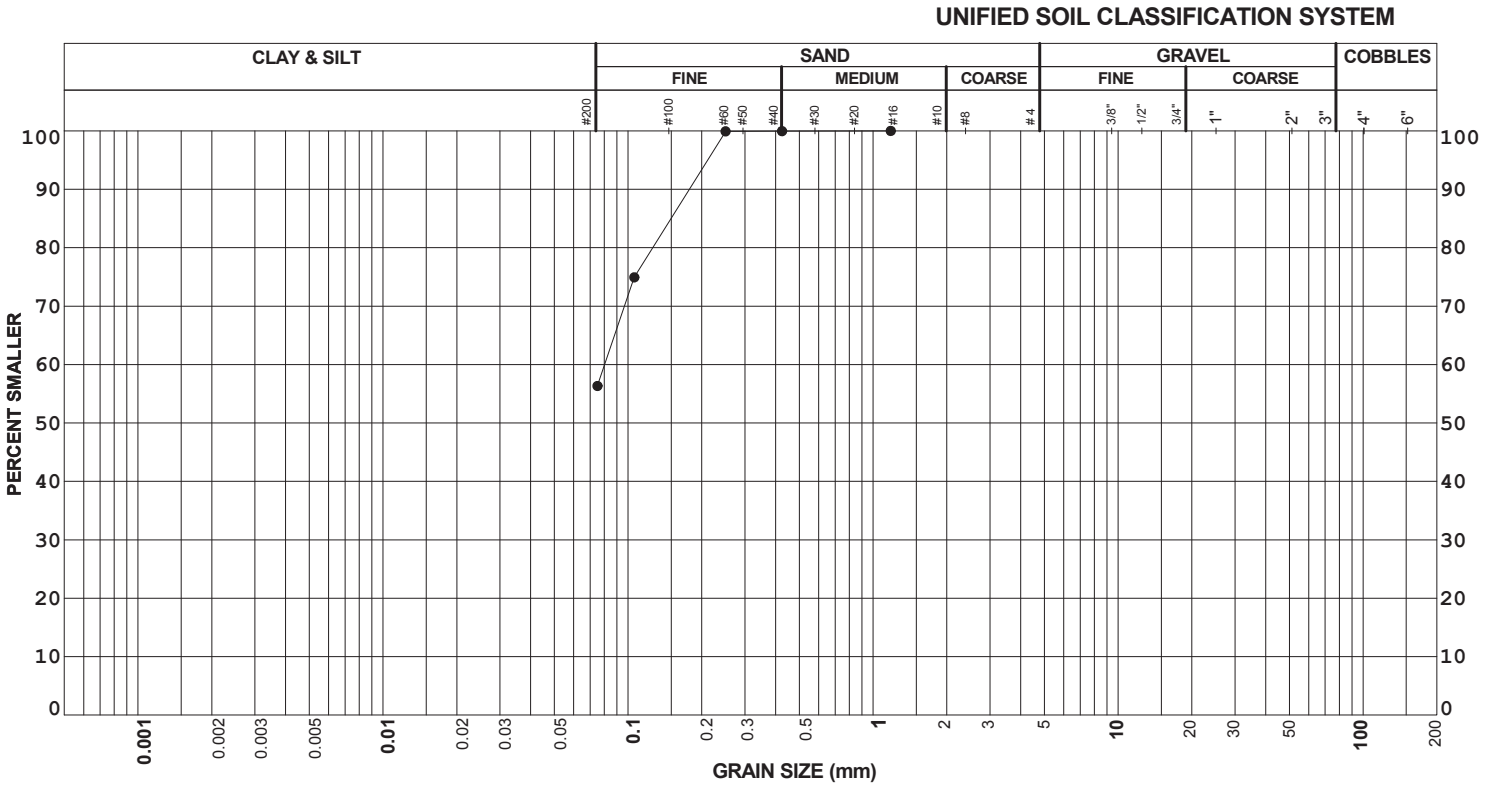
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-RD-2	DS4	4.00	0	44	56		

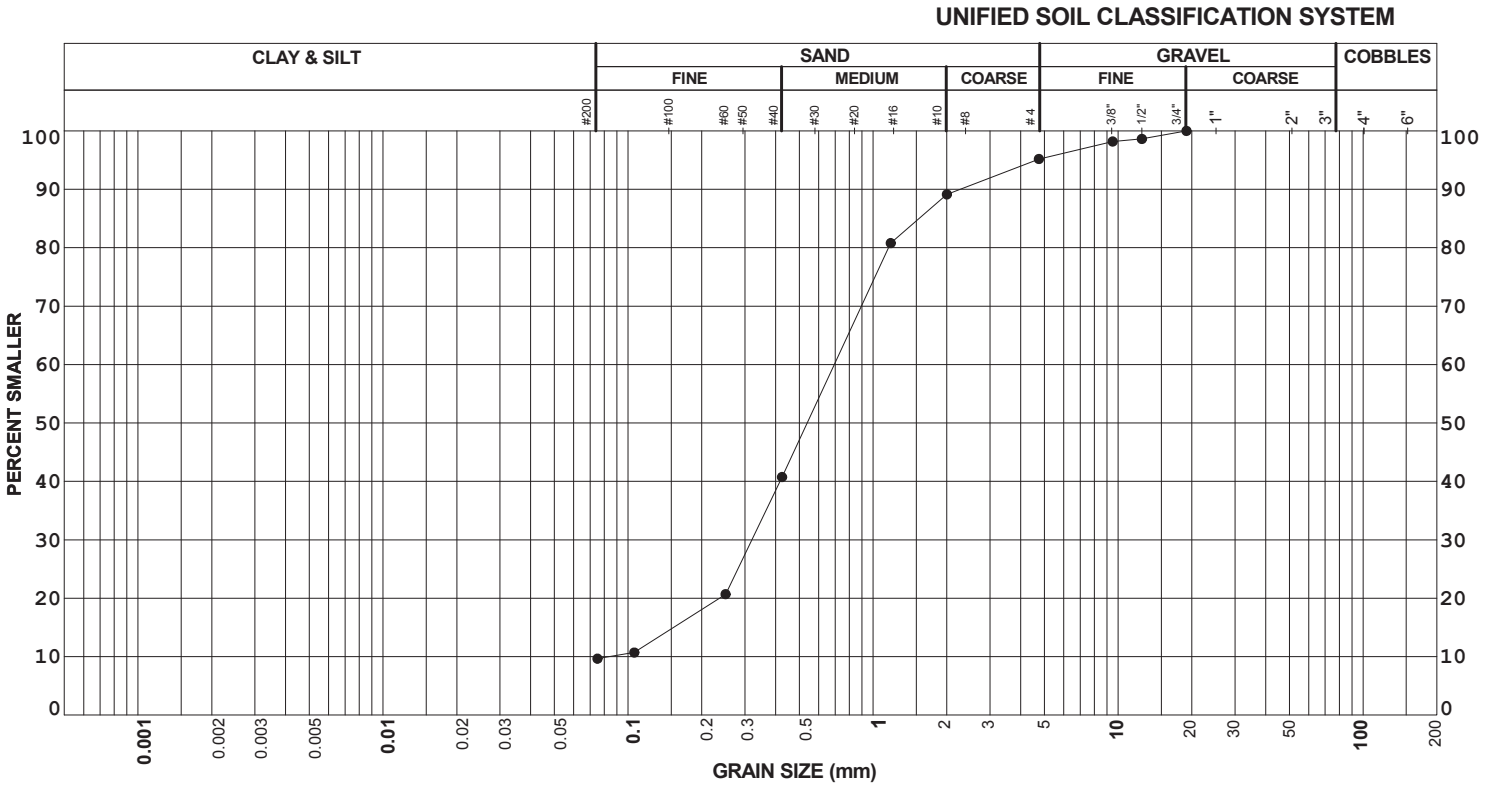
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-RD-3	DS1	3.70	5	86	10		

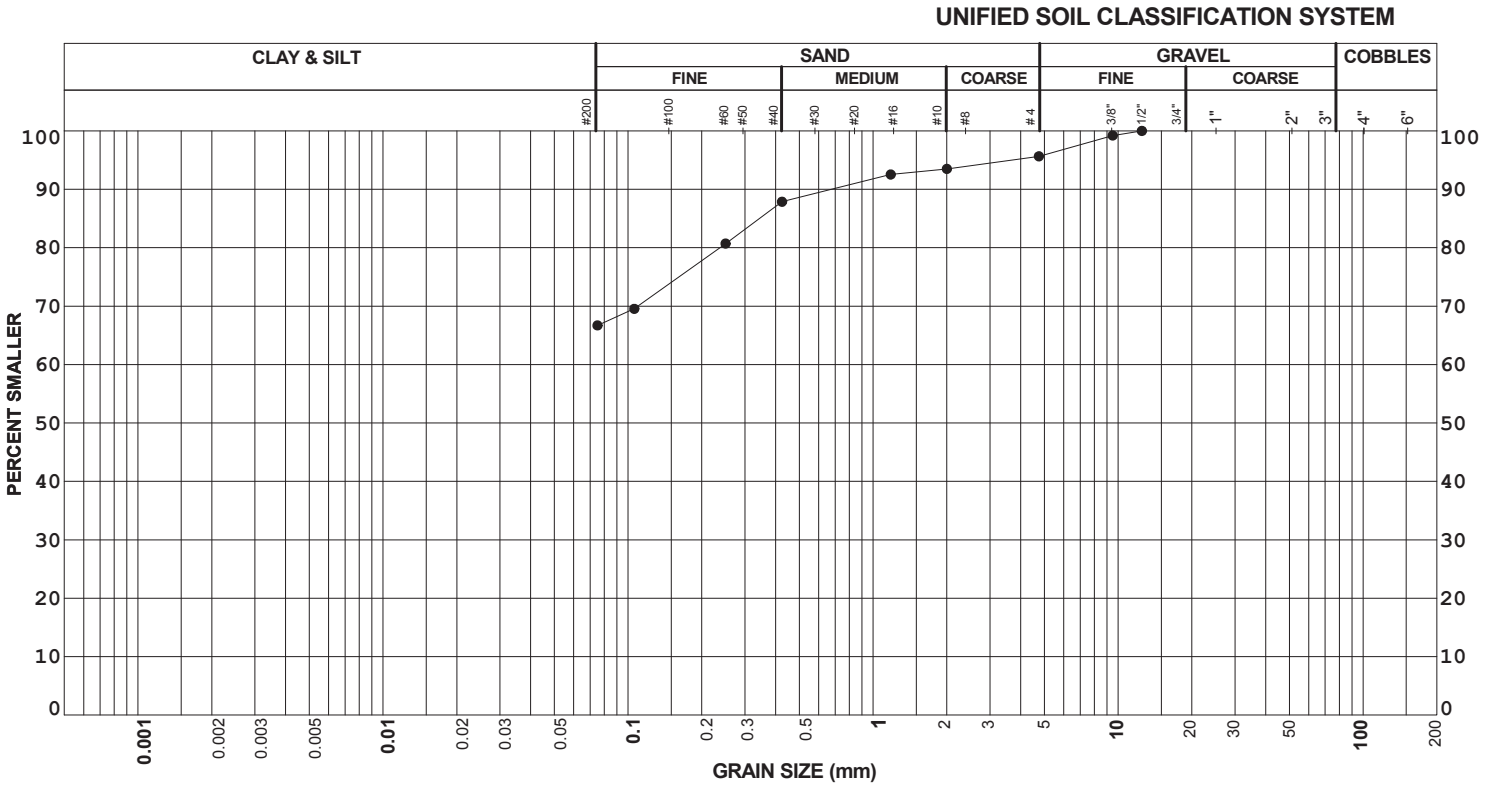
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-RD-4	DQ1	2.20	4	29	67		

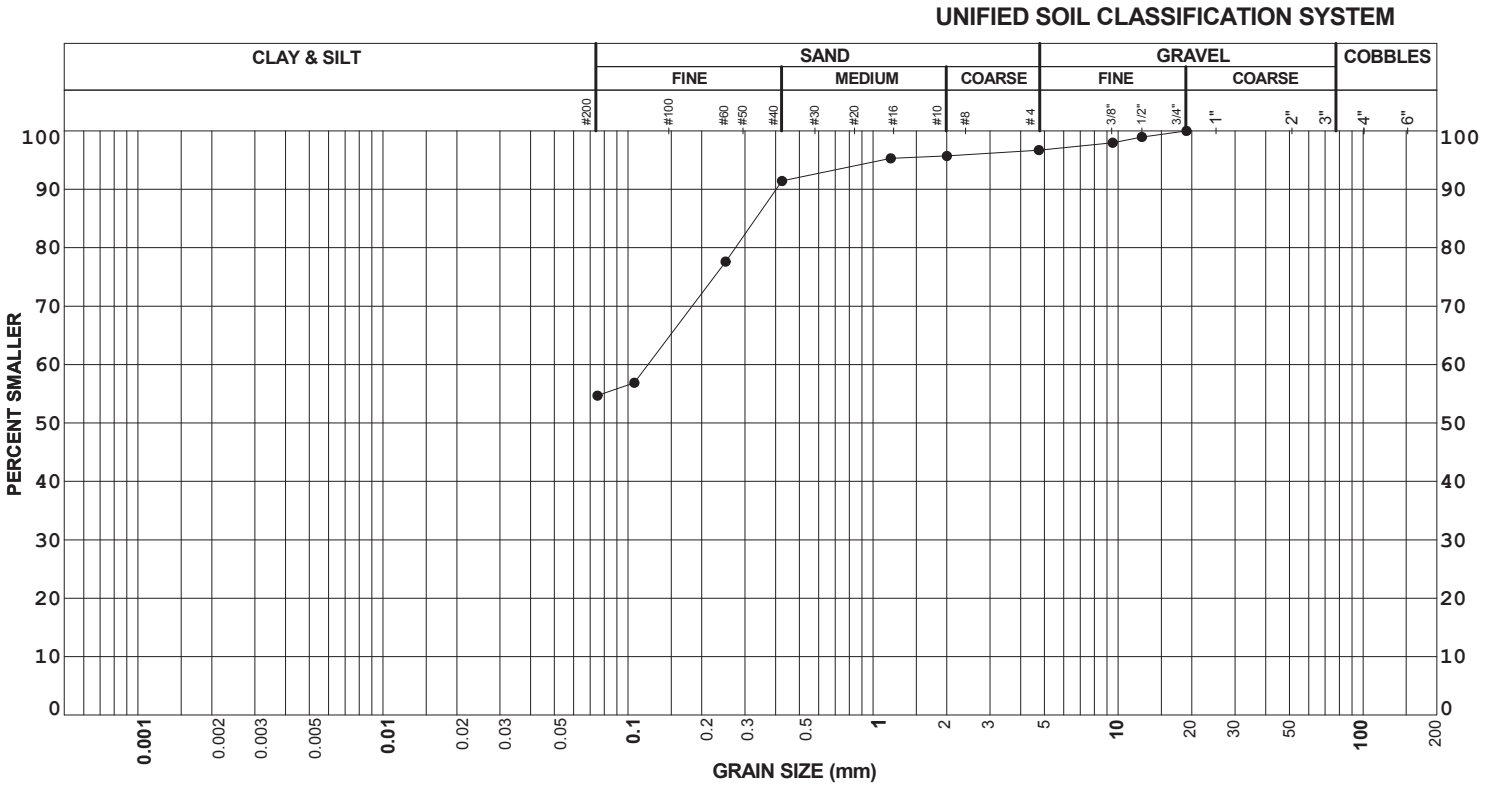
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-RD-5	DS1	2.40	3	42	55		

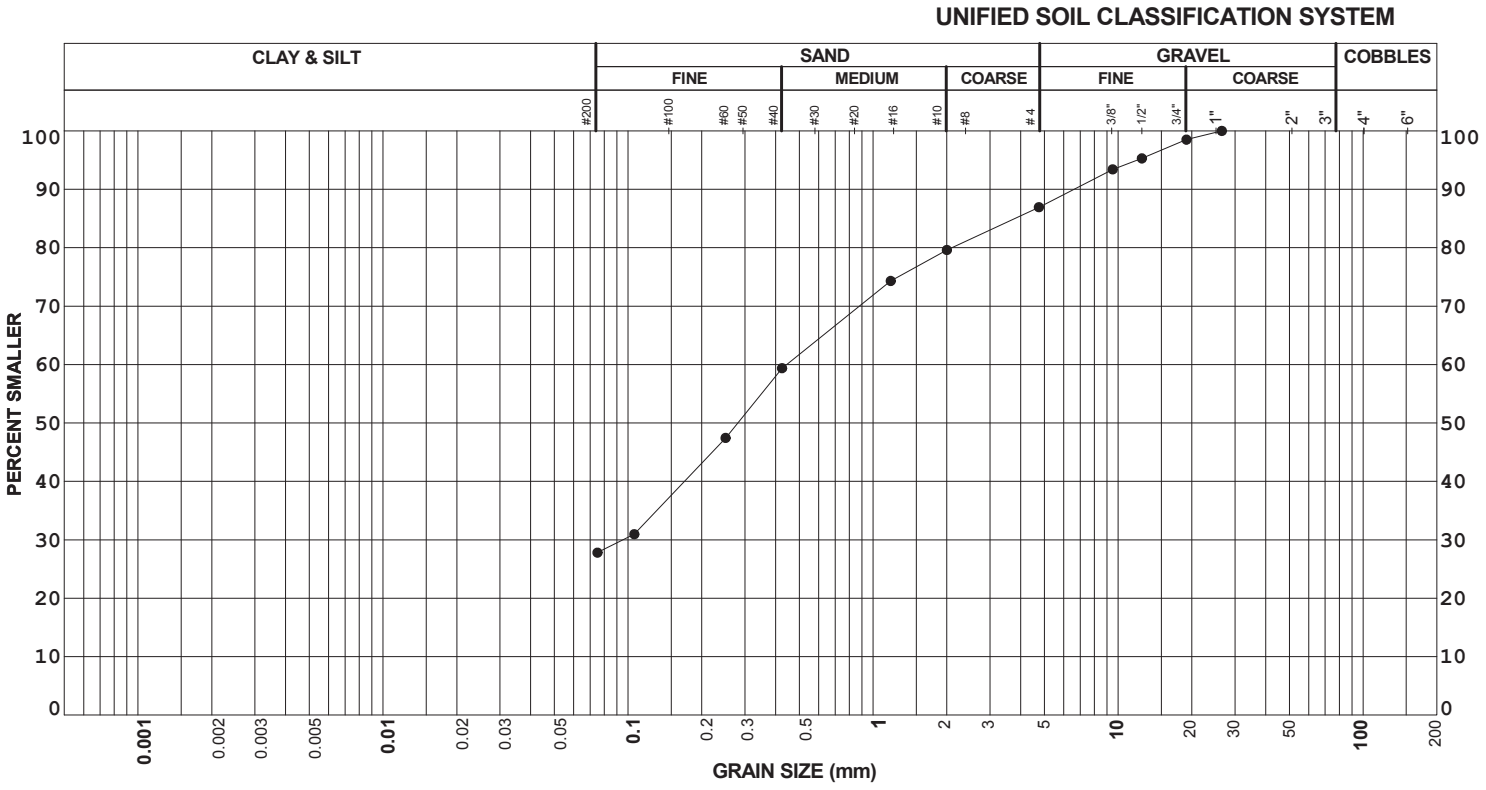
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-RD-7	DS1	1.90	13	59	28		

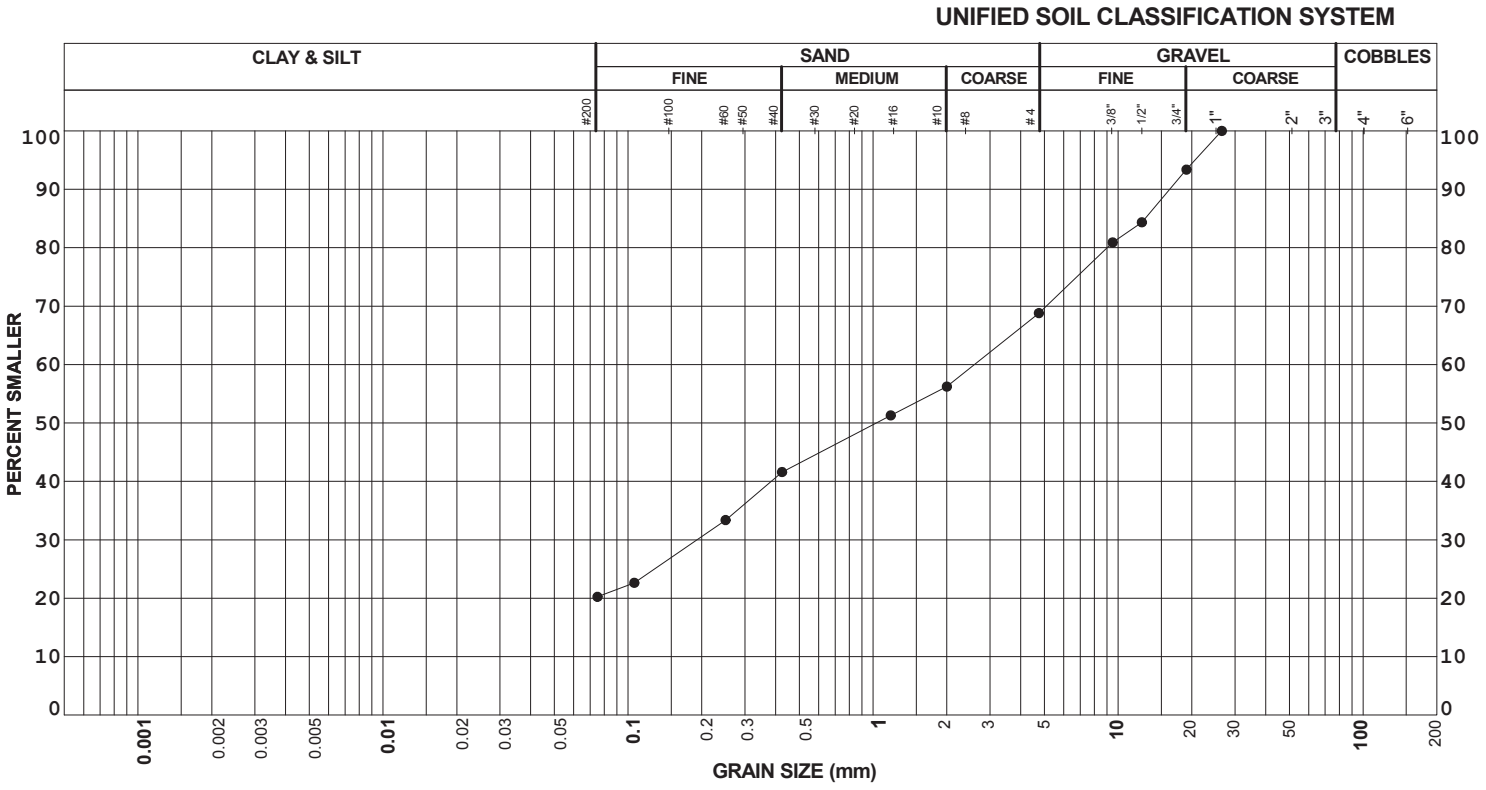
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mines Corporation

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH17-RD-7	DS2	3.40	31	49	20		

REMARKS:

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Pore Water Extraction and Determination of Soluble Salt Content of Soils by Refractometer

ASTM D4542-15

HATCH Geotechnical Laboratory

Date:	December 17, 2017	Baffinland Iron Mines
Project Number:	H/353004	2275 Upper Middle Rd, Oakville Ontario.
Project:	**Mary River Expansion Project**	**Attention:** G. Qu

Sample	**As Listed Below**
Source	**BH17-10 Milne Port**

Sample I.D	Depth (m)	Salinity Scale (ppt)	Notes
BLANK	NA	0.0	Distilled Water
DS1	0.90	3.0	
DS2	5.00	13.0	
DS4	8.70	22.0	
BLANK	NA	0.0	Distilled Water

Comments: Tested with EXTECH Model RF20 Refractometer with automatic temperature compensation.

Reported by: R. Serluca, Lab Tech., Dec. 17, 2017

Name, Title, Date

Reviewed by: G. Qu

Name. Title. Date

Notice: the test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

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Pore Water Extraction and Determination of Soluble Salt Content of Soils by Refractometer

ASTM D4542-15

HATCH Geotechnical Laboratory

Date:	December 17, 2017	Baffinland Iron Mines
Project Number:	H/353004	2275 Upper Middle Rd, Oakville Ontario.
Project:	**Mary River Expansion Project**	**Attention:** G. Qu

Sample	**As Listed Below**
Source	**BH17-11 Milne Port**

Sample I.D	Depth (m)	Salinity Scale (ppt)	Notes
BLANK	NA	0.0	Distilled Water
DS2	5.50	1.0	
DS3	8.00	6.0	
DS6	15.00	7.0	
BLANK	NA	0.0	Distilled Water

Comments: Tested with EXTECH Model RF20 Refractometer with automatic temperature compensation.

Reported by: R. Serluca, Lab Tech., Dec. 17, 2017

Name, Title, Date

Reviewed by: G. Qu

Name. Title. Date

Notice: the test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

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Pore Water Extraction and Determination of Soluble Salt Content of Soils by Refractometer

ASTM D4542-15

HATCH Geotechnical Laboratory

Date:	December 17, 2017	Baffinland Iron Mines
Project Number:	H/353004	2275 Upper Middle Rd, Oakville Ontario.
Project:	**Mary River Expansion Project**	**Attention:** Q. Qu

Sample	**As Listed Below**
Source	**BH17-12 Milne Port**

Sample I.D	Depth (m)	Salinity Scale (ppt)	Notes
BLANK	NA	0.0	Distilled Water
DS2	4.00	5.0	
DS3	5.00	27.0	
DS5	8.80	5.0	
DS6	13.60	6.0	
BLANK	NA	0.0	Distilled Water

Comments: Tested with EXTECH Model RF20 Refractometer with automatic temperature compensation.

Reported by: R. Serluca, Lab Tech., Dec. 17, 2017

Name, Title, Date

Reviewed by: G. Qu

Name. Title. Date

Notice: the test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

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Pore Water Extraction and Determination of Soluble Salt Content of Soils by Refractometer

ASTM D4542-15

HATCH Geotechnical Laboratory

Date:	December 17, 2017	Baffinland Iron Mines Corporation
Project Number:	H/353004	2275 Upper Middle Rd, Oakville Ontario.
Project:	**Mary River Expansion Project**	**Attention:** H.Ghiabi

Sample	**As Listed Below**
Source	**BH17-EBC-1**

Sample I.D	Depth (m)	Salinity Scale (ppt)	Notes
BLANK	NA	0.0	Distilled Water
DQ2	4.60	0.0	Ice Sample
DQ3	5.10	3.0	
DQ4	6.20	0.0	
DQ5	8.30	1.0	Ice Sample
DQ6	9.70	3.0	
BLANK	NA	0.0	Distilled Water

Comments: Tested with EXTECH Model RF20 Refractometer with automatic temperature compensation.

Reported by: R. Serluca, Lab Tech., Dec. 17, 2017

Name, Title, Date

Reviewed by: W. Hoyle, Feb.16, 2018

Name. Title. Date

Notice: the test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

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Pore Water Extraction and Determination of Soluble Salt Content of Soils by Refractometer

ASTM D4542-15

HATCH Geotechnical Laboratory

Date:	December 17, 2017	Baffinland Iron Mines Corporation
Project Number:	H/353004	2275 Upper Middle Rd, Oakville Ontario.
Project:	**Mary River Expansion Project**	**Attention:** H.Ghiabi

Sample	**As Listed Below**
Source	**BH17-EBC-2**

Sample I.D	Depth (m)	Salinity Scale (ppt)	Notes
BLANK	NA	0.0	Distilled Water
DQ3	2.0	0.0	
DQ4	3.05	3.0	
DQ5	4.30	3.0	
DQ6	5.0	3.0	
BLANK	NA	0.0	Distilled Water
DQ7	5.8	6.0	
BLANK	NA	0.0	Distilled Water

Comments: Tested with EXTECH Model RF20 Refractometer with automatic temperature compensation.

Reported by: R. Serluca, Lab Tech., Dec. 17, 2017

Name, Title, Date

Reviewed by: W. Hoyle, Feb.16, 2018

Name, Title, Date

Notice: the test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

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Pore Water Extraction and Determination of Soluble Salt Content of Soils by Refractometer

ASTM D4542-15

HATCH Geotechnical Laboratory

Date:	December 17, 2017	Baffinland Iron Mines Corporation
Project Number:	H/353004	2275 Upper Middle Rd, Oakville Ontario.
Project:	**Mary River Expansion Project**	**Attention: G. Qu**

Sample	**As Listed Below**
Source	**BH17-EBC-8 - New Drive House, South End**

Sample I.D	Depth (m)	Salinity Scale (ppt)	Notes
BLANK	NA	0.0	Distilled Water
DQ3	5.00	3.0	
DQ7	12.00	14.0	
DQ9	15.00	13.0	
DQ11	18.00	22.0	
DQ12	20.51	9.0	
DQ13	23.70	8.0	
BLANK	NA	0.0	Distilled Water
DQ15	29.80	10.0	
DQ16	32.90	26.0	
DQ17	37.40	5.0	
DS18	39.30	22.0	
DQ19	39.40	14.0	
BLANK	NA	0.0	Distilled Water
Sea 1	0.0	28.0	Sea Water – Off Shore 700 m
Sea 2	0.0	26.0	Sea Water – Near Shore

Comments: Tested with EXTECH Model RF20 Refractometer with automatic temperature compensation.

Reported by: R. Serluca, Lab Tech., Dec. 17, 2017

Name, Title, Date

Reviewed by: G. Qu, Dec.18,2017

Name. Title. Date

Notice: the test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

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Pore Water Extraction and Determination of Soluble Salt Content of Soils by Refractometer

ASTM D4542-15

HATCH Geotechnical Laboratory

Date:	December 17, 2017	Baffinland Iron Mines Corporation
Project Number:	H/353004	2275 Upper Middle Rd, Oakville Ontario.
Project:	**Mary River Expansion Project**	**Attention: G. Qu**

Sample	**As Listed Below**
Source	**BH17-EBC- 9 - New Drive House, North End**

Sample I.D	Depth (m)	Salinity Scale (ppt)	Notes
BLANK	NA	0.0	Distilled Water
DQ2	4.40	8.0	
DQ4	8.80	13.0	
DQ7	14.30	12.0	
BLANK	NA	0.0	Distilled Water
DQ8	15.20	88.0	Soft/unfrozen zone
DQ10	18.0	11.0	
DQ12	22.5	10.0	
BLANK	NA	0.0	Distilled Water
DQ13	24.0	11.0	
DQ14	27.0	16.0	
DQ15	27.4	15.0	
BLANK	NA	0.0	Distilled Water
DQ17	31.5	5.0	
BLANK	NA	0.0	Distilled Water
Sea 1	0.0	28.0	Sea Water – Off Shore 700 m
Sea 2	0.0	26.0	Sea Water – Near Shore

Comments: Tested with EXTECH Model RF20 Refractometer with automatic temperature compensation.

Reported by: R. Serluca, Lab Tech., Dec. 17, 2017

Name, Title, Date

Reviewed by: G. Qu, Dec.18, 2017

Name. Title. Date

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Uniaxial Compressive Strength of Intact Rock Core Specimens - Method C:
ASTM D7012-10

HATCH Geotechnical Laboratory

Date:	January 29. 2018	Baffinland Iron Mines Corporation	
Project Number:	H/353004	2275 Upper Middle Road East, Oakville Ont.	
Project:	**Mary River Expansion Project**	**Attention: G.Qu**	

Sample	**Bedrock Core Sample from 19.22 m**
Source	**BH17-EBC-1**

Core Sample Data						
Length:	13.209	**cm**		**Weight:**	1098.5	**grams**
Diameter:	6.340	**cm**		**Density:**	2.63	**g/cm³**
Area:	31.570	**cm²**		**Maximum Load:**	518	**kN**
Volume:	417.006	**cm³**		**U.C.S.**	164.1	**Mpa**





Comments:

Reported by: R. Serluca, Lab Tech., January 20, 2018
Name, Title, Date

Reviewed by: G.Qu, Jan. 23, 2018
Name. Title. Date

Notice: the test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

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Uniaxial Compressive Strength of Intact Rock Core Specimens - Method C:
ASTM D7012-10

HATCH Geotechnical Laboratory

Date:	February 5. 2018	Baffinland Iron Mines Corporation
Project Number:	H/353004	2275 Upper Middle Road East, Oakville Ont.
Project:	**Mary River Expansion Project**	**Attention: G.Qu**

Sample	**Bedrock Core Sample from 17.90 m.**
Source	**BH17-EBC-2**

Core Sample Data						
Length:	13.580	**cm**		**Weight:**	1133.5	**grams**
Diameter:	6.342	**cm**		**Density:**	2.64	**g/cm³**
Area:	31.580	**cm²**		**Maximum Load:**	510	**kN**
Volume:	428.99	**cm³**		**U.C.S.**	161.5	**Mpa**





Comments:

Reported by: R. Serluca, Lab Tech., February 5, 2018

Name, Title, Date

Reviewed by: G.Qu, Feb.6, 2018

Name. Title. Date

Notice: the test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

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Uniaxial Compressive Strength of Intact Rock Core Specimens - Method C:
ASTM D7012-10

HATCH Geotechnical Laboratory

Date:	January 29. 2018	Baffinland Iron Mines Corporation	
Project Number:	H/353004	2275 Upper Middle Road East, Oakville Ont.	
Project:	**Mary River Expansion Project**	**Attention: G.Qu**	

Sample	**Bedrock Core Sample from 20.75 m**
Source	**BH17-M008-R**

Core Sample Data						
Length:	12.854	**cm**		**Weight:**	1043.0	**grams**
Diameter:	6.325	**cm**		**Density:**	2.58	**g/cm³**
Area:	31.421	**cm²**		**Maximum Load:**	182	**kN**
Volume:	403.881	**cm³**		**U.C.S.**	57.9	**Mpa**





Comments:

Reported by: R. Serluca, Lab Tech., January 20, 2018
Name, Title, Date

Reviewed by: G.Qu, Jan.23, 2018
Name. Title. Date

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Uniaxial Compressive Strength of Intact Rock Core Specimens - Method C:
ASTM D7012-10

HATCH Geotechnical Laboratory

Date:	January 29. 2018	Baffinland Iron Mines Corporation	
Project Number:	H/353004	2275 Upper Middle Road East, Oakville Ont.	
Project:	**Mary River Expansion Project**	**Attention: G.Qu**	

Sample	**Bedrock Core Sample from 21.05 m**
Source	**BH17-M008-R**

Core Sample Data						
Length:	15.008	**cm**	**Weight:**	1216.5	**grams**
Diameter:	6.327	**cm**	**Density:**	2.58	**g/cm³**
Area:	31.440	**cm²**	**Maximum Load:**	145	**kN**
Volume:	471.859	**cm³**	**U.C.S.**	46.1	**Mpa**



Comments:

Reported by: R. Serluca, Lab Tech., January 20, 2018
Name, Title, Date

Reviewed by: G. Qu, Jan. 23, 2018
Name. Title. Date

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Uniaxial Compressive Strength of Intact Rock Core Specimens - Method C:
ASTM D7012-10

HATCH Geotechnical Laboratory

Date:	January 29. 2018	Baffinland Iron Mines Corporation	
Project Number:	H/353004	2275 Upper Middle Road East, Oakville Ont.	
Project:	**Mary River Expansion Project**	**Attention: G. Qu**	

Sample	**Bedrock Core Sample from 21.42 m**
Source	**BH17-M008-R**

Core Sample Data						
Length:	13.902	**cm**		**Weight:**	1127.3	**grams**
Diameter:	6.328	**cm**		**Density:**	2.58	**g/cm³**
Area:	31.450	**cm²**		**Maximum Load:**	298	**kN**
Volume:	437.224	**cm³**		**U.C.S.**	94.8	**Mpa**





Comments:

Reported by: R. Serluca, Lab Tech., January 20, 2018
Name, Title, Date

Reviewed by: Q. Qu, Jan.23, 2018
Name. Title. Date

Notice: the test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

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15 February 2017
File: TB152049

Hatch Ltd.
4342 Queen St., Suite 500
Niagara Falls, ON
L2E 7J7 Canada

Attention: **Mr. Warren R. Hoyle, P.Geo.**

RE: **PHYSICAL TESTING OF BEDROCK CORE AND ROCK LUMPS**

1.0 INTRODUCTION

We are pleased to present the results of our Amec Foster Wheeler Hamilton laboratory testing conducted on rock lump samples provided by HATCH Limited (HATCH). It is understood the rock lump and bedrock core samples were sampled in January 2017 by a representative of Hatch. These samples were received in our laboratory on 26 January 2017.

2.0 METHODLOGY

A total of four pails of rock grab samples (4-8 inch) and bedrock cores were provided for physical durability testing. The aggregate was crushed using a laboratory crusher at Amec Foster Wheeler Hamilton Laboratory. The material was crushed to produce a 20mm coarse aggregate to be tested.

Testing of the 20mm crushed core samples was limited to:

Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus	(CSA A23.2 - 29A)
Sieve Analysisof Coarse and Fine Aggregate	(CSA A23.2 - 2A)
Relative Density and Absorption of Coarse Aggregate	(CSA A23.2 - 12A)
Resistance of Unconfined Coarse Aggregate to Freezing and Thawing	(CSA A23.2 - 24A)

505 Woodward Avenue, Unit 1
Hamilton, Ontario L8H 6N6
Tel +1 905 312 0700
Fax +1 905 312 0771
amecfw.com

The results of testing are summarized in Table 1.

3.0 RESULTS

Table 1. Results of the Physical Testing Crushed Aggregate Sample

Test Required	Test Method	Laboratory Test Results			
		NF17-01	NF17-02	NF17-03	NF17-04
Relative Density (Specific Gravity)	CSA A23.2 - 12A	**2.662**	**2.655**	**2.618**	**2.995**
Absorption (%)	CSA A23.2 - 12A	**0.82**	**0.90**	**0.37**	**0.45**
Micro-Deval Abrasion (% loss)	CSA A23.2 - 29A	**10.5**	**11.0**	**4.5**	**7.9**
Unconfined Freeze-Thaw (% loss)	CSA A23.2 - 24A	**6.7**	**11.1**	**1.6**	**0.8**

Presented in Enclosures 1 through 4 are the gradation results of the coarse portion of each sample.

Please contact us if you have any questions, or if we can be of further service evaluating aggregate sources.

Regards,

Amec Foster Wheeler Environment & Infrastructure
a Division of Amec Foster Wheeler Americas Limited

Reviewed by,





Ognjenko Lazic
Asphalt & Concrete
Laboratory Supervisor

Kristen Hand
Soils & Aggregate
Laboratory Supervisor

LIMITS FOR DELETERIOUS SUBSTANCES AND PHYSICAL PROPERTIES OF AGGREGATE

CSA A23.1 - 14, Table 11 & 12 and A23.2 - 15A & 27A, Rev. August 2014

Clauses 4.2.3.2.2, 4.2.3.4.3, 4.2.3.5.1, 4.2.3.5.3.3, 4.2.3.5.3.4, 4.2.3.7 & 4.2.3.10.1

Job No.:	Client:	Sampled By:	Enclosure:
TB152049	Hatch Ltd.	Client	2

Name of Testing Laboratory:	Telephone No.:	Fax No.:
Amec Foster Wheeler Environment & Infrastructure	(905) 312 - 0700	(905) 312 - 0771

Sample Lab No.:	Sample Source:
S018-17	NF17-01

Sample Type:	Date Sampled:	Stockpile Quantity (t)
Crushed Core	January 2017	--

COARSE AGGREGATE

Nominal Max. Size (mm):	Aggregrate Inventory No.:	Gradation Results:	Meets Spec.: (Y/N)
20 mm	n/a	n/a	n/a

Limits for Deleterious Substances and Physical Properties of Aggregates

CSA Laboratory Test and Number	Acceptance Limits		Reference Material Results	Sample Results	Meets Spec.
	Maximum percentage by mass of total sample				
Standard Requirements	**Concrete exposed to freezing & thawing**	**Other exposure conditions**			**Y / N**
Clay lumps - A23.2 - 3A †****	0.3 % maximum	0.5 % maximum	-	-	-
Low - density granular materials - A23.2 - 4A‡****	0.5 % maximum	1 % maximum	-	-	-
Material finer than 80 µm - A23.2 - 5A**	1% maximum[1]	1% maximum[1]	-	-	-
Absorption - A23.2 - 12A	-		0.37%	**0.82%**	-
Flat & elongated particles, Procedure A, 4:1 - A23.2-13A	20.0 % maximum	20.0 % maximum	-	-	-
Micro-Deval test - A23.2 - 29A	17 % maximum	21 % maximum	14.0%	**10.5%**	**Y**
Unconfined freeze-thaw test - A23.2 - 24A‡‡	6 % maximum	10 % maximum	9.5%	**6.7%**	**N/Y**
Abrasion loss - A23.2 - 16A and A23.2 - 17A§§	50 % maximum	50 % maximum	-	-	-
Petrographic examination of aggregate - A23.2 -15A	125 maximum	140 maximum	-	-	-
Alkali-Carbonate reactivity - A23.2 - 26A	chem. comp. must plot in non-exp. field		-	-	-
Accelerated mortar bar - A23.2 - 25A	maximum 0.150% at 14 days		-	-	-
Concrete prism - A23.2 - 14A	maximum 0.040% at one year		-	-	-
Alternative Requirements* **					
$MgSO_4$ soundness loss - A23.2 - 9A	12 % maximum	18 % maximum	-	-	-

Issued By: Kristen Hand (Print Name)

Testing Laboratory Representative Signature

14 February 2017 (Date)

LIMITS FOR DELETERIOUS SUBSTANCES AND PHYSICAL PROPERTIES OF AGGREGATE

CSA A23.1 - 14, Table 11 & 12 and A23.2-15A & 27A, Rev. August 2014

Clauses 4.2.3.2.2, 4.2.3.4.3, 4.2.3.5.1, 4.2.3.5.3.3, 4.2.3.5.3.4, 4.2.3.7 & 4.2.3.10.1

Enclosure: **2**

*Limits for deleterious substances not listed in this Table, such as coal, ochre (ironstone), shalestone, siltstone, or argillaceous limestone, shall be specified by the owner to encompass deleterious materials known to be present in a particular region. In the absence of such information, aggregate shall be accepted or rejected in accordance with clause 4.2.3.9

†Clay lumps are defined as fine-grained, consolidated, sedimentary materials of a hydrous aluminosilicate nature.

‡A liquid with a relative density of 2.0 is generally used to separate particles classified as coal or lignite. Liquids with relative densities higher or lower than 2.0 might be required to identify other deleterious low-density materials.

The amount of material of clay size shall be determined by performing a hydrometer analysis as per ASTM D 422 on a sample washed through an 80 µm sieve.

**In the case of crushed aggregate, if material finer than the 80 µm sieve consists of the dust of fracture, essentially free from clay or shale, the maximum shall be 2.0%

‡‡CSA A23.2-24A, a test for coarse aggregate, has good precision and shows fair correlation with the MgSO4 soundness test. For further information, see Rogers, Senior, & Boothe (1989)

§§The abrasion loss shall not be greater than 35% when the aggregate is used in concrete paving or for other concrete surfaces subjected to significant wear. This does not refer to air- cooled iron blast-furnace-slag coarse aggregate. The abrasion loss requirements for coarse aggregate shall be waived provided that the material meets the alternative requirements for Micro-deval detailed in this Table.

***The freeze-thaw requirements for coarse aggregate shall be waived provided that the material meets the laternative requirements for $MgSO_4$ soundness loss detailed in this Table.

****If the Coarse Aggregate when tested according to A23.2-15A does not show the presence of either clay lumps or low-density granular materials, the requirements for testing in accordance with 3A and 4A may be waived.

[1]This limit applies to the amount of material finer than 80µm as determined by washing only.

Amec Foster Wheeler Environment & Infrastructure
a Division of Amec Foster Wheeler Americas Limited
505 Woodward Avenue, Unit 1
Hamilton, Ontario
Canada L8H 6N6

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

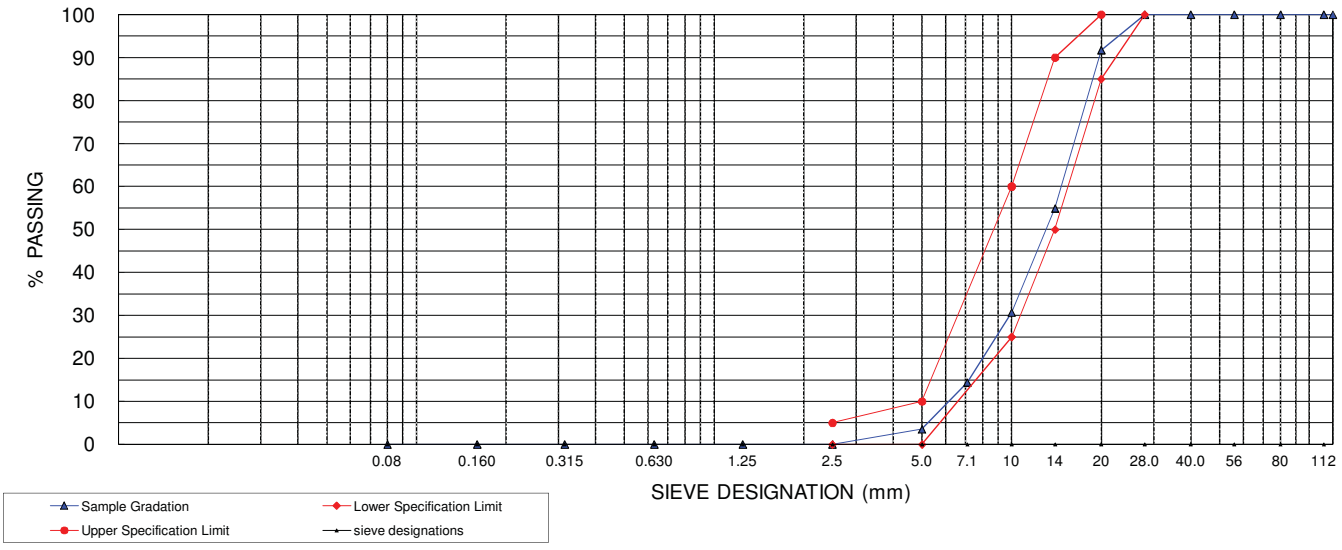
CSA A23.2-2A

Enclosure: 1
Date: 14 February 2017
Project No: TB152049

Client: Hatch
Sample Source: NF17-01
Sampled By: Client
Date Sampled: January 2017
Sample Type: Crushed Core
Specification: CSA A23.1-14, August 2014, Table 11, Group I, 20-5mm Concrete Stone Grading Requirements for Coarse Aggregate

Lab No: S018-17
Date Received: 26 January 2017
Date Tested: 6 February 2017
Lab Technician: KH

SIEVE SIZES (mm)	120	112	80	56	40.0	28.0	20	14	10	7.1	5	2.5	1.25	0.630	0.315	0.160	0.08
SPECIFICATIONS	-	-	-	-	-	100.0	85-100	50-90	25-60	-	0-10	0-5	-	-	-	-	-
% PASSING	100.0	100.0	100.0	100.0	100.0	100.0	91.7	54.9	30.7	14.4	3.5						
% RETAINING	0.0	0.0	0.0	0.0	0.0	0.0	8.3	45.1	69.3	85.6	96.5						



Amec Foster Wheeler Environment & Infrastructure
505 Woodward Avenue, Unit 1
Hamilton, Ontario L8H 6N6
PH: 905 312 0700
FX: 905 312 0771

LIMITS FOR DELETERIOUS SUBSTANCES AND PHYSICAL PROPERTIES OF AGGREGATE

CSA A23.1 - 14, Table 11 & 12 and A23.2 - 15A & 27A, Rev. August 2014

Clauses 4.2.3.2.2, 4.2.3.4.3, 4.2.3.5.1, 4.2.3.5.3.3, 4.2.3.5.3.4, 4.2.3.7 & 4.2.3.10.1

Job No.:	Client:	Sampled By:	Enclosure:
TB152049	Hatch Ltd	Client	2

Name of Testing Laboratory:	Telephone No.:	Fax No.:
Amec Foster Wheeler Environment & Infrastructure	(905) 312 - 0700	(905) 312 - 0771

Sample Lab No.:	Sample Source:
S019-17	NF17-02

Sample Type:	Date Sampled:	Stockpile Quantity (t)
Crushed Core	January 2017	--

COARSE AGGREGATE

Nominal Max. Size (mm):	Aggregrate Inventory No.:	Gradation Results:	Meets Spec.: (Y/N)
20 mm	n/a	n/a	n/a

Limits for Deleterious Substances and Physical Properties of Aggregates

CSA Laboratory Test and Number	Acceptance Limits		Reference Material Results	Sample Results	Meets Spec.
	Maximum percentage by mass of total sample				
Standard Requirements	**Concrete exposed to freezing & thawing**	**Other exposure conditions**			**Y / N**
Clay lumps - A23.2 - 3A †****	0.3 % maximum	0.5 % maximum	-	-	-
Low - density granular materials - A23.2 - 4A‡****	0.5 % maximum	1 % maximum	-	-	-
Material finer than 80 µm - A23.2 - 5A**	1% maximum[1]	1% maximum[1]	-	-	-
Absorption - A23.2 - 12A	-		0.37%	**0.90%**	-
Flat & elongated particles, Procedure A, 4:1 - A23.2-13A	20.0 % maximum	20.0 % maximum	-	-	-
Micro-Deval test - A23.2 - 29A	17 % maximum	21 % maximum	14.0%	**11.0%**	**Y**
Unconfined freeze-thaw test - A23.2 - 24A‡‡	6 % maximum	10 % maximum	9.5%	**11.1%**	**N**
Abrasion loss - A23.2 - 16A and A23.2 - 17A§§	50 % maximum	50 % maximum	-	-	-
Petrographic examination of aggregate - A23.2 -15A	125 maximum	140 maximum	-	-	-
Alkali-Carbonate reactivity - A23.2 - 26A	chem. comp. must plot in non-exp. field		-	-	-
Accelerated mortar bar - A23.2 - 25A	maximum 0.150% at 14 days		-	-	-
Concrete prism - A23.2 - 14A	maximum 0.040% at one year		-	-	-
Alternative Requirements* **					
$MgSO_4$ soundness loss - A23.2 - 9A	12 % maximum	18 % maximum			

Issued By: Kristen Hand (Print Name)

Testing Laboratory Representative Signature

14 February 2017 (Date)

LIMITS FOR DELETERIOUS SUBSTANCES AND PHYSICAL PROPERTIES OF AGGREGATE

CSA A23.1 - 14, Table 11 & 12 and A23.2-15A & 27A, Rev. August 2014

Clauses 4.2.3.2.2, 4.2.3.4.3, 4.2.3.5.1, 4.2.3.5.3.3, 4.2.3.5.3.4, 4.2.3.7 & 4.2.3.10.1

Enclosure: **2**

*Limits for deleterious substances not listed in this Table, such as coal, ochre (ironstone), shalestone, siltstone, or argillaceous limestone, shall be specified by the owner to encompass deleterious materials known to be present in a particular region. In the absence of such information, aggregate shall be accepted or rejected in accordance with clause 4.2.3.9

†Clay lumps are defined as fine-grained, consolidated, sedimentary materials of a hydrous aluminosilicate nature.

‡A liquid with a relative density of 2.0 is generally used to separate particles classified as coal or lignite. Liquids with relative densities higher or lower than 2.0 might be required to identify other deleterious low-density materials.

The amount of material of clay size shall be determined by performing a hydrometer analysis as per ASTM D 422 on a sample washed through an 80 µm sieve.

**In the case of crushed aggregate, if material finer than the 80 µm sieve consists of the dust of fracture, essentially free from clay or shale, the maximum shall be 2.0%

‡‡CSA A23.2-24A, a test for coarse aggregate, has good precision and shows fair correlation with the MgSO4 soundness test. For further information, see Rogers, Senior, & Boothe (1989)

§§The abrasion loss shall not be greater than 35% when the aggregate is used in concrete paving or for other concrete surfaces subjected to significant wear. This does not refer to air- cooled iron blast-furnace-slag coarse aggregate. The abrasion loss requirements for coarse aggregate shall be waived provided that the material meets the alternative requirements for Micro-deval detailed in this Table.

***The freeze-thaw requirements for coarse aggregate shall be waived provided that the material meets the laternative requirements for $MgSO_4$ soundness loss detailed in this Table.

****If the Coarse Aggregate when tested according to A23.2-15A does not show the presence of either clay lumps or low-density granular materials, the requirements for testing in accordance with 3A and 4A may be waived.

[1]This limit applies to the amount of material finer than 80µm as determined by washing only.

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Hamilton, Ontario
Canada L8H 6N6

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

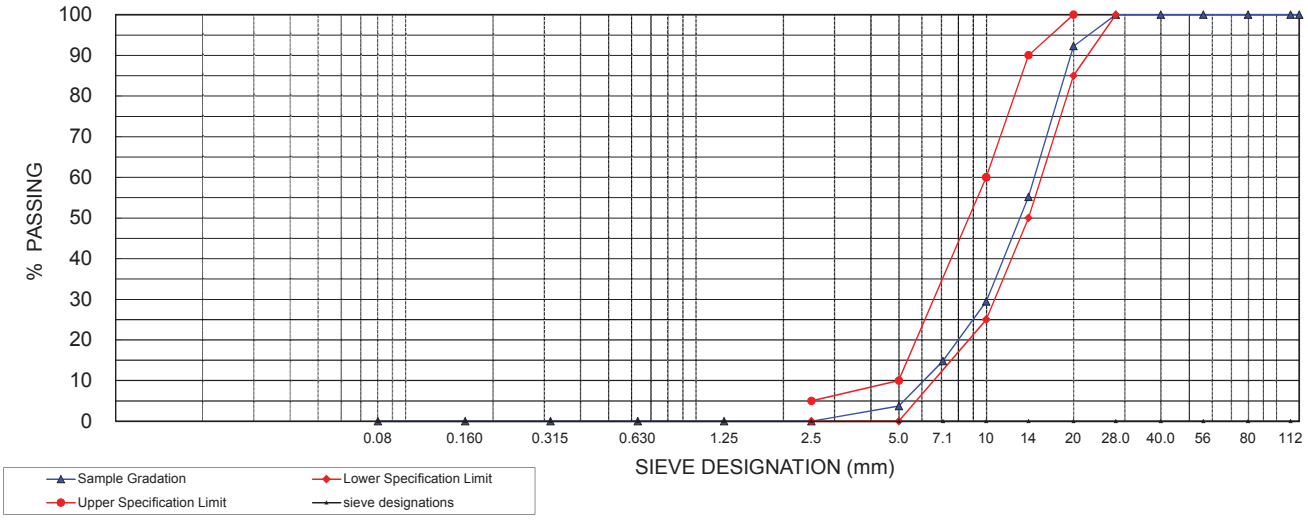
CSA A23.2-2A

Enclosure: 1
Date: 14 February 2017
Project No: TB152049

Client: Hatch Ltd
Sample Source: NF17-02
Sampled By: Client
Date Sampled: January 2017
Sample Type: Crushed Core
Specification: CSA A23.1-14, August 2014, Table 11, Group I, 20-5mm Concrete Stone Grading Requirements for Coarse Aggregate

Lab No: S019-17
Date Received: 26 January 2017
Date Tested: 6 February 2017
Lab Technician: KH

SIEVE SIZES (mm)	120	112	80	56	40.0	28.0	20	14	10	7.1	5	2.5	1.25	0.630	0.315	0.160	0.08
SPECIFICATIONS	-	-	-	-	-	100.0	85-100	50-90	25-60	-	0-10	0-5	-	-	-	-	-
% PASSING	100.0	100.0	100.0	100.0	100.0	100.0	92.3	55.2	29.4	14.8	3.7						
% RETAINING	0.0	0.0	0.0	0.0	0.0	0.0	7.7	44.8	70.6	85.2	96.3						



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LIMITS FOR DELETERIOUS SUBSTANCES AND PHYSICAL PROPERTIES OF AGGREGATE

CSA A23.1 - 14, Table 11 & 12 and A23.2 - 15A & 27A, Rev. August 2014

Clauses 4.2.3.2.2, 4.2.3.4.3, 4.2.3.5.1, 4.2.3.5.3.3, 4.2.3.5.3.4, 4.2.3.7 & 4.2.3.10.1

Job No.:	Client:	Sampled By:	Enclosure:
TB152049	Hatch Ltd.	Client	2

Name of Testing Laboratory:	Telephone No.:	Fax No.:
Amec Foster Wheeler Environment & Infrastructure	(905) 312 - 0700	(905) 312 - 0771

Sample Lab No.:	Sample Source:
S020-17	NF17-03

Sample Type:	Date Sampled:	Stockpile Quantity (t)
Crushed Core	Janaury 2017	--

COARSE AGGREGATE

Nominal Max. Size (mm):	Aggregrate Inventory No.:	Gradation Results:	Meets Spec.: (Y/N)
20 mm	n/a	n/a	n/a

Limits for Deleterious Substances and Physical Properties of Aggregates

CSA Laboratory Test and Number	Acceptance Limits		Reference Material Results	Sample Results	Meets Spec.
	Maximum percentage by mass of total sample				
Standard Requirements	**Concrete exposed to freezing & thawing**	**Other exposure conditions**			**Y / N**
Clay lumps - A23.2 - 3A †****	0.3 % maximum	0.5 % maximum	-	-	-
Low - density granular materials - A23.2 - 4A‡****	0.5 % maximum	1 % maximum	-	-	-
Material finer than 80 µm - A23.2 - 5A**	1% maximum[1]	1% maximum[1]	-	-	-
Absorption - A23.2 - 12A	-		0.37%	**0.37%**	-
Flat & elongated particles, Procedure A, 4:1 - A23.2-13A	20.0 % maximum	20.0 % maximum	-	-	-
Micro-Deval test - A23.2 - 29A	17 % maximum	21 % maximum	14.0%	**4.5%**	**Y**
Unconfined freeze-thaw test - A23.2 - 24A‡‡	6 % maximum	10 % maximum	9.5%	**1.6%**	**Y**
Abrasion loss - A23.2 - 16A and A23.2 - 17A§§	50 % maximum	50 % maximum	-	-	-
Petrographic examination of aggregate - A23.2 -15A	125 maximum	140 maximum	-	-	-
Alkali-Carbonate reactivity - A23.2 - 26A	chem. comp. must plot in non-exp. field		-	-	-
Accelerated mortar bar - A23.2 - 25A	maximum 0.150% at 14 days		-	-	-
Concrete prism - A23.2 - 14A	maximum 0.040% at one year		-	-	-
Alternative Requirements* **					
$MgSO_4$ soundness loss - A23.2 - 9A	12 % maximum	18 % maximum			

Issued By: Kristen Hand (Print Name)

Testing Laboratory Representative Signature

14 February 2017 (Date)

LIMITS FOR DELETERIOUS SUBSTANCES AND PHYSICAL PROPERTIES OF AGGREGATE

CSA A23.1 - 14, Table 11 & 12 and A23.2-15A & 27A, Rev. August 2014

Clauses 4.2.3.2.2, 4.2.3.4.3, 4.2.3.5.1, 4.2.3.5.3.3, 4.2.3.5.3.4, 4.2.3.7 & 4.2.3.10.1

Enclosure: **2**

*Limits for deleterious substances not listed in this Table, such as coal, ochre (ironstone), shalestone, siltstone, or argillaceous limestone, shall be specified by the owner to encompass deleterious materials known to be present in a particular region. In the absence of such information, aggregate shall be accepted or rejected in accordance with clause 4.2.3.9

†Clay lumps are defined as fine-grained, consolidated, sedimentary materials of a hydrous aluminosilicate nature.

‡A liquid with a relative density of 2.0 is generally used to separate particles classified as coal or lignite. Liquids with relative densities higher or lower than 2.0 might be required to identify other deleterious low-density materials.

The amount of material of clay size shall be determined by performing a hydrometer analysis as per ASTM D 422 on a sample washed through an 80 µm sieve.

**In the case of crushed aggregate, if material finer than the 80 µm sieve consists of the dust of fracture, essentially free from clay or shale, the maximum shall be 2.0%

‡‡CSA A23.2-24A, a test for coarse aggregate, has good precision and shows fair correlation with the MgSO4 soundness test. For further information, see Rogers, Senior, & Boothe (1989)

§§The abrasion loss shall not be greater than 35% when the aggregate is used in concrete paving or for other concrete surfaces subjected to significant wear. This does not refer to air- cooled iron blast-furnace-slag coarse aggregate. The abrasion loss requirements for coarse aggregate shall be waived provided that the material meets the alternative requirements for Micro-deval detailed in this Table.

***The freeze-thaw requirements for coarse aggregate shall be waived provided that the material meets the laternative requirements for $MgSO_4$ soundness loss detailed in this Table.

****If the Coarse Aggregate when tested according to A23.2-15A does not show the presence of either clay lumps or low-density granular materials, the requirements for testing in accordance with 3A and 4A may be waived.

[1]This limit applies to the amount of material finer than 80µm as determined by washing only.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

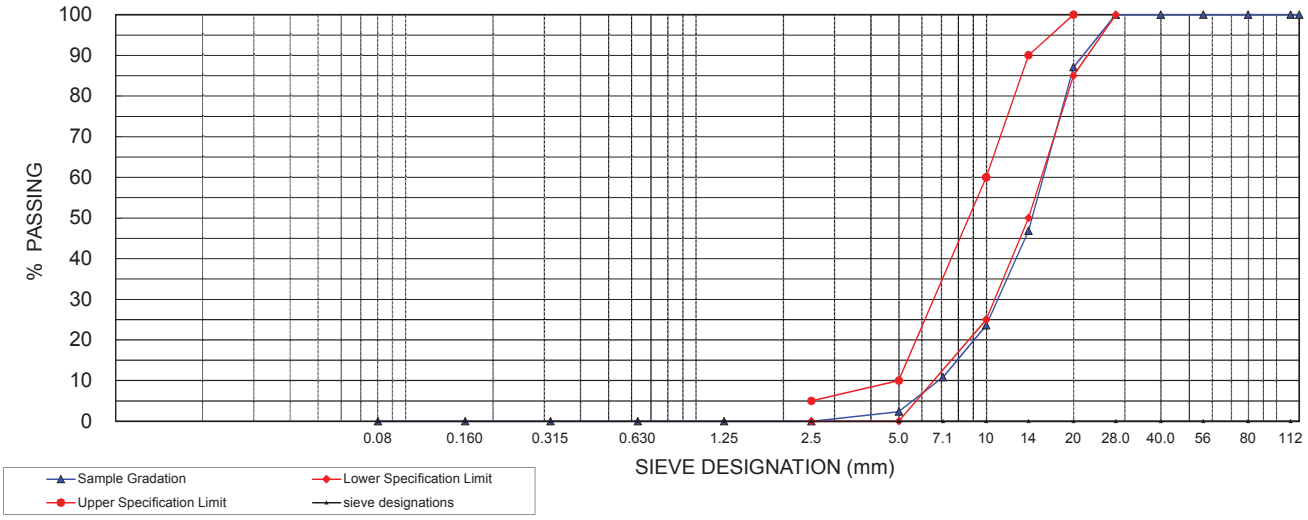
CSA A23.2-2A

Enclosure: 1
Date: 14 February 2017
Project No: TB152049

Client: Hatch Ltd.
Sample Source: NF17-03
Sampled By: Client
Date Sampled: January 2017
Sample Type: Crushed Core
Specification: CSA A23.1-14, August 2014, Table 11, Group I, 20-5mm Concrete Stone Grading Requirements for Coarse Aggregate

Lab No: S020-17
Date Received: 26 January 2017
Date Tested: 6 February 2017
Lab Technician: KH
Fineness Modulus: #DIV/0!

SIEVE SIZES (mm)	120	112	80	56	40.0	28.0	20	14	10	7.1	5	2.5	1.25	0.630	0.315	0.160	0.08
SPECIFICATIONS	-	-	-	-	-	100.0	85-100	50-90	25-60	-	0-10	0-5	-	-	-	-	-
% PASSING	100.0	100.0	100.0	100.0	100.0	100.0	87.1	46.8	23.6	10.8	2.4						
% RETAINING	0.0	0.0	0.0	0.0	0.0	0.0	12.9	53.2	76.4	89.2	97.6						



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LIMITS FOR DELETERIOUS SUBSTANCES AND PHYSICAL PROPERTIES OF AGGREGATE

CSA A23.1 - 14, Table 11 & 12 and A23.2 - 15A & 27A, Rev. August 2014

Clauses 4.2.3.2.2, 4.2.3.4.3, 4.2.3.5.1, 4.2.3.5.3.3, 4.2.3.5.3.4, 4.2.3.7 & 4.2.3.10.1

Job No.:	Client:	Sampled By:	Enclosure:
TB152049	Hatch Ltd.	Client	2

Name of Testing Laboratory:	Telephone No.:	Fax No.:
Amec Foster Wheeler Environment & Infrastructure	(905) 312 - 0700	(905) 312 - 0771

Sample Lab No.:	Sample Source:
S021-17	NF17-04

Sample Type:	Date Sampled:	Stockpile Quantity (t)
Crushed Rock	January 2017	--

COARSE AGGREGATE

Nominal Max. Size (mm):	Aggregrate Inventory No.:	Gradation Results:	Meets Spec.: (Y/N)
20 mm	n/a	n/a	n/a

Limits for Deleterious Substances and Physical Properties of Aggregates

CSA Laboratory Test and Number	Acceptance Limits		Reference Material Results	Sample Results	Meets Spec.
	Maximum percentage by mass of total sample				
Standard Requirements	**Concrete exposed to freezing & thawing**	**Other exposure conditions**			**Y / N**
Clay lumps - A23.2 - 3A †****	0.3 % maximum	0.5 % maximum	-	-	-
Low - density granular materials - A23.2 - 4A‡****	0.5 % maximum	1 % maximum	-	-	-
Material finer than 80 µm - A23.2 - 5A**	1% maximum[1]	1% maximum[1]	-	-	-
Absorption - A23.2 - 12A	-		0.37%	**0.45%**	-
Flat & elongated particles, Procedure A, 4:1 - A23.2-13A	20.0 % maximum	20.0 % maximum	-	-	-
Micro-Deval test - A23.2 - 29A	17 % maximum	21 % maximum	14.0%	**7.9%**	**Y**
Unconfined freeze-thaw test - A23.2 - 24A‡‡	6 % maximum	10 % maximum	9.5%	**0.8%**	**Y**
Abrasion loss - A23.2 - 16A and A23.2 - 17A§§	50 % maximum	50 % maximum	-	-	-
Petrographic examination of aggregate - A23.2 -15A	125 maximum	140 maximum	-	-	-
Alkali-Carbonate reactivity - A23.2 - 26A	chem. comp. must plot in non-exp. field		-	-	-
Accelerated mortar bar - A23.2 - 25A	maximum 0.150% at 14 days		-	-	-
Concrete prism - A23.2 - 14A	maximum 0.040% at one year		-	-	-
Alternative Requirements* **					
$MgSO_4$ soundness loss - A23.2 - 9A	12 % maximum	18 % maximum			

Issued By: Kristen Hand (Print Name) _____ (Testing Laboratory Representative Signature) 14 February 2017 (Date)

LIMITS FOR DELETERIOUS SUBSTANCES AND PHYSICAL PROPERTIES OF AGGREGATE

CSA A23.1 - 14, Table 11 & 12 and A23.2-15A & 27A, Rev. August 2014

Clauses 4.2.3.2.2, 4.2.3.4.3, 4.2.3.5.1, 4.2.3.5.3.3, 4.2.3.5.3.4, 4.2.3.7 & 4.2.3.10.1

Enclosure: **2**

*Limits for deleterious substances not listed in this Table, such as coal, ochre (ironstone), shalestone, siltstone, or argillaceous limestone, shall be specified by the owner to encompass deleterious materials known to be present in a particular region. In the absence of such information, aggregate shall be accepted or rejected in accordance with clause 4.2.3.9

†Clay lumps are defined as fine-grained, consolidated, sedimentary materials of a hydrous aluminosilicate nature.

‡A liquid with a relative density of 2.0 is generally used to separate particles classified as coal or lignite. Liquids with relative densities higher or lower than 2.0 might be required to identify other deleterious low-density materials.

The amount of material of clay size shall be determined by performing a hydrometer analysis as per ASTM D 422 on a sample washed through an 80 µm sieve.

**In the case of crushed aggregate, if material finer than the 80 µm sieve consists of the dust of fracture, essentially free from clay or shale, the maximum shall be 2.0%

‡‡CSA A23.2-24A, a test for coarse aggregate, has good precision and shows fair correlation with the MgSO4 soundness test. For further information, see Rogers, Senior, & Boothe (1989)

§§The abrasion loss shall not be greater than 35% when the aggregate is used in concrete paving or for other concrete surfaces subjected to significant wear. This does not refer to air- cooled iron blast-furnace-slag coarse aggregate. The abrasion loss requirements for coarse aggregate shall be waived provided that the material meets the alternative requirements for Micro-deval detailed in this Table.

***The freeze-thaw requirements for coarse aggregate shall be waived provided that the material meets the laternative requirements for $MgSO_4$ soundness loss detailed in this Table.

****If the Coarse Aggregate when tested according to A23.2-15A does not show the presence of either clay lumps or low-density granular materials, the requirements for testing in accordance with 3A and 4A may be waived.

[1]This limit applies to the amount of material finer than 80µm as determined by washing only.

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

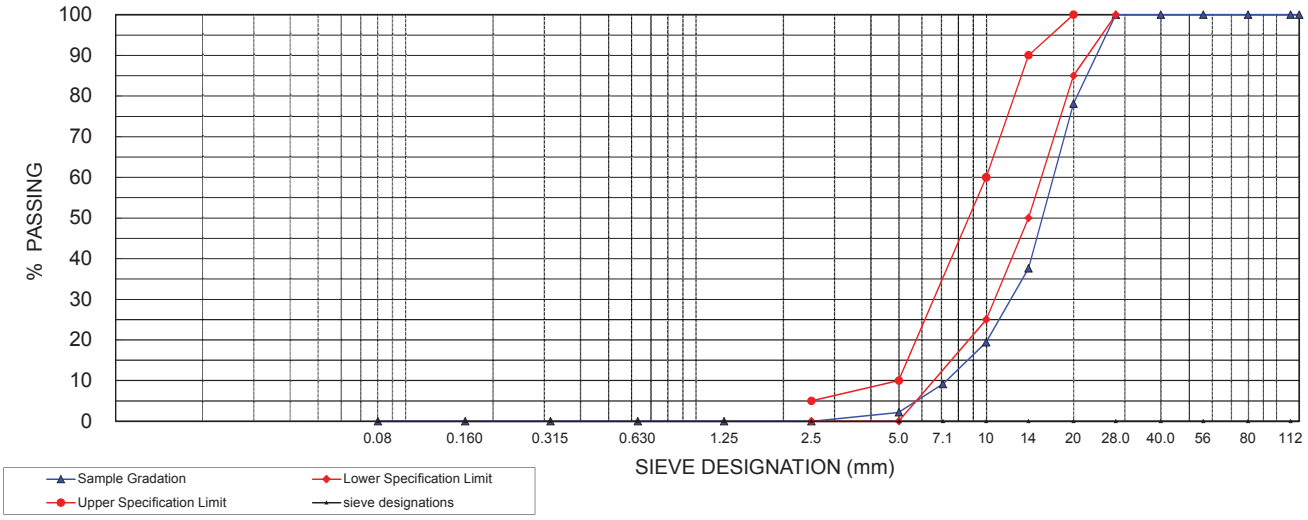
CSA A23.2-2A

Enclosure: 1
Date: 14 February 2017
Project No: TB152049

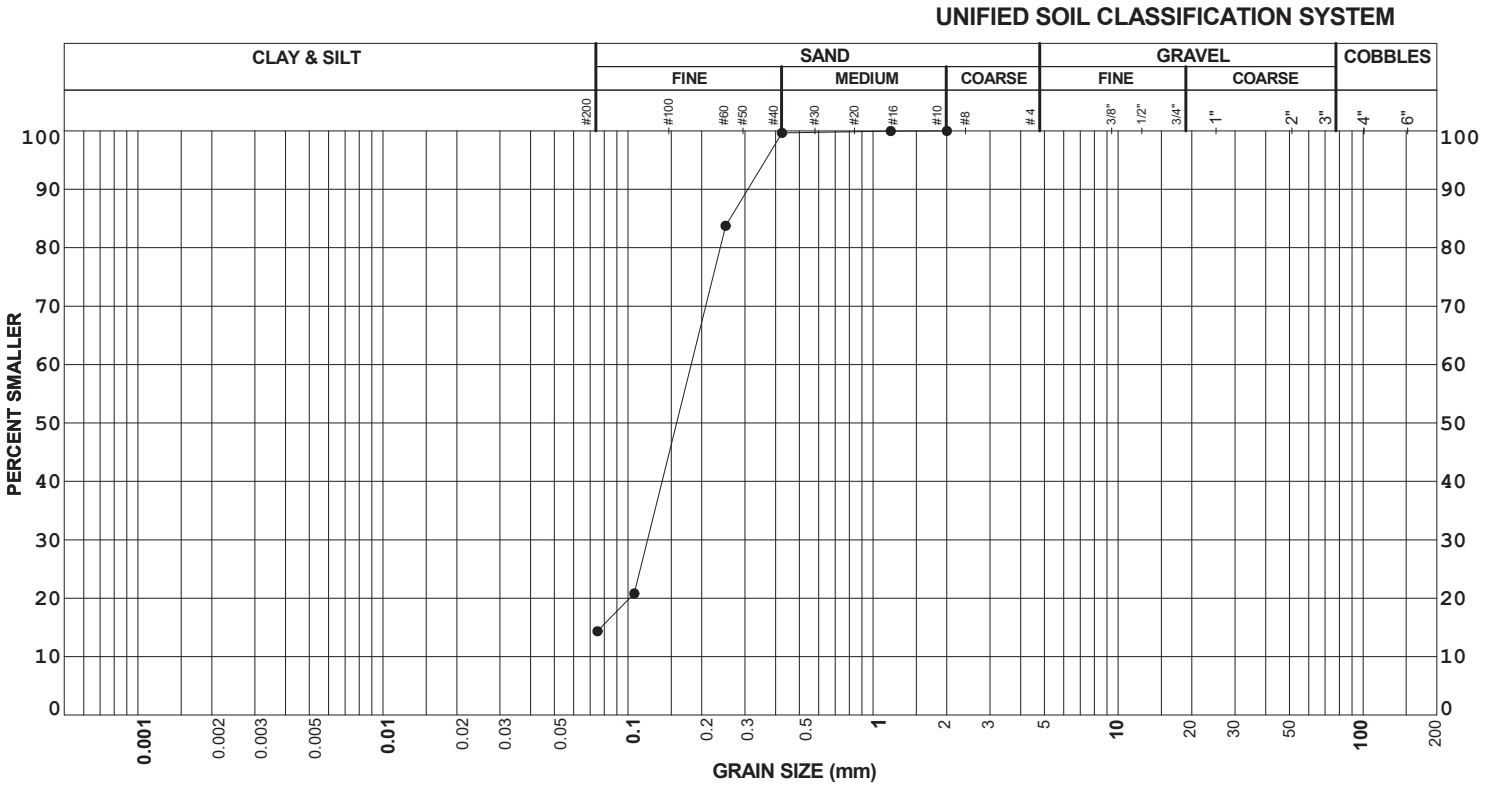
Client: Hatch Ltd.
Sample Source: NF17-04
Sampled By: Client
Date Sampled: January 2017
Sample Type: Crushed Rock
Specification: CSA A23.1-14, August 2014, Table 11, Group I, 20-5mm Concrete Stone Grading Requirements for Coarse Aggregate

Lab No: S021-17
Date Received: 26 January 2017
Date Tested: 6 February 2017
Lab Technician: KH

SIEVE SIZES (mm)	120	112	80	56	40.0	28.0	20	14	10	7.1	5	2.5	1.25	0.630	0.315	0.160	0.08
SPECIFICATIONS	-	-	-	-	-	100.0	85-100	50-90	25-60	-	0-10	0-5	-	-	-	-	-
% PASSING	100.0	100.0	100.0	100.0	100.0	100.0	78.1	37.6	19.4	9.2	2.2						
% RETAINING	0.0	0.0	0.0	0.0	0.0	0.0	21.9	62.4	80.6	90.8	97.8						



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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-004	DS-1	2.40	0	86	14		

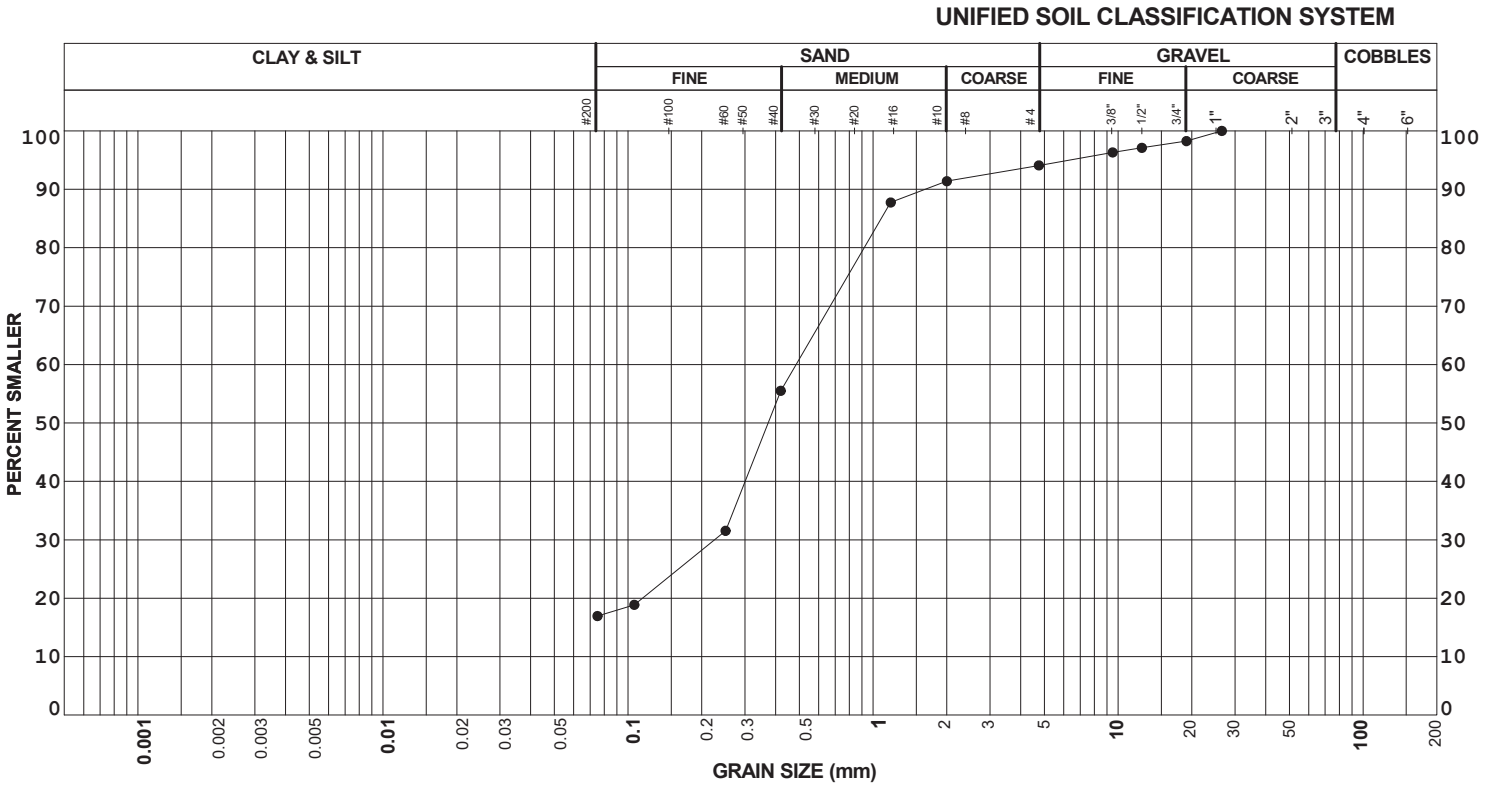
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-004	DQ-1	2.50	6	77	17		

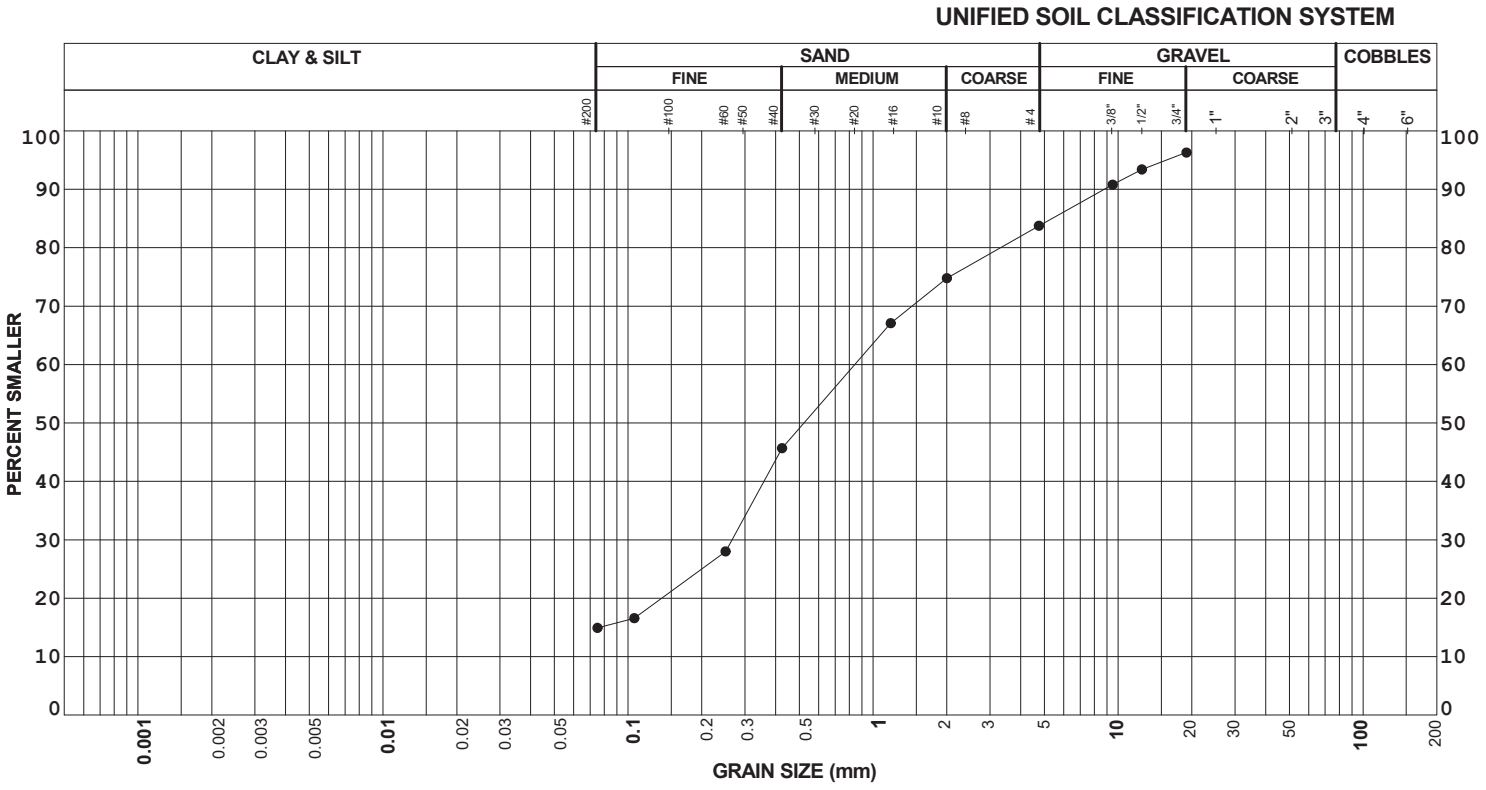
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

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	BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
●	BH18-004	DS-4	12.60	14	70	16		

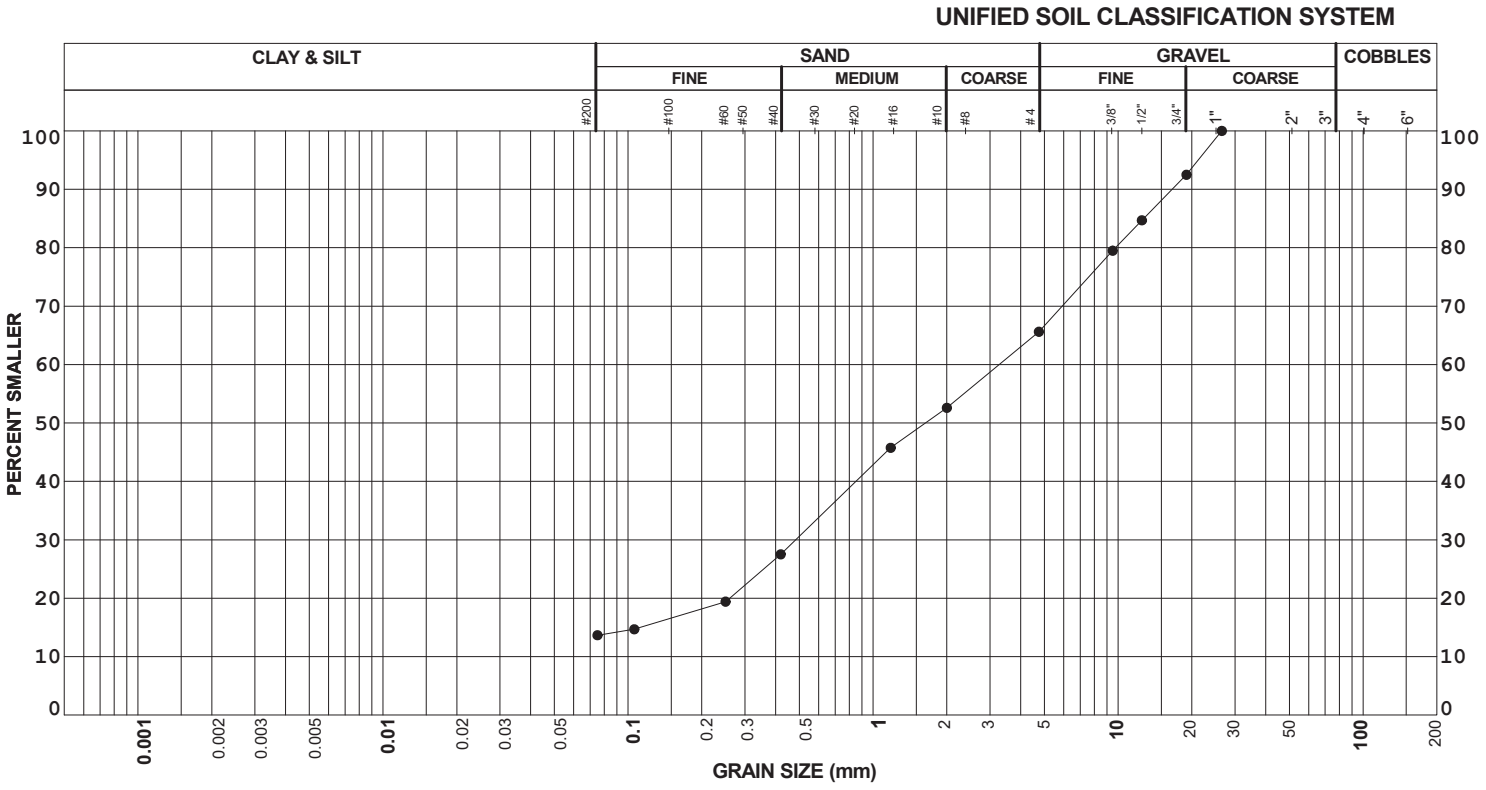
REMARKS:

GRAIN SIZE DISTRIBUTION

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BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-004	DS-6	17.40	34	52	14		

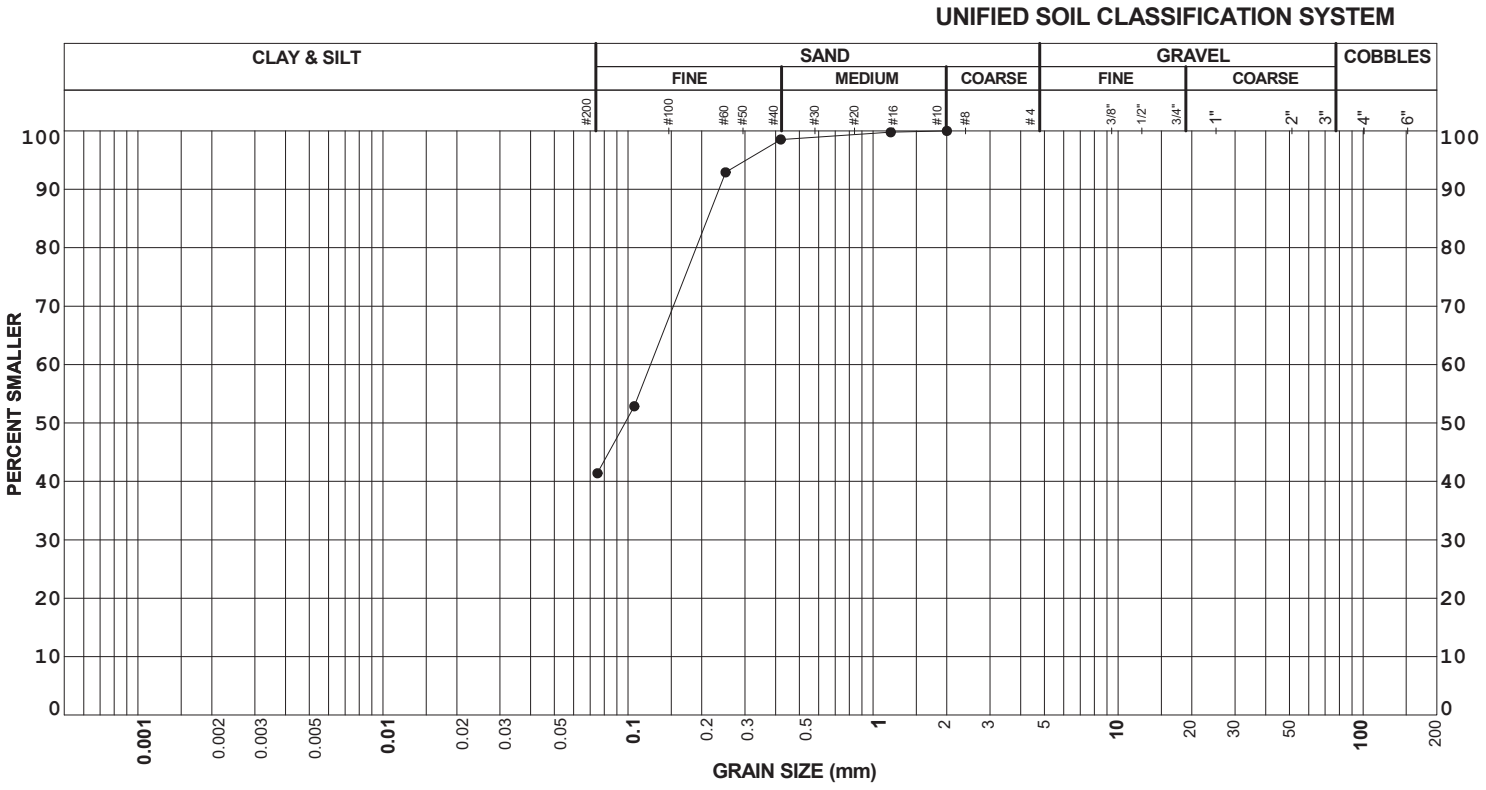
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

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Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-004	DQ-8	21.00	0	59	41		

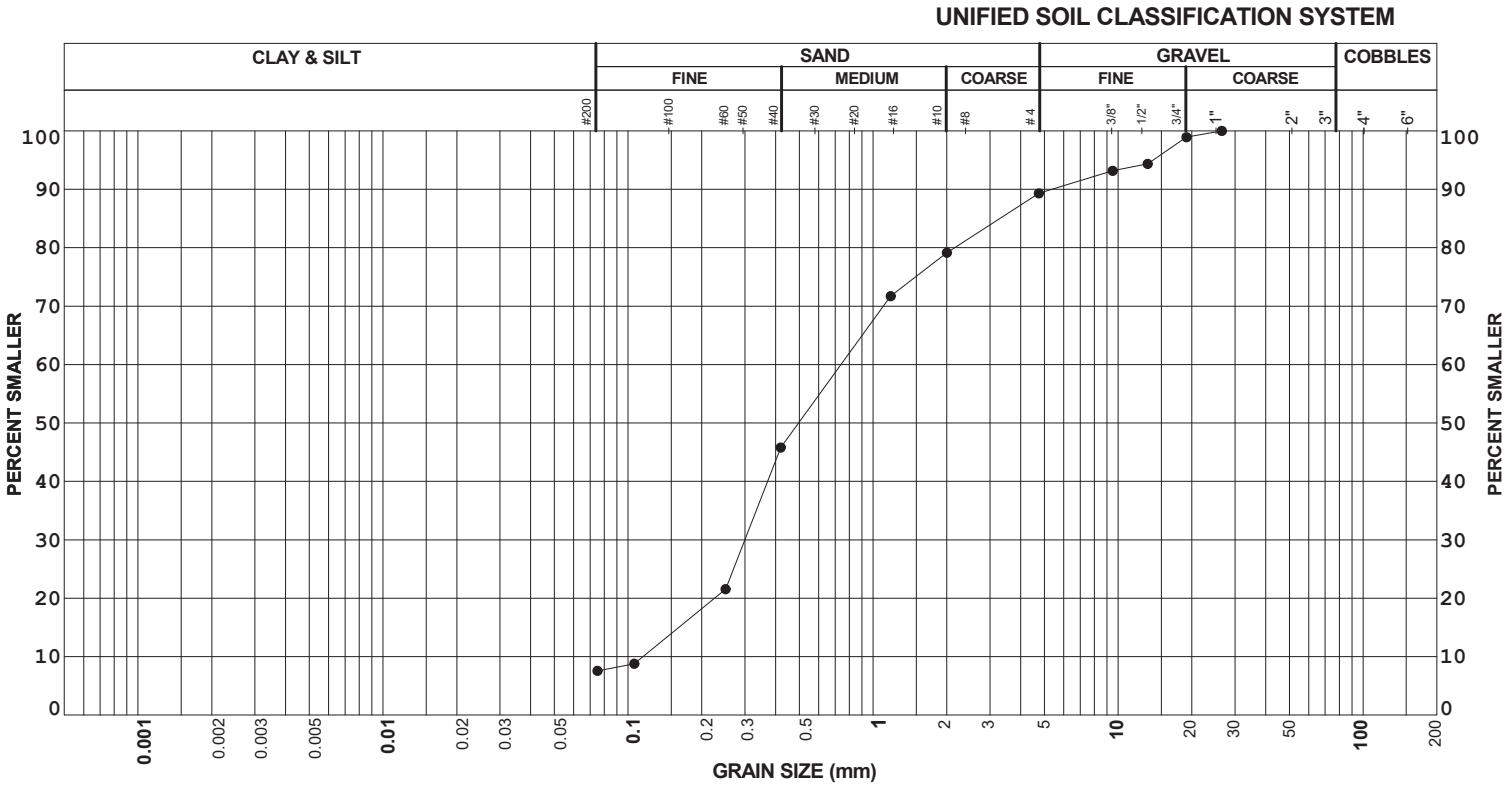
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

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	BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
●	BH18-004	DS-11	26.80	11	81	8		

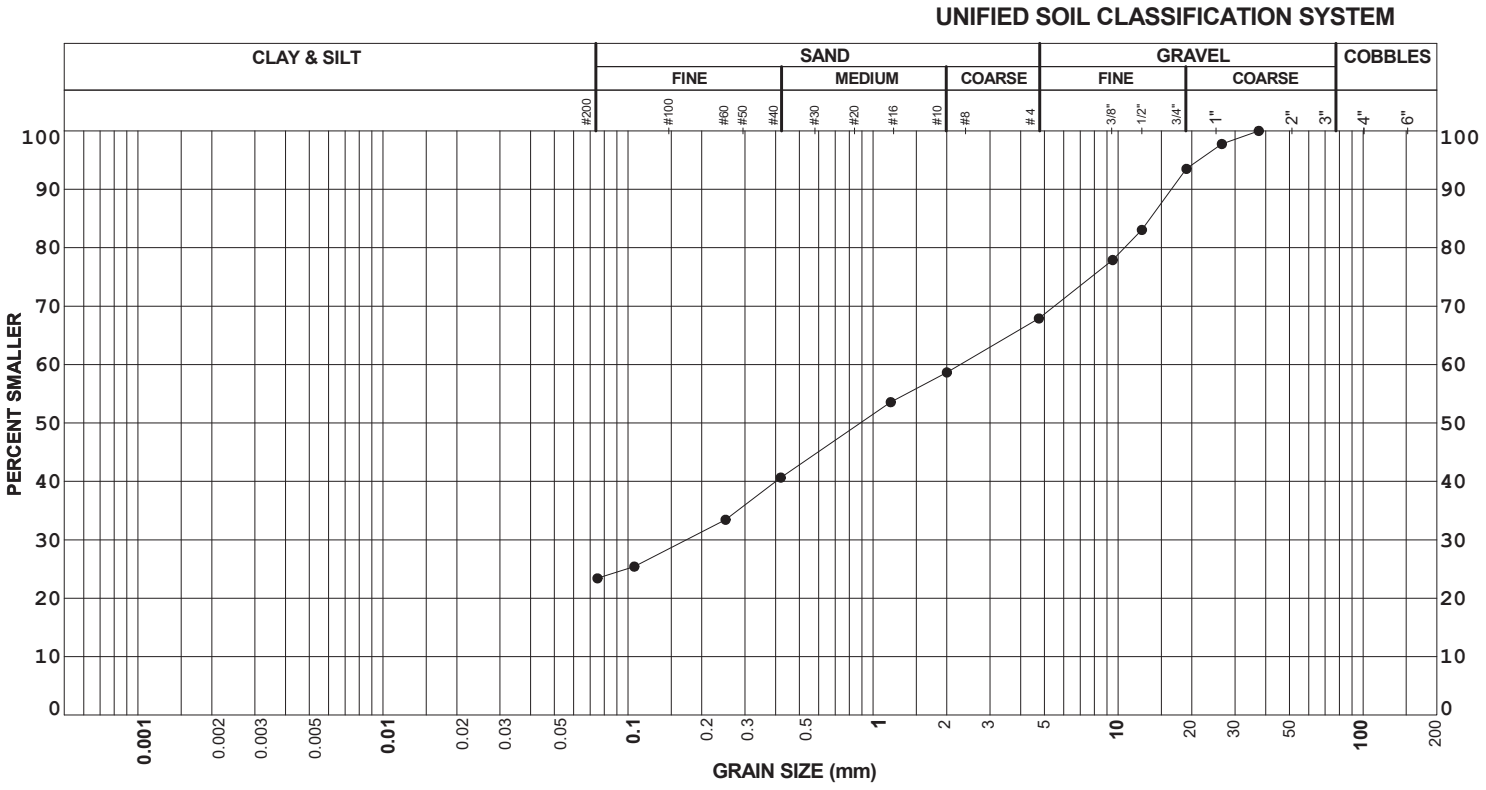
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-004	DS-14	40.20	32	45	23		

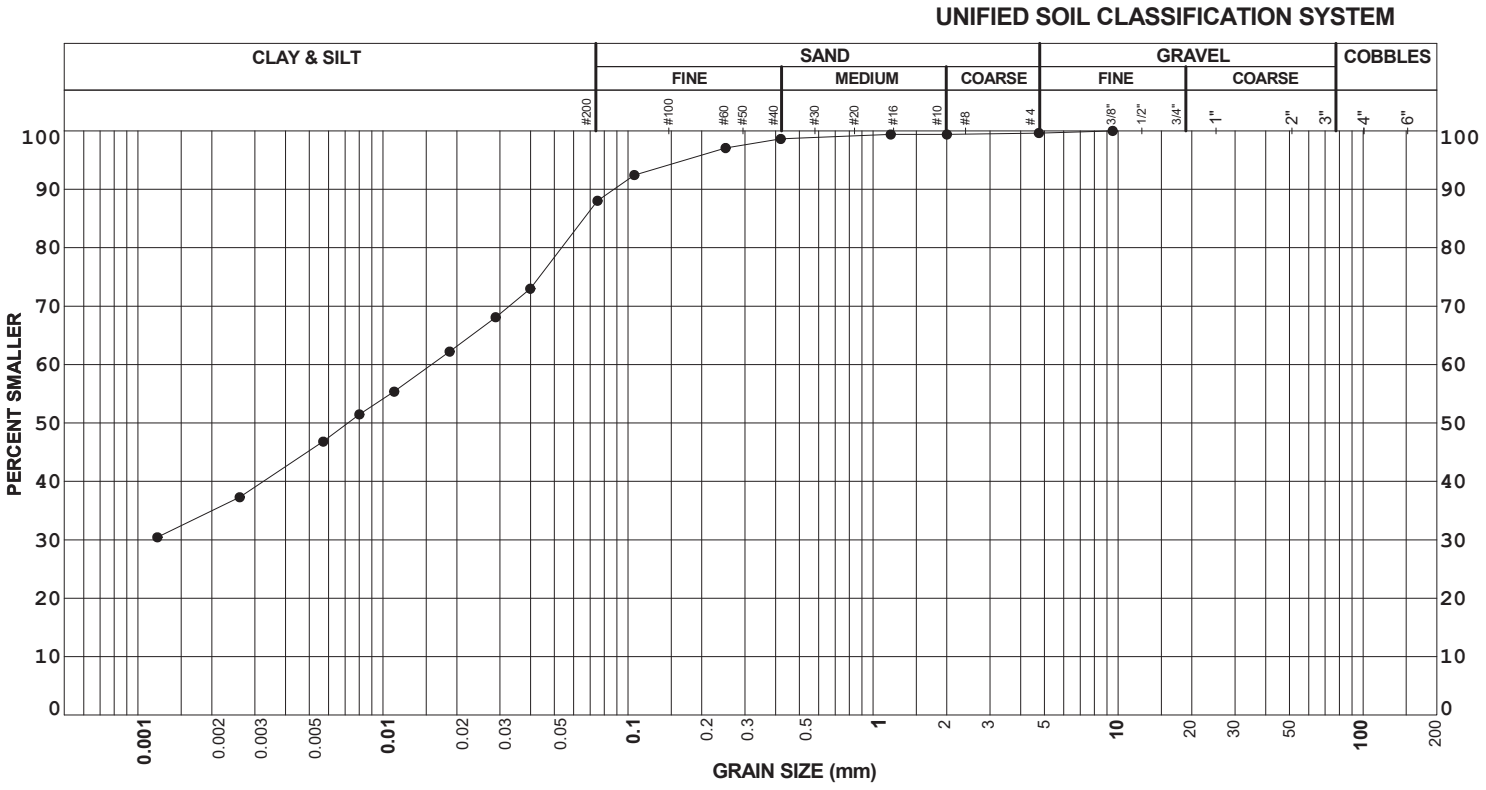
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-004	DQ-16	42.70	0	12	88		

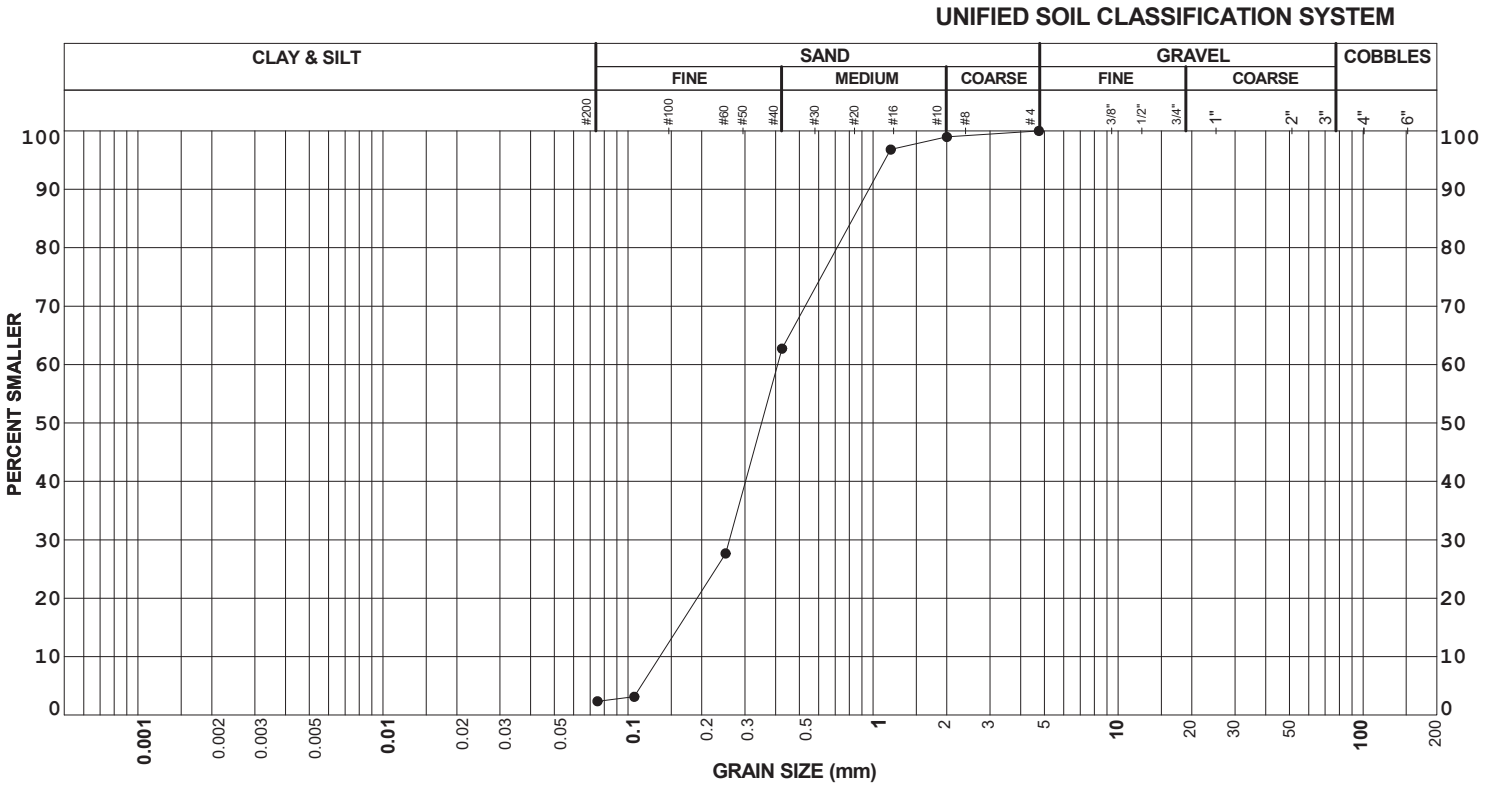
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-004	DS-17	47.20	0	98	2		

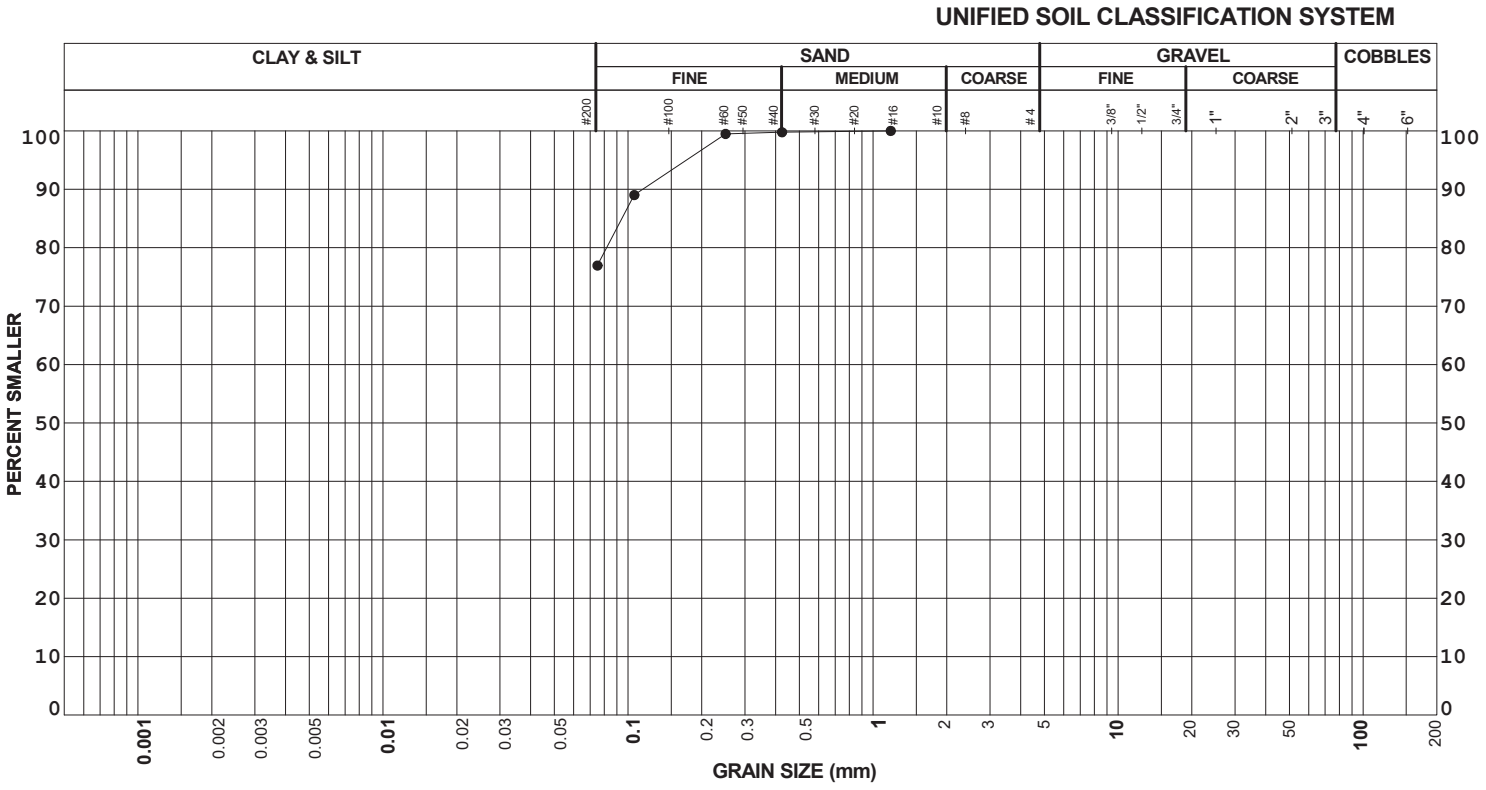
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-004	DS-24	61.70	0	23	77		

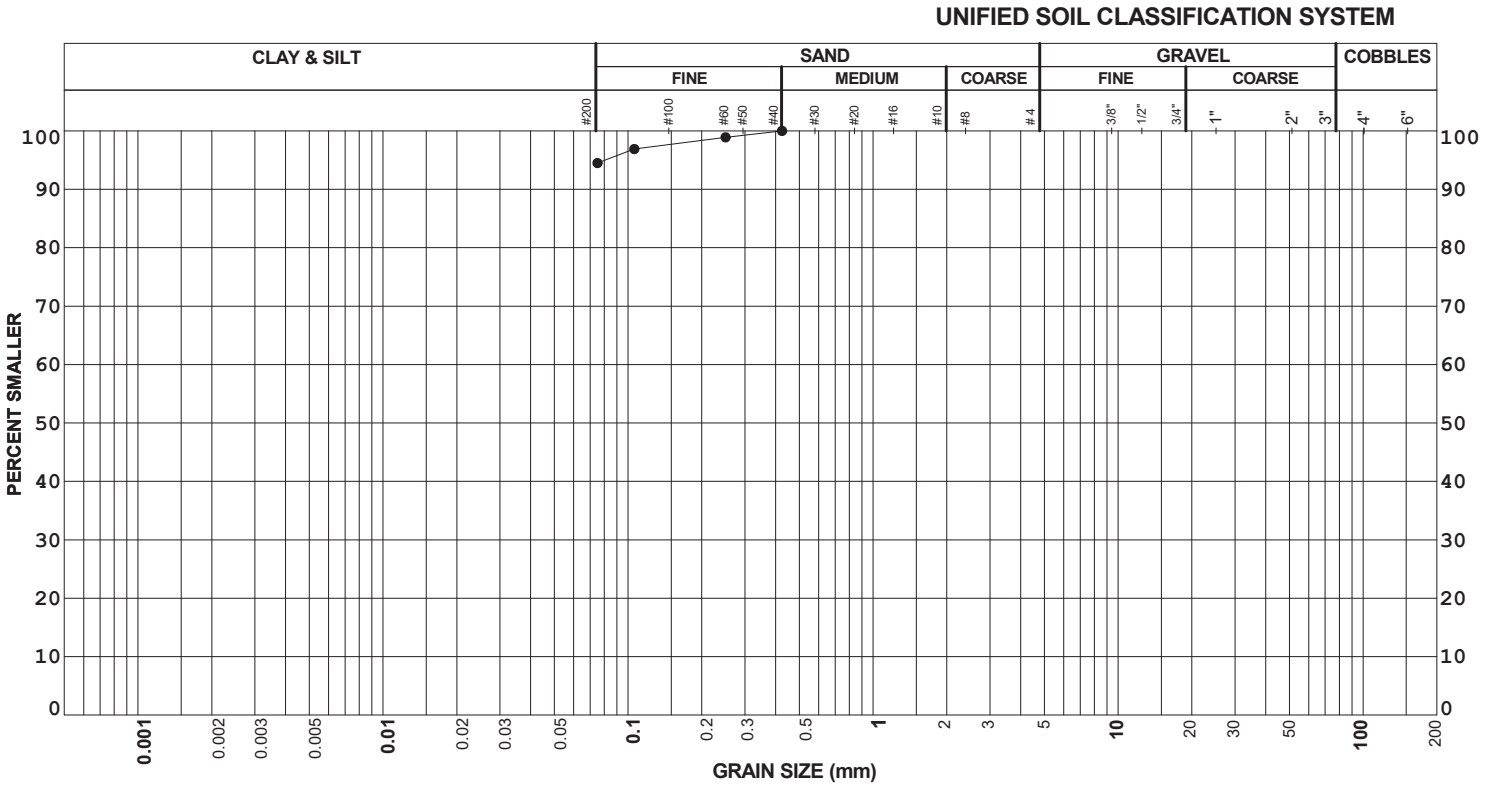
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-004	DS-26	63.20	0	6	94		

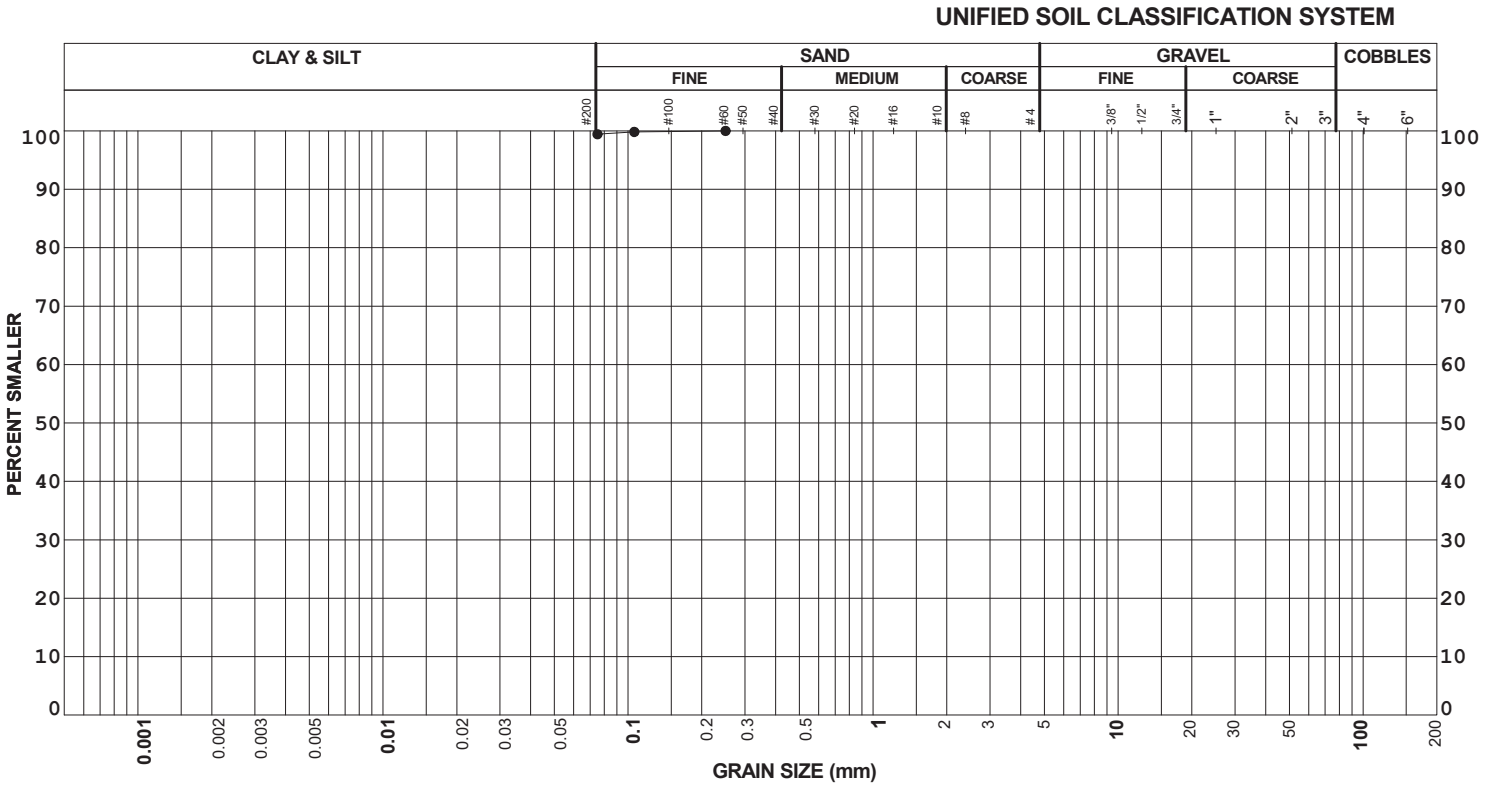
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-004	DQ-28	68.90	0	1	99		

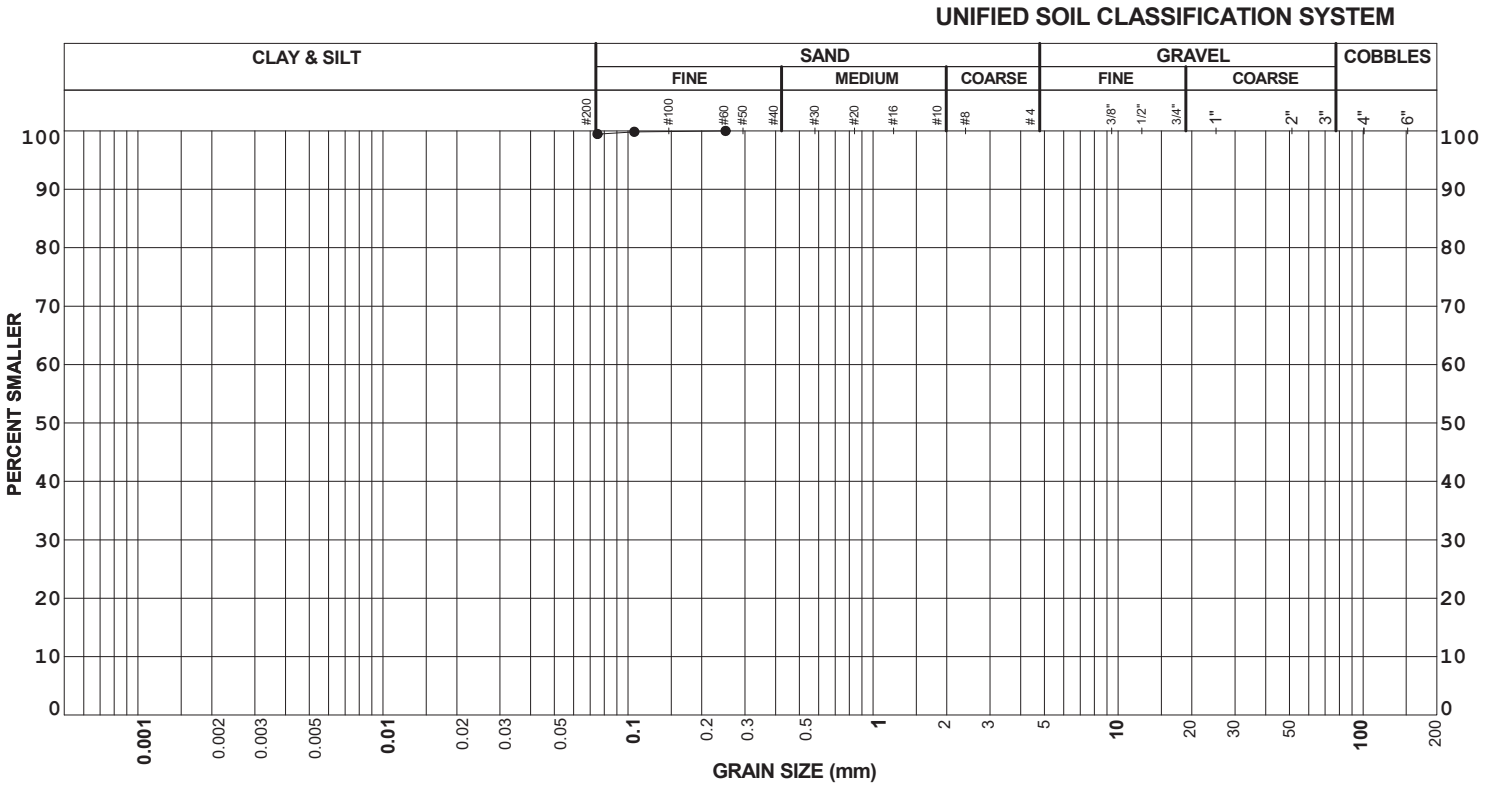
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-004	DS-29	70.50	0	1	99		

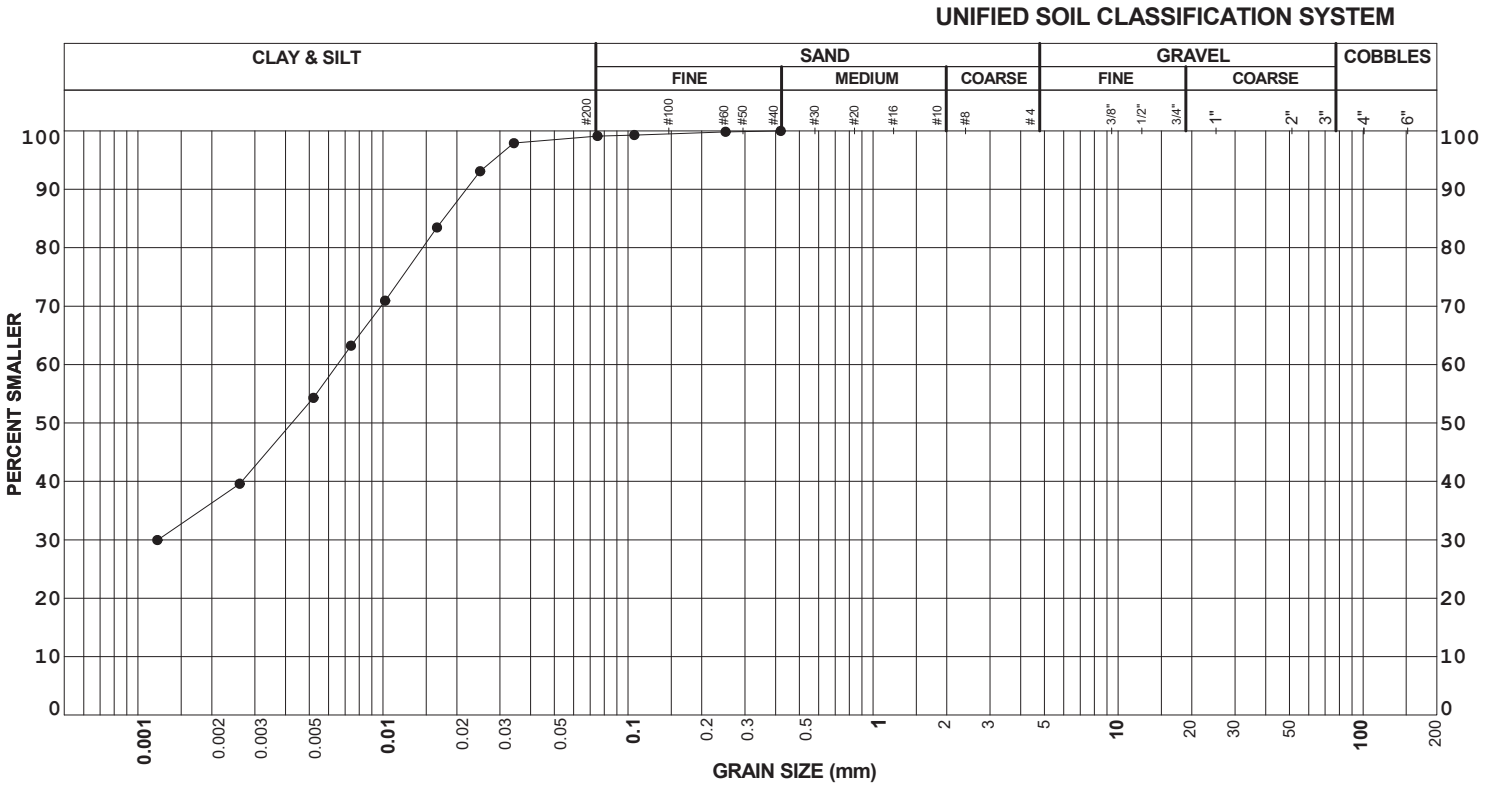
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-004	DQ-30	72.00	0	1	99	33	14

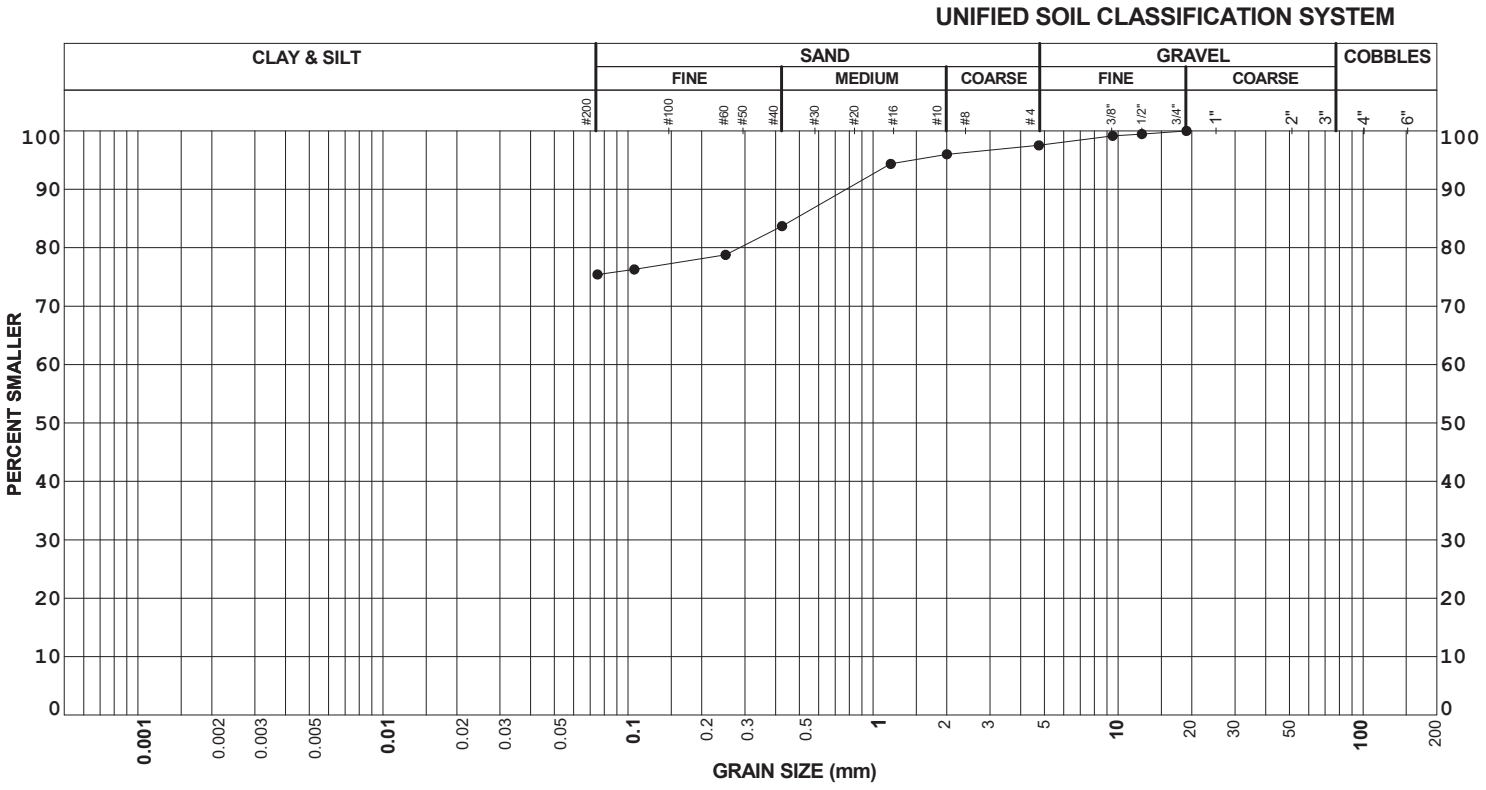
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M001	DS-3	0.90	2	23	75		

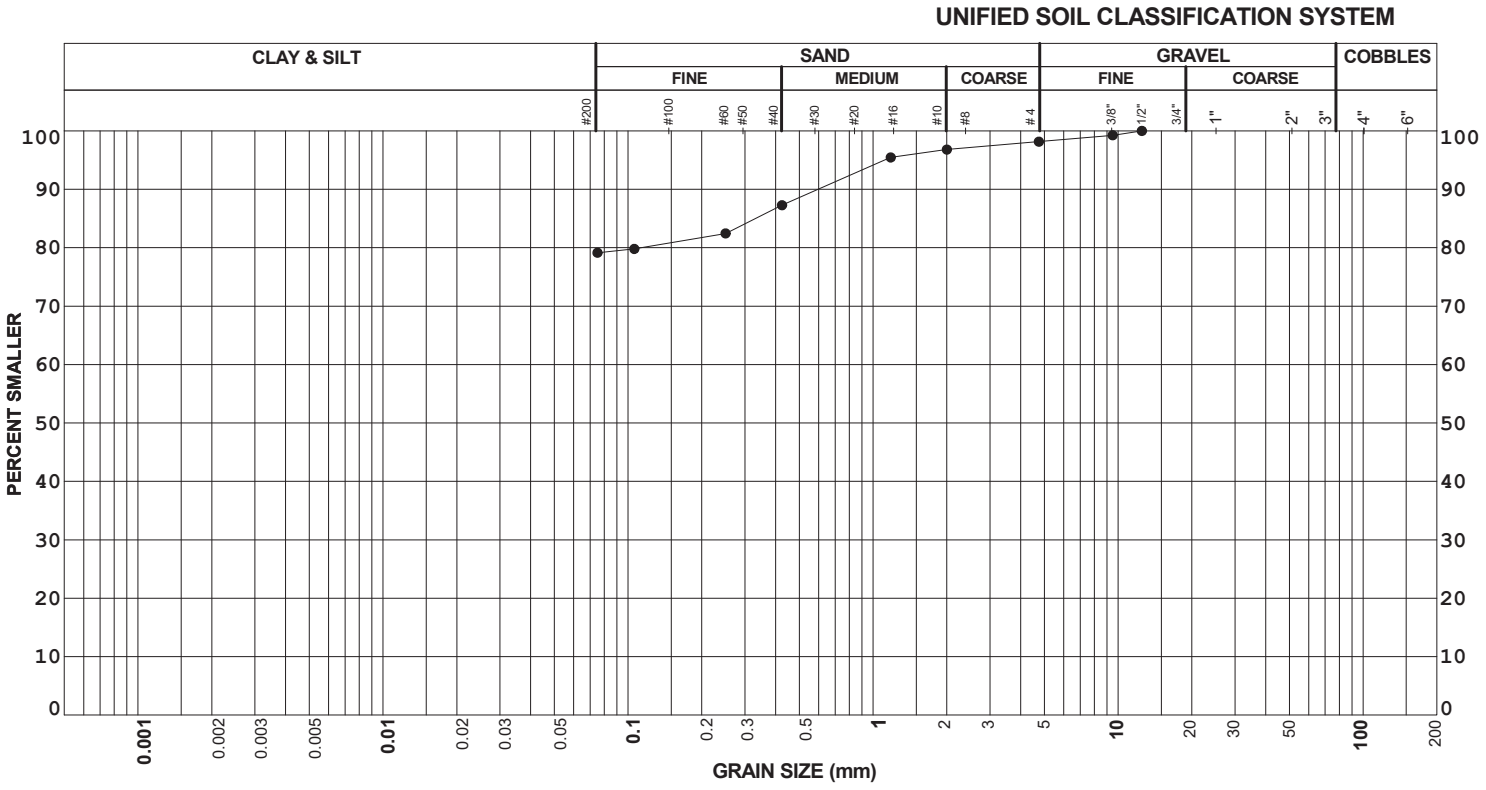
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M001	DS-5	2.40	2	19	79		

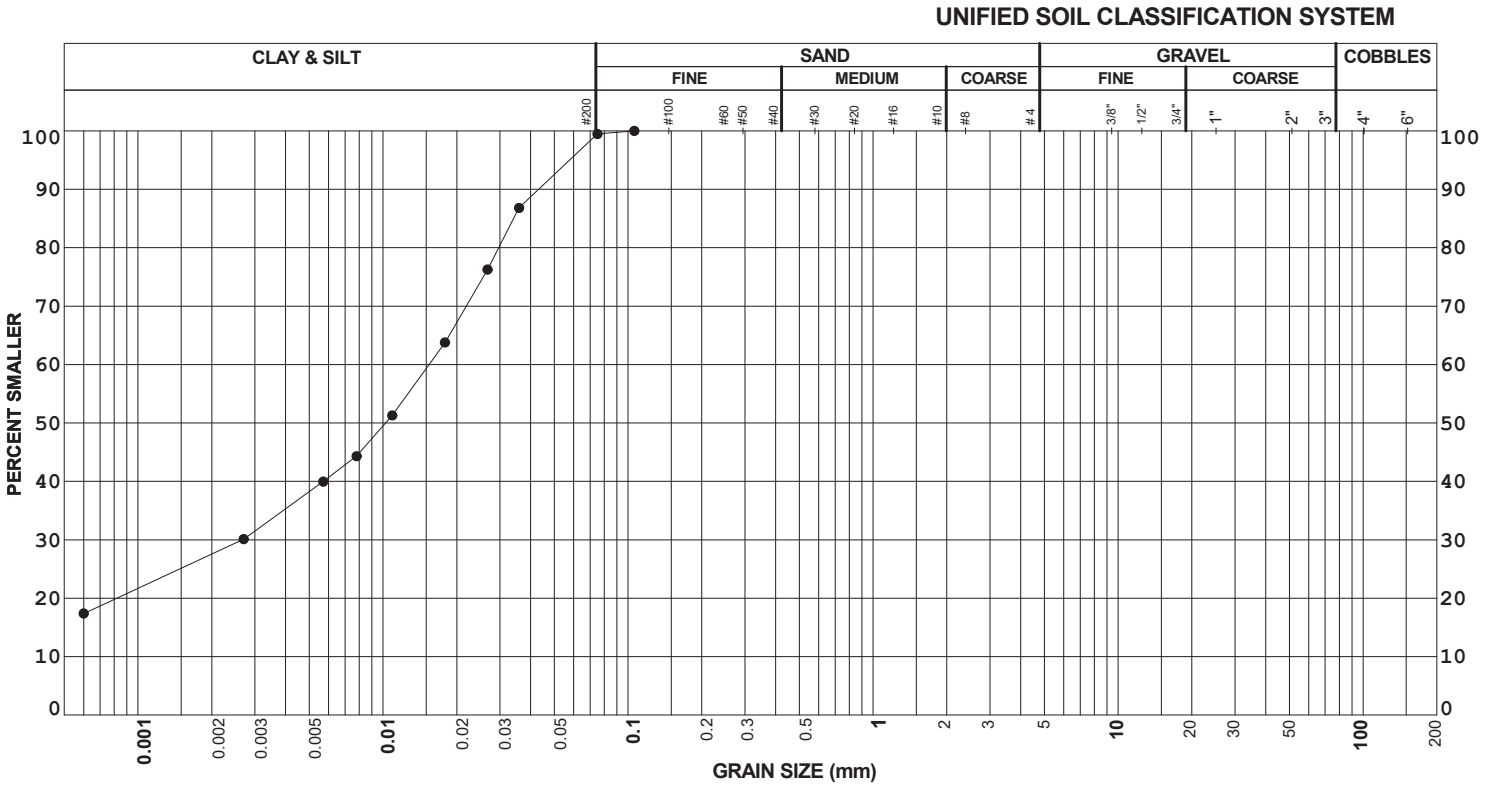
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M001	DS-6	7.00	0	1	99		

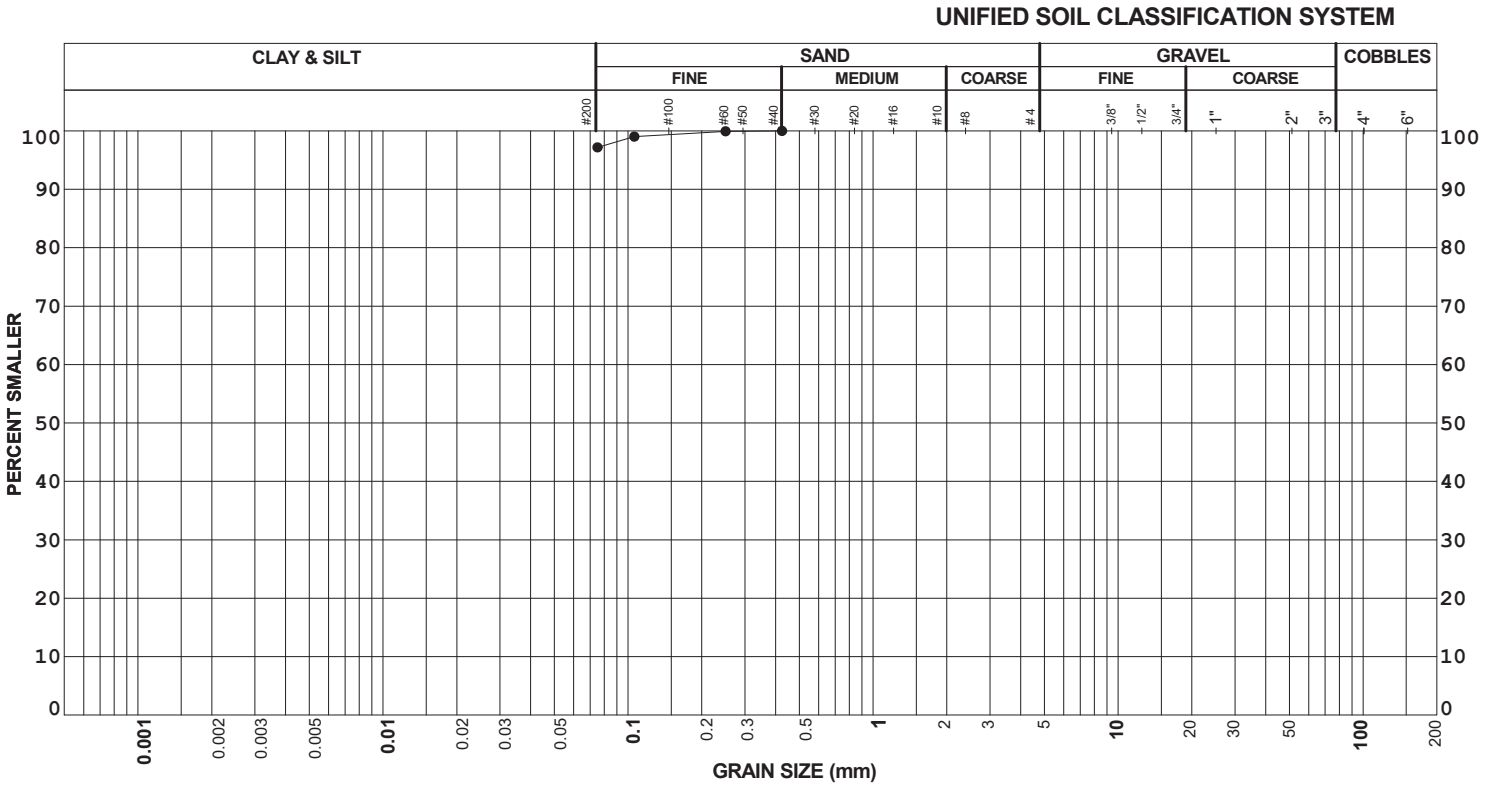
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M001	DS-8	10.18	0	3	97		

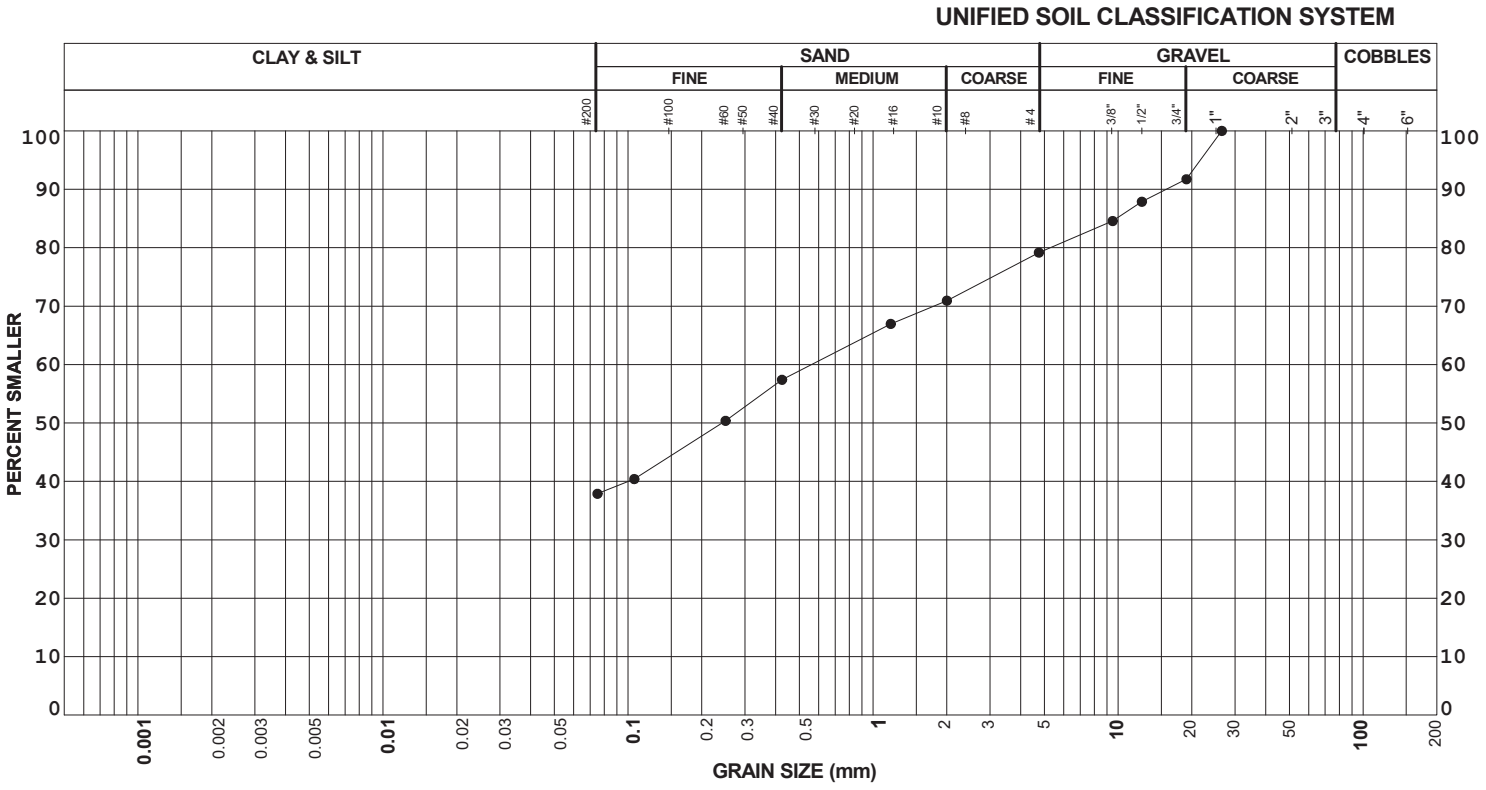
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M001	DS-14	19.40	21	41	38		

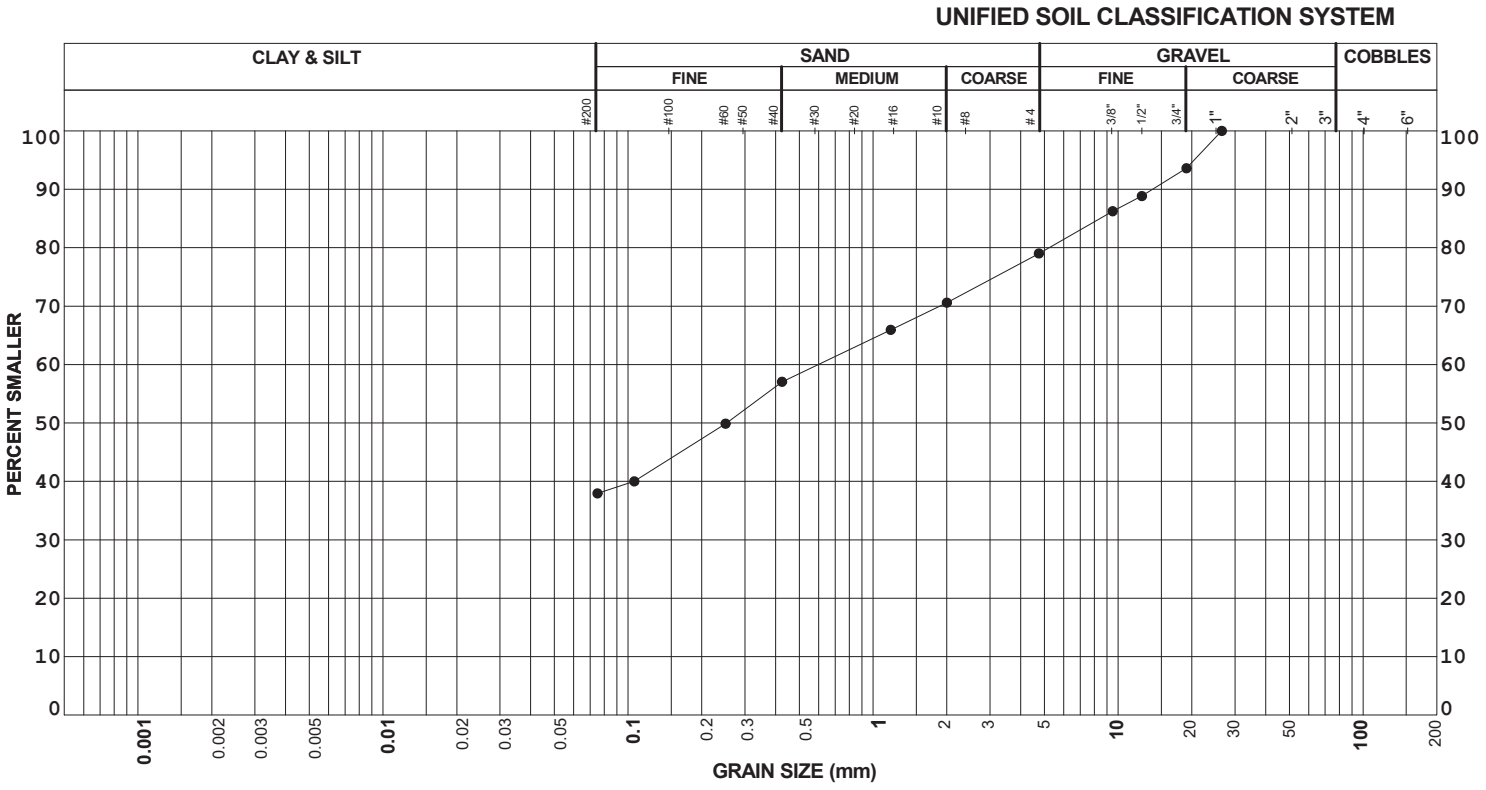
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M001	DS-15	22.00	21	41	38		

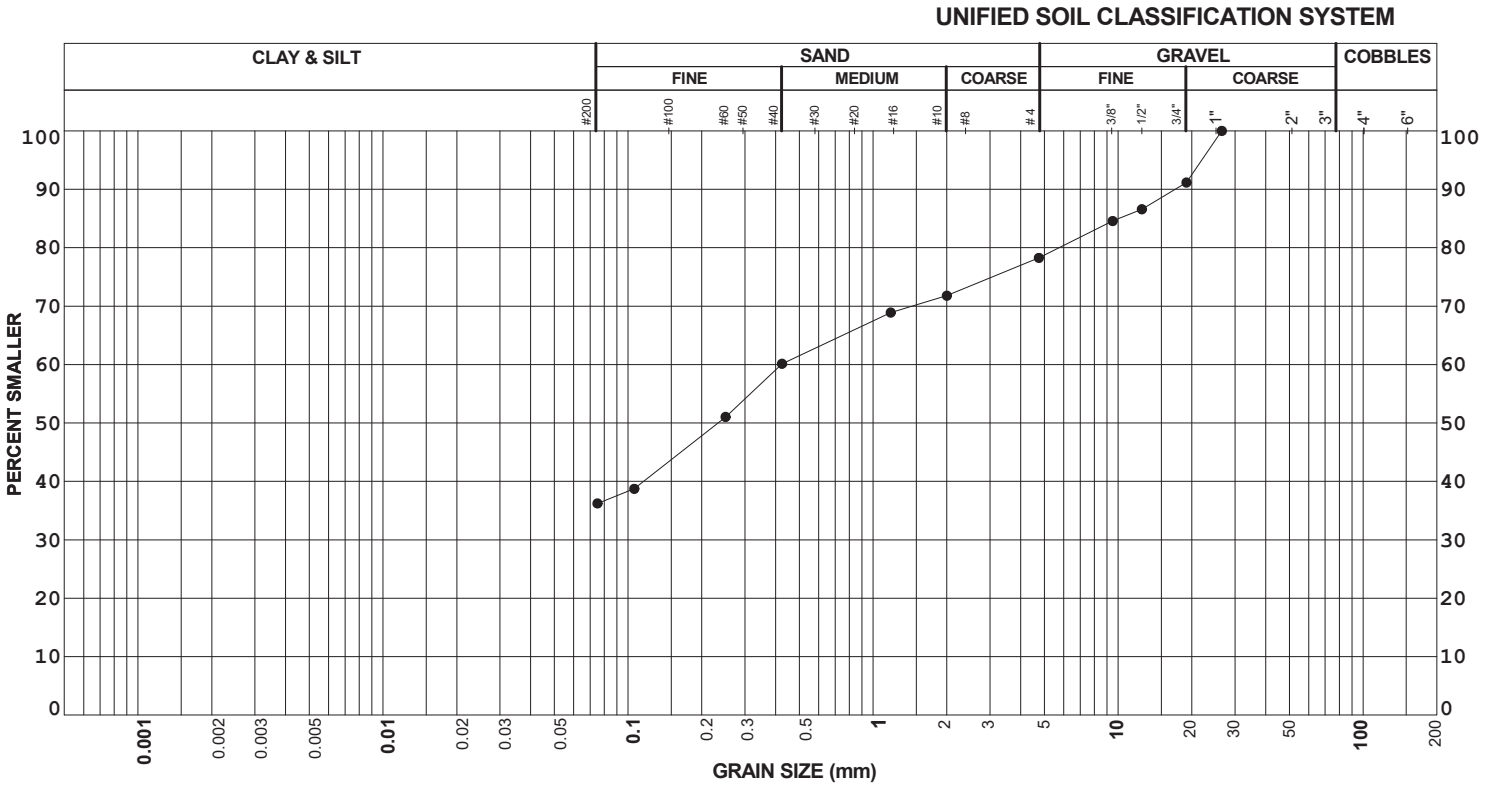
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M001	DS-16	23.34	22	42	36		

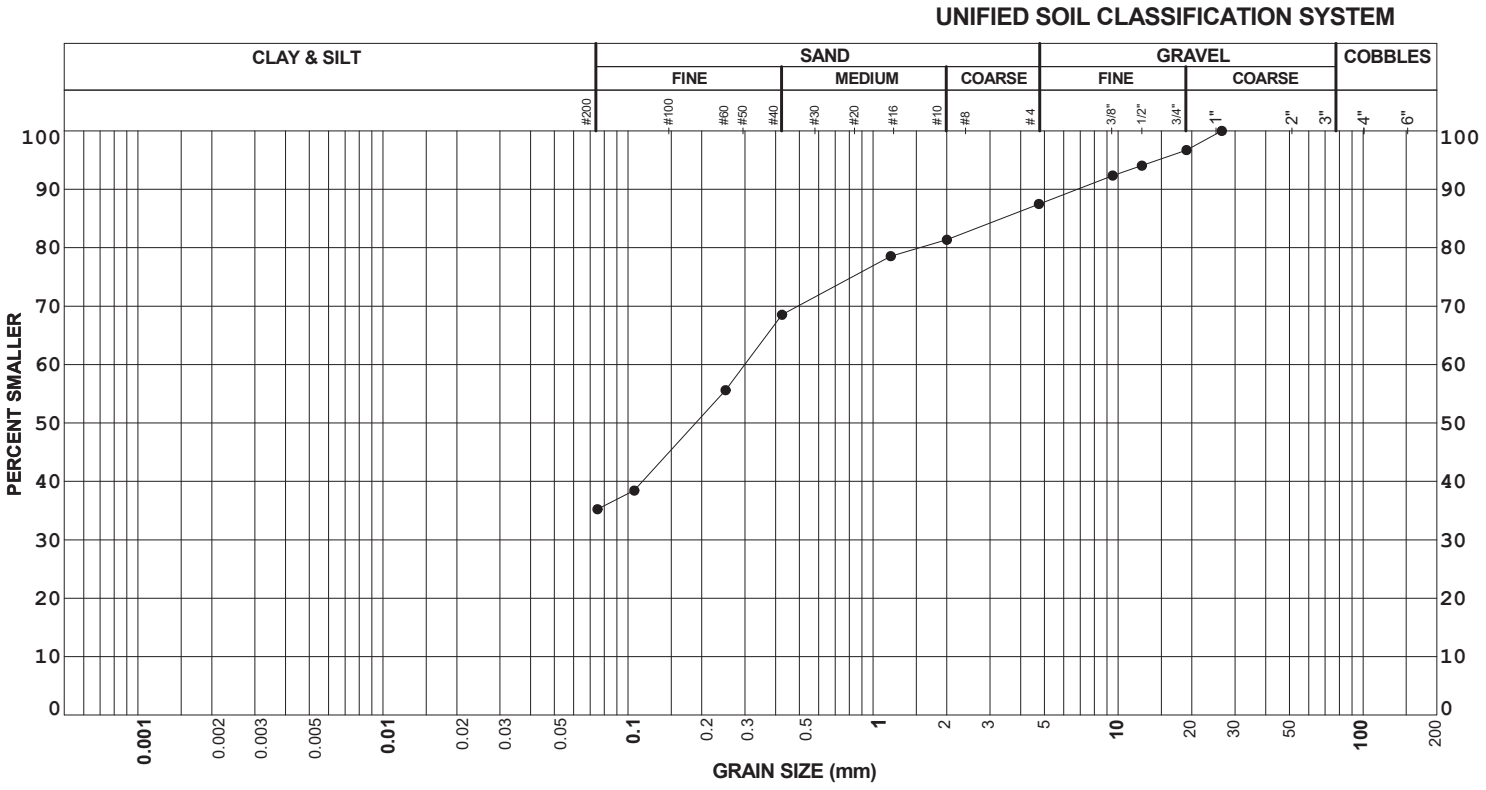
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M001	DS-17	25.35	13	52	35		

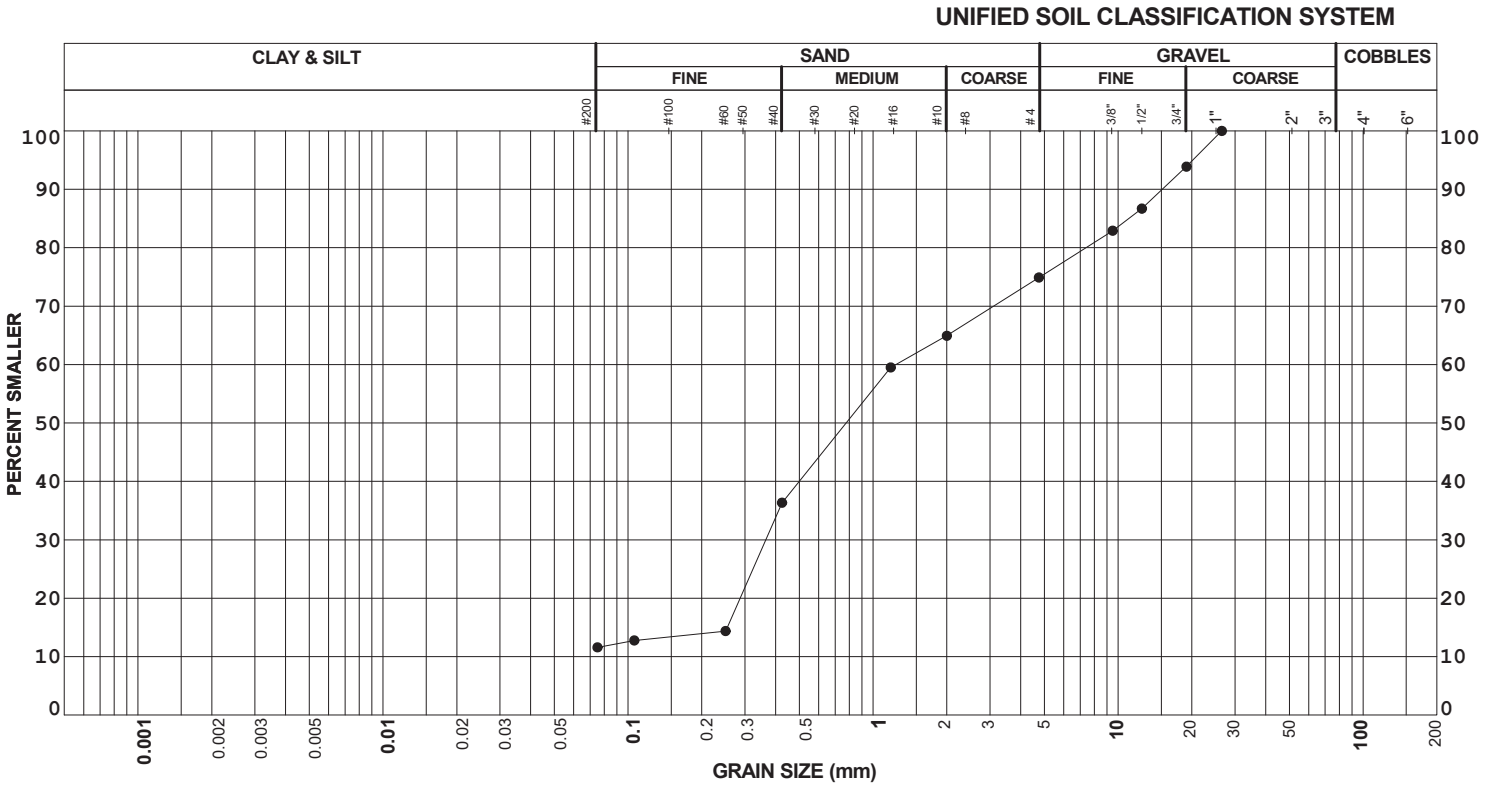
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M002	DS-2	1.20	25	63	12		

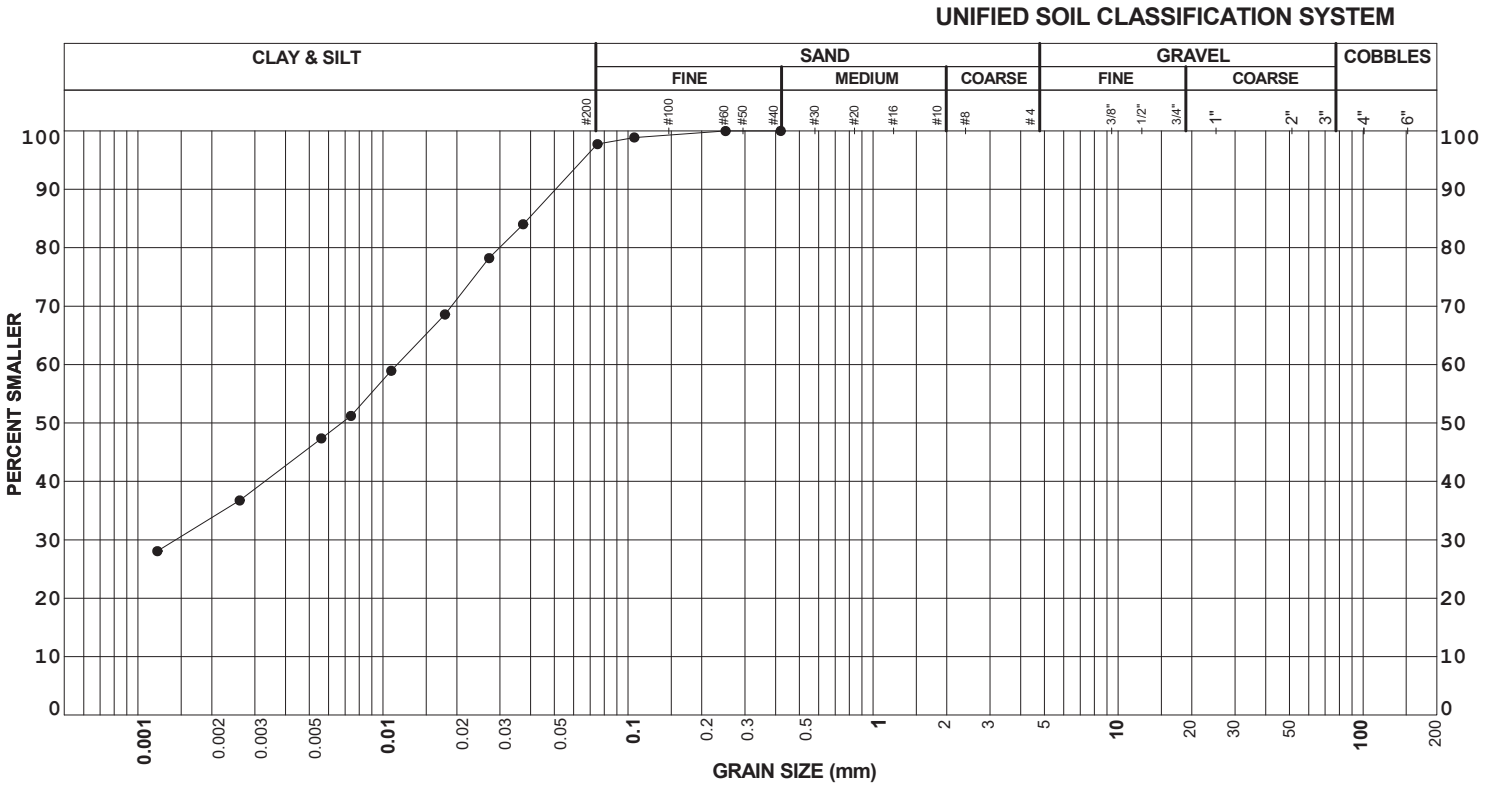
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M002	DQ-3	3.85	0	2	98		

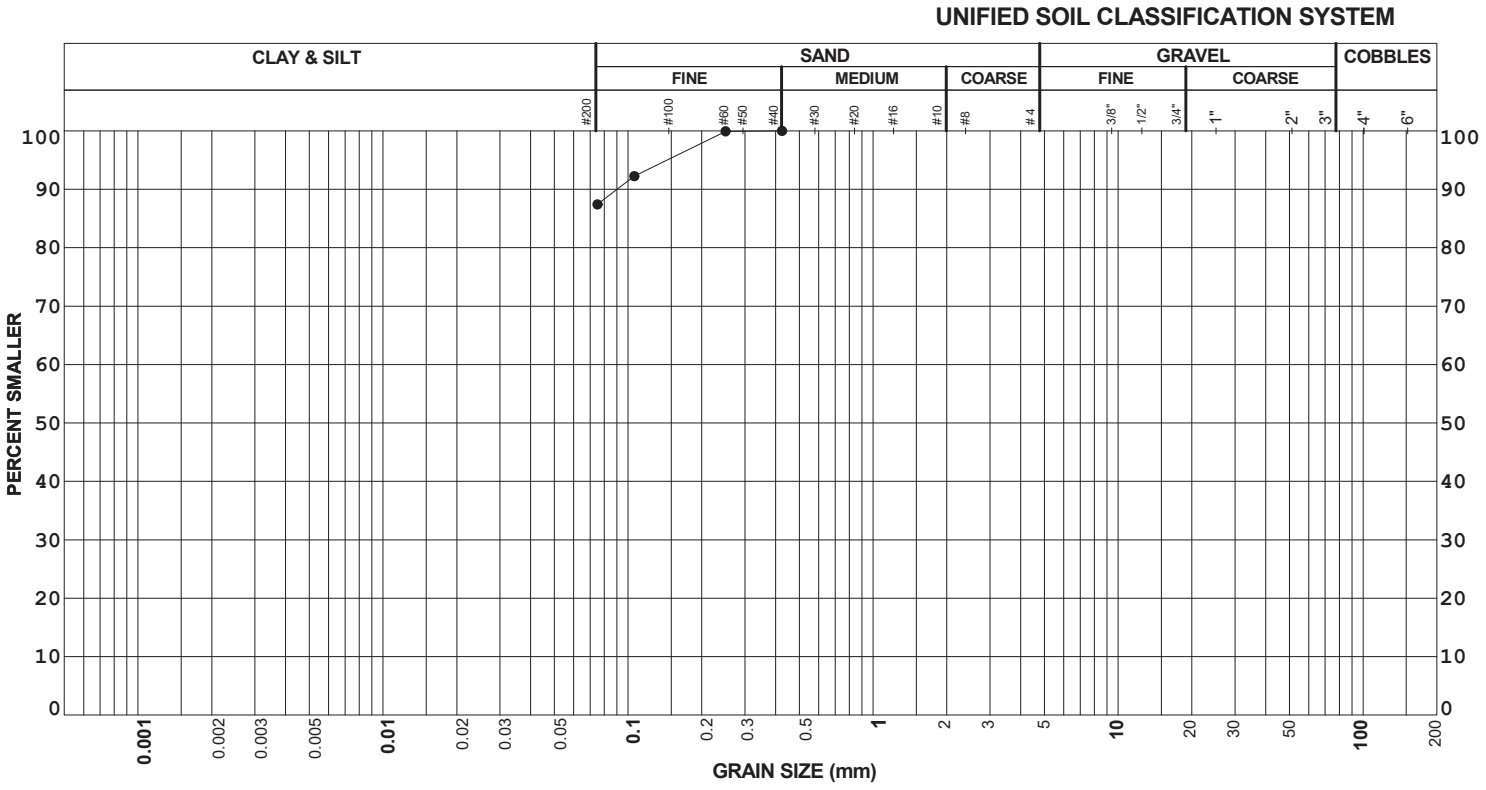
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



REMARKS:

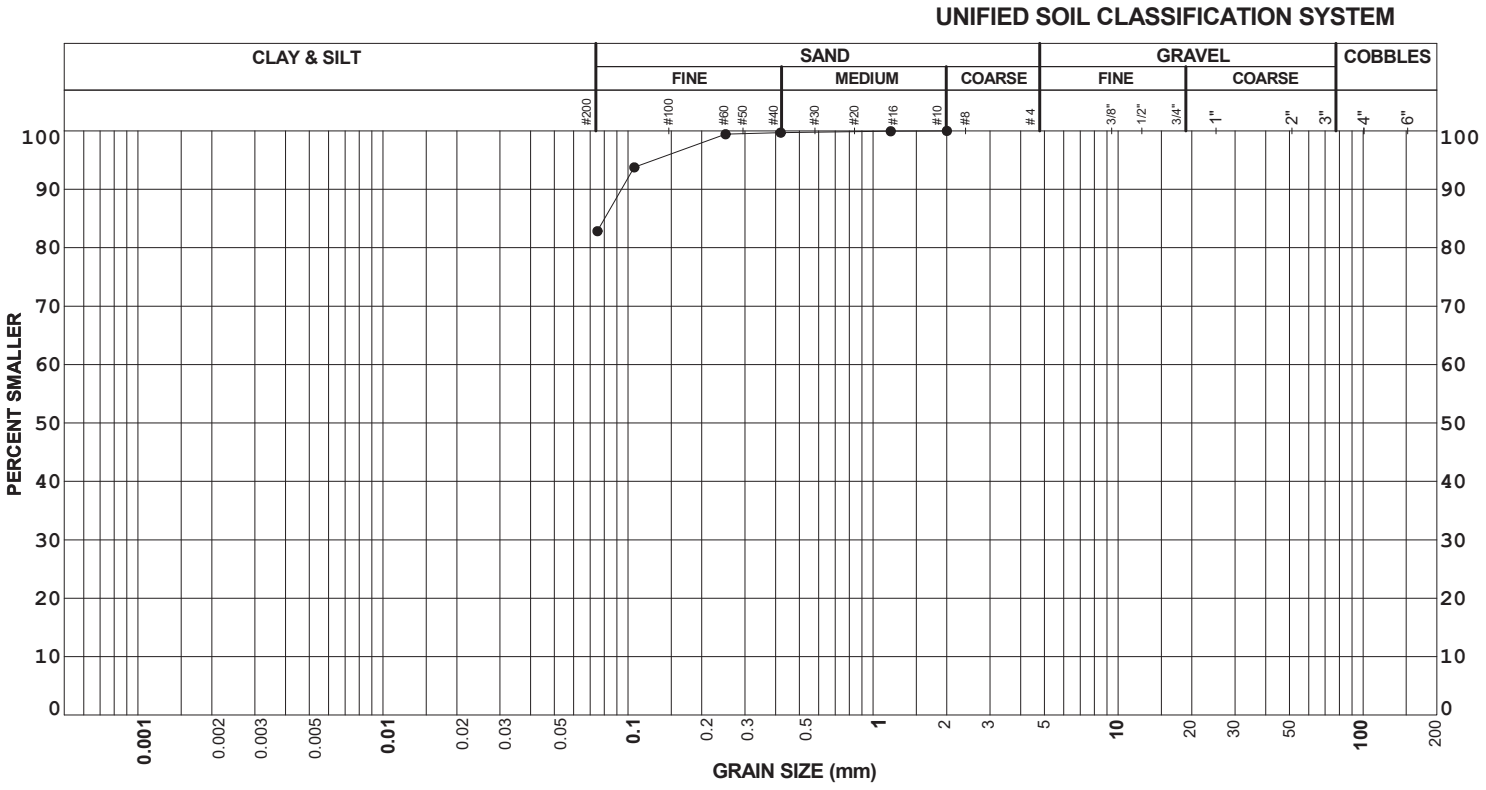
BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M002	DS-4	4.05	0	13	87		

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



REMARKS:

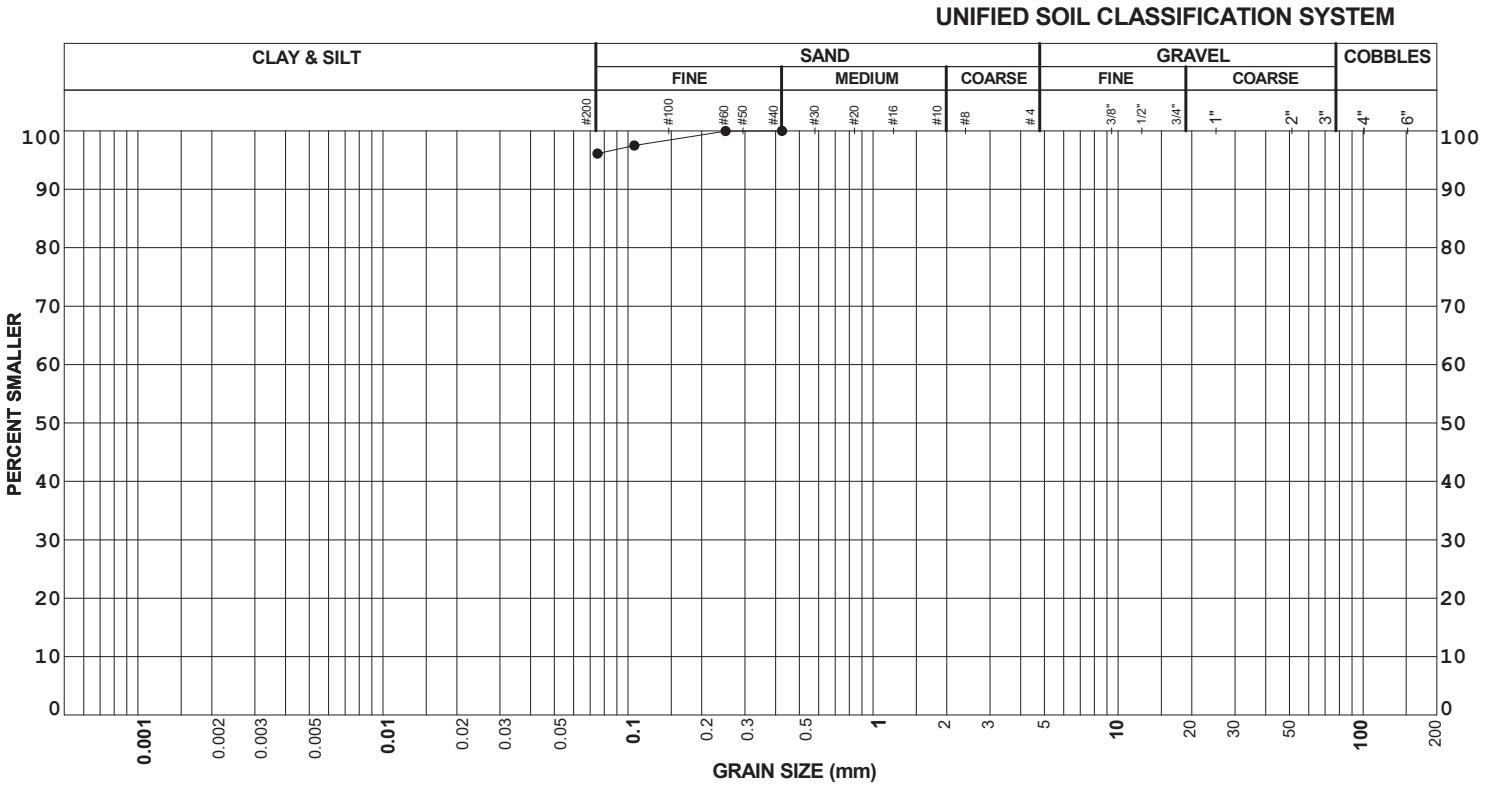
BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M002	DQ-5	5.60	0	17	83		

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M002	DS-6	8.50	0	4	96		

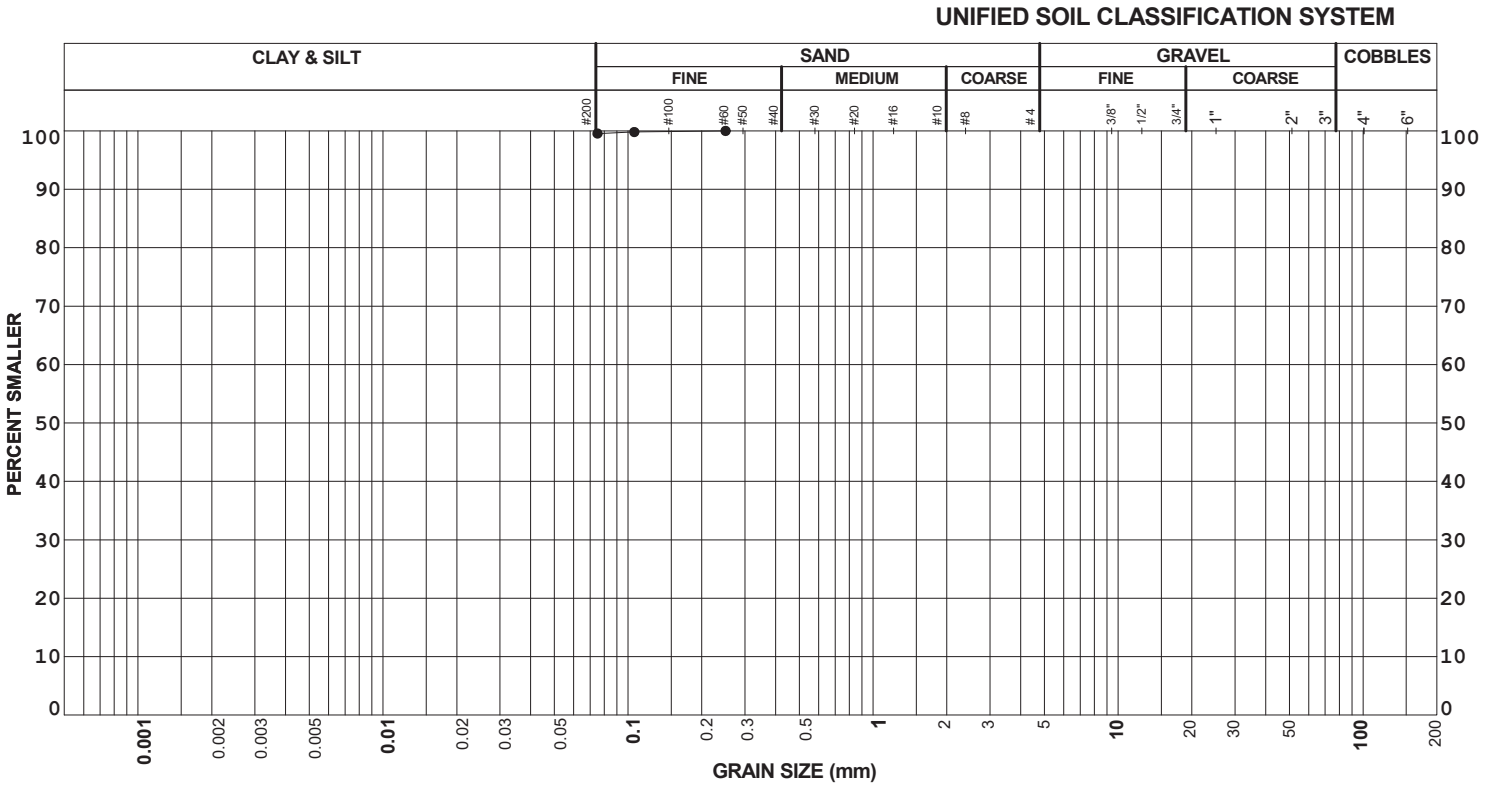
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M002	DQ-7	11.50	0	0	100		

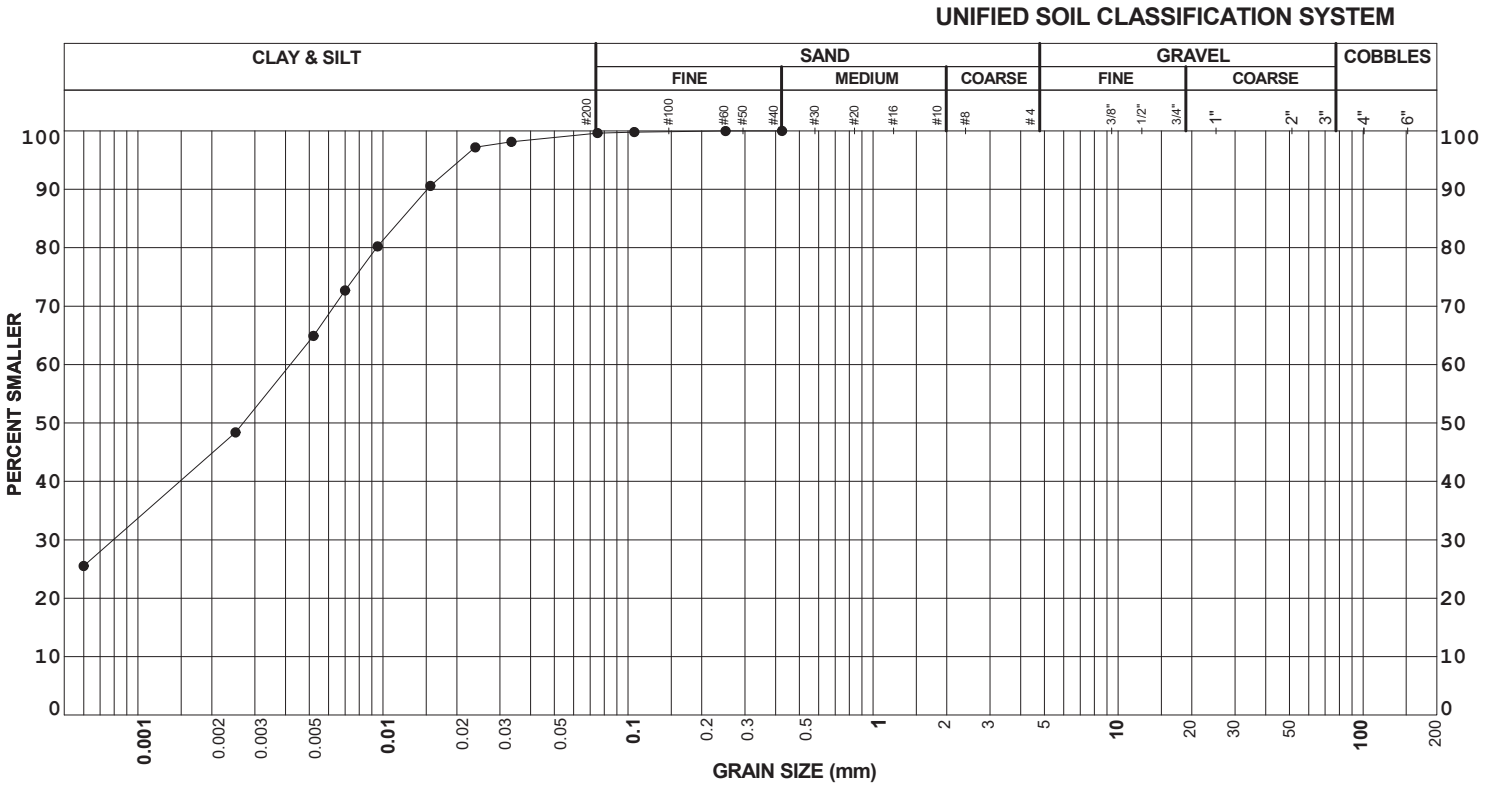
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M002	DS-16	26.70	0	0	100	31	12

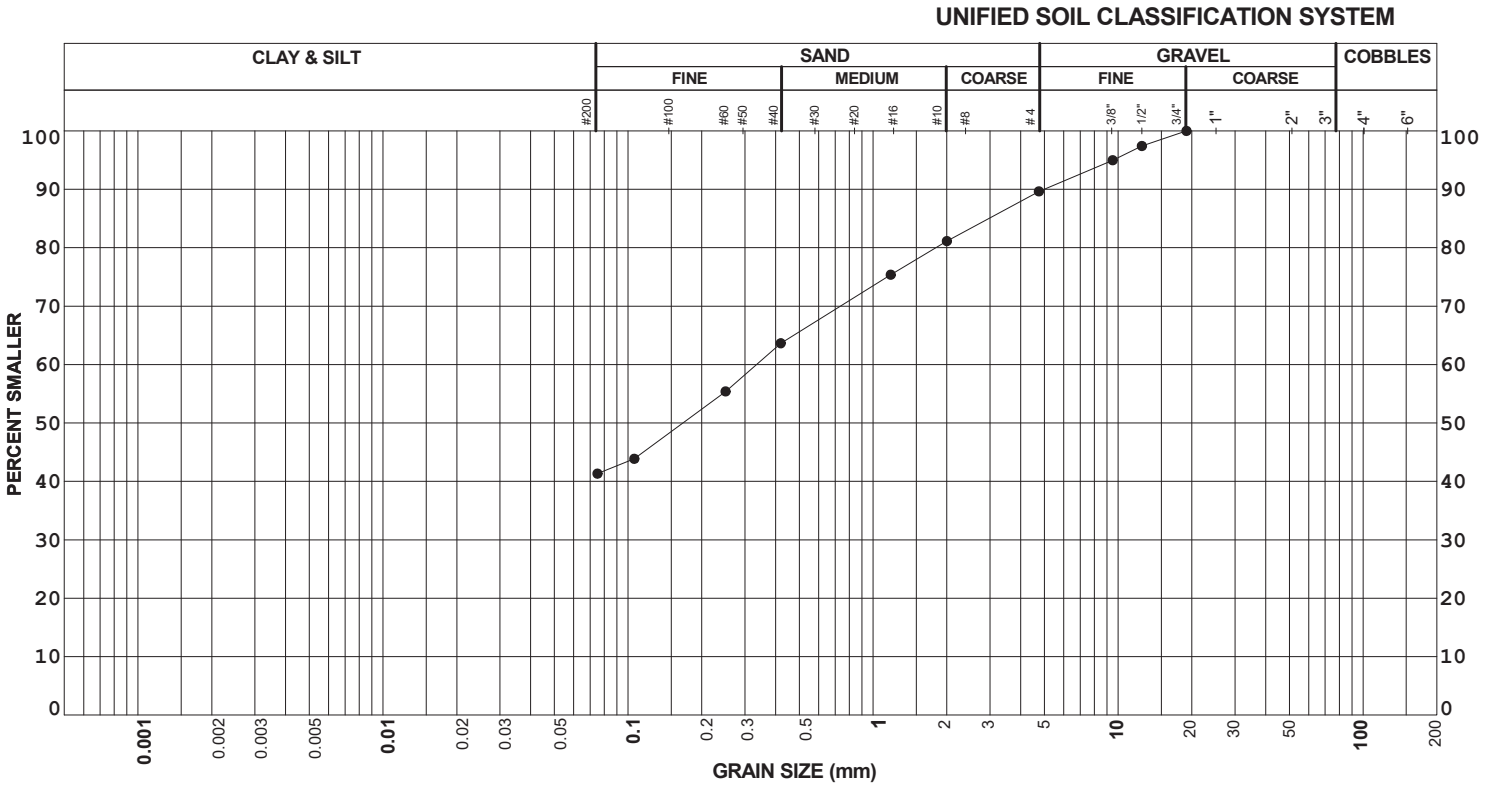
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M002	DQ-17	29.60	10	48	42		

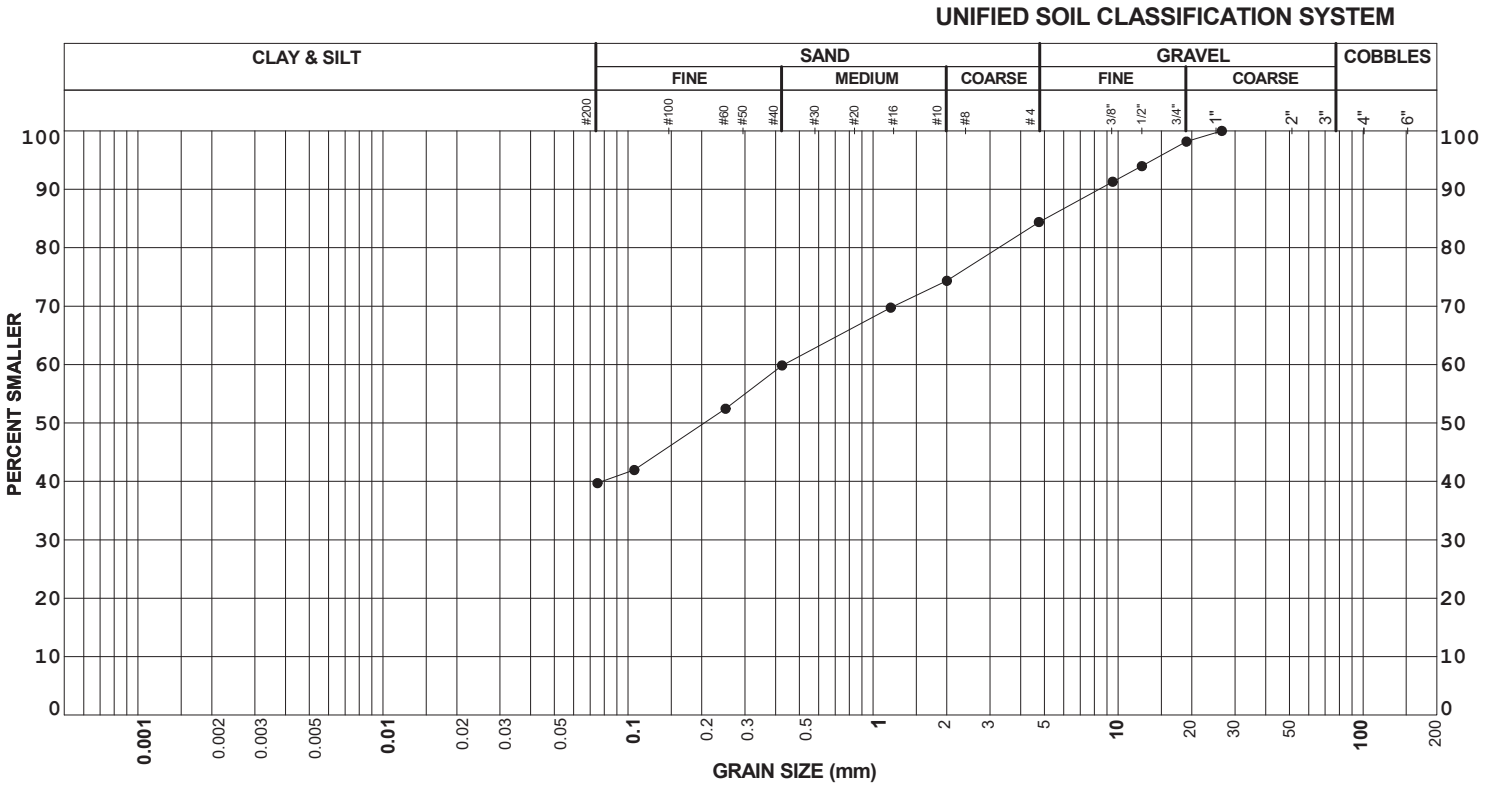
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M002	DS-18	29.80	16	44	40		

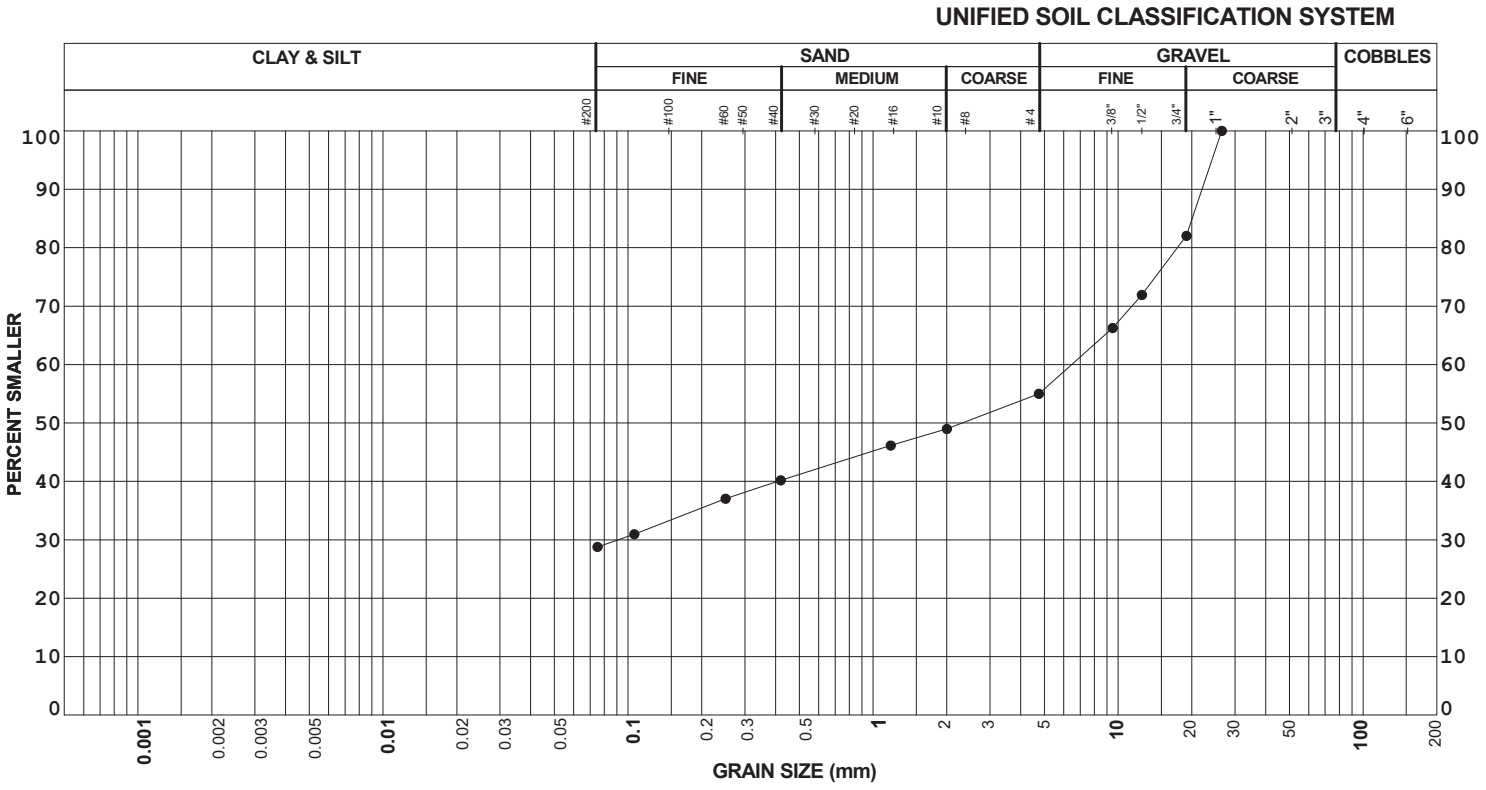
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M002	DQ-26	39.20	45	26	29		

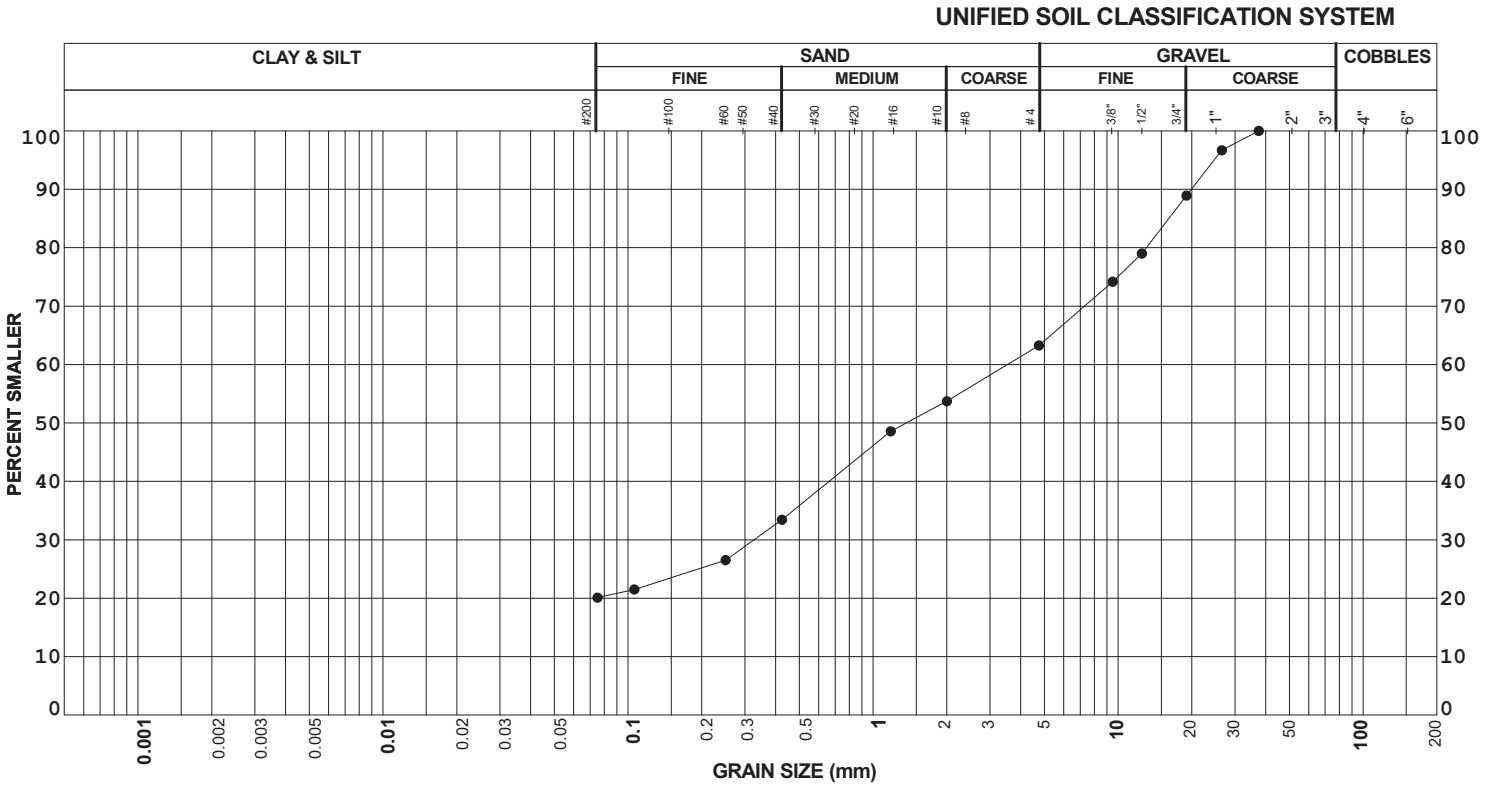
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M003	DS-2	1.00	37	43	20		

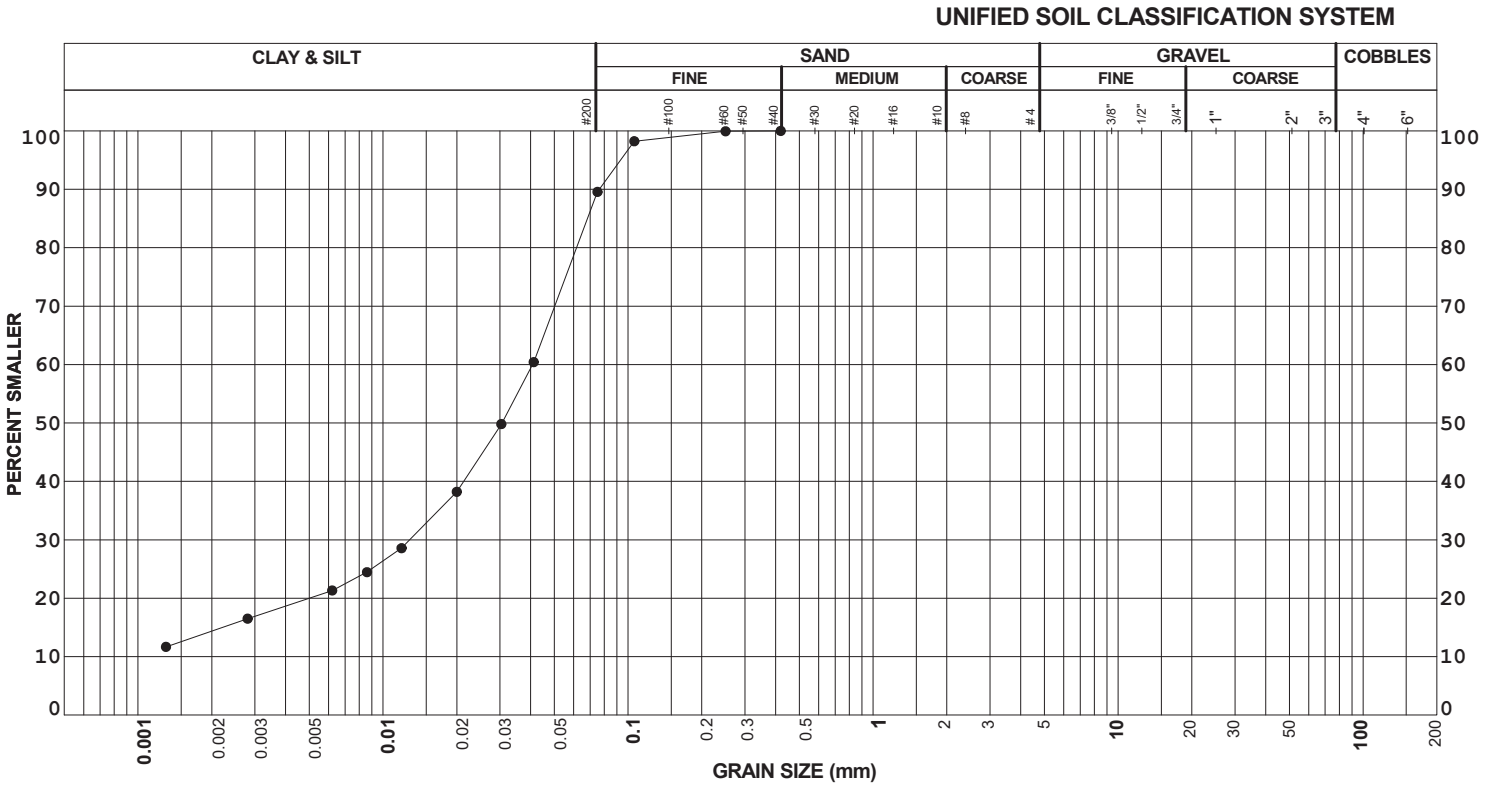
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M003	DS-4	2.20	0	10	90		

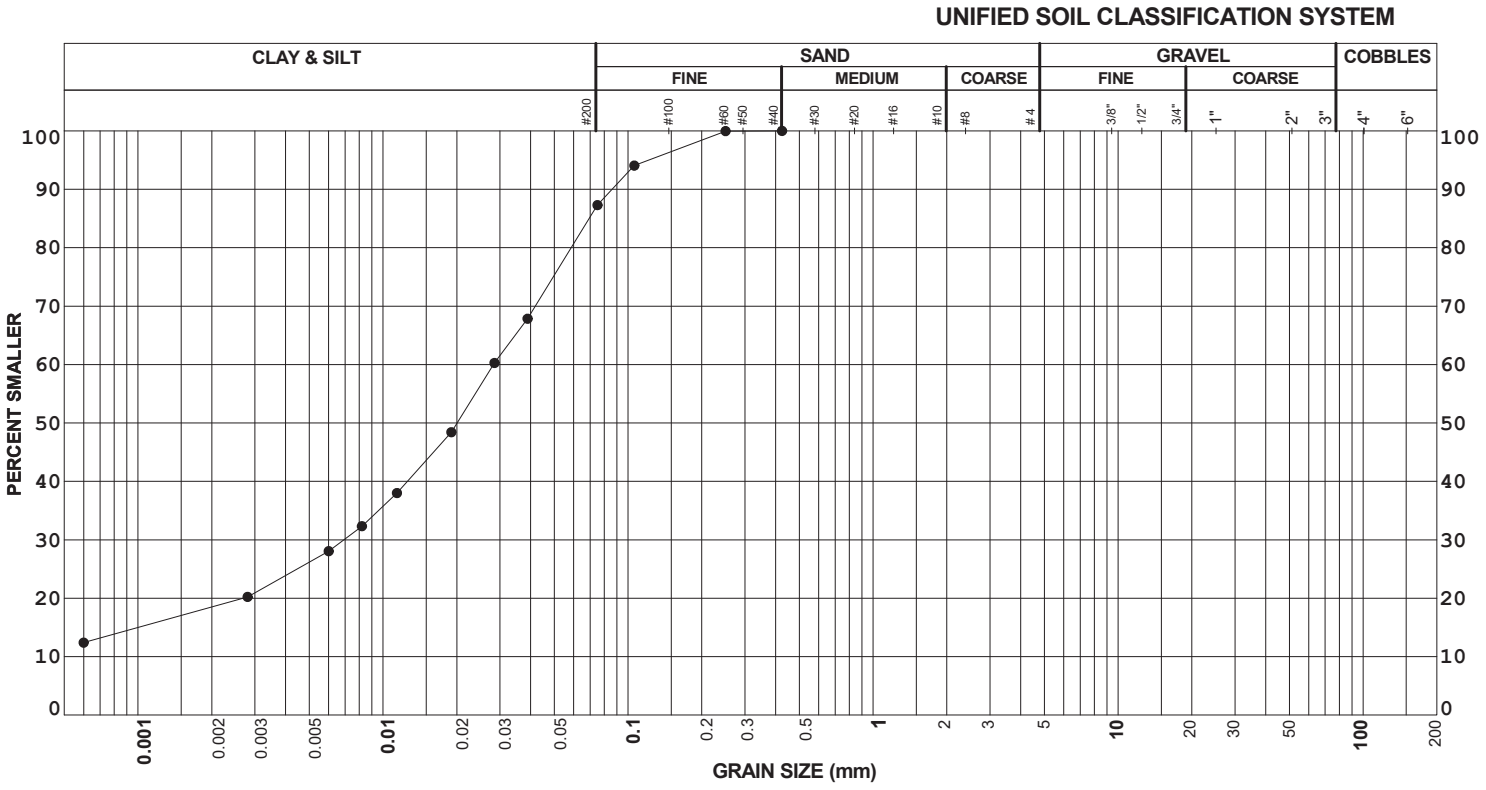
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M003	DS-5	4.05	0	13	87		

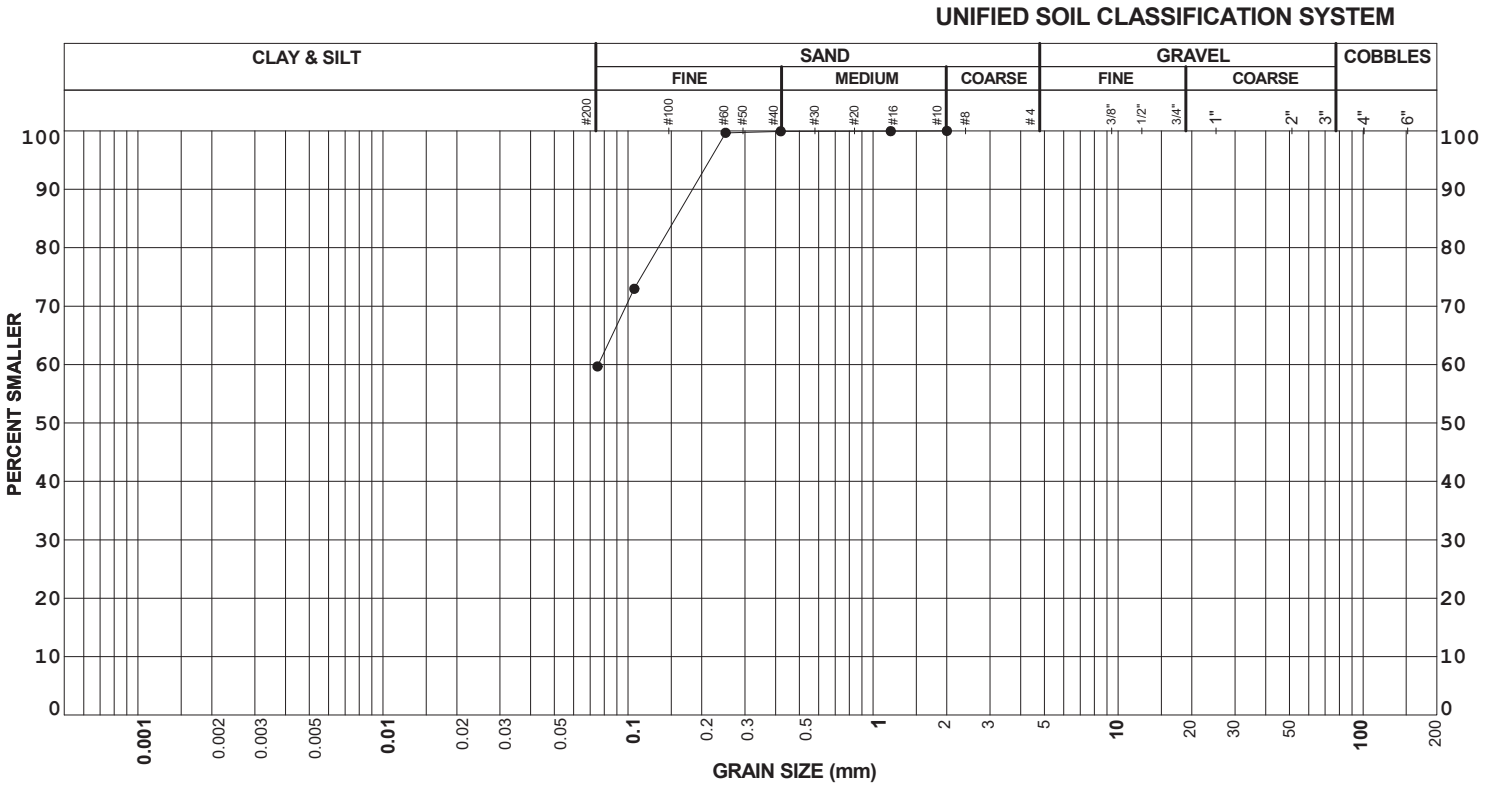
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M003	DS-7	7.20	0	40	60		

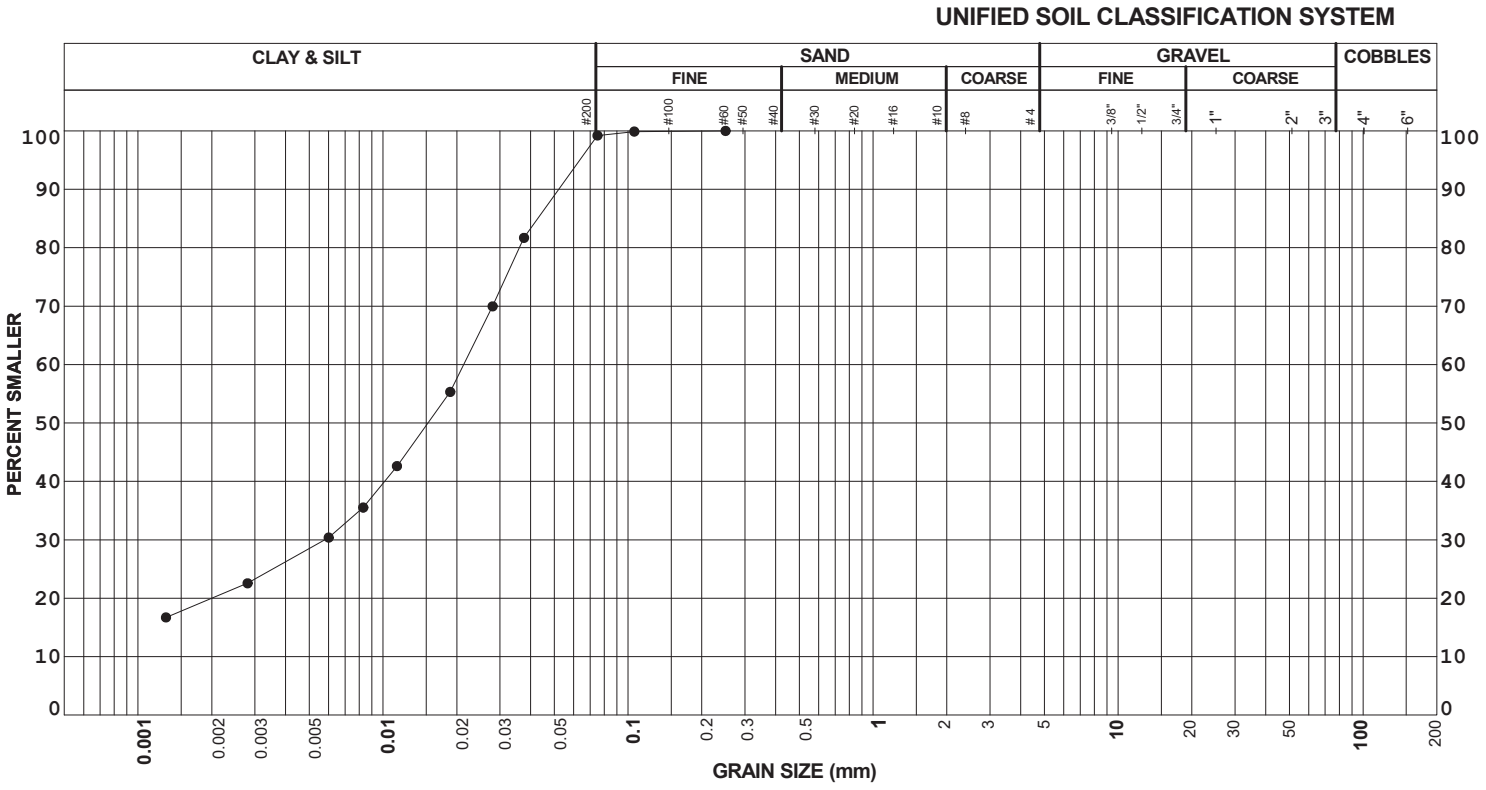
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M003	DS-8	13.25	0	1	99		

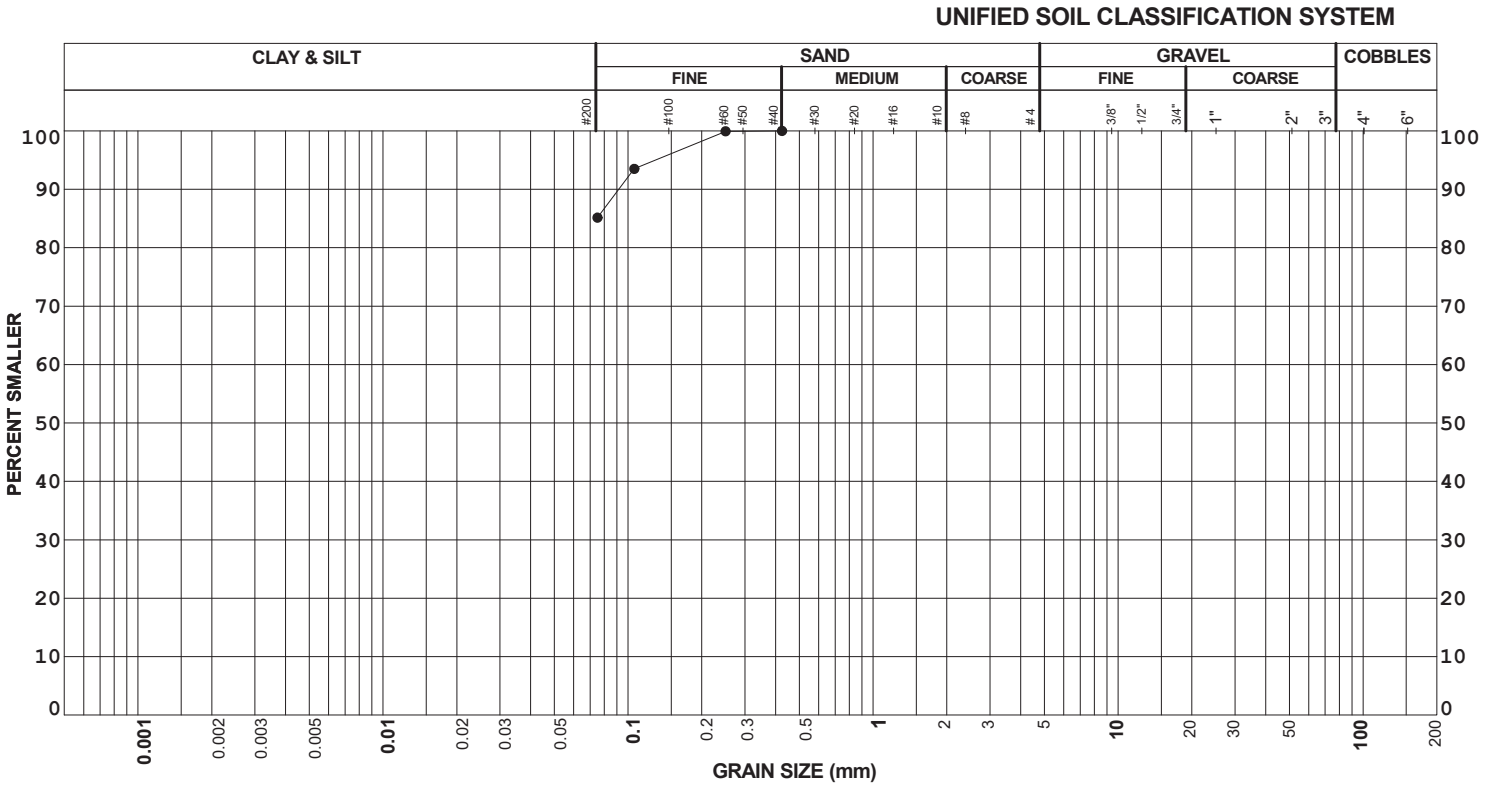
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M003	DS-11	19.46	0	15	85		

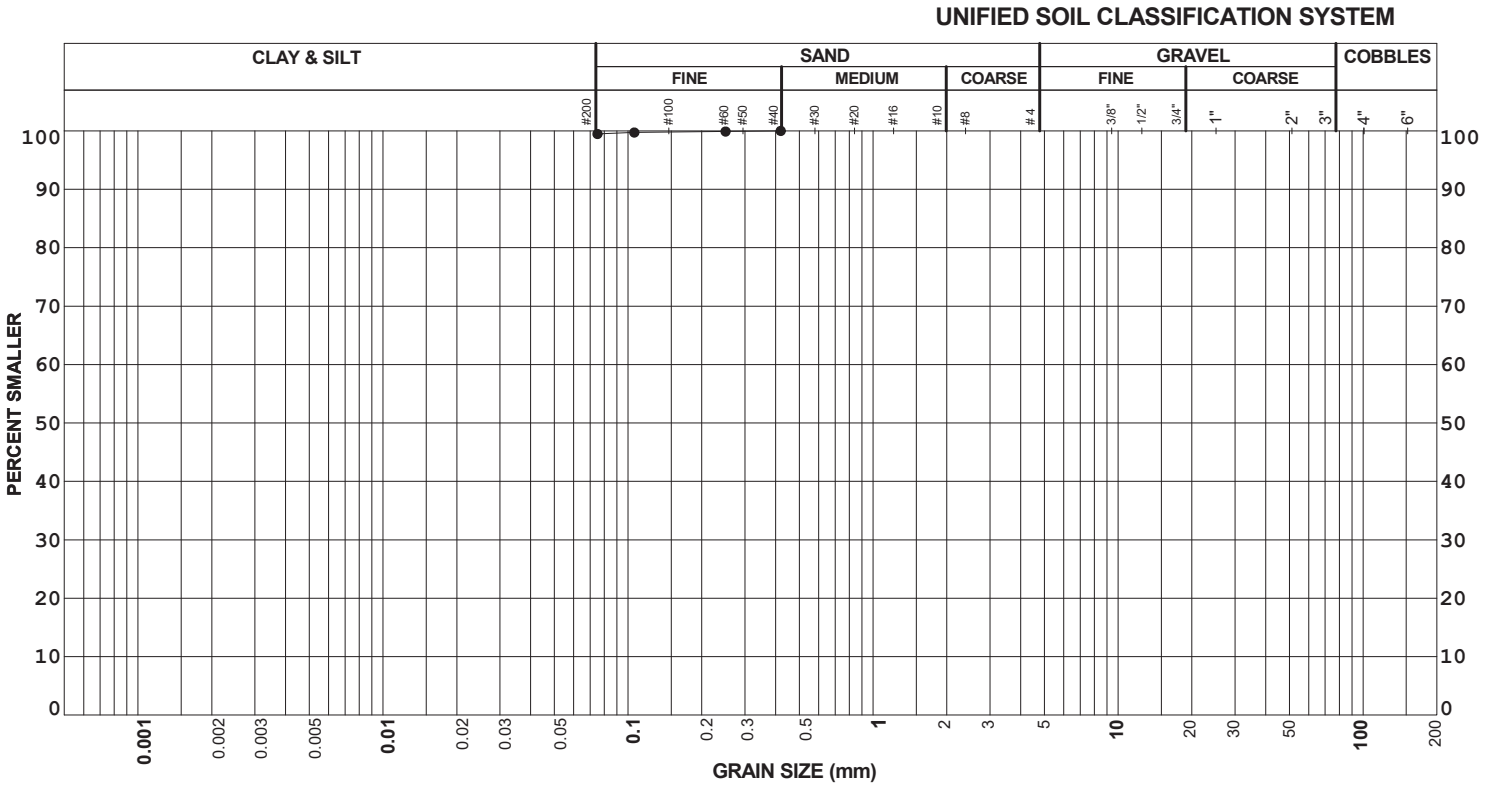
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M003	DQ-13	24.02	0	1	99		

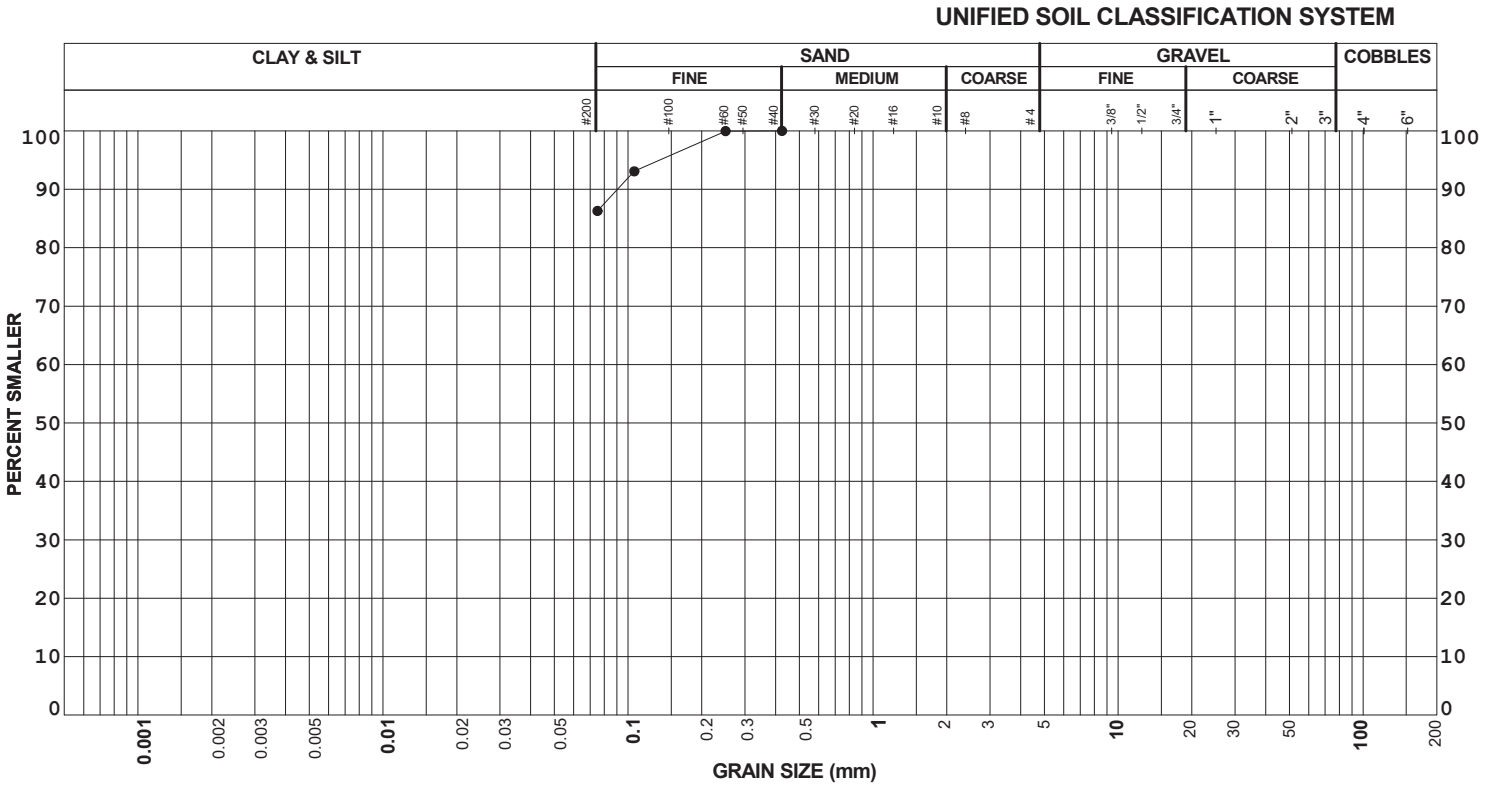
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



REMARKS:

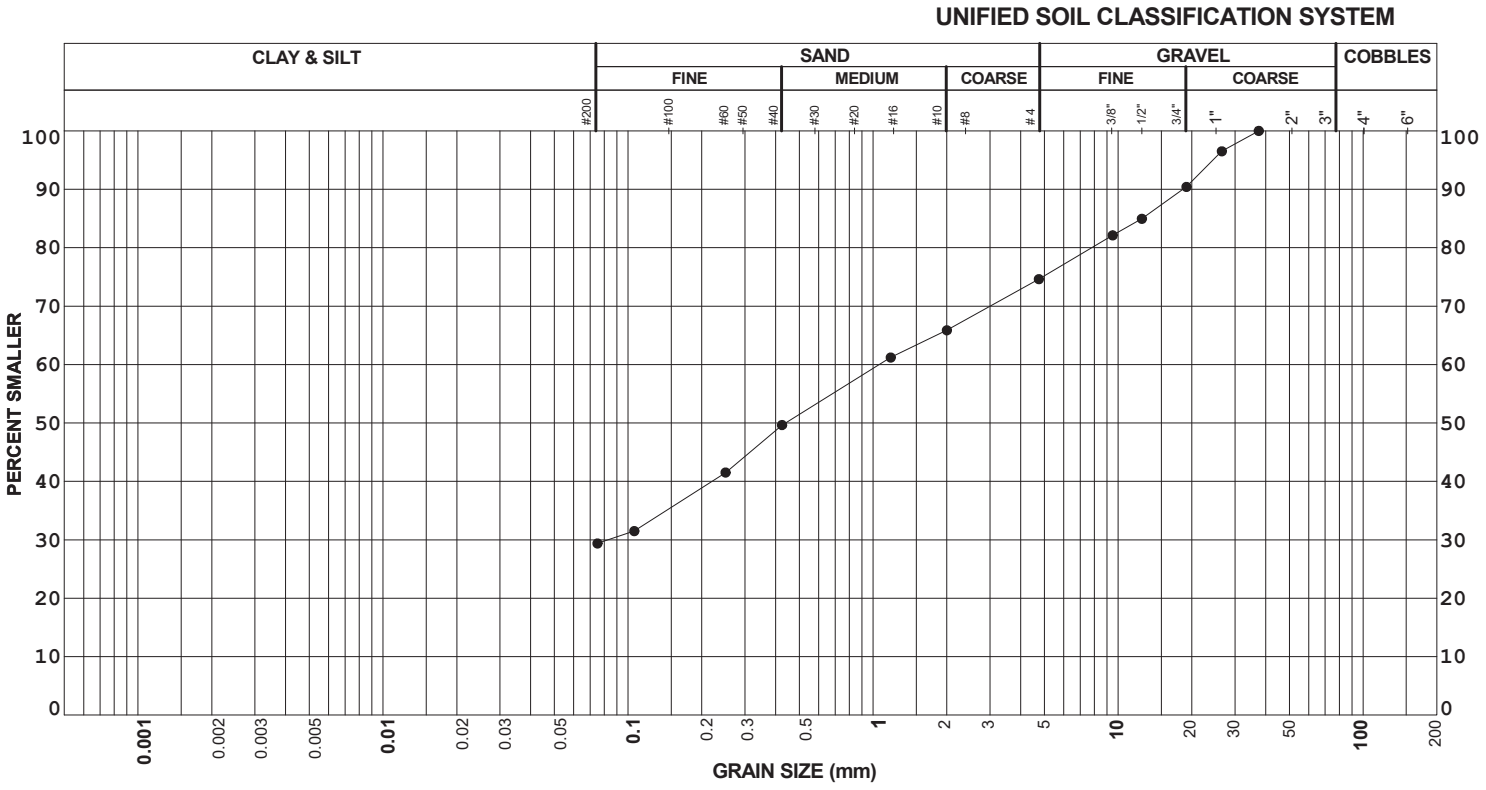
	BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
●	BH18-M003	DS-15	27.18	0	14	86		

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M003	DS-24	47.70	25	45	30		

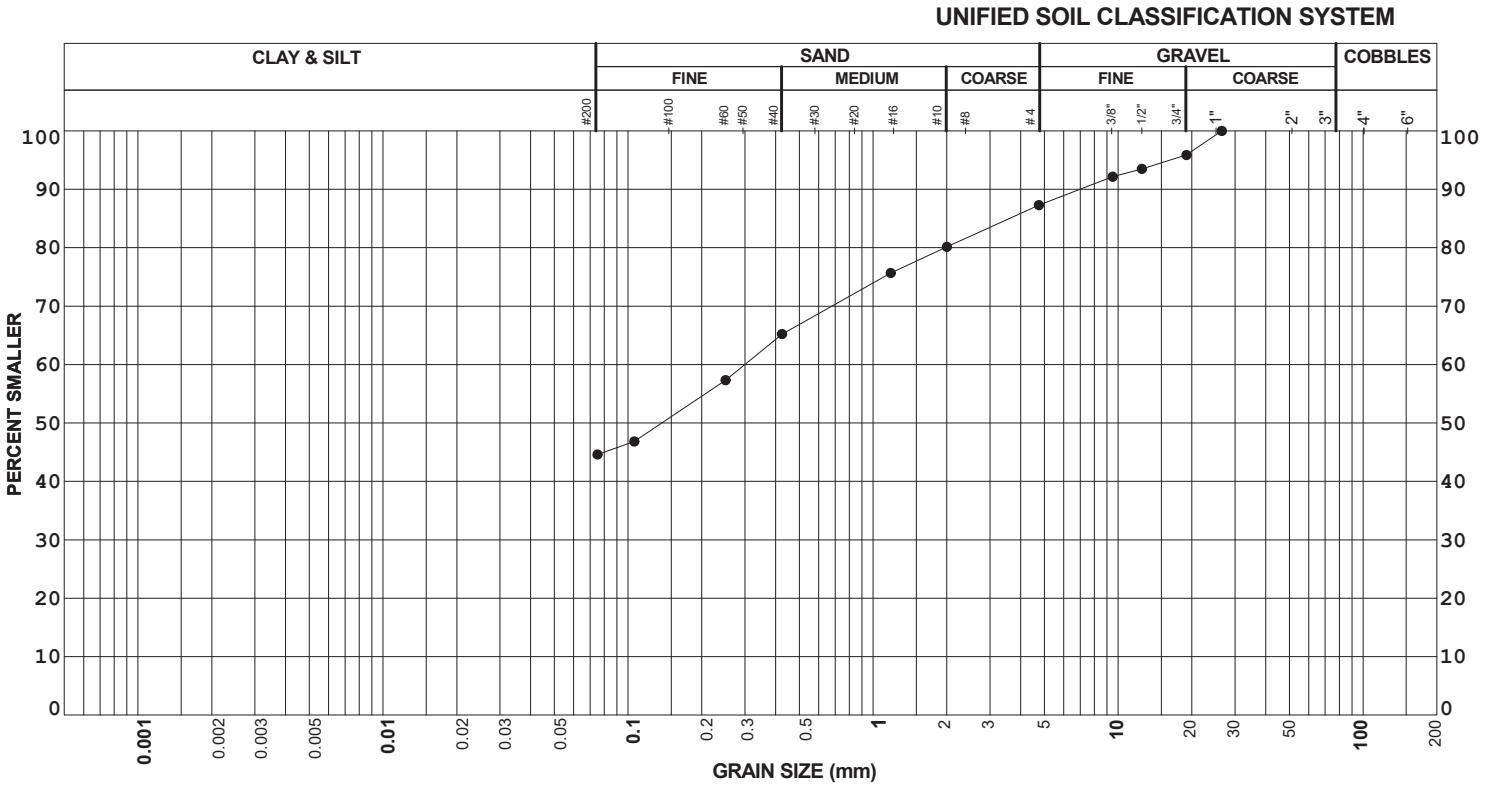
REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project



BOREHOLE	SAMPLE	DEPTH	GRAVEL (%)	SAND (%)	FINES (%)	LL (%)	PI (%)
● BH18-M003	DS-26	47.80	13	42	45		

REMARKS:

GRAIN SIZE DISTRIBUTION

Baffinland Iron Mine

HATCH

Project

Pore Water Extraction and Determination of Soluble Salt Content of Soils by Refractometer

ASTM D4542-15

HATCH Geotechnical Laboratory

Date:	June 10, 2018	Baffinland Iron Mines
Project Number:	H/353004	2275 Upper Middle Rd, Oakville Ontario.
Project:	**Mary River Expansion Project**	**Attention:** H. Ghiabi

Sample	**As Listed Below**
Source	**BH18-004 Milne Port**

Sample I.D	Depth (m)	Salinity Scale (ppt)	Notes
BLANK	NA	0.0	Distilled Water
DQ1	0.20	1.0	
DQ2	8.20	8.0	
DQ3	13.4	10	
DQ5	17.1	10	
DQ7	18.48	10	
DQ8	21.0	34	
BLANK	NA	0.0	Distilled Water
DQ10	26.60	17	
DQ12	31.9	84	
DQ13	34.5	20	
DQ15	42.5	52	
DQ 17	48.8	31	
DQ18	56.8	10	
DQ20	55.8	73	
DQ23	62.8	>100	Beyond refractometer scale.
BLANK	NA	0.0	Distilled Water

Comments: Tested with EXTECH Model RF20 Refractometer with automatic temperature compensation.

Reported by: R. Serluca, Lab Tech. June 10, 2018

Name, Title, Date

Reviewed by: G. Qu, July 10, 2018

Name, Title, Date

Notice: the test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

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Pore Water Extraction and Determination of Soluble Salt Content of Soils by Refractometer

ASTM D4542-15

HATCH Geotechnical Laboratory

Date:	April 20, 2018	Baffinland Iron Mines
Project Number:	H/353004	2275 Upper Middle Rd, Oakville Ontario.
Project:	**Mary River Expansion Project**	**Attention:** G. Qu

Sample	**As Listed Below**
Source	**BH18-M003 Milne Port**

Sample I.D	Depth (m)	Salinity Scale (ppt)	Notes
BLANK	NA	0.0	Distilled Water
DQ1	0.20	4.0	
DQ3	0.70	10.0	
DQ6	2.00	25.0	
BLANK	NA	0.0	Distilled Water

Comments: Tested with EXTECH Model RF20 Refractometer with automatic temperature compensation.

Reported by: P. Snable, G.I.T. April 20, 2018

Name, Title, Date

Reviewed by: G. Qu, July 10, 2018.

Name. Title. Date

Notice: the test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

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Pore Water Extraction and Determination of Soluble Salt Content of Soils by Refractometer

ASTM D4542-15

HATCH Geotechnical Laboratory

Date:	April 20, 2018	Baffinland Iron Mines
Project Number:	H/353004	2275 Upper Middle Rd, Oakville Ontario.
Project:	**Mary River Expansion Project**	**Attention:** G. Qu

Sample	**As Listed Below**
Source	**BH18-M001 Milne Port**

Sample I.D	Depth (m)	Salinity Scale (ppt)	Notes
BLANK	NA	0.0	Distilled Water
DQ1	0.20	NA	Not enough moisture
DQ2	0.70	3.0	
DQ4	2.00	2.0	
DQ7	11.25	NA	Not enough moisture
DQ9	13.79	NA	Not enough moisture
BLANK	NA	0.0	Distilled Water

Comments: Tested with EXTECH Model RF20 Refractometer with automatic temperature compensation.

Reported by: P. Snable, G.I.T. April 20, 2018

Name, Title, Date

Reviewed by: G. Qu, July 10, 2018.

Name. Title. Date

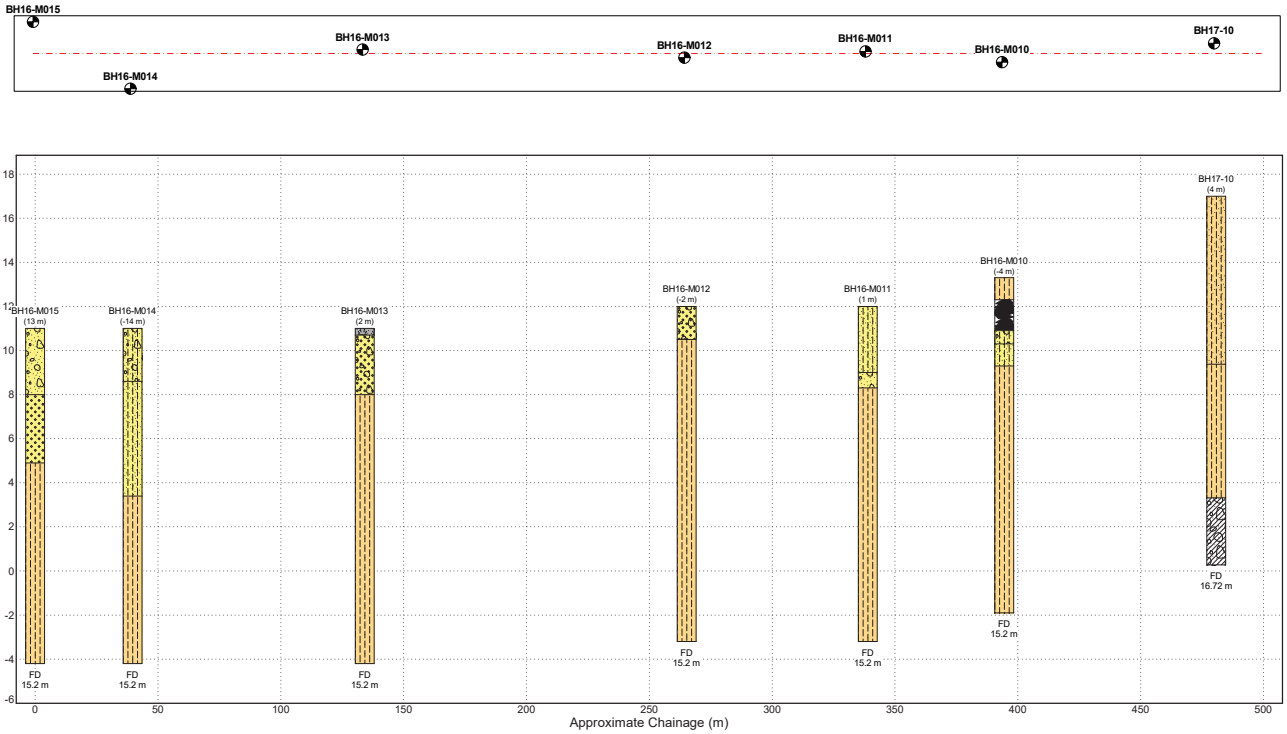
Notice: the test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

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Appendix E

Fence Diagrams

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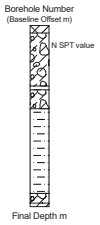




MAP KEY

- BH03 — INVESTIGATION ON SECTION
- TP03 — INVESTIGATION OFF SECTION
- SECTION LINES

POST LEGEND

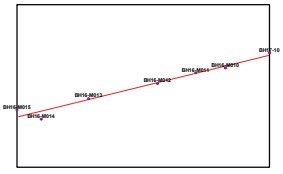


STRATAGRAPHIC BOUNDARIES

MATERIAL GRAPHICS

- SILT
- Ice
- Silty SAND with Gravel
- Silty SAND
- Poorly-graded Gravelly SAND
- Well-graded Gravelly SAND
- Topsoil
- Well-graded SAND
- Sandy SILT
- Glacial TILL

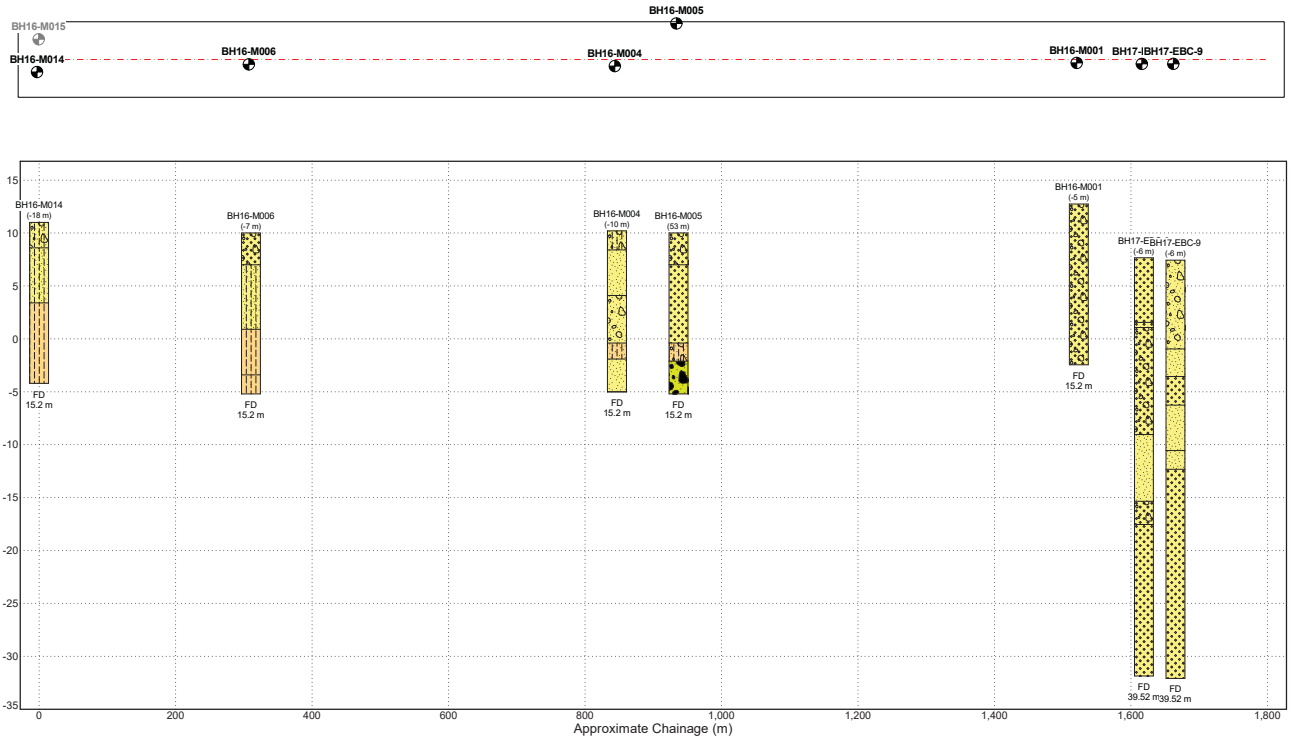
SITE MAP



H 1:1538
0 15 30 45 60 75m
V 1:171
0 2 4 6 8 10m
Coord.System: UTM Zone 17 Height Datum: NAD83

HATCH

CLIENT Baffinland Iron Mines		PROJECT Mary River Expansion Study Stage 2	
DRAWN CL	DATE 5/25/2018	TITLE CONVEYER FENCE DIAGRAM CRUSHER SECTION	
CHECKED GQ	DATE 5/25/2018		
SCALE H 1:1538 V 1:171 VE=9X		PROJECT No H352034	FIGURE No E1



MAP KEY

- BH03 — INVESTIGATION ON SECTION
- TP03 — INVESTIGATION OFF SECTION
- SECTION LINES

POST LEGEND

Borehole Number (Baseline Offset m)

N SPT value

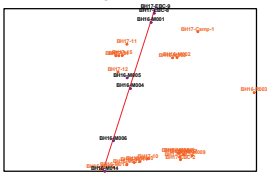
Final Depth m

STRATAGRAPHIC BOUNDARIES

MATERIAL GRAPHICS

- Well-graded Gravelly SAND
- Silty SAND with Gravel
- Poorly-graded SAND
- Poorly-graded Gravelly SAND
- Sandy SILT
- Well-graded SAND
- Gravelly Sandy SILT
- Well-graded Sandy GRAVEL
- Silty SAND
- SILT

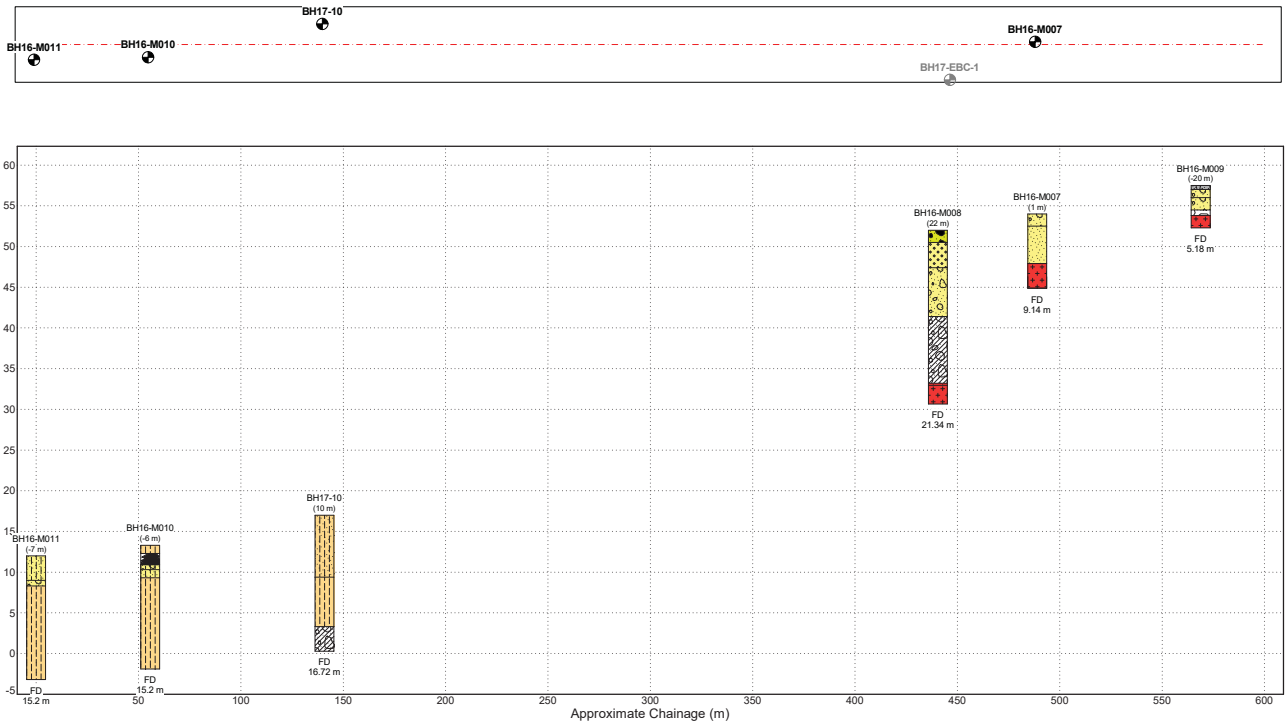
SITE MAP



H 1:5538
0 60 120 180 240 300m
V 1:357
0 4 8 12 16 20m
Coord.System: UTM Zone 17 Height Datum: NAD83

HATCH

CLIENT Baffinland Iron Mines		PROJECT Mary River Expansion Study Stage 2	
DRAWN CL	DATE 5/25/2018	TITLE CONVEYER FENCE DIAGRAM STACKER RECLAIMER SECTION	
CHECKED GQ	DATE 5/25/2018		
SCALE H 1:5538 V 1:357 VE=16X		PROJECT No H352034	FIGURE No E2



MAP KEY

- BH03 — INVESTIGATION ON SECTION
- TP03 — INVESTIGATION OFF SECTION
- SECTION LINES

POST LEGEND

Borehole Number (Baseline Offset m)

N SPT value

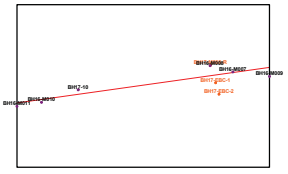
Final Depth m

STRATAGRAPHIC BOUNDARIES

MATERIAL GRAPHICS

- Poorly-graded Gravelly SAND
- Poorly-graded SAND
- Granite, Diorite, Gabbro
- Well-graded Sandy GRAVEL
- Well-graded SAND
- Glacial TILL
- Topsoil
- BOULDERS
- SILT
- Ice
- Silty SAND with Gravel
- Silty SAND
- Sandy SILT

SITE MAP



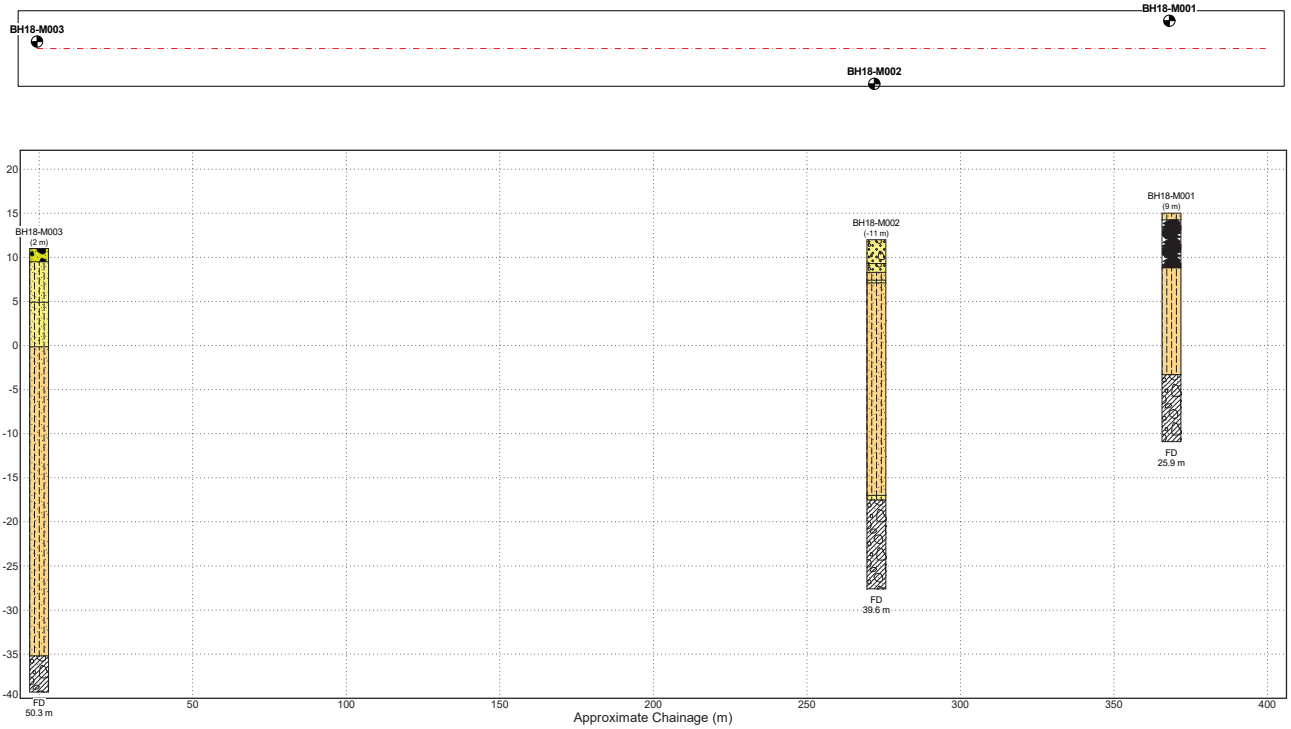
H 1:1846

V 1:464

Coord.System: UTM Zone 17 Height Datum: NAD83

HATCH

CLIENT Baffinland Iron Mines		PROJECT Mary River Expansion Study Stage 2	
DRAWN CL	DATE 5/25/2018	TITLE CONVEYER FENCE DIAGRAM HILL SECTION	
CHECKED GQ	DATE 5/25/2018		
SCALE H 1:1846 V 1:464 VE=4X		PROJECT No H352034	FIGURE No E3



MAP KEY

- BH03 — INVESTIGATION ON SECTION
- TP03 — INVESTIGATION OFF SECTION
- SECTION LINES

POST LEGEND

Borehole Number
(Baseline Offset m)

N SPT value

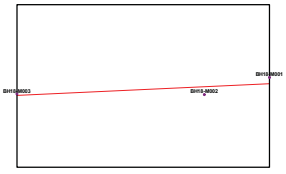
Final Depth m

STRATAGRAPHIC BOUNDARIES

MATERIAL GRAPHICS

- Sandy SILT
- Silty SAND
- Ice
- Well-graded Sandy GRAVEL
- SILT
- Glacial TILL
- Well-graded Gravelly SAND

SITE MAP



H 1:1231
0 10 20 30 40 50m

V 1:429
0 5 10 15 20 25m

Coord.System: "NAD83" Zone 17 Height Datum: NAD83

HATCH

CLIENT: Baffinland Iron Mine		PROJECT: Mary River Expansion Study	
DRAWN: CL	DATE: 8/15/2018	TITLE: PORT SITE	
CHECKED: MY	DATE: 8/15/2018		
SCALE: H 1:1231 V 1:429 VE=3X		PROJECT No: H353004	FIGURE No: I.4

Appendix F

Summary of Laboratory Results

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Borehole No.	Sample No.	Depth	Moisture Content	Gravel (%)	Sand (%)	Fines (%)
BS16-M001	BS-1	1.0				
	BS-2	2.5	18.0			
	BS-3	3.9	18.0			
	BS-4	5.9	19.0	0	82	17
	BS-5	7.0	16.0			
	BS-6	8.0	16.0			
	BS-7	9.9	16.0			
	BS-8	11.2	16.0			
	BS-9	12.4	18.0			
	BS-10	14.9	16.0			
BS16-M002	BS-1	1.3	100.0			
	BS-2	2.7	21.0	6	37	57
	BS-3	4.0	11.0	27	61	12
	BS-4	5.9				
	BS-5	7.2				
	BS-6	8.0	19.0			
	BS-7	10.0	14.0			
	BS-8	11.5	14.0			
	BS-9	13.0	16.0			
	BS-10	14.9	18.0			
BS16-M003	BS-1	1.2	18.0	17	63	20
	BS-2	2.7	33.0	0	4	96
	BS-3	4.6				
	BS-4	6.1				
	BS-5	7.3				
	BS-6	8.8				
	BS-7	10.3				
	BS-8	11.8				
	BS-9	13.4				
	BS-10	15.2				
BS16-M004	BS-1	1.0				
	BS-2	2.7		0	95	4
	BS-3	4.3				
	BS-4	5.8				
	BS-5	7.3	14.0			
	BS-6	8.8				
	BS-7	10.3				
	BS-8	11.8				
	BS-9	13.4				
	BS-10	14.9				

Borehole No.	Sample No.	Depth	Moisture Content	Gravel (%)	Sand (%)	Fines (%)
BS16-M005	BS-1	1.2				
	BS-2	2.7	13.0	35	53	12
	BS-3	4.3				
	BS-4	5.8	20.0			
	BS-5	7.3				
	BS-6	8.8	16.0			
	BS-7	10.3				
	BS-8	11.8				
	BS-9	13.4				
	BS-10	14.9				
BS16-M006	BS-1	0.9		32	45	23
	BS-2	2.5				
	BS-3	4.4				
	BS-4	5.8				
	BS-5	7.3				
	BS-6	8.8				
	BS-7	10.3				
	BS-8	11.8				
	BS-9	13.4				
	BS-10	14.6				
BS16-M007	BS-1	0.6				
	BS-2	2.4	22.0			
	BS-3	3.6	19.0	0	100	0
BS16-M008	BS-1					
	BS-2	1.5				
	BS-3	3.1	18.0	0	73	27
	BS-4	4.6				
	BS-5	7.6	20.0			
	BS-6	9.1				
	BS-7	10.6	9.0			
	BS-8	12.5	12.0			
	BS-9	13.7				
	BS-10	15.5				
BS16-M009	BS-1	0.9				
	BS-2	2.1				
BS16-M010	BS-1	0.9		0	16	84
	BS-2	2.7				
	BS-3	4.2		0	4	96
	BS-4	5.5				
	BS-5	7.0				
	BS-6	8.5				
	BS-7	10.0				
	BS-8	11.5				
	BS-9	13.0				
	BS-10	14.7				

Borehole No.	Sample No.	Depth	Moisture Content	Gravel (%)	Sand (%)	Fines (%)
BS16-M011	BS-1	1.2		0	68	32
	BS-2	2.5				
	BS-3	3.4				
	BS-4	5.5				
	BS-5	7.0				
	BS-6	8.5				
	BS-7	9.8				
	BS-8	11.6				
	BS-9	13.0				
	BS-10	14.7				
BS16-M012	BS-1	0.9		39	45	17
	BS-2	2.0				
	BS-3	4.1		0	16	84
	BS-4	5.6				
	BS-5	7.0				
	BS-6	8.6				
	BS-7	10.3				
	BS-8	11.6				
	BS-9	13.0				
	BS-10	14.9				
BS16-M013	BS-1	1.2		32	48	20
	BS-2	2.3				
	BS-3	4.0		5	33	61
	BS-4	5.1				
	BS-5	7.0				
	BS-6	8.5				
	BS-7	10.0				
	BS-8	11.5				
	BS-9	13.1				
	BS-10	14.6				
BS16-M014	BS-1	1.2		22	52	26
	BS-2	2.7				
	BS-3	4.3		0	78	22
	BS-4	6.1				
	BS-5	7.3				
	BS-6	8.8				
	BS-7	10.3				
	BS-8	11.8				
	BS-9	13.4				
	BS-10	14.9				
BS16-M015	BS-1	1.0		32	59	10
	BS-2	2.1				
	BS-3	3.9		15	71	14
	BS-4	5.5				
	BS-5	7.0				
	BS-6	8.2				
	BS-7	9.7				
	BS-8	11.5				
	BS-9	12.9				
	BS-10	14.8				

Borehole No.	Sample No.	Depth	Moisture Content	Gravel (%)	Sand (%)	Fines (%)
BH17-RD-1	DS-1	5.0	11.0	15	80	5
BH17-RD-1C	DS-1	1.0	10.2	14	71	15
	DS-2	2.0	24.5	0	68	32
	DS-3	4.0	21.3	1	23	76
BH17-RD-2	DS-1	0.7	8.9	18	73	9
	DS-2	1.4	21.8	7	30	63
	DS-3	2.2	11.7	15	74	11
	DS-4	4.0	22.7	0	44	56
BH17-RD-3	DS-1	3.7	11.8	5	86	10
BH17-RD-4	DS-1	2.2	71.6	4	29	67
BH17-RD-5	DS-1	2.4	16.8	3	42	55
BH17-RD-7	DS-1	1.7	6.8	13	59	28
	DS-2	3.3	5.1	31	49	20
BH17-CAMP-1	DS-1	0.8				
	DS-2	1.7				
	DS-3	4.0				
BH17-10	DS-1	0.9	25.9	10	42	48
	DS-2	5.0	19.0	10	35	55
	DS-3	7.6	9.2	8	36	56
	DS-4	8.7	37.2	0	1	99
	DS-5	11.4	21.1	0	2	98
	DS-6	12.5	18.4	0	30	70
	DS-7	14.3	7.5	15	69	16
	DS-8	16.2	7.6	13	60	27
BH17-11	DS-1	3.0	6.2			
	DS-2	5.5	29.4			
	DS-3	8.0	18.0			
	DS-4	9.0	18.0			
	DS-5	10.3	16.0			
	DS-6	15.0	18.7			
BH17-12	DS-1	1.5	12.8			
	DS-2	4.0	31.5			
	DS-3	5.0	27.1			
	DS-4	5.7	21.5			
	DS-5	8.8	23.6			
	DS-6	13.6	25.2			
BH17-13	DS-1	1.0				
	DS-2	2.4				
	DS-3	5.5				
BH17-14	DS-1	4.3				
BH17-EBC-1	DQ-1	3.2				
	DQ-2	4.6				
	DQ-3	5.1	21.3			
	DQ-4	6.2				
	DQ-5	8.3				
	DQ-6	9.7	25.3			
	DQ-7	11.2	9.4			
	DQ-8	12.5	8.1			
	DQ-9	13.4	9.4			
	DQ-10	14.0	4.2			

Moisture Content and Gradation Test Results

Borehole No.	Sample No.	Depth	Moisture Content	Gravel (%)	Sand (%)	Fines (%)
BH17-EBC-2	DQ-1	1.0	1.2			
	DQ-2	1.5	6.5			
	DQ-3	2.0	28.3			
	DQ-4	3.1	20.6			
	DQ-5	4.0	8.6			
	DQ-6	5.0	10.0			
	DQ-7	5.8	6.7			
	DQ-8	6.9	7.3			
	DQ-9	8.1	9.8			
BH17-EBC-8	DS-1	0.9	2.9	15	72	13
	DS-2	3.5	10.6	15	76	10
	DQ-3	5.0	21.0	7	88	5
	DS-4	6.3	15.4	2	93	5
	DS-5	7.6	10.1	33	55	11
	DS-6	9.3	8.3	42	53	4
	DQ-7	12.0	23.4			
	DS-8	12.2	5.6	46	45	9
	DS-9	15.0	9.0	29	61	10
	DS-10	17.5	16.6	0	89	11
	DQ-11	18.0	17.5	2	85	13
	DQ-12	20.5	19.5	2	98	0
	DS-13	23.6	10.5	25	63	12
	DQ-13B	23.7				
	DS-14	26.6	16.6	2	86	12
	DQ-15	29.8	23.1	0	95	5
	DQ-16	32.9	22.2	0	92	8
	DQ-17	37.4	21.5	0	92	8
	DS-18	39.3	13.1			
	DQ-19	39.4	18.8	0	93	7
BH17-EBC-9	DS-1	3.1	10.9	23	73	5
	DS-2	4.4	9.7	33	59	8
	DS-3	6.0	12.9	17	73	10
	DQ-4	8.8	23.3	0	88	12
	DQ-5	9.1	20.4	0	90	10
	DQ-6	11.0	11.5	16	78	6
	DQ-7	14.3	17.6	3	88	10
	DQ-8	15.2	13.1			
	DQ-9	17.3	20.9	0	89	11
	DQ-10	18.0	22.0	0	93	7
	DS-11	19.8	12.5	9	82	9
	DQ-12	22.5	21.1	0	95	5
	DQ-13	24.0	23.8	0	92	8
	DQ-14	27.0	18.5	7	86	8
	DQ-15	27.4	18.6	0	84	16
	DQ-16	28.9	25.7	0	97	3
	DQ-17	31.5	19.8	0	94	6
	DS-18	36.3				
	DQ-19	39.0	21.8	0	98	2

Soil Salinity Test Results

Borehole No.	Sample No.	Depth	Salinity Scale (ppt)
BH17-10	DS-1	0.9	3.0
	DS-2	5.0	13.0
	DS-4	8.7	22.0
BH17-11	DS-2	5.5	1.0
	DS-3	8.0	6.0
	DS-6	15.0	7.0
BH17-12	DS-2	4.0	5.0
	DS-3	5.0	27.0
	DS-5	8.8	5.0
	DS-6	13.6	6.0
BH17-EBC-1	DQ-2	4.6	0.0
	DQ-3	5.1	3.0
	DQ-4	6.2	0.0
	DQ-5	8.3	1.0
	DQ-6	9.7	3.0
BH17-EBC-2	DQ-3	2.0	0.0
	DQ-4	3.1	3.0
	DQ-5	4.3	3.0
	DQ-6	5.0	3.0
	DQ-7	5.8	6.0
BH17-EBC-8	DQ-3	5.0	3.0
	DQ-7	12.0	14.0
	DS-9	15.0	13.0
	DQ-11	18.0	22.0
	DQ-12	20.5	9.0
	DS-13	23.6	8.0
	DQ-15	29.8	10.0
	DQ-16	32.9	26.0
	DQ-17	37.4	5.0
	DS-18	39.3	22.0
	DQ-19	39.4	14.0
	Sea 1	0.0	28.0
	Sea 2	0.0	26.0
BH17-EBC-9	DS-2	4.4	8.0
	DQ-4	8.8	13.0
	DQ-7	14.3	12.0
	DQ-8	15.2	88.0
	DQ-10	18.0	11.0
	DQ-12	22.5	10.0
	DQ-13	24.0	11.0
	DQ-14	27.0	16.0
	DQ-15	27.4	15.0
	DQ-17	31.5	5.0
	Sea 1	0.0	28.0
	Sea 2	0.0	26.0

UCS and Point Load ASTM Test Results

Borehole No.	Sample No.	U.C.S. (MPa)	Depth	Point Load ASTM(Mpa)
BH17-EBC-1	1	164.1	15.0	75.5
			16.0	182.5
			19.1	151.7
			19.2	
			19.4	
			19.8	119.6
			21.4	147.9
BH17-EBC-2	1	161.5	13.6	100.7
			14.0	157.4
			18.7	70.8
			17.8	
			18.7	133.8
			20.3	
BH17-M008-R	1	57.9	19.1	70.8
	2	46.1	19.4	47.2
	3	94.8	19.5	23.6
			20.3	94.4
			21.4	28.3
			21.9	100.7

Borehole No.	Sample No.	Depth	Moisture Content	Gravel (%)	Sand (%)	Fines (%)
BH18-M001	DQ-1	0.2				
	DQ-2	0.7				
	DS-3	0.9	20	2	23	75
	DQ-4	2.0				
	DS-5	2.4	17	2	19	79
	DS-6	7.0	27	0	1	99
	DQ-7	9.7				
	DS-8	10.2	23	0	3	97
	DQ-9	12.3				
	DS-10	12.4				
	DS-12	16.5				
	DS-14	19.4	1	21	41	38
	DS-15	22.0	6	21	41	38
	DS-16	23.3	6	22	42	36
	DS-17	25.4	7	13	52	35
BH18-M002	DQ-1	1.1				
	DS-2	1.2	9	25	63	12
	DQ-3	3.8	20	0	2	98
	DS-4	4.0	20	0	13	87
	DQ-5	5.6	21	0	17	83
	DS-6	8.5	20	0	4	96
	DQ-7	11.5	25	0	0	100
	DS-8	11.6				
	DS-10	13.1				
	DQ-9	13.3				
	DS-11	17.0				
	DQ-12	17.1				
	DS-13	21.7				
	DQ-14	21.7				
	DQ-15	26.2				
	DS-16	26.7	23	0	0	100
	DQ-17	29.6	5	10	48	42
	DS-18	29.8	5	16	44	40
	DQ-19	32.0				
	DQ-23	33.7				
	DQ-22	34.5				
	DS-21	34.7				
	DS-24	36.3	2			
	DQ-25	36.6				
	DQ-26	39.2	3	45	26	29
BH18-M003	DQ-1	0.6				
	DS-2	1.0	8	37	43	20
	DQ-3	2.0				
	DS-4	2.2	27	0	10	90
	DS-5	4.0	21	0	13	87
	DQ-6	7.1				
	DS-7	7.2	24	0	40	60
	DS-8	13.3	22	0	1	99
	DQ-9	14.7				

Borehole No.	Sample No.	Depth	Moisture Content	Gravel (%)	Sand (%)	Fines (%)
BH18-M003	DQ-10	19.2				
	DS-11	19.5	21	0	15	85
	DS-12	23.5				
	DQ-13	24.0	25	0	1	99
	DQ-14	26.2				
	DS-15	27.2	20	0	14	86
	DS-16	27.7				
	DQ-17	28.7				
	DQ-18	32.2				
	DS-19	33.2				
	DS-20	38.4				
	DS-23	42.8				
	DQ-22	43.4				
	DS-24	47.7	6	25	45	30
	DS-26	50.9	7	13	42	45
	DQ-25	48.1				
BH18-004	DS-1	2.4	21	0	86	14
	DQ-1	2.5	14	6	77	17
	DQ-2	8.2				
	DS-4	12.6	9	14	70	16
	DQ-3	13.4				
	DQ-5	17.1				
	DS-6	17.4	7	34	52	14
	DQ-7	18.5				
	DQ-8	21.0	22	0	59	41
	DQ-10	26.6				
	DS-11	26.8	14	11	81	8
	DQ-12	31.9				
	DQ-13	35.4				
	DS-14	40.2	7	32	45	23
	DQ-15	42.5				
	DQ-16	42.7	20	0	12	88
	DS-17	47.2		0	98	2
	DQ-19	51.8				
	DQ-20	55.3				
	DQ-23	61.3				
	DS-24	61.7	18	0	23	77
	DQ-25	62.8				
	DS-26	63.2	18	0	6	94
	DQ-27	64.5				
	DQ-28	68.9	20	0	1	99
	DS-29	70.5		0	1	99
	DQ-30	72.0	20	0	1	99
	DQ-32	77.1				

Borehole No.	Sample No.	Depth	Salinity Scale (ppt)
BH18-004	DQ-1	0.2	1.0
	DQ-2	8.2	8.0
	DQ-3	13.4	10.0
	DQ-5	17.1	10.0
	DQ-7	18.5	10.0
	DQ-8	21.0	34.0
	DQ-10	26.6	17.0
	DQ-12	31.9	84.0
	DQ-13	24.5	20.0
	DQ-15	42.5	52.0
	DQ-17	48.8	31.0
	DQ-18	56.8	10.0
	DQ-20	55.8	73.0
	DQ-23	62.8	>100
BH18-M001	DQ-1	0.2	N/A
	DQ-2	0.7	3.0
	DQ-4	2.0	2.0
	DQ-7	11.3	N/A
	DQ-9	13.8	3.0
BH18-M003	DQ-1	0.2	4.0
	DQ-3	0.7	10.0
	DQ-6	2.0	25.0

Appendix G

Laboratory Certification

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Canadian Council of Independent Laboratories

CERTIFICATE OF CONFORMANCE

AGGREGATE LABORATORY CERTIFICATION

This is to certify that

Hatch Geotechnical Laboratory

Located at:

Niagara Falls ON

Has met the Standardization and Interlaboratory Testing Requirements of the CCIL/OSSGA AGGREGATE LABORATORY CERTIFICATION PROGRAM and has qualified under the following categories and test methods:

AGGREGATE QUALITY CONTROL LABORATORY (TYPE C)

LS-600/C-702; LS-601/C-117; LS-602/C-136; LS-607; LS-608; LS-621

AGGREGATE PHYSICAL PROPERTY LABORATORY (TYPE D)

LS-706/D698; LS-702/AASHTO T88; LS-703,704/D4318; LS-705/D854; LS-709/D2434

GIB MCINTEE, P. ENG.
CHAIRMAN, CERTIFICATION PROGRAM ADMINISTRATION COMMITTEE

May 1, 2018 - April 30, 2019

Date

GORDON H. LEAMAN, P. ENG.
PRESIDENT

Canadian Council of Independent Laboratories

CERTIFICATE OF CONFORMANCE

AGGREGATE LABORATORY CERTIFICATION

This is to certify that

Hatch

Located at:

Niagara Falls ON

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LS-706/D698; LS-702/AASHTO T88; LS-703,704/D4318; LS-705/D854; LS-709/D2434

GIB MCINTEE, P. ENG.
CHAIRMAN, CERTIFICATION PROGRAM ADMINISTRATION COMMITTEE

May 1, 2017 - April 30, 2018

Date

GORDON H. LEAMAN, P. ENG.
PRESIDENT

CCIL

Canadian Council of Independent Laboratories

CERTIFICATE OF CONFORMANCE

AGGREGATE LABORATORY CERTIFICATION

This is to certify that

Amec Foster Wheeler Environment & Infrastructure
A Division of Amec Foster Wheeler Americas Limited

Located at:

Hamilton ON

Has met the Standardization and Interlaboratory Testing Requirements of the CCIL/OSSGA AGGREGATE LABORATORY CERTIFICATION PROGRAM and has qualified under the following categories and test methods:

AGGREGATE QUALITY CONTROL LABORATORY (TYPE C)

LS-600/C-702; LS-601/C-117; LS-602/C-136; LS-607; LS-608; LS-621

AGGREGATE PHYSICAL PROPERTY LABORATORY (TYPE D)

LS-412/CSA A23.2-2C,-4C; LS-603/C131&535; LS-604/C127; LS-605/C128; LS-606/C88; LS-609/C294,5 (Petrographic Analysts : John Balinski, Martin Little, Amy McCulloch & Ivan Severenski); LS-610/C40; LS-613/D3042; LS-614/CSA A23.2-24A; LS-615/CSA A23.2-26A; LS-617; LS-618/D6928; LS-619/D7428; LS-620/CSA A23.2-25A; LS-623/D698; LS-709/D2434

Superpave Aggregate Consensus Properties

AASHTO T176/D2419; LS-629/AASHTO T304; ASTM D4791; ASTM D5821

May 1, 2016 - April 30, 2017

Date

GIB MCINTEE, P. ENG.
CHAIRMAN, CERTIFICATION PROGRAM ADMINISTRATION COMMITTEE

GORDON H. LEAMAN, P. ENG.
PRESIDENT

Appendix H

Geotechnical Investigation Safety Plan

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1. Introduction

A geotechnical field investigation is underway to gather subsurface data for the 12 Mtpa mine expansion prefeasibility study, which includes an offshore (on ice) investigation for the proposed Ore Dock No. 2. This job hazard analysis (JHA) presents an assessment of the hazards and control measures to reduce the likelihood or consequence of the hazards in order to carry out the offshore investigation program. There are a total of 10 proposed boreholes for the dock area including 5 sonic boreholes and 5 Piezocone (CPTu) test holes.

Job Hazard Analysis Form

PROJECT/TASK: ZG003 Geotechnical Marine Drilling Milne Inlet		**Department: Projects Boart Longyear**				**JOB No.:ZG003**			
SUPERVISOR: Emile Beauchamp		**LOCATION: Future Ore Dock Milne Inlet**				**DATE: March 12 ,2017**			
JOB STEP Break the job into steps. Listing work which may be hazardous.	**HAZARDS** List the hazard or type of harm identified with each step.	**Inherent**			**CONTROL MEASURE** List the necessary control measures to be followed to eliminate/reduce the identified hazards.	**Residual**			**ACTION** Person who will ensure this happens
		Consequence	**Likelihood**	**Risk Ranking**		**Consequence**	**Likelihood**	**Risk Ranking**	
1. Pre-job JHA Review.	Missing critical items on the JHA that can lead to an incident	3	2	5	Conduct a pre-job JHA review with Safety and critical team members All workers will have the opportunity to identify changes needed Any changes will be added to this document	1	1	2	Marlon Coakley/Warren Hoyle
2. Workers to complete FLRA card in the field at location prior to starting work.	Additional hazards in the area that may not have been identified on the JHA and daily changes that may pose additional danger to the health and safety of workers, the environment and property	3	3	6	Look at immediate work area for hazards that may exist, not identified on the JHA. Have other workers in the group sign off on the FLHA	1	1	2	All workers
3. Load Weights – The number and types of vehicles and equipment and their maximum gross weights	Not knowing load calculations will run the risk of breaking through the ice.	5	3	8	All equipment and material shall have posted GVW or gross equipment weight or maximum pull back loads available for use with load-ice thickness tables and shall follow the Ice Safety Plan. Refer to Attachment B for minimum ice thickness required for the drilling operations and Attachment C for further guidelines regarding Ice Safety	4	2	6	Warren Hoyle

4. General Site	Ice Conditions – Slip falls Ice Conditions – Adequate load bearing capacity Inadequate lighting Interaction with a Polar Bear Cold Whiteout conditions Emergency Procedures	3	2	5	Construct a working platform for outside of drill shack to store drill steel and allow the use of salt Use of traction aids on work boots will be required for work on ice surfaces. Apply salt to drill shack decks Engineered Assessment of minimum ice thickness as referenced in Attachment B for ice thickness required for the drilling operations and Attachment C for further guidelines regarding Ice Safety Place delineators in the snow marking access from the drilling location to the shoreline Existing Baffinland procedure “Safely Working On Fresh And Salt Water Ice” shall be followed Polar Bear Monitor will be available at all times Employees will have appropriate PPE including clothing available for safely working in -40 C and windy conditions Worksite location is approximately 300 meters from the shoreline. No work will be conducted in whiteout conditions and a safety shelter will be available immediately adjacent to the work area Site emergency procedures will be provided and reviewed at site	2	1	3	All Crew

5. Working around water and sea ice	Water may appear to be completely frozen over, but not enough to support persons Falling in water Equipment breaking through ice Workers unaware of potential dangerous conditions	5 5 4 3	1 1 2 1	6 6 6 4	Ice thickness to be assessed before walking on ice as per BIM Policy. Initial ice profiling will be conducted with an ice auger Floatation suit will be used for the initial ice profiling using an ice auger. Survival Bag (sleeping bag) will be available to reduce the risk of hyperthermia Follow the BIM Working On Ice Procedure (BAF-PH1-320-PRO-005, Rev 0, March 1, 2016) All workers will be required to complete the Alberta Working Safely on Ice Procedure online training	2	1	3	Marlon Coakley/Warren Hoyle
6. Drill testing for ice thickness	Water may appear to be completely frozen over, but not enough to support persons. Large ice cracks or crevices Falling in water Strains/Sprains Slipping on ice Drilling ice with power auger Changes in ice conditions	3	4	7	Traction aids will be used for any ice work Ice thickness to be assessed before walking on ice Floatation suits will be worn by workers while ice auguring, the worker is to be tethered to a primary rescue worker at a distance of 30m Snow must be removed at the hole location so ice can be examined for quality as described in the Ice field guide. Hand shovelling may be necessary If crevices/ cracks greater than 50% of the ice thickness are present, repairs must be made if there is risk of falling through ice into deep water	2	2	4	Warren Hoyle / Marlon Coakley

					Ice thickness for a person to walk on must be a minimum 13 cm. **STOP** all work if this condition is not met and return to shore. Be aware when using power ice auger that auger bit could bind or jam, have secure footing and grip on auger The ice auger hole spacing will be 20 m along the centreline access and the grid established in the designated work area. Secondary test holes will be augured at 10 m spacing within 250 m of the shoreline, if required based on the variable ice thickness Complete daily inspections of ice surfaces and record on ice log inspection sheet				
7. Access from Land to Sea Ice Snow removal equipment, drill rig and access vehicles are to be used for borehole access	Long distances to walk Exposure to cold White Out conditions Risk of falling under sea ice along the shoreline	4	1	5	Proper warm winter wear to be used Sat phones and digital radio use. Rig mats to be used to bridge over the fractured ice transition area if the transition between sea ice and shoreline needs leveling Buddy system is important to verify presence of frost bite or other cold related concerns **Vehicle operators and passengers are not to wear seat belts when working on ice**	1	1	2	All workers

8. Refueling of equipment	Fuel spills Regulatory or social impacts Spills into water bodies	3	2	5	Use of duck ponds with any refueling Have sufficient spill cleanup supplies on hand to respond to potential spills Maximize space between refueling vehicle	3	1	4	All workers
9. Extreme weather exposure when working outdoors or driving to and from the Borehole Location	Stranded work crew in white out conditions Cold emergencies or cold injuries Mechanical equipment failure	4	2	6	BIM has a procedure that is designed for white out conditions – it would be announced on the radio An emergency shelter to be used when in the Marine Drilling areas Emergency Shelter: Heated wooden shack (7' 8" by 7' 8") set on platform with skis Crews to radio from Hatch leads Buddy system to watch out for fellow workers who may not realize they are developing frost bite Workers to dress in arctic gear and layered clothing Proper PPE required Equipment check list Review Tidal charts on a daily basis Workers to take warm up breaks to stay warm and alert At toolbox review weather forecast with crew and prepare accordingly	2	1	3	All workers

10. Chemical handling- No unusual chemicals other than equipment needs are anticipated to be used.	Spills, leaks Chemical splash Chemical exposure	2	2	4	All products to be stored in secondary containment MSDS to supplied to BIM for review MSDS books to be accessible at the work front MSDS training and WHMIS training completed before arriving to site PPE will be followed as per MSDS recommendations as will first aid and environmental responses Spills response training and supplies to be kept with the equipment	1	1	2	Boart Longyear
11. Waste management and Wildlife Encounters	Risk of wildlife encounters due to improper waste controls Regulatory non compliance	3	2	5	Crews will collect waste daily and transport it back to camp Crews will follow BIM waste management guidelines No placing or storing of food in the back of pickup trucks Secure all small tools and PPE as foxes may carry away small articles from the site	2	2	4	All workers
12. Ecological and Cultural sensitive areas	Risk of causing damage to archeological areas Destroying vegetation Sensitive wildlife and marine life areas Regulatory and reputation damage	3	3	6	Crews have been instructed that there will be **NO** entry to the area east of the sealift ramp Crews are not to build or alter any inukshuk's or other rock formations on the tundra Permits will be required for the work	2	2	4	All personnel

13. Assemble Drill on skid platform skid and construct four walls and roofs	General hazards associated with drill assembly Inadequate communication between Boart Longyear and Site Services / mobile equipment operators	2	2	4	FLRA to be complete by Boart Longyear supervisor prior to executing work Boart Longyear Drilling operations SOPs to be followed including Boart Longyear Procedure 4001	1	1	2	Warren Hoyle / Marlon Coakley
14. Auguring holes in ice for sonic drilling and CPT work	Large ice cracks or crevices Falling in water Strains/Sprains Slipping on ice Drilling ice with power auger Changes in ice conditions	3	3	6	Wear traction aids for any ice work PFDs to be worn by workers while ice auguring during the sonic drilling and CPT operations Snow must be removed at the hole location so ice can be examined for quality. Hand shovelling may be necessary Be aware when using power ice auger that auger bit could bind or jam, have secure footing and grip on auger Complete daily inspections of ice surfaces and record on ice log inspection sheet All holes must be marked using an orange spray paint Any hole in ice over 30 cm in diameter must have a physical barrier around the hole	3	2	5	
15. Working around rotating equipment	Entanglement injuries	3	2	5	All equipment guards to be in place and in good working condition No loose clothing or drawstrings that can get pulled into rotating equipment Long hair must be contained to prevent entanglement into rotating equipment	2	1	3	All workers

					If any maintenance is required then energy isolation procedures to be followed				
16. Isolation of energy sources	Potential energy release that causes injury	3	2	5	All crews will follow the BIM Zero Energy State (ZES) procedure Crews to be given the BIM ZES training on site and fully understand the BIM requirements	1	1	2	Boart Longyear Crews BIM H&S
17. Working on equipment	Slip and trip hazards around railings, stairs and uneven ground.	2	2	4	Rails are installed around deck and to be properly maintained in good condition Stairs to be used on equipment A head cage will be used to reduce chance of contact with the rotating head Estops to be in good working order and easily accessible FLRA to be completed daily to review hazards All crews will follow the BIM Zero Energy State (ZES) procedure	1	1	2	Boart Longyear crew
18. Ice monitoring during drilling activities	Excessive deflection in ice	4	3	7	Hatch geotechs crew will monitor ice conditions during drilling including cracks around the work area, monitor freeboard in drilled holes for signs of ice deflection	2	2	4	All crew

19. Spotter activities	Equipment could come in contact with Spotter	4	2	6	Spotter to maintain eye contact with driver Spotter to review FLRA Agreed hand signals to be used with drivers in conjunction with BIM spotter procedure Agreed hand signals will be documented on the FLRA Drivers to immediately stop if the Spotter is out of eye contact	1	1	2	Boart Longyear crew
20. Manual lifting	Pinch point, back injuries, muscle and joint sprains and strains	2	3	5	Work in pairs, FLRA reviews Work with a buddy on heavy or awkward lifts Use proper lifting techniques 100 pound pipes to be handled by two workers	1	1	2	All crew
21. Working with pressure systems	Pressurized water and hydraulic fluids are used on drill and support equipment	3	2	5	Pre operational inspection Follow all safe work procedures. ZES when maintenance is required.	1	1	2	Boart Longyear crew
22. Falling objects	Potential exists for falling of drill rod and casing falling from overhead	3	2	5	Rigging and slinging training required when working with suspended loads and overhead hazards Perform FLRA	1	1	2	Boart Longyear Hatch Geotec EHS techs
23. High noise and vibration areas on the rigs	Hearing damage	2	2	4	Hearing protection is required by use of ear plugs or muffs.	2	1	3	Boart Longyear Hatch Geotec EHS techs

24. Housekeeping	Potential exists for poor housekeeping causing slip/trips and other hazards	3	2	5	Daily site assessments and toolbox meetings by drillers and site supervisors BIM EHS techs to perform daily inspections	2	2	4	All Crew
25. Fatigue	Potential exists for crew fatigue	2	2	4	Fit for duty confirmation required for all employees, daily FLRA reviews Micro breaks to stretch Proper rest during off shift period	1	1	2	All Crew
26. Working at night or 24 hour darkness	Higher risk of injury due to poor visibility	3	3	6	Hi-vis work gear to be used Use of flashlight and headlamp Workers to stay within 10 meters (30 feet) of the worksites at any time Use of wobble lights and light tower Emergency shelter	1	1	2	All Crew
27. Hot work - welding	Fire risk Burn injuries Welders Flash	2	2	4	Hot work training Use of hot work permits and JHA for any Hot Work Fire Watch required Proper PPE Welding training required	1	1	2	Boart Longyear crew

28. Rescue Plan	Rough terrain Further injuries to casualty during transit. Snow storm, white out conditions. Darkness	3	3	6	The track unit will be used to pull the survival shack (survival shack is 7' 8" x 7' 8" square) on platform with skis. When an incident has occurred, the Geotechnical Engineer must call a Code 1. Provide first aid treatment to the injured person until MRT arrives on site MRT will be dispatched to the location. MRT will transport the casualty. Visibility (whiteout conditions) will hinder rescue time, rescuers will have to wait out the storm, or until the whiteout conditions have subsided.	2	2	4	Marlon Coakley/ Warren Hoyle
29. Cleanup and Demob	Unfrozen open holes Complacency	3	3	6	All drill holes must be filled in with water and snow upon completion of drilling operations A Hatch site representative will confirm safe conditions upon demob All debris must be removed from ice surface and disposed off site per waste management plan BIM safety and environment representatives to attend a post project closeout inspection to document the completion of the clean-up	2	2	4	Boart Longyear

Comments:

Baffinland

Baffinland Iron Mines Corporation - Mary River Project - ERP
Job Hazard Analysis Form

Score	CONSEQUENCE		
	People	Plant	Environment
5 – Very High/ Catastrophic	Multiple Fatalities.	Greater than $10 Million Loss	Catastrophe, destruction of sensitive environment, worldwide attention. Likely EPA prosecution. More than 30 days delay.
4 – High/ Major	Fatality or Permanent Disabilities.	$1 Million to $10 Million Loss	Disaster, high levels of media attention, high cost of clean-up. Offsite environmental harm; more than 10 days delay.
3 – Moderate	Major Injuries – Incapacitations or requiring time of work.	$100 Thousand to $1 Million Loss	Major spills, onsite release, substantial environmental nuisance, more than 1day delay. (Leads to additional resources call out i.e. SES).
2 – Low/ Minor	Significant Injuries – Medical Treatments, non-permanent injury.	$10 Thousand to $100 Thousand Loss	Significant spills. (Leads to a call out of Site Emergency Response Group).
1 – Very Low/ Insignificant	Minor Injuries – First Aid Treatments (cuts/bruises).	Less than $10 Thousand Loss	Low environmental impact. Minor Spills less than 80 Litres.

Score	LIKELIHOOD
5 – Almost Certain	The event is expected to occur in most circumstances. Likely to occur frequently - More than 1 per year.
4 – Likely/ Probable	The event will probably occur in most circumstances. Likely to occur several times – 1 per year.
3 – Moderate/ Occasional	The event should occur at some time. Likely to occur at some time – 1 per 5 years.
2 – Remote/ Unlikely	The event could occur at some time. Unlikely but possible. 1 per 10 years.
1 – Rare/ Very Unlikely	The event may occur only in exceptional circumstances. Assumed it may not be experienced. 1 per 100 years.

Job Hazard Analysis Attendees: Darryl Finlay, Marlon Coakley, Warren Hoyle, Usman Khan, Alex Boissonneault

	Name	Signature	Date
Written by:	Marlon Coakley	Marlon Coakley	Mar 20/2017
Reviewed by:	Warren Hoyle (Hatch)	Warren Hoyle	March 20, 2017
	Darryl Finlay (BIM Safety Coordinator)		March 20, 2017

Risk Rating = Consequence + Likelihood

Consequence	Risk Rating				
5	6	7	8	9	10
4	5	6	7	8	9
3	4	5	6	7	8
2	3	4	5	6	7

Risk Rating - Definitions

Risk Rating	Definitions	Action Required
8 - 10	Intolerable	Task not to start till the risk is eliminated or reduced. Bring to the immediate attention of management. Formal assessment required. MUST reduce the risk as a matter of priority.
7	High	Bring to the immediate attention of management. Task not to start till the risk is eliminated or reduced. Further Assessment required. MUST reduce the risk as a matter of priority.
6	Significant Risk	Bring to the attention of supervision. Review risks and ensure that they are reduced to as low as reasonably practicable. To be dealt with as soon as possible, preferably before the task commences. Introduce some form of hardware to control risk.
5	Moderate Risk	Needs to be controlled but not necessarily immediately, an action plan to control the risk should be drawn up. Review effectiveness of controls. Ensure responsibilities for

1	2	3	4	5	6
	1	2	3	4	5
	Likelihood				

		control are specified.
2-4	Low Risk	If practical reduce the risk. Ensure personnel are competent to do the task. Manage by routing procedure. Monitor for change

A JHA considers a variety of activities/tasks involved in a job scope and analyses the key hazards (sources of harm) and their consequences (types of harm) eg. Sources of harm – lifting a heavy pipe - manual handling. Types of harm – Back strain.

Main Points – On how to write a JHA.

1. Define the task – what is to be done.
2. Review previous JHA if any – have we done it before?
3. Identify the steps – what is to be done.
4. Identify the hazards of each step.
5. Identify who or what could be harmed.
6. Give the task a risk rating – Consequence + Frequency
7. Develop solutions to eliminate or control hazards in each step.
8. Review the risk rating after the control system has been implemented.
9. If risk rating unacceptable review the solutions till risk rating acceptable.
10. Agree who will implement the control system.
11. Document the JHA and discuss with the relevant personnel.

Hierarchy of Hazard Management – Control Measures

These steps outline what should be planned for when deciding what control measures are to be put in place. Whenever possible the highest step should be used first and then progress down the list.

1. Eliminate the hazard.
2. Substitution.
3. Reducing the frequency of a hazardous task.
4. Enclosing the hazard.
5. Additional procedures.
6. Additional supervision.
7. Additional training.
8. Instructions / information.
9. Some personal protective equipment.

Worker / Visitor review	Signature
Warren Hoyle	March 19/2017
Marlon Coakley	March 19/2017
Usman Khan	
Alex Boissonneault	March 19, 2017
Emile Beauchamp	March 19/2017
Samuel Flynn	March 19/2017
Ruben Gross	MARCH 19/2017
Justin Gross	March 19/2017
Chris Entz	March 19/2017
Doug Roach	
Robbie Jordan	

Enclosed:

Attachment A – BIM Working on Ice Procedure
Attachment B – On Ice Platform for Geotechnical Drilling
Attachment C – Best Practice for Building and Working Safely on Ice Covers in Alberta
Attachment D – Ice Thickness Assessment
Attachment E – Ice Assessment Drawing

Attachment A – BIM Working on Ice Procedure

Baffinland Iron Mines Corporation

Working on Ice Procedure

BAF-PH1-320-PRO-0055

Rev 0

Prepared By: Shawn Parry
Department: Road Maintenance
Title: Manager
Date: February 9, 2017
Signature:

Approved By: Sylvain Proulx
Title: Chief Operating Officer
Date: February 9, 2017
Signature:

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DOCUMENT REVISION RECORD

Issue Date MM/DD/YY	Revision	Prepared By	Approved By	Issue Purpose
01/19/17	1	S.P.	R.G.	use

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1 PURPOSE AND SCOPE

Baffinland Iron Mines Corporation is committed to taking the necessary steps to ensure that work performed on ice of lakes, rivers, streams or the ocean is conducted in a safe, efficient and environmentally compliant manner.

This procedure is not intended to provide instructions for large scale ice operations such as ice road construction and operation. For large scale ice operations, refer to "Best Practice for Building and Working Safely on Ice Covers in Alberta (Work Safe Alberta)".

2 DEFINITIONS

2.1 BAFFINLAND CLASSIFICATIONS FOR WORKING ON ICE

Class A Job – The ice is between 15 centimetres and 38 centimetres thick and the load weight, including people on the ice will be 4,536 kilograms or less.

Class B Job – The ice is more than 38 centimetres thick and the load weight, including people, is greater than 4,536 kilograms but less than 63,000 kilograms.

Class C Job – The job requirements cannot be met by either Class A or B guidelines.

See section 4, Protocols for a discussion of Class A, B and C requirements.

3 RESPONSIBILITIES

The following roles have specific accountabilities that must be met to ensure that any work on ice is conducted in a safe and environmentally responsible manner.

3.1 CHIEF OPERATING OFFICER OR GENERAL MANAGER, OPERATIONS

The Chief Operating Officer or General Manager, Operations must review and approve any Class C job for working on ice.

3.2 DEPARTMENT MANAGER/SUPERINTENDENT

The Department Manager and Superintendent are responsible to ensure their department supervisors are aware of and comply with this procedure. The manager and superintendent are also responsible to validate the terms and conditions of the JHA are implemented.

3.3 DEPARTMENT SUPERVISOR

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The Supervisor is responsible for supervising the work/tasks in accordance with this procedure and the terms and conditions of the JHA. Specifically, the supervisor is responsible for:

- Notify the department manager and superintendent of the requirement to work on ice and send each a copy of the completed JHA.
- Ensure a geographically specific JHA is completed and implemented, prior to starting work.
- Notify the MRT Trainer and have them participate in the JHA.
- Ensuring that workers have reviewed and understand the JHA, prior to starting work.
- Supervise the work and act as the main point of contact for workers working on ice.

3.4 Worker

The worker, is responsible for the following:

- Review, sign and comply with the terms and conditions of the JHA.
- Promptly reporting to their supervisor, any safety concerns or incidents that occur while working on ice.

3.5 Safety Superintendent or Coordinator

The Safety Superintendent or Coordinator will facilitate the working on ice JHA process.

3.6 Mine Rescue Team Trainer or Delegate

The Mine Rescue Team Trainer or delegate is responsible to work with the supervisor to develop the rescue plan component of the JHA.

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4 PROTOCOL

4.1 CLASS A JOB

The following table provides requirements for performing work on ice under Class A conditions. The JHA must meet the following conditions;

Equipment Example	Weight (kilograms)	Minimum Ice Thickness (centimetres)	Ice Integrity
1 or 2 people and their tools and equipment	Up to 272	15	Solid ice that is free of cracks, water and slush
Snowmobile and rider	Up to 363	20	Solid ice that is free of cracks, water and slush
2 snowmobiles and riders	Up to 726	25	Solid ice that is free of cracks, water and slush
Pickup truck or other mobile equipment, cargo and driver/passengers	Up to 4536	38	Solid ice that is free of cracks, water and slush

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4.2 Class B Job

The ice is greater than 38 centimetres thick and the load weight, including people, is greater than 4536 kilograms but less than 63, 000 kilograms.

Ice Thickness Calculation	Weight and Ice Thickness	Ice Integrity
The Golds formula found in Section 5 must be applied to calculate the safe ice thickness. The calculation, including safe ice thickness must be documented in or attached to the working on ice JHA.	The combined weight of the load, including equipment and people is greater than 4536 kilograms but less than 63, 000 kilograms and the ice is 38 centimetres thick or greater	Solid ice that is free of cracks, water and slush

4.3 Class C Job

The job requirements cannot be met by either Class A or B guidelines. The assistance of a professional engineer recognized as an authority on ice covers, must be consulted and their guidance documented in or attached to, the JHA.

5 Golds Ice Weight Bearing Capacity Formula

GOLD'S FORMULA
All guidelines currently in use in Canada are based on a technical paper published by Dr. Lorne Gold in 1971 entitled "Use of Ice Covers for Transportation". Gold's Formula is;

$P = A \times h^2$
Where:

- **P** is the allowable load in kilograms
- **A** is a parameter that depends on the strength of the ice
- **h** is the effective thickness of good quality ice (cm)

Gold suggested a range of A-values for lake ice that corresponds to a range of safe ice thicknesses for a given load or a range of acceptable loads for a given ice thickness. Baffinland has adopted Golds "Tolerable Risk" value for ice quality, therefore the A value in Golds formula will be four (4) when calculating ice thickness for a Baffinland Class B job.

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Gold's formula A value of 4 is most commonly used for normal operations with moving vehicles. When equipment will be working in the same spot (stationary) for more than 2 hours, the value for A in Golds formula, must be reduced to two (2).

Two examples using the Golds Formula for a Class B job:

What is the weight capacity of good quality ice that is 60 cm thick?
Capacity (in Kgs) = A x h^2
Capacity (in Kgs) = 4 x (60x60)
Capacity (in Kgs) = 4 x 3600
Capacity = 14400 Kgs

The weight bearing capacity of good quality ice that is 60 cm thick is up to 14400 kilograms.

What is the weight bearing capacity of good quality ice that is 60 cm thick and the load will be stationary for 2 hours or more?
Capacity (in Kgs) = A x h^2
Capacity (in Kgs) = 2 x (60x60)
Capacity (in Kgs) = 2 x 3600
Capacity = 7200 Kgs

7, 200 kgs is the weight bearing capacity of good quality ice that is 60 cm thick and the load will be stationary for 2 hours or more.

5.1 Working on Ice frozen to the bottom (River, Lake – etc.)

When Ice thickness measurements determine the ice has frozen to the bottom in the area of travel and work, the ice may be considered as safe provided the ice quality is routinely monitored and remains solid and free of slush and water.

6 Working on Ice JHA and Work Planning Meeting

Working on ice may be divided into two parts;
1. initial measurement of ice thickness
2. working on the ice

Both parts require a JHA.

A work planning meeting must be held prior to any work on ice. This meeting will be based on review of the completed JHA. All individuals participating in the work must present and review their work instructions, roles and responsibilities. The following points will be covered

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in the JHA and will be covered as part of the topics of discussion during the "planning meeting":

- A description of the work to be done – with sufficient detail for individuals to understand their role
- Potential hazards associated with the work
- Personal safety equipment
- Specific safety procedures for working on ice
- Rescue procedures and necessary equipment
- Individual job tasks
- Communications and hand signals to be used
- Load (i.e. equipment, personnel) weight and distribution on ice during work
- Ice assessment – thickness and condition

JHA safety and emergency response considerations;

- Measuring ice thickness should always be a two person operation.
- Initial ice measurement must be done with a PFD and the lead tester on a tether to the second person who is a safe distance behind.
- Self-recovery is not the primary means of rescue, it's the second person and the tether.
- The MRT will provide a backup rescue plan.

7 MEASURING AND RECORDING ICE THICKNESS

The task of ice thickness measurements may be the subject of a separate JHA or may be included in the working on ice JHA.

Ice thickness is the primary measurement required to determine the safe working load that can be put on the ice (allowable load bearing capacity). Manual measurements are made by cutting a hole in the ice cover with an auger, a saw or an ice chisel and then directly measuring the ice thickness. Measurements are made in a prescribed spacing or pattern to provide sufficient coverage and verify the thickness of the ice cover.

It must be mentioned that in all cases of manual ice thickness measurements it is the absolute minimum thickness measured in all holes that must be used. Not an average or any other measurement.

It is imperative that a systematic procedure be implemented to document all ice thickness measurements. Measurement locations should be taken either with a Global Positioning System (GPS) receiver or marked with stakes, or other reliable system so that these locations can be tracked in future measurements or identified for repairs. This information is a key element in the monitoring control plan.

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These records are vital to reconcile any ice failures that may occur. These records must be maintained in a log that is specific to recording ice thickness. See Appendix #1 - Ice Thickness Measurement Log

Suitable equipment and personal protective equipment (PPE) must be prescribed for the work. Initial testing should be conducted by at least two trained crew members travelling separately over the ice. The work could be carried out by travelling:

- On foot, by snowmobile or by amphibious vehicle.
- While testing, the crew should also be checking the ice for cracks and noting the snow load.
- If vehicles are used, two separate vehicles must be used at all times and must be separated at safe distance unless ice conditions are known.

7.1 Test Hole Spacing

Rivers

If GPR is used, test holes are only required for calibration and for mapping of thin areas. Recommend 30 meters between test holes along alternate edges. Look for thin areas caused by river current.

Lakes

If GPR is used, test holes are only required for calibration. If within 250 metres of shore: 30 meters between test holes along centre line. If more than 250 metres from shore: 250 metres between test holes along centre line

Note – these recommendations indicate normal test hole spacing. Good judgement based on field experience must be used when varying from these recommendations. In thin ice areas the suggested spacing should be reduced to determine their extent and severity.

8 REFERENCES AND RECORDS

- Baffinland Job Hazard Analysis Procedure BAF-PH1-810-PRO-0016r1
- Baffinland Iron Mines Corporation– Emergency Response Plan (BAF-PH1-830-P16-0007)
- Best Practice for Building and Working Safely on Ice Covers in Alberta (Work Safe Alberta)
- NWT Transportations Guide to Ice Road Construction

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Appendix #1
Ice Thickness Measurement Log

Date:		Location:
Completed by:		Signature:
Weather Conditions, including temperature:		
Test Hole #	Ice Thickness	Notes on test hole – clear solid ice cracking, water – etc.
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Names of other participants		Signature of other participants

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Attachment B – On Ice Platform for Geotechnical Drilling

On-Ice Platforms for Geotechnical Drilling at Steensby Island

2013-04-09	0	Approved for Use	V. Tatone	D. Wolek	S. Perry	D. Matthews
DATE	**REV.**	**STATUS**	**PREPARED BY**	**CHECKED BY**	**APPROVED BY**	**APPROVED BY**

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Appendix B

Consideration of Bearing Capacity of Ice for Geotechnical Drilling Program

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1. Purpose

1.1 This Procedure identifies minimum safe work practices for the set-up and maintenance of on-ice platforms to be used to support geotechnical drill rigs for near shore work at Steensby Island.

NOTE: This Procedure does not replace safe work procedures for working on ice.

2. Scope

2.1 This Procedure applies to all locations where on-ice platforms are required for near shore work at Steensby Island.

3. Roles and Responsibilities

3.1 Construction Manager

3.1.1 The Construction Manager shall be accountable for ensuring full implementation and compliance with the requirements of this Procedure.

3.2 Contractor's Line Managers

3.2.1 Contractor's Line Managers shall have the following accountabilities:

- Conduct risk assessments for tasks associated with this Procedure and ensure the implementation of controls
- Ensure equipment is used and processes are applied in accordance with this Procedure

3.3 Site Health and Safety Manager

3.3.1 The Site Health and Safety Manager shall have the following accountabilities:

- Audit and monitor compliance with this Procedure
- Identify remedial corrective actions required to meet this Procedure

3.4 Supervisors

3.4.1 Supervisors shall have the following accountabilities:

- Ensure the application of this Procedure
- Responsibility for details of construction of the platforms
- Ensure that a JHA/FLRA is developed for tasks associated with this Procedure

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- Ensure that employees review and sign the JHA/FLRA prior to task commencement
- Responsibility for removal of the ice platforms

3.5 Employees

3.5.1 All employees shall have the following accountabilities:

- Ensure they follow this Procedure
- Ensure that JHA/FLRA developed for tasks associated with this Procedure are followed

4. Definitions

4.1 Solid Ice

4.1.1 Stable sheet of solid ice, thickness adequate to safely support the operation. The solid ice may be subject to movement due to tides.

4.2 Sea Ice

4.2.1 Sea ice is any form of ice that is found at sea and has originated from the freezing of sea water.

4.3 Rafted Ice or Raft Ice

4.3.1 Ice in cakes or sheets overlapping or piled on one another. This is a body of near shore ice segments fused together and formed during fall freeze-up. The surface of suitable rafted ice should be reasonably flat and elevation at or near high tide. This rafted ice is a stable entity. Rafted ice that moves with the tides shall be regarded as unstable.

4.4 Ice Platform

4.4.1 A platform constructed on the rafted ice by flooding with salt water and including embedded rig mats.

4.5 Rig Mat

4.5.1 A portable platform used to support equipment used in construction and resource based activity including drill rigs.

4.6 Drill Rig

4.6.1 A track mounted drill rig used for geotechnical investigations.

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5. Procedure

5.1 Specific Requirements for Ice Platforms

5.1.1 The rafted ice must be stable and fused to act as a homogeneous mass. Appropriate ice profiling and/or direct measurement of ice thickness is required.

5.1.2 Do not attempt to construct an ice platform in locations where sea ice is pushed up onto the rafted ice to a height exceeding 2 m.

5.1.3 The solid ice adjacent to the ice platform must be stable during tidal influence and capable of safely supporting the gravity loads imposed by the operation, including at the edge of the ice sheet. Appropriate ice profiling and/or direct measurement of ice thickness is required.

5.1.4 The zone of discontinuity between the solid and rafted ice must not be open water at any time and must be sufficiently narrow so that the rig mats will safely support the movement of equipment and personnel across this zone. No work is to be performed over this zone of discontinuity. Appropriate ice profiling and/or direct measurement of ice thickness is required.

5.1.5 The ice platform shall be constructed by alternate overlapping layers of rig mats and flooding with salt water until a suitable work space is created over the rafted ice. Profile the ice with an ice profiler or measure ice thickness using a mechanical ice auger prior to any flooding.

5.1.6 The rig mats shall be constructed of steel frames and timber cross beams. The rig mats shall be strong enough to bridge across the zone of discontinuity. Note that the attached sketch is conceptual only. The number of rig mats must be determined on site. It is anticipated that the number of available rig mats will not be more than six.

5.1.7 The rig mats shall be adequately connected by mechanical means to be determined at site.

5.1.8 The platform must be sufficiently long and wide to permit a clearance of at least two metres on each side of the equipment and supplies.

5.1.9 The platforms must be removed by means established by the supervisor.

6. References

Nunavut General Safety Regulations, R.R.N.W.T. 1990.

Nunavut Mine Health and Safety Regulations, R-125-95.

Safe Work Procedure – Working on Ice (HS-SWP-092).

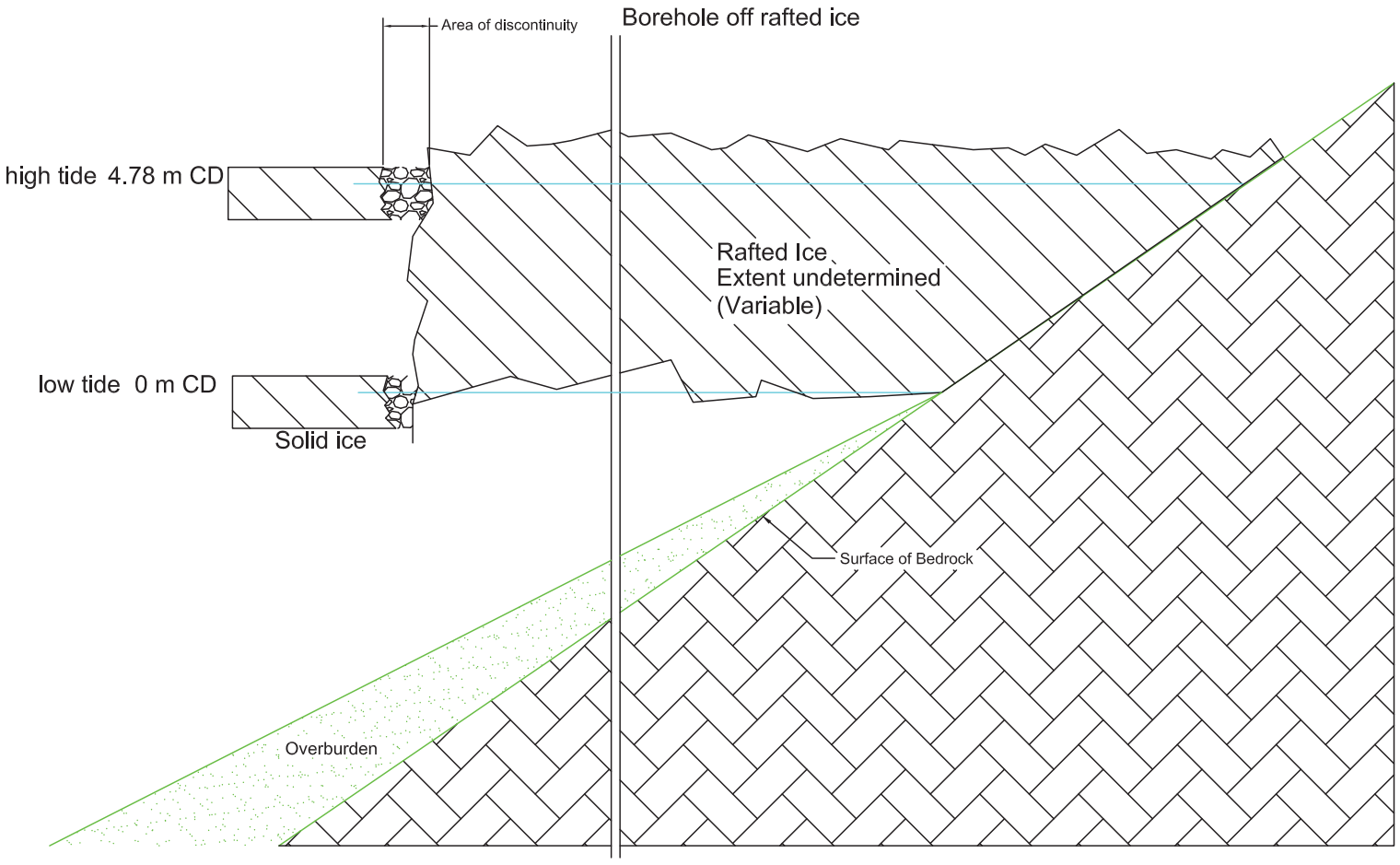
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Appendix A

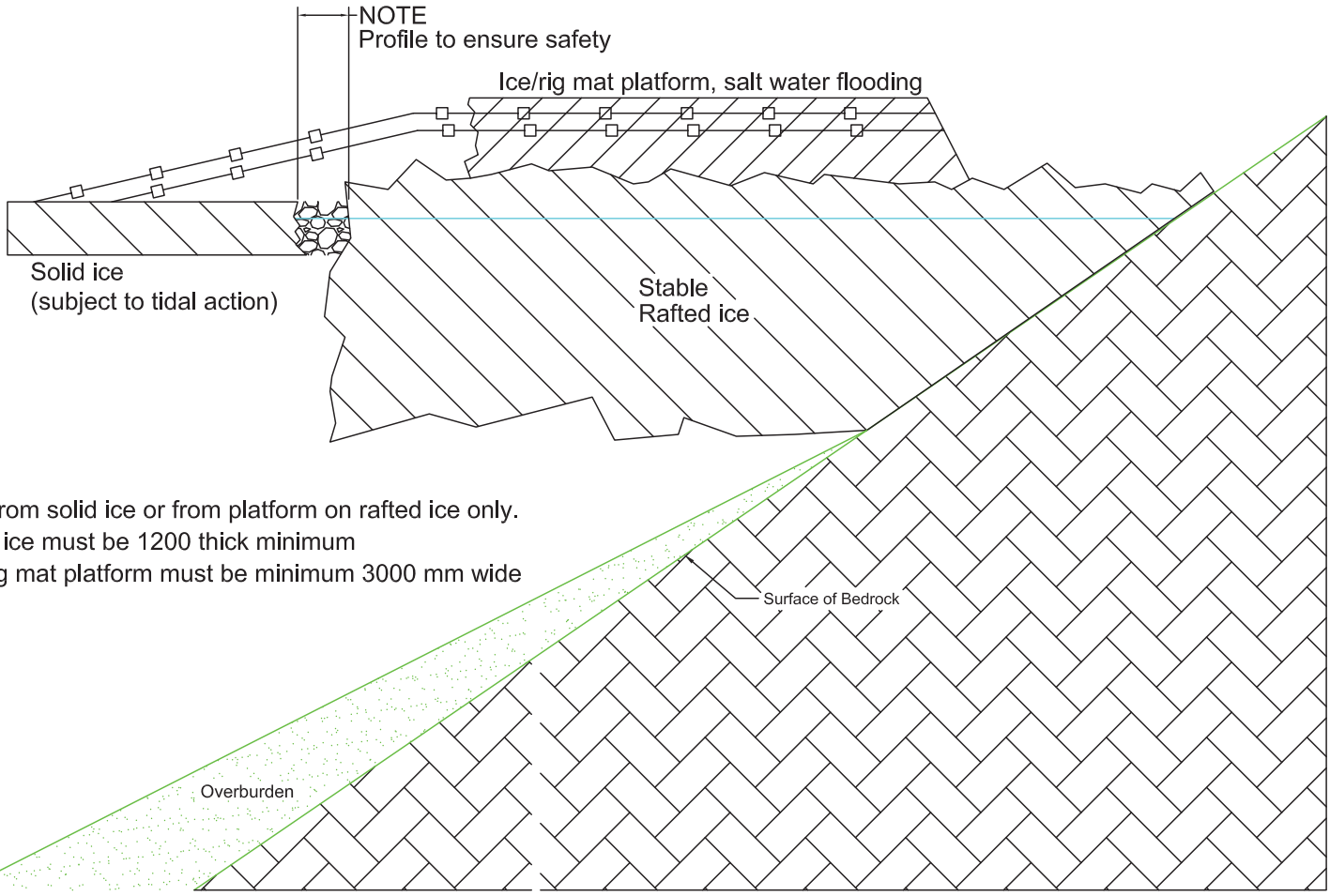
Illustrations

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Dredged Depth -23 m CD

ORE DOCK
NEARSHORE CROSS SECTION



Notes:

1. Drill from solid ice or from platform on rafted ice only.
2. Solid ice must be 1200 thick minimum
3. Ice/rig mat platform must be minimum 3000 mm wide

ORE DOCK
ICE PLATFORM CONCEPT

Appendix B

Consideration of Bearing Capacity of Ice for Geotechnical Drilling Program

Safety • Quality • Sustainability • Innovation

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Project Memo

December 14, 2011

TO: K. Skebo FROM: B. Gill

cc: S. Hinchberger
R. MacCrimmon

Baffinland Iron Mines Corporation
Mary River Project

Consideration of Bearing Capacity of Ice for Geotechnical Drilling Program

1. Introduction

The purpose of this note is to consider the ice features that may affect the execution of a planned geotechnical drilling program in a safe and effective manner. The program will be conducted during April and May in the proposed mine and marine facilities areas of the Baffinland project on northern Baffin Island. This note addresses primarily the bearing capacity of the ice cover for supporting the drilling program vehicles and equipment.

1.1 Air Temperatures and Ice Thickness

The air temperatures over the period from 1971 to 2000 for Hall Beach to the southwest and Pond Inlet to the northeast for April and May are as follows:

Table 1-1: Air Temperatures

	Hall Beach		Pond Inlet	
	April	**May**	**April**	**May**
Daily Average	-20.4	-9.0	-22.1	-9.9
Daily Maximum	-15.2	-4.8	-17.7	-5.8
Daily Minimum	-25.6	-13.2	-26.5	-13.9

Thus it is seen that the air temperature is well below freezing for the period and ice will continue to grow. Ice thickness data for Hall Beach show that in most years, the thickness reaches to 2 m or greater by May. The minimum thickness for May over 50 years is approximately 1.5 m. This is a significant thickness that is capable of supporting very heavy loads.

1.2 The Bearing Capacity of Ice

The guidelines in Canada for determining safe working loads for operations on ice are based on work by Dr. L. Gold of the National Research Council (see for example, "A Field Guide to Ice Construction Safety" by NWT Department of Transportation, November, 2007 and "Best Practice for Building and Working Safely on Ice Covers in Alberta by Work Safe Alberta, Government of Alberta, October, 2009). Dr. Gold published his paper "Use of Ice Covers for Transportation" in 1971. His formula, which says that the safe working load is a function of the ice thickness squared, is $P = Ah^2$ where A is a parameter that is related to the ice strength and h is the ice

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thickness. The value of A may vary depending on the degree of risk one is willing to take and the offsetting precautionary and response measures that are implemented in a given case. For the current case in which the ice thickness is large, the ice is static, and the equipment loads are relatively modest in relation to the ice bearing capacity, one could assume a low risk factor, and the subsequent calculated minimum ice thickness for the planned equipment weight would be relatively high, but still well below the thickness in April and May. In the Alberta and NWT documents referred to above, the former document uses a range of values for 'A' from 3.5 to 7 and suggests hazard control measures appropriate to each level, whereas the latter document uses a single value of 4 for 'A'. Both of these documents are concerned with freshwater lake and river ice.

Using a value of 4 for 'A' and an ice thickness of 200 cm results in an allowable load of 160 tonnes or more than 12 times the weight of a Cat 950 loader. The ratio would be presumably even greater in the case of a drill rig. In the same manner, the minimum (freshwater) ice thickness that a stationary or slowly moving 950 loader weighing about 13,000 kg would require is 57 cm.

The allowable load in the case of sea ice would be less than that for an equivalent thickness of freshwater ice because of the lower strength (under the same temperature conditions) that results from brine inclusions in the sea ice. A reasonable understanding of this derating can be obtained by comparing the flexural strengths of the two types of ice. For a salinity of 8 ppt (parts per thousand) for arctic sea ice at an average ice temperature of -20 deg C, the resulting flexural strength is about 65 percent of the strength of freshwater ice at the same temperature. The minimum sea ice thickness for a 950 loader would then be about 70 cm. This is 35 percent of the expected ice thickness at the project site during the drilling period.

The rate of movement of the equipment is not expected to be a significant factor, unlike in the case of transport vehicles moving at speed on ice covers over relatively shallow water. The speeds in the present case will not be sufficient to cause any dynamic effects that could lead to a magnification in deflection of the ice cover. According to field studies reported in the above-referenced Alberta Government document, a vehicle would have to travel at 50 km/h over ice 1 m thick in 15 m of water to cause such effects.

1.3 Potential Hazard Control

As noted, the large ice thickness in relation to the minimums required to safely carry the loads and the static nature of the ice cover in the present case mean that this is a low-risk operation in terms of potential ice bearing problems. An appropriate hazard control procedure would entail prior ice measurements to confirm the anticipated thickness in the working areas, measurements thereafter if any uncertainties exist with respect to ice thickness, monitoring the ice quality (e.g. cracks, effects of warming, water on the ice, etc), and checking for deflection of the ice cover as time of equipment in one location increases (this can be done by observing the water level in boreholes).

An overall ice safety plan should be implemented, including orientation and instruction for employees and contractors and routine daily observations to ensure rules of working on an ice cover are followed.

BG:vl

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Internal Memo

H352034

March 18, 2017

To: Warren Hoyle

From: Usman Khan

cc: Marlon Coakley
Alex Boissonneault
Sean Hinchberger
Tyler Bruce
Sven Heiner

Baffinland Iron Mines
Mary River Expansion Study Stage 2

Minimum Ice Thickness for Offshore Drilling at Milne Port 2017

1. Introduction

Hatch Ltd. (Hatch) was retained by Baffinland Iron Mines to conduct an offshore, on-ice, geotechnical drilling investigation at the Milne Port Site. This investigation is scheduled for the period of mid to late March 2017. In order to mitigate risk relating to ice breakthrough, the investigation team reviewed ice strength evaluation completed for a similar offshore investigation at the Steensby site in 2011.

2. Allowable Ice Loading

2.1 Moving Loads

The 2011 evaluation of ice thickness utilized Gold's formula to calculate the allowable weight for a variable ice thickness. Gold's formula is based on literature that utilizes data collected from ice breakthroughs and forms an empirical relationship to predict the allowable bearing capacity of ice.

$$P = Ah^2$$

P = Allowable load in kilograms

A = Constant which depends on the quality of the ice, the geometry of the load and the factor of safety appropriate

h = Effective thickness of the ice in centimeters

Further literature review suggests using a value of 4 as a conservative estimate for freshwater ice. Government of Alberta and Northwest territories both recommend using a factor of 4.

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It is noted that a factor of 4 is used for freshwater ice and does not account for the reduction of flexural strength in sea ice due to the presence of brine. A reduction factor of 0.65 is applied per Hatch project memo entitled, “On-Ice Platforms for Geotechnical Drilling at Steensby Island” (Document # H349000-HS-SWP-165).

Table 2-1: Maximum Allowable Load On Sea Ice

Ice Thickness (cm)	Load (kg)	Load (lb)		Ice Thickness (cm)	Load (kg)	Load (lb)
5	60	150		105	28,660	63,200
10	260	580		110	31,460	69,360
15	580	1,290		115	34,380	75,810
20	1,040	2,300		120	37,440	82,550
25	1,620	3,590		125	40,620	89,570
30	2,340	5,160		130	43,940	96,880
35	3,180	7,030		135	47,380	104,470
40	4,160	9,180		140	50,960	112,350
45	5,260	11,610		145	54,660	120,520
50	6,500	14,340		150	58,500	128,980
55	7,860	17,340		155	62,460	137,720
60	9,360	20,640		160	66,560	146,740
65	10,980	24,220		165	70,780	156,060
70	12,740	28,090		170	75,140	165,660
75	14,620	32,250		175	79,620	175,550
80	16,640	36,690		180	84,240	185,720
85	18,780	41,420		185	88,980	196,180
90	21,060	46,430		190	93,860	206,930
95	23,460	51,740		195	98,860	217,970
100	26,000	57,330		200	104,000	229,290

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2.2 Static Loads

Gold's formula is adequate for calculating the allowable bearing capacity for moving loads on ice but it does not propose a relationship between allowable loads and ice thickness for static loads. To ensure ice safety for a static load operation, a literature review was completed. It was concluded that the deflection in ice must be monitored throughout the drilling operation and loading must be removed in case of excessive deflections. Ice cover should not exceed the freeboard elevation to ensure safety of the drilling crew.

3. Monitoring During Drilling Activities

A hole will be augured through ice within 5 m of the point of maximum load. The depth of water in the hole will be monitored throughout the duration of the drilling investigation at each borehole location. Drilling will be terminated if sea water is observed flowing through the top of the augured hole. Ref 3 provides further details regarding the bearing capacity of ice covers under static loads.

4. References

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UK:UK
Attachment(s)/Enclosure

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Appendix I

Geophysical Assessment

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GEOPHYSICS GPR
INTERNATIONAL INC.

GEOPHYSICAL INVESTIGATION FOR BAFFINLAND RAILWAY, MARY RIVER PROJECT, NUNAVUT

PREPARED FOR:
Baffinland Iron Mines Corporation

Presented to:

4342 Queen Street, Suite 500
Niagara Falls, Ontario
L2E 7J7



Project T17001B-Revision#004 **April 2018**

Geophysics GPR International Inc.
6741 Columbus Road, Unit 14
Mississauga (Ontario) L5T 2G9
Tel. : +1 905.696.0656
info@geophysicsgpr.com
January 2018 T-17001B

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APPENDIX B – Georadar Fact Sheet

1 INTRODUCTION

Geophysics GPR International Inc. was requested by Hatch Ltd. to carry out a geophysical survey to aid in projection and planning of a proposed railway for the Mary River Project, Baffin Island, Nunavut.

The purpose of this investigation was to determine the extent of, as well as the thickness of subsurface ice.

The ground penetrating radar (georadar) method was applied to determine the presence of ice and calculate its thickness.

Data was collected from November 3rd to November 15, 2017.

The investigation included the following:

1) Georadar mapping of subsurface ice at nine sites approximately at Km 0, 19.4, 20.5, 39.5, 49.3, 82.2, 97.0, 100.1 and 109 along the proposed rail alignment. Further exploration with gridded georadar lines was conducted in regions both with and without the presence of ice.

Figure 1 presents an overview map of the investigation area with the locations of the respective sites.

The following report describes the various aspects of the survey including field techniques, survey design, interpretation techniques, and finally an interpretation in the form ice thickness maps.

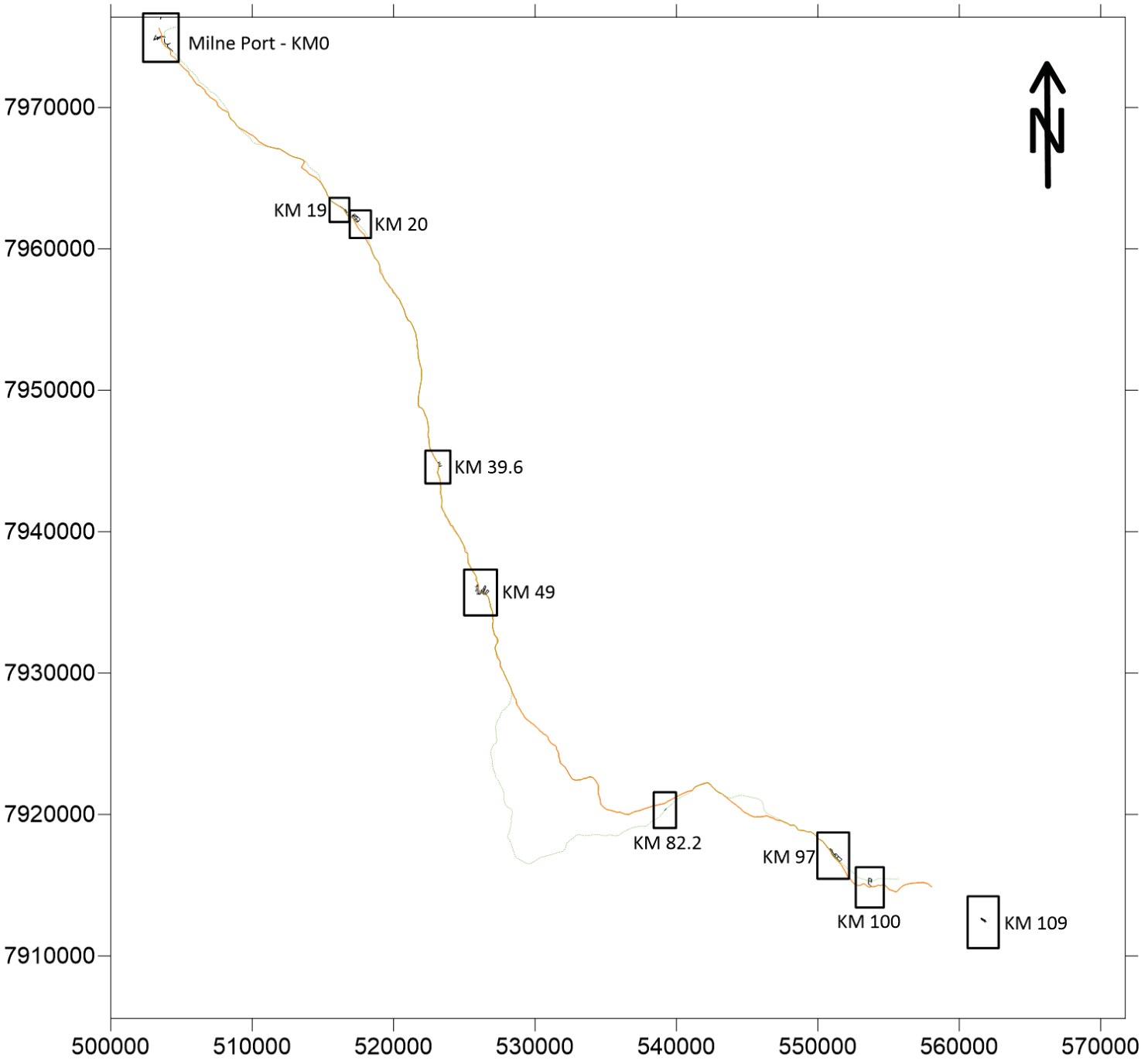


Figure 1: Overview map of the investigation area

2 METHODOLOGY

Georadar was used to determine the presence and thickness of ice.

2.1 Positioning, Topography and Units of Measurement

The emplacement of the survey areas was determined by the client.

The locations of the georadar survey lines for the purpose of subsurface ice mapping were oriented to align with the design of the proposed railway. Length and number of the lines were chosen based on in-field interpretation of georadar data. Positioning was controlled by the GPS device integrated into the georadar antenna. The UTM coordinates should be accurate to within +/- 2.0 m.

Table 1: UTM coordinates of GPR survey lines

Line No.	Start (0+00)		End (0+69)		Chainage (km)		Notes
	Easting	Northing	Easting	Northing	Start	End	
Line 0	502871.8	7976754.0	504000.0	7974502.0	0	2	Milne Port Area
Line 19.4	516252.0	7962974.0	516644.0	7962535.0	19.25	19.85	
Line 20.5	517047.0	7962251.0	517390.0	7961888.0	20.46	20.9	
Line 39.6	523146.0	7944888.0	523216.0	7944604.0	39.6	39.9	
Line 49.3	525992.0	7935880.0	526497.0	7935589.0	49.5	49.9	Rough Terrain
Line 82.2	539154.0	7920274.0	539291.0	7920419.0	82.2	82.4	
Line 97.0	551121.0	7917097.0	551250.0	7916944.0	97.0	97.6	Rough Terrain
Line 100.1	553584.0	7915318.0	553779.0	7915281.0	100.1	100.3	
Line 109.0	561530.0	7912604.0	561844.0	7912356.0	109.0	109.4	

The provided coordinates are NAD83/WGS84, UTM zone 17N.

The depth measurements are noted as depth from surface.

All geophysical measurements were collected in SI units.

In addition to Table 1, further georadar survey lines were created to further explore the given areas. These additional survey lines were generated in a grid-like fashion with the topography dictating the spacing of the lines.

2.2 Ground Penetrating Radar (Georadar)

Basic Theory

Georadar utilises radar technology to obtain a near-continuous profile of the subsurface. The basic principle is to emit an electromagnetic impulse into the ground at a predetermined frequency rate (typically 10 to 80 scans/second). This pulse will travel through the sub-surface and reflect off boundaries of differing dielectric constants (contrasts of EM impedances). The reflected pulse returns to the surface and is recorded by a receiver and displayed in real-time as a cross-sectional image. Only by moving the antennas along a profile directly over the targets can the locations and depths be determined. Examples of radar reflecting boundaries include air/water (water table); water/earth (bathymetry); earth/metal, PVC, or concrete (pipe locating); and differing earth materials (stratigraphic profiles, including bedrock profiles).

The depth of investigation is controlled by the frequency and power of the antenna limited by attenuation and diffraction of the radar signal. Lower frequency antennas provide greater depth penetration at the expense of resolution. The radar signal is attenuated by conductive ground materials (e.g. clays, dissolved salts etc.). The radar signal is diffracted by irregular shaped material (e.g. boulders, debris etc.) that prevents the clear return of the reflected pulse.

More information on the georadar operating principle can be found in Appendix B.

Survey Design

The georadar data were collected with a MALA Ground Explorer system and 160 MHz antenna. This antenna provides a favourable trade off between depth and resolution for ice detection. As well, this antenna has sufficient durability for the terrain and weather conditions for Baffin Island.

Positioning for the georadar survey was controlled by built-in GPS receiver.

Interpretation Method

Processing of the radar images involved basic horizontal normalization, elevation corrections and gain adjustments.

The vertical scale on all radar images is a two-way time scale representing the time taken for a radar pulse to transmit to a reflector and back to the receiver. In order to convert the time scale to a depth scale a signal velocity must be applied. The velocity with which the pulse travels through the given material is determined by the dielectric constant. This dielectric will vary with the type of material.

Calculating a velocity can be done in many ways but the most reliable method is with a test pit or borehole where the real rock contact can be exposed. Based on in-situ measurements or borehole data, the dielectric value can be approximated depending on the expect material type. An underestimate of the dielectric will result in an over estimate of the signal velocity and in turn an over estimate of the depths. For this site a dielectric of 4 (velocity of 15 cm/ns) was assumed based on the expected soil type and tables of relative dielectric values for commonly encountered materials. In this case the materials were mostly frozen granular/boulders with high ice content.

Interpretation of the data is based primarily on the qualitative analysis of three characteristics of radar reflections: continuity, amplitude and shape. The interpreter then identifies reflectors and textures within the radar records that represent subsurface contacts, objects or zones. The true nature of the interpreted features can only be assumed without corroborating evidence.

Ice bodies have a distinctive appearance on radar images. Granular host material appears as "noise" on the images, whereas uniform ice layer looks transparent with clearly defined top and bottom contacts and can be confidently identified. An example of a uniform ice lens is presented in Figure 2.

Non-uniform ice bodies (stratified or containing layers of soil) are more challenging for interpretation since structure irregularities create multiple reflections within the ice body. Often a borehole is needed to confirm the presence of ice. Other features such as increasing depth of investigation in the presence of thick ice layer may corroborate the interpretation.

In summary, ability of georadar is limited by the structure of the ice layer being surveyed and its composition. The identification of an ice layer may be impacted by irregularities inside the ice body, such as layering, fractures and soil inclusions. However, it is possible to create two categories of ice lenses, the obvious and less obvious that may need some ground truthing.

3 RESULTS

3.1 Subsurface Ice Mapping

Georadar data was collected at nine sites approximately at Km 0, 19.4, 20.5, 39.5, 49.3, 82.2, 97.0, 100.1 and 109 along the proposed rail alignment.

Locations of the survey lines and results of the georadar survey are presented in drawings GPR17 – MILNE INLET, GPR17 –KM19, GPR17 –KM20, GPR17 –KM39.6, GPR17 –KM49, GPR17 –KM82.2, GPR17 –KM97, GPR17 –KM100.1, GPR17 –KM109.

KM 0 - GPR17 – MILNE INLET

Multitude of survey lines conducted in the Milne Port area with no evidence of the presence of ice. Georadar penetration of the surface appeared shallow with poor signal attenuation, possibly due to material used for subsurface in port area. Total distance of 1.2km covered.

KM 19 - GPR17 –KM19

Two main survey lines conducted. No apparent ice presence in area. Area was not explored further due to time constraints. Total distance of 1.0km covered.

KM 20 - GPR17 –KM20

No apparent ice presence in area. Grid-like survey conducted to further explore region for ice; two further longitudinal lines, with three additional perpendicular cuts. Total distance of 2.9km covered.

KM 39.6 - GPR17 –KM39.6

No apparent ice presence in area. Latitudinal cuts conducted to further explore region for ice. No longitudinal lines due to topographic obstacle in area. Total distance of 1.5km covered.

KM 49 - GPR17 –KM49

Ice found in region, explored with additional lines where possible. Survey lines constrained due to topography and water in area. Total distance of 4.5km

KM 82.2 - GPR17 –KM82.2

No apparent ice presence in area. Due to distance from tote-road and time constraints no additional surveying was conducted in this area. Total distance of 200m covered.

KM 97 - GPR17 –KM97

No apparent ice presence in area. Area heavily constrained by topographic change. Additional survey lines done around topography to ensure safety maintained. Total distance of 2.2 km covered.

KM 100.1 - GPR17 –KM100.1

No apparent ice presence in area. Area constrained by water. Additional survey lines conducted in area. Total distance of 1.2km covered.

KM 109 - GPR17 –KM109

No apparent ice presence in area. Area constrained by topographic change. Additional survey lines conducted in area. Total distance of 1.2km covered.

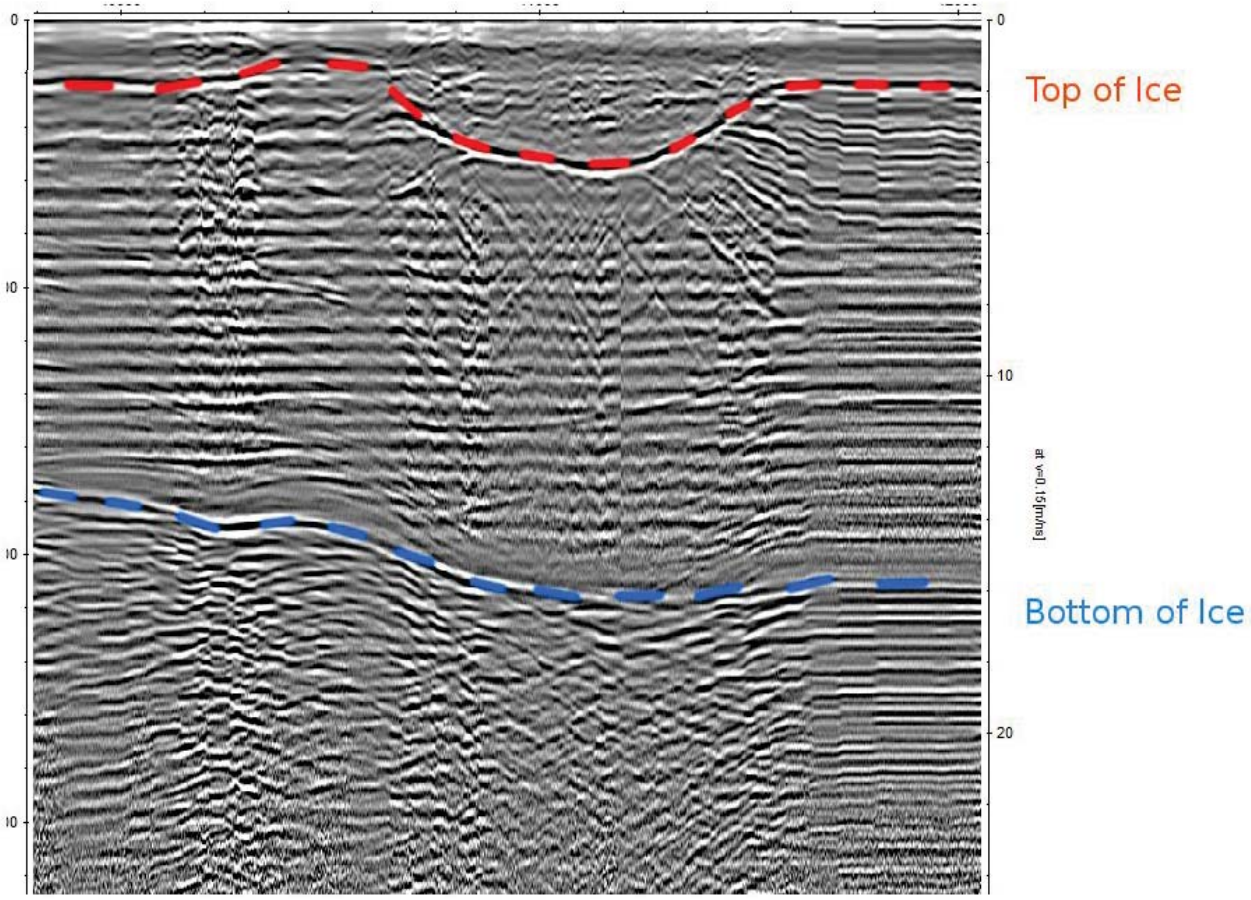


Figure 2: Interpreted georadar image showing a typical ice body

4 CONCLUSIONS

A geophysical investigation involving Georadar was carried out at the Mary River Project, Baffin Island, Nunavut.

Subsurface ice mapping was carried out at nine sites along the proposed rail alignment. Results of the survey are presented in Drawings GPR17 – MILNE INLET, GPR17 –KM19, GPR17 –KM20, GPR17 –KM39.6, GPR17 – KM49, GPR17 –KM82.2, GPR17 –KM97, GPR17 –KM100.1, GPR17 –KM109. Ice was only found in Km 49, seen in drawing GPR17-KM49.

Interpretation of the geophysical data has been performed by Mauritz van Zyl. This report has been written by Milan Situm, P.Geo.



_____
Milan Situm, P.Geo.
Manager



APPENDIX A

Drawings GPR17 – MILNE INLET,

GPR17 –KM19,

GPR17 –KM20,

GPR17 –KM39.6,

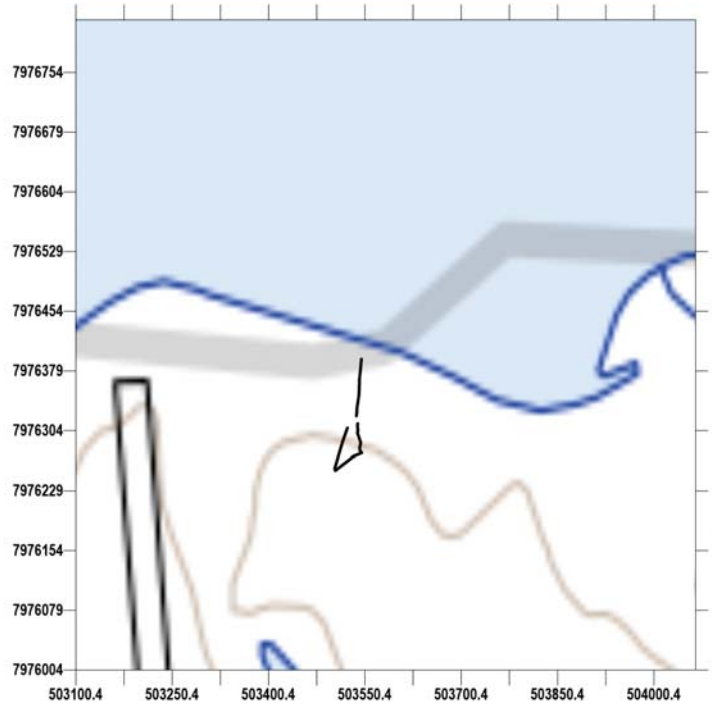
GPR17 –KM49, Ice was only found in Km 49, seen in drawing GPR17-KM49.

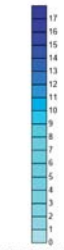
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GPR17 –KM97,

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GPR17 –KM109.





LEGEND

- EXISTING ROAD ALIGNMENT
- PROPOSED RAILWAY ALIGNMENT
- BH17-C002 GEOTECHNICAL BOREHOLE
- GROUND RADAR SURVEY LINE

1	THE RADAR SURVEY WAS EXECUTED BY GEOPHYSICS GPR INTERNATIONAL INC. NOVEMBER 2017				
2	COORDINATE SYSTEM: WGS84 UTM ZONE 17N				
3	REFER TO FULL REPORT FOR DISCUSSION OF METHODOLOGIES, RESULTS AND LIMITATIONS				
4	BOREHOLE DATA PROVIDED BY THE CLIENT FOR REFERENCE PURPOSES				
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6					
No.	NOTES	No.	DATE	MODIFICATIONS	APP.

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PROFESSIONAL SEAL

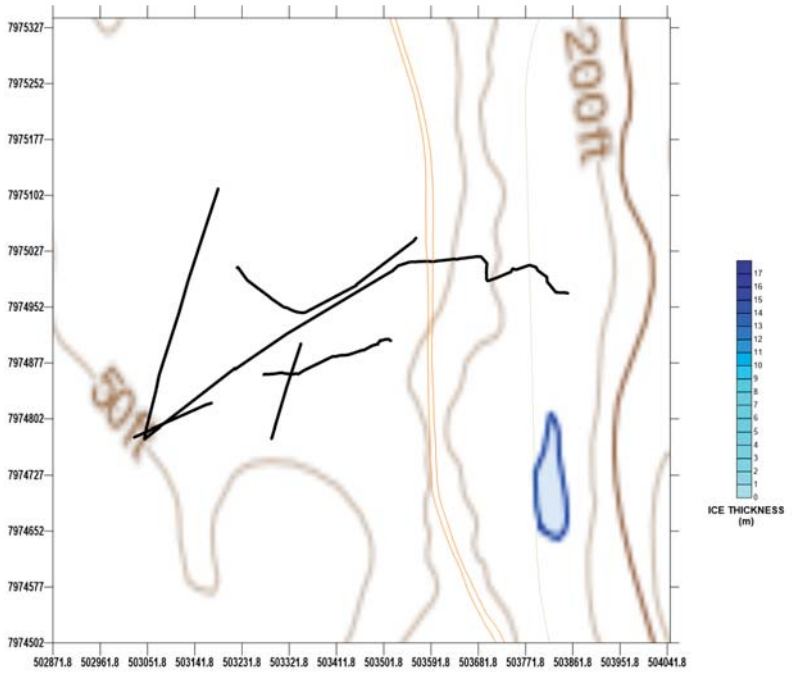
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VERIFIE PAR / CHECKED BY			
APPROUVE PAR / APPROVED BY	M.Sloan, P. Geo		
N CONTRAT / CONTRACT #	T17001b		
ECHELLE / SCALE	AS SHOWN	N DESSIN / DRAWING #	T17001b-A2

CLIENT: HATCH

PROJET / PROJECT: BAFFINLAND EXPANSION

TITRE / TITLE: GROUND RADAR SURVEY
GPR17-MILNE INLET



LEGEND

- EXISTING ROAD ALIGNMENT
- PROPOSED RAILWAY ALIGNMENT
- BH17-C002 GEOTECHNICAL BOREHOLE
- GROUND RADAR SURVEY LINE

1	THE RADAR SURVEY WAS EXECUTED BY GEOPHYSICS GPR INTERNATIONAL INC. NOVEMBER 2017				
2	COORDINATE SYSTEM: WGS84 UTM ZONE 17N				
3	REFER TO FULL REPORT FOR DISCUSSION OF METHODOLOGIES, RESULTS AND LIMITATIONS				
4	BOREHOLE DATA PROVIDED BY THE CLIENT FOR REFERENCE PURPOSES				
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No.	NOTES	No.	DATE	MODIFICATIONS	APP.

SEAL/ PROFESSIONAL

PROFESSIONAL SEAL

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GEOPHYSICIST CHECKED BY:

APPROVED PAR APPROVED BY: M.Sikorn, P. Geo

P. CONTRACT #: F17201b

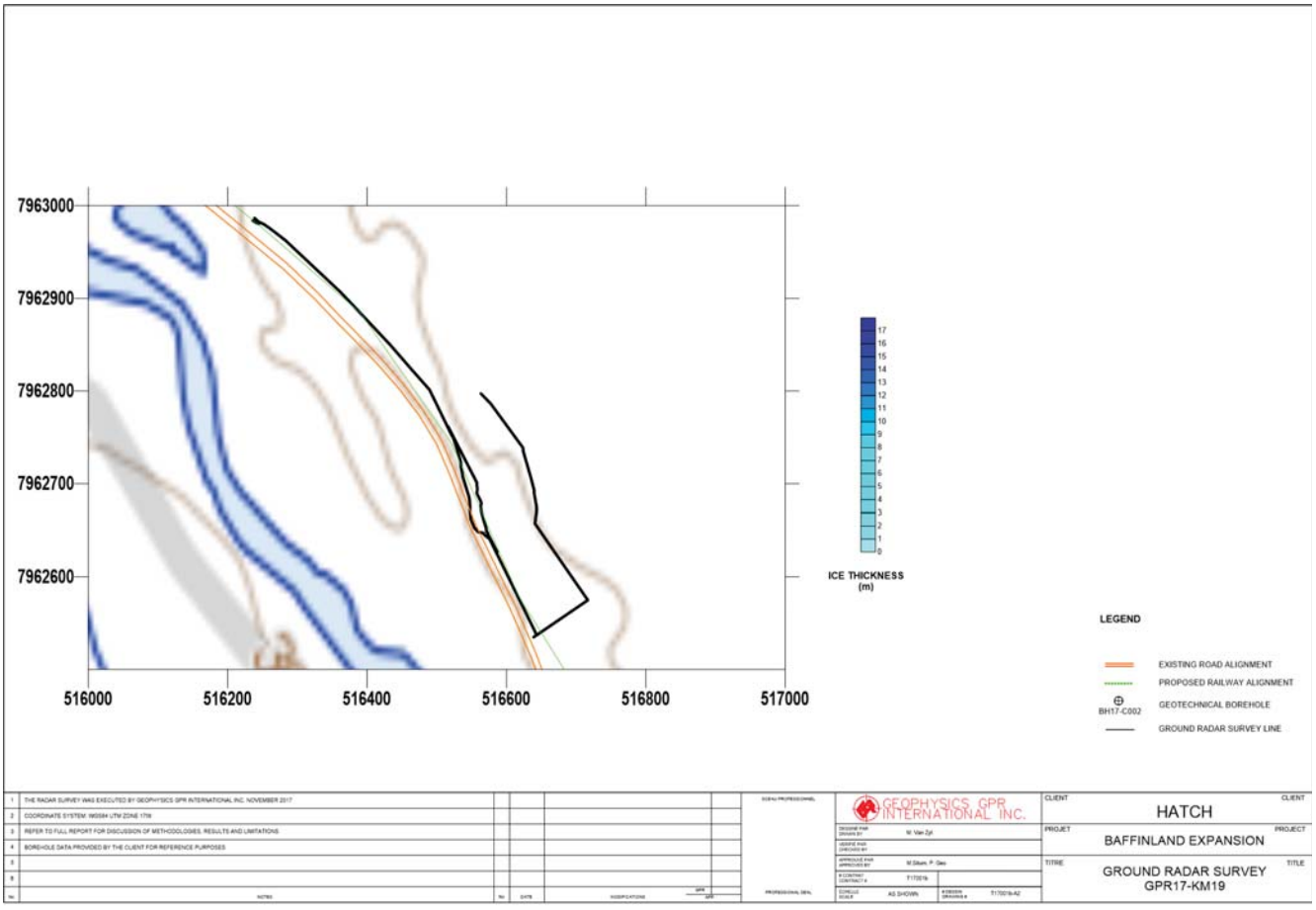
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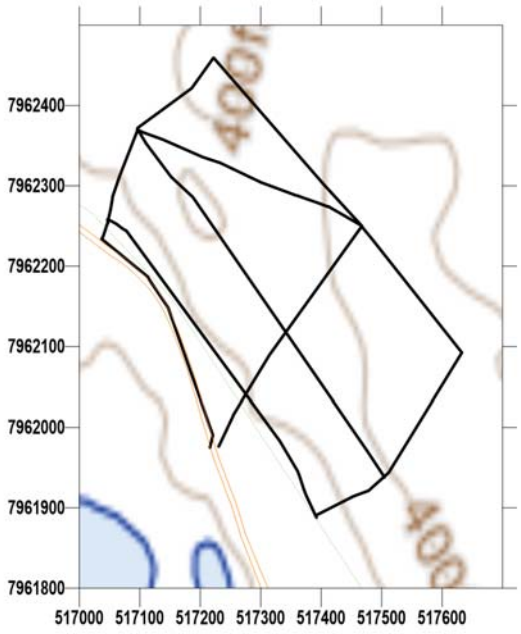
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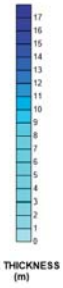
PROJECT: BAFFINLAND EXPANSION

TITRE / TITLE: GROUND RADAR SURVEY GPR17-MILNE INLET



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3	REFER TO FULL REPORT FOR DISCUSSION OF METHODOLOGIES, RESULTS AND LIMITATIONS					VÉRIFIÉ PAR / CHECKED BY:	
4	BOREHOLE DATA PROVIDED BY THE CLIENT FOR REFERENCE PURPOSES					APPROUVÉ PAR / APPROVED BY: M.Sikorn, P. Geo	TITRE / TITLE: GROUND RADAR SURVEY GPR17-KM19
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No.	NOTES	No.	DATE	MODIFICATIONS	PROFESSIONAL SEAL		





ICE THICKNESS
(m)

LEGEND

- EXISTING ROAD ALIGNMENT
- PROPOSED RAILWAY ALIGNMENT
- BH17-C002 GEOTECHNICAL BOREHOLE
- GROUND RADAR SURVEY LINE

1	THE RADAR SURVEY WAS EXECUTED BY GEOPHYSICS GPR INTERNATIONAL INC. NOVEMBER 2017				
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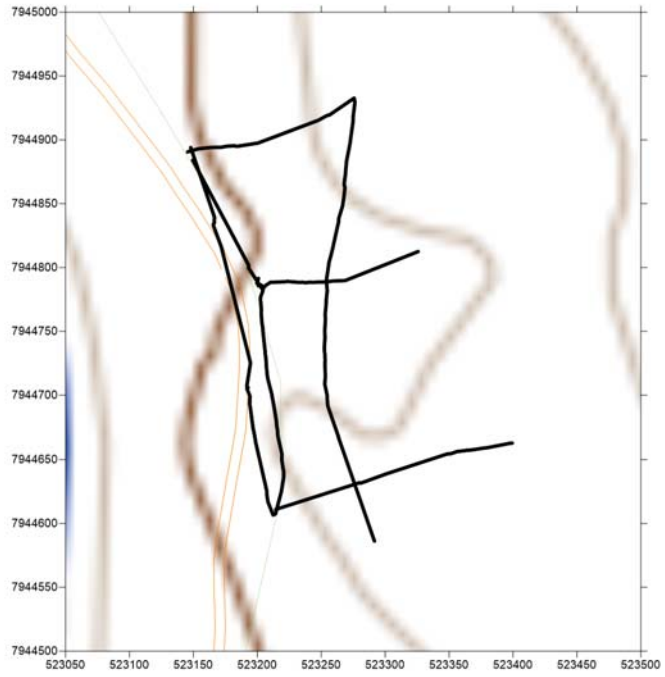
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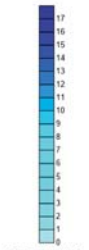
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CLIENT: HATCH

PROJET / PROJECT: BAFFINLAND EXPANSION

TITRE / TITLE: GROUND RADAR SURVEY
GPR17-KM20





LEGEND

- EXISTING ROAD ALIGNMENT
- PROPOSED RAILWAY ALIGNMENT
- BH17-C002 GEOTECHNICAL BOREHOLE
- GROUND RADAR SURVEY LINE

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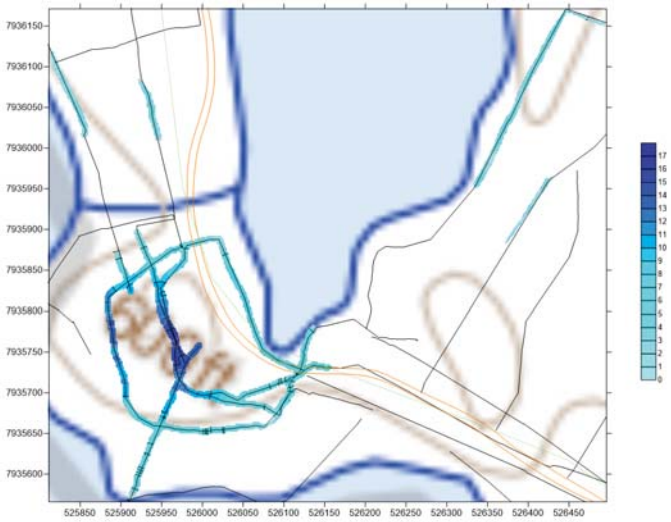
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CLIENT: HATCH

PROJET / PROJECT: BAFFINLAND EXPANSION

TITRE / TITLE: GROUND RADAR SURVEY GPR17-KM39.6

Ice Thickness
KM49



PRELIMINARY

LEGEND

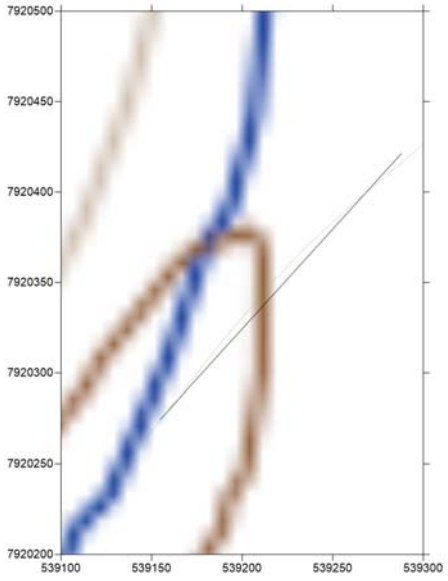
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- GROUND RADAR SURVEY LINE
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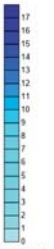
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GEOPHYSICS GPR INTERNATIONAL INC.

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GEOPHYSICIST PAR / CHECKED BY:
APPROVED PAR / APPROVED BY: M.Sloan, P. Geo
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CLIENT: HATCH
PROJECT: BAFFINLAND EXPANSION
TITLE: GROUND RADAR SURVEY GPR17-SITE 1





ICE THICKNESS
(m)

LEGEND

- EXISTING ROAD ALIGNMENT
- PROPOSED RAILWAY ALIGNMENT
- BH17-C002 GEOTECHNICAL BOREHOLE
- GROUND RADAR SURVEY LINE

PRELIMINARY

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3	REFER TO FULL REPORT FOR DISCUSSION OF METHODOLOGIES, RESULTS AND LIMITATIONS				
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No.	NOTES	No.	DATE	MODIFICATIONS	APP.

SEAL/ PROFESSIONNEL

PROFESSIONAL SEAL

GEOPHYSICS GPR INTERNATIONAL INC.

DESIGNE PAR / DRAWN BY: M. Van Zyl

VERIFIE PAR / CHECKED BY:

APPROUVE PAR / APPROVED BY: M.Sloan, P. Geo

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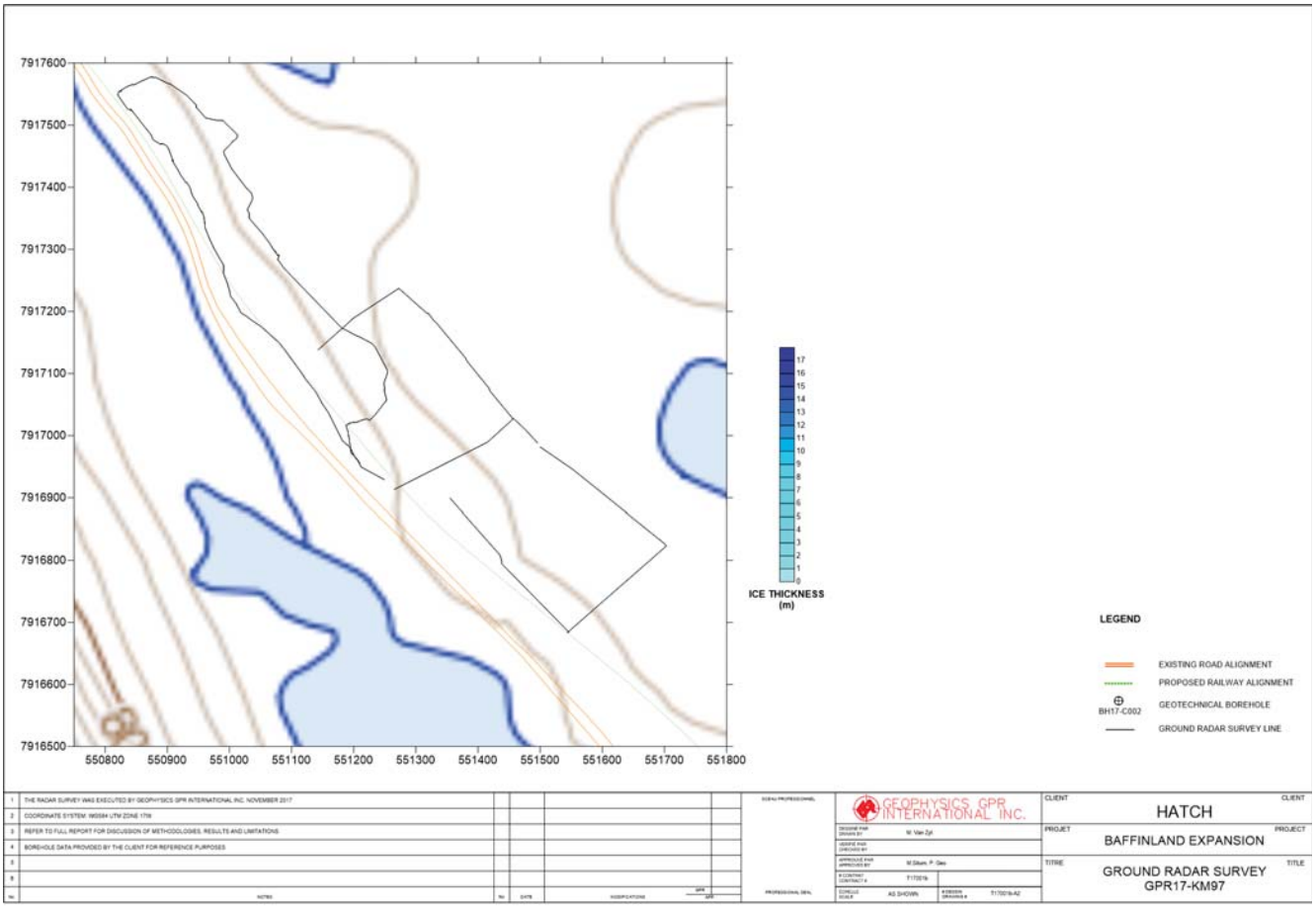
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CLIENT: HATCH

PROJET / PROJECT: BAFFINLAND EXPANSION

TITRE / TITLE: GROUND RADAR SURVEY
GPR17-KM82.2



1	THE RADAR SURVEY WAS EXECUTED BY GEOPHYSICS GPR INTERNATIONAL INC. NOVEMBER 2017				
2	COORDINATE SYSTEM: WGS84 UTM ZONE 17N				
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4	BOREHOLE DATA PROVIDED BY THE CLIENT FOR REFERENCE PURPOSES				
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No.	NOTES	No.	DATE	MODIFICATIONS	APP.

SEAL/ PROFESSIONAL

PROFESSIONAL SEAL

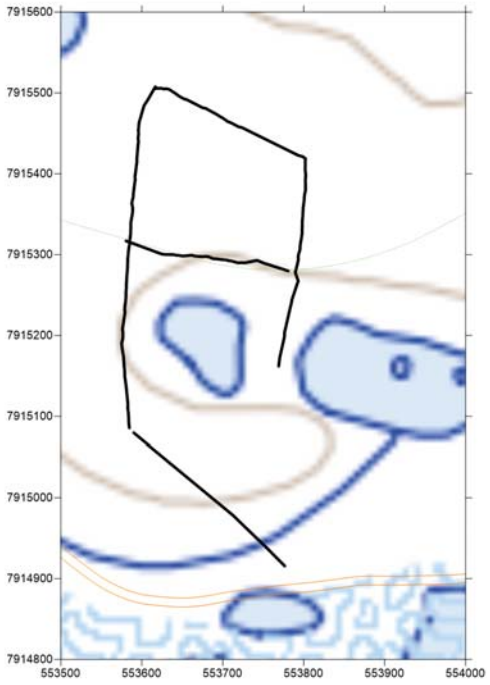
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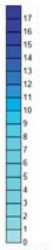
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CHECKED BY VÉRIFIÉ PAR			
APPROVED BY APPROUVÉ PAR	M.Sloan, P. Geo		
CONTRACT # N° CONTRAT	F17001b		
SCALE ÉCHELLE	AS SHOWN	DRAWING # N° DESSIN	F17001b-A2

CLIENT: HATCH

PROJECT: BAFFINLAND EXPANSION

TITLE: GROUND RADAR SURVEY GPR17-KM97





ICE THICKNESS
(m)

LEGEND

- EXISTING ROAD ALIGNMENT
- PROPOSED RAILWAY ALIGNMENT
- BH17-C002 GEOTECHNICAL BOREHOLE
- GROUND RADAR SURVEY LINE

1	THE RADAR SURVEY WAS EXECUTED BY GEOPHYSICS GPR INTERNATIONAL INC. NOVEMBER 2017				
2	COORDINATE SYSTEM: WGS84 UTM ZONE 17N				
3	REFER TO FULL REPORT FOR DISCUSSION OF METHODOLOGIES, RESULTS AND LIMITATIONS				
4	BOREHOLE DATA PROVIDED BY THE CLIENT FOR REFERENCE PURPOSES				
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6					
No.	NOTES	No.	DATE	MODIFICATIONS	APP.

SEAL/ PROFESSIONNEL

PROFESSIONAL SEAL

GEOPHYSICS GPR INTERNATIONAL INC.

DESIGNE PAR / DRAWN BY: M. Van Zyl

VERIFIE PAR / CHECKED BY:

APPROUVE PAR / APPROVED BY: M.Sikumi, P. Geo

N CONTRAT / CONTRACT #: T170019

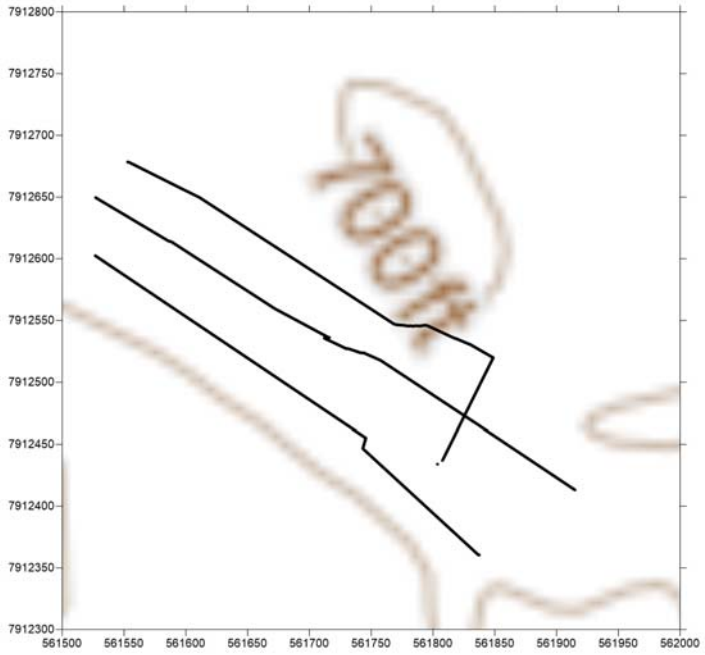
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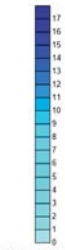
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CLIENT: HATCH

PROJET / PROJECT: BAFFINLAND EXPANSION

TITRE / TITLE: GROUND RADAR SURVEY
GPR17-KM100.1





ICE THICKNESS
(m)

LEGEND

- EXISTING ROAD ALIGNMENT
- PROPOSED RAILWAY ALIGNMENT
- BH17-C002 GEOTECHNICAL BOREHOLE
- GROUND RADAR SURVEY LINE

1	THE RADAR SURVEY WAS EXECUTED BY GEOPHYSICS GPR INTERNATIONAL INC. NOVEMBER 2017				
2	COORDINATE SYSTEM: WGS84 UTM ZONE 17N				
3	REFER TO FULL REPORT FOR DISCUSSION OF METHODOLOGIES, RESULTS AND LIMITATIONS				
4	BOREHOLE DATA PROVIDED BY THE CLIENT FOR REFERENCE PURPOSES				
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6					
No.	NOTES	No.	DATE	MODIFICATIONS	APP.

SEAL/ PROFESSIONAL

PROFESSIONAL SEAL

GEOPHYSICS GPR INTERNATIONAL INC.

DESIGNED PAR DRAWN BY: M. Van Zyl

GEOPHYSICS PAR CHECKED BY:

APPROVED PAR APPROVED BY: M.Sikorn, P. Geo

PROJECT CONTRACT #: F17001b

SCALE: AS SHOWN

DRAWING #: F17001b-A2

CLIENT: HATCH

PROJECT: BAFFINLAND EXPANSION

TITLE: GROUND RADAR SURVEY GPR17-KM109

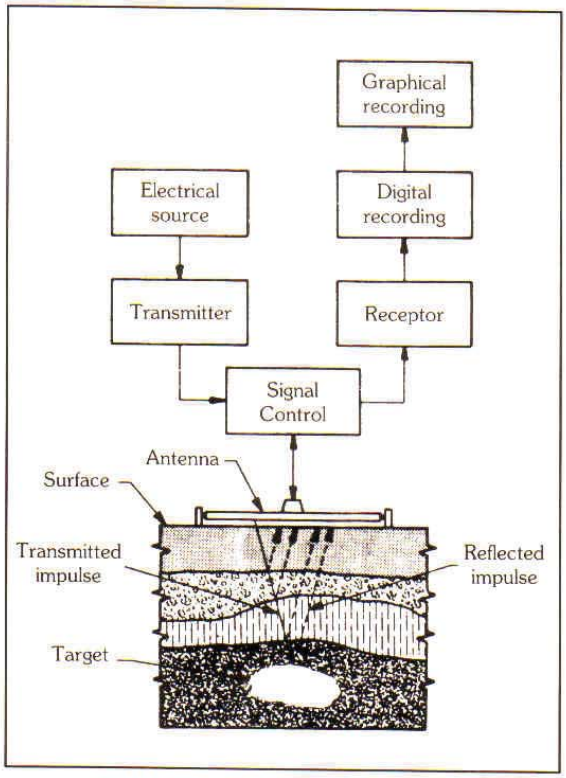
APPENDIX B

Additional Georadar information

GEOPHYSICS G P R INTERNATIONAL INC.

GEORADAR

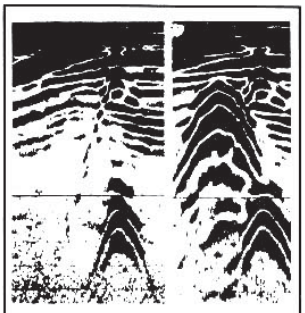
As indicated by its name, georadar combines high resolution radar with geology. The underlying principle is based on the propagation of electromagnetic wave impulses (VHF) that are reflected by anomalies in the terrain (joints, irregularities, interfaces, etc.) at different depths, and then captured by the antenna. The georadar records the time taken by each transmitted signal to complete the cycle in order to calculate the depth of the anomaly. The result is similar to a seismic reflection profile where all the reflections are displayed graphically. This technique is used to solve problems for which there had previously been no practical solution.



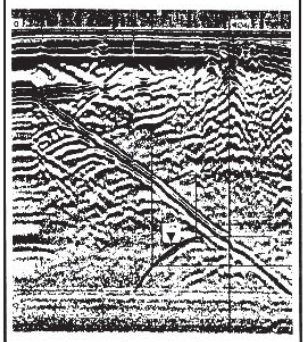
PRINCIPLES OF GEORADAR

FEATURES

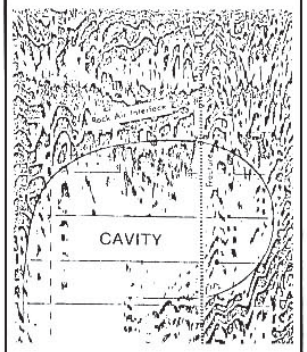
- Penetration of more than 20 metres in certain materials (penetration being inversely proportional to conductivity).
- Surveying in continuous mode.
- Identification of objects measuring only a few centimeters.
- Light and manoeuvrable equipment.
- Detection of conductivity, open spaces and/or holes (cavities).
- Detection of breaks: faults, fractures, joints, cavities.
- Results similar to seismic reflection: continuous underground profile.
- Results available immediately.
- Can be used in land, sea or airborne surveys.



PIPES



JOINTS



CAVITIES

FIELDS OF APPLICATION

Civil Engineering / Mining Exploration-Exploitation / Research / Archaeology / Environment

- Geotechnology: investigation of soils and surface deposits.
- Optimal selection of anchor bolts in mines and quarries.
- Detection of buried pipes before beginning excavation.
- Detection of liquid or gas leakage in soils.
- Detection of cracks in concrete structures.
- Checking material homogeneity.
- Detection of cavities beneath road pavement.
- Determination of water saturation level.
- Detection of girders in reinforced concrete.
- Detection of pollutant leakage in water bodies.
- Inspection of buried disposal sites and or dangerous deposits.
- Continuous measurement of ice thickness.
- Archaeological research: ancient foundations, artifacts.
- Non-destructive method for measuring road pavement thickness.
- Localization and measurement of soil's thickness (swamps, peat bogs).
- Determination of rock beddings (location and thickness).
- Bathymetric studies (depth sounding).
- Calculation of the thickness of permafrost and ice.
- Geotechnical studies for the installation of aqueducts.

SPECIAL FEATURES

The equipment is practical, easy to manoeuvre, and multi-faceted. The field of application of georadar continues to expand in various sectors, particularly in geotechnology (aqueducts), civil engineering (excavation, structures) and mining (structures).

GUIDELINEGEO

MALÅ GroundExplorer

GROUND PENETRATING RADAR

GPR with exceptional range and resolution

MALÅ GroundExplorer (GX) is an integrated GPR solution with four MALÅ GX antenna options: GX80, GX160, GX450 and GX750. Through unique hyperstacking HDR technology, MALÅ GX offers significantly faster data acquisition rates, with outstanding signal-to-noise ratio and depth penetration. An easy-to-use GPR solution on a rugged platform, with excellent detection capabilities for a wide range of applications.

MALÅ GX CONTROLLER

Processor	1.6 GHz Intel Atom
Display	1024 x 768 mm
OS	Linux
Memory	8 GB compact Flash memory
Data output resolution	32 bit
Comms	Ethernet, WiFi (optional), USB 3.0, RS232 (serial)
GPS	Integrated support for built-in GPS, or external GPS via USB/serial port (NMEA 0183 protocol)
Power supply	Internal 12V/20.8 Ah Li-Ion battery, or any external 10-15 V DC source
Charger	Internal. Unit can also be charged from any external 12 - 15 V DC source
Power consumption	1.3 – 2.0 A
Operating time	8 – 10 h
Dimensions	326 x 216 x 92 mm including handles 326 x 216 x 52 mm excluding handles
Weight	3.2 kg
Operating temp	- 20° to + 50° C or 0° to 120° F
Environmental	IP 65

GX WIFI OPTION

Wireless standard:	IEEE802.11 g
Power consumption:	0,3 A



MALÅ

MALÅ GX ANTENNAS

MALÅ GX750 HDR

Technology	MALÅ Semi-Real- Time pat pending
Antenna center freq.	750 MHz
SNR	97 dB
No. of bits	16 bit
Scans/second	> 1290, time window 75 ns
Survey speed	460 [km/h] point distance 10 cm
Bandwidth	120%, fractional, -10 dB
Time window	75 ns
Positioning	Built-in DGPS, external GPS (NMEA 0183 protocol), wheel encoder
Operating time	5 h
Power supply	Interchangeable 12 V Li-Ion batt. or ext. 12 V DC source
Power consumption	1.3 A
Acq. mode	Wheel, time or manual
Dimensions	375 x 235 x 170 mm
Weight	3.6 kg
Operating temp.	- 20° to + 50° C or 0° to 120° F
Environmental	IP 65

MALÅ GX450 HDR

Technology	MALÅ Semi-Real-Time pat pending
Antenna center freq.	450 MHz
SNR	101 dB
No. of bits	> 16 bit
Scans/second	> 770, time window 300 ns
Survey speed	275 [km/h] point distance 10 cm
Bandwidth	>120%, fractional, -10 dB
Time window	300 ns
Positioning	Inbuilt DGPS, external GPS (NMEA 0183 protocol), wheel encoder
Operating time	5 h
Power supply	Interchangeable 12 V Li-Ion batt. or ext. 12 V DC source
Power consumption	1.3 A
Acq. mode	Wheel, time or manual
Dimensions	430 x 360 x 180 mm
Weight	5.5 kg
Operating temp.	- 20° to + 50° C or 0° to 120° F
Environmental	IP 65

MALÅ GX160 HDR

Technology	MALÅ Semi-Real-Time pat pending
Antenna center freq.	160 MHz
SNR	> 107 dB
No. of bits	> 17 bit
Scans/second	> 880, time window 625 ns
Survey speed	320 [km/h] point distance 10 cm
Bandwidth	>120 %, fractional, -10 dB
Time window	625 ns
Positioning	Inbuilt DGPS, external GPS (NMEA 0183 protocol), wheel encoder
Operating time	5 h
Power supply	Interchangeable 12 V Li-Ion batt. or ext. 12 V DC source
Power consumption	1.3 A
Acq. mode	Wheel, time or manual
Dimensions	720 x 480 x 190 mm
Weight	10.7 kg
Operating temp.	- 20° to + 50° C or 0° to 120° F
Environmental	IP 65

MALÅ GX80 HDR

Technology	MALÅ Semi-Real-Time pat pending
Antenna center freq.	80 MHz
SNR	> 114.4 dB
No. of bits	> 19 bit
Scans/second	> 1200, time window 812 ns
Survey speed	430 [km/h] point distance 10 cm
Bandwidth	>120 %, fractional, -10 dB
Time window	812 ns
Positioning	Built-in DGPS, external GPS (NMEA 0183 protocol), wheel encoder
Operating time	5 h
Power supply	Interchangeable 12 V Li-Ion batt. or ext. 12 V DC source
Power consumption	1.3 A
Acq. mode	Wheel, time or manual
Dimensions	1010 x 780 x 220 mm
Weight	24,6 kg
Operating temp.	- 20° to + 50° C or 0° to 120° F
Environmental	IP 65

ABEM | MALÅ

Guideline Geo is a world-leader in geophysics and geo-technology offering sensors, software, services and support necessary to map and visualize the subsurface. Guideline Geo operates in four international market areas: Infrastructure – examination at start-up and maintenance of infrastructure, Environment – survey of environmental risks and geological hazards, Water – mapping and survey of water supplies and Minerals – efficient exploration. Our offices and regional partners serve clients in 121 countries. The Guideline Geo AB share (GGEO) is listed on NGM Equity.

GUIDELINEGEO

GUIDELINE GEO
Löfströms Allé 6A
SE-172 66 Sundbyberg, Sweden
Tel: +46 8 557 613 00
sales@guidelinegeo.com
www.guidelinegeo.com

MALÅ GEOSCIENCE
Skolgatan 11
SE-930 70 Malå, Sweden
Tel: +46 953 345 50
sales@guidelinegeo.com
www.guidelinegeo.com

ABEM INSTRUMENT
Löfströms Allé 6A
SE-172 66 Sundbyberg, Sweden
Tel: +46 8 564 883 00
sales@guidelinegeo.com
www.guidelinegeo.com

MALÅ GEOSCIENCE USA
465 Deanna Lane
Charleston, South Carolina 29492, USA
Tel: +1 843 852 5021
sales@guidelinegeo.com
www.guidelinegeo.com

Appendix J

CPT Results

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PRESENTATION OF SITE INVESTIGATION RESULTS

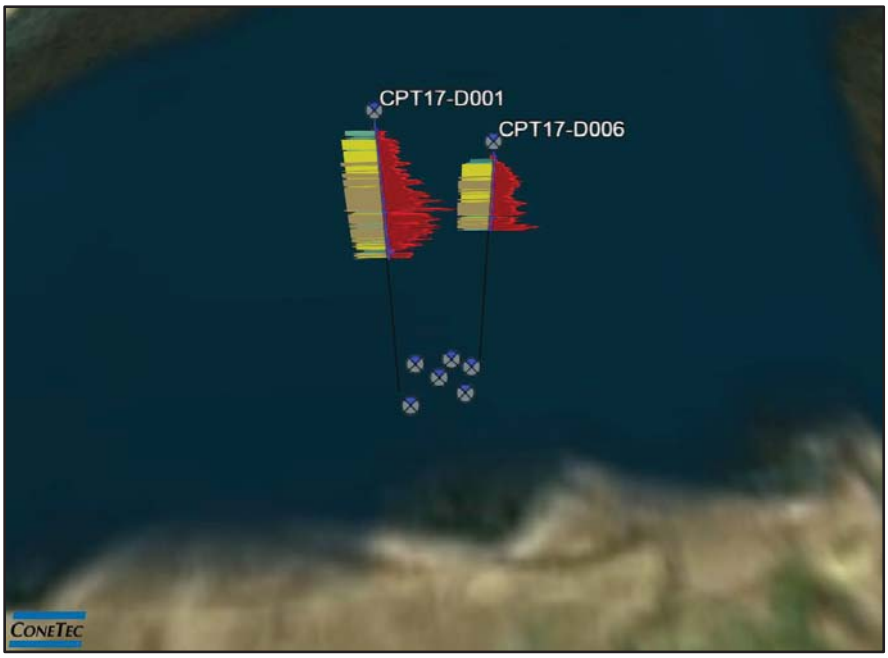
Milne Port Expansion

Prepared for:

Baffinland Iron Mines Corporation

ConeTec Job No: 17-05010

Project Start Date: 22-Mar-2017
Project End Date: 09-Apr-2017
Report Date: 13-Apr-2017
Revised Date: 21-Apr-2017



Prepared by:

ConeTec Investigations Ltd.
9033 Leslie Street, Unit 15
Richmond Hill, ON L4B 4K3

Tel: (905) 886-2663
Fax: (905) 886-2664
Toll Free: (800) 504-1116

Email: conetecON@conetec.com
www.conetec.com
www.conetecdataservices.com

CONETEC

Introduction

The enclosed report presents the results of the site investigation program conducted by ConeTec Investigations Ltd. for Baffinland Iron Mines Corporation at Milne Inlet, Baffin Island, Nunavut. The program consisted of six cone penetration tests (CPT) and two seismic cone penetration tests (SCPT) carried out under the direction of Hatch Ltd.

Project Information

Project	
Client	Baffinland Iron Mines Corporation
Project	Milne Port Expansion
ConeTec project number	17-05010

A map from Google earth including the CPT and SCPT test locations is presented below.



Rig Description	Deployment System	Test Type
Boart LS100	Portable	CPT, SCPT

Coordinates		
Test Type	Collection Method	EPSG Number
CPT, SCPT	ConeTec Trimble Survey (RTK)	26917

Cone Penetration Test (CPT)	
Depth reference	Depths are referenced to the existing mudline at the time of each test.
Tip and sleeve data offset	0.1 meter This has been accounted for in the CPT data files.
Additional plots	Advanced CPT plots with Ic, Phi, and N1(60) and SCPT plots have been included.

Cone Penetrometers Used for this Project						
Cone Description	Cone Number	Cross Sectional Area (cm^2)	Sleeve Area (cm^2)	Tip Capacity (bar)	Sleeve Capacity (bar)	Pore Pressure Capacity (psi)
338:T1500F15U500	338	15	225	1500	15	500
374:T1500F15U500	374	15	225	1500	15	500
The CPT summary indicates which cone was used for each sounding.						

Interpretation Tables	
Additional information	The Soil Behaviour Type (SBT) classification chart (Robertson et al., 1986 presented by Lunne, Robertson and Powell, 1997) was used to classify the soil for this project. A detailed set of calculated CPT parameters were generated and are provided in Excel format files in the release folder. The calculated CPT parameters are based on values of corrected tip (q_t), sleeve friction (f_s) and pore pressure (u_2). Soils were classified as either drained or undrained based on the Soil Behaviour Type (SBT) classification chart (Robertson et al., 1986 presented by Lunne, Robertson and Powell, 1997). Calculations for both drained and undrained parameters were included for materials that classified as silt (zone 6).

Survey	
Tidal Fluctuations	As requested by Hatch Ltd., a survey grid was setup to monitor ice movement due to tidal fluctuation throughout the drill program. The grid was laid out around the proposed drilling area using six survey points in a 200m by 100m grid. ½ inch steel pins was installed at each point by drilling out a section of ice and freezing the rod in place. The pins were surveyed repeatedly throughout a 12-hour period to determine if the ebb and flow of the tide was moving the ice laterally. After installation they were then surveyed every couple of days.
Surveying Methodology	Due to the lack of compatibility with the onsite base station, a second base station broadcasting in the 450MHz band had to be setup to support the drill program surveying. An observed control point was surveyed in by the BIM

	surveyor onsite in datum NAD83 using an ellipsoid model. Our base station was permanently setup over the surveyed point with a vertical offset of 1.32m to the bottom of the R8 base. An existing control point, KM002, was surveyed for quality control. A second control point, PRJCNTRL, was surveyed in to allow for easy quality control when restarting the base station.
Depth Control	Significant tidal fluctuations between two and seven feet were observed on the ice throughout the drill program. Constant monitoring of the elevation of the ice was required while conducting the cone penetration tests (CPTs) to ensure the depth was correct throughout the sounding. At the beginning of the CPT, the Northing, Easting, and Elevation of the sounding was recorded along with a dip tape measurement to the sea floor. The dip tape measurement was subtracted from the ice elevation to get the sea floor elevation. Throughout the CPT, the elevation of ice was monitored and compared to the initial measurement to get an accurate depth at the end of every meter.
Ice Cracks and Survey Grid	There were large cracks in the ice near the drilling pad. They appeared to open and close as the tide went up and down. The Northing and Easting coordinates of the grid were surveyed using a continuous topo. The survey grid coordinates are not presented as part of this report.

Limitations

This report has been prepared for the exclusive use of Baffinland Iron Mines Corporation (Client) and Hatch Ltd. for the project titled “Milne Port Expansion”. The report’s contents may not be relied upon by any other party without the express written permission of ConeTec Investigations Ltd. (ConeTec). ConeTec has provided site investigation services, prepared the factual data reporting, and provided geotechnical parameter calculations consistent with current best practices. No other warranty, expressed or implied, is made.

The information presented in the report document and the accompanying data set pertain to the specific project, site conditions and objectives described to ConeTec by the Client and Hatch Ltd. In order to properly understand the factual data, assumptions and calculations, reference must be made to the documents provided and their accompanying data sets, in their entirety.

The cone penetration tests (CPTu) are conducted using an integrated electronic piezocone penetrometer and data acquisition system manufactured by Adara Systems Ltd. of Richmond, British Columbia, Canada.

ConeTec's piezocone penetrometers are compression type designs in which the tip and friction sleeve load cells are independent and have separate load capacities. The piezocones use strain gauged load cells for tip and sleeve friction and a strain gauged diaphragm type transducer for recording pore pressure. The piezocones also have a platinum resistive temperature device (RTD) for monitoring the temperature of the sensors, an accelerometer type dual axis inclinometer and a geophone sensor for recording seismic signals. All signals are amplified down hole within the cone body and the analog signals are sent to the surface through a shielded cable.

ConeTec penetrometers are manufactured with various tip, friction and pore pressure capacities in both 10 cm^2 and 15 cm^2 tip base area configurations in order to maximize signal resolution for various soil conditions. The specific piezocone used for each test is described in the CPT summary table presented in the first Appendix. The 15 cm^2 penetrometers do not require friction reducers as they have a diameter larger than the deployment rods. The 10 cm^2 piezocones use a friction reducer consisting of a rod adapter extension behind the main cone body with an enlarged cross sectional area (typically 44 mm diameter over a length of 32 mm with tapered leading and trailing edges) located at a distance of 585 mm above the cone tip.

The penetrometers are designed with equal end area friction sleeves, a net end area ratio of 0.8 and cone tips with a 60 degree apex angle.

All ConeTec piezocones can record pore pressure at various locations. Unless otherwise noted, the pore pressure filter is located directly behind the cone tip in the "u_2" position (ASTM Type 2). The filter is 6 mm thick, made of porous plastic (polyethylene) having an average pore size of 125 microns (90-160 microns). The function of the filter is to allow rapid movements of extremely small volumes of water needed to activate the pressure transducer while preventing soil ingress or blockage.

The piezocone penetrometers are manufactured with dimensions, tolerances and sensor characteristics that are in general accordance with the current ASTM D5778 standard. ConeTec's calibration criteria also meets or exceeds those of the current ASTM D5778 standard. An illustration of the piezocone penetrometer is presented in Figure CPTu.

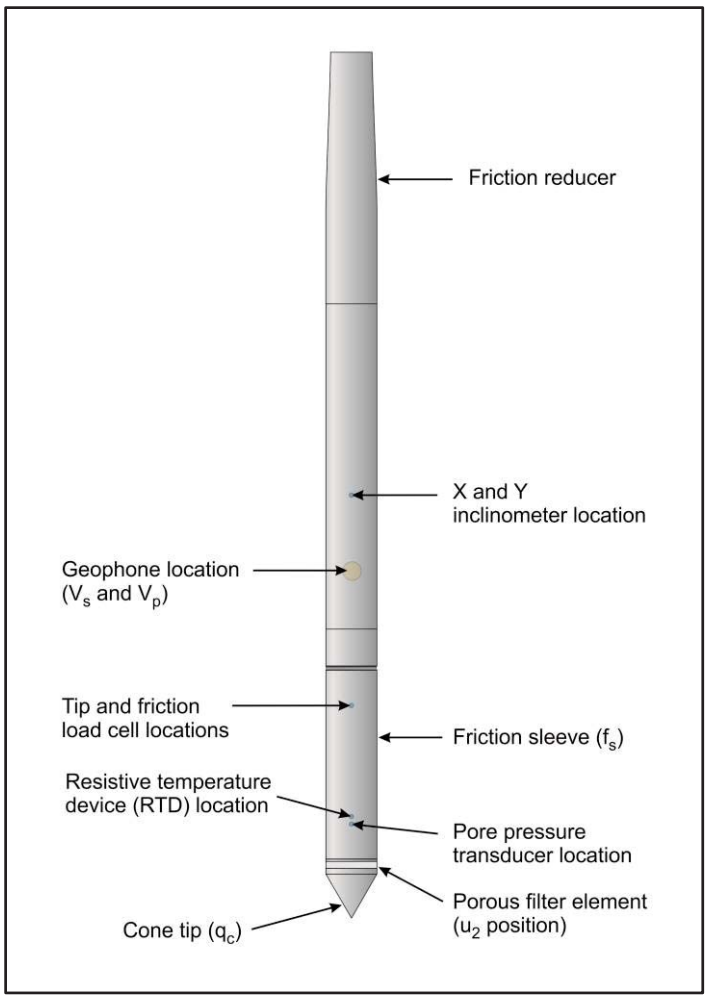


Figure CPTu. Piezocone Penetrometer (15 cm^2)

The ConeTec data acquisition systems consist of a Windows based computer and a signal conditioner and power supply interface box with a 16 bit (or greater) analog to digital (A/D) converter. The data is recorded at fixed depth increments using a depth wheel attached to the push cylinders or by using a spring loaded rubber depth wheel that is held against the cone rods. The typical recording intervals are either 2.5 cm or 5.0 cm depending on project requirements; custom recording intervals are possible. The system displays the CPTu data in real time and records the following parameters to a storage media during penetration:

- Depth
- Uncorrected tip resistance (q_c)
- Sleeve friction (f_s)
- Dynamic pore pressure (u)
- Additional sensors such as resistivity, passive gamma, ultra violet induced fluorescence, if applicable

All testing is performed in accordance to ConeTec's CPT operating procedures which are in general accordance with the current ASTM D5778 standard.

Prior to the start of a CPTu sounding a suitable cone is selected, the cone and data acquisition system are powered on, the pore pressure system is saturated with either glycerine or silicone oil and the baseline readings are recorded with the cone hanging freely in a vertical position.

The CPTu is conducted at a steady rate of 2 cm/s, within acceptable tolerances. Typically one meter length rods with an outer diameter of 1.5 inches are added to advance the cone to the sounding termination depth. After cone retraction final baselines are recorded.

Additional information pertaining to ConeTec's cone penetration testing procedures:

- Each filter is saturated in silicone oil or glycerine under vacuum pressure prior to use
- Recorded baselines are checked with an independent multi-meter
- Baseline readings are compared to previous readings
- Soundings are terminated at the client's target depth or at a depth where an obstruction is encountered, excessive rod flex occurs, excessive inclination occurs, equipment damage is likely to take place, or a dangerous working environment arises
- Differences between initial and final baselines are calculated to ensure zero load offsets have not occurred and to ensure compliance with ASTM standards

The interpretation of piezocone data for this report is based on the corrected tip resistance (q_t), sleeve friction (f_s) and pore water pressure (u). The interpretation of soil type is based on the correlations developed by Robertson (1990) and Robertson (2009). It should be noted that it is not always possible to accurately identify a soil type based on these parameters. In these situations, experience, judgment and an assessment of other parameters may be used to infer soil behaviour type.

The recorded tip resistance (q_c) is the total force acting on the piezocone tip divided by its base area. The tip resistance is corrected for pore pressure effects and termed corrected tip resistance (q_t) according to the following expression presented in Robertson et al, 1986:

$$q_t = q_c + (1\text{-}a) \bullet u_2$$

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure behind the tip (u_2 position)
a is the Net Area Ratio for the piezocone (0.8 for ConeTec probes)

The sleeve friction (f_s) is the frictional force on the sleeve divided by its surface area. As all ConeTec piezocones have equal end area friction sleeves, pore pressure corrections to the sleeve data are not required.

The dynamic pore pressure (u) is a measure of the pore pressures generated during cone penetration. To record equilibrium pore pressure, the penetration must be stopped to allow the dynamic pore pressures to stabilize. The rate at which this occurs is predominantly a function of the permeability of the soil and the diameter of the cone.

The friction ratio (Rf) is a calculated parameter. It is defined as the ratio of sleeve friction to the tip resistance expressed as a percentage. Generally, saturated cohesive soils have low tip resistance, high

friction ratios and generate large excess pore water pressures. Cohesionless soils have higher tip resistances, lower friction ratios and do not generate significant excess pore water pressure.

A summary of the CPTu soundings along with test details and individual plots are provided in the appendices. A set of interpretation files were generated for each sounding based on published correlations and are provided in Excel format in the data release folder. Information regarding the interpretation methods used is also included in the data release folder.

For additional information on CPTu interpretations, refer to Robertson et al. (1986), Lunne et al. (1997), Robertson (2009), Mayne (2013, 2014) and Mayne and Peuchen (2012).

Shear wave velocity testing is performed in conjunction with the piezocone penetration test (SCPTu) in order to collect interval velocities. For some projects seismic compression wave (Vp) velocity is also determined.

ConeTec's piezocone penetrometers are manufactured with a horizontally active geophone (28 hertz) that is rigidly mounted in the body of the cone penetrometer, 0.2 meters behind the cone tip.

Shear waves are typically generated by using an impact hammer horizontally striking a beam that is held in place by a normal load. In some instances an auger source or an imbedded impulsive source maybe used for both shear waves and compression waves. The hammer and beam act as a contact trigger that triggers the recording of the seismic wave traces. For impulsive devices an accelerometer trigger may be used. The traces are recorded using an up-hole integrated digital oscilloscope which is part of the SCPTu data acquisition system. An illustration of the shear wave testing configuration is presented in Figure SCPTu-1.

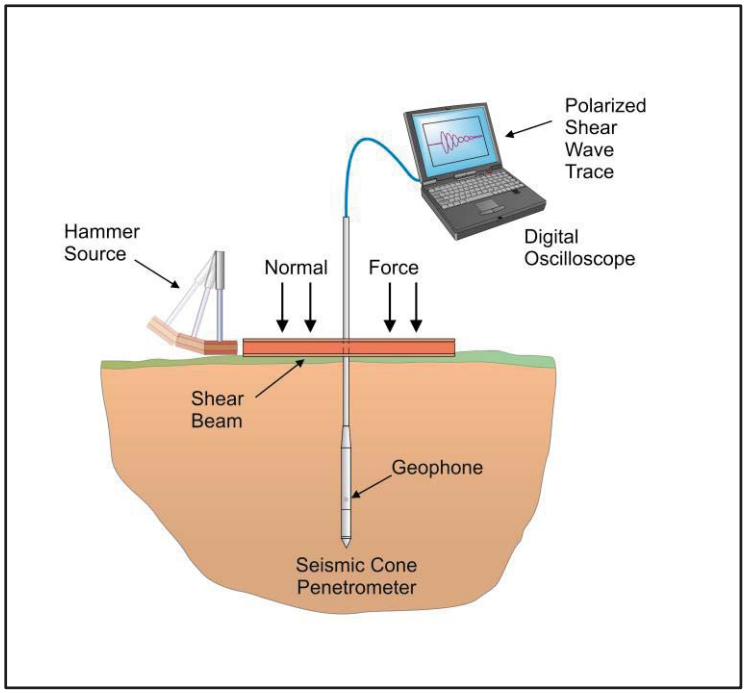


Figure SCPTu-1. Illustration of the SCPTu system

All testing is performed in accordance to ConeTec's SCPTu operating procedures.

Prior to the start of a SCPTu sounding, the procedures described in the Cone Penetration Test section are followed. In addition, the active axis of the geophone is aligned parallel to the beam (or source) and the horizontal offset between the cone and the source is measured and recorded.

Prior to recording seismic waves at each test depth, cone penetration is stopped and the rods are decoupled from the rig to avoid transmission of rig energy down the rods. Multiple wave traces are recorded for quality control purposes. After reviewing wave traces for consistency the cone is pushed to the next test depth (typically one meter intervals or as requested by the client). Figure SCPTu-2 presents an illustration of a SCPTu test.

For additional information on seismic cone penetration testing refer to Robertson et.al. (1986).

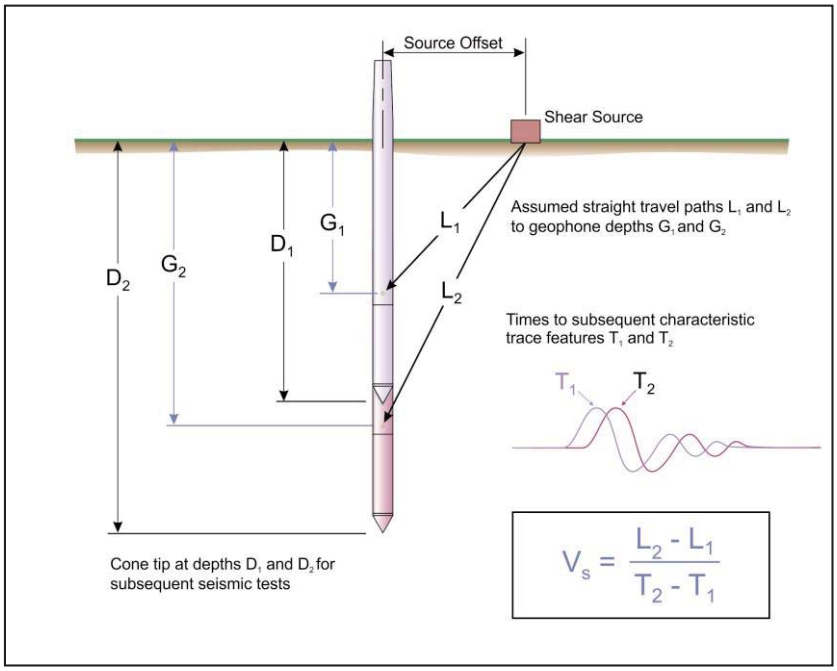


Figure SCPTu-2. Illustration of a seismic cone penetration test

Calculation of the interval velocities are performed by visually picking a common feature (e.g. the first characteristic peak, trough, or crossover) on all of the recorded wave sets and taking the difference in ray path divided by the time difference between subsequent features. Ray path is defined as the straight line distance from the seismic source to the geophone, accounting for beam offset, source depth and geophone offset from the cone tip.

The average shear wave velocity to a depth of 30 meters (V_{s30}) has been calculated and provided for all applicable soundings using an equation presented in Crow et al., 2012.

$$V_{s30} = \frac{total\ thickness\ of\ all\ layers\ (30m)}{\sum(layer\ traveltimes)}$$

The layer travel times refers to the travel times propagating in the vertical direction, not the measured travel times from an offset source.

Tabular results and SCPTu plots are presented in the relevant appendix.

The cone penetration test is halted at specific depths to carry out pore pressure dissipation (PPD) tests, shown in Figure PPD-1. For each dissipation test the cone and rods are decoupled from the rig and the data acquisition system measures and records the variation of the pore pressure (u) with time (t).

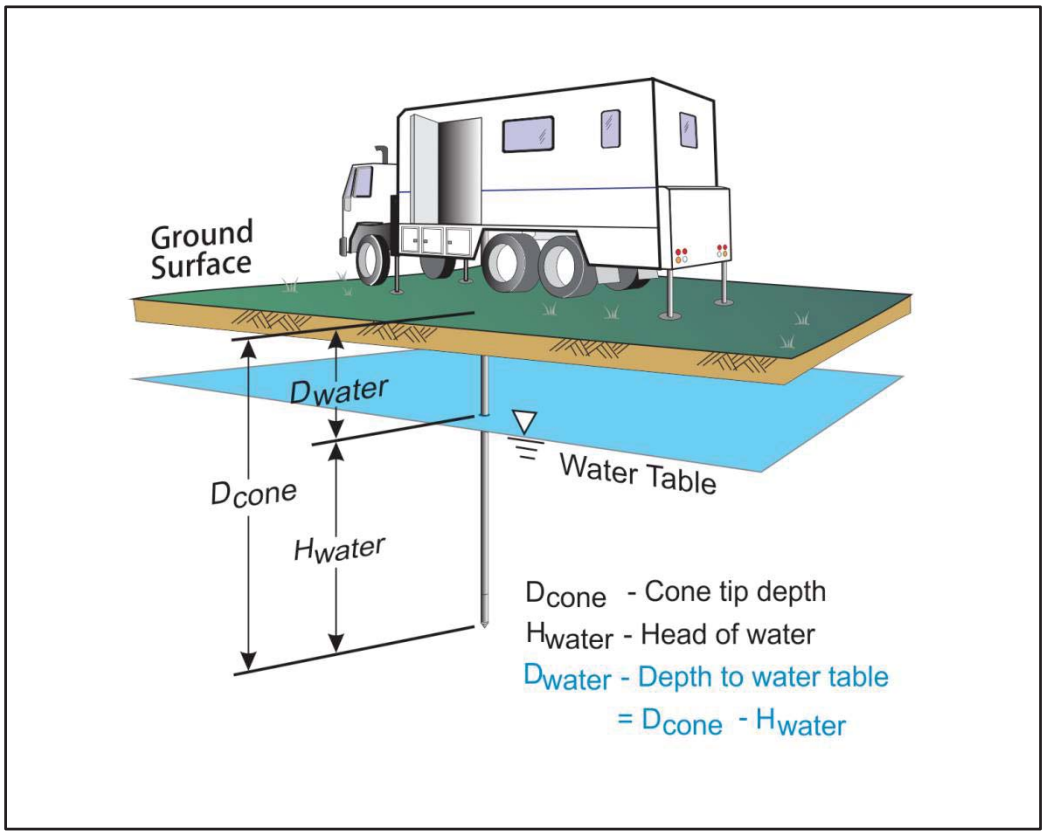


Figure PPD-1. Pore pressure dissipation test setup

Pore pressure dissipation data can be interpreted to provide estimates of ground water conditions, permeability, consolidation characteristics and soil behaviour.

The typical shapes of dissipation curves shown in Figure PPD-2 are very useful in assessing soil type, drainage, in situ pore pressure and soil properties. A flat curve that stabilizes quickly is typical of a freely draining sand. Undrained soils such as clays will typically show positive excess pore pressure and have long dissipation times. Dilative soils will often exhibit dynamic pore pressures below equilibrium that then rise over time. Overconsolidated fine-grained soils will often exhibit an initial dilatory response where there is an initial rise in pore pressure before reaching a peak and dissipating.

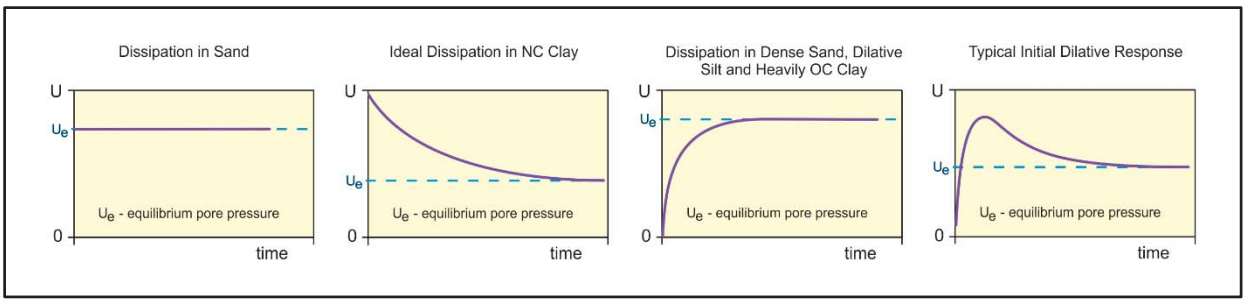


Figure PPD-2. Pore pressure dissipation curve examples

In order to interpret the equilibrium pore pressure (u_{eq}) and the apparent phreatic surface, the pore pressure should be monitored until such time as there is no variation in pore pressure with time as shown for each curve of Figure PPD-2.

In fine grained deposits the point at which 100% of the excess pore pressure has dissipated is known as t_{100}. In some cases this can take an excessive amount of time and it may be impractical to take the dissipation to t_{100}. A theoretical analysis of pore pressure dissipations by Teh and Houlsby (1991) showed that a single curve relating degree of dissipation versus theoretical time factor (T*) may be used to calculate the coefficient of consolidation (c_h) at various degrees of dissipation resulting in the expression for c_h shown below.

$$c_h = \frac{T^* \cdot a^2 \cdot \sqrt{I_r}}{t}$$

Where:

T* is the dimensionless time factor (Table Time Factor)
a is the radius of the cone
I_r is the rigidity index
t is the time at the degree of consolidation

Table Time Factor. T* versus degree of dissipation (Teh and Houlsby, 1991)

Degree of Dissipation (%)	20	30	40	50	60	70	80
T* (u_2)	0.038	0.078	0.142	0.245	0.439	0.804	1.60

The coefficient of consolidation is typically analyzed using the time (t_{50}) corresponding to a degree of dissipation of 50% (u_{50}). In order to determine t_{50}, dissipation tests must be taken to a pressure less than u_{50}. The u_{50} value is half way between the initial maximum pore pressure and the equilibrium pore pressure value, known as u_{100}. To estimate u_{50}, both the initial maximum pore pressure and u_{100} must be known or estimated. Other degrees of dissipations may be considered, particularly for extremely long dissipations.

At any specific degree of dissipation the equilibrium pore pressure (u at t_{100}) must be estimated at the depth of interest. The equilibrium value may be determined from one or more sources such as measuring the value directly (u_{100}), estimating it from other dissipations in the same profile, estimating the phreatic surface and assuming hydrostatic conditions, from nearby soundings, from client provided information, from site observations and/or past experience, or from other site instrumentation.

For calculations of c_h (Teh and Houlsby, 1991), t_{50} values are estimated from the corresponding pore pressure dissipation curve and a rigidity index (I_r) is assumed. For curves having an initial dilatory response in which an initial rise in pore pressure occurs before reaching a peak, the relative time from the peak value is used in determining t_{50}. In cases where the time to peak is excessive, t_{50} values are not calculated.

Due to possible inherent uncertainties in estimating I_r, the equilibrium pore pressure and the effect of an initial dilatory response on calculating t_{50}, other methods should be applied to confirm the results for c_h.

Additional published methods for estimating the coefficient of consolidation from a piezocone test are described in Burns and Mayne (1998, 2002), Jones and Van Zyl (1981), Robertson et al. (1992) and Sully et al. (1999).

A summary of the pore pressure dissipation tests and dissipation plots are presented in the relevant appendix.

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Robertson, P.K., Sully, J.P., Woeller, D.J., Lunne, T., Powell, J.J.M. and Gillespie, D.G., 1992, "Estimating coefficient of consolidation from piezocone tests", Canadian Geotechnical Journal, 29(4): 551-557.

Sully, J.P., Robertson, P.K., Campanella, R.G. and Woeller, D.J., 1999, "An approach to evaluation of field CPTU dissipation data in overconsolidated fine-grained soils", Canadian Geotechnical Journal, 36(2): 369-381.

Teh, C.I., and Houlsby, G.T., 1991, “An analytical study of the cone penetration test in clay”, Geotechnique, 41(1): 17-34.

The following appendices listed below are included in the report:

- Cone Penetration Test Summary and Standard Cone Penetration Test Plots
- Advanced Cone Penetration Test Plots with Ic, Phi, and N1(60)
- Seismic Cone Penetration Test Tabular Results
- Seismic Cone Penetration Test Plots
- Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots

Cone Penetration Test Summary and Standard Cone Penetration Test Plots

CONETEC

Job No:	17-05010
Client:	Baffinland Iron Mines Corporation
Project:	Milne Port Expansion
Start Date:	03-Apr-2017
End Date:	07-Apr-2017

CONE PENETRATION TEST SUMMARY

Sounding ID	File Name	Date	Cone	Assumed Phreatic Surface[1] (m)	Final Depth[2] (m)	Northing[3] (m)	Easting (m)	Elevation (m)	Refer to Notation Number
CPT17-D001	17-05010_CPD001	05-Apr-2017	338:T1500F15U500	-17.6	32.750	7976717.62	503607.38	-16.97	
SCPT17-D002	17-05010_SPD002	05-Apr-2017	338:T1500F15U500	-16.9	39.475	7976728.05	503705.30	-16.12	
CPT17-D003	17-05010_CPD003	06-Apr-2017	338:T1500F15U500	-23.2	30.425	7976757.71	503785.39	-22.68	
SCPT17-D004	17-05010_SPD004	04-Apr-2017	338:T1500F15U500	-27.3	32.050	7976768.10	503646.44	-26.59	
CPT17-D005	17-05010_CPD005	03-Apr-2017	338:T1500F15U500	-26.0	25.125	7976780.84	503736.09	-24.98	
CPT17-D006	17-05010_CPD006	06-Apr-2017	374:T1500F15U500	-32.0	20.575	7976808.43	503807.55	-31.32	
CPT17-D007	17-05010_CPD007	07-Apr-2017	374:T1500F15U501	-4.7	30.200	7976683.63	503767.46	-4.23	
CPT17-D008	17-05010_CPD008	07-Apr-2017	374:T1500F15U502	-1.4	30.000	7976650.76	503635.99	-1.80	

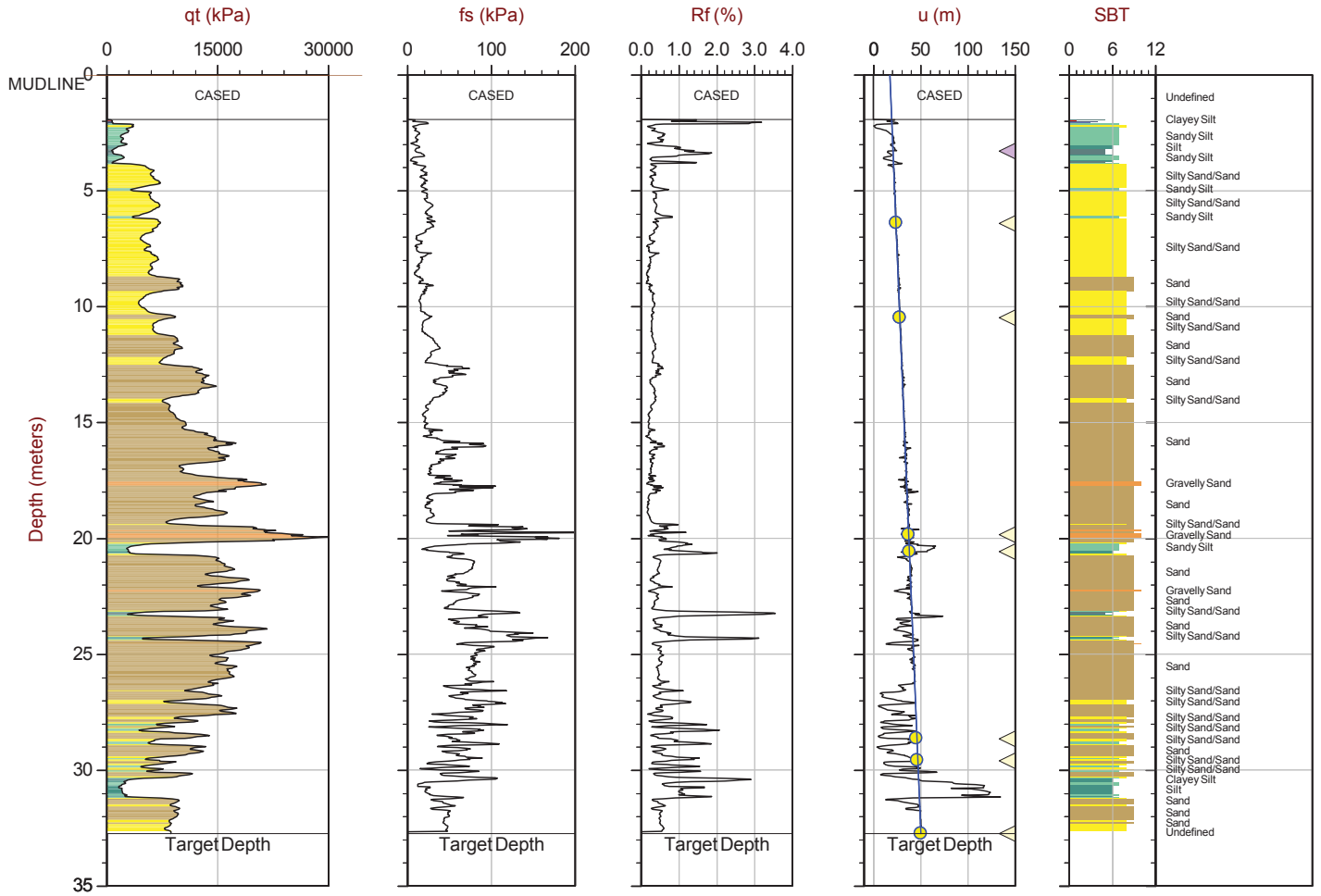
1. The assumed phreatic surface was based on pore pressure dissipation tests. Hydrostatic conditions were assumed for the interpretation tables.
2. Depth is referenced from the mudline at the time of testing.
3. Coordinates and elevations were acquired using ConeTec Trimble Survey in datum NAD 83 / UTM Zone 17 North. Elevation is of the mudline at the time of testing.

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-05 09:17
Site: Milne Port Expansion

Sounding: CPT17-D001
Cone: 338:T1500F15U500



Max Depth: 32.750 m / 107.45 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 17-05010_CPD001.COR
Unit Wt: SBT (R&C1986)

SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976717.62m E: 503607.38m Elev: -16.97m

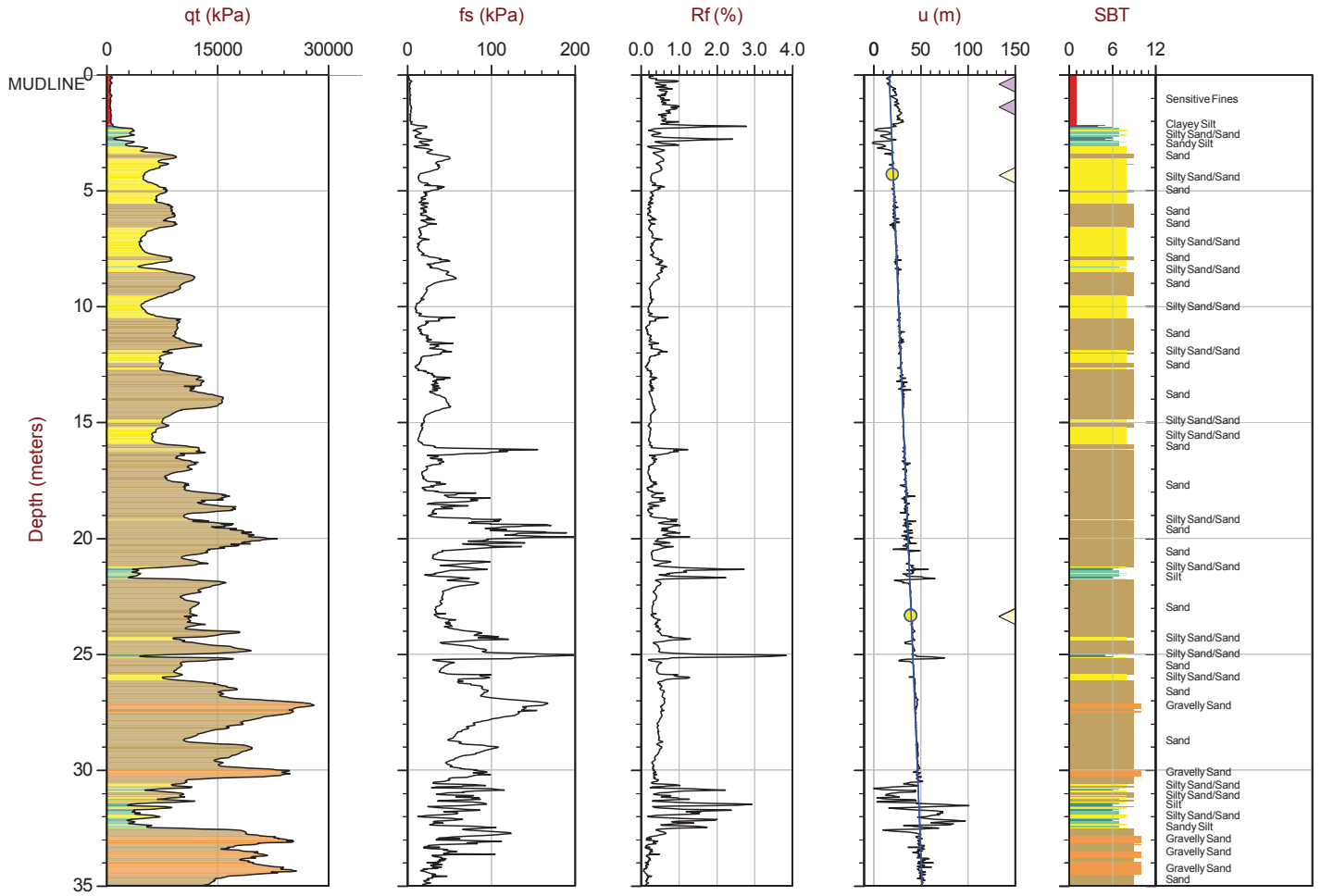
Equilibrium Pore Pressure (Ueq)
Dissipation, Ueq not achieved
Dissipation, Ueq achieved
Hydrostatic Line

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-05 20:44
Site: Milne Port Expansion

Sounding: SCPT17-D002
Cone: 338:T1500F15U500



Max Depth: 39.475 m / 129.51 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 17-05010_SPD002.COR
Unit Wt: SBT (R&C1986)

SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976728.05m E: 503705.30m Elev: -16.12m

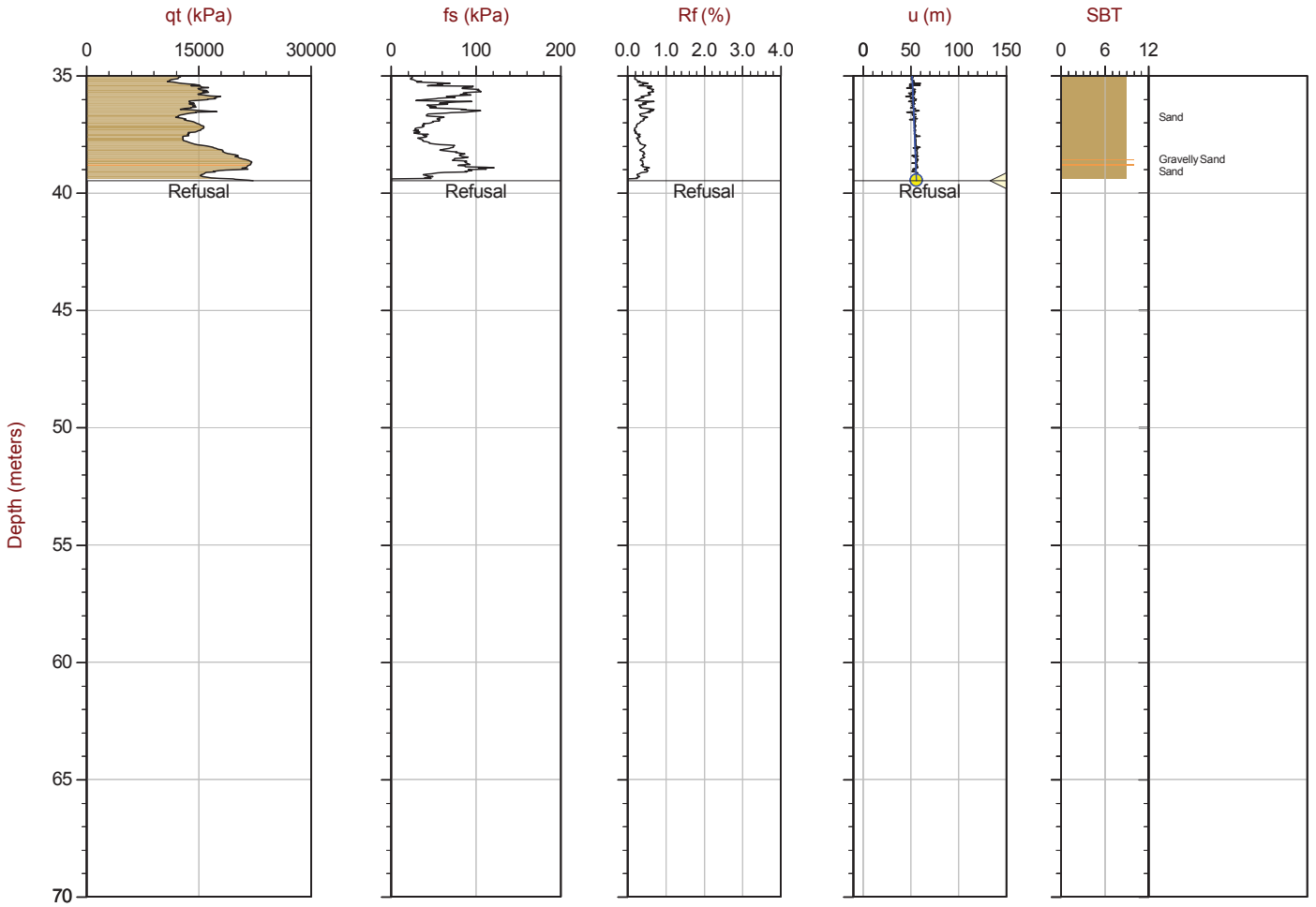
Equilibrium Pore Pressure (Ueq)
Dissipation, Ueq not achieved
Dissipation, Ueq achieved
Hydrostatic Line

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-05 20:44
Site: Milne Port Expansion

Sounding: SCPT17-D002
Cone: 338:T1500F15U500



Max Depth: 39.475 m / 129.51 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 17-05010_SPD002.COR
Unit Wt: SBT (R&C1986)

SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976728.05m E: 503705.30m Elev: -16.12m

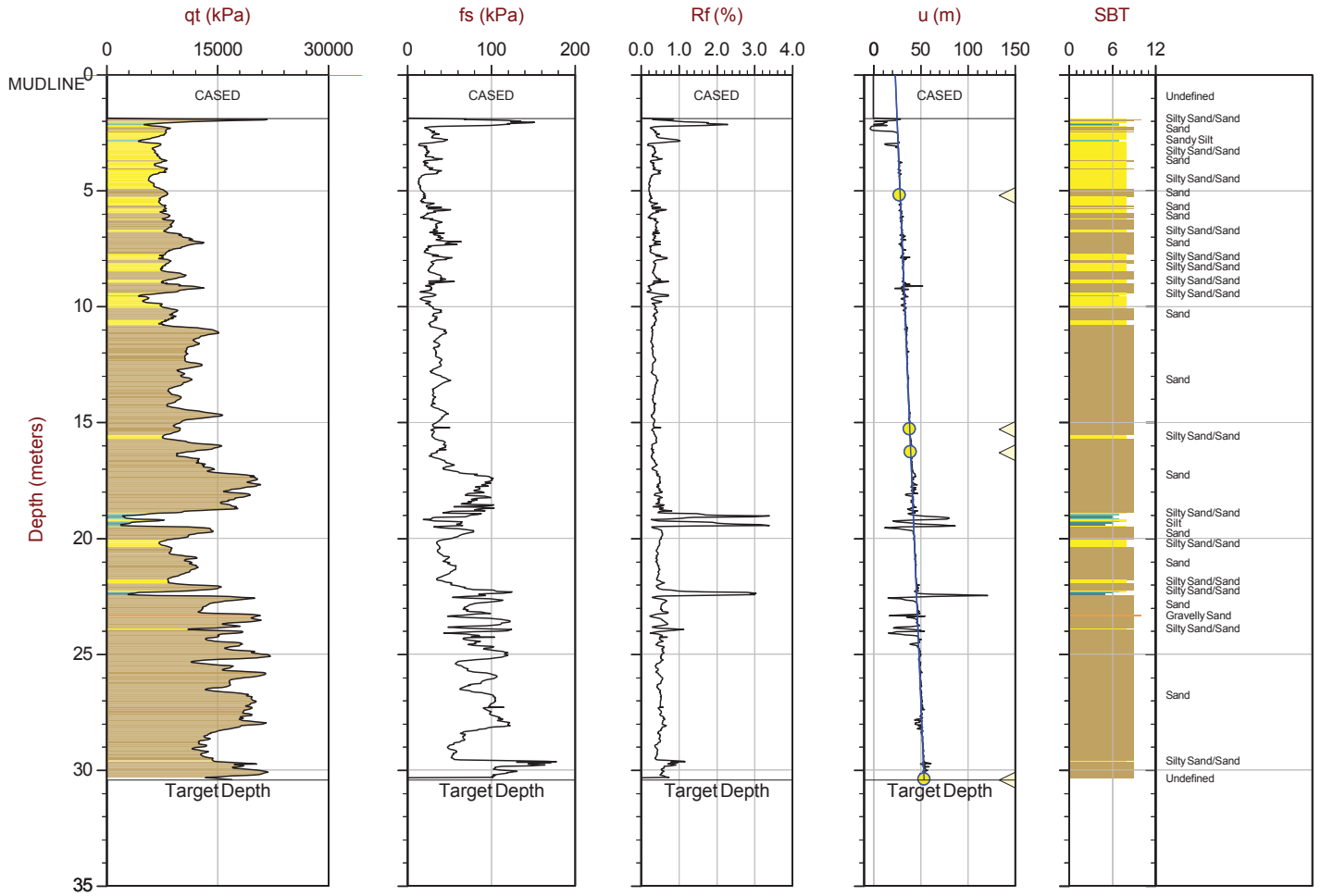
Equilibrium Pore Pressure (Ueq)
Dissipation, Ueq not achieved
Dissipation, Ueq achieved
Hydrostatic Line

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-06 13:34
Site: Milne Port Expansion

Sounding: CPT17-D003
Cone: 338:T1500F15U500



Max Depth: 30.425 m / 99.82 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 17-05010_CPD003.COR
Unit Wt: SBT (R&C1986)

SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976757.71m E: 503785.39m Elev: -22.68m

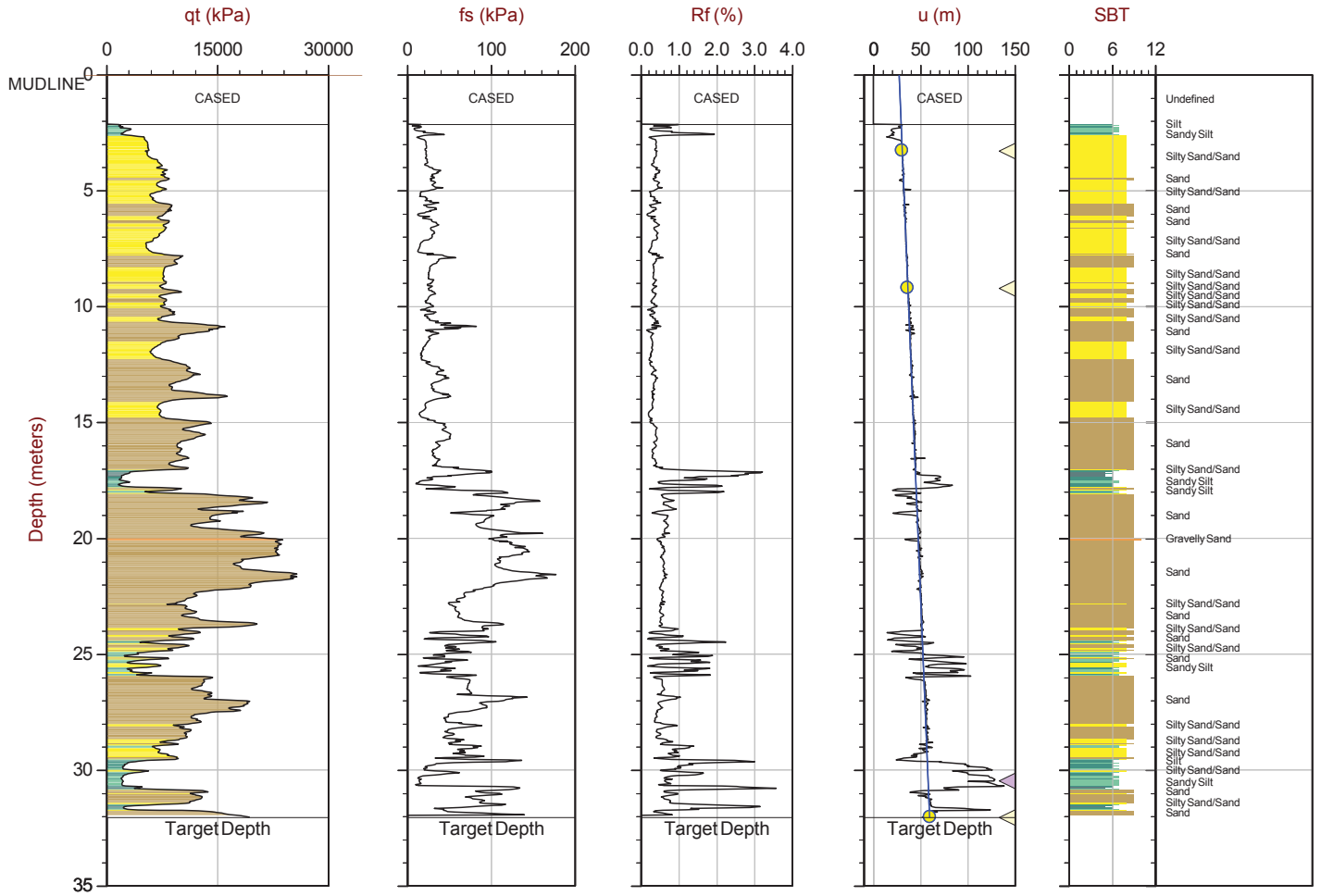
Equilibrium Pore Pressure (Ueq)
Dissipation, Ueq not achieved
Dissipation, Ueq achieved
Hydrostatic Line

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-04 16:44
Site: Milne Port Expansion

Sounding: SCPT17-D004
Cone: 338:T1500F15U500



Max Depth: 32.050 m / 105.15 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 17-05010_SPD004.COR
Unit Wt: SBT (R&C1986)

SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976768.10m E: 503646.44m Elev: -26.59m

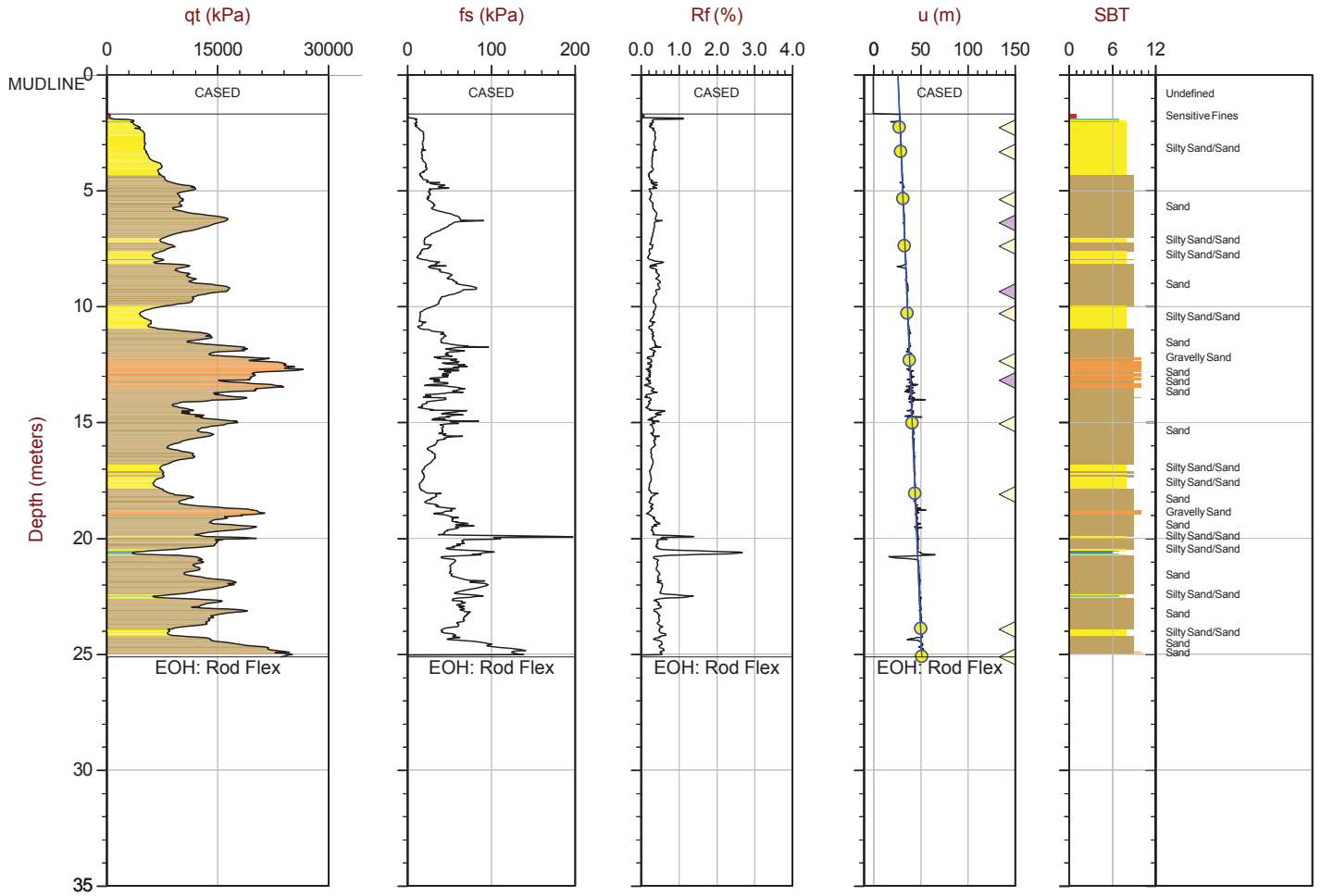
Equilibrium Pore Pressure (Ueq)
Dissipation, Ueq not achieved
Dissipation, Ueq achieved
Hydrostatic Line

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-03 02:19
Site: Milne Port Expansion

Sounding: CPT17-D005
Cone: 338:T1500F15U500



Max Depth: 25.125 m / 82.43 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 17-05010_CPD005.COR
Unit Wt: SBT (R&C1986)

SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976780.84m E: 503736.09m Elev: -24.98m

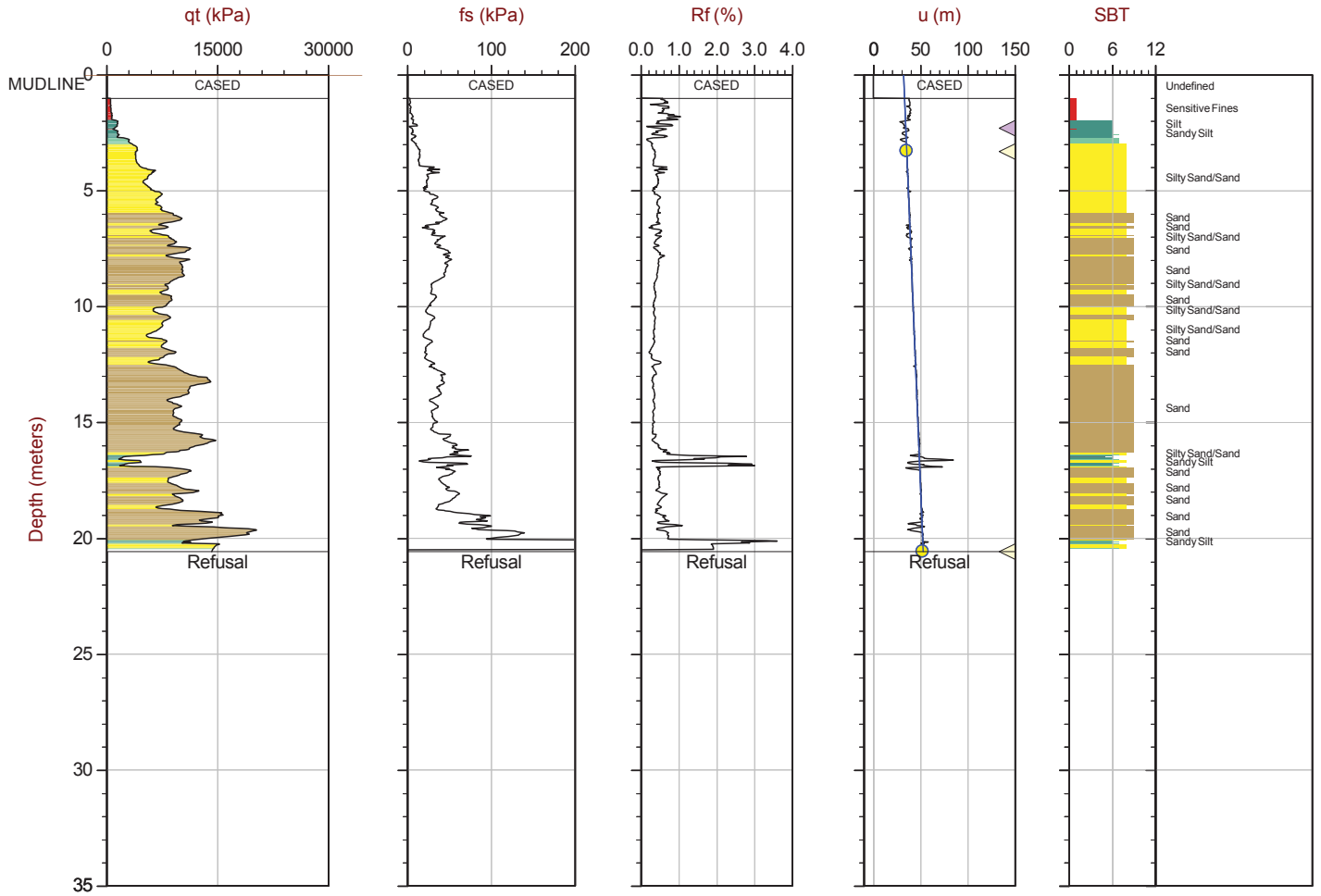
Equilibrium Pore Pressure (Ueq)
Dissipation, Ueq not achieved
Dissipation, Ueq achieved
Hydrostatic Line

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-06 23:59
Site: Milne Port Expansion

Sounding: CPT17-D006
Cone: 374:T1500F15U500



Max Depth: 20.575 m / 67.50 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 17-05010_CPD006.COR
Unit Wt: SBT (R&C1986)

SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976808.43m E: 503807.55m Elev: -31.32m

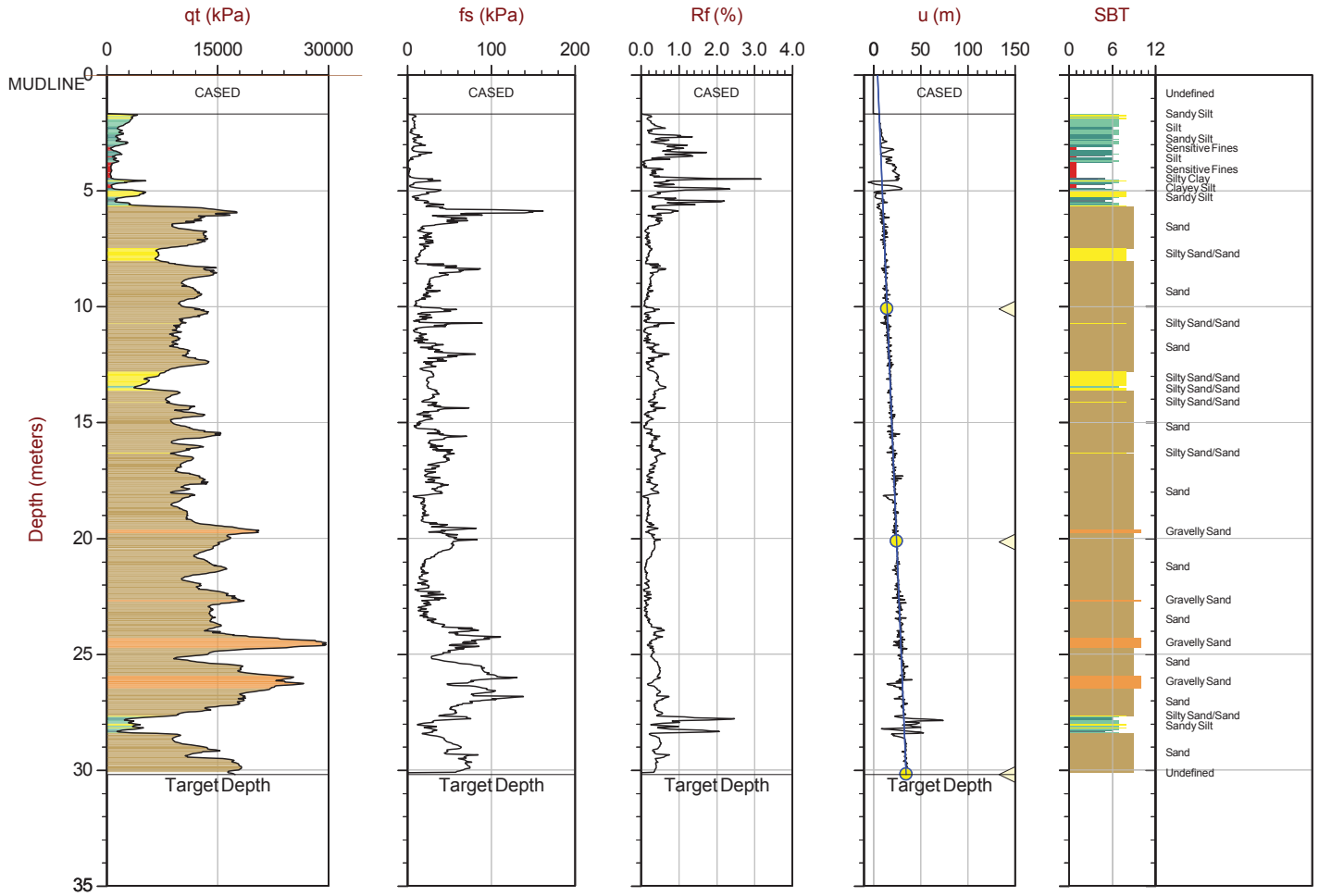
Equilibrium Pore Pressure (Ueq)
Dissipation, Ueq not achieved
Dissipation, Ueq achieved
Hydrostatic Line

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-07 11:27
Site: Milne Port Expansion

Sounding: CPT17-D007
Cone: 374:T1500F15U500



Max Depth: 30.200 m / 99.08 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 17-05010_CPD007.COR
Unit Wt: SBT (R&C1986)

SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976683.63m E: 503767.46m Elev: -4.23m

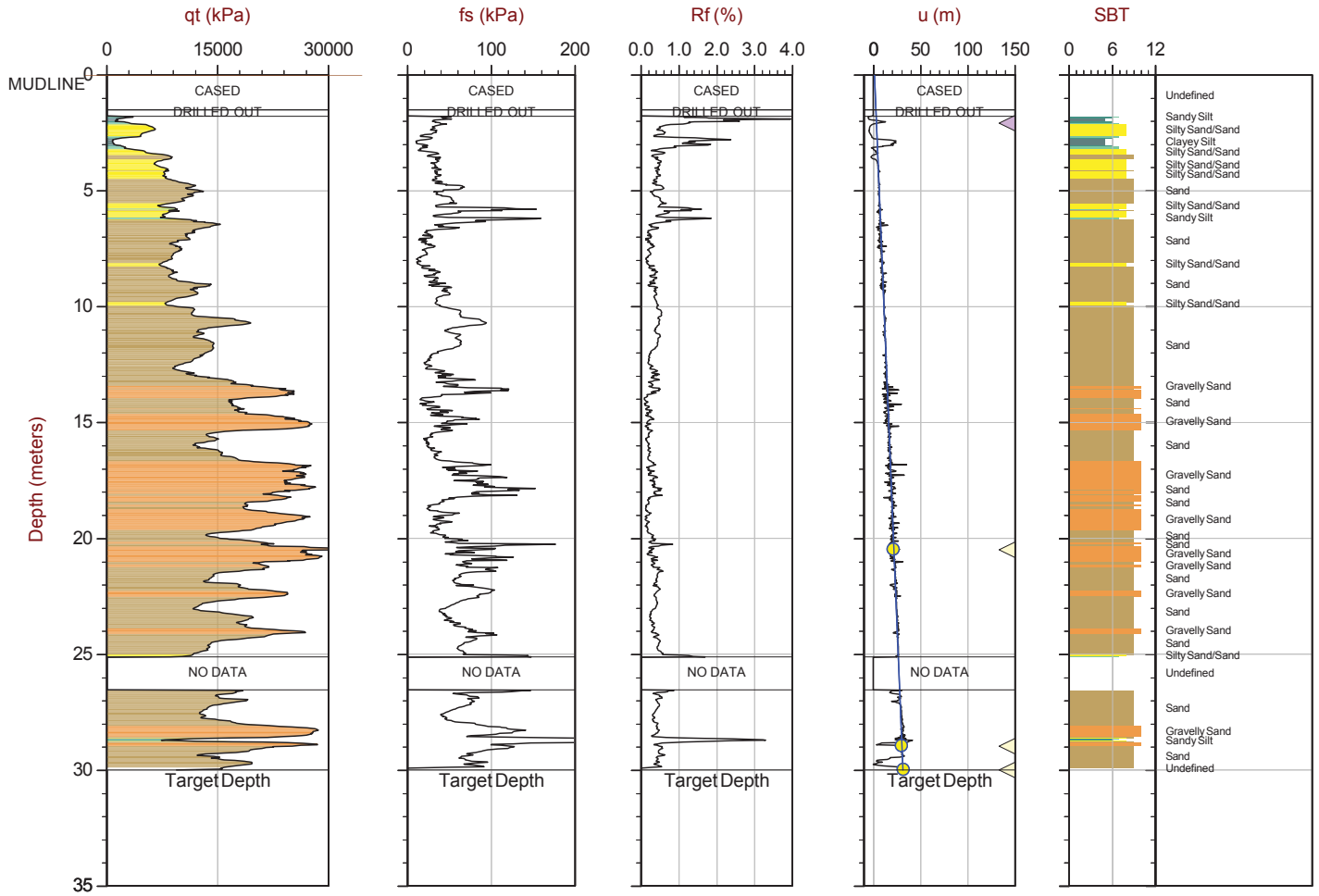
Equilibrium Pore Pressure (Ueq)
Dissipation, Ueq not achieved
Dissipation, Ueq achieved
Hydrostatic Line

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-07 16:47
Site: Milne Port Expansion

Sounding: CPT17-D008
Cone: 374:T1500F15U500



Max Depth: 30.000 m / 98.42 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 17-05010_CPD008.COR
Unit Wt: SBT (R&C1986)

SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976650.76m E: 503635.99m Elev: -1.80m

Equilibrium Pore Pressure (Ueq)
Dissipation, Ueq not achieved
Dissipation, Ueq achieved
Hydrostatic Line

Advanced Cone Penetration Test Plots with Ic, Phi, and N1(60)

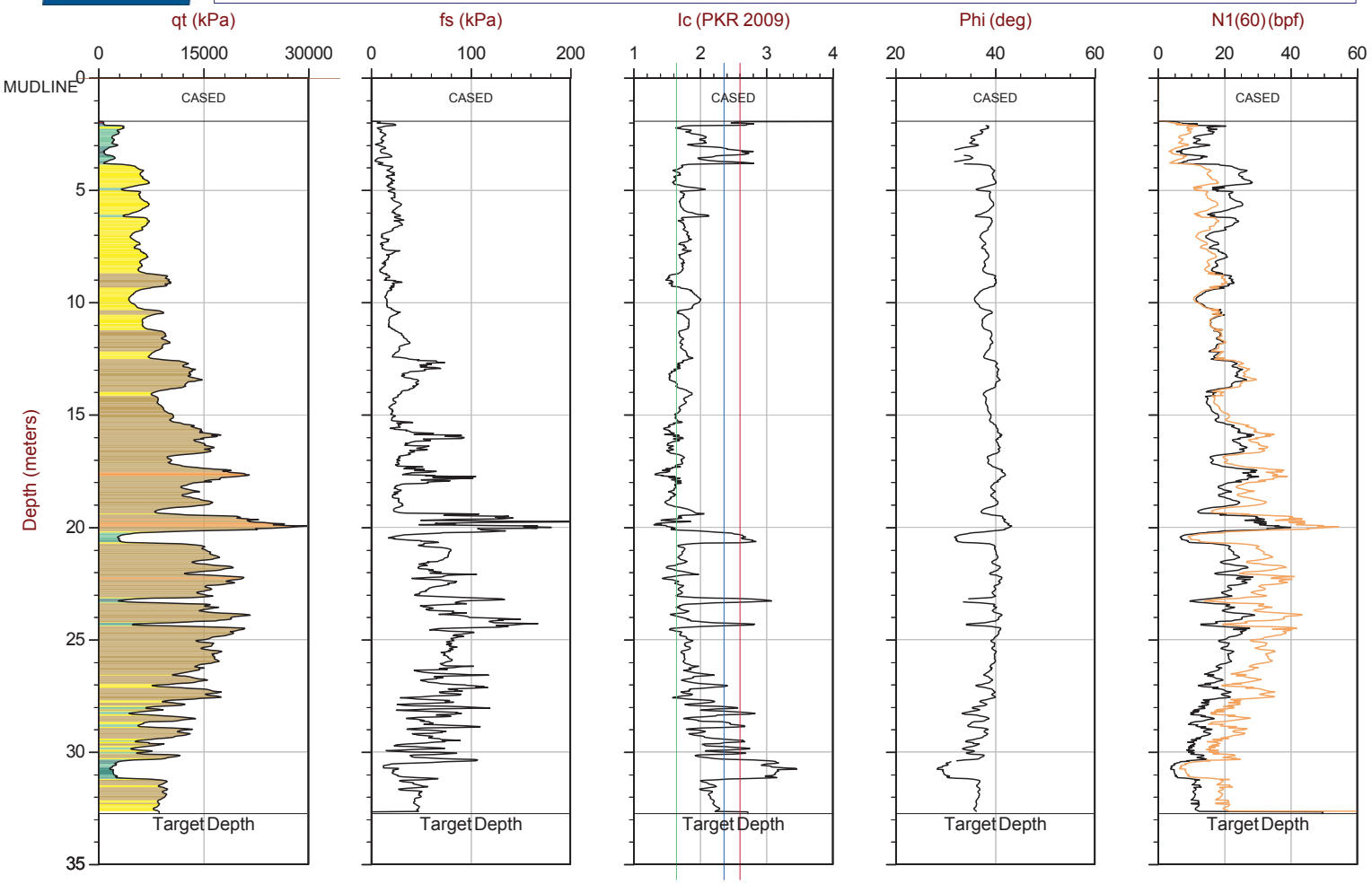


CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-05 09:17
Site: Milne Port Expansion

Sounding: CPT17-D001
Cone: 338:T1500F15U500



Max Depth: 32.750 m / 107.45 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point
N(60) (bpf)

File: 17-05010_CPD001.COR
Unit Wt: SBT (R&C1986)

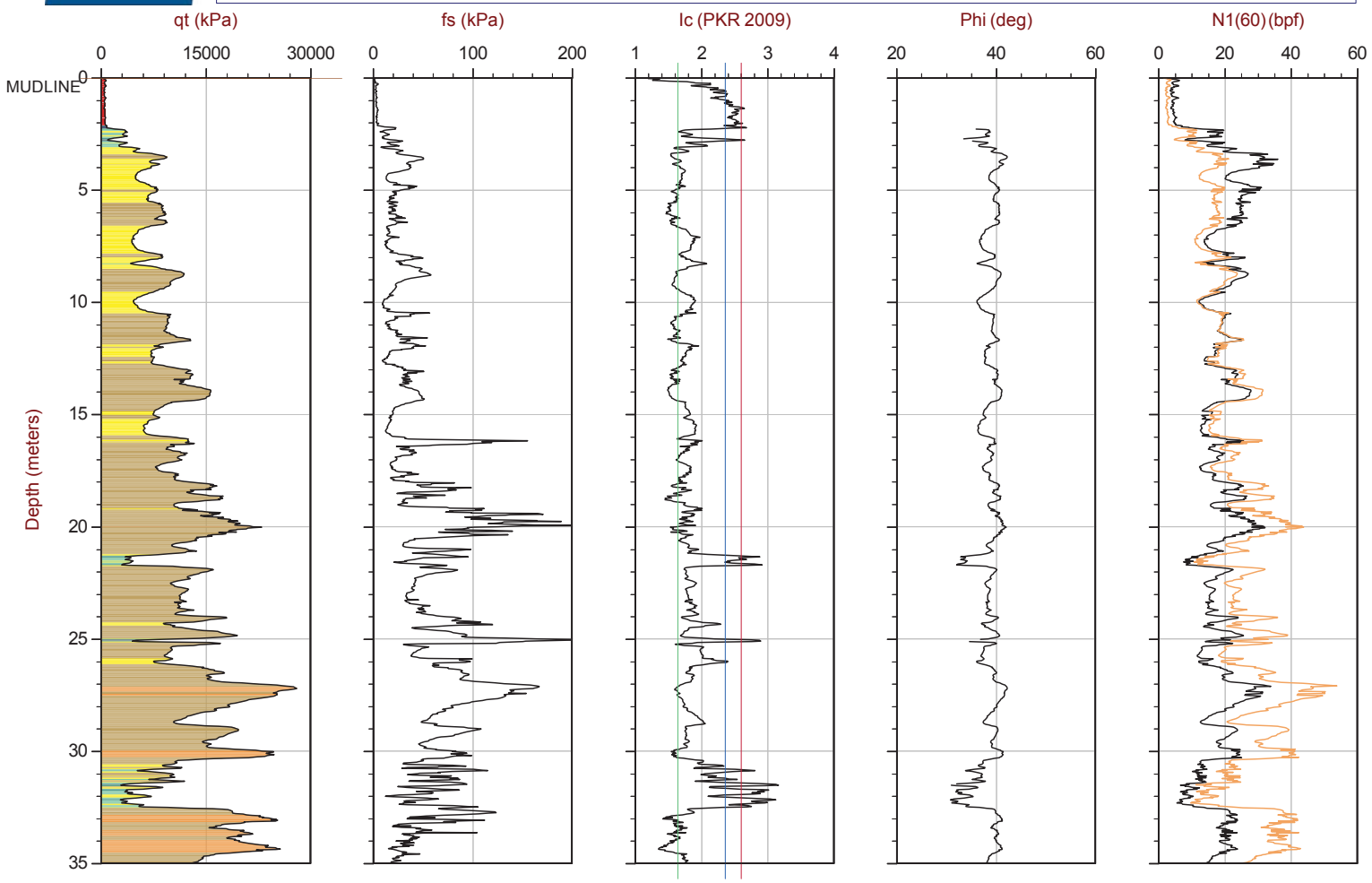
SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976717.62m E: 503607.38m Elev: -16.97m

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-05 20:44
Site: Milne Port Expansion

Sounding: SCPT17-D002
Cone: 338:T1500F15U500



Max Depth: 39.475 m / 129.51 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point
N(60) (bpf)

File: 17-05010_SPD002.COR
Unit Wt: SBT (R&C1986)

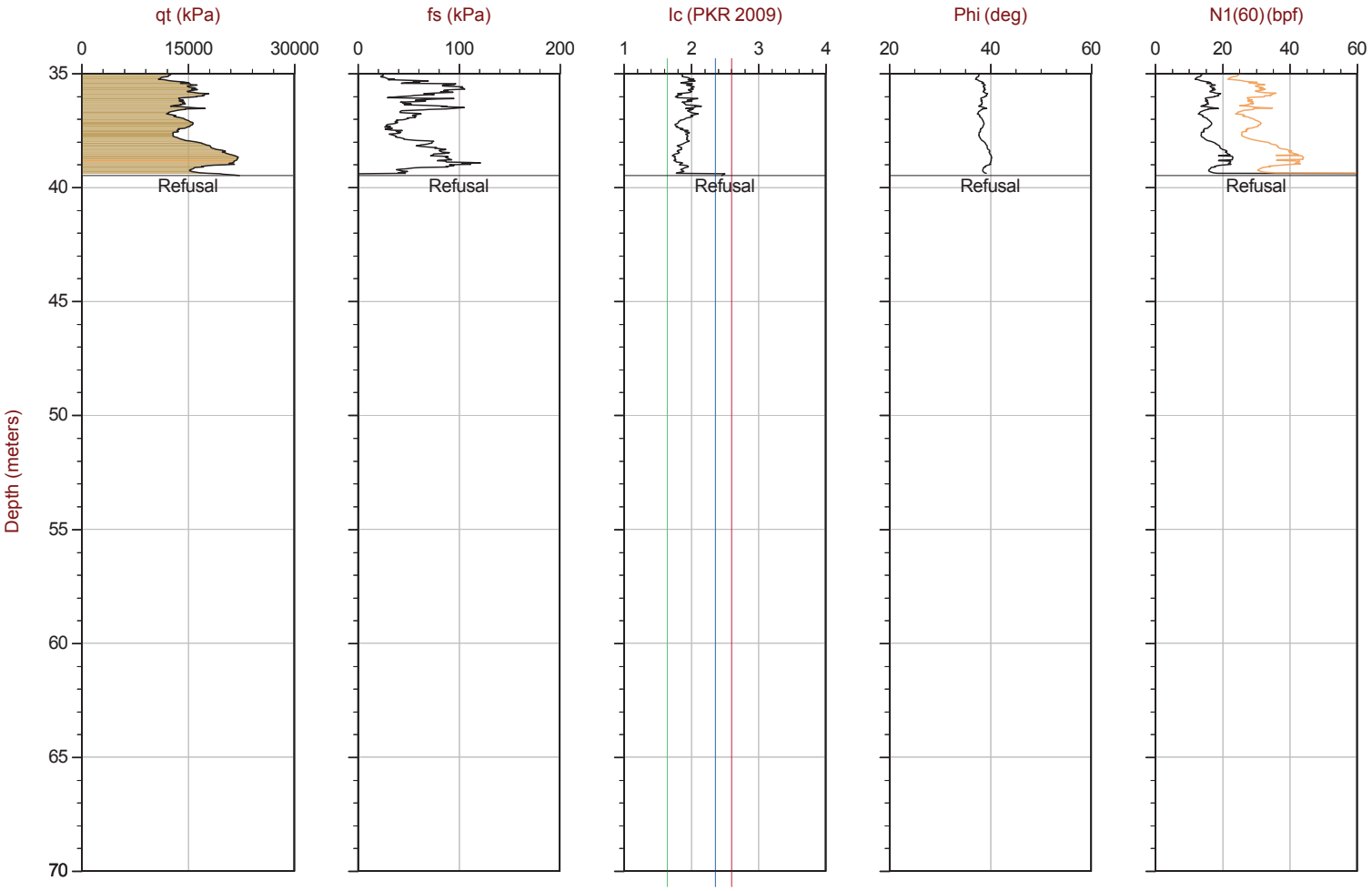
SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976728.05m E: 503705.30m Elev: -16.12m

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-05 20:44
Site: Milne Port Expansion

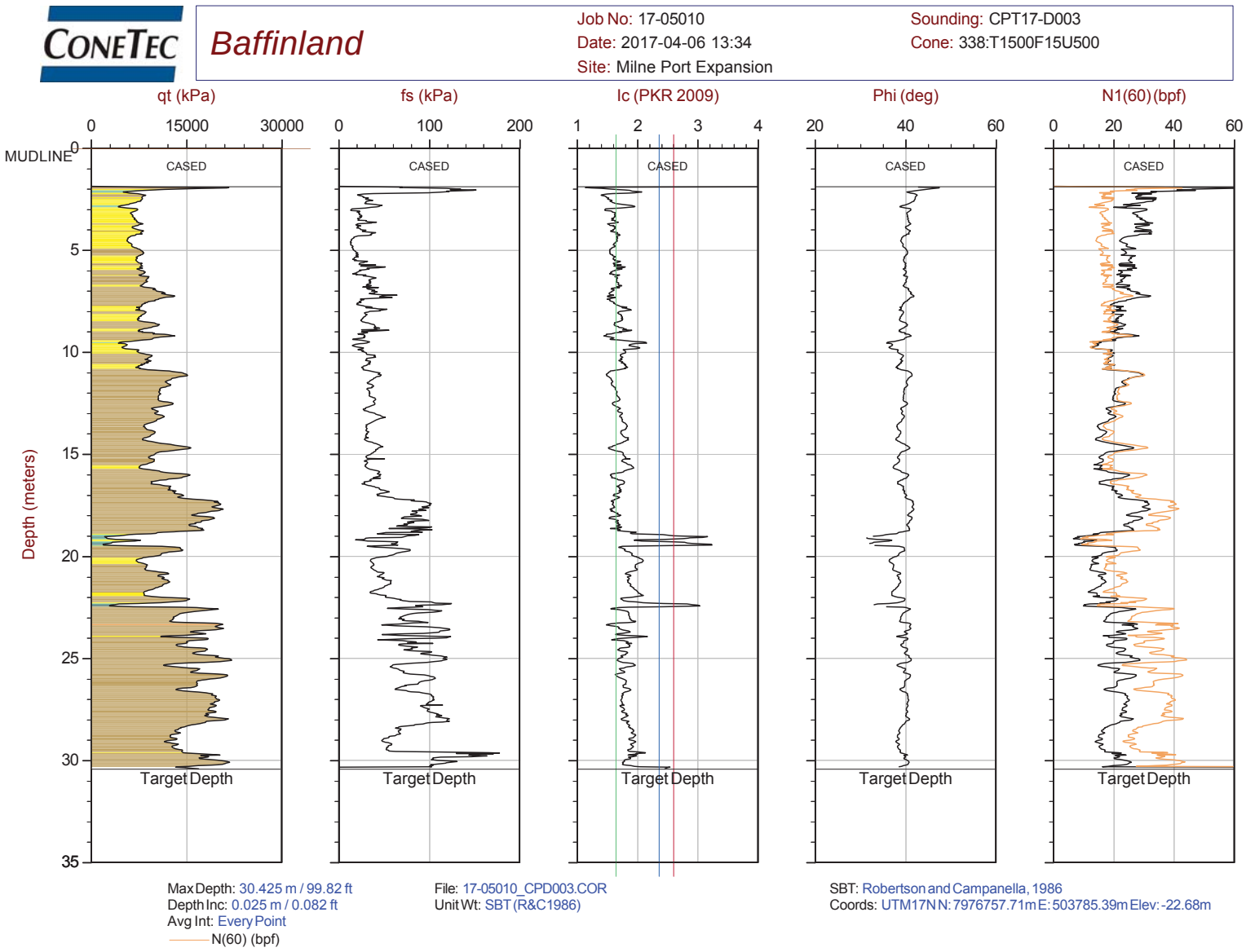
Sounding: SCPT17-D002
Cone: 338:T1500F15U500



Max Depth: 39.475 m / 129.51 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point
N(60) (bpf)

File: 17-05010_SPD002.COR
Unit Wt: SBT (R&C1986)

SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976728.05m E: 503705.30m Elev: -16.12m

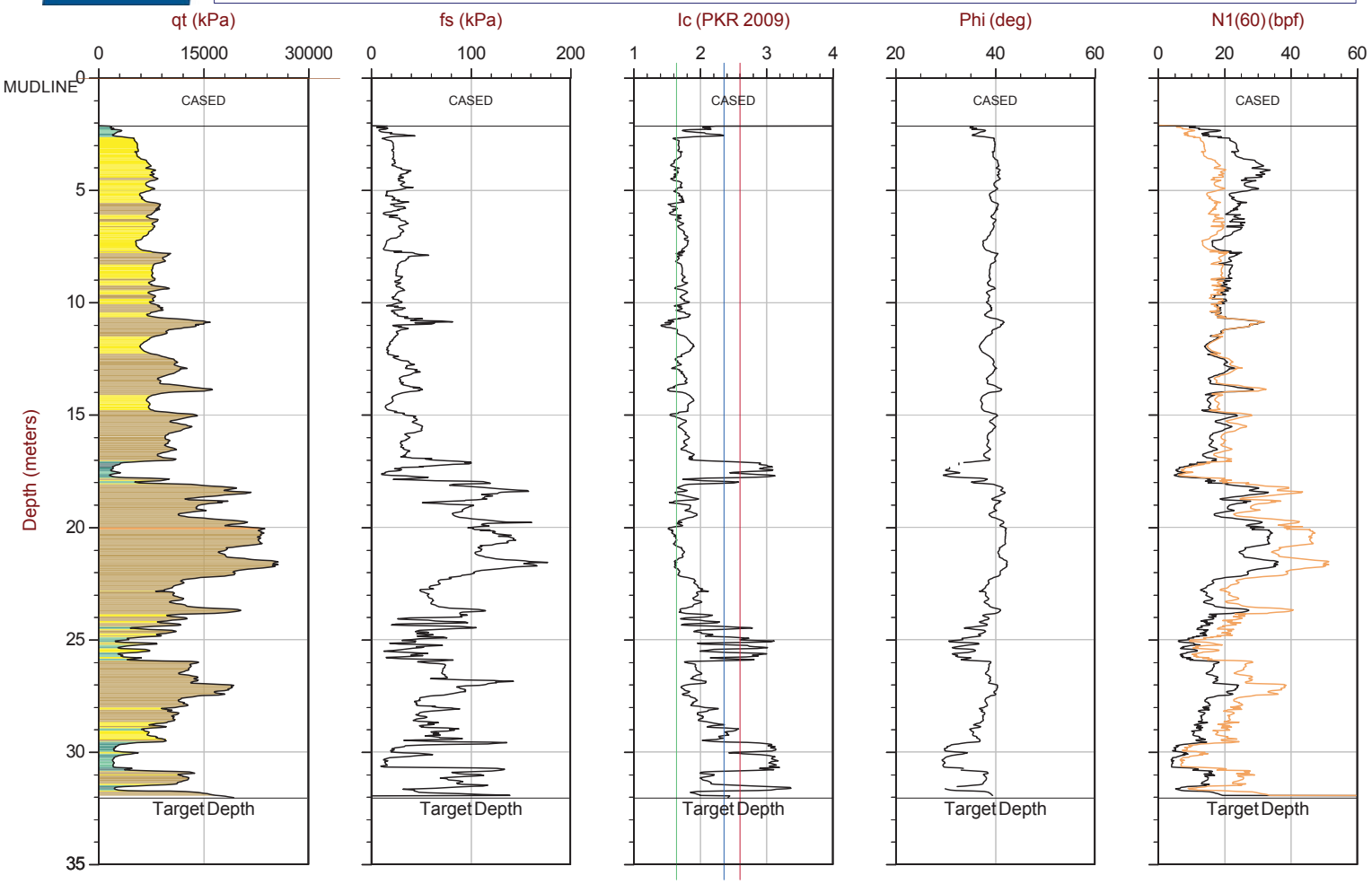

Baffinland
Job No: 17-05010
Date: 2017-04-06 13:34
Site: Milne Port Expansion
Sounding: CPT17-D003
Cone: 338:T1500F15U500
qt (kPa)
fs (kPa)
Ic (PKR 2009)
Phi (deg)
N1(60) (bpf)
MUDLINE
CASED
Target Depth
Depth (meters)
Max Depth: 30.425 m / 99.82 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point
N(60) (bpf)
File: 17-05010_CPD003.COR
Unit Wt: SBT (R&C1986)
SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976757.71m E: 503785.39m Elev: -22.68m

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-04 16:44
Site: Milne Port Expansion

Sounding: SCPT17-D004
Cone: 338:T1500F15U500



Max Depth: 32.050 m / 105.15 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point
N(60) (bpf)

File: 17-05010_SPD004.COR
Unit Wt: SBT (R&C1986)

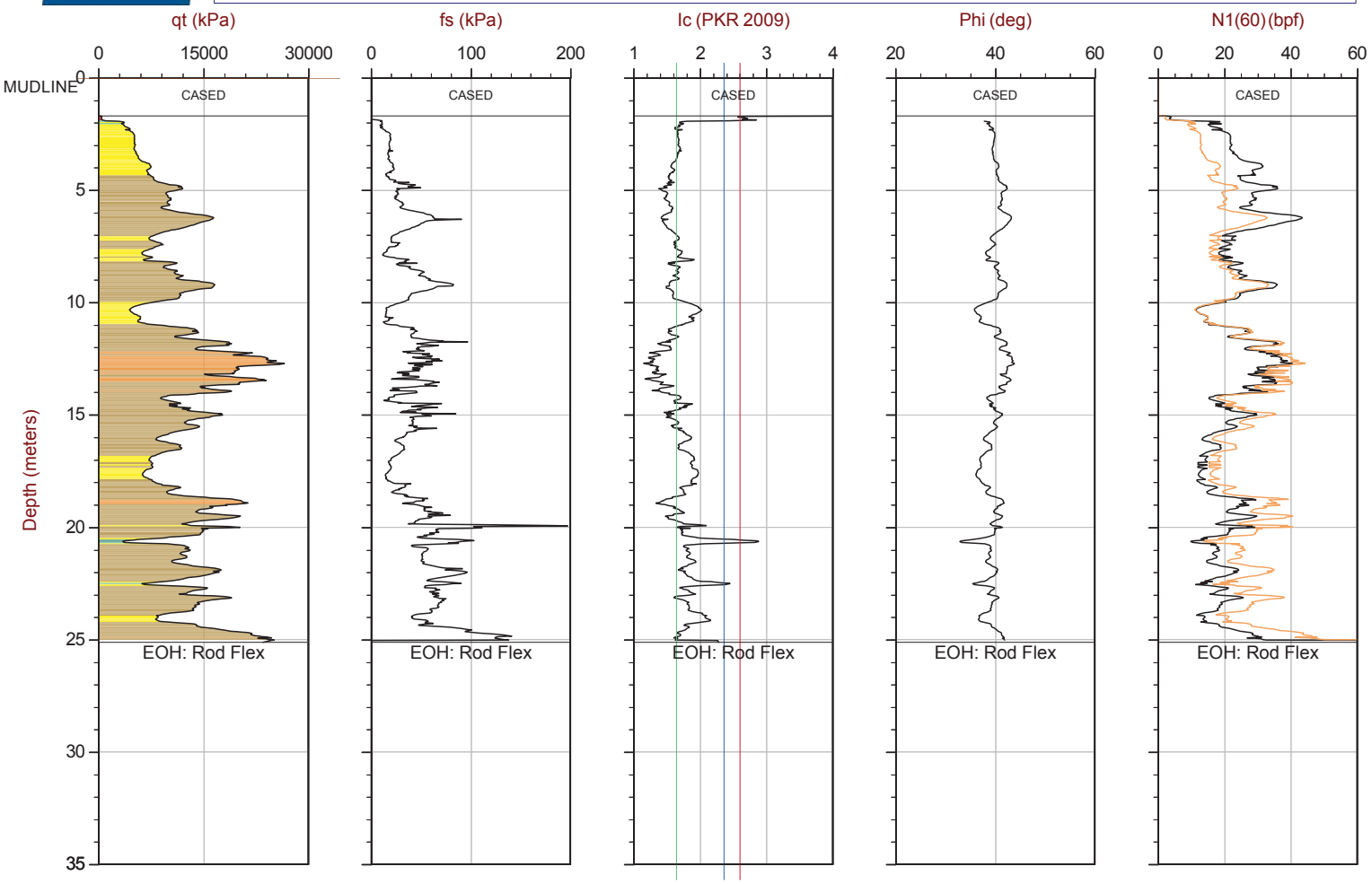
SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976768.10m E: 503646.44m Elev: -26.59m

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-03 02:19
Site: Milne Port Expansion

Sounding: CPT17-D005
Cone: 338:T1500F15U500



Max Depth: 25.125 m / 82.43 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point
N(60) (bpf)

File: 17-05010_CPD005.COR
Unit Wt: SBT (R&C1986)

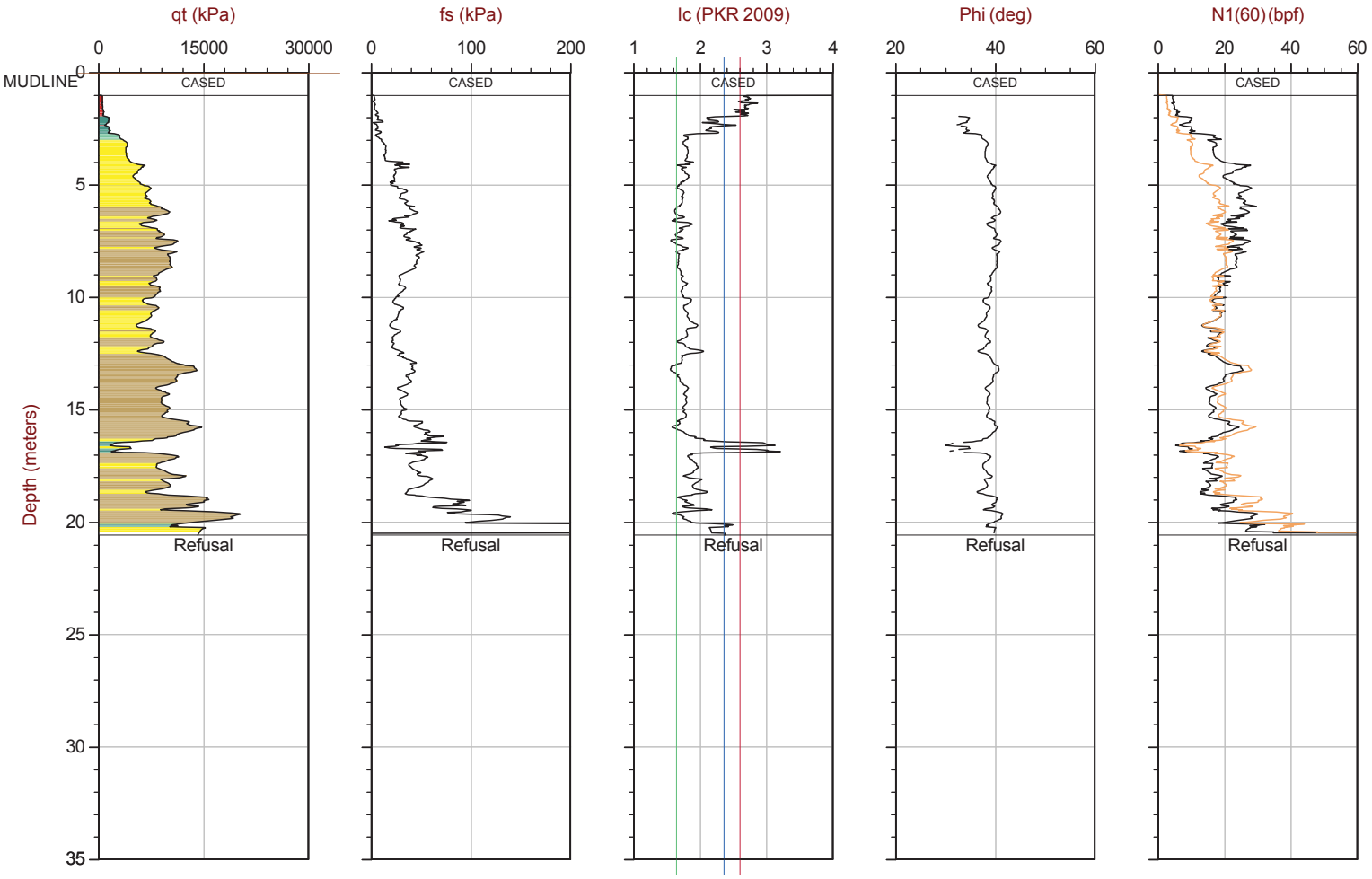
SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976780.84m E: 503736.09m Elev: -24.98m

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-06 23:59
Site: Milne Port Expansion

Sounding: CPT17-D006
Cone: 374:T1500F15U500



Max Depth: 20.575 m / 67.50 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point
N(60) (bpf)

File: 17-05010_CPD006.COR
Unit Wt: SBT (R&C1986)

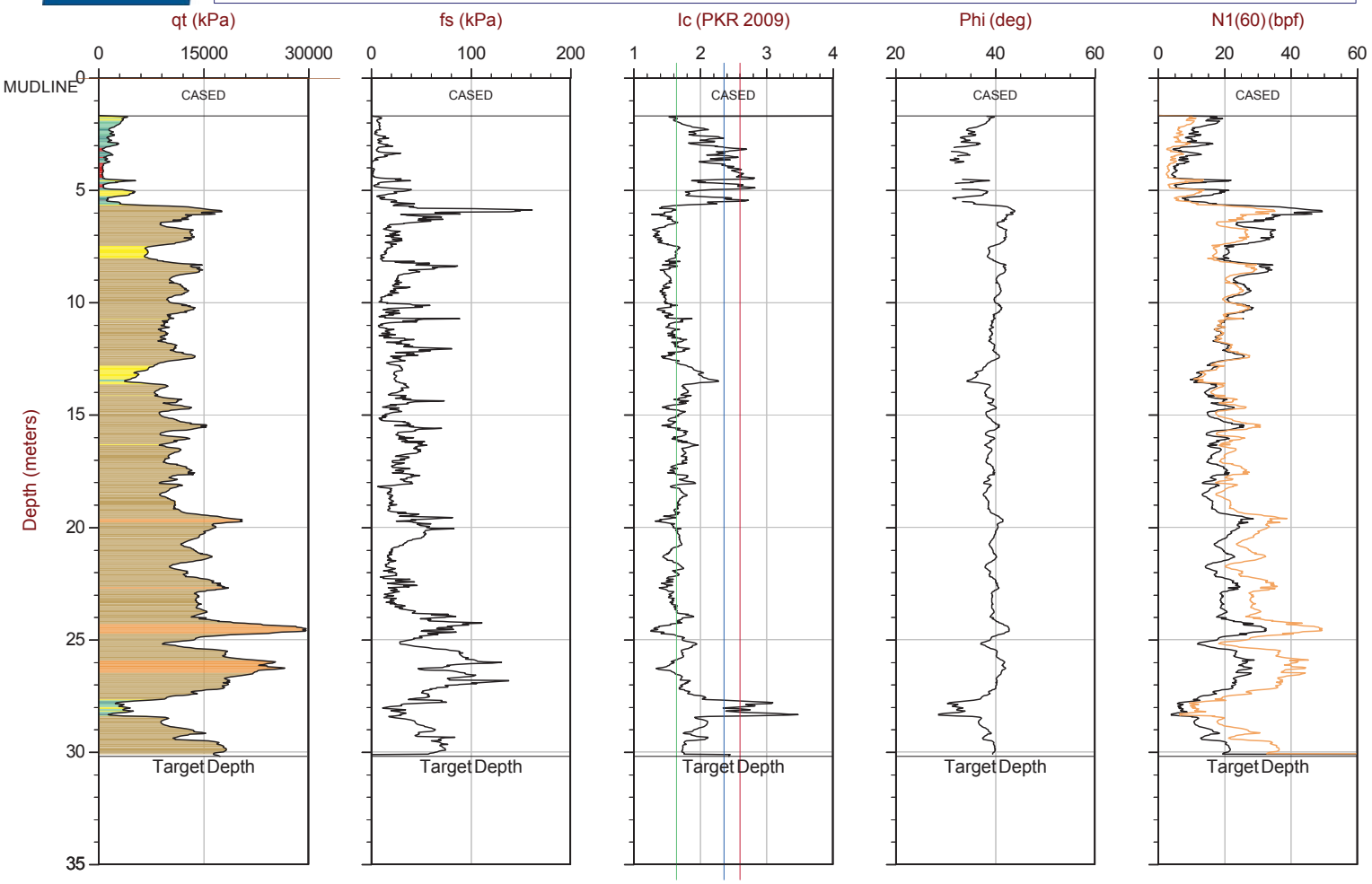
SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976808.43m E: 503807.55m Elev: -31.32m

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-07 11:27
Site: Milne Port Expansion

Sounding: CPT17-D007
Cone: 374:T1500F15U500



Max Depth: 30.200 m / 99.08 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point
N(60) (bpf)

File: 17-05010_CPD007.COR
Unit Wt: SBT (R&C1986)

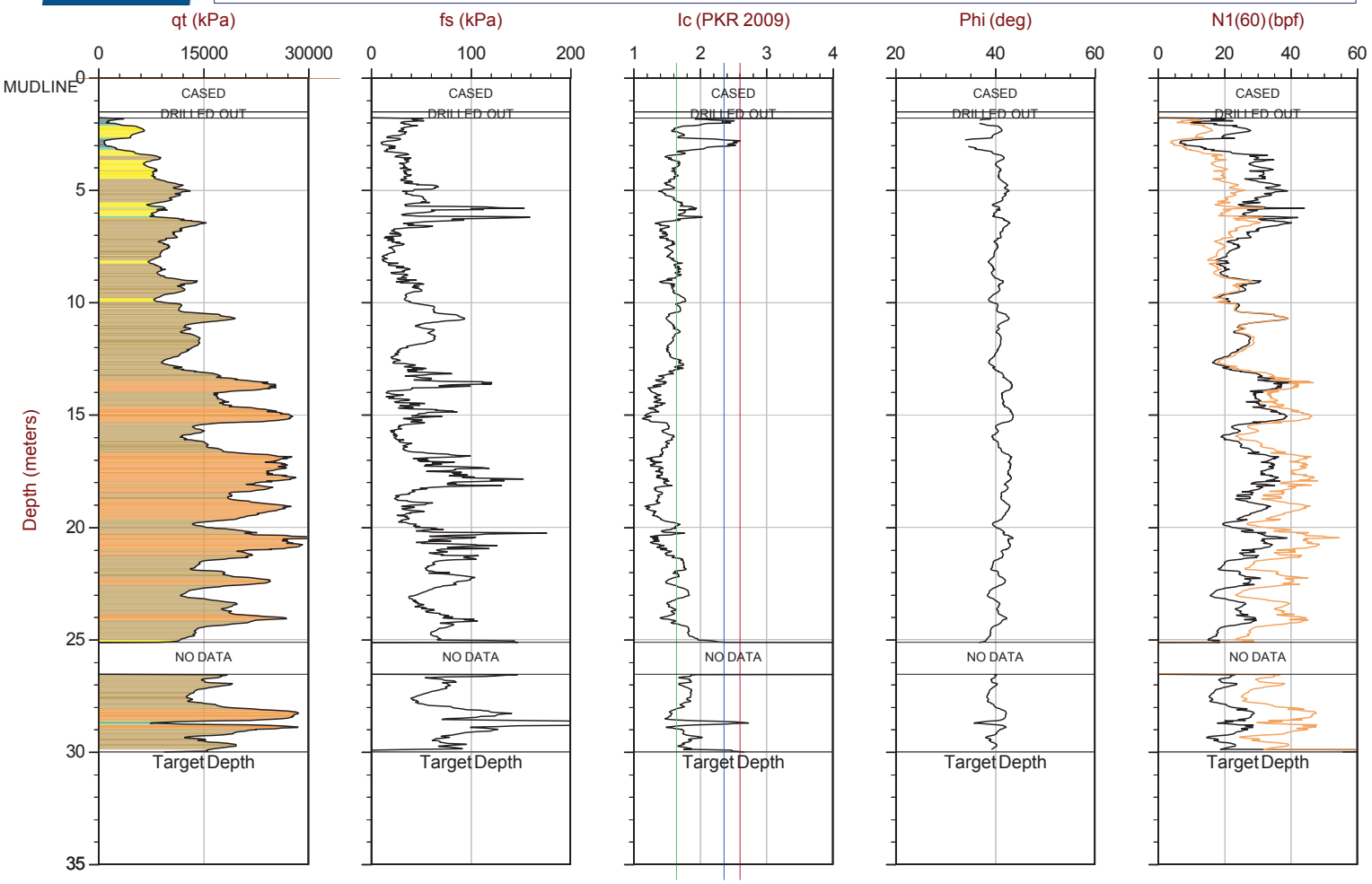
SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976683.63m E: 503767.46m Elev: -4.23m

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-07 16:47
Site: Milne Port Expansion

Sounding: CPT17-D008
Cone: 374:T1500F15U500



Max Depth: 30.000 m / 98.42 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point
N(60) (bpf)

File: 17-05010_CPD008.COR
Unit Wt: SBT (R&C1986)

SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976650.76m E: 503635.99m Elev: -1.80m

Seismic Cone Penetration Test Tabular Results

CONETEC

Job No:	17-05010
Client:	Baffinland Iron Mines Corporation
Project:	Milne Port Expansion
Sounding ID:	SCPT17-D002
Date:	05-Apr-2017

Seismic Source:	Auto-seismic
Source Offset (m):	4.30
Source Depth (m):	0.00
Geophone Offset (m):	0.20

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (m)	Geophone Depth (m)	Ray Path (m)	Ray Path Difference (m)	Travel Time Interval (ms)	Interval Velocity (m/s)
3.38	3.18	5.35			
5.38	5.18	6.73	1.38	8.94	155
6.35	6.15	7.50	0.77	4.62	167
7.40	7.20	8.39	0.88	5.00	177
8.38	8.18	9.24	0.86	4.38	195
9.40	9.20	10.16	0.91	5.21	175
10.38	10.18	11.05	0.90	4.78	187
11.38	11.18	11.98	0.93	5.35	173
12.40	12.20	12.94	0.96	4.82	198
13.43	13.23	13.91	0.98	4.81	203
14.43	14.23	14.87	0.95	4.70	203
15.43	15.23	15.83	0.96	4.39	219
16.43	16.23	16.79	0.96	4.40	219
17.40	17.20	17.73	0.94	4.13	228
18.45	18.25	18.75	1.02	4.54	225
19.40	19.20	19.68	0.93	3.87	239
20.35	20.15	20.60	0.93	3.91	238
21.35	21.15	21.58	0.98	4.50	217
22.35	22.15	22.56	0.98	4.44	221
23.35	23.15	23.55	0.98	4.67	210
24.27	24.07	24.45	0.91	4.13	219
25.30	25.10	25.47	1.01	4.00	254
26.27	26.07	26.42	0.96	3.80	252

Job No:	17-05010
Client:	Baffinland Iron Mines Corporation
Project:	Milne Port Expansion
Sounding ID:	SCPT17-D002
Date:	05-Apr-2017

Seismic Source:	Auto-seismic
Source Offset (m):	4.30
Source Depth (m):	0.00
Geophone Offset (m):	0.20

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (m)	Geophone Depth (m)	Ray Path (m)	Ray Path Difference (m)	Travel Time Interval (ms)	Interval Velocity (m/s)
27.32	27.12	27.46	1.04	4.08	254
28.38	28.18	28.51	1.05	3.93	267
29.43	29.23	29.54	1.04	4.08	254
30.40	30.20	30.50	0.96	3.54	271
31.40	31.20	31.49	0.99	3.55	279
32.38	32.18	32.47	0.97	3.59	270
33.38	33.18	33.46	0.99	3.56	279
34.40	34.20	34.47	1.01	3.63	279
35.40	35.20	35.46	0.99	3.60	276
36.40	36.20	36.45	0.99	3.75	265
37.40	37.20	37.45	0.99	3.87	257
38.40	38.20	38.44	0.99	3.81	261
39.40	39.20	39.44	0.99	3.81	261

Job No:	17-05010
Client:	Baffinland Iron Mines Corporation
Project:	Milne Port Expansion
Sounding ID:	SCPT17-D004
Date:	04-Apr-2017

Seismic Source:	Auto-seismic
Source Offset (m):	3.40
Source Depth (m):	0.00
Geophone Offset (m):	0.20

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (m)	Geophone Depth (m)	Ray Path (m)	Ray Path Difference (m)	Travel Time Interval (ms)	Interval Velocity (m/s)
4.30	4.10	5.33			
5.30	5.10	6.13	0.80	4.48	179
6.20	6.00	6.90	0.77	3.86	198
7.20	7.00	7.78	0.89	3.86	229
8.20	8.00	8.69	0.91	4.17	218
9.20	9.00	9.62	0.93	4.33	214
10.95	10.75	11.27	1.65	7.11	233
11.93	11.73	12.21	0.94	3.87	243
12.93	12.73	13.18	0.96	4.33	223
13.95	13.75	14.16	0.99	4.10	241
14.88	14.68	15.07	0.90	3.75	241
15.88	15.68	16.04	0.98	4.50	217
16.88	16.68	17.02	0.98	4.05	242
17.85	17.65	17.97	0.95	4.80	198
18.85	18.65	18.96	0.98	3.75	262
19.88	19.68	19.97	1.01	4.21	241
20.90	20.70	20.98	1.01	3.94	255
21.82	21.62	21.89	0.91	3.18	286
22.82	22.62	22.87	0.99	3.63	272
23.85	23.65	23.89	1.02	4.39	232
24.80	24.60	24.83	0.94	3.63	259
25.80	25.60	25.82	0.99	4.09	242
26.80	26.60	26.82	0.99	3.63	273

Job No:	17-05010
Client:	Baffinland Iron Mines Corporation
Project:	Milne Port Expansion
Sounding ID:	SCPT17-D004
Date:	04-Apr-2017

Seismic Source:	Auto-seismic
Source Offset (m):	3.40
Source Depth (m):	0.00
Geophone Offset (m):	0.20

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (m)	Geophone Depth (m)	Ray Path (m)	Ray Path Difference (m)	Travel Time Interval (ms)	Interval Velocity (m/s)
27.82	27.62	27.83	1.01	3.63	278
28.82	28.62	28.82	0.99	3.94	252
29.82	29.62	29.81	0.99	3.79	262
30.77	30.57	30.76	0.94	3.48	271
31.80	31.60	31.78	1.02	3.79	270
32.05	31.85	32.03	0.25	0.91	274

Seismic Cone Penetration Test Plots

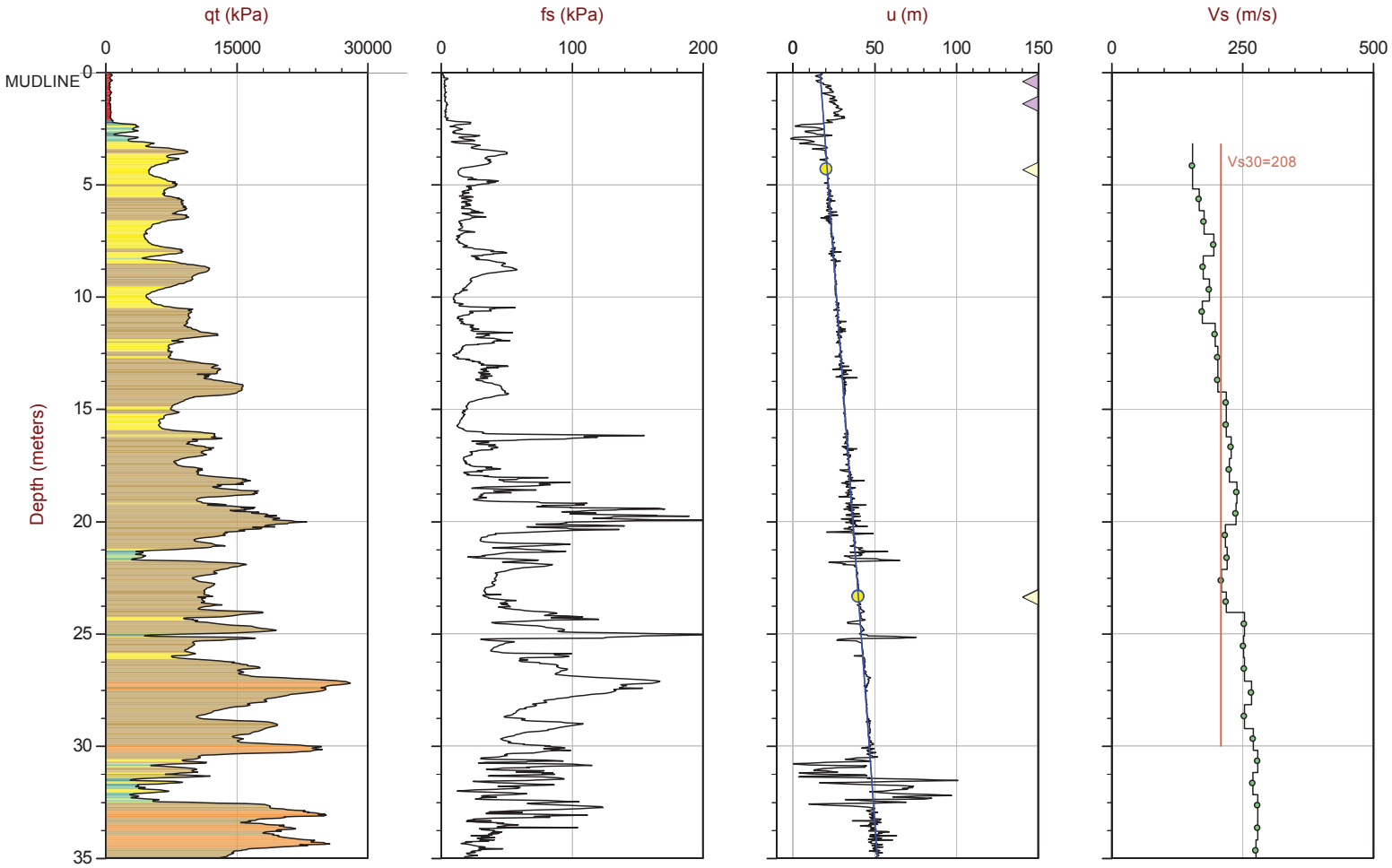
CONETEC

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-05 20:44
Site: Milne Port Expansion

Sounding: SCPT17-D002
Cone: 338:T1500F15U500



Max Depth: 39.475 m / 129.51 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 17-05010_SPD002.COR
Unit Wt: SBT (R&C1986)

SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976728.05m E: 503705.30m Elev: -16.12m

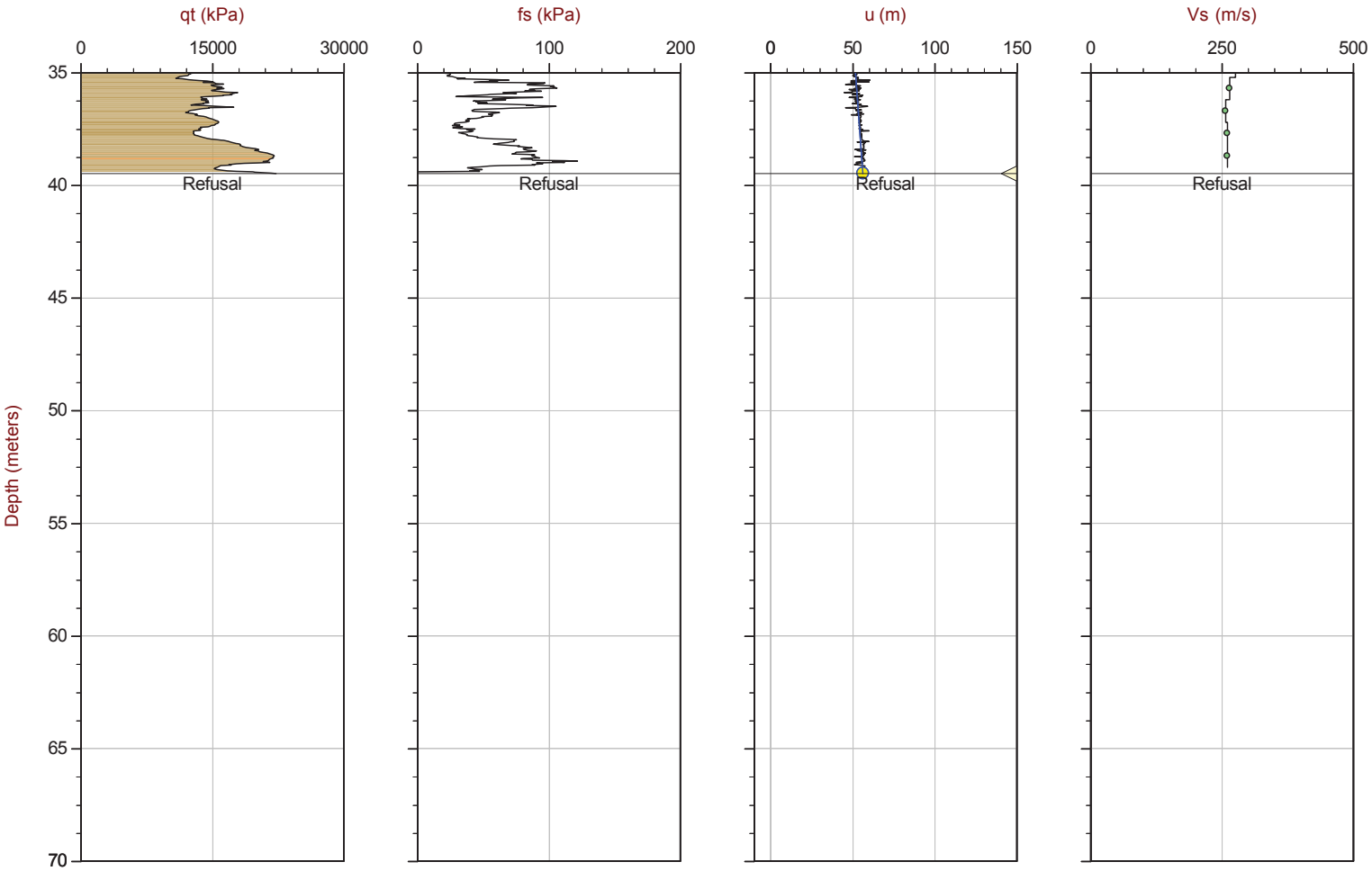
Equilibrium Pore Pressure (Ueq)
Dissipation, Ueq not achieved
Dissipation, Ueq achieved
Hydrostatic Line

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-05 20:44
Site: Milne Port Expansion

Sounding: SCPT17-D002
Cone: 338:T1500F15U500



Max Depth: 39.475 m / 129.51 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 17-05010_SPD002.COR
Unit Wt: SBT (R&C1986)

SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976728.05m E: 503705.30m Elev: -16.12m

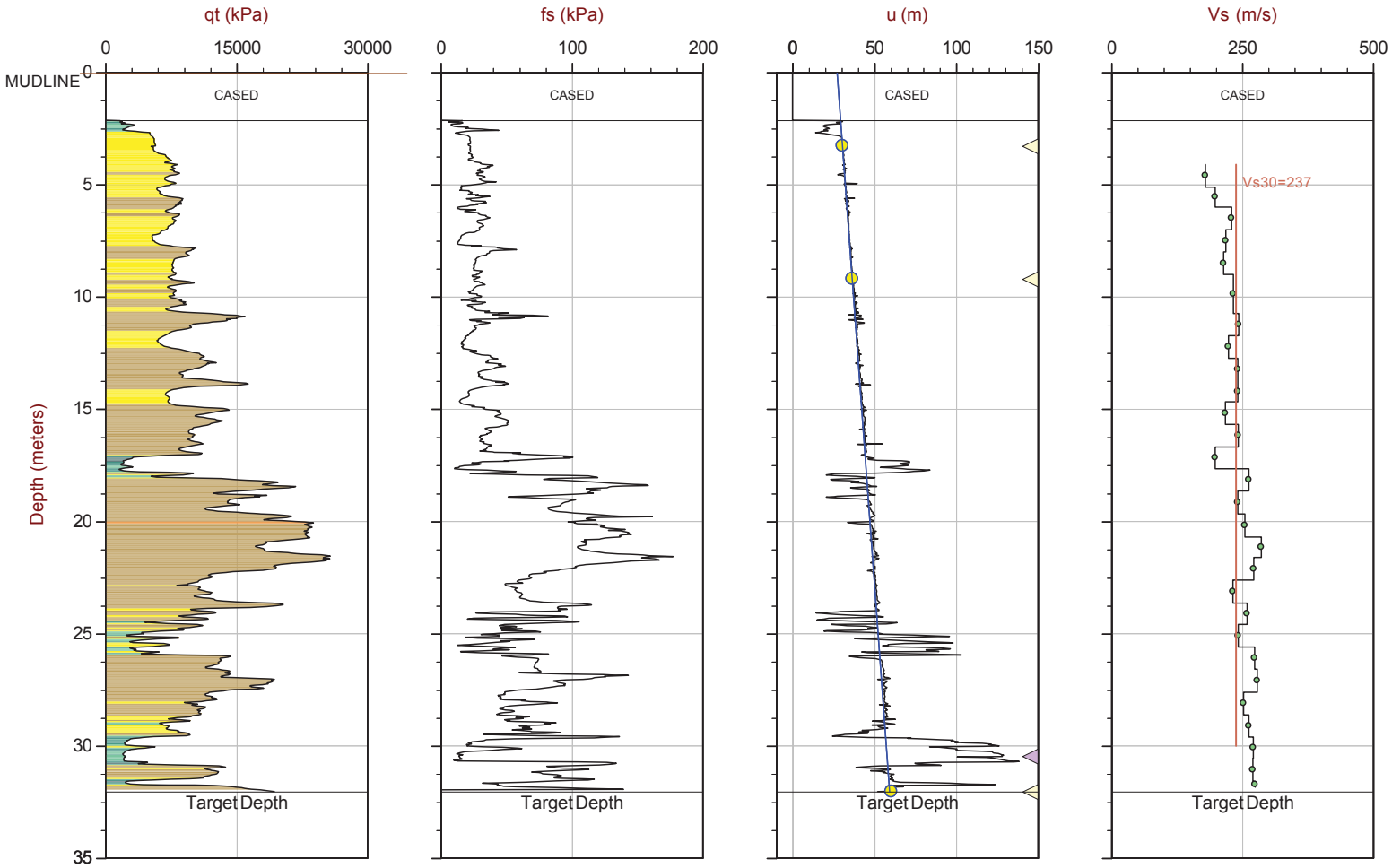
Equilibrium Pore Pressure (Ueq)
Dissipation, Ueq not achieved
Dissipation, Ueq achieved
Hydrostatic Line

CONETEC

Baffinland

Job No: 17-05010
Date: 2017-04-04 16:44
Site: Milne Port Expansion

Sounding: SCPT17-D004
Cone: 338:T1500F15U500



Max Depth: 32.050 m / 105.15 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 17-05010_SPD004.COR
Unit Wt: SBT (R&C1986)

SBT: Robertson and Campanella, 1986
Coords: UTM17N N: 7976768.10m E: 503646.44m Elev: -26.59m

Equilibrium Pore Pressure (Ueq)
Dissipation, Ueq not achieved
Dissipation, Ueq achieved
Hydrostatic Line

Pore Pressure Dissipation Summary and
Pore Pressure Dissipation Plots

CONETEC

Job No:	17-05010
Client:	Baffinland Iron Mines Corporation
Project:	Milne Port Expansion
Start Date:	03-Apr-2017
End Date:	07-Apr-2017

CPTu PORE PRESSURE DISSIPATION SUMMARY

Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (m)	Estimated Equilibrium Pore Pressure U_{eq} (m)	Calculated Phreatic Surface (m)
CPT17-D001	17-05010_CPD001	15	260	3.275	Not Achieved	
CPT17-D001	17-05010_CPD001	15	95	6.400	24.0	-17.6
CPT17-D001	17-05010_CPD001	15	300	10.475	28.1	-17.6
CPT17-D001	17-05010_CPD001	15	100	19.850	37.5	-17.6
CPT17-D001	17-05010_CPD001	15	400	20.575	38.5	-17.9
CPT17-D001	17-05010_CPD001	15	95	28.650	45.6	-16.9
CPT17-D001	17-05010_CPD001	15	150	29.600	46.7	-17.1
CPT17-D001	17-05010_CPD001	15	400	32.750	50.4	-17.7
SCPT17-D002	17-05010_SPD002	15	105	0.400	Not Achieved	
SCPT17-D002	17-05010_SPD002	15	110	1.375	Not Achieved	
SCPT17-D002	17-05010_SPD002	15	150	4.325	20.7	-16.4
SCPT17-D002	17-05010_SPD002	15	600	23.350	40.2	-16.9
SCPT17-D002	17-05010_SPD002	15	275	23.375	40.4	-17.0
SCPT17-D002	17-05010_SPD002	15	200	39.475	56.6	-17.1
CPT17-D003	17-05010_CPD003	15	110	5.200	28.2	-23.0
CPT17-D003	17-05010_CPD003	15	400	15.300	38.5	-23.2
CPT17-D003	17-05010_CPD003	15	105	16.300	39.6	-23.3
CPT17-D003	17-05010_CPD003	15	1200	30.425	54.1	-23.7
SCPT17-D004	17-05010_SPD004	15	95	3.275	30.4	-27.1
SCPT17-D004	17-05010_SPD004	15	300	9.200	36.5	-27.3
SCPT17-D004	17-05010_SPD004	15	600	30.475	Not Achieved	
SCPT17-D004	17-05010_SPD004	15	300	32.050	60.3	-28.2
CPT17-D005	17-05010_CPD005	15	1340	2.275	28.3	-26.0
CPT17-D005	17-05010_CPD005	15	110	3.325	29.5	-26.2
CPT17-D005	17-05010_CPD005	15	95	5.375	31.8	-26.4
CPT17-D005	17-05010_CPD005	15	145	6.375	Not Achieved	
CPT17-D005	17-05010_CPD005	15	110	7.400	33.5	-26.1
CPT17-D005	17-05010_CPD005	15	125	9.350	Not Achieved	
CPT17-D005	17-05010_CPD005	15	300	10.300	36.5	-26.2

Job No:	17-05010
Client:	Baffinland Iron Mines Corporation
Project:	Milne Port Expansion
Start Date:	03-Apr-2017
End Date:	07-Apr-2017

CPTu PORE PRESSURE DISSIPATION SUMMARY

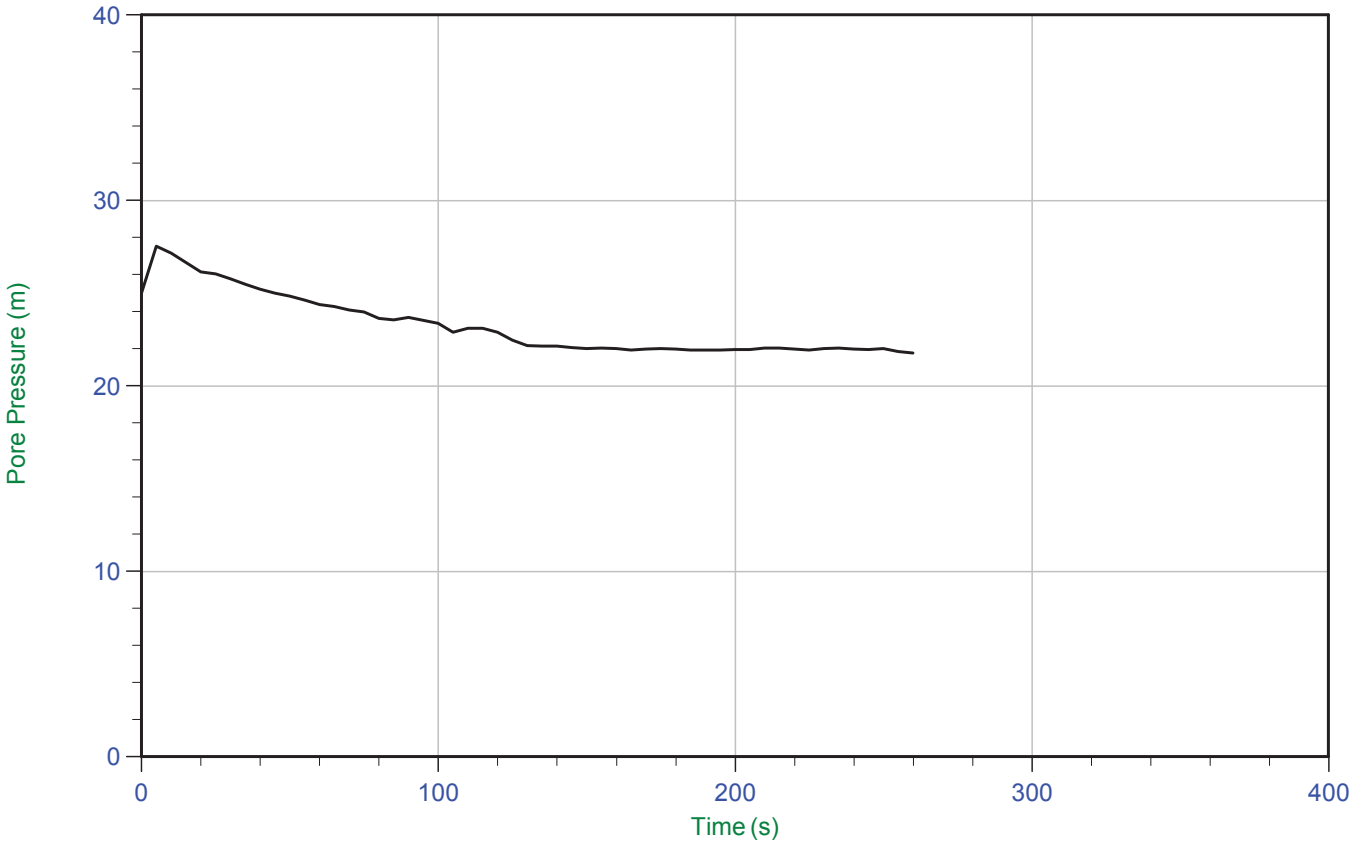
Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (m)	Estimated Equilibrium Pore Pressure U_{eq} (m)	Calculated Phreatic Surface (m)
CPT17-D005	17-05010_CPD005	15	1460	12.350	38.8	-26.4
CPT17-D005	17-05010_CPD005	15	275	13.175	Not Achieved	
CPT17-D005	17-05010_CPD005	15	305	15.050	41.7	-26.6
CPT17-D005	17-05010_CPD005	15	165	18.100	44.7	-26.6
CPT17-D005	17-05010_CPD005	15	130	23.925	50.7	-26.8
CPT17-D005	17-05010_CPD005	15	300	25.125	51.9	-26.8
CPT17-D006	17-05010_CPD006	15	105	2.300	Not Achieved	
CPT17-D006	17-05010_CPD006	15	2100	3.300	35.3	-32.0
CPT17-D006	17-05010_CPD006	15	300	20.575	52.4	-31.8
CPT17-D007	17-05010_CPD007	15	200	10.100	14.8	-4.7
CPT17-D007	17-05010_CPD007	15	200	20.150	25.1	-5.0
CPT17-D007	17-05010_CPD007	15	200	30.200	35.5	-5.3
CPT17-D008	17-05010_CPD008	15	180	2.075	Not Achieved	
CPT17-D008	17-05010_CPD008	15	200	20.500	21.9	-1.4
CPT17-D008	17-05010_CPD008	15	120	28.975	30.4	-1.4
CPT17-D008	17-05010_CPD008	15	405	30.000	32.2	-2.2

CONETEC

Baffinland

Job No: 17-05010
Date: 04/05/2017 09:17
Site: Milne Port Expansion

Sounding: CPT17-D001
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD001.PPF
Depth: 3.275 m / 10.745 ft
Duration: 260.0 s

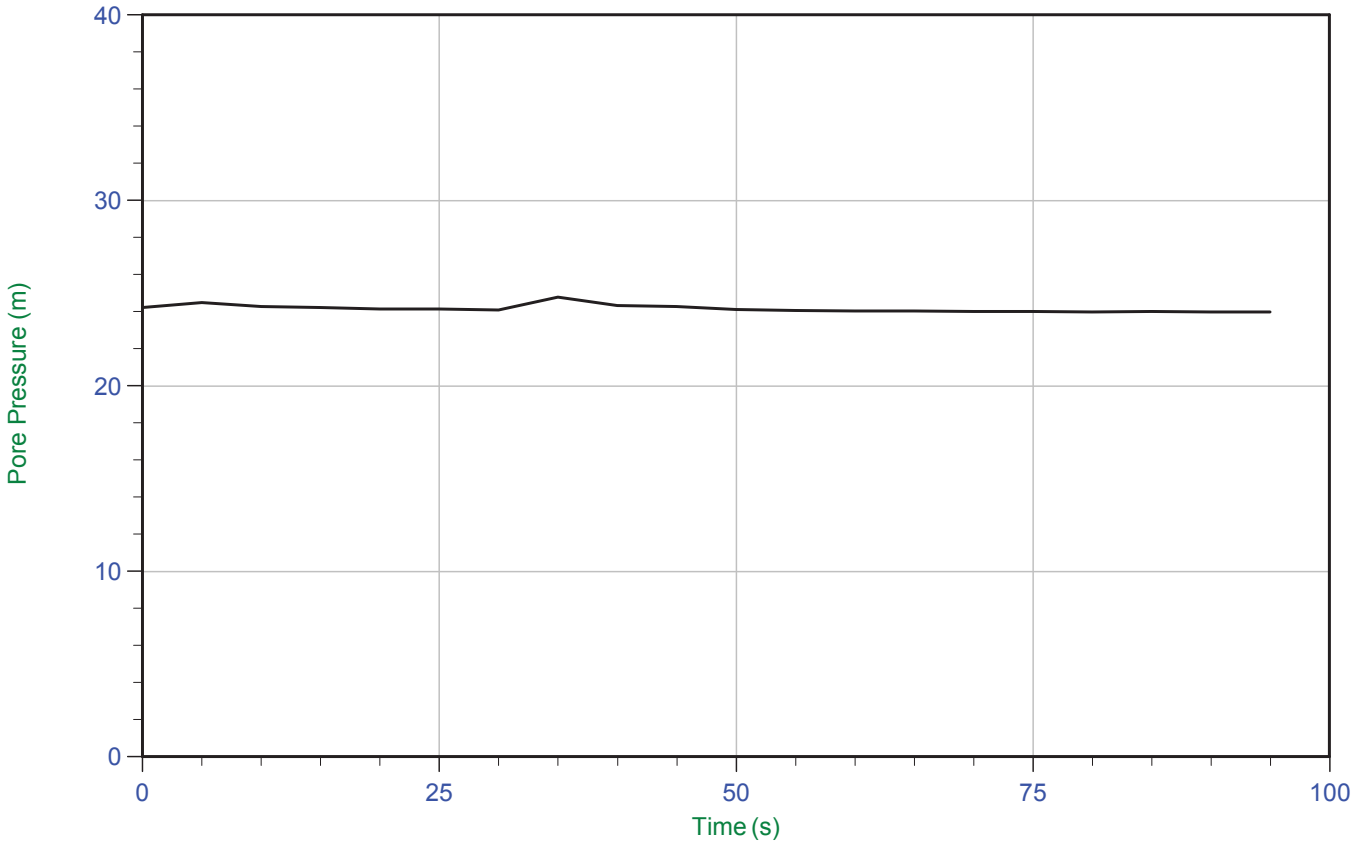
U Min: 21.8 m
U Max: 27.5 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/05/2017 09:17
Site: Milne Port Expansion

Sounding: CPT17-D001
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD001.PPF
Depth: 6.400 m / 20.997 ft
Duration: 95.0 s

U Min: 24.0 m
U Max: 24.8 m

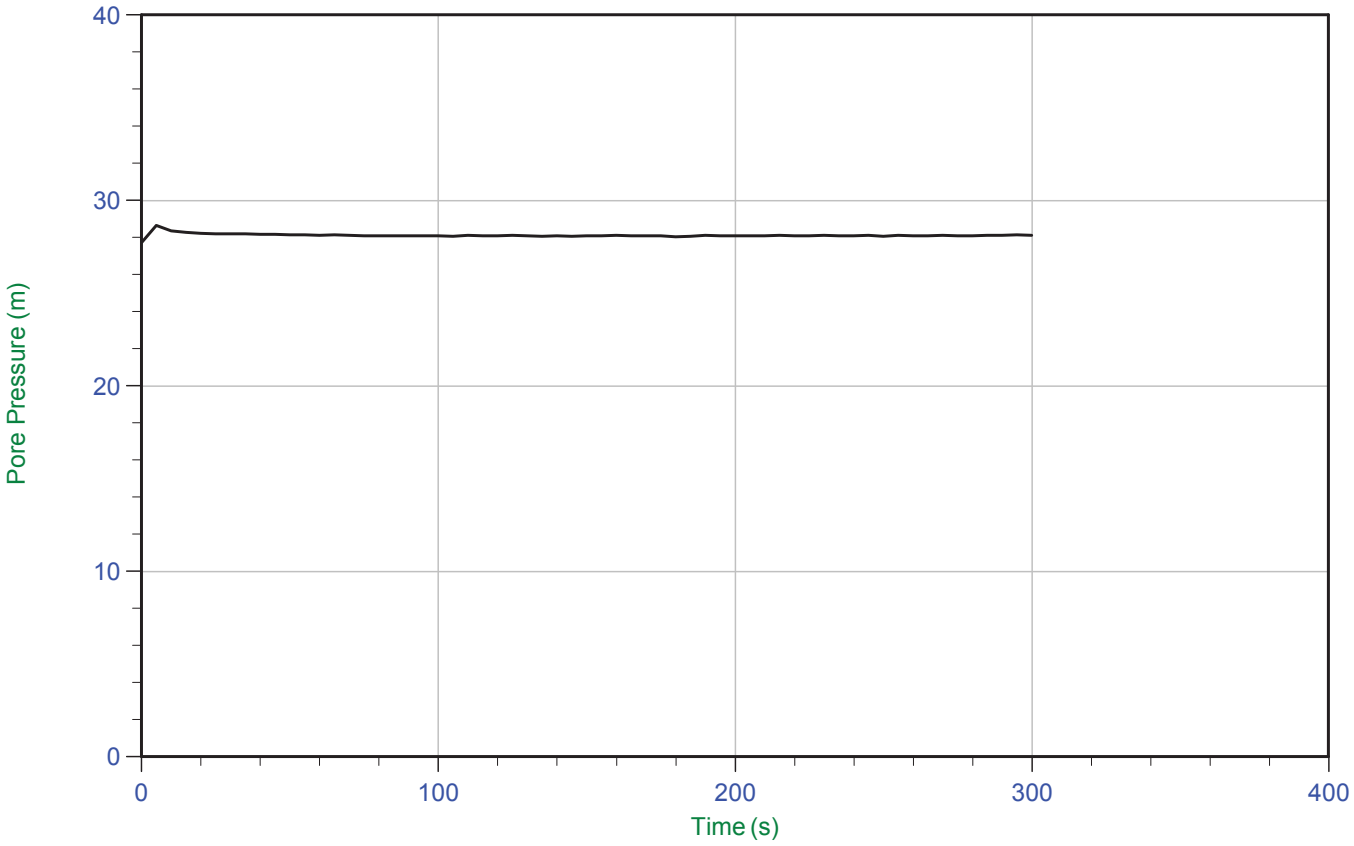
WT: -17.600 m / -57.742 ft
Ueq: 24.0 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/05/2017 09:17
Site: Milne Port Expansion

Sounding: CPT17-D001
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD001.PPF
Depth: 10.475 m / 34.366 ft
Duration: 300.0 s

U Min: 27.7 m
U Max: 28.6 m

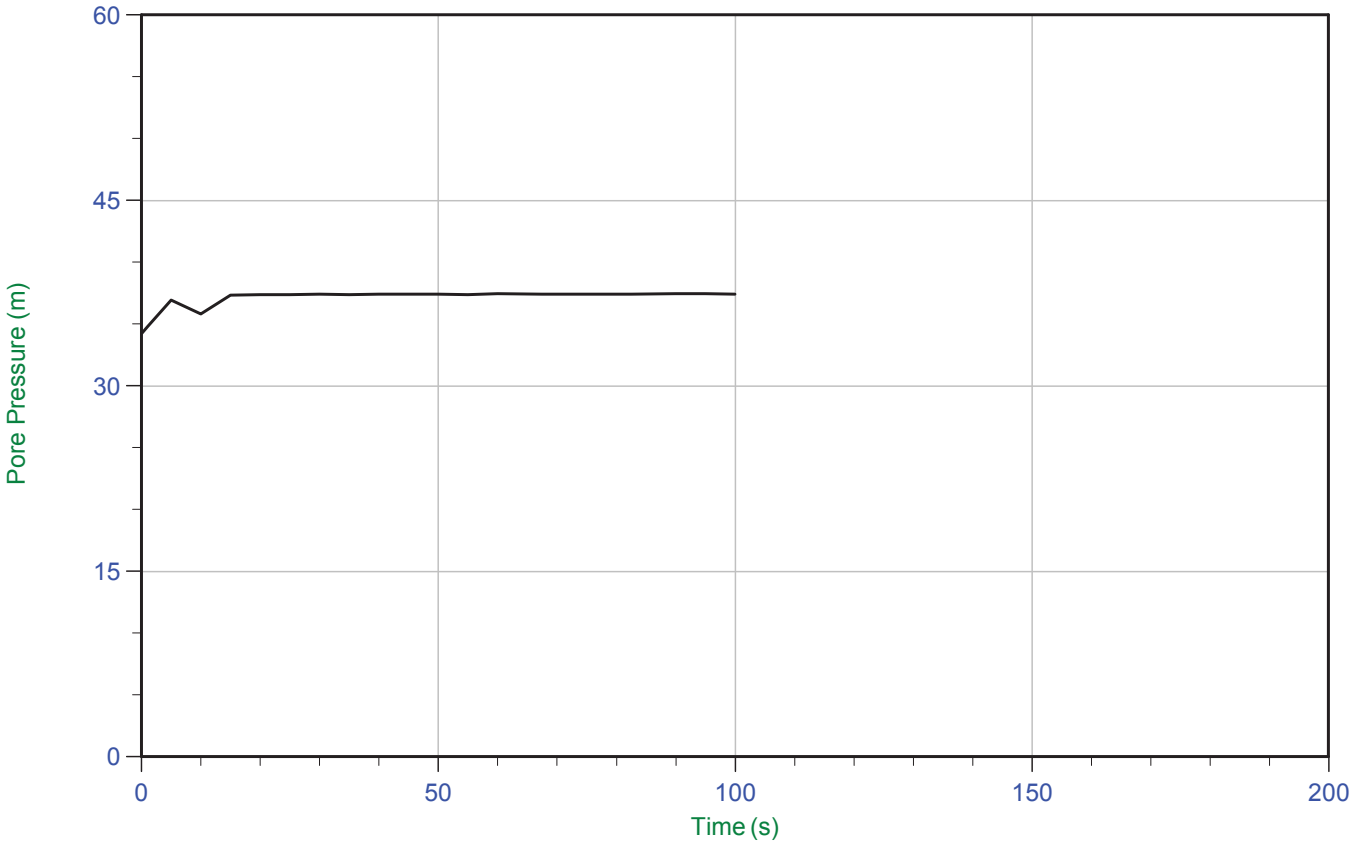
WT: -17.646 m / -57.893 ft
Ueq: 28.1 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/05/2017 09:17
Site: Milne Port Expansion

Sounding: CPT17-D001
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD001.PPF
Depth: 19.850 m / 65.124 ft
Duration: 100.0 s

U Min: 34.2 m
U Max: 37.5 m

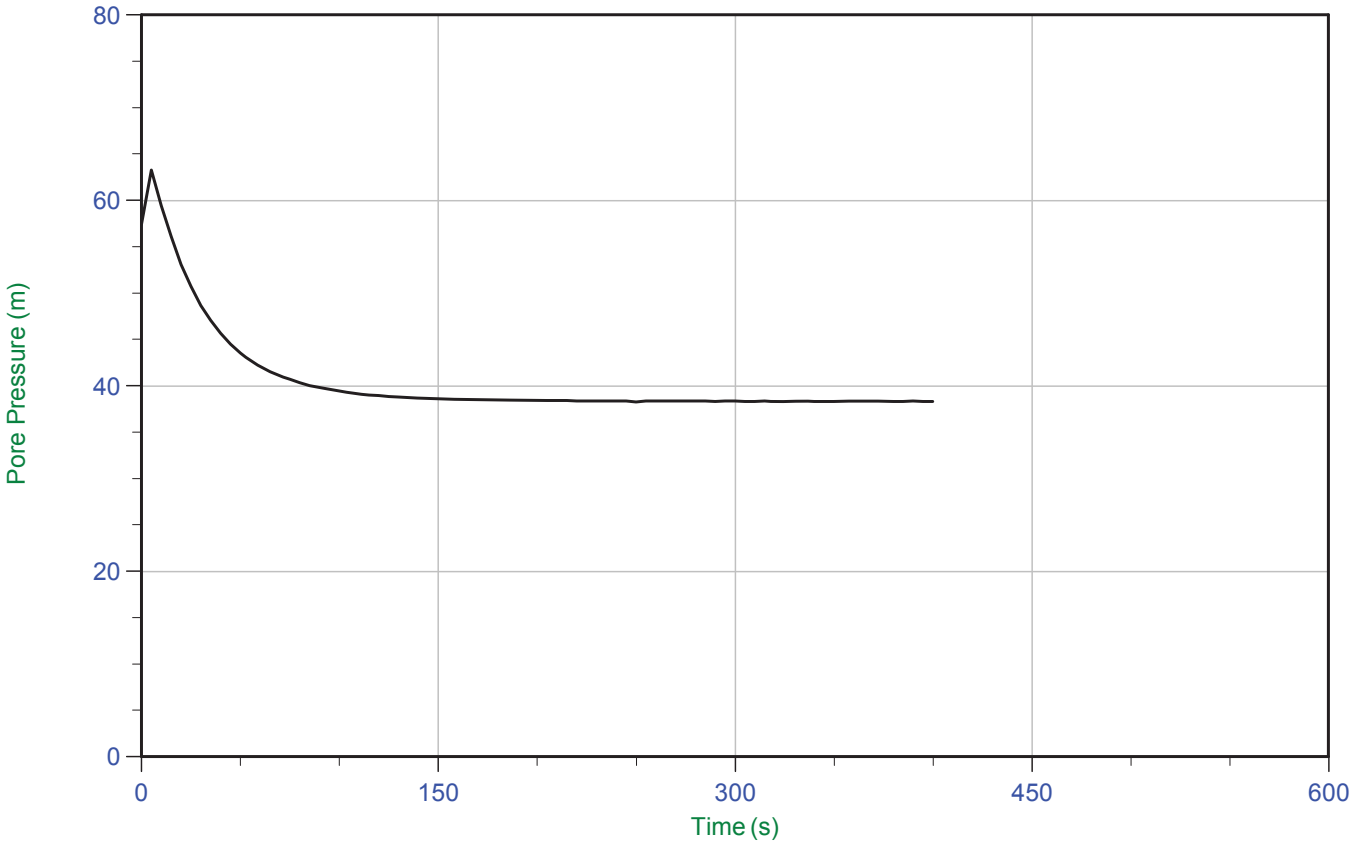
WT: -17.605 m / -57.758 ft
Ueq: 37.5 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/05/2017 09:17
Site: Milne Port Expansion

Sounding: CPT17-D001
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD001.PPF
Depth: 20.575 m / 67.502 ft
Duration: 400.0 s

U Min: 38.3 m
U Max: 63.3 m

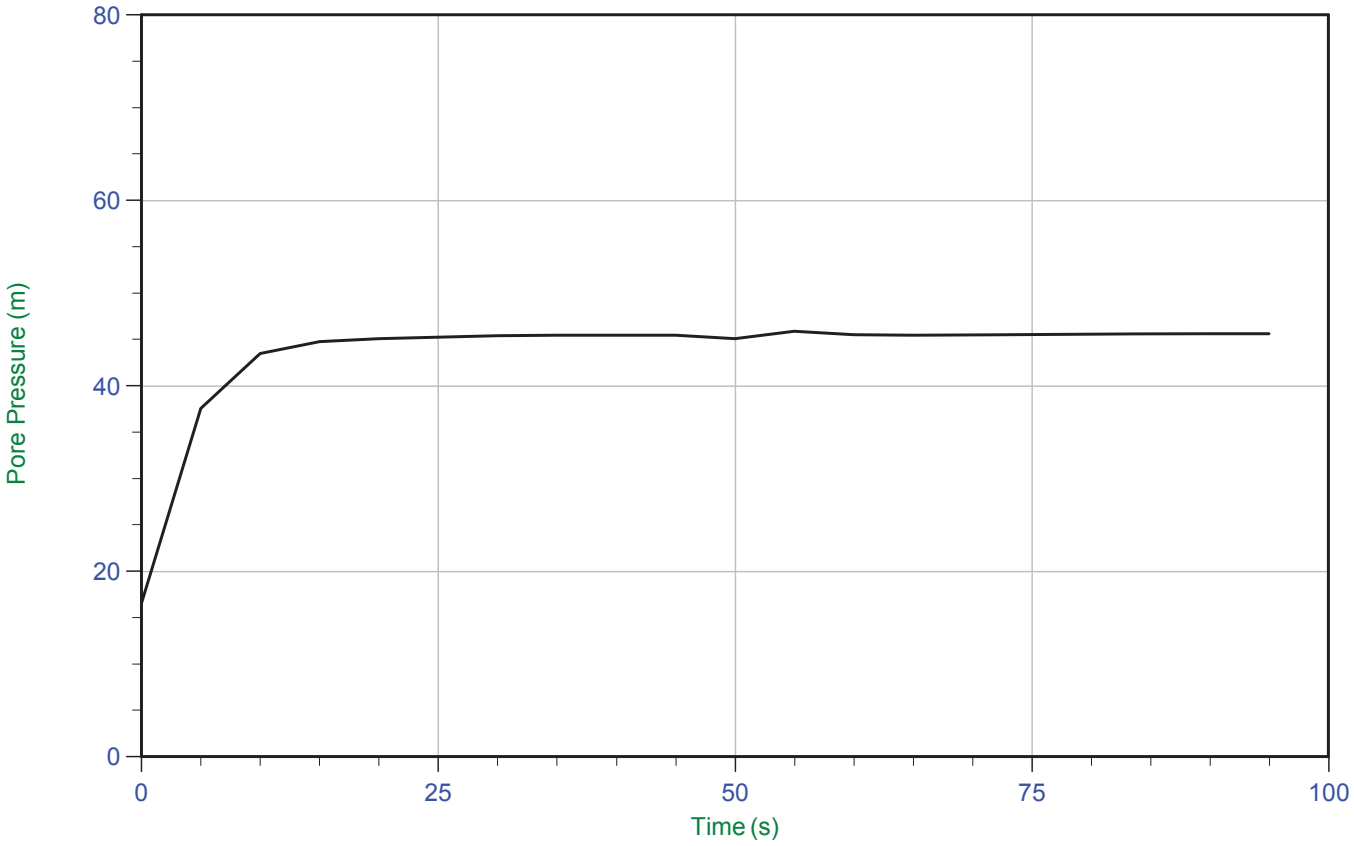
WT: -17.890 m / -58.694 ft
Ueq: 38.5 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/05/2017 09:17
Site: Milne Port Expansion

Sounding: CPT17-D001
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD001.PPF
Depth: 28.650 m / 93.995 ft
Duration: 95.0 s

U Min: 16.6 m
U Max: 45.9 m

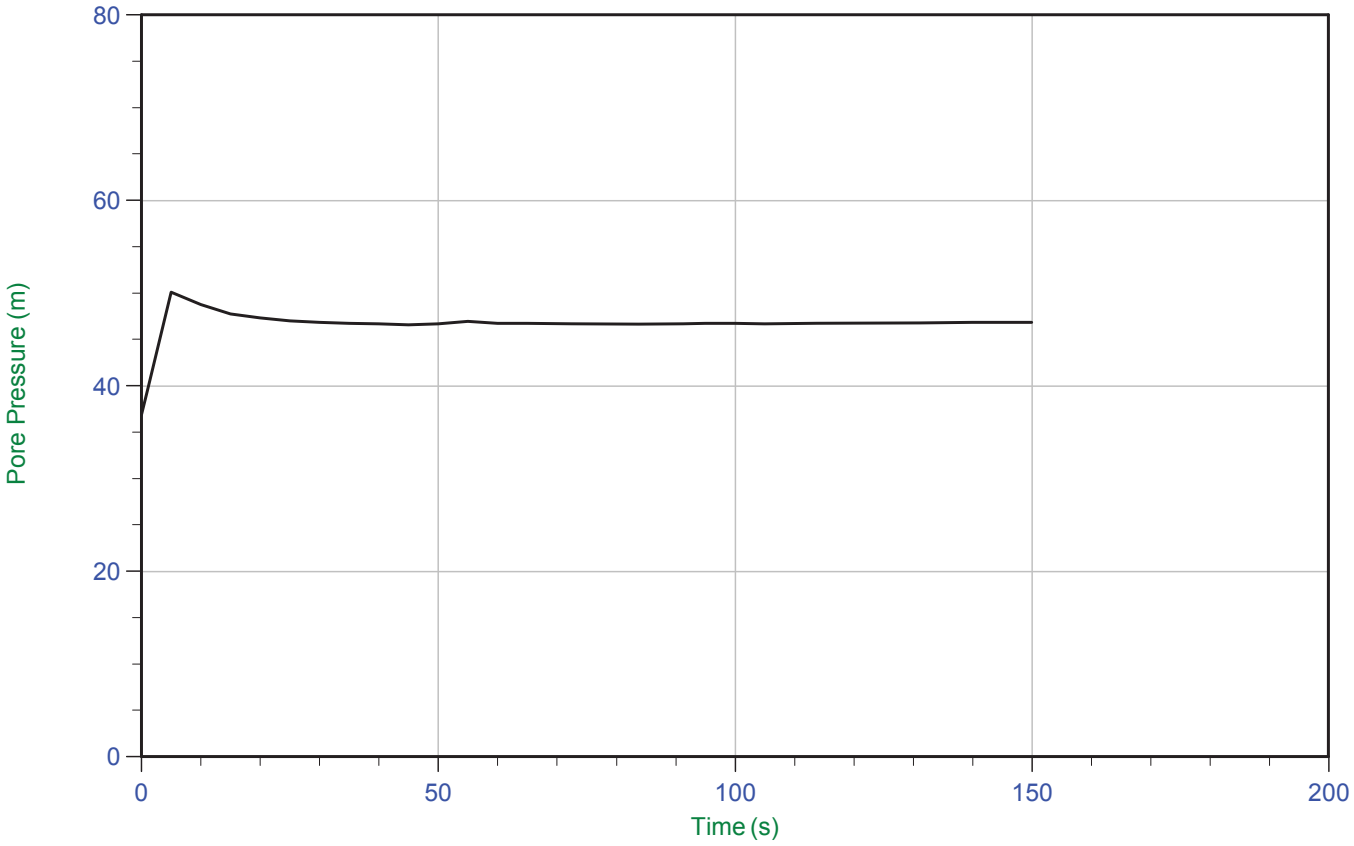
WT: -16.926 m / -55.531 ft
Ueq: 45.6 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/05/2017 09:17
Site: Milne Port Expansion

Sounding: CPT17-D001
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD001.PPF
Depth: 29.600 m / 97.112 ft
Duration: 150.0 s

U Min: 36.9 m
U Max: 50.1 m

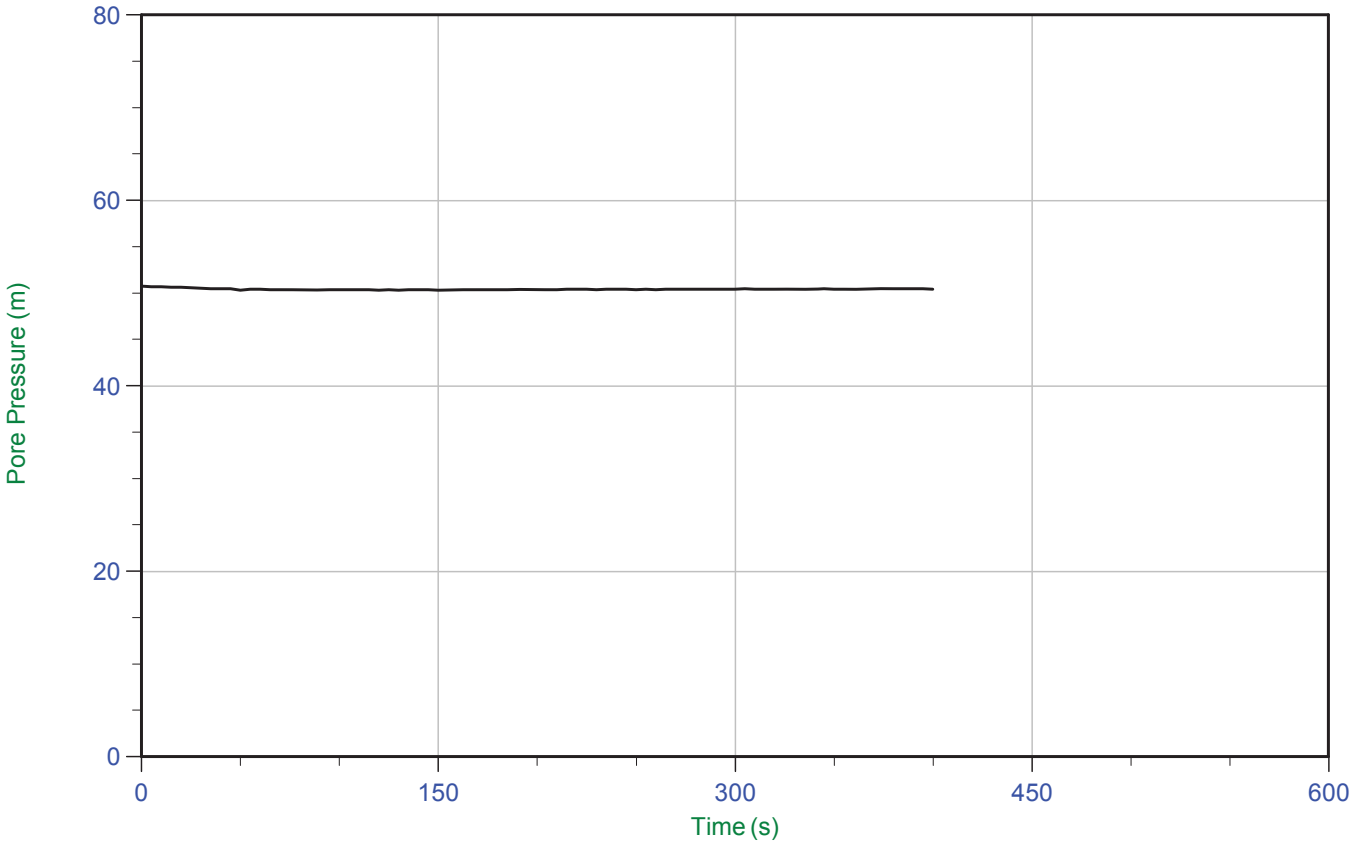
WT: -17.107 m / -56.125 ft
Ueq: 46.7 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/05/2017 09:17
Site: Milne Port Expansion

Sounding: CPT17-D001
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD001.PPF
Depth: 32.750 m / 107.446 ft
Duration: 400.0 s

U Min: 50.3 m
U Max: 50.7 m

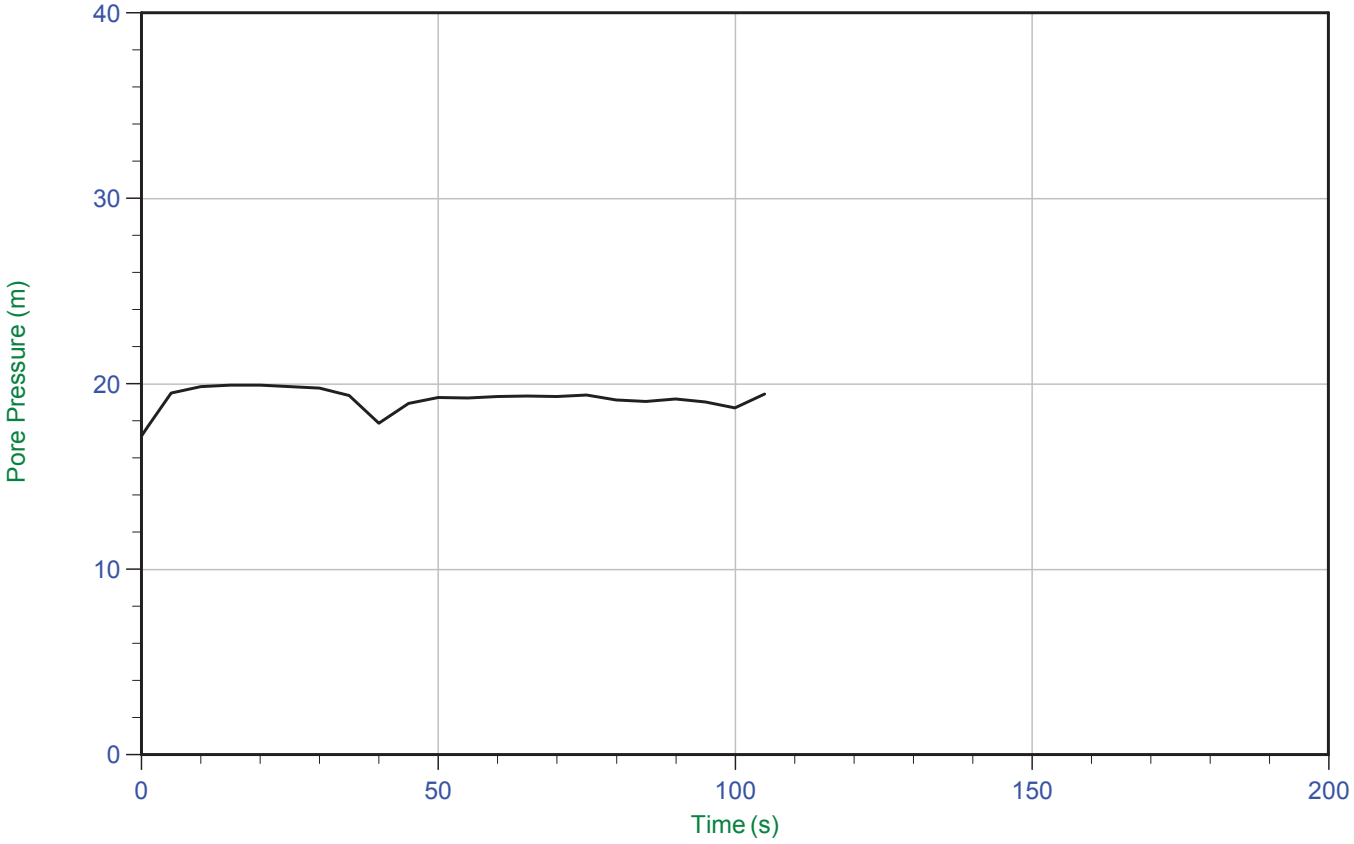
WT: -17.674 m / -57.985 ft
Ueq: 50.4 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/05/2017 20:44
Site: Milne Port Expansion

Sounding: SCPT17-D002
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_SPD002.PPF
Depth: 0.400 m / 1.312 ft
Duration: 105.0 s

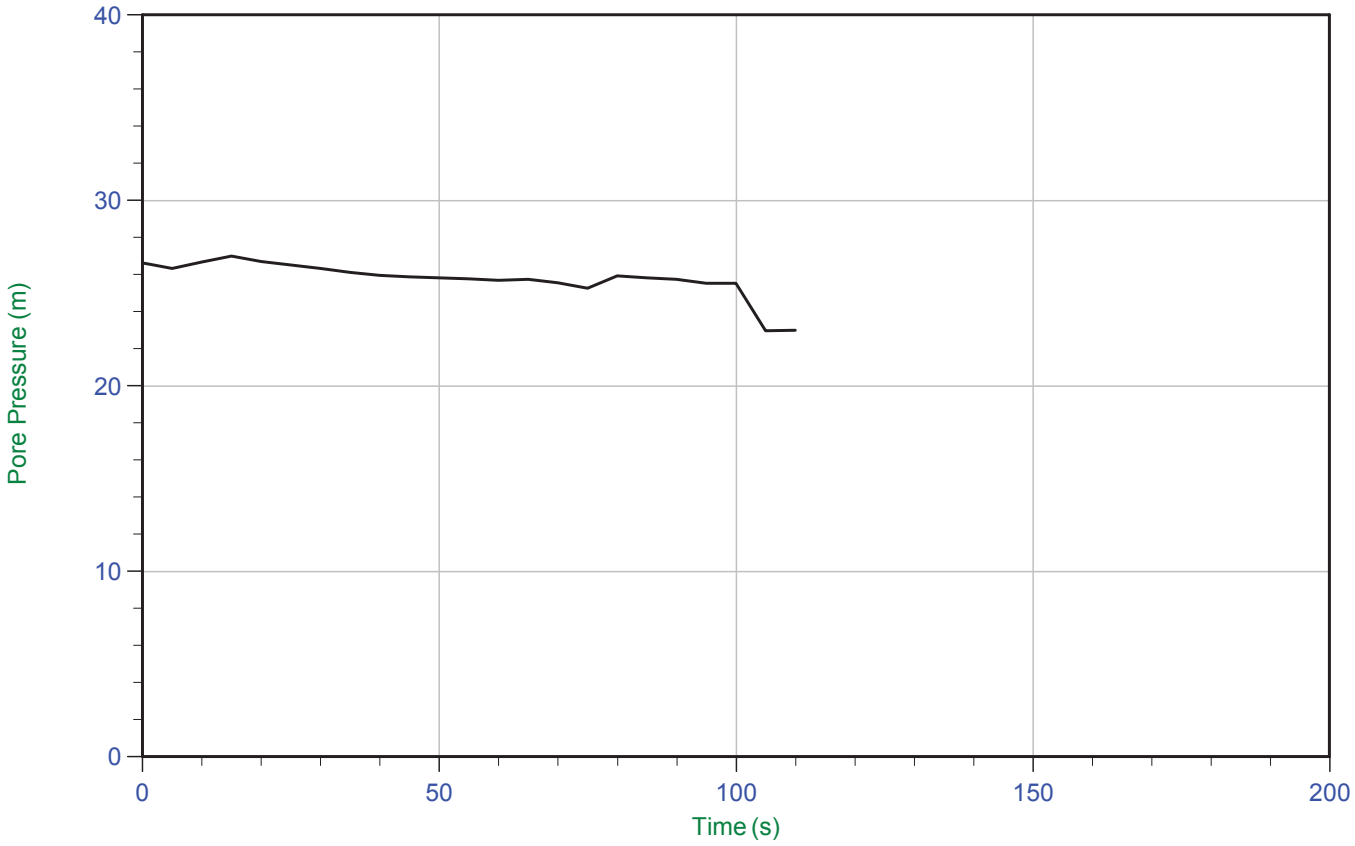
U Min: 17.2 m
U Max: 19.9 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/05/2017 20:44
Site: Milne Port Expansion

Sounding: SCPT17-D002
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_SPD002.PPF
Depth: 1.375 m / 4.511 ft
Duration: 110.0 s

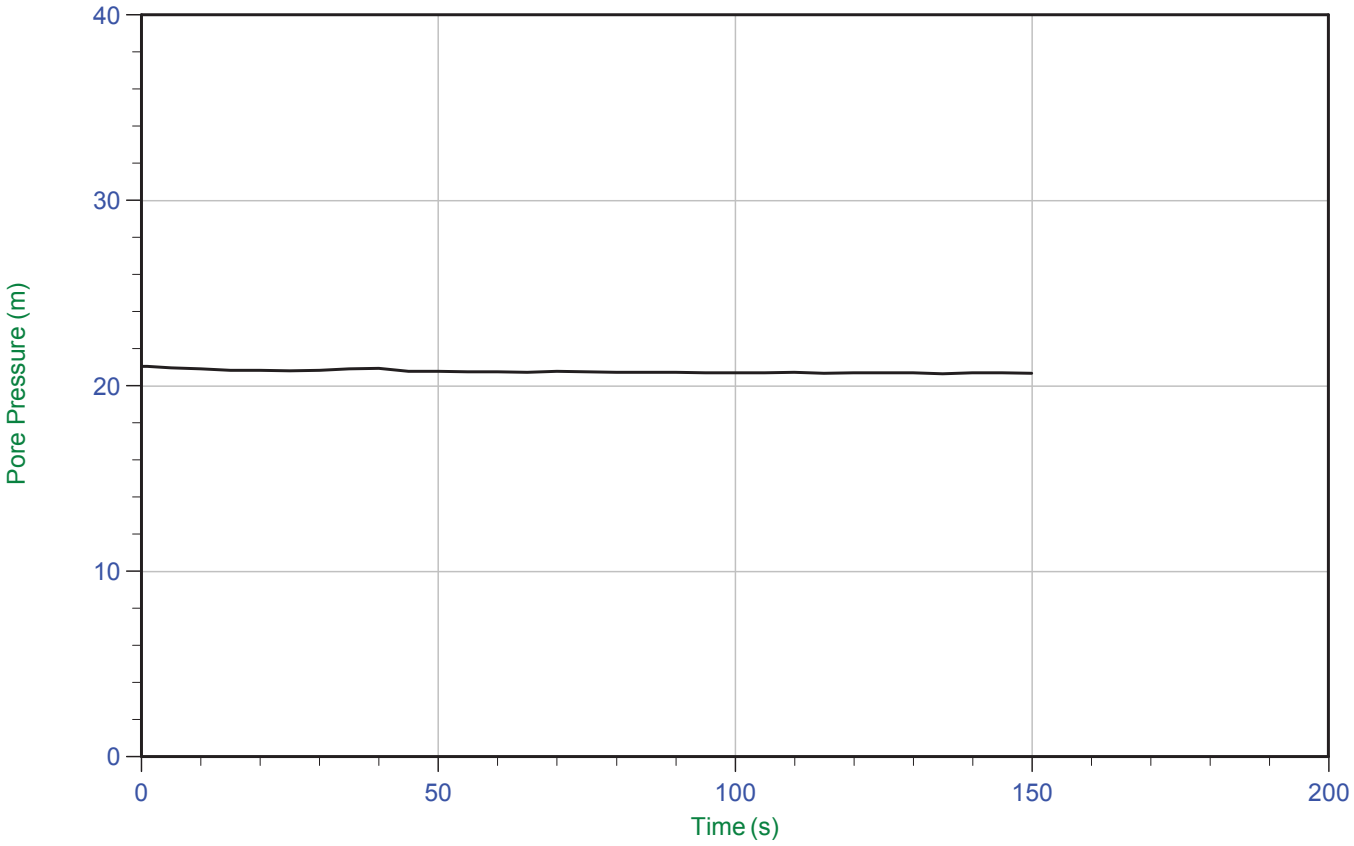
U Min: 23.0 m
U Max: 27.0 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/05/2017 20:44
Site: Milne Port Expansion

Sounding: SCPT17-D002
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_SPD002.PPF
Depth: 4.325 m / 14.189 ft
Duration: 150.0 s

U Min: 20.7 m
U Max: 21.1 m

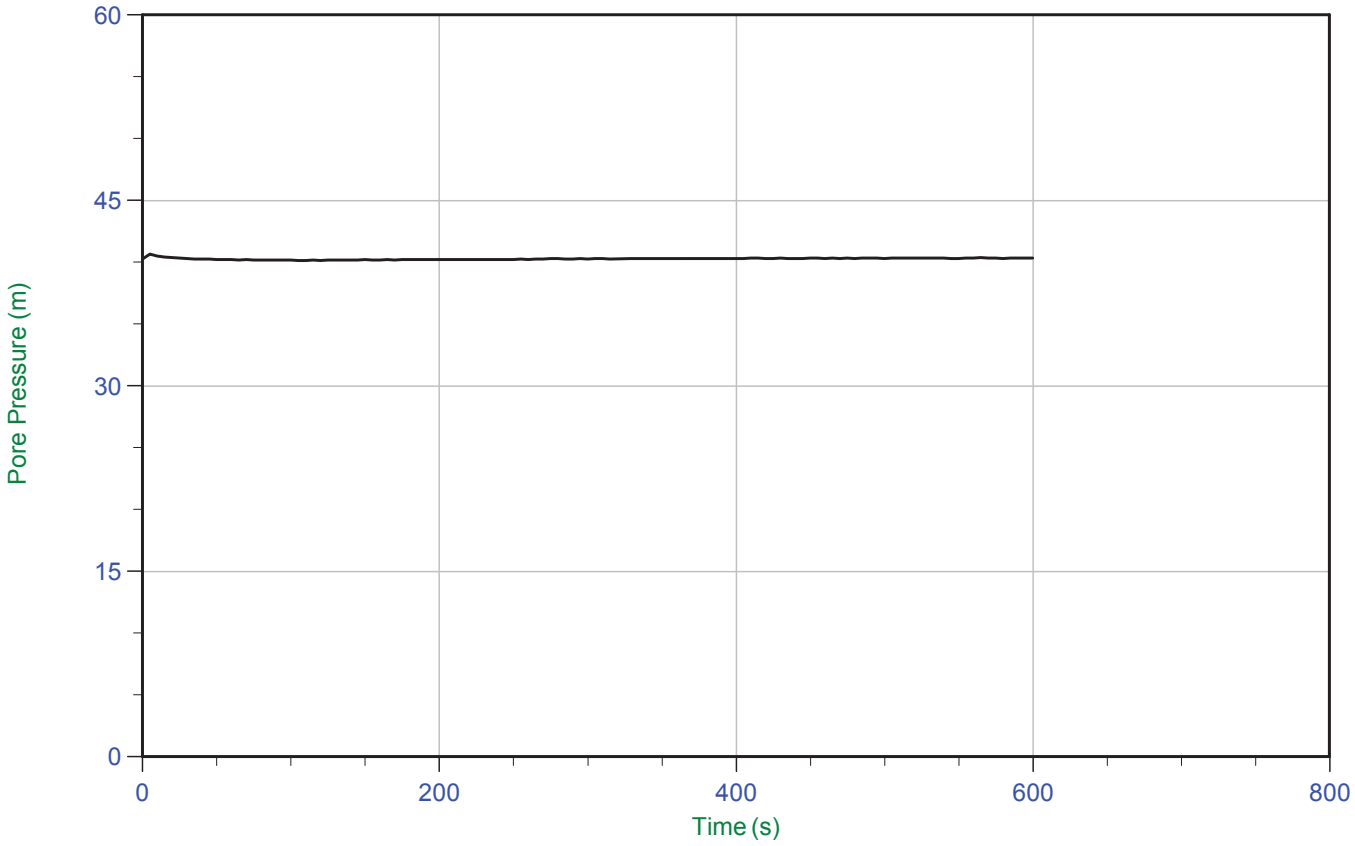
WT: -16.362 m / -53.680 ft
Ueq: 20.7 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/05/2017 20:44
Site: Milne Port Expansion

Sounding: SCPT17-D002
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_SPD002.PPF
Depth: 23.350 m / 76.607 ft
Duration: 600.0 s

U Min: 40.1 m
U Max: 40.6 m

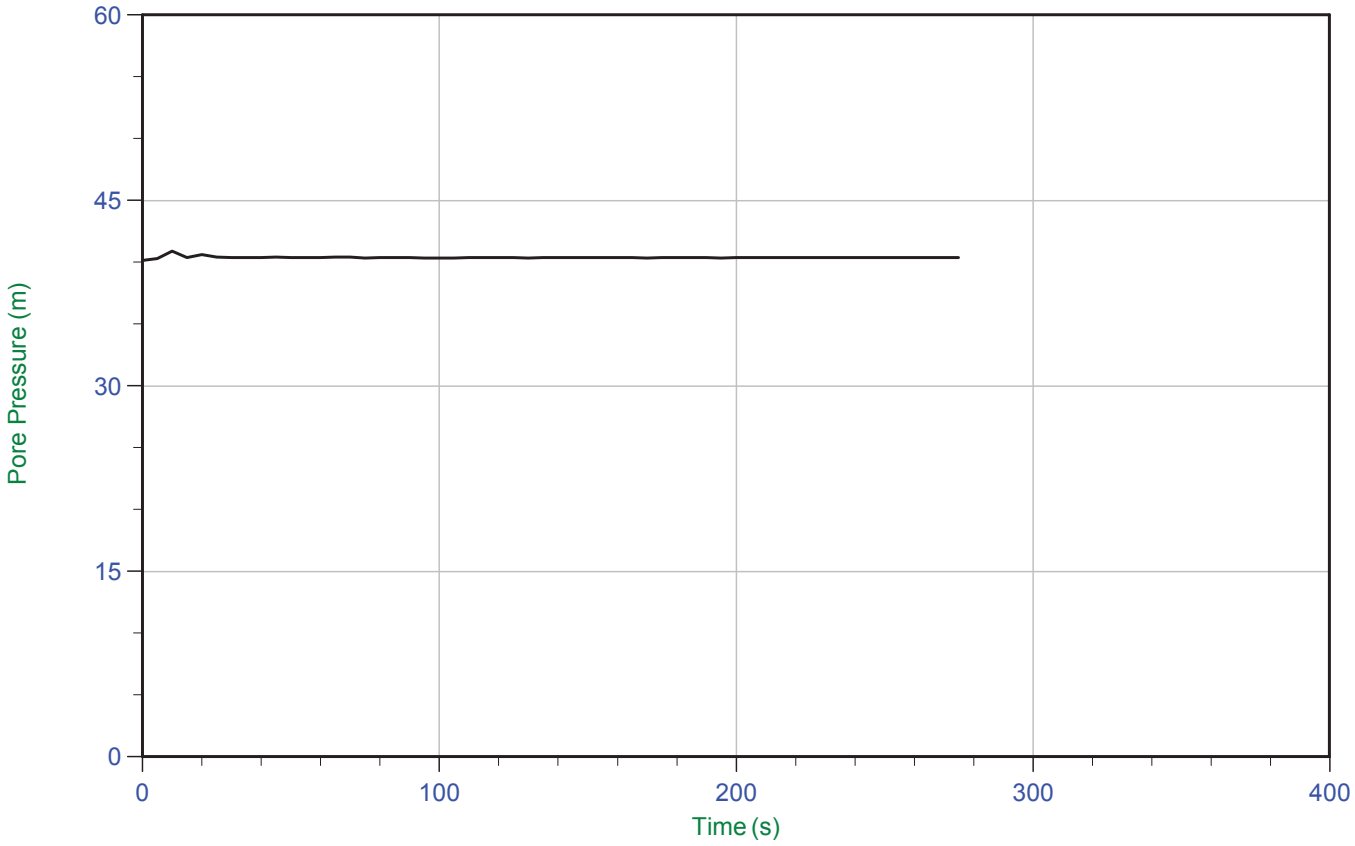
WT: -16.892 m / -55.419 ft
Ueq: 40.2 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/05/2017 20:44
Site: Milne Port Expansion

Sounding: SCPT17-D002
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_SPD002.PPF
Depth: 23.375 m / 76.689 ft
Duration: 275.0 s

U Min: 40.2 m
U Max: 40.9 m

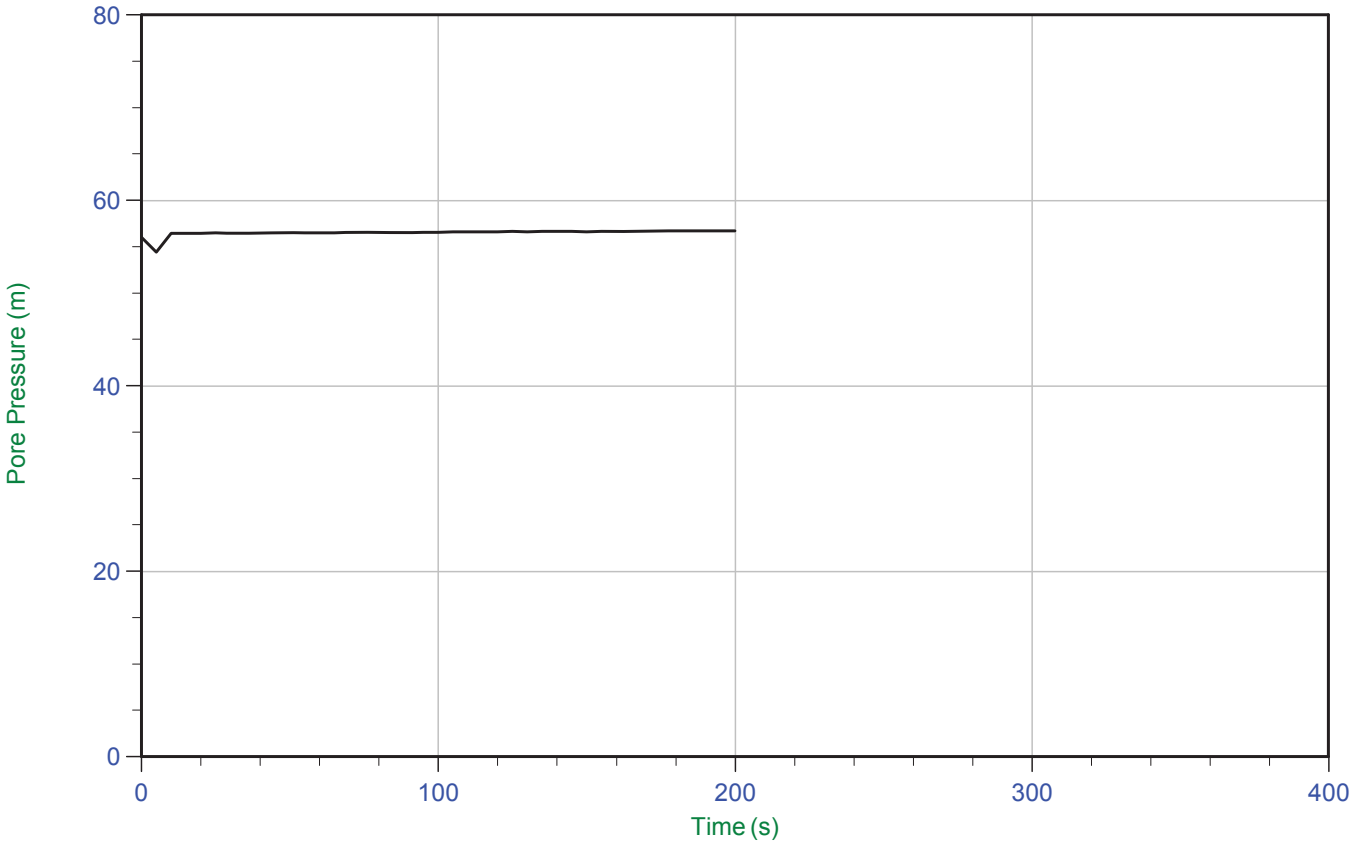
WT: -16.989 m / -55.738 ft
Ueq: 40.4 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/05/2017 20:44
Site: Milne Port Expansion

Sounding: SCPT17-D002
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_SPD002.PPF
Depth: 39.475 m / 129.510 ft
Duration: 200.0 s

U Min: 54.4 m
U Max: 56.7 m

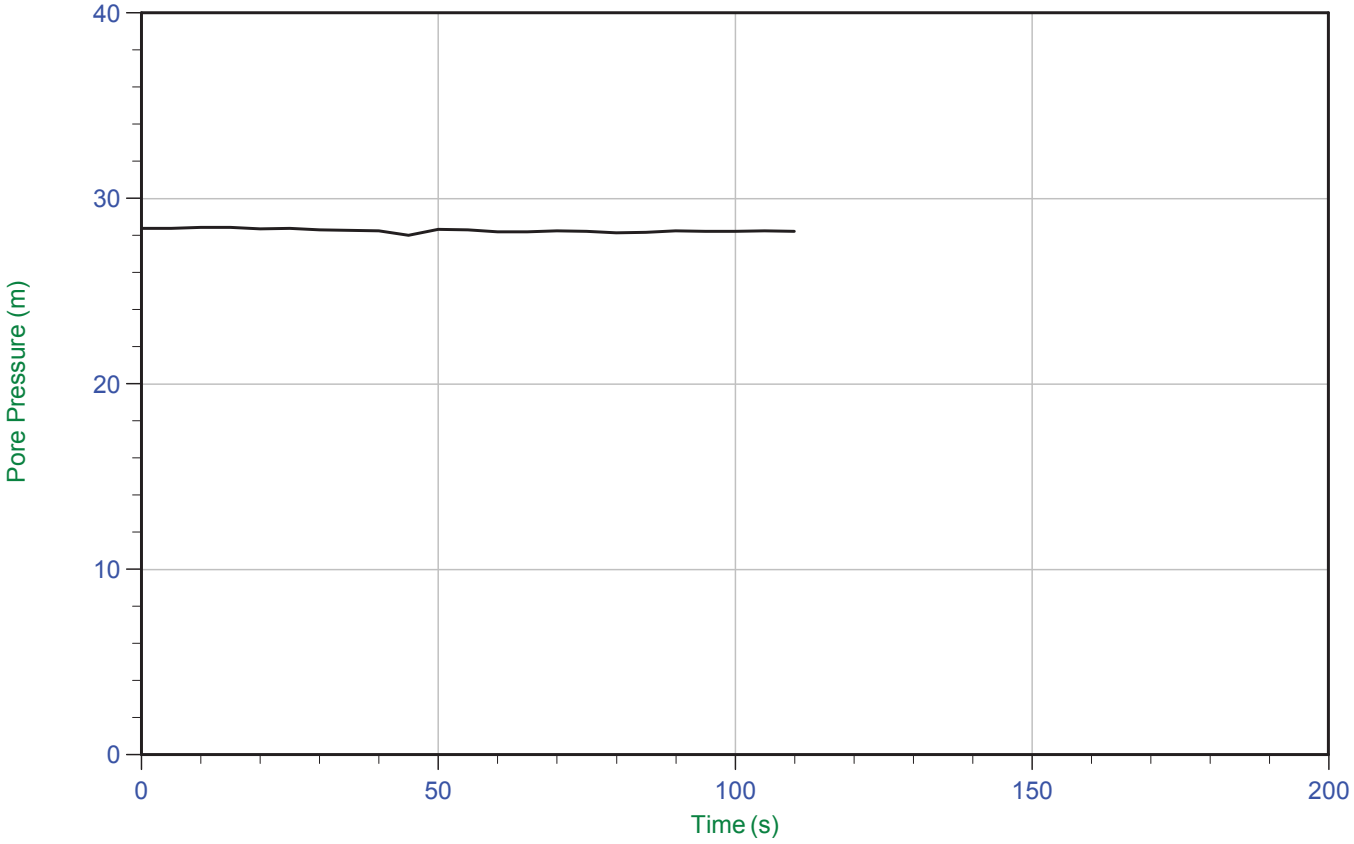
WT: -17.091 m / -56.072 ft
Ueq: 56.6 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/06/2017 13:34
Site: Milne Port Expansion

Sounding: CPT17-D003
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD003.PPF
Depth: 5.200 m / 17.060 ft
Duration: 110.0 s

U Min: 28.0 m
U Max: 28.4 m

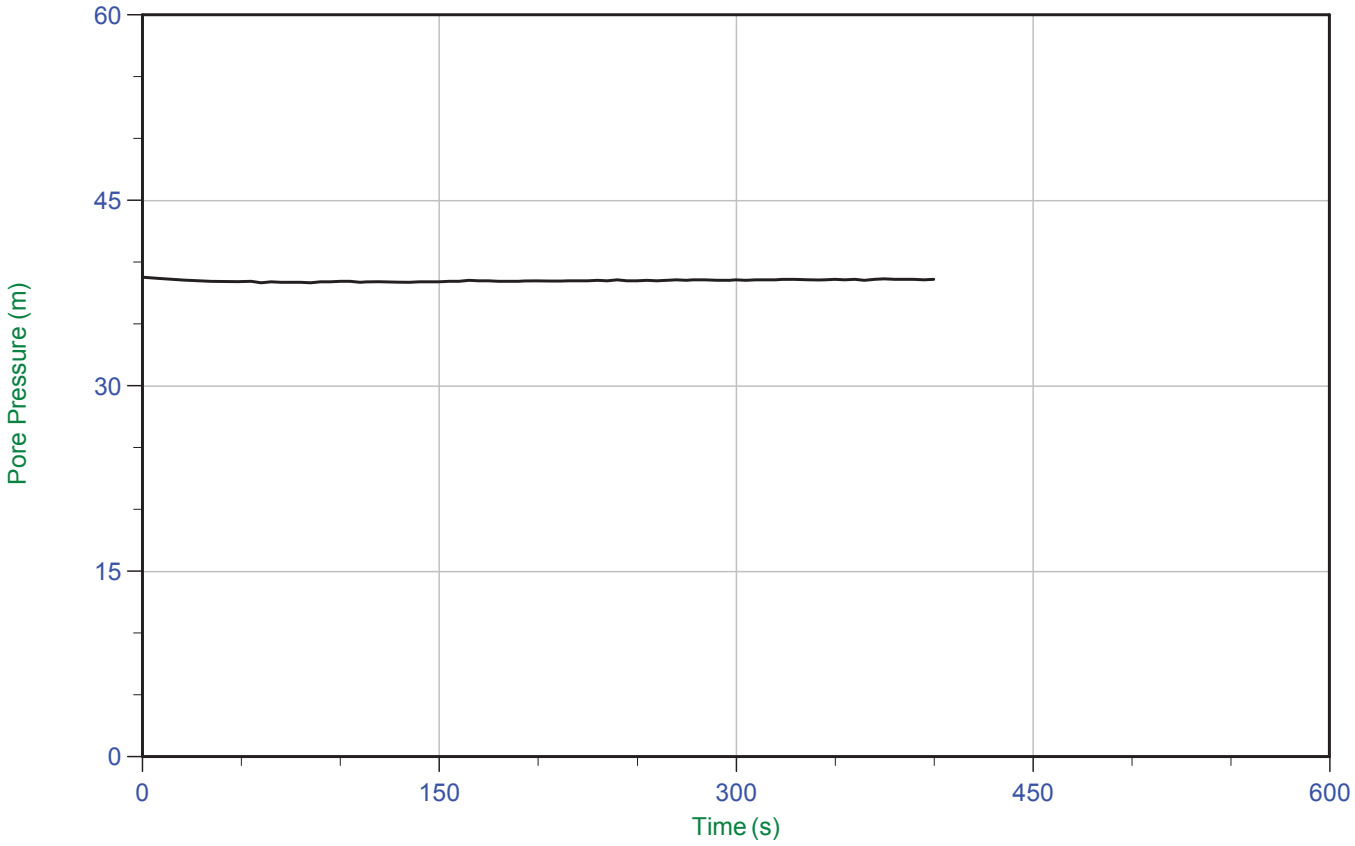
WT: -23.002 m / -75.465 ft
Ueq: 28.2 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/06/2017 13:34
Site: Milne Port Expansion

Sounding: CPT17-D003
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD003.PPF
Depth: 15.300 m / 50.196 ft
Duration: 400.0 s

U Min: 38.3 m
U Max: 38.8 m

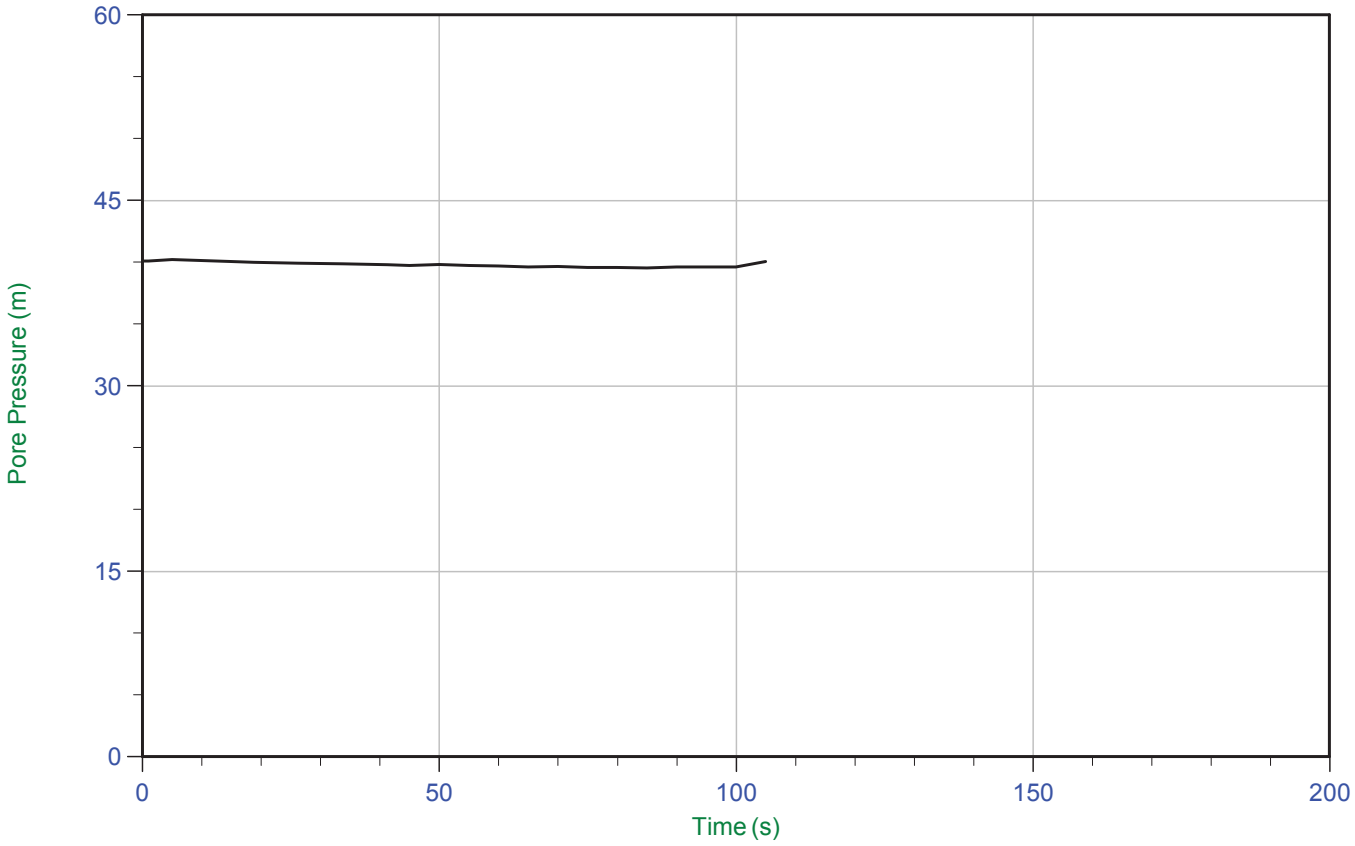
WT: -23.245 m / -76.262 ft
Ueq: 38.5 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/06/2017 13:34
Site: Milne Port Expansion

Sounding: CPT17-D003
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD003.PPF
Depth: 16.300 m / 53.477 ft
Duration: 105.0 s

U Min: 39.5 m
U Max: 40.2 m

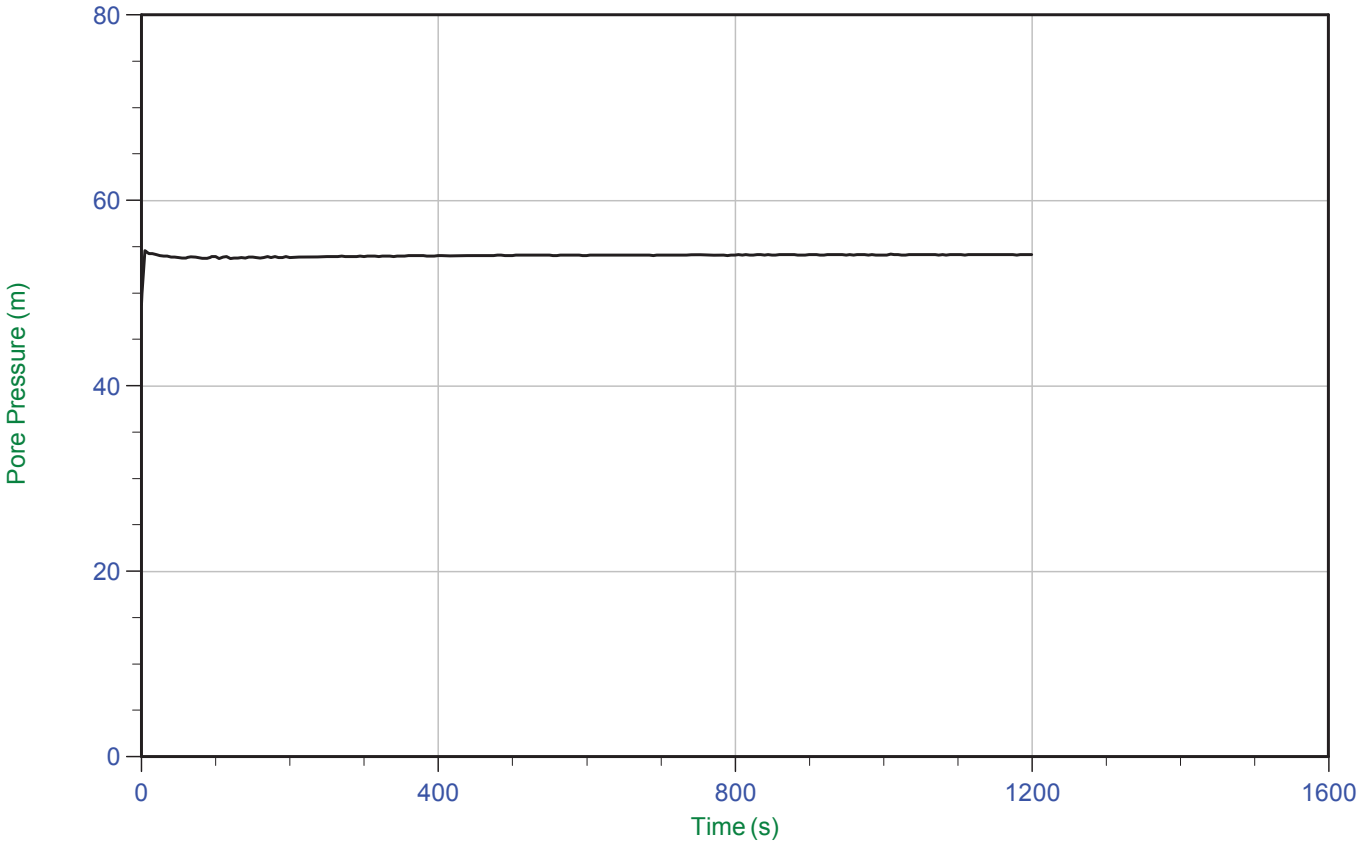
WT: -23.336 m / -76.561 ft
Ueq: 39.6 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/06/2017 13:34
Site: Milne Port Expansion

Sounding: CPT17-D003
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD003.PPF
Depth: 30.425 m / 99.818 ft
Duration: 1200.0 s

U Min: 48.8 m
U Max: 54.6 m

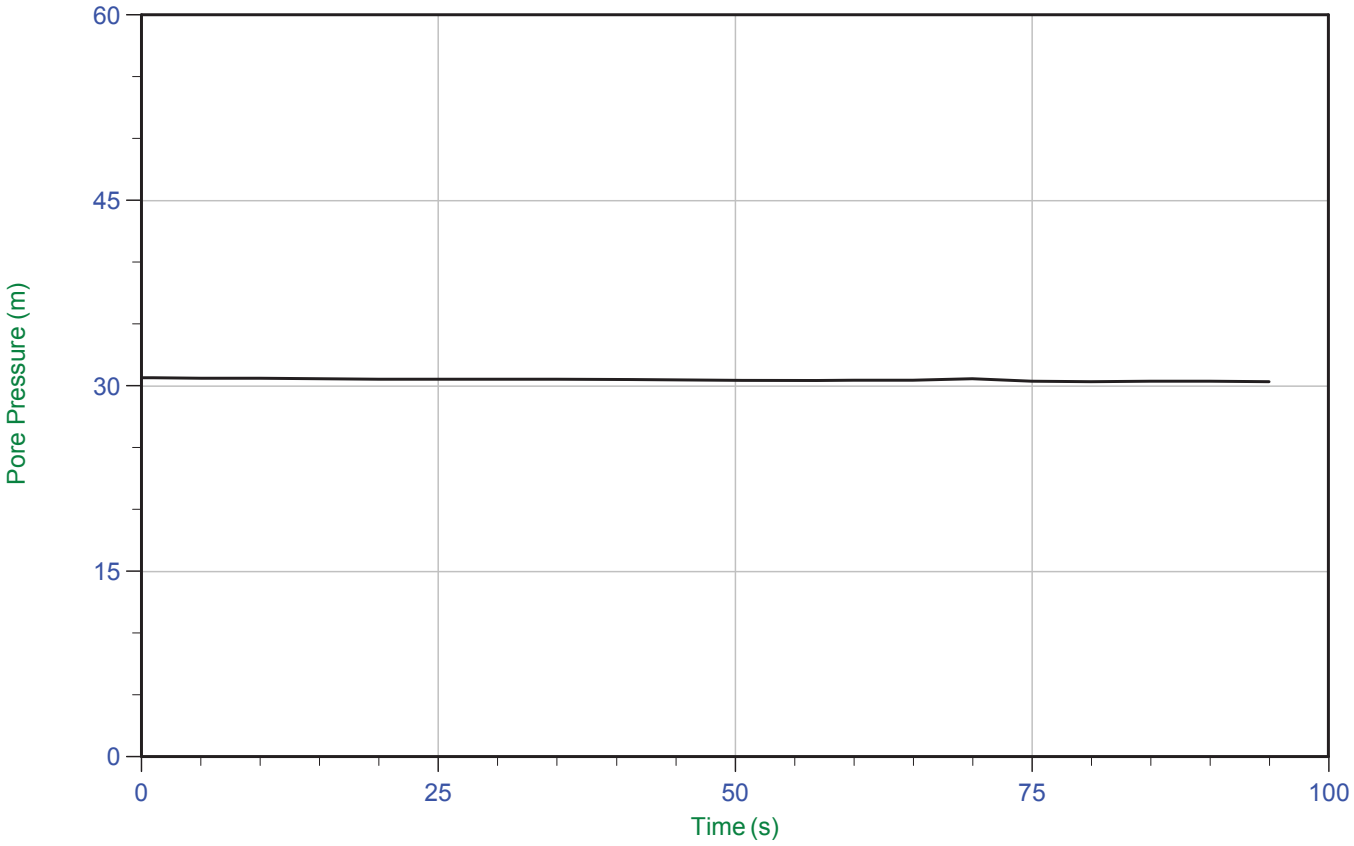
WT: -23.716 m / -77.807 ft
Ueq: 54.1 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/04/2017 16:44
Site: Milne Port Expansion

Sounding: SCPT17-D004
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_SPD004.PPF
Depth: 3.275 m / 10.745 ft
Duration: 95.0 s

U Min: 30.3 m
U Max: 30.7 m

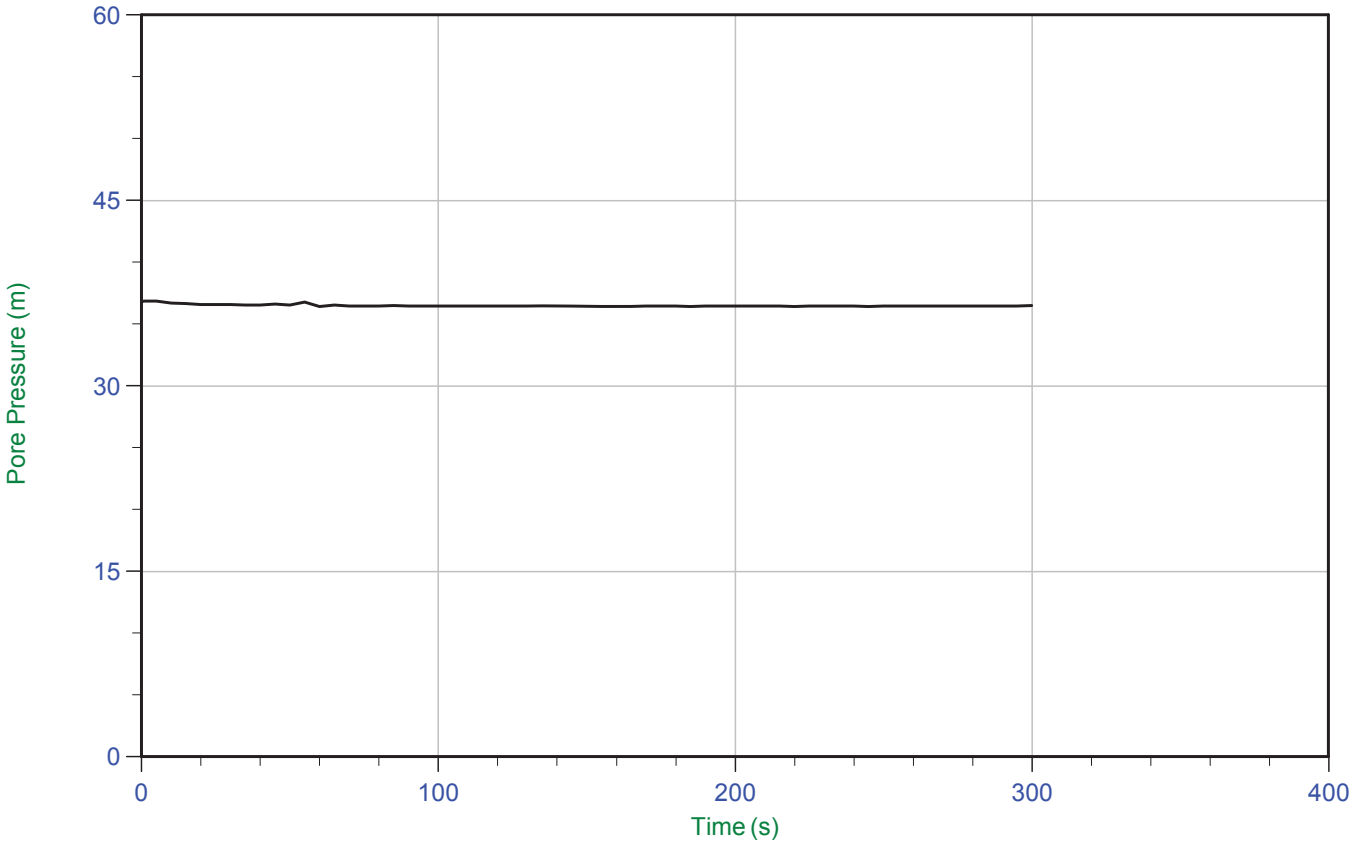
WT: -27.149 m / -89.070 ft
Ueq: 30.4 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/04/2017 16:44
Site: Milne Port Expansion

Sounding: SCPT17-D004
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_SPD004.PPF
Depth: 9.200 m / 30.183 ft
Duration: 300.0 s

U Min: 36.4 m
U Max: 36.9 m

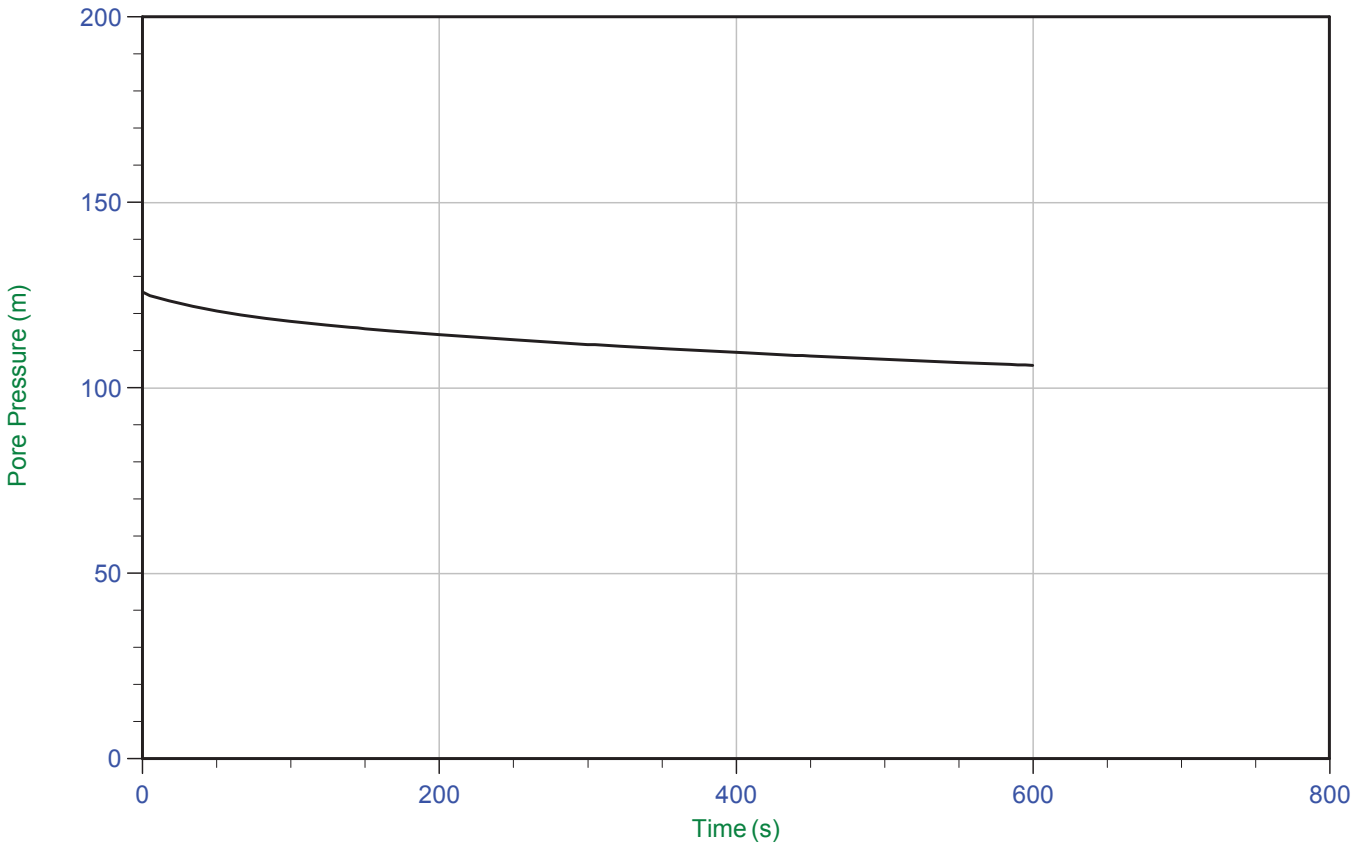
WT: -27.285 m / -89.517 ft
Ueq: 36.5 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/04/2017 16:44
Site: Milne Port Expansion

Sounding: SCPT17-D004
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_SPD004.PPF
Depth: 30.475 m / 99.982 ft
Duration: 600.0 s

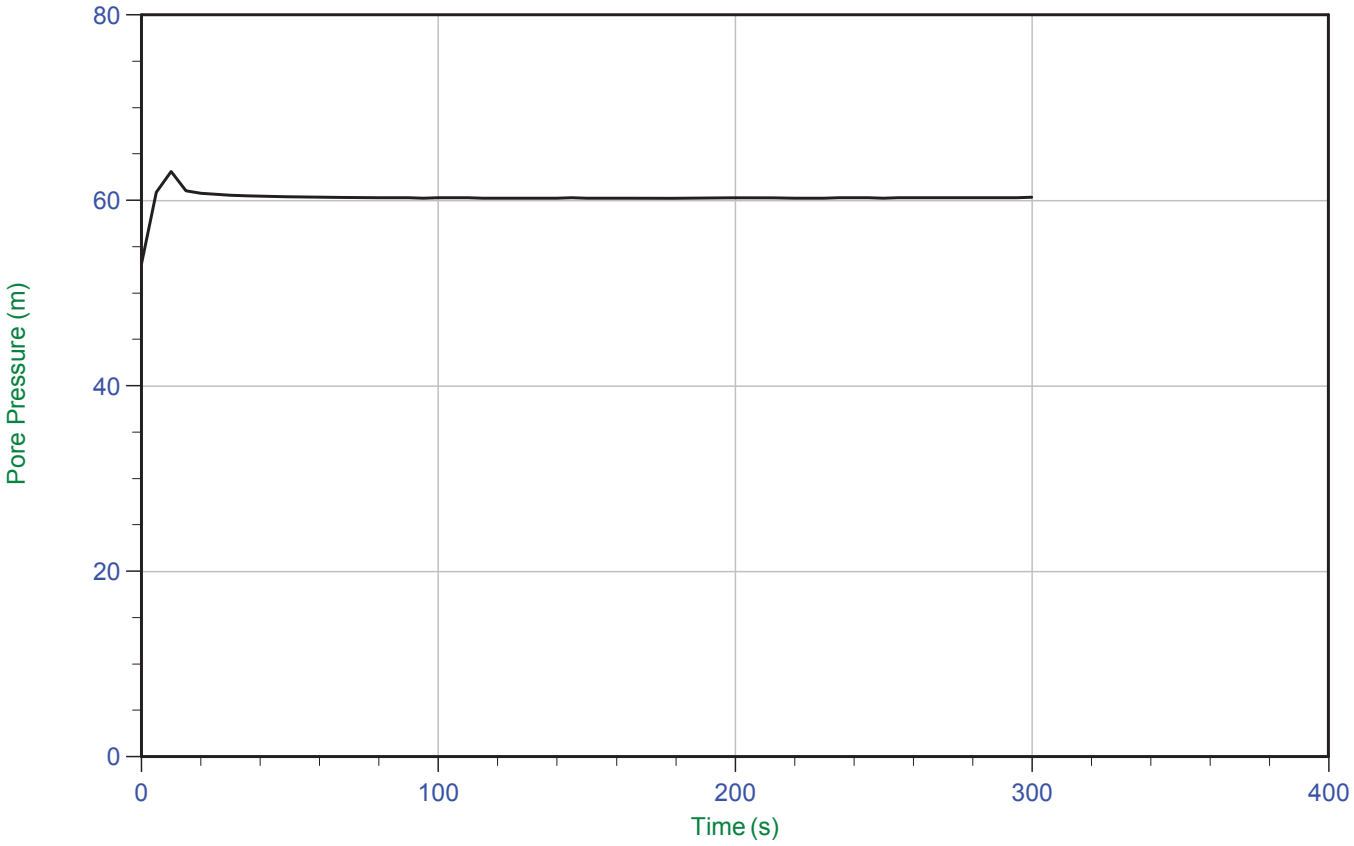
U Min: 106.1 m
U Max: 125.8 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/04/2017 16:44
Site: Milne Port Expansion

Sounding: SCPT17-D004
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_SPD004.PPF
Depth: 32.050 m / 105.150 ft
Duration: 300.0 s

U Min: 53.2 m
U Max: 63.1 m

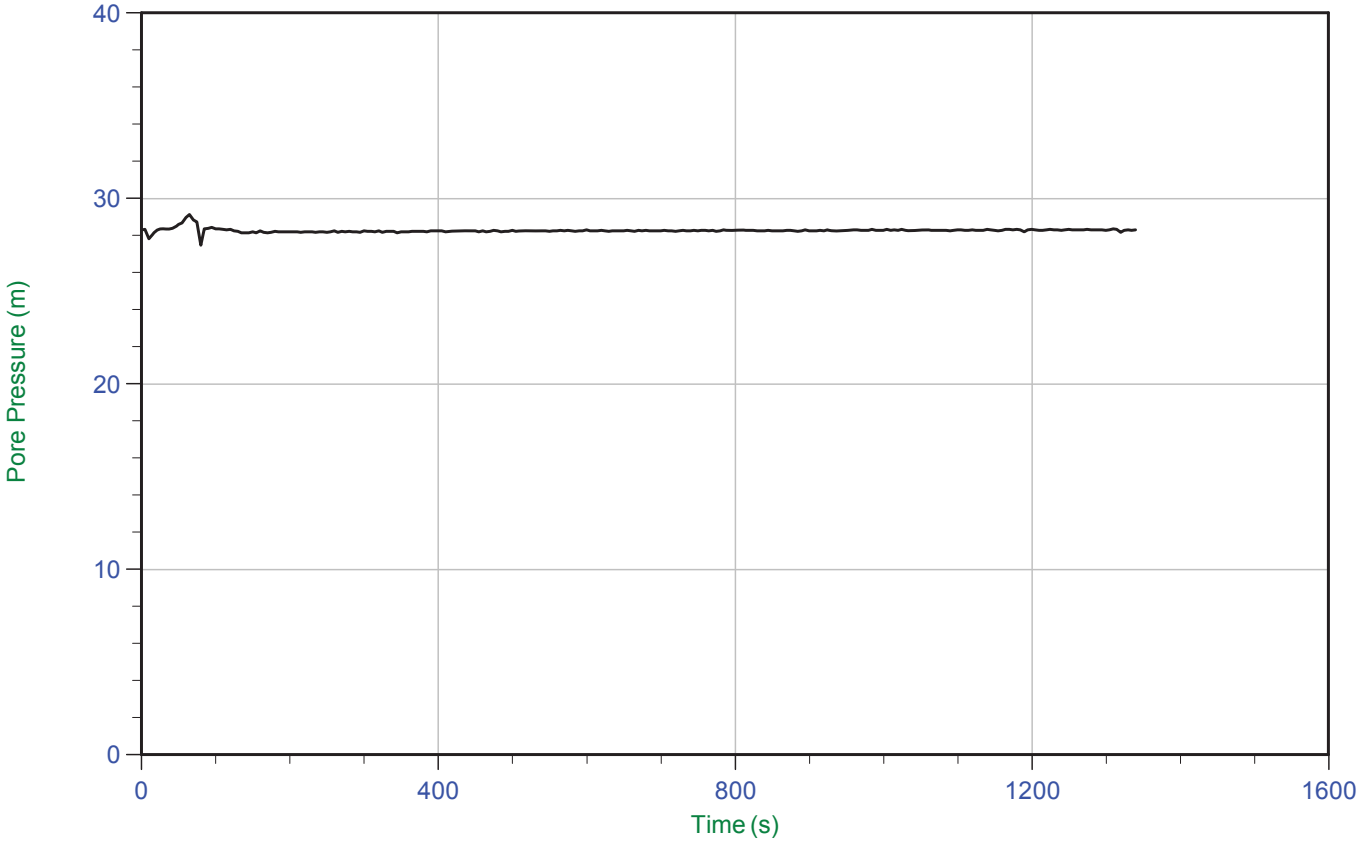
WT: -28.233 m / -92.627 ft
Ueq: 60.3 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/03/2017 02:19
Site: Milne Port Expansion

Sounding: CPT17-D005
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD005.PPF
Depth: 2.275 m / 7.464 ft
Duration: 1340.0 s

U Min: 27.5 m
U Max: 29.1 m

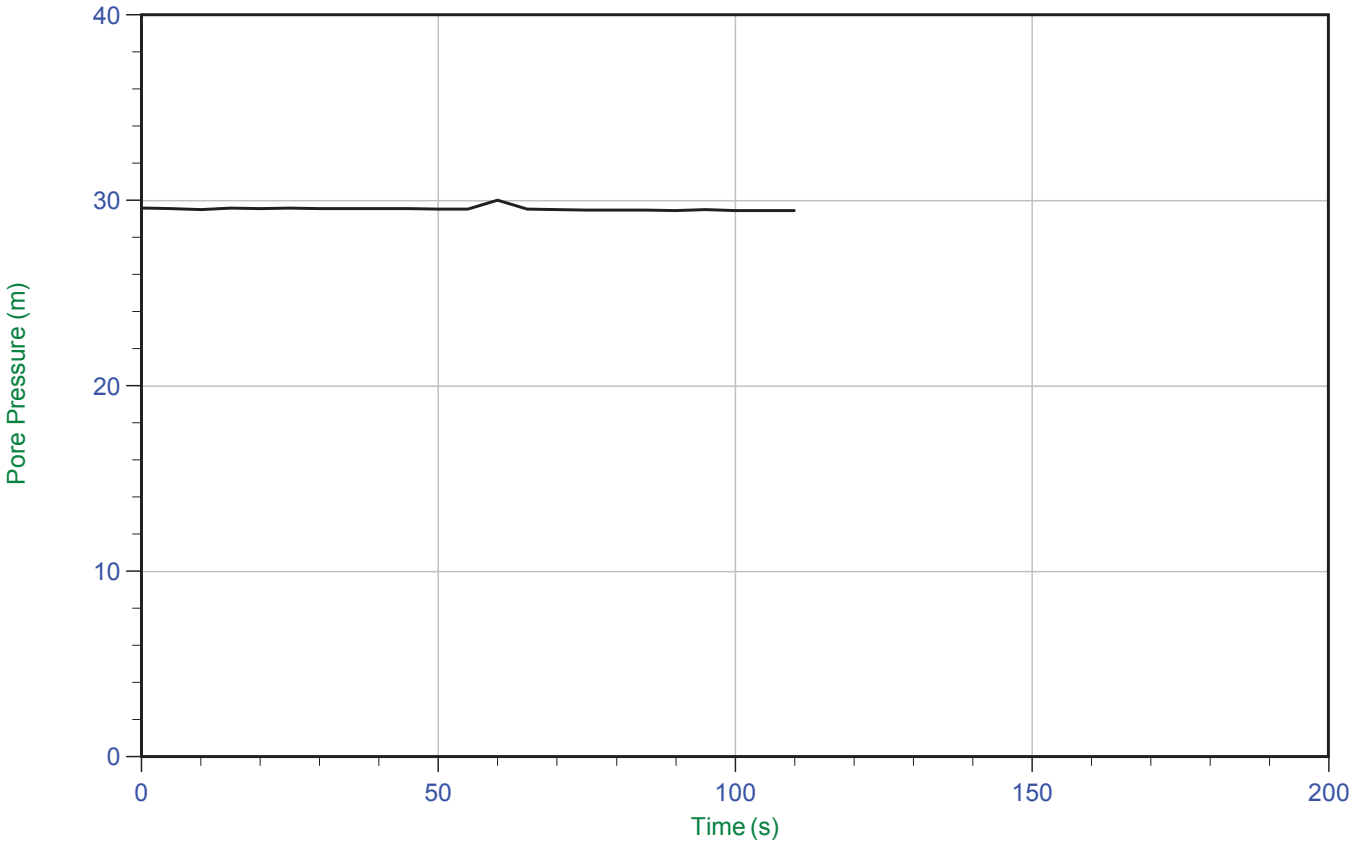
WT: -26.008 m / -85.327 ft
Ueq: 28.3 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/03/2017 02:19
Site: Milne Port Expansion

Sounding: CPT17-D005
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD005.PPF
Depth: 3.325 m / 10.909 ft
Duration: 110.0 s

U Min: 29.4 m
U Max: 30.0 m

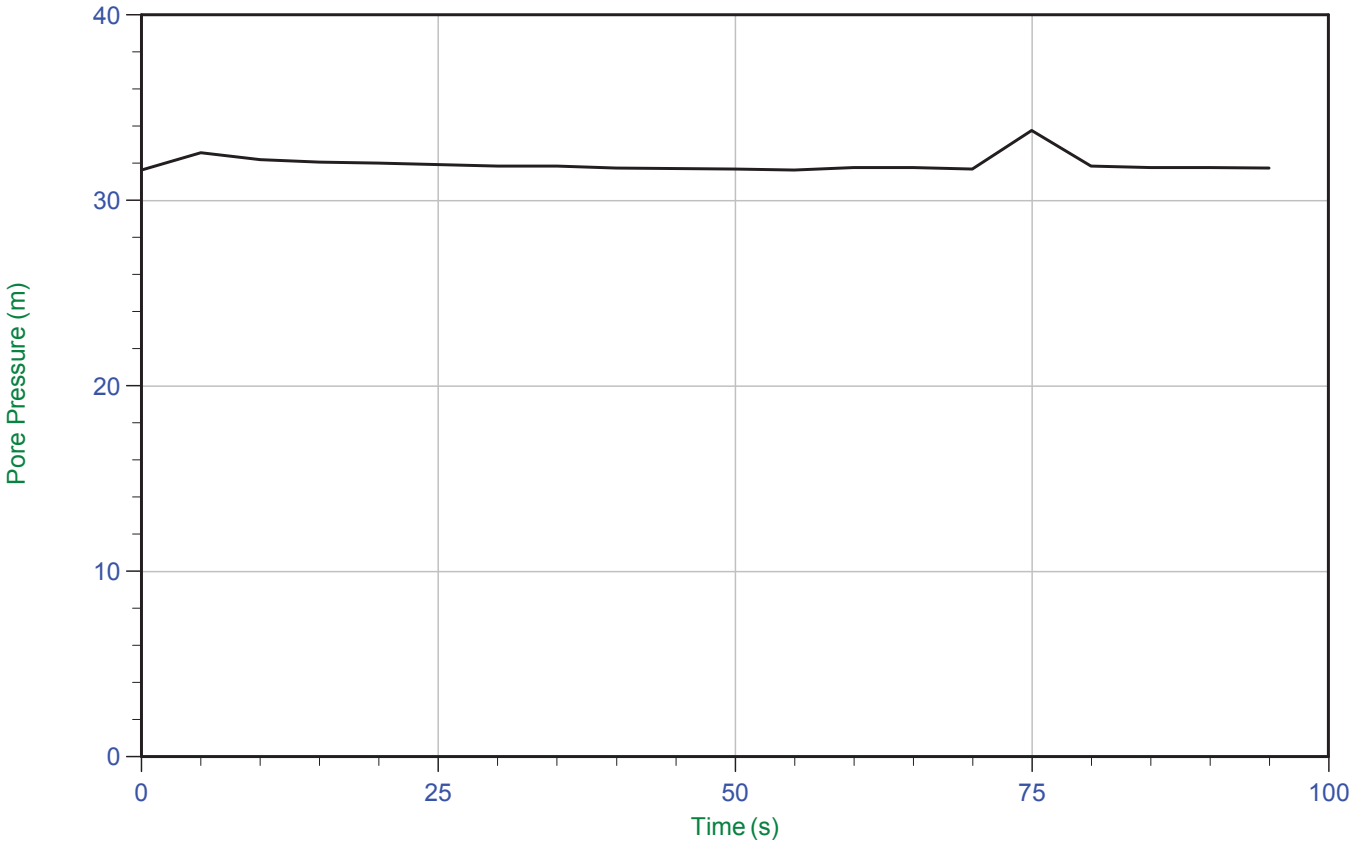
WT: -26.170 m / -85.859 ft
Ueq: 29.5 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/03/2017 02:19
Site: Milne Port Expansion

Sounding: CPT17-D005
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD005.PPF
Depth: 5.375 m / 17.634 ft
Duration: 95.0 s

U Min: 31.6 m
U Max: 33.8 m

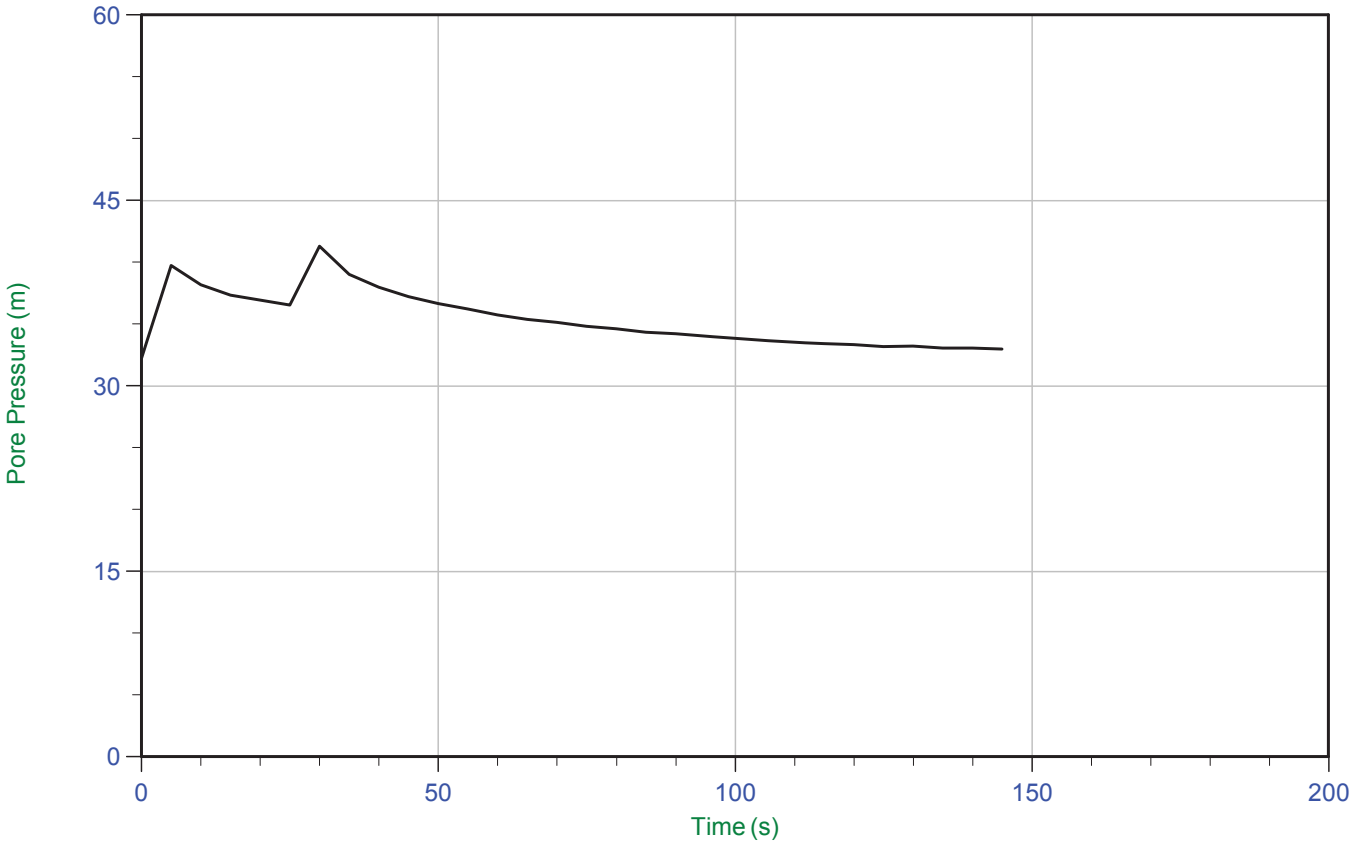
WT: -26.383 m / -86.557 ft
Ueq: 31.8 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/03/2017 02:19
Site: Milne Port Expansion

Sounding: CPT17-D005
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD005.PPF
Depth: 6.375 m / 20.915 ft
Duration: 145.0 s

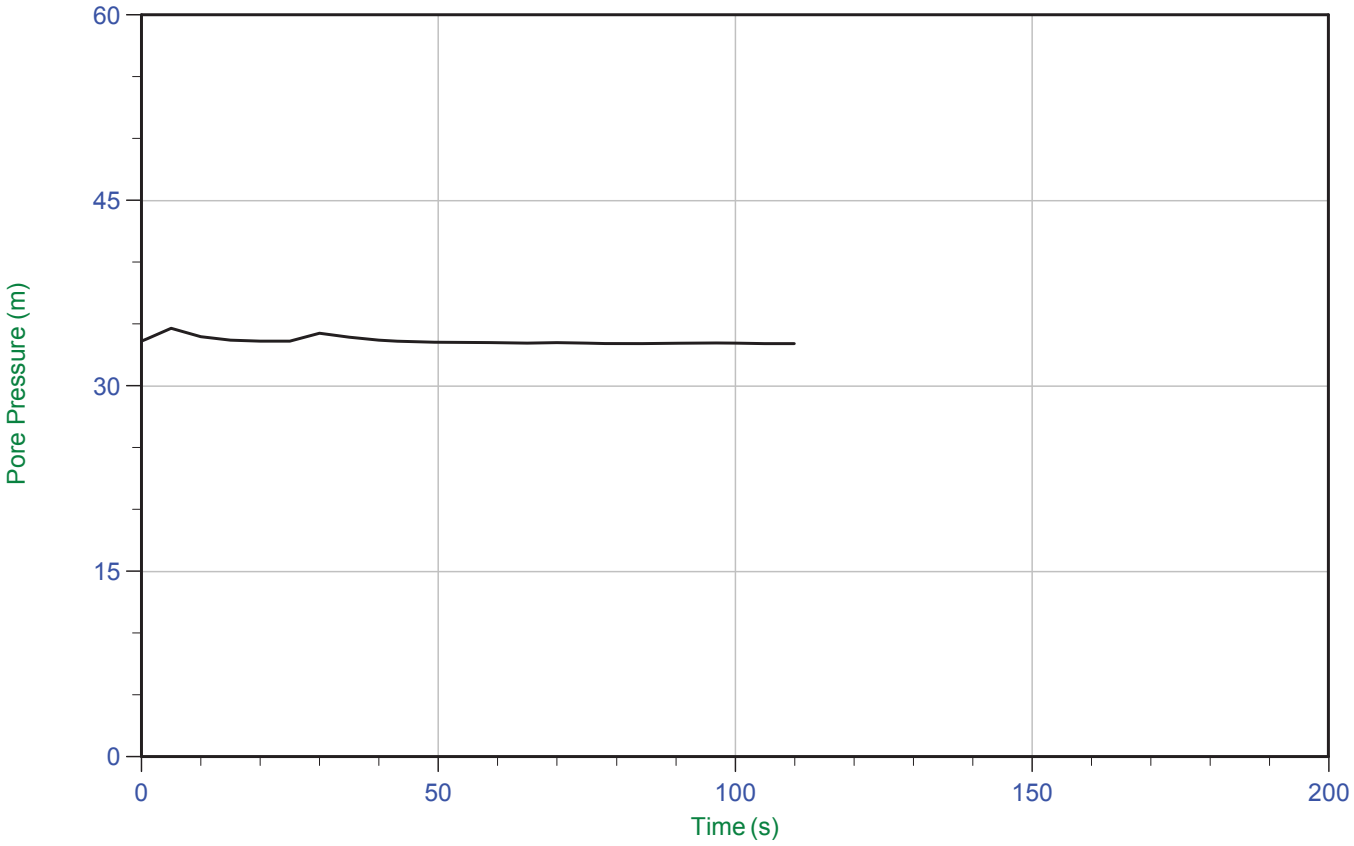
U Min: 32.2 m
U Max: 41.3 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/03/2017 02:19
Site: Milne Port Expansion

Sounding: CPT17-D005
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD005.PPF
Depth: 7.400 m / 24.278 ft
Duration: 110.0 s

U Min: 33.4 m
U Max: 34.6 m

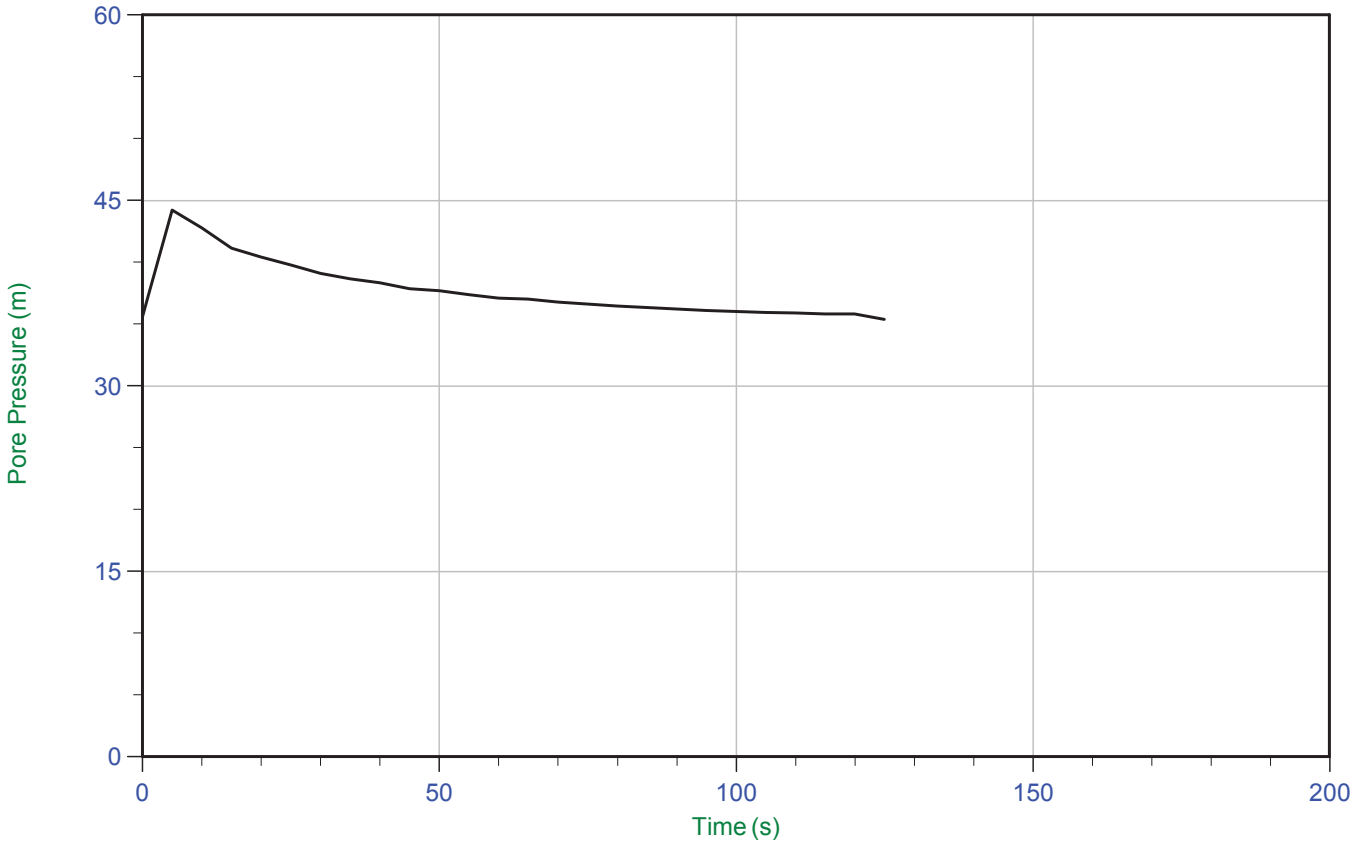
WT: -26.055 m / -85.481 ft
Ueq: 33.5 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/03/2017 02:19
Site: Milne Port Expansion

Sounding: CPT17-D005
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD005.PPF
Depth: 9.350 m / 30.675 ft
Duration: 125.0 s

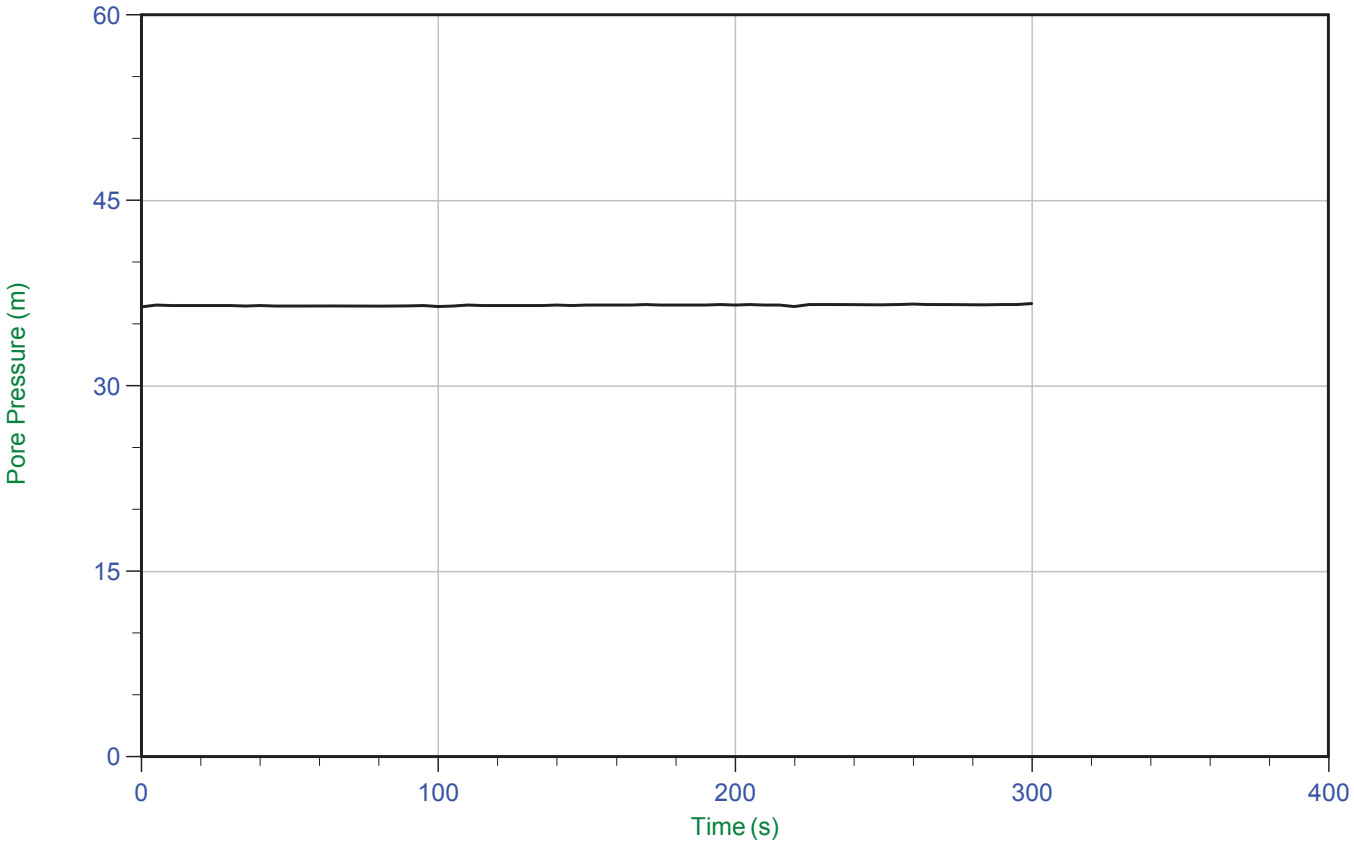
U Min: 35.4 m
U Max: 44.2 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/03/2017 02:19
Site: Milne Port Expansion

Sounding: CPT17-D005
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD005.PPF
Depth: 10.300 m / 33.792 ft
Duration: 300.0 s

U Min: 36.4 m
U Max: 36.6 m

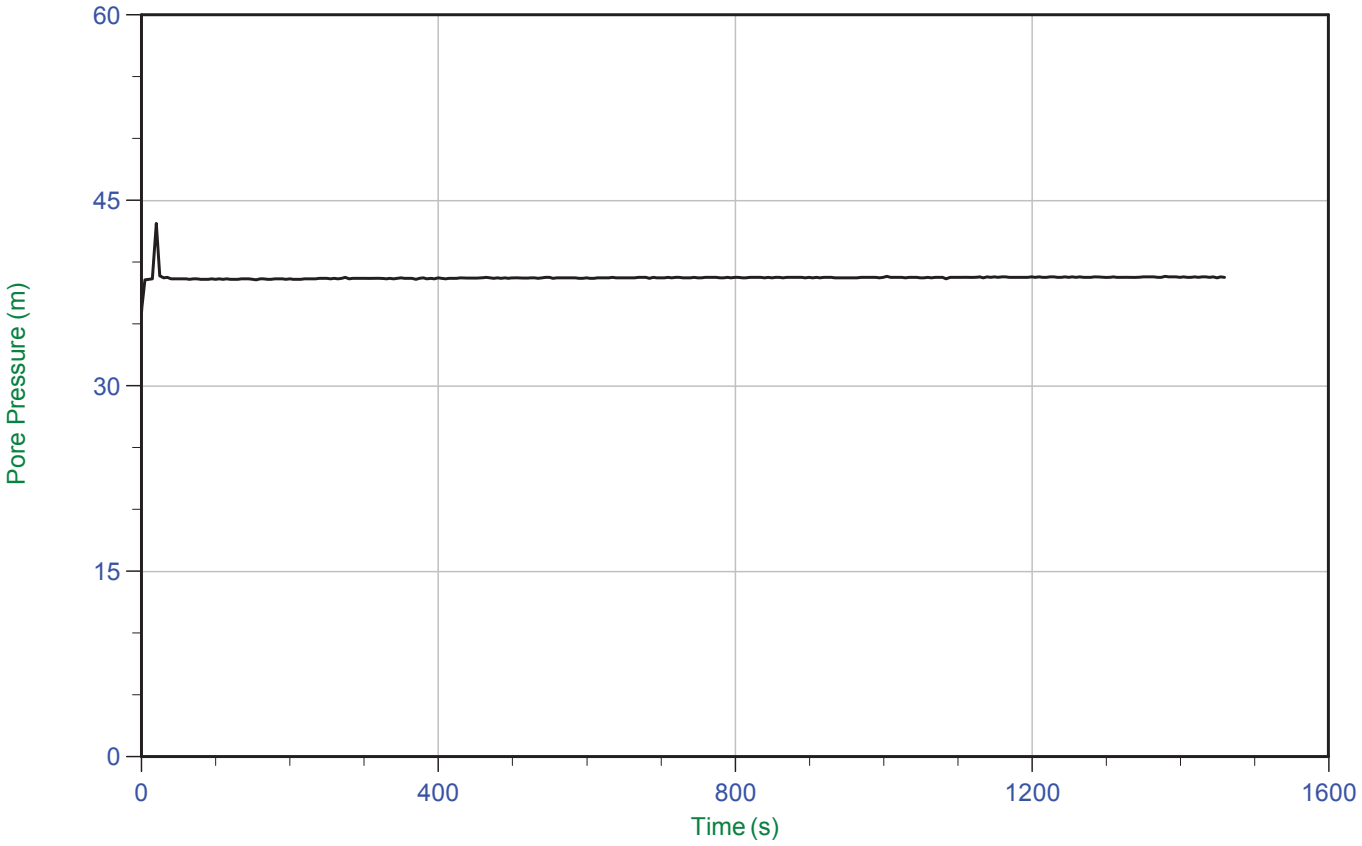
WT: -26.185 m / -85.908 ft
Ueq: 36.5 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/03/2017 02:19
Site: Milne Port Expansion

Sounding: CPT17-D005
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD005.PPF
Depth: 12.350 m / 40.518 ft
Duration: 1460.0 s

U Min: 35.9 m
U Max: 43.1 m

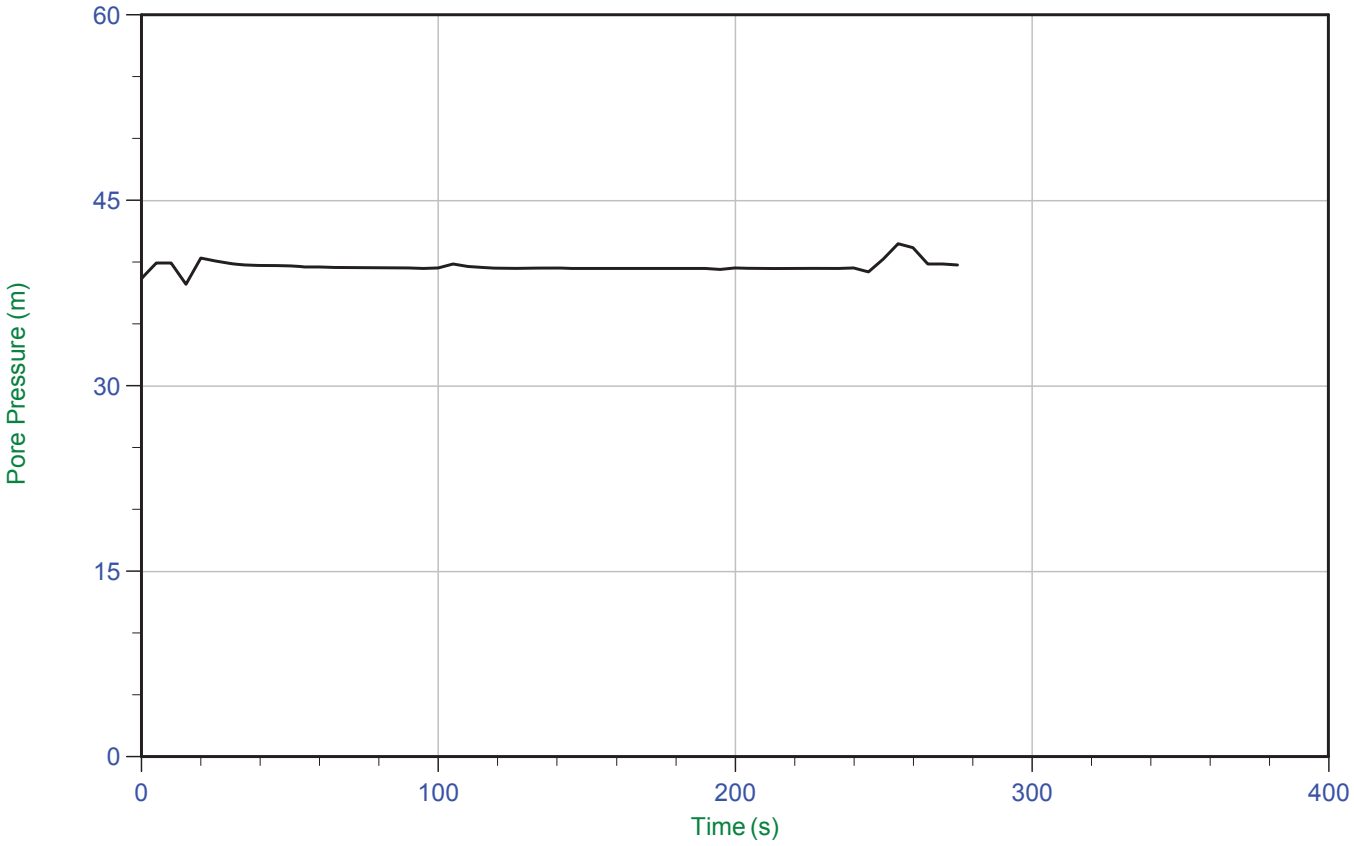
WT: -26.438 m / -86.738 ft
Ueq: 38.8 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/03/2017 02:19
Site: Milne Port Expansion

Sounding: CPT17-D005
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD005.PPF
Depth: 13.175 m / 43.225 ft
Duration: 275.0 s

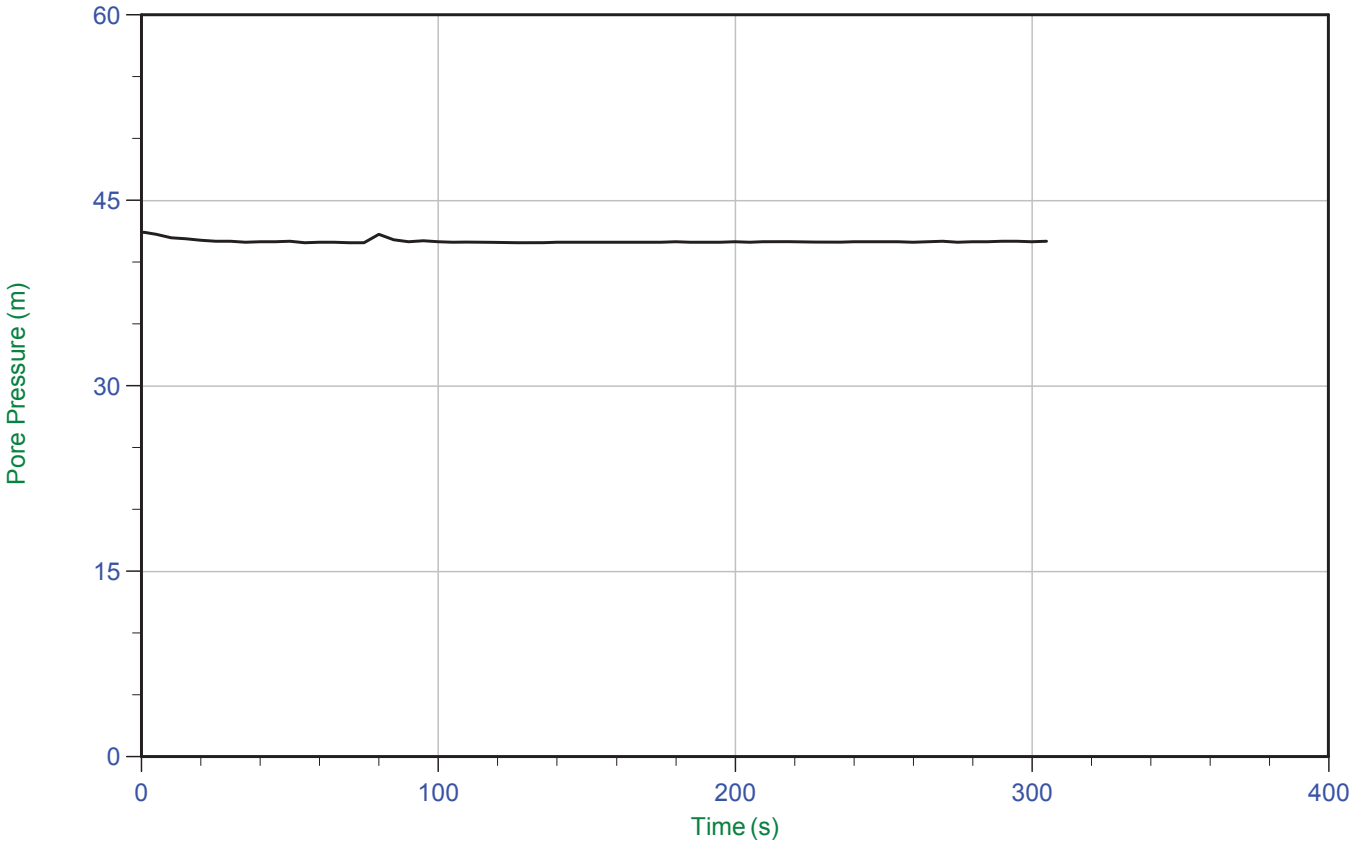
U Min: 38.2 m
U Max: 41.5 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/03/2017 02:19
Site: Milne Port Expansion

Sounding: CPT17-D005
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD005.PPF
Depth: 15.050 m / 49.376 ft
Duration: 305.0 s

U Min: 41.6 m
U Max: 42.4 m

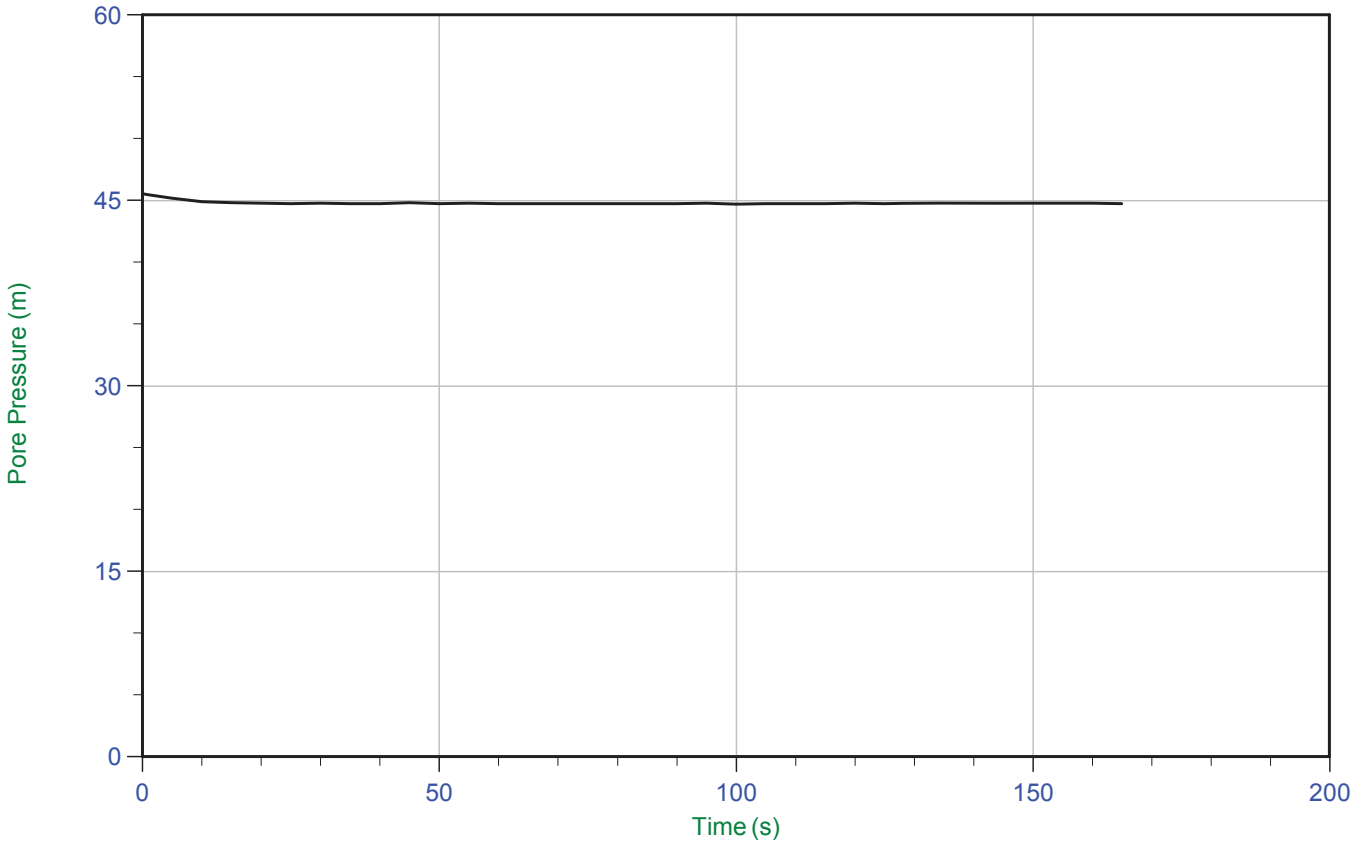
WT: -26.647 m / -87.423 ft
Ueq: 41.7 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/03/2017 02:19
Site: Milne Port Expansion

Sounding: CPT17-D005
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD005.PPF
Depth: 18.100 m / 59.382 ft
Duration: 165.0 s

U Min: 44.7 m
U Max: 45.5 m

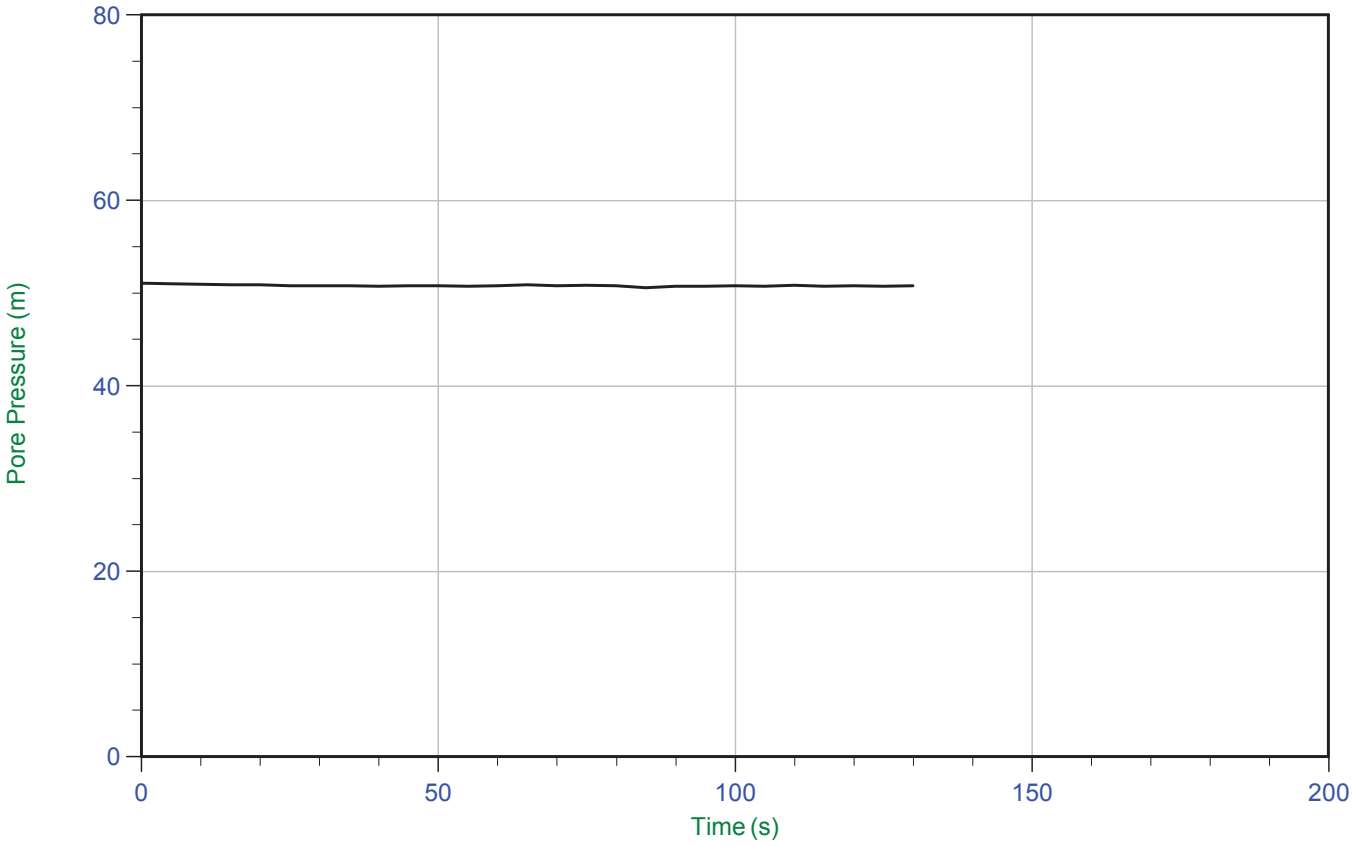
WT: -26.627 m / -87.358 ft
Ueq: 44.7 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/03/2017 02:19
Site: Milne Port Expansion

Sounding: CPT17-D005
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD005.PPF
Depth: 23.925 m / 78.493 ft
Duration: 130.0 s

U Min: 50.6 m
U Max: 51.1 m

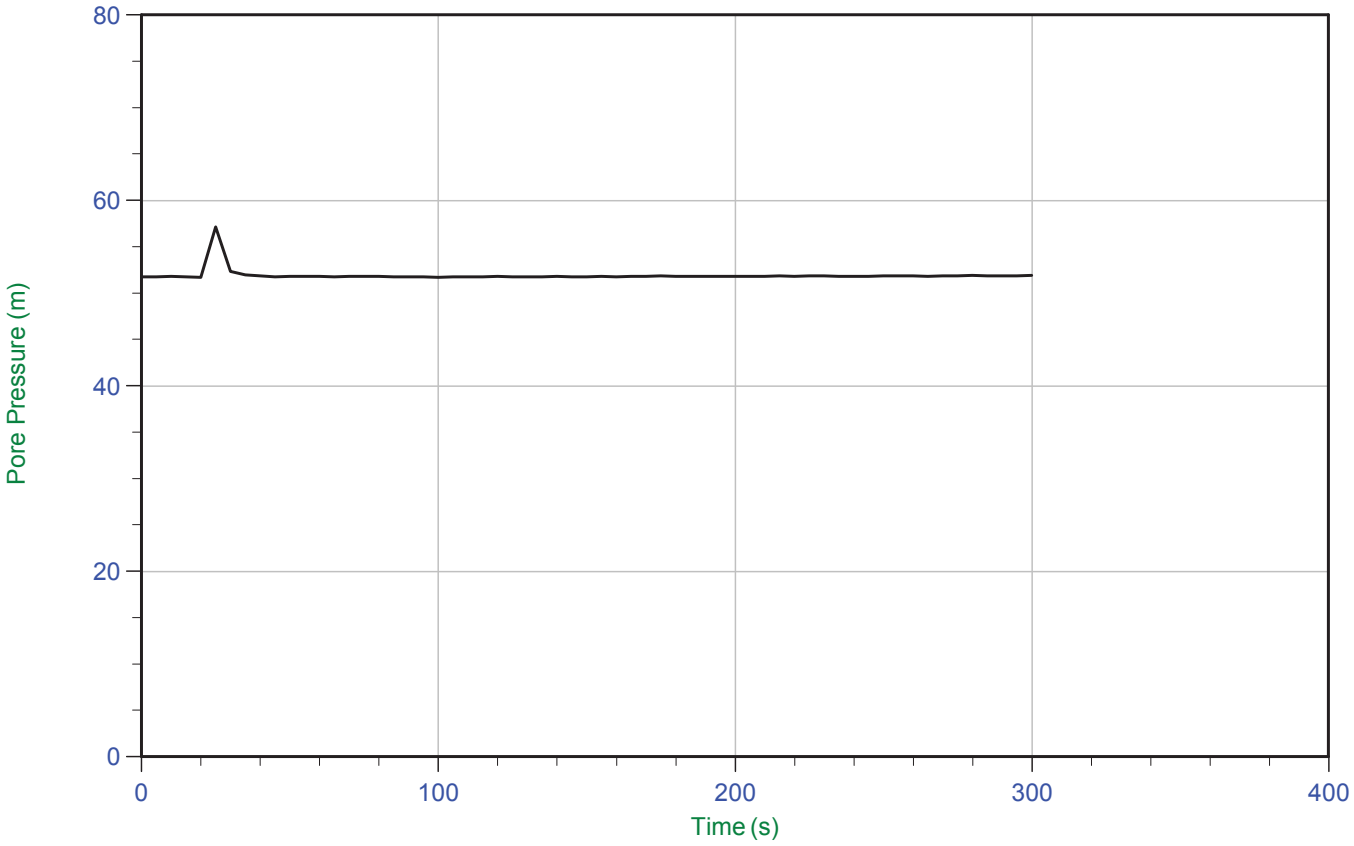
WT: -26.822 m / -87.998 ft
Ueq: 50.7 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/03/2017 02:19
Site: Milne Port Expansion

Sounding: CPT17-D005
Cone: 338:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD005.PPF
Depth: 25.125 m / 82.430 ft
Duration: 300.0 s

U Min: 51.7 m
U Max: 57.2 m

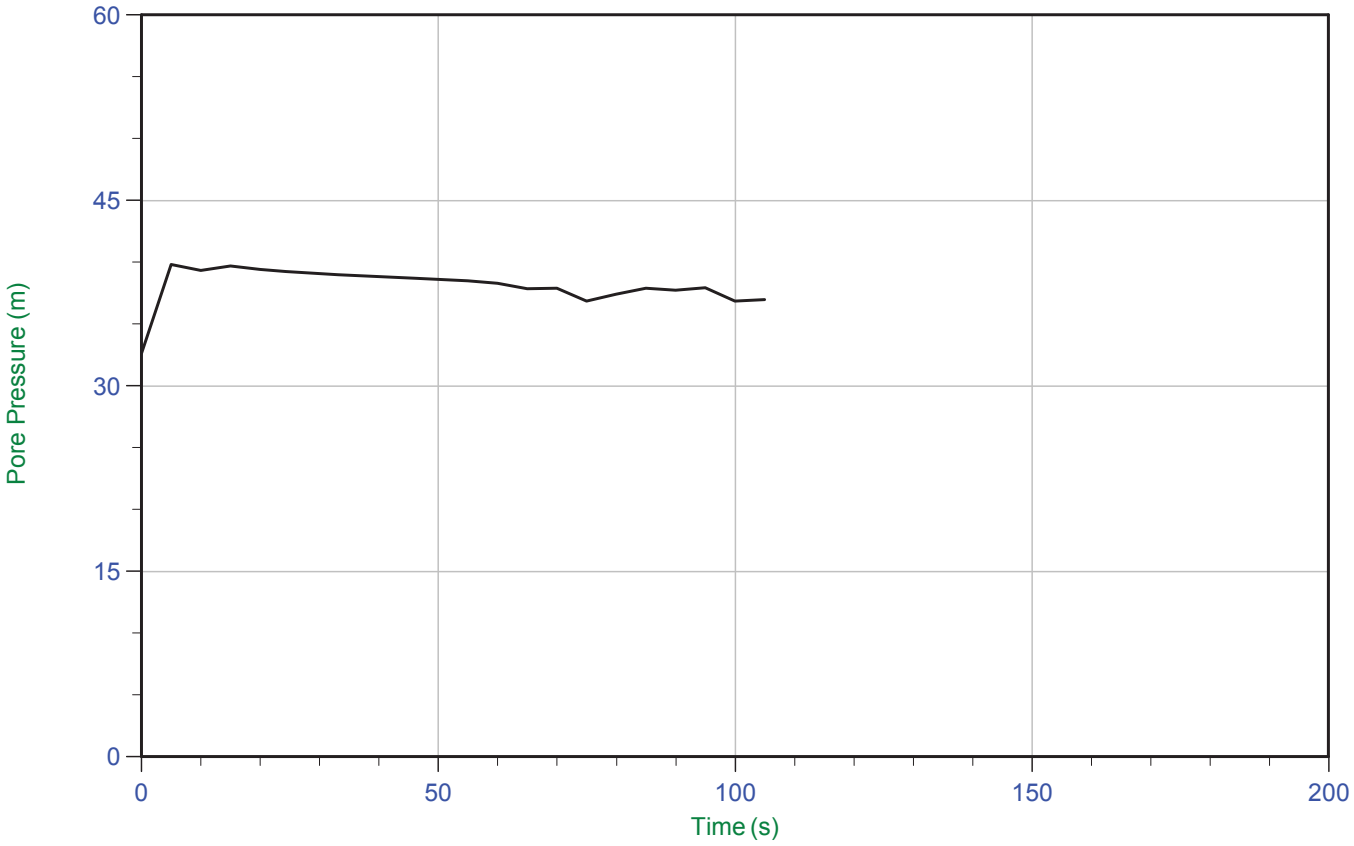
WT: -26.754 m / -87.775 ft
Ueq: 51.9 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/06/2017 23:59
Site: Milne Port Expansion

Sounding: CPT17-D006
Cone: 374:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD006.PPF
Depth: 2.300 m / 7.546 ft
Duration: 105.0 s

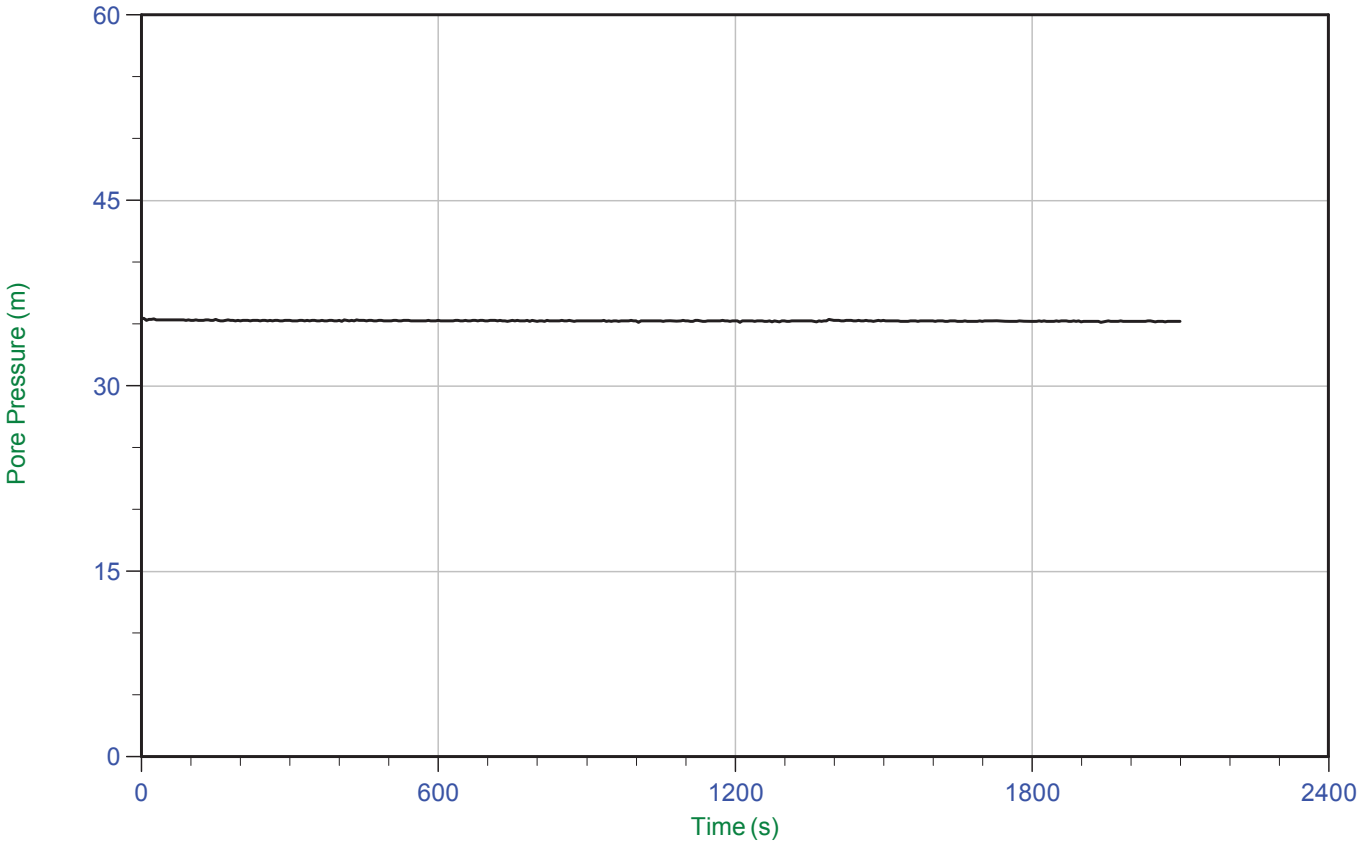
U Min: 32.6 m
U Max: 39.8 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/06/2017 23:59
Site: Milne Port Expansion

Sounding: CPT17-D006
Cone: 374:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD006.PPF
Depth: 3.300 m / 10.827 ft
Duration: 2100.0 s

U Min: 35.1 m
U Max: 35.4 m

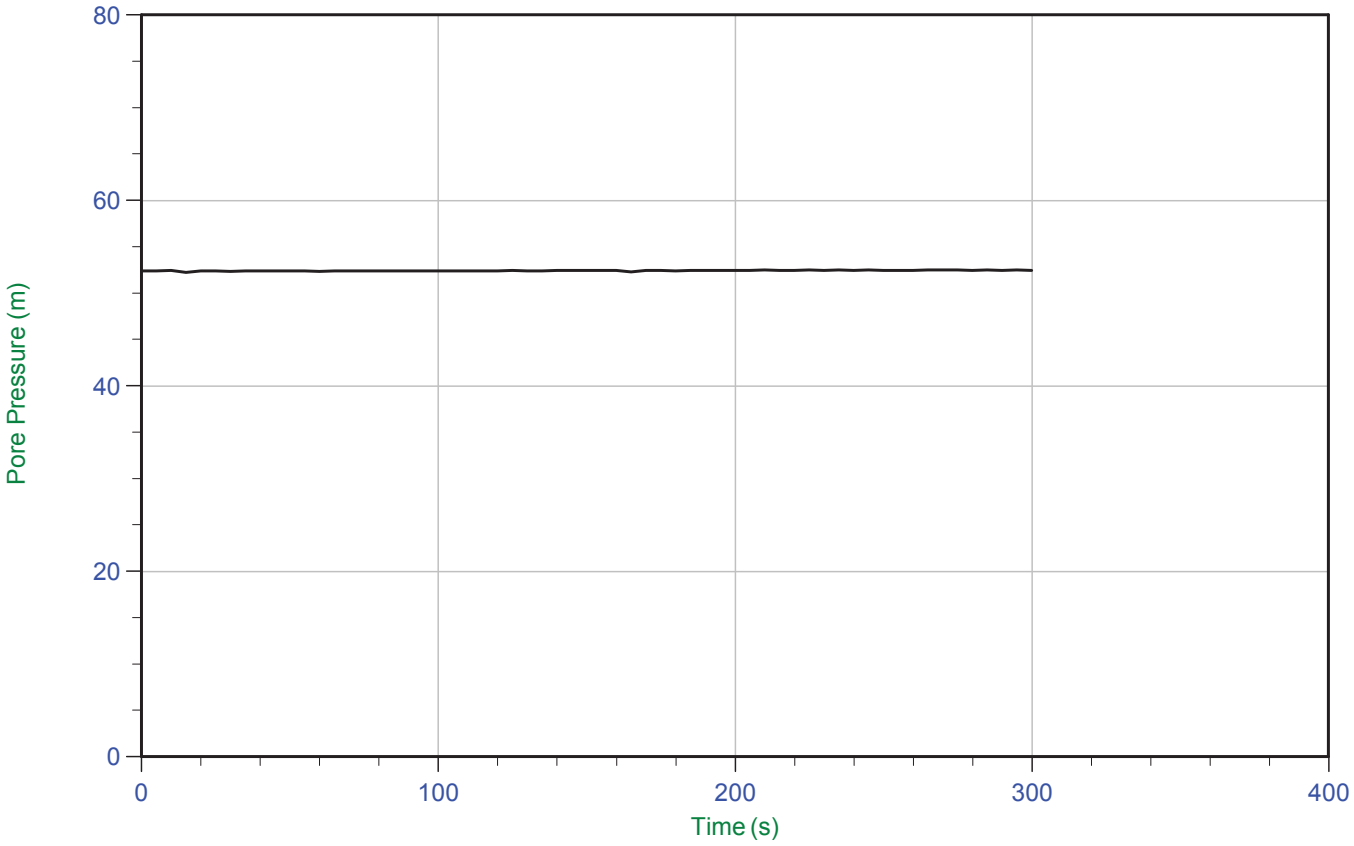
WT: -31.973 m / -104.897 ft
Ueq: 35.3 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/06/2017 23:59
Site: Milne Port Expansion

Sounding: CPT17-D006
Cone: 374:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD006.PPF
Depth: 20.575 m / 67.502 ft
Duration: 300.0 s

U Min: 52.2 m
U Max: 52.5 m

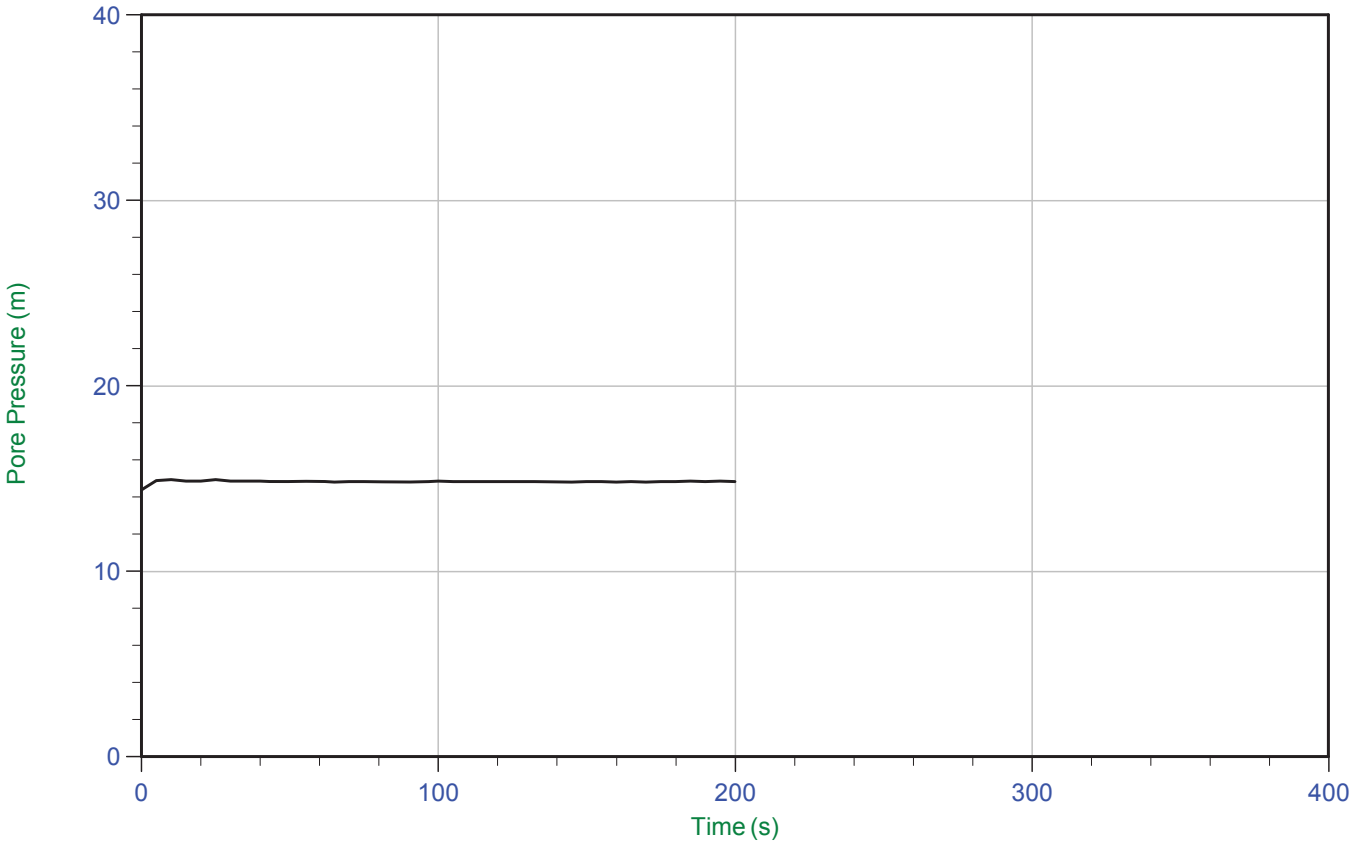
WT: -31.789 m / -104.293 ft
Ueq: 52.4 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/07/2017 11:27
Site: Milne Port Expansion

Sounding: CPT17-D007
Cone: 374:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD007.PPF
Depth: 10.100 m / 33.136 ft
Duration: 200.0 s

U Min: 14.4 m
U Max: 15.0 m

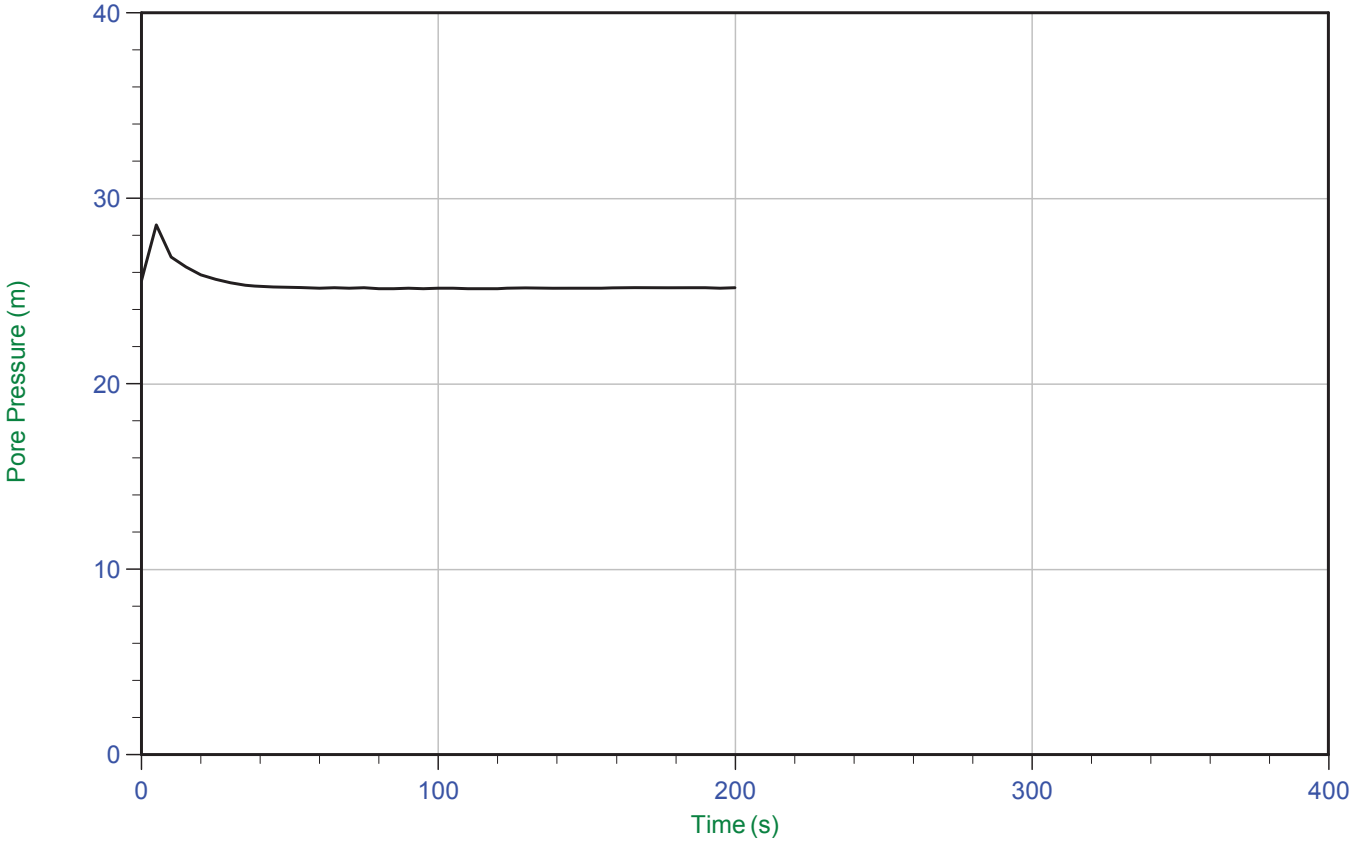
WT: -4.688 m / -15.380 ft
Ueq: 14.8 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/07/2017 11:27
Site: Milne Port Expansion

Sounding: CPT17-D007
Cone: 374:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD007.PPF
Depth: 20.150 m / 66.108 ft
Duration: 200.0 s

U Min: 25.1 m
U Max: 28.6 m

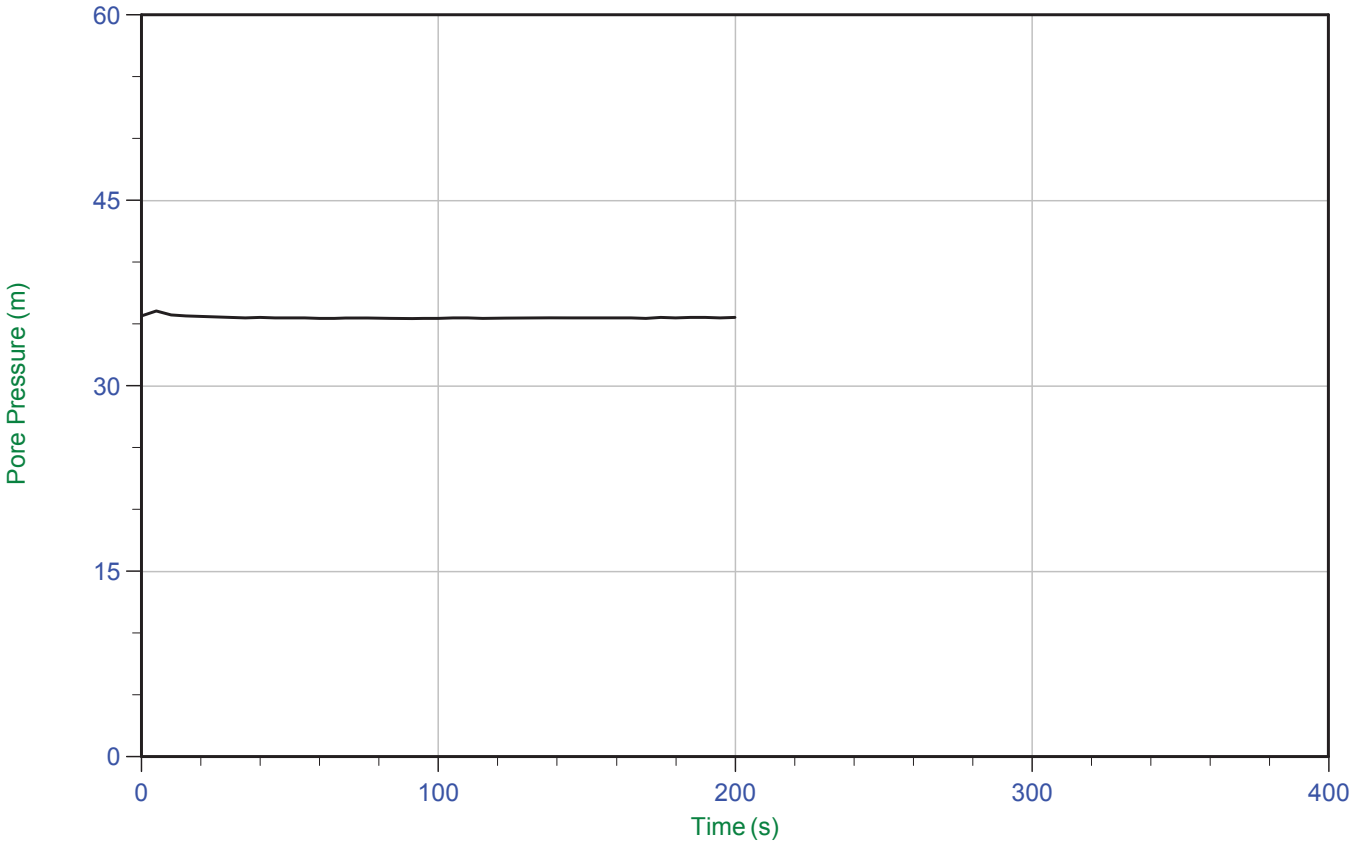
WT: -4.981 m / -16.342 ft
Ueq: 25.1 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/07/2017 11:27
Site: Milne Port Expansion

Sounding: CPT17-D007
Cone: 374:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD007.PPF
Depth: 30.200 m / 99.080 ft
Duration: 200.0 s

U Min: 35.5 m
U Max: 36.0 m

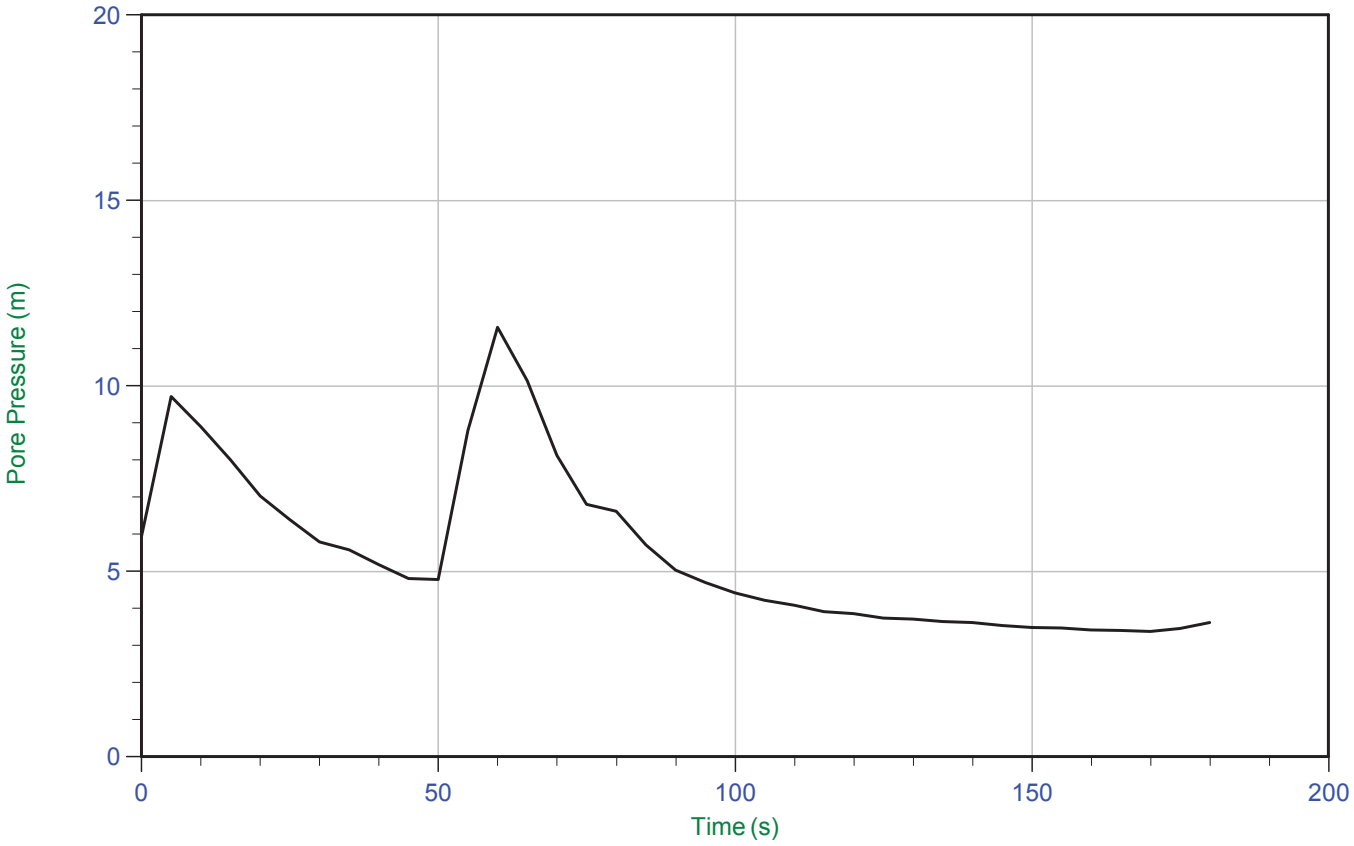
WT: -5.315 m / -17.437 ft
Ueq: 35.5 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/07/2017 16:47
Site: Milne Port Expansion

Sounding: CPT17-D008
Cone: 374:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD008.PPF
Depth: 2.075 m / 6.808 ft
Duration: 180.0 s

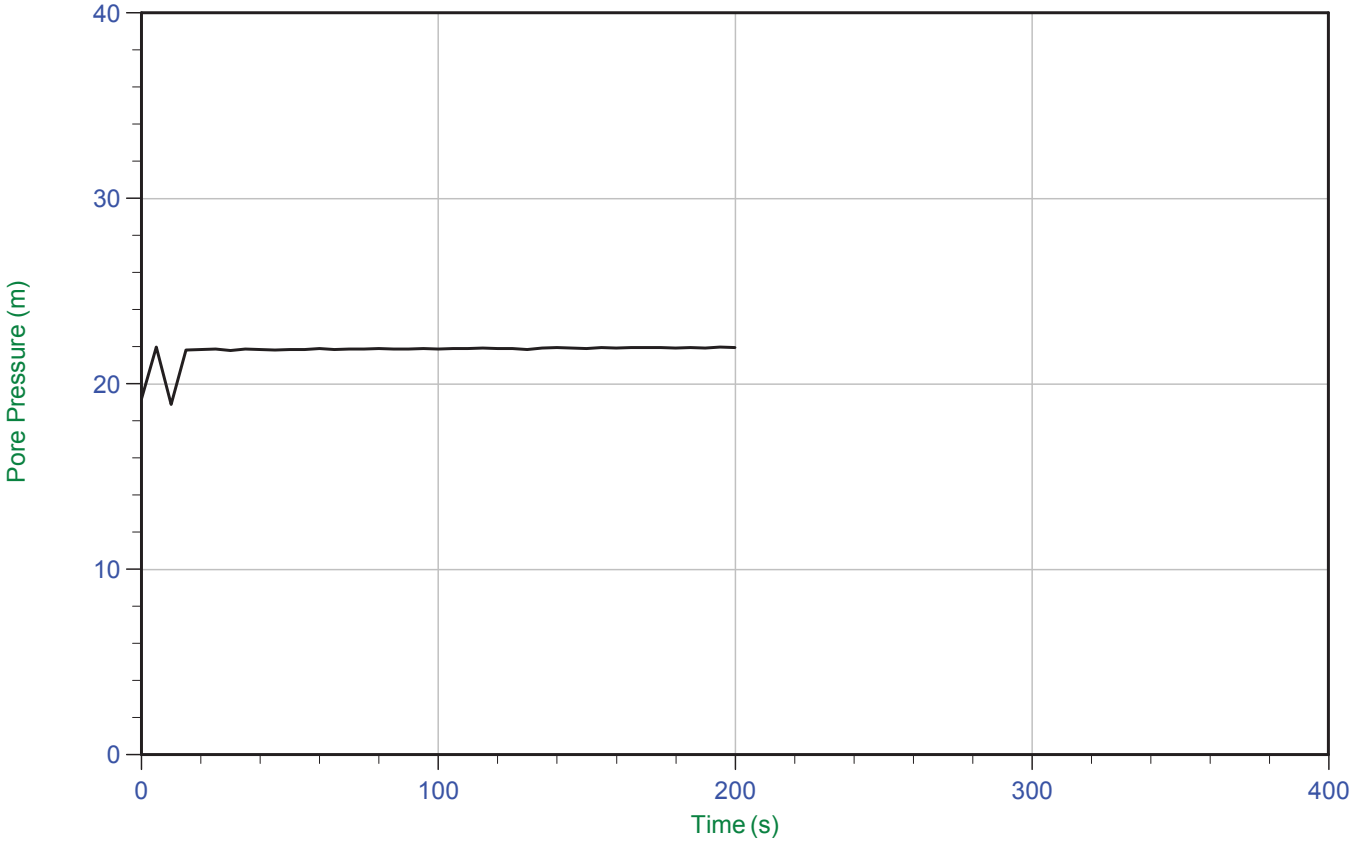
U Min: 3.4 m
U Max: 11.6 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/07/2017 16:47
Site: Milne Port Expansion

Sounding: CPT17-D008
Cone: 374:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD008.PPF
Depth: 20.500 m / 67.256 ft
Duration: 200.0 s

U Min: 18.9 m
U Max: 22.0 m

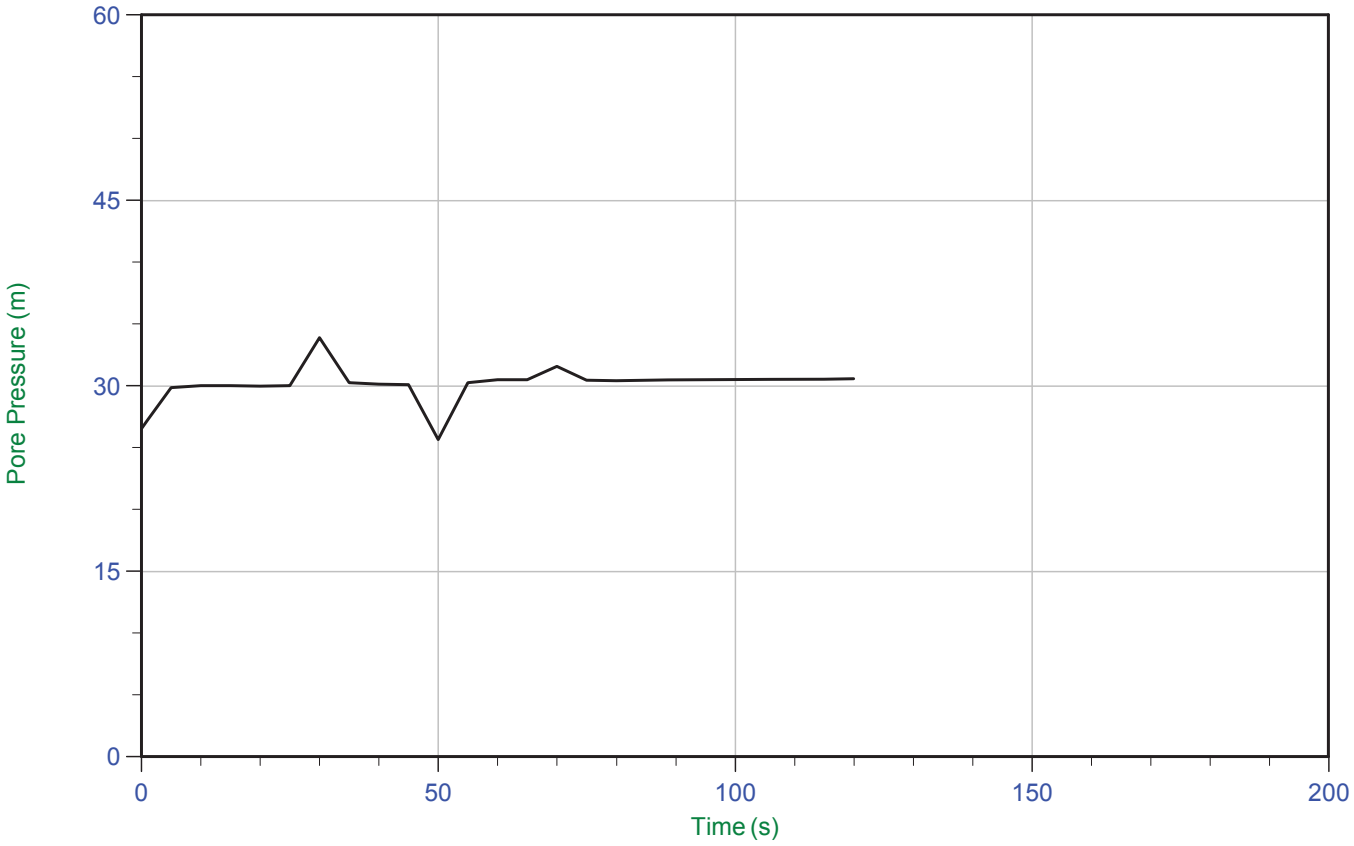
WT: -1.399 m / -4.590 ft
Ueq: 21.9 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/07/2017 16:47
Site: Milne Port Expansion

Sounding: CPT17-D008
Cone: 374:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD008.PPF
Depth: 28.975 m / 95.061 ft
Duration: 120.0 s

U Min: 25.6 m
U Max: 33.9 m

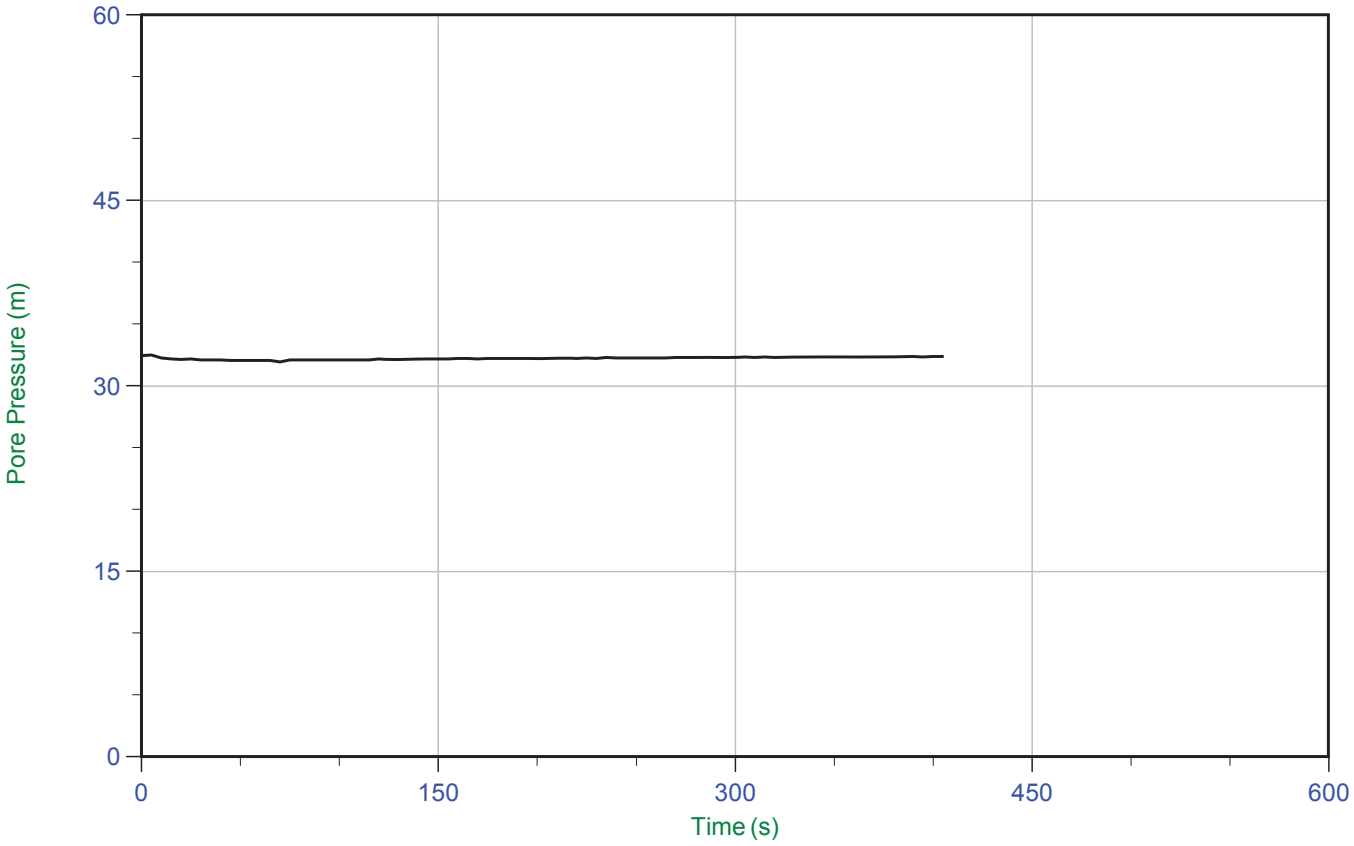
WT: -1.449 m / -4.754 ft
Ueq: 30.4 m

CONETEC

Baffinland

Job No: 17-05010
Date: 04/07/2017 16:47
Site: Milne Port Expansion

Sounding: CPT17-D008
Cone: 374:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 17-05010_CPD008.PPF
Depth: 30.000 m / 98.424 ft
Duration: 405.0 s

U Min: 32.0 m
U Max: 32.5 m

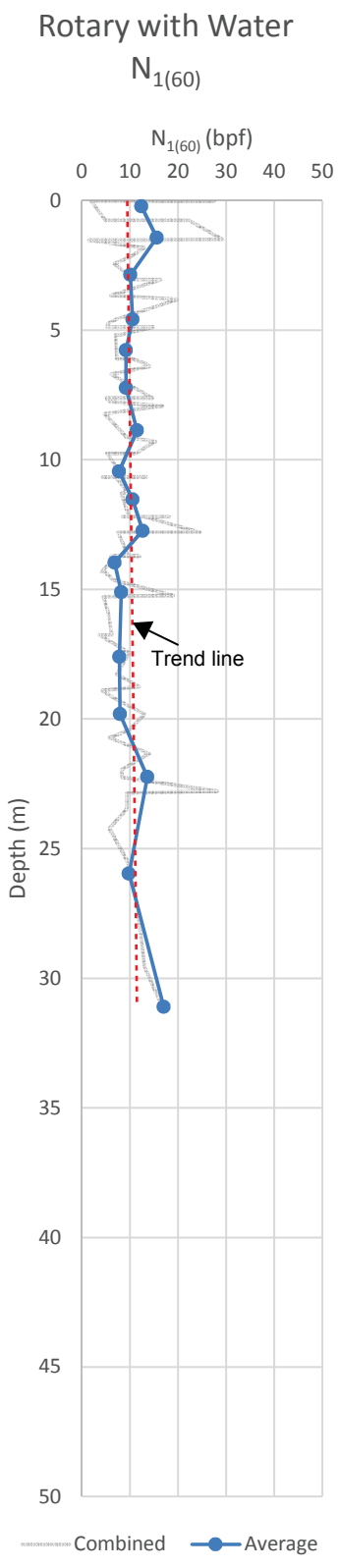
WT: -2.242 m / -7.356 ft
Ueq: 32.2 m

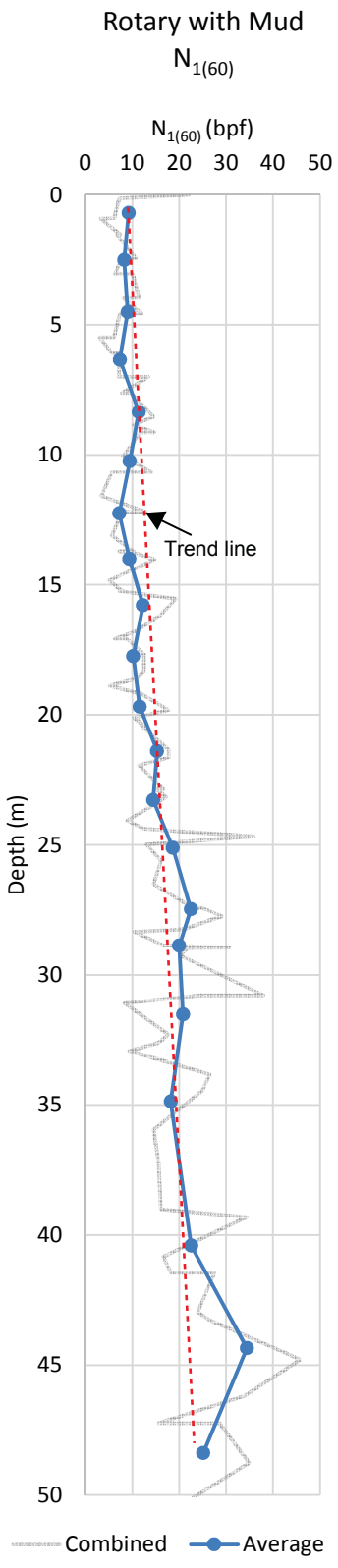
Appendix K

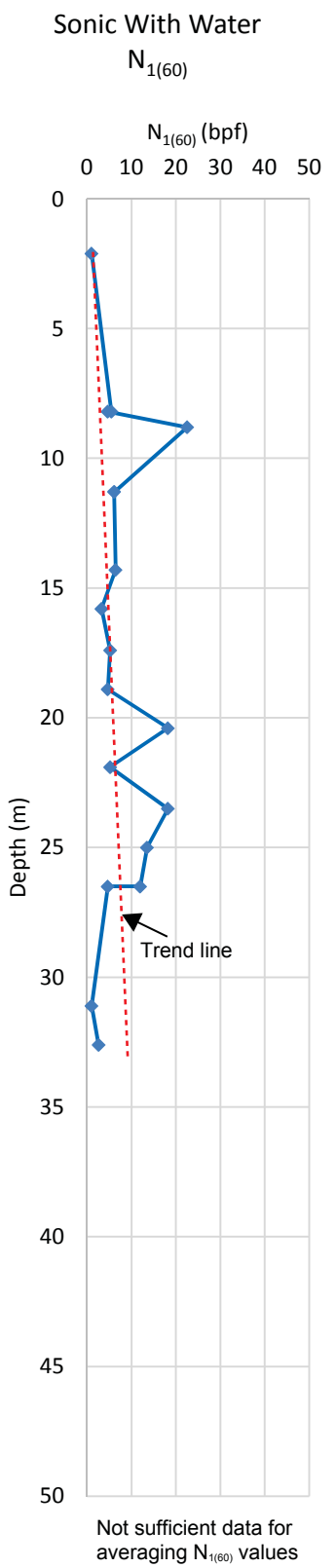
Influence of Drilling Methods on SPT

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Influence of Drilling Methods on SPT $N_{1(60)}$ values

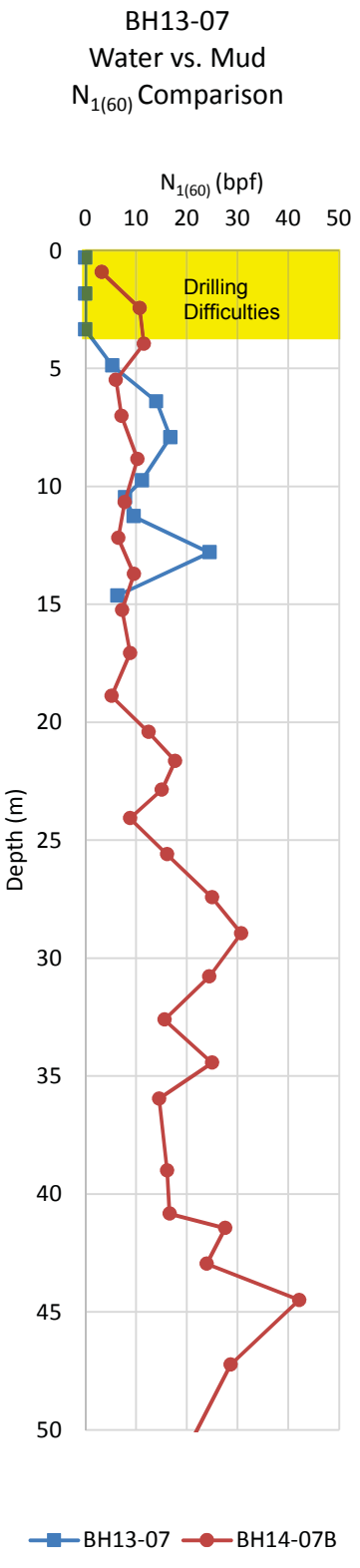


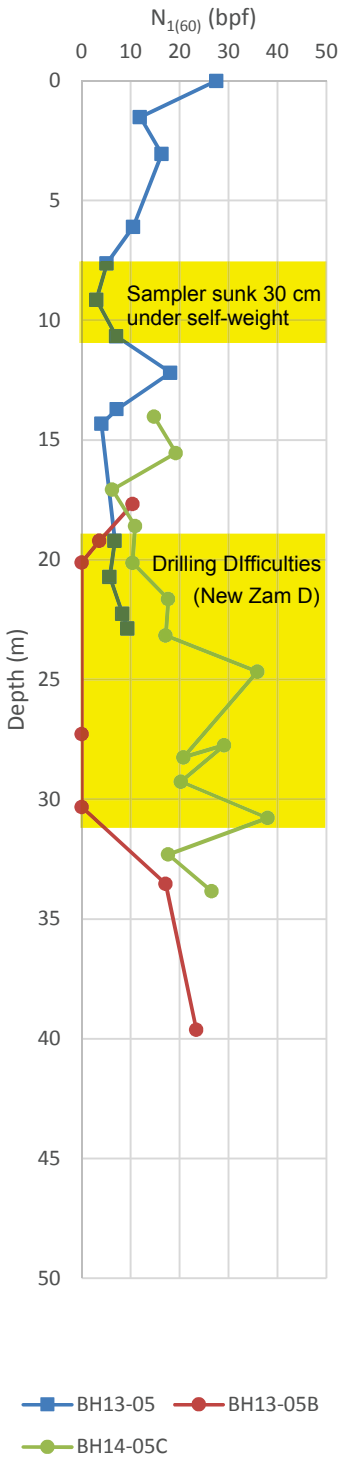


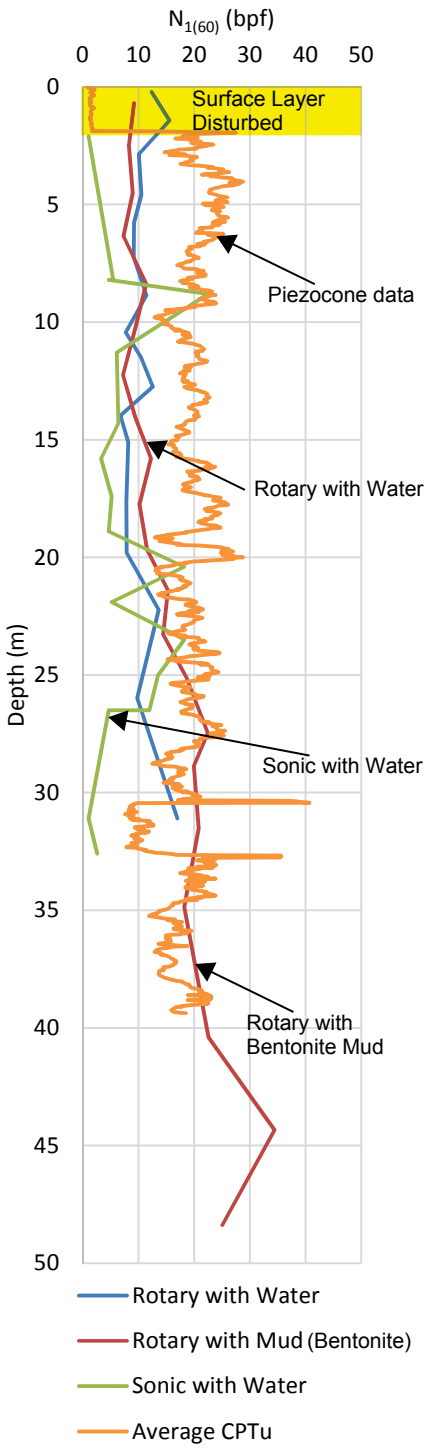


Notes:
Diamond Rotary with water includes data from BH13-03, BH13-05, BH13-07, BH13-08, BH13-09 and BH13-011
Diamond Rotary with Mud includes data from BH14-05C, BH14-06, BH14-07B, BH14-12 and BH14-13
Sonic with Water includes data from BH17-D001, BH17-D002, BH17-D003, BH17-D004, BH17-D005 and BH17-D006.

HATCH







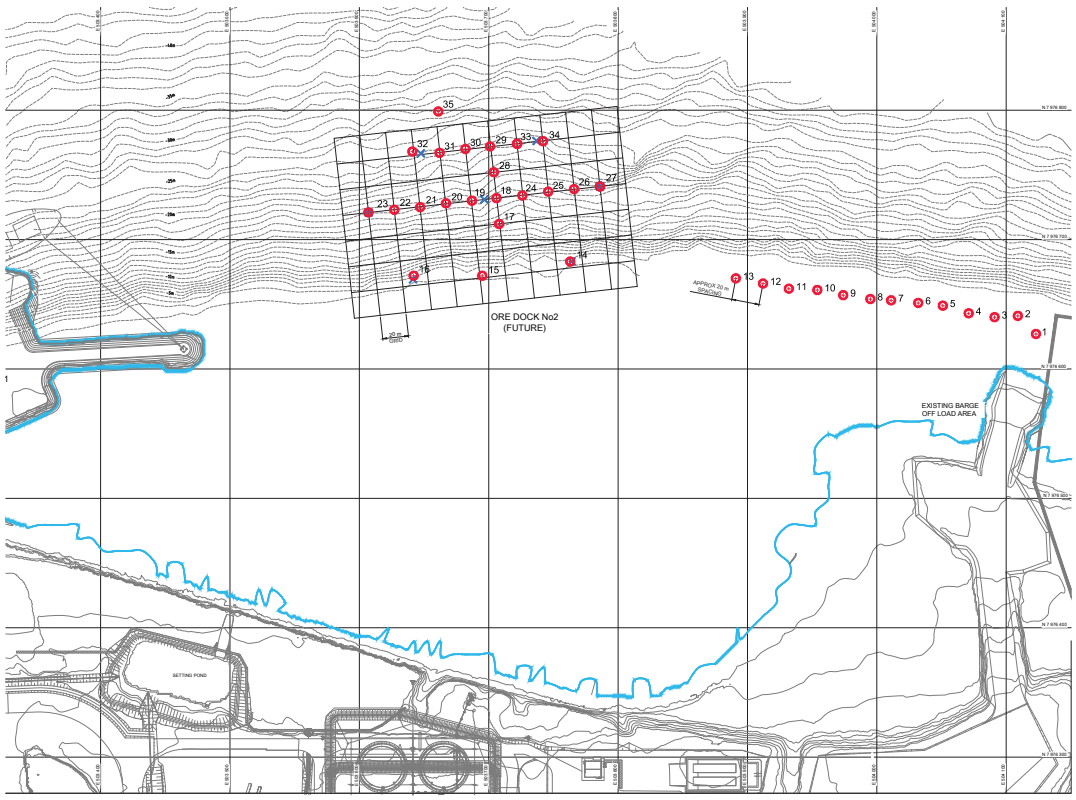
Notes:
BH13-05B was drilled with New Zam D Mud Only
BH14-05C and BH14-07B were drilled with New Zam D Mud and Bentonite
CPTu was averaged using data from CPT-D001, CPT-D002 and CPT-D003

Appendix L

Ice Thickness Tests

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DWG. No. H352034-GEOSKT-229-292-0007



PLAN

0 30 60 90 120 150 METRES

SCALE 1:1500

NOTES:

1. COORDINATE GRID IS UTM, NAD 83, ZONE 17
2. INFORMATION FOR BATHIMETRY IS A COMBINATION OF LOGISTEC STEVEDORING INC. AND M&S.
3. THE CHART DATUM HAS BEEN ASSUMED TO BE 1.2 METRES BELOW CGVD 28 (0.0m CHART DATUM = -1.2m GEODETIC DATUM)
4. ELEVATIONS ARE BASED ON CHART DATUM
5. DIMENSIONS AND ELEVATIONS ARE SHOWN IN METERS

LEGEND

- GEOTECHNICAL INVESTIGATION LOCATION
- AUGER HOLE LOCATION FOR OFFSHORE ICE ASSESSMENT (20 METERS SPACING, MAXIMUM)

DESIGN SHOWN IS A HATCH CONCEPT DESIGN
CONTRACTOR TO PROVIDE HIS OWN DESIGN

DRAWING No.	DRAWING TITLE
REFERENCE DRAWINGS	

NAME
SIGNATURE
ENG REG NUMBER
REVISION DATE
ORIGINAL DATE
REGISTERED PROFESSIONAL

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No.	DESCRIPTION	BY	CHKD	DATE
-	-	-	-	-

REVISIONS

HATCH

ROLE	NAME	SIGNATURE	DATE
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DESIGNER		NR	
CHECKER			
DESIGN COORD.	W HOYLE		
RESP. ENG.			
LEAD DISC. ENG.	S HINCHBERGER		
ENG. MANAGER			
PROJ. MANAGER	S HEINER		

DRAWING APPROVAL STATUS: CLIENT REVIEW

Baffinland

BAFFINLAND EXPANSION 12 MTPA MINE OPTION
PRE FEASIBILITY STUDY

PORT SITE - ORE DOCK No. 2
OFF SHORE ICE ASSESSMENT
AUGER HOLE LOCATIONS

SCALE 1:50,000 OR AS NOTED

DWG. No. H352034-GEOSKT-229-292-0007

REV B

$USERNAME$
$DATE$
$TIME$