ATTACHMENT 28

LTWP Aggregate Assessment Report

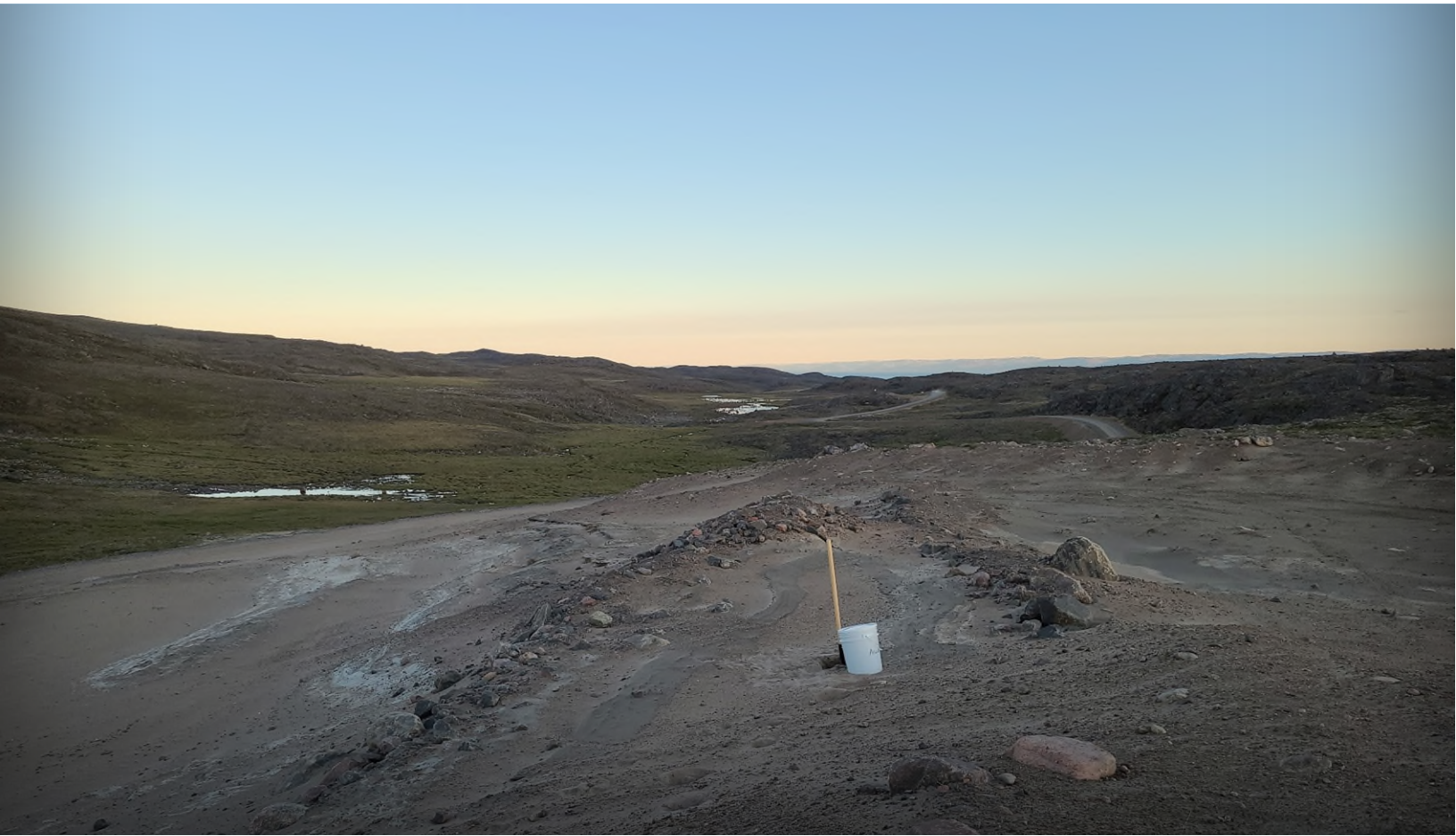
City of Iqaluit

Granular Material Requirements and Local Sources Report

Long Term Water Program – Supply and Storage

Iqaluit, Nunavut

May 2025



Granular Material Requirements and Local Sources Report – DRAFT

16 May 2025

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30192375 Iqaluit LTWP – Aggregate Assessment Report

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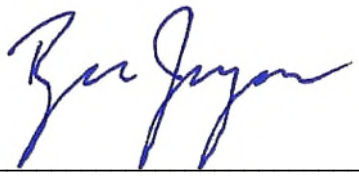

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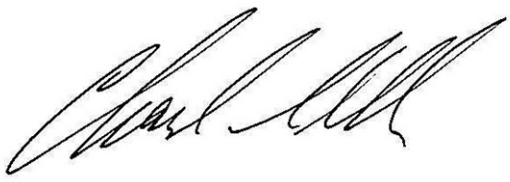

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1	0	31 Jan. 2025	--	Draft Report	CG, JEH
2	0	16 May 2025	ES-2, 12–16	Final Report	RVJ, JEH

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Acronyms and Abbreviations

Arcadis	Arcadis Canada Inc.
BP	Borrow Pit
BV	Bureau Veritas
City	City of Iqaluit
cm	centimetres
EBA	EBA Engineering Consultants Ltd.,
ha	hectares
ISA	Iqaluit Shooting Association
km	kilometer
kPa	kilopascal
LG	Lake Geraldine
LQ	Lake Qikiqtalik
LTWP	Long Term Water Program
mbgs	metres below ground surface
m	metre
m^2	square metre
m^3	cubic metre
mm	millimetres
MPa	megapascal
SPMDD	Standard Proctor Maximum Dry Density
SR	Shooting Range
Stantec	Stantec Consulting Ltd.

Executive Summary

Arcadis Canada Inc. (Arcadis) has prepared this draft granular material requirements and local sources assessment report for the City of Iqaluit (the City) to provide a summary of the geotechnical results obtained as of January 2025 for the Long-Term Water Program – Supply and Storage project, specifically with respect to the potential aggregate sources in proximity to the project construction areas. The field evaluation program outlined in this report was completed to assess the suitability of the readily available native materials for use as construction aggregates.

The potential aggregate sources (i.e., areas BP1 to BP4 shown on **Figure 2** appended) are located on a parcel of untitled City land located northeast of the surveyed portion of the community in Iqaluit, Nunavut (the Site). The total Site area is approximately 1,150 hectares in size and is mostly undeveloped. Its terrain comprises rolling hills with rocky outcrops and tundra valleys, with finger lakes oriented northwest-southeast. The Niaqunnguk River traverses the Site from its northwest boundary to its southern corner. The Site resides in a zone of continuous permafrost. Quaternary geological events have resulted in surficial units of till infill, glacial outwash features, or bare bedrock.

Per the Preliminary Design Report, at least two types of aggregates will be required during LTWP facilities construction: Cushion 1 (a relatively coarse material to act as filter gradation, initial protection for the layered dam/dyke liner system, function as an access road surface course, etc.) and Cushion 2 (a finer material to act as the geosynthetic liner bedding). Preliminary volume requirement estimates are on the order of 80,000m^3 for Cushion 1 and 15,000m^3 for Cushion 2.

Glacial outwash features are expected to provide the most appropriate granular construction materials. Potential aggregate sources were identified through a combination of previous report review, desktop study (including interviews with City staff, local contractors, and other stakeholders), and field reconnaissance. Four potential sources were identified for further field evaluation:

- BP1 Shooting Range: currently in use as a firearms training facility. Previously used as a sand source for City projects. Noted in previous reports;
- BP2 Lower Sand Deposit: a relatively small glacial outwash feature used as a borrow pit during the emergency measures extension of the Lake Qikiqtalik (LQ) access road;
- BP3 Upper Sand Deposit: another relatively small outwash feature, also previously used as a borrow pit during the LQ access road expansion; and
- BP4 Qikiqtalik Moraine: a feature on the shores of LQ, identified and excavated when the access road was constructed.

Preliminary field evaluation of the potential borrow sources identified was performed from 13 to 18 August 2025 by Mr. Ryan Janzen, P.Eng., of Arcadis. Borrow pit extents were traversed on foot and surficial soil characteristics were noted across the area. Borrow pit areas were measured in the field and verified against existing digital mapping layers given to Arcadis by the City at the outset of the LTWP.

Manual testpits were advanced to a maximum of 1.0m below ground surface (mbgs). Refusal was encountered at several locations, either through material too compact for manual tools or the presence of permafrost. Composite soil samples were taken at each location and examined at the time of collection for general soil classification purposes (type, texture, colour, and moisture content). A photographic log of the various borrow pit areas, general surficial soil conditions, and test pit locations has been included in **Appendix A**.

Soil samples were placed in 5-gallon pails and transported under Chain of Custody protocols to geotechnical testing facilities in Ontario. Grain size and moisture content analyses were performed by Bureau Veritas Labs of

Ottawa, Ontario, and the more detailed Proctor, direct shear, and permeability testing was carried out by Stantec in Ottawa, Ontario. The scope of geotechnical testing performed to date includes:

- 12 moisture/ice content analyses;
- 12 grain size analyses (sieve and hydrometer);
- 12 standard Proctor tests;
- 4 direct shear tests; and
- 7 hydraulic conductivity tests.

The results of the geotechnical testing are summarized in **Section 4**, and geotechnical laboratory certificates are attached in **Appendix B**.

Based on the field evaluation and review of the geotechnical testing results, the materials sampled from BP1,2, and 3 are considered acceptable for use, with the possible exception of material from the BP1-A2 location south of the access road. These soils are found to be well sorted, homogeneous, free-draining, and of appropriate grain size distribution for the proposed project works.

With a conservatively estimated total volume of greater than 200,000m^3 available from BP1, 2, and 3 (with an estimated 162,000m^3 available from BP1 alone), available volume is not expected to be a concern.

Soils from BP4 may be acceptable for use as well, depending on design specifications. These soils are found to be typical of a glacial moraine (till) feature, albeit a relatively well-drained one: compact, heterogeneous, poorly sorted, and with a relatively high density and internal friction angle. Several layers in the dam construction design call for coarser gradations, and BP4 materials may have adequate drainage, shear strength, and internal friction angles to be of potential use. It is anticipated that some processing would be required to render these materials acceptable for use in construction.

Additional field investigation work is recommended to more adequate define the volumetric quantities available and confirm material quality. The City may also give thought to investigating previously identified deposits. Though they are not considered applicable to this project, they may be a potential future resource as described in previous reports.

Confirmatory sampling and stockpiling is recommended prior to construction phases. Liner installation, in particular, is a relatively complex process with simultaneous operations. Having prepared stockpiles on hand can help avoid issues or delays.

A qualified geotechnical engineer must be retained to confirm the suitability of proposed materials and provide site supervision during construction activities. A material testing and observation program is recommended, with a report confirming that construction activities have been carried out in accordance with specifications and geotechnical recommendations.

The geotechnical work outlined in this report was completed to assist with the ongoing development of the reservoir, conveyance, and pumphouse designs. As design parameters change and further geotechnical data is obtained, this report will be updated accordingly. Further site investigation and QA/QC programs are recommended.

1 Introduction

Arcadis Canada Inc. (Arcadis) was retained by the City of Iqaluit (the City) to complete professional engineering and environmental services for the City's Long Term Water Program Raw Water Supply and Storage (LTWP – S&S). As part of this assessment and design project, Arcadis has performed a preliminary assessment of potential aggregate sources in the parcel of untitled land located northeast of the surveyed portion of the community in Iqaluit, Nunavut (the Site).

The field investigations and laboratory testing outlined in this report were carried out to provide preliminary geotechnical information on local aggregates and to assess their suitability for use as construction materials. The ramifications on the design and the potential construction of a raw water reservoir and conveyance system associated with the City's LTWP project are to be discussed in the appropriate design documents.

1.1 Site Description

The Site lies northeast of the residentially developed portion of Iqaluit and is roughly square in shape, with aerial coverage of approximately 1,150 hectares (ha), please refer to **Figure 1** located at the rear of this report. The northeast half of Lake Geraldine (LG) is included in the Site, as is the southwest half of Lake Qikiqtalik (LQ). The Road to Nowhere leads from a residential area in the southeast portion of Iqaluit to the approximate centre of the Site. An access road splits from the Road to Nowhere north of the Niaqunnguk (Apex) River and leads to the southwest shore of Lake Qikiqtalik. These site features are shown in **Figure 2** at the rear of this report.

The Site is mostly undeveloped. Topography varies from rolling to rough, with some major and numerous minor ridges and scarps, with tundra valleys and finger lakes oriented northwest-southeast in the direction of glacial scouring. Vegetation is continuous to absent, low Arctic to mid-Arctic. The Niaqunnguk River traverses the Site from its northwest boundary to its southern corner. Water in the Niaqunnguk River flows across the Site and south to Frobisher Bay.

The Site is within the municipal boundary of Iqaluit but outside of the surveyed area and is therefore classified as Untitled Municipal Land by the City's Planning and Development Department.

1.2 Background

The current LTWP design calls for various aggregates in substantial quantities. The majority of the structures are to be constructed using blast rock obtained from the excavation of the required reservoir volume. Cushion 1 and 2 are the sand and gravel requirements for the various structures, and are described in the Preliminary Design Report as:

- Cushion 1: this will be a filter graded material (gravel and sand) designed to retain the subsequent bedding layers from the rock fill. May also be used as a surface course for access roads and laydown areas. Intended to be produced onsite from excavated bedrock or suitable native sources, this material will be crushed and screened to achieve the filter grade required. Material to be placed in 300mm vertical lifts and

compacted at ±2% optimum moisture content using a smooth drum vibratory roller to 95% Standard Proctor Maximum Dry Density (SPMDD). In the event that a coarser material is selected (e.g., 2" minus grading), a process compaction method will be specified.

- Cushion 2: bedding material for the geosynthetic liner. This sandy material will be obtained from local borrow sources and screened as necessary to protect the geosynthetic liner according to the manufacturer's recommendations. Material to be placed in 300mm vertical lifts and compacted at ±2% optimum moisture content using a smooth drum vibratory roller to 95% SPMDD.

The estimated quantities required, as noted in the Preliminary Design Report, are presented below.

Table 1-1 Estimated Material Quantities - Retention Structures

STRUCTURE	TOTAL QUANTITIES					
	VOLUME (m^3)				AREA (m^2)	
	ROCKFILL	CUSHION 1	CUSHION 2	RIPRAP	GEOMEMBRANE	GEOTEXTILE
Dam 1	100788	16676	6922	9234	11063	22126
Dyke 2	5116	2035	680	1148	1368	2736
Dyke 3	6887	3460	1266	2005	2326	4653
Dyke 4	2071	1569	501	842	942	1885
Dyke 5	740	673	199	366	408	816
Dyke 6	24802	5935	2279	3063	3707	7414
Dyke 7 (Spillway)	1405	1114	339	583	1445	2890
Dyke 8	15902	5134	1933	2824	1445	2890
Total	**157715**	**36599**	**14121**	**20069**	**22706**	**45413**

Table 1-2 Estimated Material Quantities - Peripheral Structures

STRUCTURE	VOLUME (m^3)		ESTIMATED LENGTH / AREA
	ROCKFILL	CUSHION 1 (VEHICLE SURFACE)	
Access Road	16,000	1,600	1,600 m
Ring Road	20,000	2,000	2,000 m
Laydown Areas (Various)	75,000	25,000	50,000 m^2
Pipeline Berm	18,000	9,000	4,200 m
Qikiqtalik Road	24,000	4,800	6,000 m
Repair Stockpile	100,000	-	-
Total	**253,000**	**42,400**	

The total estimated volume requirements are on the order of 80,000m^3 for Cushion 1 and 15,000m^3 for Cushion 2. These estimates will be refined as the design progresses.

1.3 Local Geology

Synopses of the local geology are provided in Arcadis' Preliminary Geotechnical Report (2025) and by EBA in their Granular Resource Study (2003). The reader is encouraged to reference those documents for greater detail. A brief summary of the information in those documents is presented below.

The project area is underlain by the Cumberland Batholith, a large, Paleoproterozoic igneous formation consisting primarily of granitoids (monzogranite, syenogranite). Glacial events during the Quaternary period have resulted in the modified bedrock topography of the area as well as a combination of bare bedrock, till infill, and glaciofluvial outwash features.

The typical outwash features comprise well to poorly sorted sand and/or gravel with some minor silt. Eskers are considered the best source of well-sorted granular construction material.

2 Potential Local Aggregate Sources

Potential local aggregate sources were identified through a combination of desktop study, information provided by local resources (City staff, local contractors, and other stakeholders), and field evaluation. A primary consideration when identifying potential sources was proximity to the proposed works and accessibility.

2.1 Previous Studies

Previous granular resource investigations are well summarized in EBA (2003). Of the areas identified in that report, two are of potential immediate utility to the LTWP.

- The Road to Nowhere Pits: an agglomeration of small glaciofluvial features along the Road to Nowhere. The area noted includes the current Shooting Range (SR) facility and several smaller features to the south.
    - All of these, with the exception of the current SR area, were noted to be 'depleted';
    - A total of 177,000m^3 was estimated to be present. It is noted, however, that the SR area is the current source of sand for the City, and no formal tracking of quantities taken or current remaining volume estimates are made.
- Area 2; Niaqunnguk Valley north of the Road to Nowhere: from figures, this area appears to be north of LQ and includes several discrete features.
    - These areas are not immediately accessible. Surveys were performed via pick and shovel and estimates thus do not have a high degree of certainty;
    - The most recent survey lists 87,000m^3 as proven, 1.89M m^3 as probable, and 2.6M m^3 as possible appropriate granular material in this area.

2.2 Desktop Study

In addition to previous studies, Arcadis has reviewed publicly accessible geological maps and digital resources in an effort to locate potentially appropriate material sources. City staff and local contractors have also provided knowledge with regard to potential sources. The vast majority of outwash features are present in the Niaqunnguk Valley, as a result of the quaternary geological events.

The LTWP began after previous aggregate studies were performed, and the Road to Nowhere has since been extended up to LQ under emergency measures. This has resulted in immediate access to a larger area of the Niaqunnguk Valley, and the necessary development of several small outwash features – originally too small for consideration – as borrow pits. Several of these areas are considered appropriate material sources for the LTWP works.

2.3 Potential Feasible Borrow Sources

As noted, accessibility and proximity to the proposed works were the primary considerations when designating potential sites for further study. When taking into account the relatively small quantities required for the project, the larger deposits to the northwest of LQ (Area 2 as defined in previous studies) were not investigated as expansion and development in that area is not considered financially viable at this time. Traffic restrictions and haul times were also considered when evaluating the feasibility of borrow sources.

Several previous borrow pits are noted as being 'depleted'; this is understood to mean that the amount of material that can be used for Iqaluit Public Works projects without processing may have declined. Given the robust construction of the LTWP works however, much more material suitable to different construction specifications may be available. It is also considered more feasible to introduce some minor processing (e.g., rebar grill or screening) than to construct new access roads and open new areas to development at this time.

Between the previous report review, existing desktop study, and multiple site reconnaissance opportunities in 2023 and 2024, four sites were designated for further field evaluation.

2.3.1 BP1 Shooting Range

This is the area identified in previous studies and has been used as a sand source in the past. There are no current estimates of the remaining volume present in this feature. The material has been proven to meet City construction specifications. Variously referred to as one of the 'Road to Nowhere Pits', 'the Shooting Range' or 'Area 5' in previous studies, it is shown on **Figure 2** as BP1: Shooting Range. This is the largest by area of the potential borrow pits.

2.3.2 BP2 Lower Sand Deposit

Noted on the City's reference maps as an aggregate source used during the emergency extension of the Road to Nowhere, this outwash deposit is on the west side of the Niaqunnguk River Valley, along the Road to Nowhere, roughly 3.3km from the nearest subdivision. It is shown on **Figure 2** as BP2: Lower Sand Deposit.

2.3.3 BP3 Upper Sand Deposit

Seemingly similar to BP2 in its glaciofluvial origin, composition, and size, BP3 is located another 600m along the Road to Nowhere towards LQ. It is also shown on the City's reference map as a previously used aggregate source during the emergency road extension, and is shown on **Figure 2** as BP3: Upper Sand Deposit.

2.3.4 BP4 Qikiqtalik Moraine

Immediately adjacent LQ at the end of the extended Road to Nowhere, this feature forms the ridge along the southwest side of the lake. Unlike the other potential borrow pits, coarse gravel, cobbles, and several boulders are immediately visible at surface. Comparatively little material has been removed from this borrow area, and its suitability requires further sampling and study. It is shown as BP4: Qikiqtalik Moraine on **Figure 2**.

3 Field Evaluation and Sampling

Preliminary field evaluation of the potential borrow sources identified was performed from 13 to 18 August 2024 by Mr. Ryan Janzen, P.Eng., of Arcadis. Borrow pit extents were traversed on foot and surficial soil characteristics were noted across the area. Borrow pit areas were measured in the field and verified against existing digital mapping layers given to Arcadis by the City at the outset of the LTWP.

Manual testpits were advanced to a maximum of 1.0m below ground surface (mbgs). Refusal was encountered at several locations, either through material too compact for manual tools or the presence of permafrost. Composite soil samples were taken at each location and examined at the time of collection for general soil classification purposes (type, texture, colour, and moisture content). A photographic log of the various borrow pit areas, general surficial soil conditions, and test pit locations has been included in **Appendix A**.

Soil samples were placed in 5-gallon pails and transported under Chain of Custody protocols to geotechnical testing facilities in Ontario. Grain size and moisture content analyses were performed by Bureau Veritas (BV) Labs of Ottawa, Ontario, and the more detailed Proctor, direct shear, and permeability testing was carried out by Stantec in Ottawa, Ontario. The scope of geotechnical testing performed to date includes:

- 12 moisture/ice content analyses;
- 12 grain size analyses (sieve and hydrometer);
- 8 standard Proctor tests;
- 4 direct shear tests; and
- 6 hydraulic conductivity tests.

The results of the geotechnical testing are summarized in **Section 4** below, and laboratory certificates of analysis are available in **Appendix B**.

3.1 BP1 Shooting Range

BP1 is located between the Niaqunnguk River and the Road to Nowhere, roughly 2.5km from the nearest subdivision down the Road to Nowhere, as shown on **Figure 2** at the rear of this report. A more detailed view of the extent of the potential borrow pit, along with sampling locations and the current configuration of the shooting range, is shown on **Figure 3-1**: BP1 Shooting Range

below.

This area is currently in use as a firearms range, operated by the Iqaluit Shooting Association (ISA). An access road runs along the south of the main deposit body, passing both long gun and pistol ranges, enroute to the Temporary Pumping Station on the banks of the Niaqunnguk River. This facility is used by the ISA (private citizens) as well as by enforcement agencies for training exercises.

Three test pits were advanced in different areas of the potential borrow pit. Soils at locations BP1-A1 and -A3 (northwest and east of the current shooting range facility, respectively) were described as brown to gray, wet to moist, fine to coarse sand, with variations in gradation visually apparent across the total area. Trace gravel, cobbles and gravel were all visible at surface. This description stands in contrast to the soils at BP1-A2, which is located south of the shooting range access road and in the area that receives drainage from the rest of the site.

Soils here were described as grey, wet and fine sandy silt, with evidence of frozen ground. Soils at each location were described as homogeneous and well sorted.

The potential borrow area measures roughly 81,150m^2, not including the areas south of the access road (includes only the light green area shown on **Figure 3-1**: BP1 Shooting Range). Assuming an average granular material depth of 2m across the areal extent, a total volume of around 162,000m^3 could be present at this source.

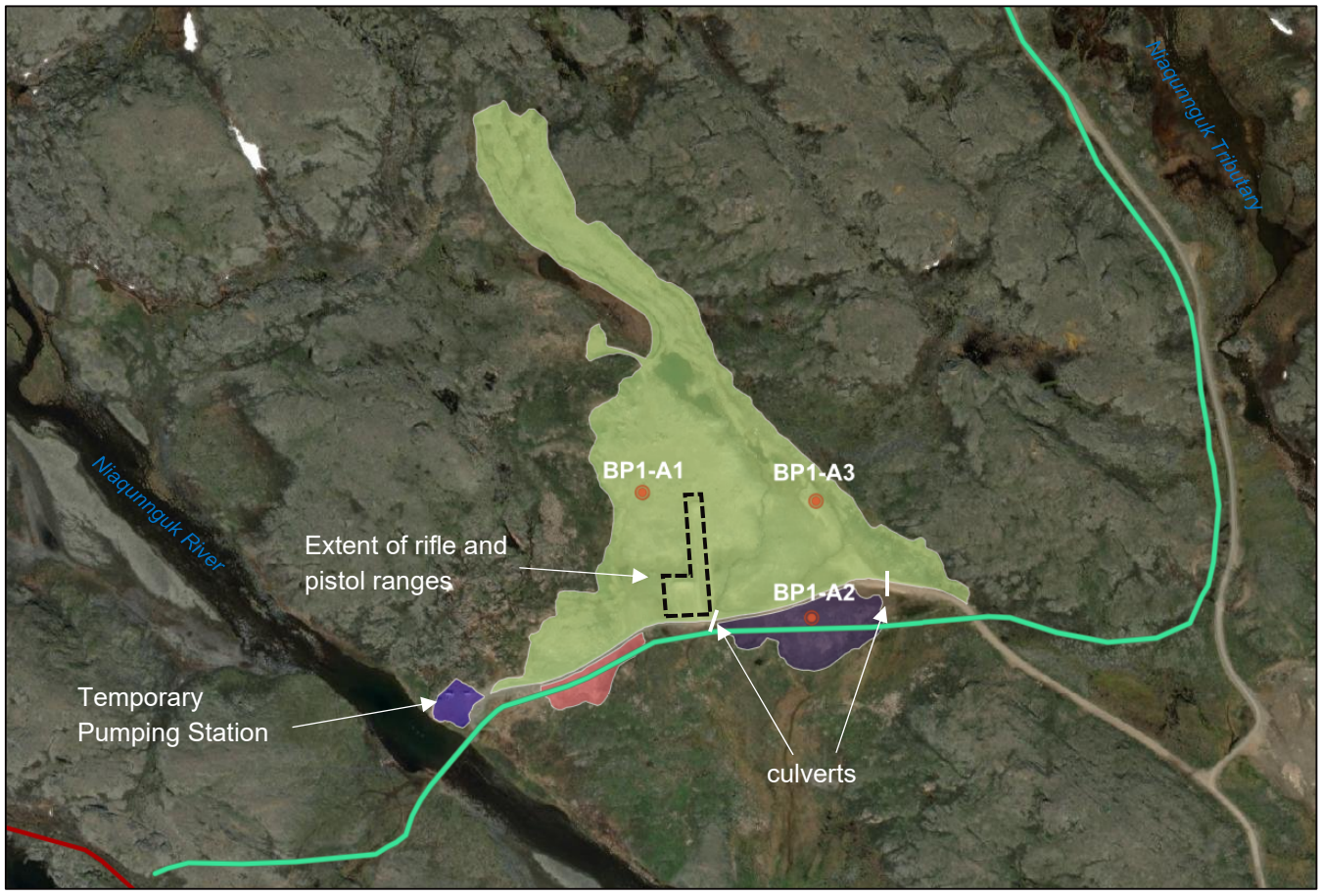

Figure 3-1: BP1 Shooting Range

3.2 BP2 Lower Sand Deposit

BP2 is located in the Niaqunnguk River Valley, along the Road to Nowhere roughly 830m past the LQ access road gate, as shown on **Figure 2**. It comprises a glacial outwash deposit on the western side of the river valley, with the access road cutting through the heart of the feature. A detailed view of the potential borrow pit and test pit locations is shown on Figure 3-2: BP2 Lower Sand Deposit below.

The minor sand body lies across the LQ access road. Vehicle traffic and recreational ATV use appears to be prevalent, based on tracks observed. This feature occurs on the west side of the Niaqunnguk tributary that drains LQ, with a steep sand slope dropping to the river some 10m below.

Three test pits were advanced across the extent of the feature. Soils observed were consistent across the feature extent and were described in the field as brown, dry to moist, fine to medium sand, homogeneous, and well sorted. Little variation in soil composition was noted across the area, with some coarse sand and fine gravel visible at surface.

The total area of the feature is calculated at approximately 9,400m^2, including the access road area. At an average depth of 2m, an estimated volume of 18,800m^3 would be present at this source. This is considered a conservative estimate, given that the sand slope down to the river is at least 10m high.

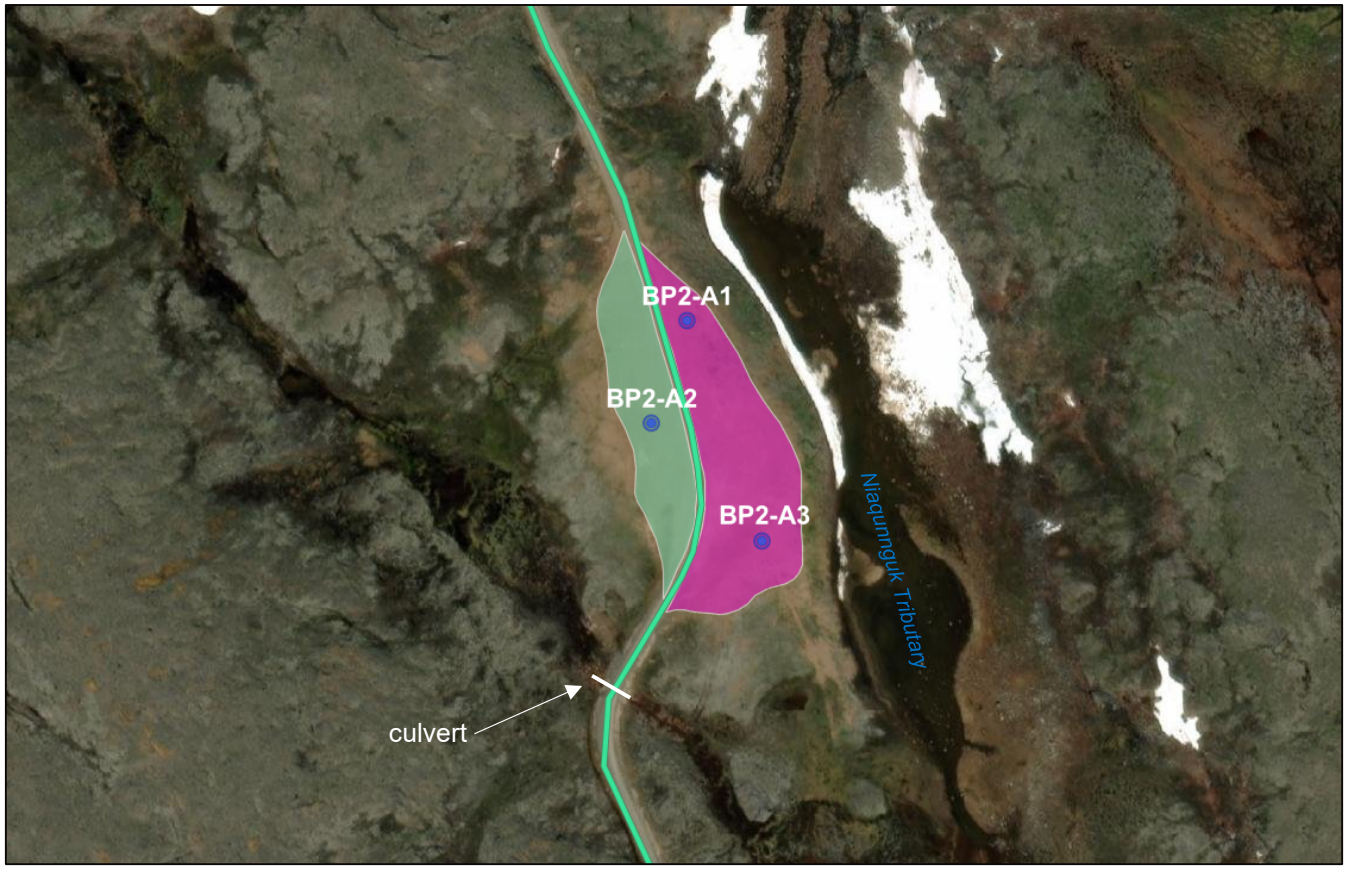

Figure 3-2: BP2 Lower Sand Deposit

3.3 BP3 Upper Sand Deposit

BP3 is located another 500m farther along the LQ access road from BP2, and 1.1km from LQ itself, as shown on **Figure 2**. It comprises a glacial outwash deposit on the western side of the river valley, with the access road

cutting across the bottom third of the feature. A detailed view of the potential borrow pit and test pit locations is shown on Figure 3-3: BP3 Upper Sand Deposit below.

The minor sand body lies across the LQ access road. As with BP2, vehicle traffic and recreational ATV use appear to be prevalent – the steep slopes of this feature appear to make it a favourite with ATV users. This feature occurs across a throat of the Niaqunnguk tributary that drains LQ, with a total slope of around 15m from the feature's highest extent to the bottom of the river valley, at a steep grade. Material from this feature has clearly been used to repair a periodic washout located just up the LQ access road, where the existing culverts appear to have difficulty handling the spring freshet volume.

Three test pits were advanced across the extent of the feature. Soils observed were consistent across the feature extent and were described in the field as brown, dry to moist, fine to medium sand, homogeneous and well sorted. Little variation in soil composition was noted across the area, with trace fine gravel and cobble not visible initially but encountered below the surface. There is enough fine material that aeolian transport was observed across the roadway, and migration from the peak downslope to the river valley is ongoing.

The total area of the feature is calculated at approximately 14,800m^2, including the access road area. At an average depth of 2m, an estimated volume of 29,600m^3 would be present at this source. This is considered a conservative estimate, given that the sand slope down to the river is at least 15m high.

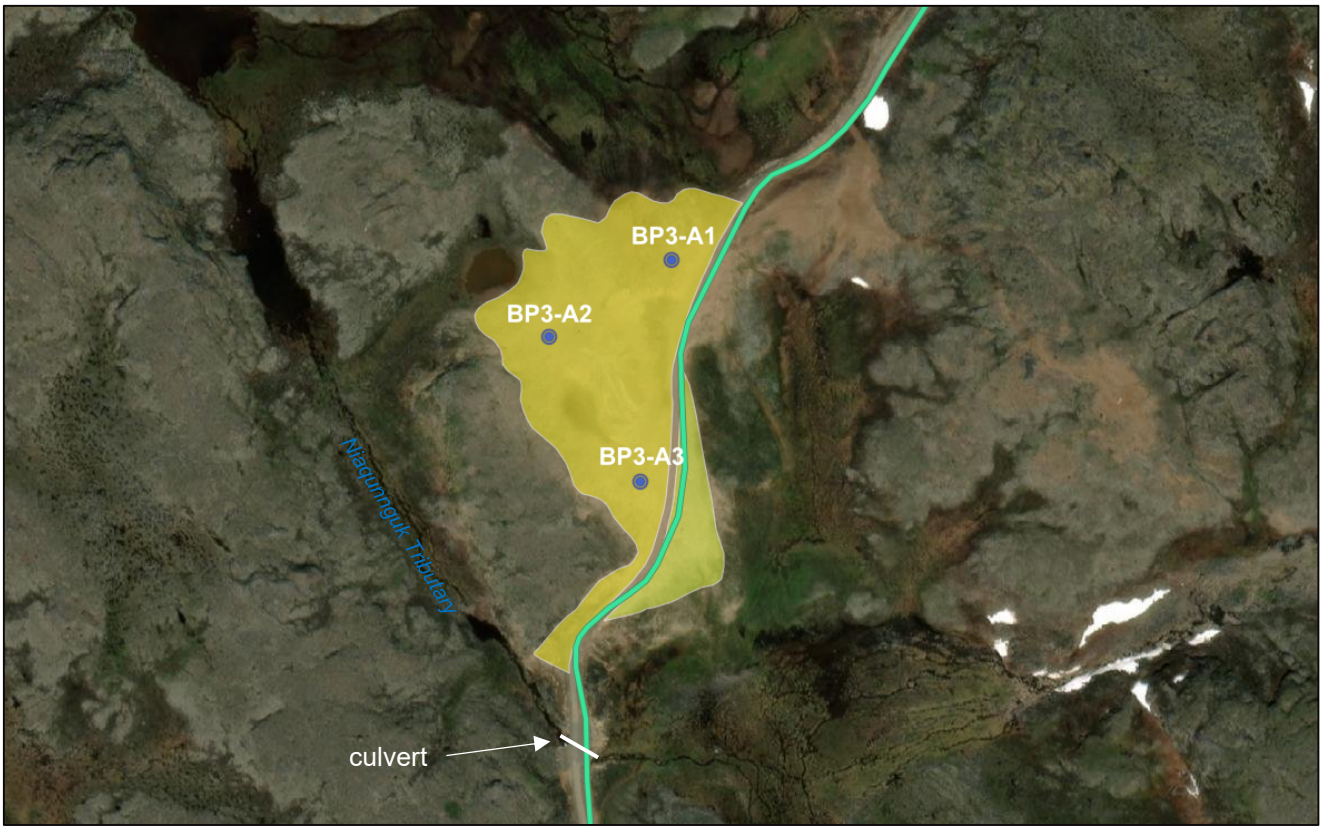

Figure 3-3: BP3 Upper Sand Deposit

3.4 BP4 Qikiqtalik Moraine

BP4 is a larger area with relatively undefined extents, located adjacent LQ and continuing for an unknown length. This feature appears to be a glacial deposit left at the edge of LQ during glacial retreat. A detailed view of the potential borrow pit and test pit locations is shown on Figure 3-4: BP4 Qikiqtalik Moriane below. Two excavated areas of this deposit are also shown; these are designated the 'upper' and 'lower' areas. Approximate, conservative extents have been outlined based on topographical inference and the observed excavations.

The feature has been cut to allow passage of the LQ access road, resulting in the two excavated areas. The upper excavated area bisects the glacial feature's ridge that runs parallel to the long axis of LQ, while the lower excavated area is at the base of the feature slope as the road turns to avoid a low-lying boulder field. The total slope of the deposit is at least 20m from the ridge crest to the base, at a steep grade.

Three test pits were advanced in the excavation areas. Soils observed were consistent across the feature extent and were described in the field as brown, moist, gravelly, medium to coarse sand with some cobble and trace boulder, heterogeneous and poorly sorted. A stockpile of boulders (estimated at 0.6 to 1.2m in nominal diameter) was observed in the lower area. Composition appears consistent with the excavated areas. Excavation with manual tools was relatively difficult, with boulders encountered at each location; maximum test pit depth was 0.5m.

The total area of the feature is calculated at approximately 63,100m^2. At an average depth of 2m, an estimated volume of 126,200m^3 would be present at this source. This is considered a conservative estimate, given that the feature is at least 20m high from the crest of the ridge to the base of the lower area.

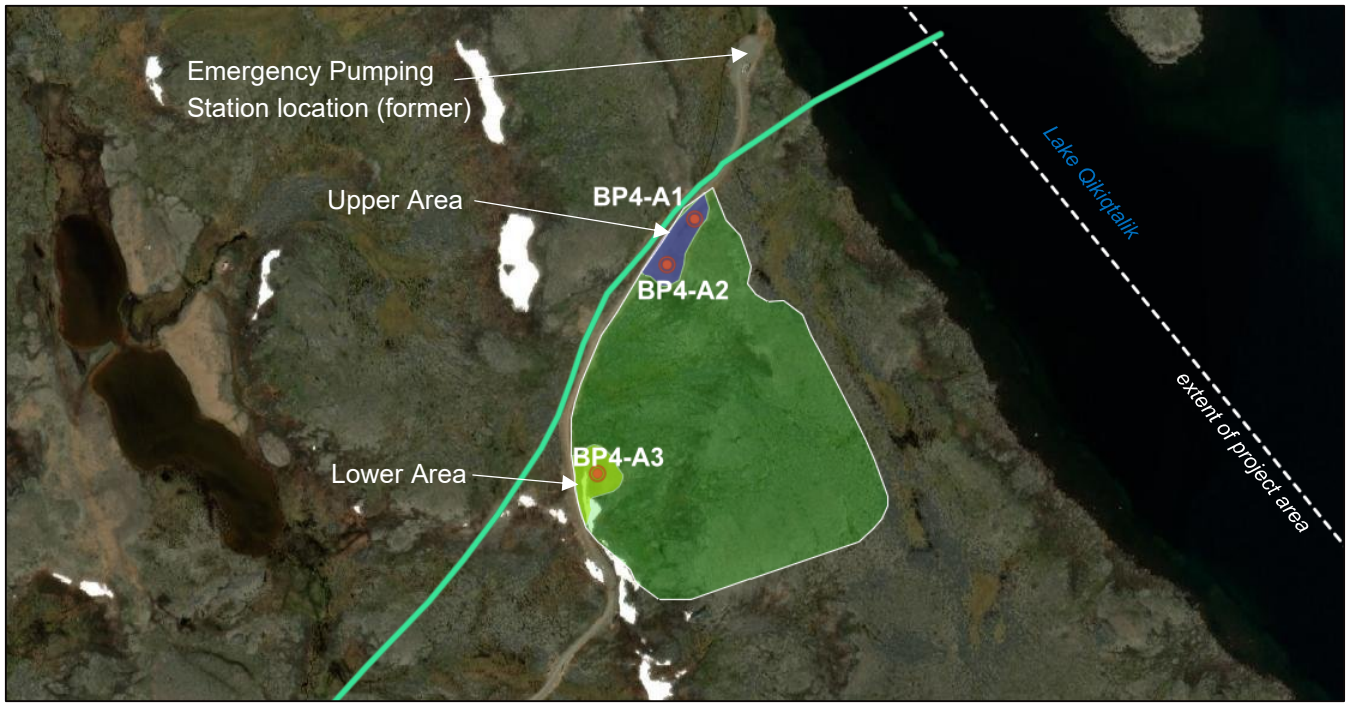

Figure 3-4: BP4 Qikiqtalik Moriane

4 Results

Composite samples were retrieved from each borehole location and submitted for geotechnical analyses. The results of the various analyses have been summarized below. All laboratory certificates are compiled in **Appendix B**.

4.1 Moisture Content

Natural moisture content was performed on all samples.

Table 4-1: Summary of Natural Moisture Content Testing

Sample No.	Moisture Content	Notes
BP1 Shooting Range		
BP1-A1	3%	Well drained.
BP1-A2	14%	Ice crystals noted in sample. Area receives drainage from rest of feature, culvert crosses the road nearby. Finer particle size noted.
BP1-A3	16%	Area receives drainage from slope to the E.
BP2 Lower Sand Deposit		
BP2-A1	16%	E of roadway. Drainage slopes E to W.
BP2-A2	3%	W of roadway, higher elevation.
BP2-A3	14%	E of roadway, lower elevation.
BP3 Upper Sand Deposit		
BP3-A1	7%	W or roadway. Drainage slopes NE to SW.
BP3-A2	16%	Higher elevation, close to crest of feature.
BP3-A3	14%	Lower elevation.
BP4 Qikiqtalik Moraine		
BP4-A1	10%	Upper area.
BP4-A2	10%	Upper area.
BP4-A3	12%	Lower area, lower elevation.

Soil samples were generally characterized as ‘moist’ in the field, with some ‘dry’ designations corresponding to lower moisture content results.

4.2 Grain Size Analyses

Grain size analyses (sieve and hydrometer) were performed on all samples (ASTM D6913-17M and D7928-17M).

Table 4-2: Summary of Grain Size Analyses

Sample No.	Gravel	Sand	Silt	Clay	Classification
BP1 Shooting Range					
BP1-A1	3%	91%	4%	2%	SAND.
BP1-A2	0%	10%	81%	8%	SILT, trace sand and clay.
BP1-A3	0%	89%	9%	2%	SAND, trace silt.
BP2 Lower Sand Deposit					
BP2-A1	13%	85%	1%	1%	SAND, some gravel.
BP2-A2	4%	93%	2%	1%	SAND.
BP2-A3	1%	79%	19%	2%	SAND, some silt.
BP3 Upper Sand Deposit					
BP3-A1	0%	93%	6%	1%	SAND, trace silt.
BP3-A2	0%	84%	14%	2%	SAND, some silt.
BP3-A3	0%	95%	5%	0%	SAND, trace silt.
BP4 Qikiqtalik Moraine					
BP4-A1	14%	71%	15%	0%	SAND, some gravel and silt.
BP4-A2	15%	69%	15%	1%	SAND, some gravel and silt.
BP4-A3	14%	64%	21%	1%	SAND, some gravel and silt.

Laboratory test certificates and grain size distribution graphs are included in **Appendix B**. Graphical analysis supports the field characterization of well sorted material in BP1,2, and 3, with material from BP4 being poorly sorted.

Given the results of the grain size analyses, no Atterberg limit testing was performed.

4.3 Standard Proctor Testing

All recovered samples were submitted for Standard Proctor testing (ASTM D698).

Table 4-3: Results of Standard Proctor Testing

Sample No.	Maximum Dry Density (kg/m^3)	Optimum Moisture Content (%)
BP1 Shooting Range		
BP1-A1	1728	14.6
BP1-A2	1748	15.5
BP1-A3	1647	15.4
BP2 Lower Sand Deposit		
BP2-A1	1782 / 1840*	13.4 / 12.4*
BP2-A2	1672	12.0
BP2-A3	1761	11.2
BP3 Upper Sand Deposit		
BP3-A1	1642	15.2
BP3-A2	1718	13.0
BP3-A3	1690	14.0
BP4 Qikiqtalik Moraine		
BP4-A1	2135 / 2209*	5.0 / 4.4*
BP4-A2	2104 / 2198*	7.1 / 6.0*
BP4-A3	2010 / 2118*	8.8 / 7.1*

* corrected value.

4.4 Direct Shear Testing

Four samples were submitted for direct shear testing (ASTM D3080 / D3080M), one from each potential borrow source. Samples were tested for peak shear stress at normal stresses of 5, 150, and 350kPa under consolidated, drained conditions. Soil cohesion, peak internal friction angle, and ultimate internal friction angle have been determined through graphical analyses of the shear stress v. normal stress plots.

Table 4-4: Graphically Interpreted Results of Direct Shear Testing

Sample No.	Cohesion (kPa)	Peak Friction Angle (degrees)	Ultimate Friction Angle (degrees)
BP1-A1	0	33	27
BP2-A1	0	38	27
BP3-A1	0	33	27
BP4-A1	0	38	32

4.5 Hydraulic Conductivity Testing

Seven samples were submitted for hydraulic conductivity testing (coarse-grained soil procedure, ASTM D2434).

Table 4-5: Results of Hydraulic Conductivity Testing

Sample No.	Test No.	k_{20} (cm/s)	Average k_{20} (cm/s)
BP1-A1	1	1.28E-03	1.36E-03
	2	1.42E-03	
	3	1.39E-03	
BP2-A1	1	1.49E-02	1.25E-02
	2	1.13E-02	
	3	1.13E-02	
BP2-A2	1	2.27E-03	2.90E-03
	2	2.76E-03	
	3	3.67E-03	
BP2-A3	1	9.10E-04	9.73E-04
	2	9.79E-04	
	3	1.03E-03	
BP3-A1	1	1.46E-03	1.55E-03
	2	1.54E-03	
	3	1.65E-03	
BP3-A3	1	1.30E-03	1.42E-03

Sample No.	Test No.	k_{20} (cm/s)	Average k_{20} (cm/s)
BP4-A1	2	1.45E-03	6.46E-05
	3	1.50E-03	
	1	6.54E-05	
	2	6.48E-05	
	3	6.36E-05	

Samples were tested under 95% SPMDD to simulate post-construction conditions.

5 Conclusions and Recommendations

The materials sampled from BP1, 2, and 3 are considered acceptable for use, with the possible exception of material from the BP1-A2 location south of the access road. Field characterization and laboratory testing describe sand soils that are typical of glacial outwash features: well sorted, homogeneous, free-draining, and of appropriate grain size distribution for the proposed project works.

As stated in design documents, the current estimated volume requirements are on the order of 80,000m^3 for Cushion 1 (coarser) and 15,000m^3 for Cushion 2 (finer) granular materials. These estimates will be refined as the design progresses, but with a conservatively estimated total volume of greater than 200,000m^3 available from BP1, 2, and 3 (with an estimated 162,000m^3 available from BP1 alone), available volume is not expected to be a concern. Should coarser gradations than are present in the native sources be required, there will be no shortage of blast rock available to amend stockpiles as necessary.

Soils from BP4 may be acceptable for use as well, depending on design specifications. Field characterization and laboratory testing show a material is typical of a glacial moraine (till) feature, albeit a relatively well-drained one: compact, heterogeneous, poorly sorted, and with a relatively high density and internal friction angle. Several layers in the dam construction design call for coarser gradations, and BP4 materials may have adequate drainage, shear strength, and internal friction angles to be of potential use. It is anticipated that some processing would be required to render these materials acceptable for use in construction, but with a potentially very large volume available, this resource may be worth developing.

5.1 Future Recommendations

Further recommendations may be made as design work progresses or following other investigations onsite.

5.1.1 Additional Investigation Work

A test pit program using powered equipment (e.g., backhoe or excavator) is recommended to more adequately define the deposit extents and depths. Further sampling is recommended at the same time to confirm material gradations and geotechnical parameter variation across the deposit bodies. Greater investigation and sampling prior to construction phases will reduce the amount of confirmatory sampling that needs to take place during construction and can help avoid delays.

The City may wish to give thought to potentially investigating the ‘Niaqunnguk Valley Deposits’ located northwest of LQ, as described in the EBA (2003) Granular Resource Study. The access road extended to LQ has almost reached this location, and with the estimated granular material deposits estimated to be in the millions of cubic metres, the City may wish to further quantify these deposits.

5.1.2 Construction Considerations

In addition to further pre-construction investigation and sampling, any necessary processing and stockpiling is recommended prior to construction phases. Once design volumes are finalized and borrow pit locations are selected, preparing material for direct haul and placement can avoid costly delays during construction/installation. Confirmatory sampling at volumetric intervals will be required to conform to design specifications; performing this

beforehand will avoid potential delays associated with greater material excavation and processing due to pockets of potentially unsuitable materials encountered during excavation.

Aggregate will be primarily required during liner installation, which will be a relatively complex, simultaneous construction process. Having pre-processed aggregate volumes on hand for immediate placement and compaction in the various specification layers will be critical to the installation process.

5.1.2.1 Geotechnical Supervision During Construction

Development of appropriate aggregates will require movement of a variety of soil and rock types, field confirmation, and QA/QC laboratory results review. A qualified geotechnical engineer must be retained to inspect and approve aggregates prior to placement of any engineered media and to supervise the installation. Geotechnical supervision should also be provided to ensure that engineered fill placed beneath floor slabs, roadways, embankment layers, and other applications is properly compacted and that any weak soil layers are properly removed. Geotechnical inspection of the bearing conditions for any systems must also be carried out.

Geotechnical site supervision and review is required during future construction activities. It is recommended that the following material testing and observation program be performed by a licensed geotechnical engineering consultant during construction operations:

- Observation of all bearing surfaces prior to the placement of concrete/crushed stone/engineered fill;
- Sampling and testing of any concrete and fill materials used;
- Periodic observation of the condition of unsupported excavation side slopes, if applicable;
- Observation of all subgrades prior to backfilling;
- Field density tests to determine the level of compaction achieved, as applicable;
- Sampling, testing and verification of construction materials; and
- Verification of spec compliance and any necessary amendments to design specifications.

A report confirming that these construction works have been conducted in general accordance with geotechnical recommendations would then be issued following the completion of a satisfactory material testing and observation program by the geotechnical consultant.

6 Statement of Limitations

This draft iteration of this report is not to be distributed, reproduced, or relied upon by any party. Further data and site investigation is expected, and the report will be expanded.

This report, prepared for City of Iqaluit, does not provide certification or warranty, expressed or implied, that the investigation conducted by Arcadis uncovered all potential geotechnical constraints at the Site. The conclusions and recommendations presented in this report are based on the information determined at the visual observation and test pit locations. The information contained within this report in no way reflects the environmental aspect of the Site or soil, unless specifically reported upon. Subsurface and groundwater conditions between and beyond the test locations may differ from those encountered at the specific locations tested, and conditions may be encountered during construction which were not detected and could not be anticipated at the time of the site investigation. It is recommended that Arcadis be retained during construction to confirm that the subsurface conditions throughout the Site do not differ materially from those conditions encountered at the test locations.

The recommendations provided in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not have been available at the time this report was prepared, it is recommended that Arcadis be retained during future stages of the design process to verify that the design is consistent with the recommendations of this report, and that the assumptions made in the analyses contained in this report are still valid. The need for additional subsurface investigation work and laboratory testing should be reviewed by Arcadis during the course of the detail design work.

The comments given in this report on are intended only for the guidance of the designer. The number of test locations and samples taken/analyses performed may not be sufficient to determine all of the factors that may affect construction methods and costs (e.g., the thickness of surficial topsoil and fill layers can vary markedly and unpredictably). Contractors bidding on the project or undertaking the construction should, therefore, make their own interpretations of the factual information in this report and draw their own conclusions as to how the subsurface conditions may affect their bid or work.

The material in this report reflects the best judgement of Arcadis based on the information available at the time of preparation, January 2025. Changes to soil and/or groundwater quality in the areas investigated can occur following the date of testing. Any use which a third party makes of the report, or reliance on, or decisions to be based on it, is the responsibility of such third parties. Arcadis accepts no liability, whether in negligence, contract or arising on any other basis for damages or from indemnification arising from decisions or actions by others based on this report.

7 References

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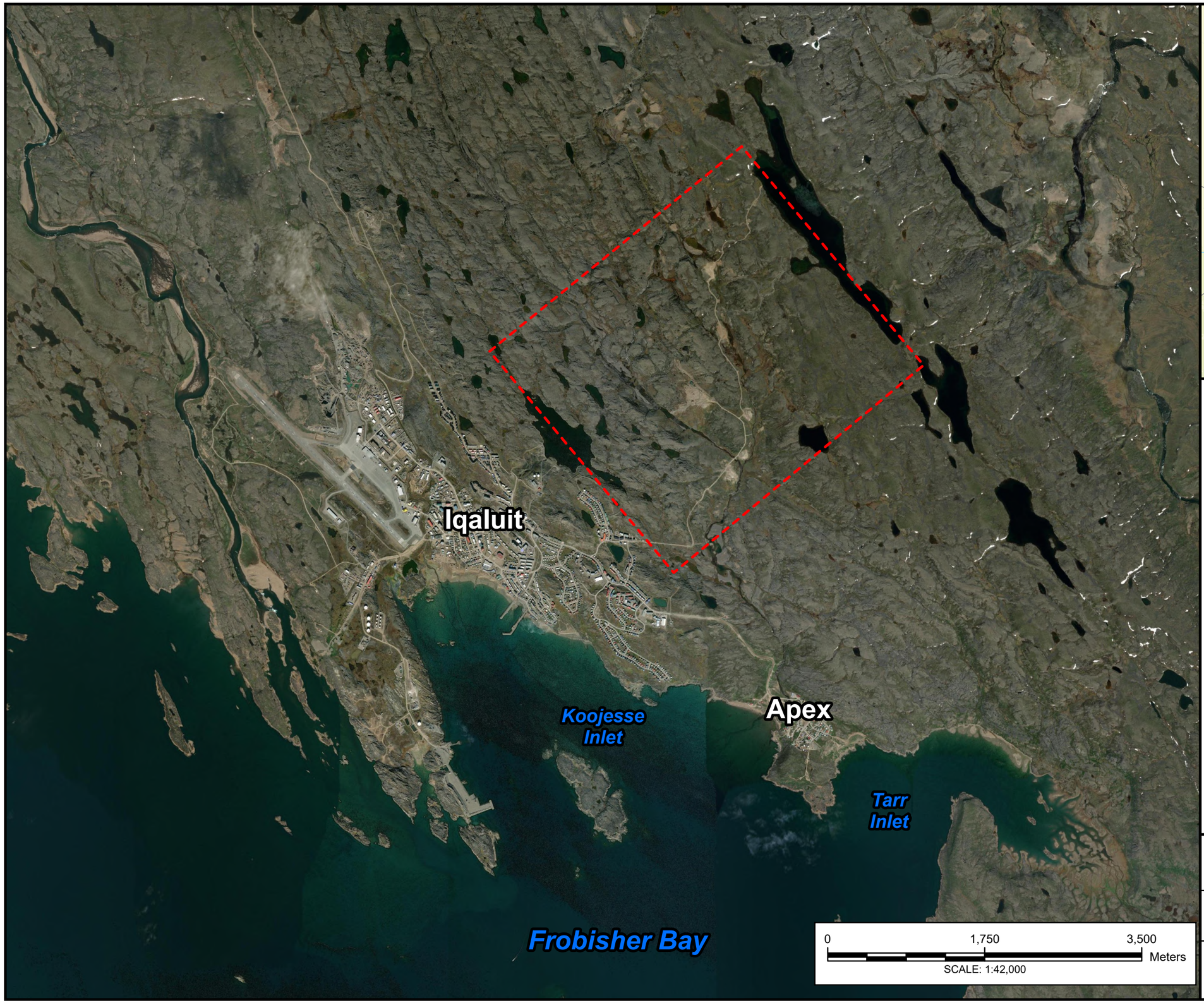
Figures



0 1,750 3,500 Meters

SCALE: 1:42,000

LEGEND

SITE BOUNDARY

NOTES:

1. HORIZONTAL DATUM: NAD 1983 CSRS UTM ZONE 19N METER.
2. BASEMAP SOURCE: ESRI NAIP IMAGERY WEB SERVICE.

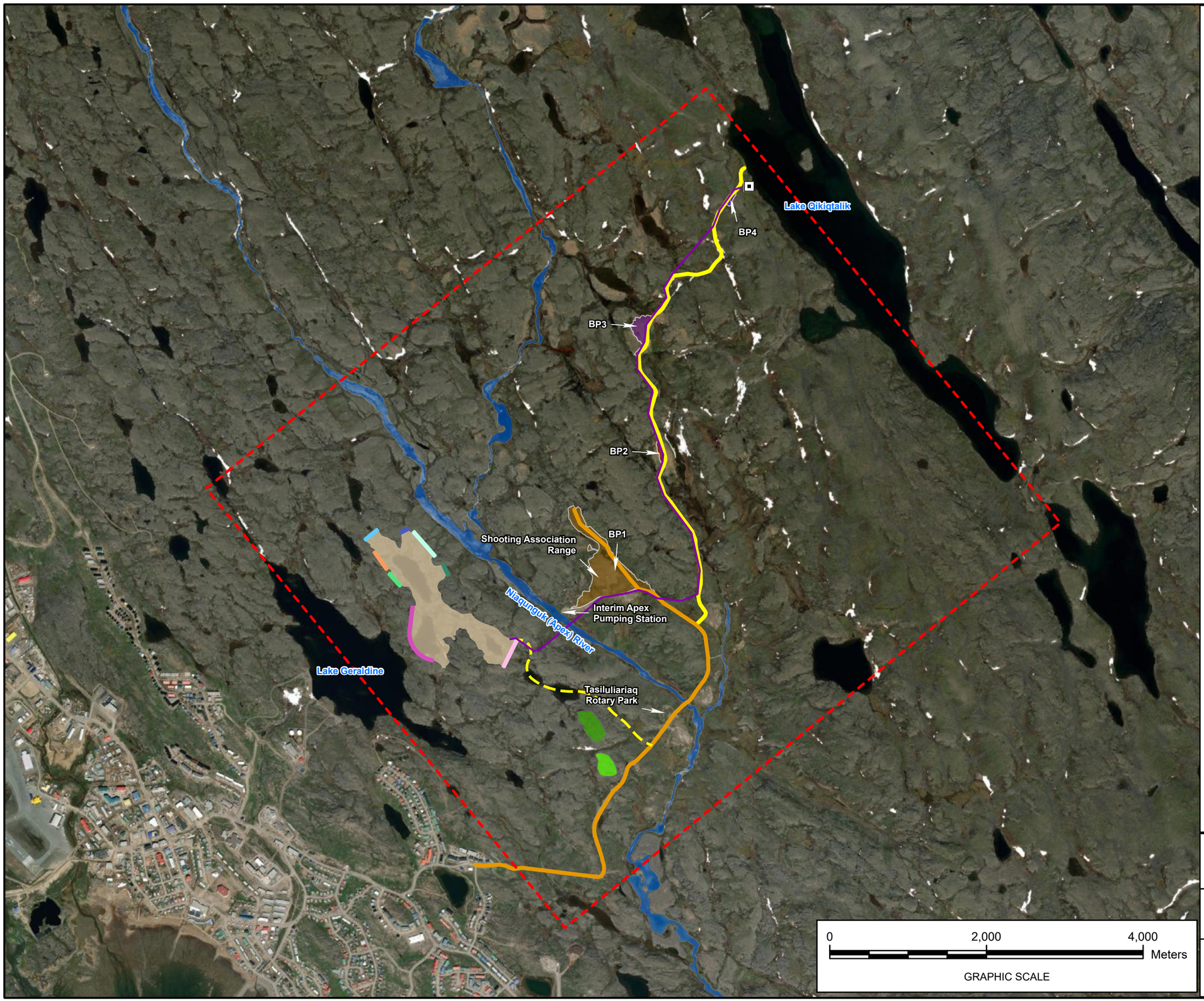
AGGREGATE ASSESSMENT REPORT
LONG TERM WATER PROGRAM IN IQALUIT, NUNAVUT
CITY OF IQALUIT

SITE LOCATION PLAN

ARCADIS

FIGURE 1

City: SYR Div/Group: IM/DV Created By: J.RAPP Last Saved By: mayyar7350 T:_ENV\City of Iqaluit\Pro\City of Iqaluit.aprx\Figure1_Site_Location_Plan Geotechnical Work Plan 29-05-2024 12:17



LEGEND

- PROPOSED PUMP STATION
- ACCESS ROAD TO LAKE QIKIQTALIK
- ROAD TO NOWHERE
- PROPOSED WATER CONVEYANCE PIPELINE
- PROPOSED ACCESS ROAD
- SITE BOUNDARY
- PROPOSED RESERVOIR
- WATERCOURSE
- PROPOSED DAM1
- PROPOSED DYKE2
- PROPOSED DYKE3
- PROPOSED DYKE4
- PROPOSED DYKE5
- PROPOSED DYKE6
- PROPOSED DYKE7(SPILLWAY)
- PROPOSED DYKE8
- PROPOSED ROCK QUARRY (KNOB 09)
- PROPOSED ROCK QUARRY (KNOB 10)
- PROPOSED BORROW 1: SHOOTING RANGE
- PROPOSED BORROW 2: LOWER SAND DEPOSIT
- PROPOSED BORROW 3: UPPER SAND DEPOSIT
- PROPOSED BORROW 4: QIKIQTALIK MORAINE

NOTES:

1. HORIZONTAL DATUM: NAD 1983 CSRS UTM ZONE 19N METER.
2. BASEMAP SOURCE: ESRI NAIP IMAGERY WEB SERVICE.

AGGREGATE ASSESSMENT REPORT
LONG TERM WATER PROGRAM IN IQALUIT, NUNAVUT
CITY OF IQALUIT

SITE PLAN

ARCADIS

FIGURE
2

City: SYR Div/Group: IM/DV Created By: J.RAPP Last Saved By: mayyar7350 T:_ENV\City of Iqaluit\Pro\City of Iqaluit.aprx\Figure2 Site Plan Geotech 1/17/2025 9:54 AM

Appendix A

A – Photographic Log

Photograph Log

City of Iqaluit
LTWP – Aggregate Assessment Report
30192375

Photograph: 1

Description:
BP4 Upper Area

Location:
BP4-A1

Photograph taken by:
RVJ

Date: 8/16/2024

Photograph: 2

Description:
BP4 Upper Area

Location:
BP4-A2

Photograph taken by:
RVJ

Date: 8/16/2024

Photograph Log

City of Iqaluit
LTWP – Aggregate Assessment Report
30192375

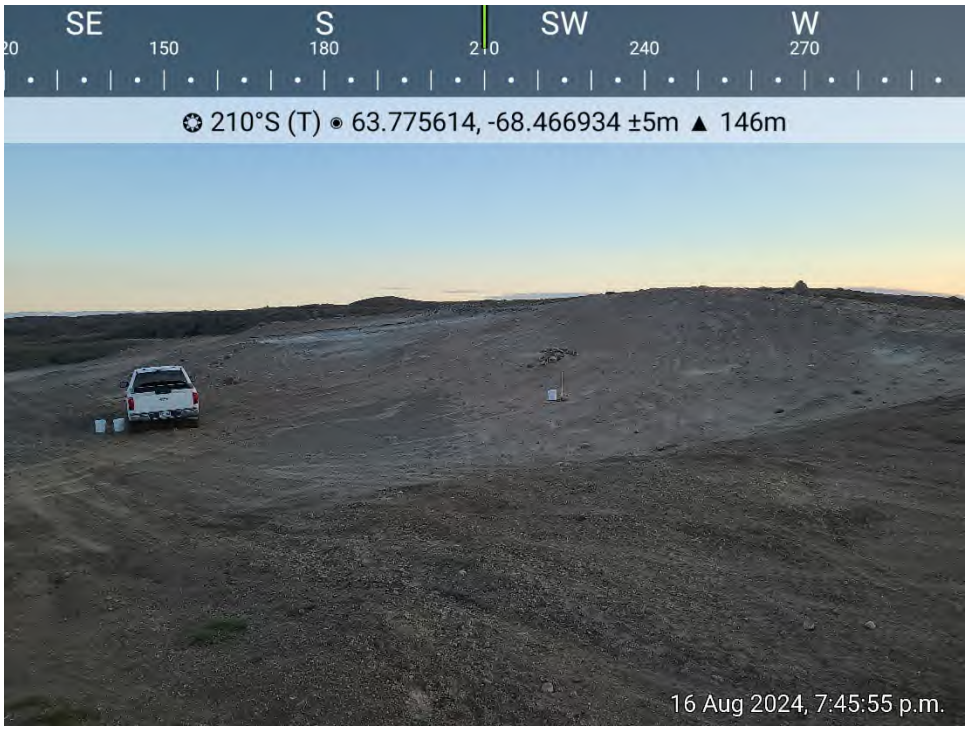
Photograph: 3

Description:
BP4 Lower Area

Location:
BP4-A3

Photograph taken by:
RVJ

Date: 8/16/2024



Photograph: 4

Description:
BP3 North End

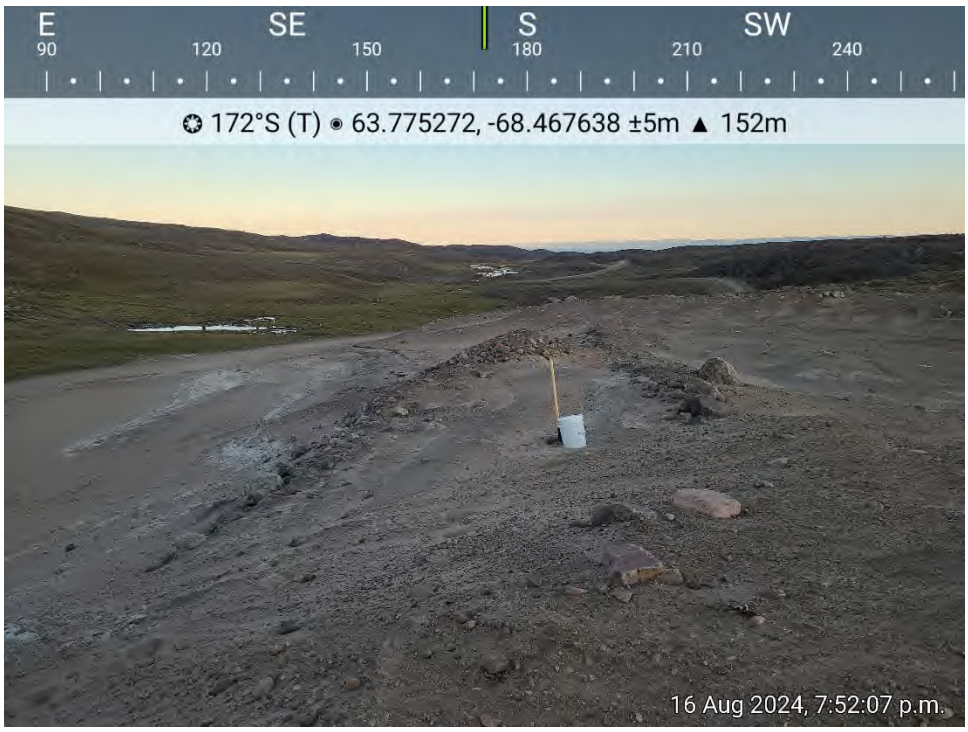
Location:
BP3-A1

Photograph taken by:
RVJ

Date: 8/16/2024

Photograph Log

City of Iqaluit
LTWP – Aggregate Assessment Report
30192375



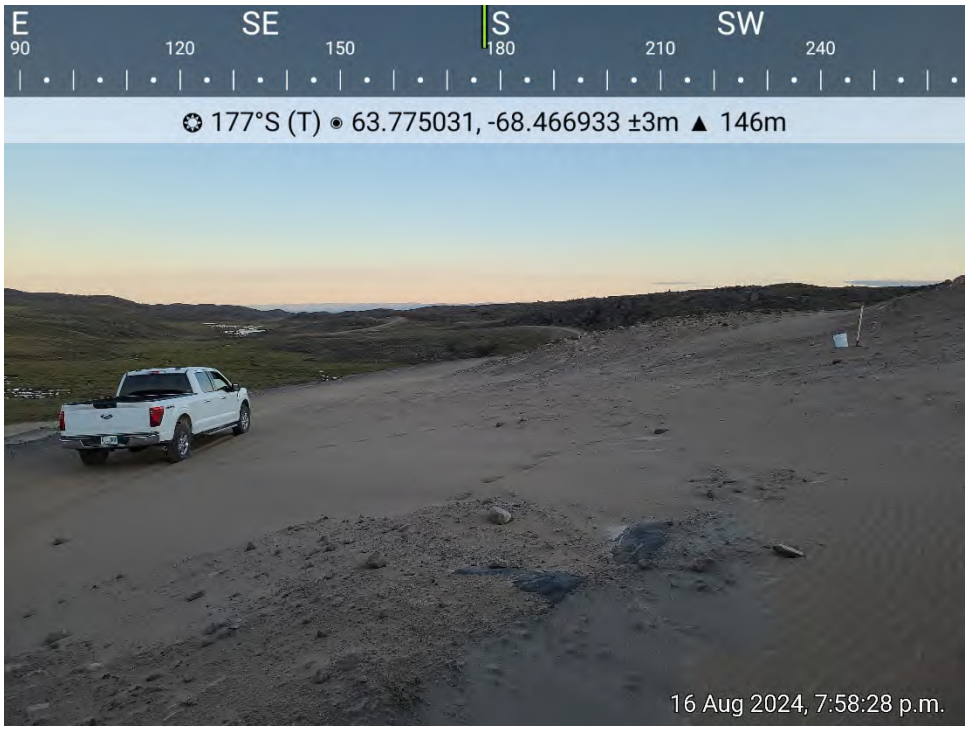
Photograph: 5

Description:
BP3 Centre

Location:
BP3-A2

Photograph taken by:
RVJ

Date: 8/16/2024



Photograph: 6

Description:
BP3 South End

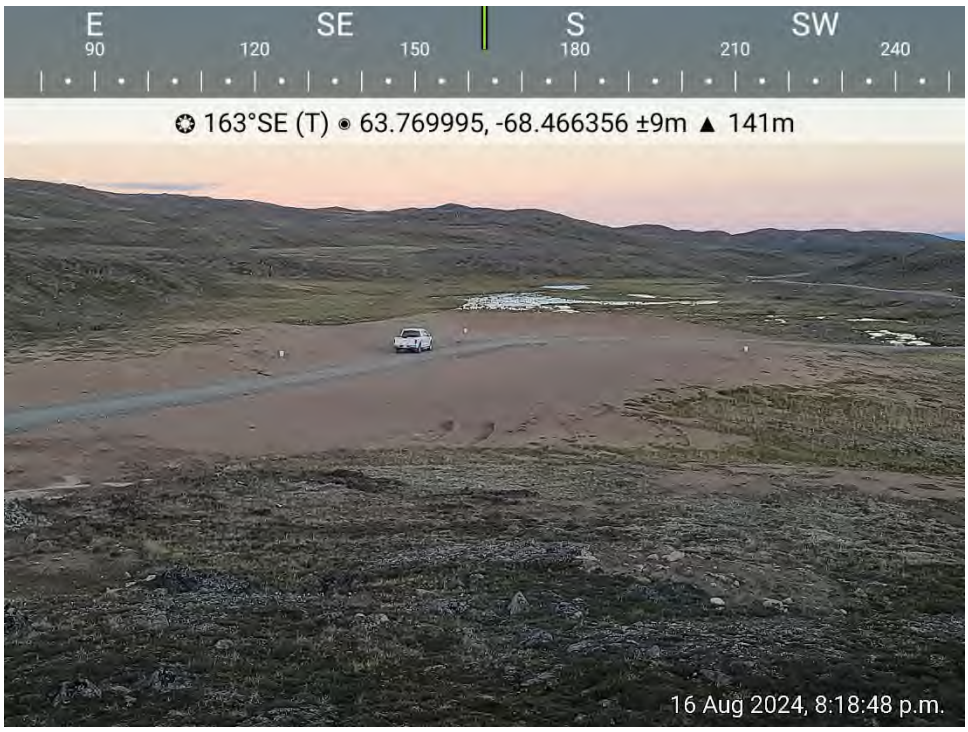
Location:
BP3-A3

Photograph taken by:
RVJ

Date: 8/16/2024

Photograph Log

City of Iqaluit
LTWP – Aggregate Assessment Report
30192375



Photograph: 7

Description:
BP2 Entire Area

Location:
BP2-A1
BP2-A2
BP2-A3

Photograph taken by:
RVJ

Date: 8/16/2024

Photograph: 8

Description:
BP1 West Area

Location:
BP1-A1

Photograph taken by:
RVJ

Date: 8/16/2024

Photograph Log

City of Iqaluit
LTWP – Aggregate Assessment Report
30192375

Photograph: 9

Description:
BP1 South Area

Location:
BP1-A2

Photograph taken by:
RVJ

Date: 8/16/2024

Photograph: 10

Description:
BP1 East Area

Location:
BP1-A3

Photograph taken by:
RVJ

Date: 8/16/2024

Appendix B

B – Geotechnical Laboratory Certificates

Your Project #: C4T0005
Your C.O.C. #: C4T0005-M060-01-01

Attention: Katherine Szozda

BUREAU VERITAS
CAMPOBELLO
6740 CAMPOBELLO ROAD
MISSISSAUGA, ON
CANADA L5N 2L8

Report Date: 2024/09/28
Report #: R3563707
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C475010
Received: 2024/09/21, 10:30

Sample Matrix: Soil
Samples Received: 12

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Moisture	12	N/A	2024/09/26	AB SOP-00002	CCME PHC-CWS m
Particle Size by Sieve (Dry) (1)	12	N/A	2024/09/27	AB SOP-00022	ASTM D6913-17 m
Grain Size Analysis Report	12	N/A	2024/09/27	AB SOP-00049	ASTM D7928-17 m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Result indicates % of sample retained on the sieve.

Bureau Veritas Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Your Project #: C4T0005
Your C.O.C. #: C4T0005-M060-01-01

Attention: Katherine Szozda

BUREAU VERITAS
CAMPOBELLO
6740 CAMPOBELLO ROAD
MISSISSAUGA, ON
CANADA L5N 2L8

Report Date: 2024/09/28
Report #: R3563707
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C475010
Received: 2024/09/21, 10:30

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Stephanie Rodriguez Camacho, Customer Solutions Representative
Email: Stephanie.Rodriguez@bureauveritas.com
Phone# (403) 291-3077
==========
This report has been generated and distributed using a secure automated process.
Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Scott Cantwell, General Manager responsible for Alberta Environmental laboratory operations.

Bureau Veritas Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Bureau Veritas Job #: C475010
Report Date: 2024/09/28

BUREAU VERITAS
Client Project #: C4T0005
Sampler Initials: RJ

PARTICLE SIZE PACKAGE WITH GRAPH (SIEVE)

Bureau Veritas ID		CWA660	CWA660		CWA660	
Sampling Date		2024/09/15	2024/09/15		2024/09/15	
COC Number		C4T0005-M060-01-01	C4T0005-M060-01-01		C4T0005-M060-01-01	
	UNITS	ADAW69-BP1-A1	ADAW69-BP1-A1 Lab-Dup	QC Batch	ADAW69-BP1-A1 Lab-Dup 2	QC Batch
Industrial						
See Attachment	N/A	ATTACHED	ATTACHED	B536879		
Physical Properties						
Attachment	%	ATTACHED (1)	ATTACHED	B538002	ATTACHED	B538002

Lab-Dup = Laboratory Initiated Duplicate
(1) Duplicate exceeds acceptance criteria due to sample non homogeneity in Sieve#4. Reanalysis yields similar results.

Bureau Veritas ID		CWA661	CWA662	CWA663	CWA664	
Sampling Date		2024/09/15	2024/09/15	2024/09/15	2024/09/15	
COC Number		C4T0005-M060-01-01	C4T0005-M060-01-01	C4T0005-M060-01-01	C4T0005-M060-01-01	
	UNITS	ADAW70-BP1-A2	ADAW71-BP1-A3	ADAW72-BP2-A1	ADAW73-BP2-A2	QC Batch
Industrial						
See Attachment	N/A	ATTACHED	ATTACHED	ATTACHED	ATTACHED	B536879
Physical Properties						
Attachment	%	ATTACHED	ATTACHED	ATTACHED	ATTACHED	B538002

Bureau Veritas ID		CWA665	CWA666	CWA667	CWA668	
Sampling Date		2024/09/15	2024/09/15	2024/09/15	2024/09/15	
COC Number		C4T0005-M060-01-01	C4T0005-M060-01-01	C4T0005-M060-01-01	C4T0005-M060-01-01	
	UNITS	ADAW74-BP2-A3	ADAW75-BP3-A1	ADAW76-BP3-A2	ADAW77-BP3-A3	QC Batch
Industrial						
See Attachment	N/A	ATTACHED	ATTACHED	ATTACHED	ATTACHED	B536879
Physical Properties						
Attachment	%	ATTACHED	ATTACHED	ATTACHED	ATTACHED	B538002

Bureau Veritas ID		CWA669	CWA670	CWA671	
Sampling Date		2024/09/15	2024/09/15	2024/09/15	
COC Number		C4T0005-M060-01-01	C4T0005-M060-01-01	C4T0005-M060-01-01	
	UNITS	ADAW78-BP4-A1	ADAW79-BP4-A2	ADAW80-BP4-A3	QC Batch
Industrial					
See Attachment	N/A	ATTACHED	ATTACHED	ATTACHED	B536879
Physical Properties					
Attachment	%	ATTACHED	ATTACHED	ATTACHED	B538002

Bureau Veritas Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

PHYSICAL TESTING (SOIL)

Bureau Veritas ID		CWA660	CWA661	CWA662	CWA663		
Sampling Date		2024/09/15	2024/09/15	2024/09/15	2024/09/15		
COC Number		C4T0005-M060-01-01	C4T0005-M060-01-01	C4T0005-M060-01-01	C4T0005-M060-01-01		
	UNITS	ADAW69-BP1-A1	ADAW70-BP1-A2	ADAW71-BP1-A3	ADAW72-BP2-A1	RDL	QC Batch
Physical Properties							
Moisture	%	4.9	18	16	16	0.30	B537552
RDL = Reportable Detection Limit							

Bureau Veritas ID		CWA664	CWA665		CWA666		
Sampling Date		2024/09/15	2024/09/15		2024/09/15		
COC Number		C4T0005-M060-01-01	C4T0005-M060-01-01		C4T0005-M060-01-01		
	UNITS	ADAW73-BP2-A2	ADAW74-BP2-A3	QC Batch	ADAW75-BP3-A1	RDL	QC Batch
Physical Properties							
Moisture	%	2.6	14	B537538	6.8	0.30	B537552
RDL = Reportable Detection Limit							

Bureau Veritas ID		CWA667	CWA667		CWA668		
Sampling Date		2024/09/15	2024/09/15		2024/09/15		
COC Number		C4T0005-M060-01-01	C4T0005-M060-01-01		C4T0005-M060-01-01		
	UNITS	ADAW76-BP3-A2	ADAW76-BP3-A2 Lab-Dup	QC Batch	ADAW77-BP3-A3	RDL	QC Batch
Physical Properties							
Moisture	%	16	16	B537552	14	0.30	B537538
RDL = Reportable Detection Limit Lab-Dup = Laboratory Initiated Duplicate							

Bureau Veritas ID		CWA669		CWA670		CWA671		
Sampling Date		2024/09/15		2024/09/15		2024/09/15		
COC Number		C4T0005-M060-01-01		C4T0005-M060-01-01		C4T0005-M060-01-01		
	UNITS	ADAW78-BP4-A1	QC Batch	ADAW79-BP4-A2	QC Batch	ADAW80-BP4-A3	RDL	QC Batch
Physical Properties								
Moisture	%	9.6	B537538	10	B537552	12	0.30	B537538
RDL = Reportable Detection Limit								

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TEST SUMMARY

Bureau Veritas ID: CWA660
Sample ID: ADAW69-BP1-A1
Matrix: Soil

Collected: 2024/09/15
Shipped: 2024/09/20
Received: 2024/09/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	B537552	N/A	2024/09/26	Basilla Ashrafi
Particle Size by Sieve (Dry)	SIEV	B538002	N/A	2024/09/27	Jagreet Dhanoa
Grain Size Analysis Report	HY	B536879	N/A	2024/09/27	Vincent Sok

Bureau Veritas ID: CWA660 Dup
Sample ID: ADAW69-BP1-A1
Matrix: Soil

Collected: 2024/09/15
Shipped: 2024/09/20
Received: 2024/09/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particle Size by Sieve (Dry)	SIEV	B538002	N/A	2024/09/27	Jagreet Dhanoa
Grain Size Analysis Report	HY	B536879	N/A	2024/09/27	Vincent Sok

Bureau Veritas ID: CWA660 Dup2
Sample ID: ADAW69-BP1-A1
Matrix: Soil

Collected: 2024/09/15
Shipped: 2024/09/20
Received: 2024/09/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particle Size by Sieve (Dry)	SIEV	B538002	N/A	2024/09/27	Jagreet Dhanoa

Bureau Veritas ID: CWA661
Sample ID: ADAW70-BP1-A2
Matrix: Soil

Collected: 2024/09/15
Shipped: 2024/09/20
Received: 2024/09/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	B537552	N/A	2024/09/26	Basilla Ashrafi
Particle Size by Sieve (Dry)	SIEV	B538002	N/A	2024/09/27	Jagreet Dhanoa
Grain Size Analysis Report	HY	B536879	N/A	2024/09/27	Vincent Sok

Bureau Veritas ID: CWA662
Sample ID: ADAW71-BP1-A3
Matrix: Soil

Collected: 2024/09/15
Shipped: 2024/09/20
Received: 2024/09/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	B537552	N/A	2024/09/26	Basilla Ashrafi
Particle Size by Sieve (Dry)	SIEV	B538002	N/A	2024/09/27	Jagreet Dhanoa
Grain Size Analysis Report	HY	B536879	N/A	2024/09/27	Vincent Sok

Bureau Veritas ID: CWA663
Sample ID: ADAW72-BP2-A1
Matrix: Soil

Collected: 2024/09/15
Shipped: 2024/09/20
Received: 2024/09/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	B537552	N/A	2024/09/26	Basilla Ashrafi
Particle Size by Sieve (Dry)	SIEV	B538002	N/A	2024/09/27	Jagreet Dhanoa
Grain Size Analysis Report	HY	B536879	N/A	2024/09/27	Vincent Sok

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TEST SUMMARY

Bureau Veritas ID: CWA664
Sample ID: ADAW73-BP2-A2
Matrix: Soil

Collected: 2024/09/15
Shipped: 2024/09/20
Received: 2024/09/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	B537538	N/A	2024/09/26	Joyce Loan Phan
Particle Size by Sieve (Dry)	SIEV	B538002	N/A	2024/09/27	Jagreet Dhanoa
Grain Size Analysis Report	HY	B536879	N/A	2024/09/27	Vincent Sok

Bureau Veritas ID: CWA665
Sample ID: ADAW74-BP2-A3
Matrix: Soil

Collected: 2024/09/15
Shipped: 2024/09/20
Received: 2024/09/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	B537538	N/A	2024/09/26	Joyce Loan Phan
Particle Size by Sieve (Dry)	SIEV	B538002	N/A	2024/09/27	Jagreet Dhanoa
Grain Size Analysis Report	HY	B536879	N/A	2024/09/27	Vincent Sok

Bureau Veritas ID: CWA666
Sample ID: ADAW75-BP3-A1
Matrix: Soil

Collected: 2024/09/15
Shipped: 2024/09/20
Received: 2024/09/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	B537552	N/A	2024/09/26	Basilla Ashrafi
Particle Size by Sieve (Dry)	SIEV	B538002	N/A	2024/09/27	Jagreet Dhanoa
Grain Size Analysis Report	HY	B536879	N/A	2024/09/27	Vincent Sok

Bureau Veritas ID: CWA667
Sample ID: ADAW76-BP3-A2
Matrix: Soil

Collected: 2024/09/15
Shipped: 2024/09/20
Received: 2024/09/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	B537552	N/A	2024/09/26	Basilla Ashrafi
Particle Size by Sieve (Dry)	SIEV	B538002	N/A	2024/09/27	Jagreet Dhanoa
Grain Size Analysis Report	HY	B536879	N/A	2024/09/27	Vincent Sok

Bureau Veritas ID: CWA667 Dup
Sample ID: ADAW76-BP3-A2
Matrix: Soil

Collected: 2024/09/15
Shipped: 2024/09/20
Received: 2024/09/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	B537552	N/A	2024/09/26	Basilla Ashrafi

Bureau Veritas ID: CWA668
Sample ID: ADAW77-BP3-A3
Matrix: Soil

Collected: 2024/09/15
Shipped: 2024/09/20
Received: 2024/09/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	B537538	N/A	2024/09/26	Joyce Loan Phan
Particle Size by Sieve (Dry)	SIEV	B538002	N/A	2024/09/27	Jagreet Dhanoa
Grain Size Analysis Report	HY	B536879	N/A	2024/09/27	Vincent Sok

Bureau Veritas Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Bureau Veritas Job #: C475010
Report Date: 2024/09/28

BUREAU VERITAS
Client Project #: C4T0005
Sampler Initials: RJ

TEST SUMMARY

Bureau Veritas ID: CWA669
Sample ID: ADAW78-BP4-A1
Matrix: Soil

Collected: 2024/09/15
Shipped: 2024/09/20
Received: 2024/09/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	B537538	N/A	2024/09/26	Joyce Loan Phan
Particle Size by Sieve (Dry)	SIEV	B538002	N/A	2024/09/27	Jagreet Dhanoa
Grain Size Analysis Report	HY	B536879	N/A	2024/09/27	Vincent Sok

Bureau Veritas ID: CWA670
Sample ID: ADAW79-BP4-A2
Matrix: Soil

Collected: 2024/09/15
Shipped: 2024/09/20
Received: 2024/09/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	B537552	N/A	2024/09/26	Basilla Ashrafi
Particle Size by Sieve (Dry)	SIEV	B538002	N/A	2024/09/27	Jagreet Dhanoa
Grain Size Analysis Report	HY	B536879	N/A	2024/09/27	Vincent Sok

Bureau Veritas ID: CWA671
Sample ID: ADAW80-BP4-A3
Matrix: Soil

Collected: 2024/09/15
Shipped: 2024/09/20
Received: 2024/09/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	B537538	N/A	2024/09/26	Joyce Loan Phan
Particle Size by Sieve (Dry)	SIEV	B538002	N/A	2024/09/27	Jagreet Dhanoa
Grain Size Analysis Report	HY	B536879	N/A	2024/09/27	Vincent Sok

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	2.1°C

Results relate only to the items tested.

Bureau Veritas Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Bureau Veritas Job #: C475010
Report Date: 2024/09/28

QUALITY ASSURANCE REPORT

BUREAU VERITAS
Client Project #: C4T0005
Sampler Initials: RJ

			Method Blank		RPD	
QC Batch	**Parameter**	**Date**	**Value**	**UNITS**	**Value (%)**	**QC Limits**
B537538	Moisture	2024/09/26	<0.30	%	13	20
B537552	Moisture	2024/09/26	<0.30	%	0	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

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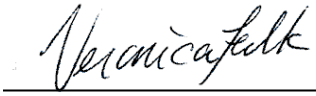
VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics



Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

Automated Statchk

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Scott Cantwell, General Manager responsible for Alberta Environmental laboratory operations.

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Grain Size Analysis Report

Client Sample ID: ADAW69-BP1-A1
Maxxam Sample ID: CWA660-01
Maxxam Job #: C475010

Tot. Sample Wt (g)*: 13.84
> 2 mm Sample Wt (g)*: 0.47
* Dry mass based on Sieve Aliquot

Batch # (Sieve): B538002
Batch # (Hydro): B536879

Analysis Date (Sieve): 9/26/2024
Analysis Date (Hydro): 9/25/2024

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	100.0
	Sieve 10	2.000	96.6
	Sieve 20	0.850	93.4
	Sieve 40	0.425	81.9
	Sieve 100	0.150	33.2
	Sieve 200	0.075	11.4
Hydrometer	R1min	0.0519	5.7
	R3min	0.0301	4.7
	R10min	0.0167	1.9
	R30min	0.0096	1.9
	R90min	0.0055	1.9
	R270min	0.0032	1.9
	R1080min	0.0016	1.9

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	94.2
Silt	0.002	0.050	3.8
Clay	-	0.002	2.0

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

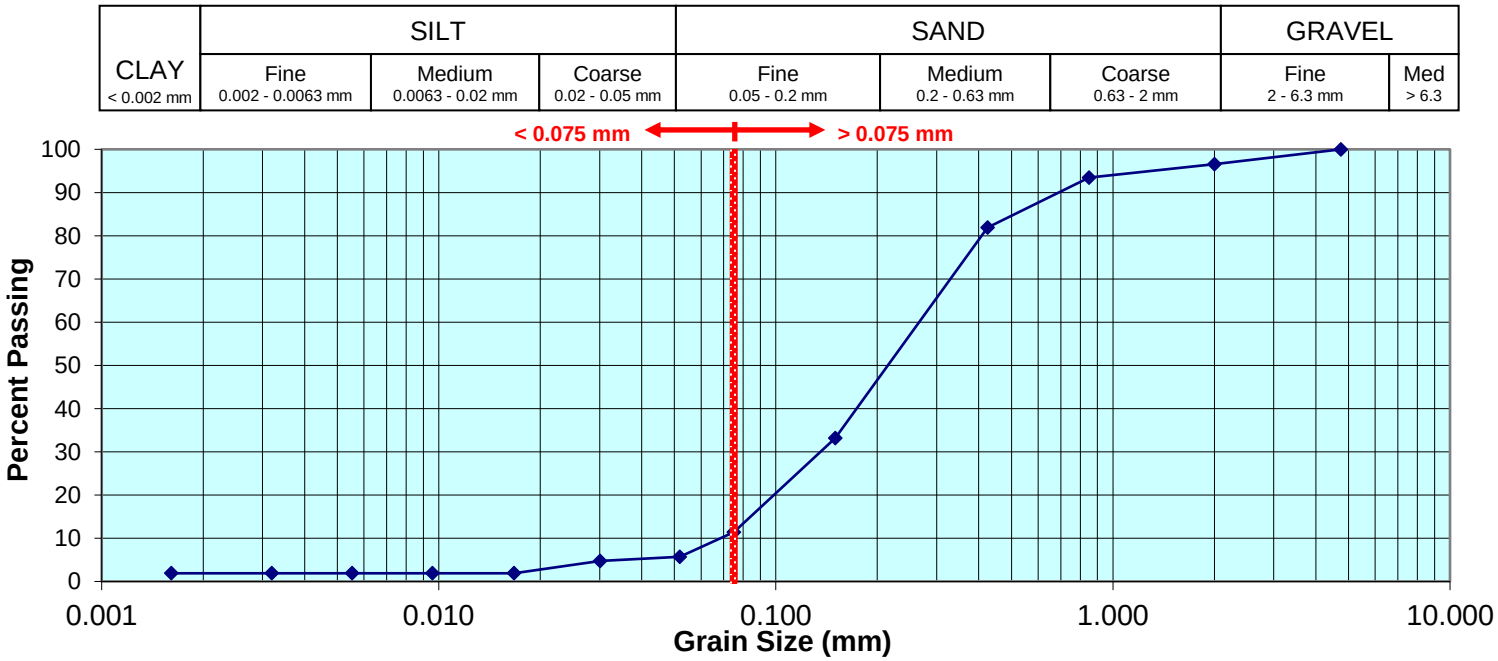
Based on the entire sample

Percentage (by mass) less than 0.075 mm = 11.4
Classification = Coarse Textured Soil

Based on the < 2 mm fraction **

Percentage (by mass) less than 0.075 mm = 11.8
Classification = Coarse Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report

Client Sample ID: ADAW69-BP1-A1
Maxxam Sample ID: DUP CWA660-01
Maxxam Job #: C475010

Tot. Sample Wt (g)*: 14.07
> 2 mm Sample Wt (g)*: 0.72
* Dry mass based on Sieve Aliquot

Batch # (Sieve): B538002
Batch # (Hydro): B536879

Analysis Date (Sieve): 9/26/2024
Analysis Date (Hydro): 9/25/2024

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	96.1
	Sieve 10	2.000	94.9
	Sieve 20	0.850	91.6
	Sieve 40	0.425	79.2
	Sieve 100	0.150	30.5
	Sieve 200	0.075	9.8
Hydrometer	R1min	0.0519	5.7
	R3min	0.0301	3.8
	R10min	0.0168	1.0
	R30min	0.0096	1.0
	R90min	0.0056	1.0
	R270min	0.0032	1.0
	R1080min	0.0016	1.0

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	94.1
Silt	0.002	0.050	4.9
Clay	-	0.002	1.0

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

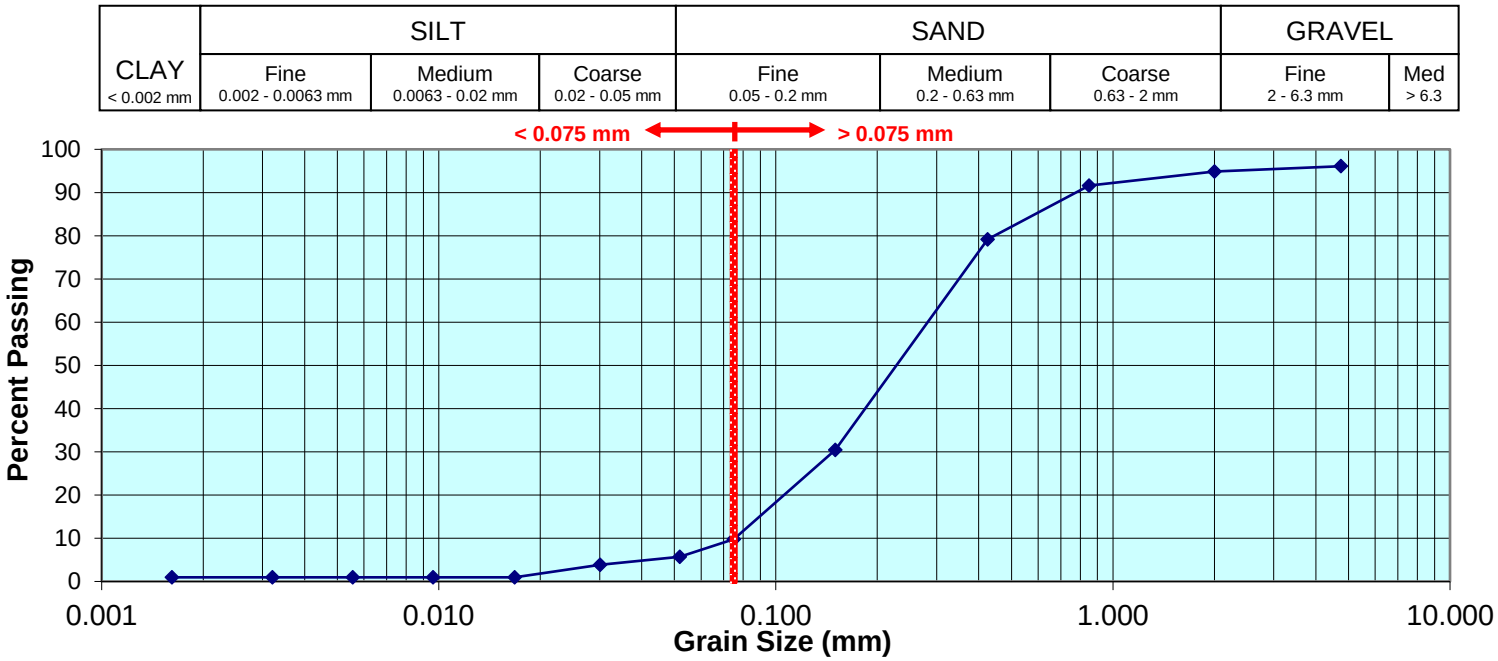
Based on the entire sample

Percentage (by mass) less than 0.075 mm = 9.8
Classification = Coarse Textured Soil

Based on the < 2 mm fraction **

Percentage (by mass) less than 0.075 mm = 10.3
Classification = Coarse Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report

Client Sample ID: ADAW69-BP1-A1
Maxxam Sample ID: DUP CWA660-01
Maxxam Job #: C475010

Tot. Sample Wt (g)*: 10.02
> 2 mm Sample Wt (g)*: 0.07
* Dry mass based on Sieve Aliquot

Batch # (Sieve): B538002
Batch # (Hydro): B536879

Analysis Date (Sieve): 9/26/2024
Analysis Date (Hydro): 9/25/2024

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	100.0
	Sieve 10	2.000	99.3
	Sieve 20	0.850	95.9
	Sieve 40	0.425	83.1
	Sieve 100	0.150	34.9
	Sieve 200	0.075	19.5
Hydrometer	R1min	0.0519	6.0
	R3min	0.0301	4.0
	R10min	0.0168	1.0
	R30min	0.0096	1.0
	R90min	0.0056	1.0
	R270min	0.0032	1.0
	R1080min	0.0016	1.0

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	94.1
Silt	0.002	0.050	4.9
Clay	-	0.002	1.0

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

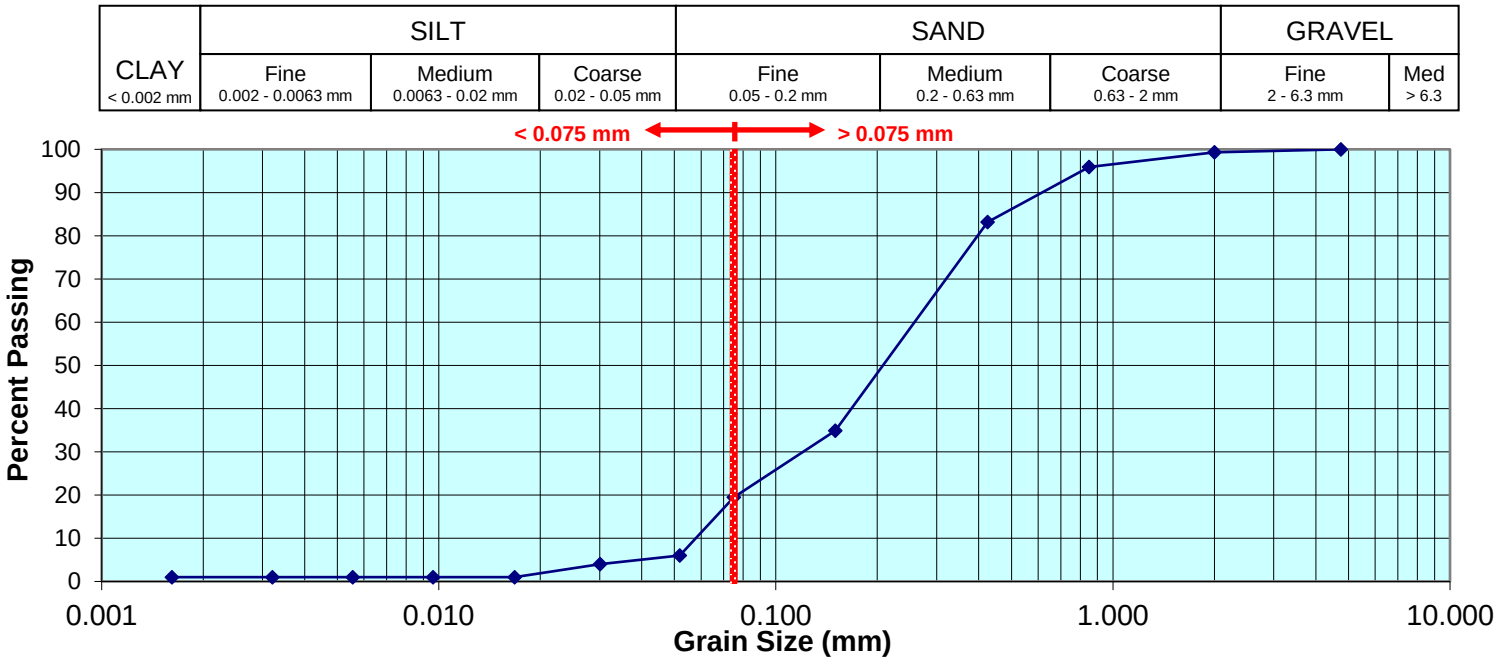
Based on the entire sample

Percentage (by mass) less than 0.075 mm = 19.5
Classification = Coarse Textured Soil

Based on the < 2 mm fraction **

Percentage (by mass) less than 0.075 mm = 19.6
Classification = Coarse Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report

Client Sample ID: ADAW70-BP1-A2
Maxxam Sample ID: CWA661-01
Maxxam Job #: C475010

Tot. Sample Wt (g)*: 10.24
> 2 mm Sample Wt (g)*: 0.00
* Dry mass based on Sieve Aliquot

Batch # (Sieve): B538002
Batch # (Hydro): B536879

Analysis Date (Sieve): 9/26/2024
Analysis Date (Hydro): 9/25/2024

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	100.0
	Sieve 10	2.000	100.0
	Sieve 20	0.850	100.0
	Sieve 40	0.425	100.0
	Sieve 100	0.150	99.9
	Sieve 200	0.075	99.6
Hydrometer	R1min	0.0448	87.6
	R3min	0.0266	72.8
	R10min	0.0155	46.3
	R30min	0.0093	23.2
	R90min	0.0055	13.2
	R270min	0.0032	8.3
	R1080min	0.0016	8.3

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	10.3
Silt	0.002	0.050	81.4
Clay	-	0.002	8.3

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

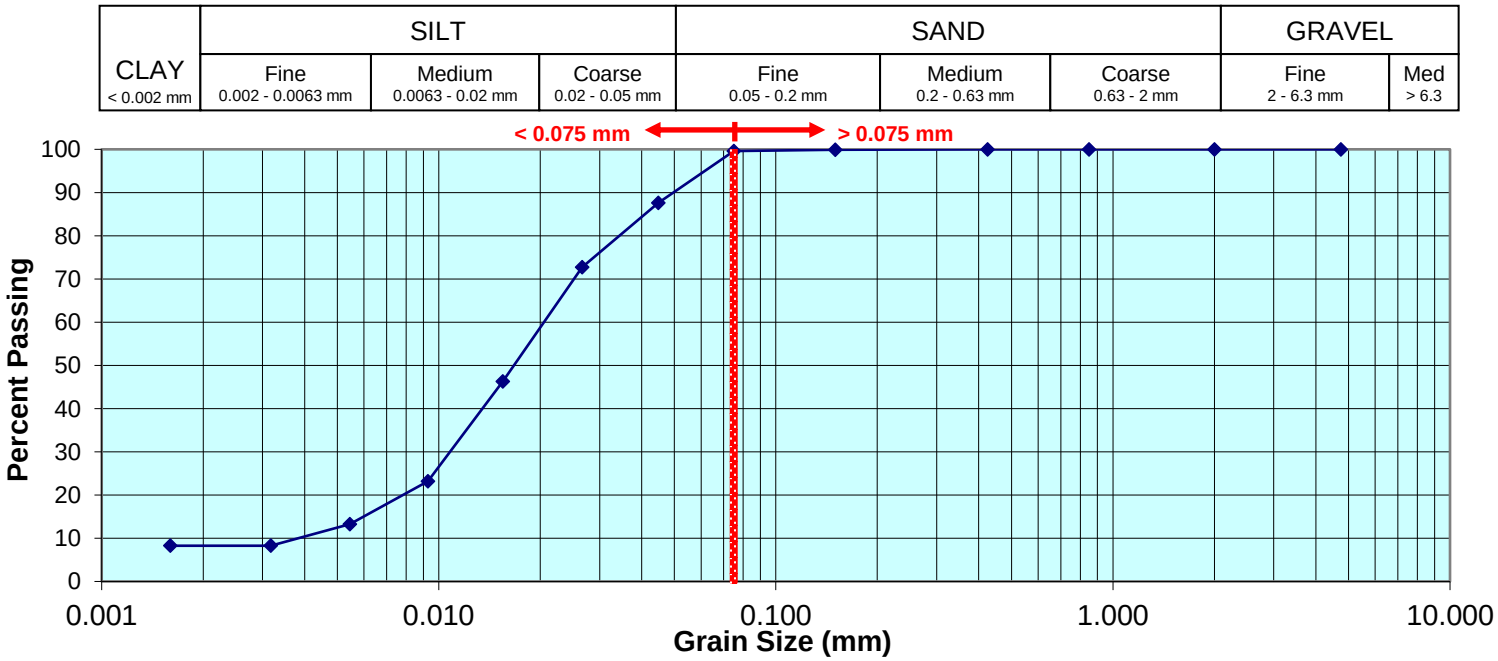
Based on the entire sample

Percentage (by mass) less than 0.075 mm = 99.6
Classification = Fine Textured Soil

Based on the < 2 mm fraction **

Percentage (by mass) less than 0.075 mm = 99.6
Classification = Fine Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report

Client Sample ID: ADAW71-BP1-A3
Maxxam Sample ID: CWA662-01
Maxxam Job #: C475010

Tot. Sample Wt (g)*: 11.23
> 2 mm Sample Wt (g)*: 0.01
* Dry mass based on Sieve Aliquot

Batch # (Sieve): B538002
Batch # (Hydro): B536879

Analysis Date (Sieve): 9/26/2024
Analysis Date (Hydro): 9/25/2024

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	100.0
	Sieve 10	2.000	99.9
	Sieve 20	0.850	99.6
	Sieve 40	0.425	98.6
	Sieve 100	0.150	77.3
	Sieve 200	0.075	37.7
Hydrometer	R1min	0.0508	11.0
	R3min	0.0300	4.7
	R10min	0.0167	1.6
	R30min	0.0096	1.6
	R90min	0.0055	1.6
	R270min	0.0032	1.6
	R1080min	0.0016	1.6

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	89.3
Silt	0.002	0.050	9.2
Clay	-	0.002	1.6

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

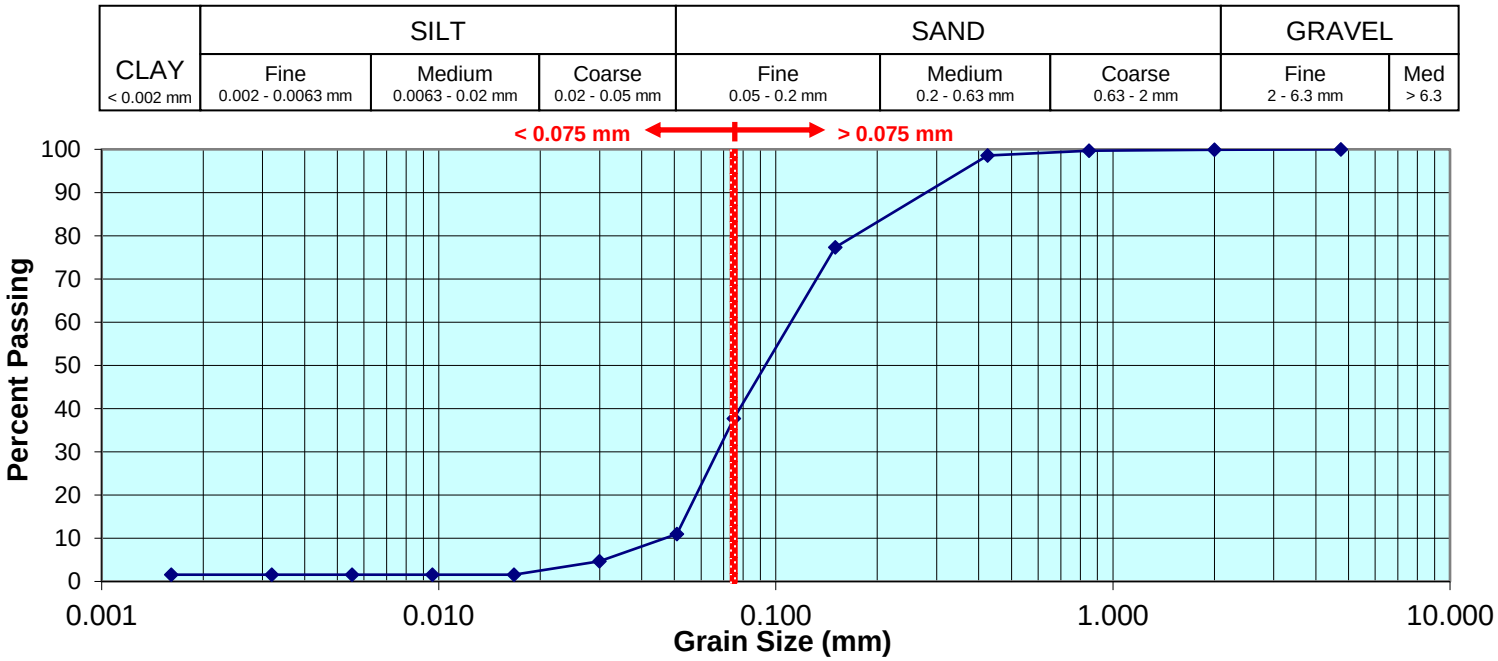
Based on the entire sample

Percentage (by mass) less than 0.075 mm = 37.7
Classification = Coarse Textured Soil

Based on the < 2 mm fraction **

Percentage (by mass) less than 0.075 mm = 37.7
Classification = Coarse Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report

Client Sample ID: ADAW72-BP2-A1
Maxxam Sample ID: CWA663-01
Maxxam Job #: C475010

Tot. Sample Wt (g)*: 11.95
> 2 mm Sample Wt (g)*: 1.60
* Dry mass based on Sieve Aliquot

Batch # (Sieve): B538002
Batch # (Hydro): B536879

Analysis Date (Sieve): 9/26/2024
Analysis Date (Hydro): 9/25/2024

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	94.8
	Sieve 10	2.000	86.6
	Sieve 20	0.850	65.9
	Sieve 40	0.425	33.4
	Sieve 100	0.150	2.2
	Sieve 200	0.075	0.7
Hydrometer	R1min	0.0525	1.9
	R3min	0.0303	1.9
	R10min	0.0167	1.3
	R30min	0.0096	1.3
	R90min	0.0055	1.3
	R270min	0.0032	1.3
	R1080min	0.0016	1.3

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	97.8
Silt	0.002	0.050	0.7
Clay	-	0.002	1.5

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

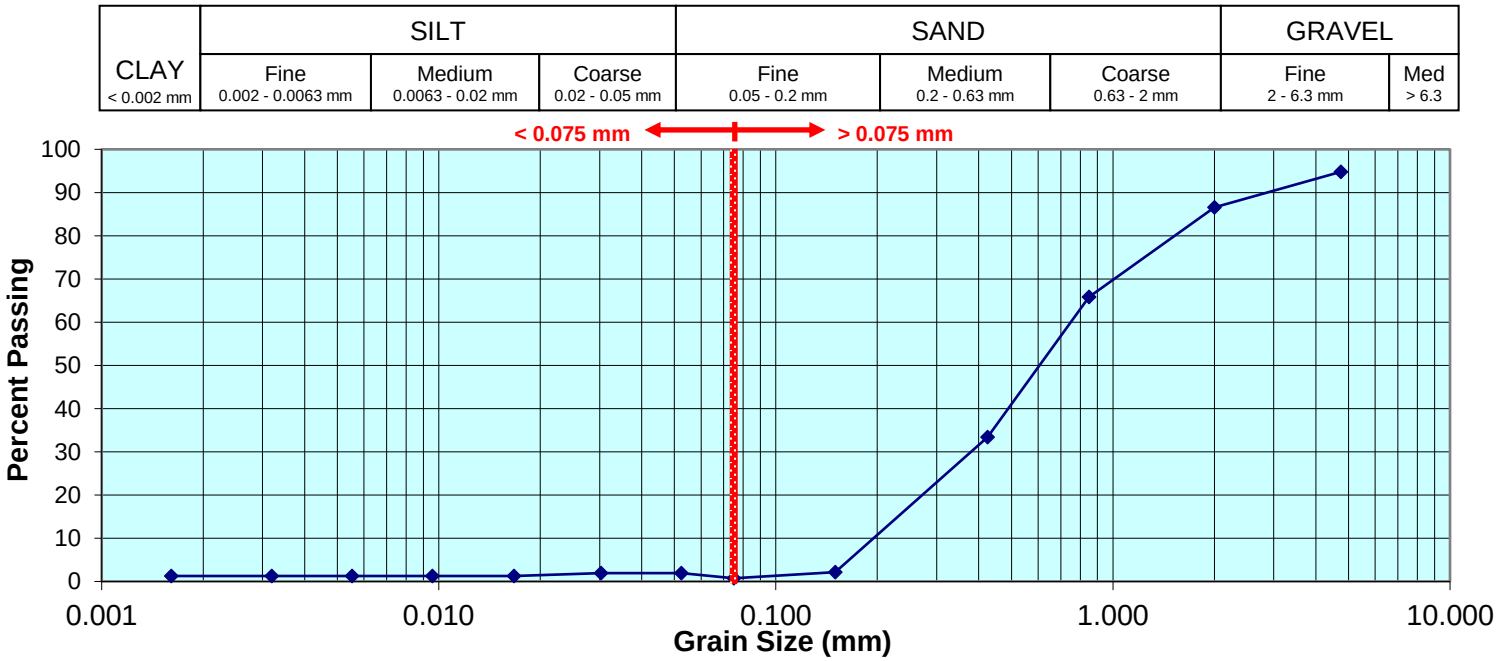
Based on the entire sample

Percentage (by mass) less than 0.075 mm = 0.7
Classification = Coarse Textured Soil

Based on the < 2 mm fraction **

Percentage (by mass) less than 0.075 mm = 0.9
Classification = Coarse Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report

Client Sample ID: ADAW73-BP2-A2
Maxxam Sample ID: CWA664-01
Maxxam Job #: C475010

Tot. Sample Wt (g)*: 10.10
> 2 mm Sample Wt (g)*: 0.38
* Dry mass based on Sieve Aliquot

Batch # (Sieve): B538002
Batch # (Hydro): B536879

Analysis Date (Sieve): 9/26/2024
Analysis Date (Hydro): 9/25/2024

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	100.0
	Sieve 10	2.000	96.2
	Sieve 20	0.850	87.6
	Sieve 40	0.425	65.8
	Sieve 100	0.150	12.7
	Sieve 200	0.075	2.2
Hydrometer	R1min	0.0521	3.1
	R3min	0.0303	2.3
	R10min	0.0168	0.8
	R30min	0.0096	0.8
	R90min	0.0056	0.8
	R270min	0.0032	0.8
	R1080min	0.0016	0.8

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	96.9
Silt	0.002	0.050	2.3
Clay	-	0.002	0.8

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

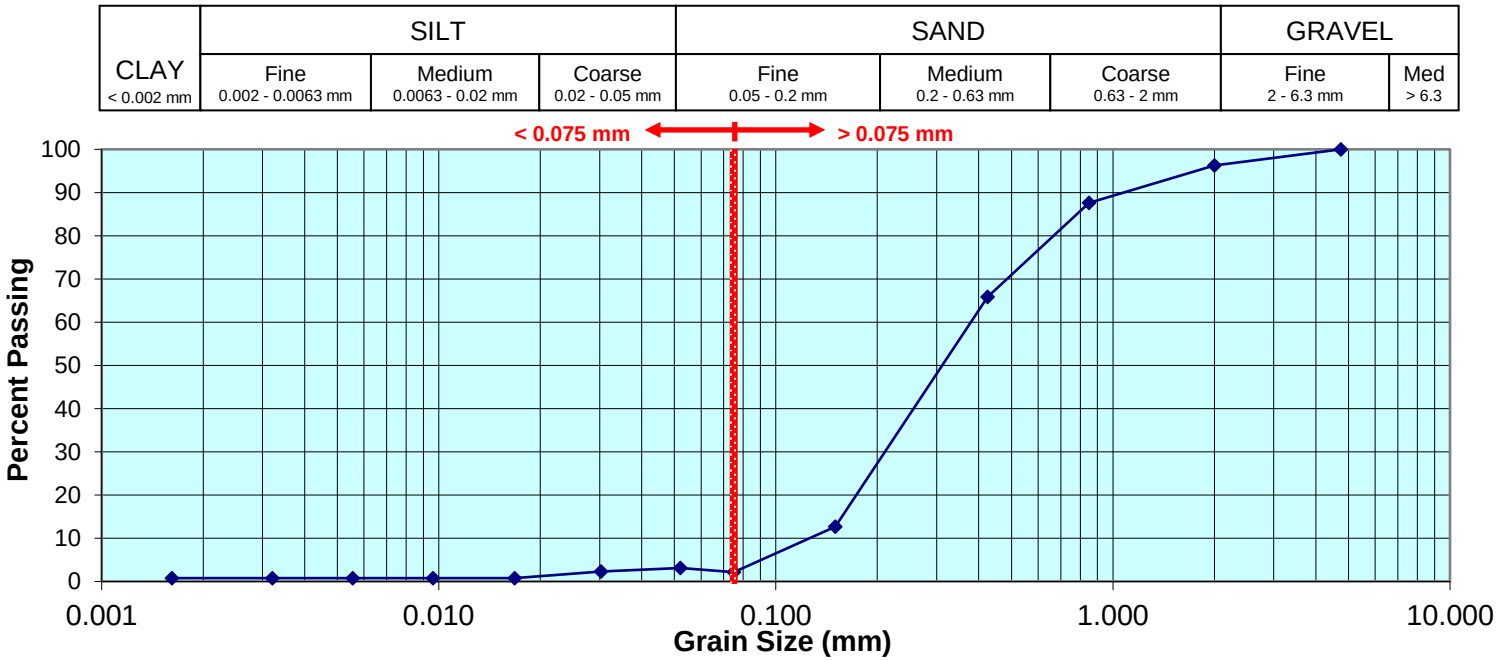
Based on the entire sample

Percentage (by mass) less than 0.075 mm = 2.2
Classification = Coarse Textured Soil

Based on the < 2 mm fraction **

Percentage (by mass) less than 0.075 mm = 2.3
Classification = Coarse Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report

Client Sample ID: ADAW74-BP2-A3
Maxxam Sample ID: CWA665-01
Maxxam Job #: C475010

Tot. Sample Wt (g)*: 10.27
> 2 mm Sample Wt (g)*: 0.06
* Dry mass based on Sieve Aliquot

Batch # (Sieve): B538002
Batch # (Hydro): B536879

Analysis Date (Sieve): 9/26/2024
Analysis Date (Hydro): 9/25/2024

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	100.0
	Sieve 10	2.000	99.4
	Sieve 20	0.850	97.4
	Sieve 40	0.425	91.5
	Sieve 100	0.150	70.0
	Sieve 200	0.075	43.7
Hydrometer	R1min	0.0493	19.6
	R3min	0.0295	9.8
	R10min	0.0167	2.5
	R30min	0.0096	1.6
	R90min	0.0055	1.6
	R270min	0.0032	1.6
	R1080min	0.0016	1.6

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	79.6
Silt	0.002	0.050	18.8
Clay	-	0.002	1.6

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

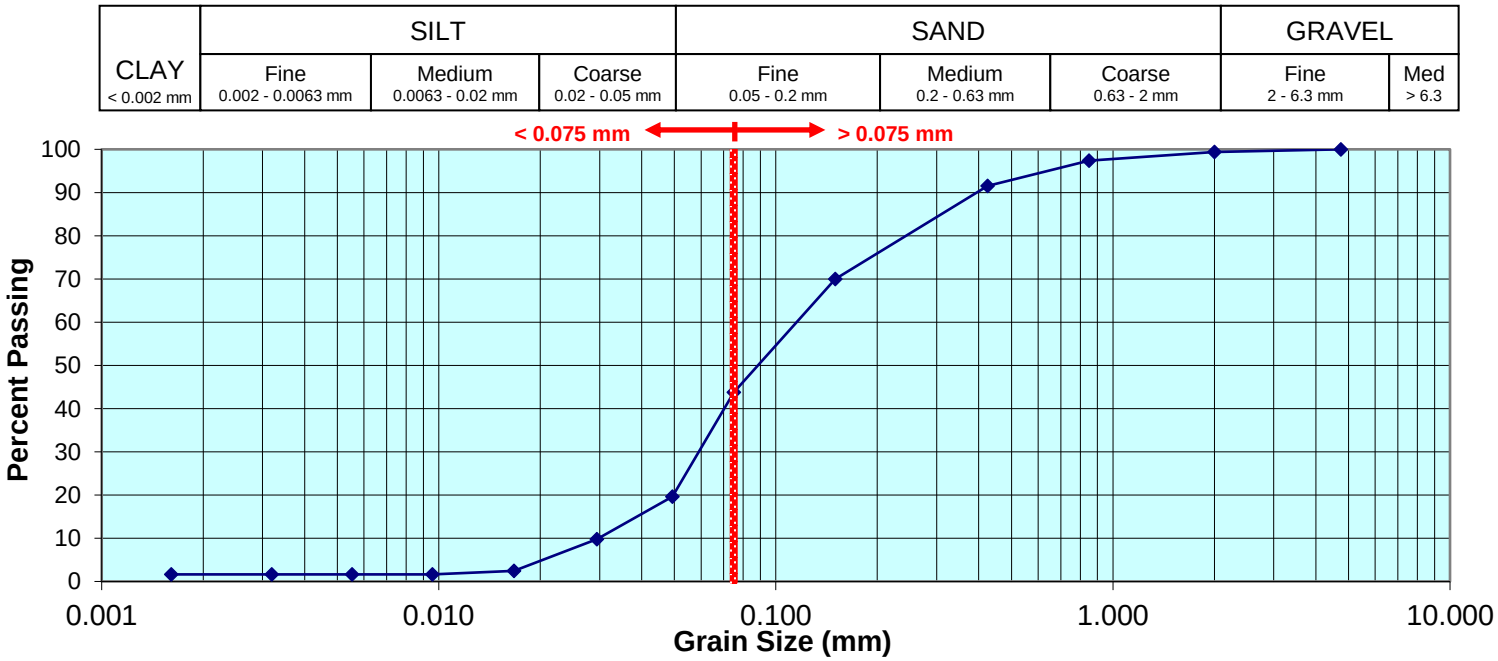
Based on the entire sample

Percentage (by mass) less than 0.075 mm = 43.7
Classification = Coarse Textured Soil

Based on the < 2 mm fraction **

Percentage (by mass) less than 0.075 mm = 44.0
Classification = Coarse Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report

Client Sample ID: ADAW75-BP3-A1
Maxxam Sample ID: CWA666-01
Maxxam Job #: C475010

Tot. Sample Wt (g)*: 10.27
> 2 mm Sample Wt (g)*: 0.00
* Dry mass based on Sieve Aliquot

Batch # (Sieve): B538002
Batch # (Hydro): B536879

Analysis Date (Sieve): 9/26/2024
Analysis Date (Hydro): 9/25/2024

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	100.0
	Sieve 10	2.000	100.0
	Sieve 20	0.850	100.0
	Sieve 40	0.425	100.0
	Sieve 100	0.150	66.3
	Sieve 200	0.075	18.1
Hydrometer	R1min	0.0517	7.1
	R3min	0.0301	3.2
	R10min	0.0168	0.8
	R30min	0.0096	0.8
	R90min	0.0056	0.8
	R270min	0.0032	0.8
	R1080min	0.0016	0.8

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	93.2
Silt	0.002	0.050	6.0
Clay	-	0.002	0.8

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

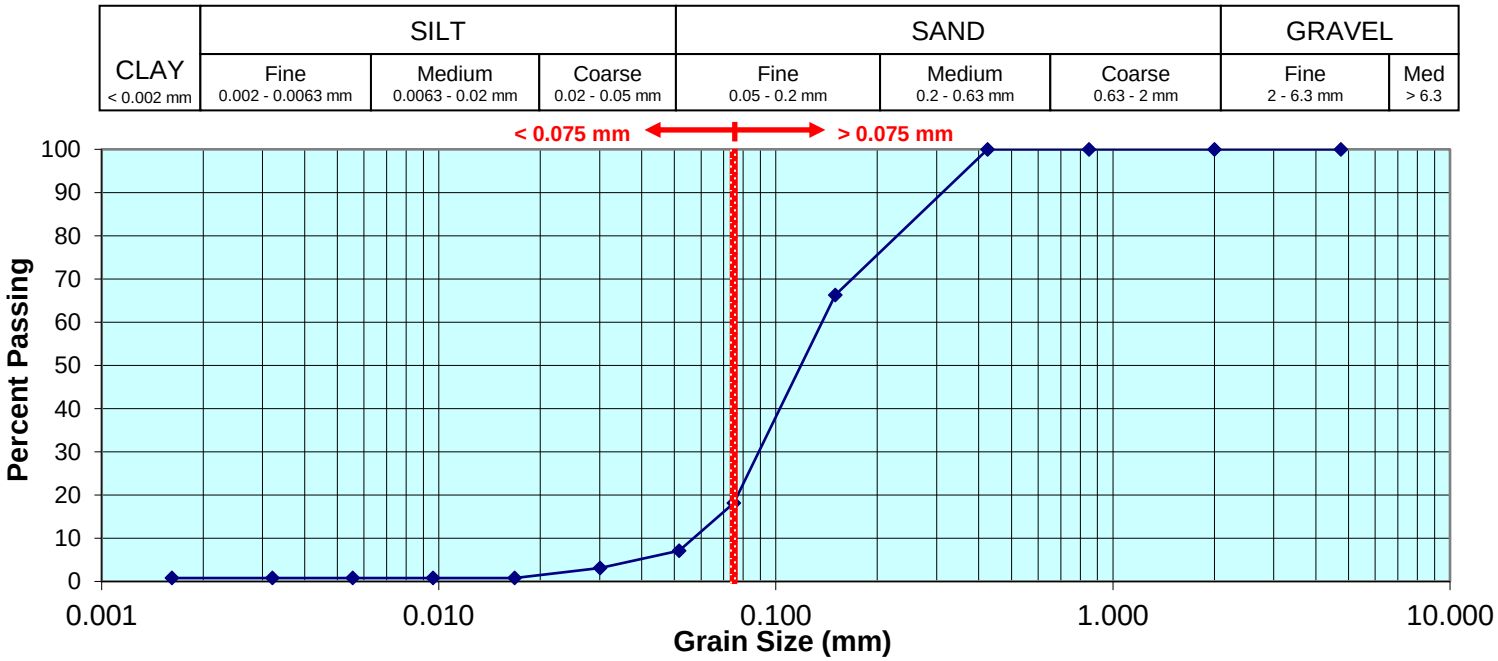
Based on the entire sample

Percentage (by mass) less than 0.075 mm = 18.1
Classification = Coarse Textured Soil

Based on the < 2 mm fraction **

Percentage (by mass) less than 0.075 mm = 18.1
Classification = Coarse Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report

Client Sample ID: ADAW76-BP3-A2
Maxxam Sample ID: CWA667-01
Maxxam Job #: C475010

Tot. Sample Wt (g)*: 10.26
> 2 mm Sample Wt (g)*: 0.00
* Dry mass based on Sieve Aliquot

Batch # (Sieve): B538002
Batch # (Hydro): B536879

Analysis Date (Sieve): 9/26/2024
Analysis Date (Hydro): 9/25/2024

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	100.0
	Sieve 10	2.000	100.0
	Sieve 20	0.850	100.0
	Sieve 40	0.425	99.3
	Sieve 100	0.150	79.8
	Sieve 200	0.075	43.6
Hydrometer	R1min	0.0498	15.7
	R3min	0.0297	7.8
	R10min	0.0167	1.6
	R30min	0.0096	1.6
	R90min	0.0055	1.6
	R270min	0.0032	1.6
	R1080min	0.0016	1.6

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	84.1
Silt	0.002	0.050	14.3
Clay	-	0.002	1.6

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

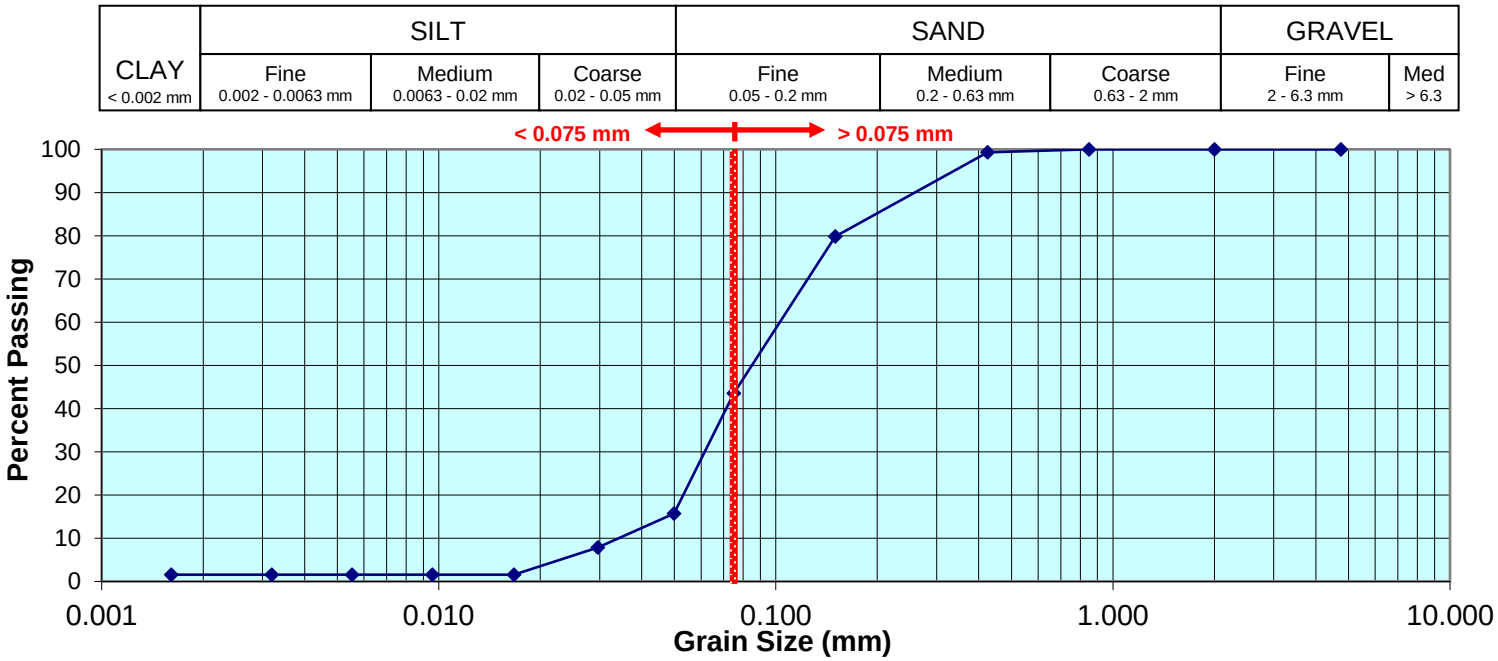
Based on the entire sample

Percentage (by mass) less than 0.075 mm = 43.6
Classification = Coarse Textured Soil

Based on the < 2 mm fraction **

Percentage (by mass) less than 0.075 mm = 43.6
Classification = Coarse Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report

Client Sample ID: ADAW77-BP3-A3
Maxxam Sample ID: CWA668-01
Maxxam Job #: C475010

Tot. Sample Wt (g)*: 10.32
> 2 mm Sample Wt (g)*: 0.00
* Dry mass based on Sieve Aliquot

Batch # (Sieve): B538002
Batch # (Hydro): B536879

Analysis Date (Sieve): 9/26/2024
Analysis Date (Hydro): 9/25/2024

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	100.0
	Sieve 10	2.000	100.0
	Sieve 20	0.850	99.9
	Sieve 40	0.425	92.3
	Sieve 100	0.150	31.8
	Sieve 200	0.075	6.9
Hydrometer	R1min	0.0519	4.8
	R3min	0.0300	4.8
	R10min	0.0168	0.0
	R30min	0.0096	0.0
	R90min	0.0056	0.0
	R270min	0.0032	0.0
	R1080min	0.0016	0.0

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	95.2
Silt	0.002	0.050	4.8
Clay	-	0.002	0.0

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

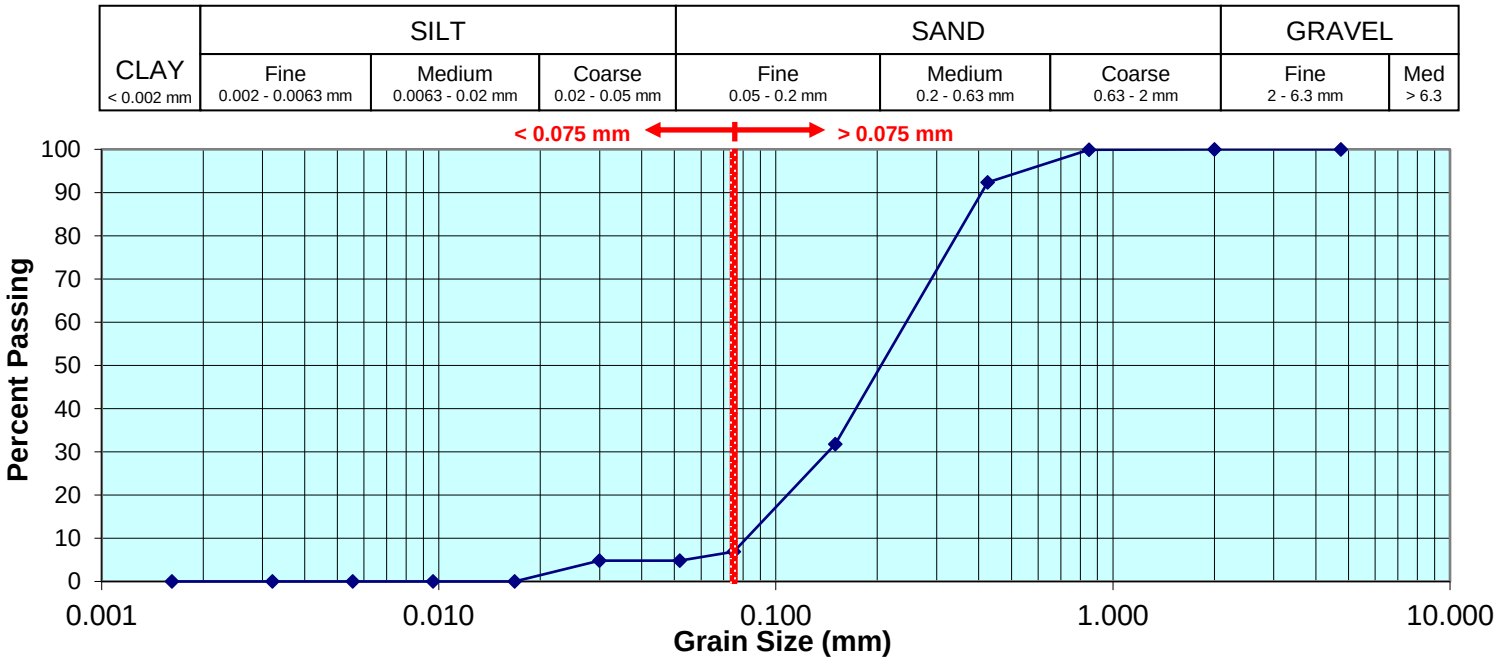
Based on the entire sample

Percentage (by mass) less than 0.075 mm = 6.9
Classification = Coarse Textured Soil

Based on the < 2 mm fraction **

Percentage (by mass) less than 0.075 mm = 6.9
Classification = Coarse Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report

Client Sample ID: ADAW78-BP4-A1
Maxxam Sample ID: CWA669-01
Maxxam Job #: C475010

Tot. Sample Wt (g)*: 12.04
> 2 mm Sample Wt (g)*: 1.66
* Dry mass based on Sieve Aliquot

Batch # (Sieve): B538002
Batch # (Hydro): B536879

Analysis Date (Sieve): 9/26/2024
Analysis Date (Hydro): 9/25/2024

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	97.2
	Sieve 10	2.000	86.2
	Sieve 20	0.850	73.3
	Sieve 40	0.425	59.7
	Sieve 100	0.150	38.3
	Sieve 200	0.075	26.1
Hydrometer	R1min	0.0502	15.4
	R3min	0.0293	12.0
	R10min	0.0164	8.6
	R30min	0.0095	5.1
	R90min	0.0055	2.6
	R270min	0.0032	0.9
	R1080min	0.0016	0.0

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	82.1
Silt	0.002	0.050	17.6
Clay	-	0.002	0.2

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

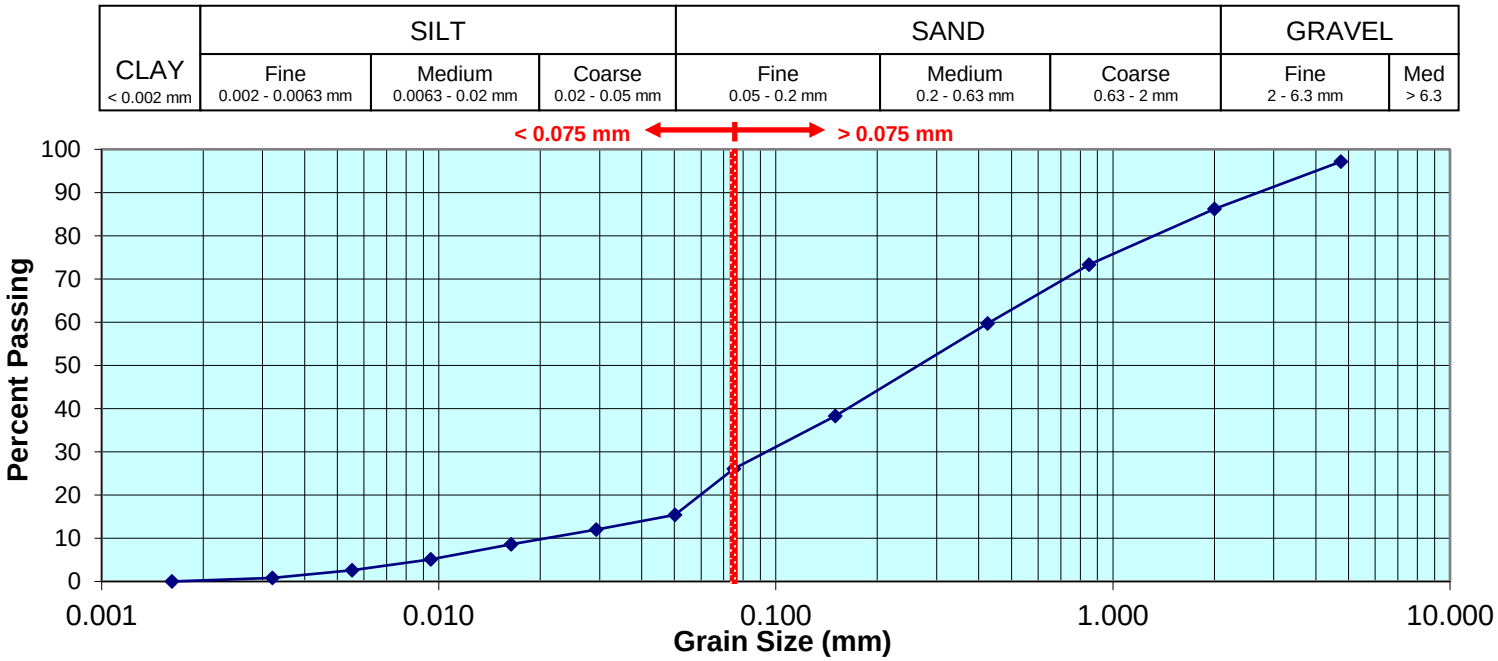
Based on the entire sample

Percentage (by mass) less than 0.075 mm = 26.1
Classification = Coarse Textured Soil

Based on the < 2 mm fraction **

Percentage (by mass) less than 0.075 mm = 30.3
Classification = Coarse Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report

Client Sample ID: ADAW79-BP4-A2
Maxxam Sample ID: CWA670-01
Maxxam Job #: C475010

Tot. Sample Wt (g)*: 12.49
> 2 mm Sample Wt (g)*: 1.90
* Dry mass based on Sieve Aliquot

Batch # (Sieve): B538002
Batch # (Hydro): B536879

Analysis Date (Sieve): 9/26/2024
Analysis Date (Hydro): 9/25/2024

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	100.0
	Sieve 10	2.000	84.8
	Sieve 20	0.850	72.1
	Sieve 40	0.425	59.7
	Sieve 100	0.150	38.8
	Sieve 200	0.075	27.9
Hydrometer	R1min	0.0495	16.1
	R3min	0.0293	10.2
	R10min	0.0164	8.0
	R30min	0.0095	4.4
	R90min	0.0055	2.9
	R270min	0.0032	1.5
	R1080min	0.0016	1.5

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	80.8
Silt	0.002	0.050	17.5
Clay	-	0.002	1.7

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

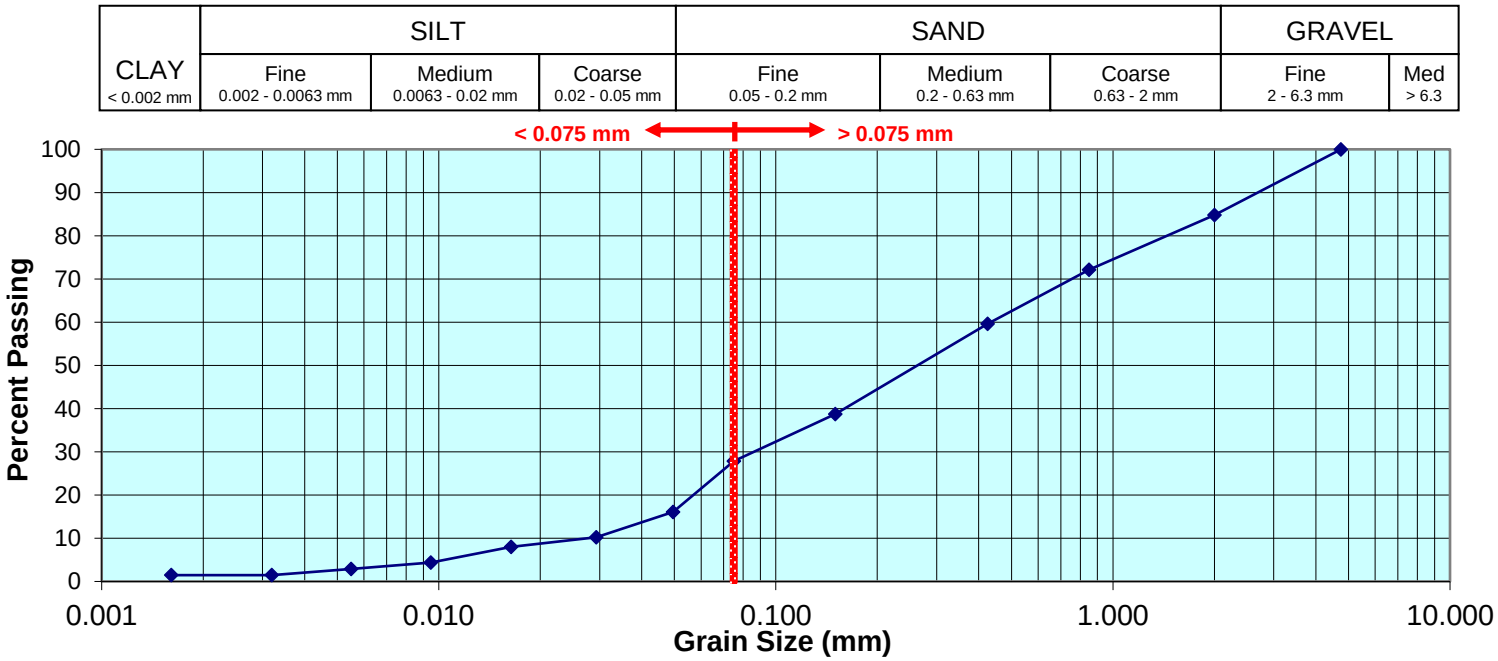
Based on the entire sample

Percentage (by mass) less than 0.075 mm = 27.9
Classification = Coarse Textured Soil

Based on the < 2 mm fraction **

Percentage (by mass) less than 0.075 mm = 32.9
Classification = Coarse Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report

Client Sample ID: ADAW80-BP4-A3
Maxxam Sample ID: CWA671-01
Maxxam Job #: C475010

Tot. Sample Wt (g)*: 12.38
> 2 mm Sample Wt (g)*: 1.67
* Dry mass based on Sieve Aliquot

Batch # (Sieve): B538002
Batch # (Hydro): B536879

Analysis Date (Sieve): 9/26/2024
Analysis Date (Hydro): 9/25/2024

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	96.2
	Sieve 10	2.000	86.5
	Sieve 20	0.850	74.7
	Sieve 40	0.425	63.5
	Sieve 100	0.150	45.6
	Sieve 200	0.075	33.9
Hydrometer	R1min	0.0495	22.4
	R3min	0.0290	18.3
	R10min	0.0162	14.3
	R30min	0.0094	9.2
	R90min	0.0055	4.1
	R270min	0.0032	2.0
	R1080min	0.0016	1.0

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	73.8
Silt	0.002	0.050	24.7
Clay	-	0.002	1.5

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

Based on the entire sample

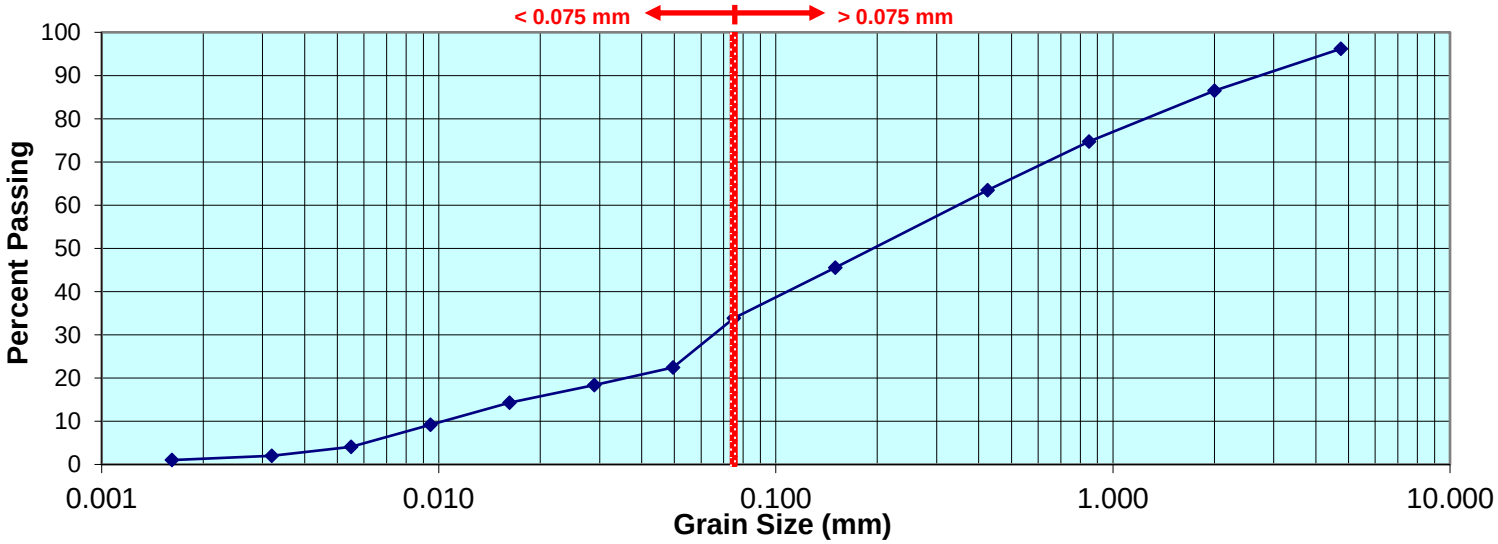
Percentage (by mass) less than 0.075 mm = 33.9
Classification = Coarse Textured Soil

Based on the < 2 mm fraction **

Percentage (by mass) less than 0.075 mm = 39.1
Classification = Coarse Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.

CLAY	SILT			SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Med
< 0.002 mm	0.002 - 0.0063 mm	0.0063 - 0.02 mm	0.02 - 0.05 mm	0.05 - 0.2 mm	0.2 - 0.63 mm	0.63 - 2 mm	2 - 6.3 mm	> 6.3



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report (QA-SRM)

Sieve Batch #: B538002

Hydrometer Batch #: B536879

Standard Reference Material

			Acceptance Limits	
	Fraction	% Recovery	Minimum	Maximum
Sieve	> 0.075 mm	102	75	125
	< 0.075 mm	99	75	125
Hydrometer	Sand	105	75	125
	Silt	100	75	125
	Clay	95	75	125

Grain Size Analysis Report (QA-DUP)

Sieve Batch #: B538002
Hydrometer Batch #: B536879
Maxxam Job #: C475010

Duplicate Sample ID: CWA660

			Acceptance Limit
	Fraction (mm)	% RPD	Maximum
Sieve	4.750	200.0	30
	2.000	95.0	30
	0.850	NC	30
	0.425	7.9	30
	0.150	NC	30
	0.075	5.0	30
Hydrometer	0.0519	NC	30
	0.0301	NC	30
	0.0168	NC	30
	0.0096	NC	30
	0.0056	NC	30
	0.0032	NC	30
	0.0016	NC	30

Grain Size Analysis Report (QA-DUP)

Sieve Batch #: B538002
Hydrometer Batch #: B536879
Maxxam Job #: C475010

Duplicate Sample ID: CWA660

			Acceptance Limit
	Fraction (mm)	% RPD	Maximum
Sieve	4.750	nc	30
	2.000	131.8	30
	0.850	nc	30
	0.425	10.5	30
	0.150	1.0	30
	0.075	34.4	30
Hydrometer	0.0519	NC	30
	0.0301	NC	30
	0.0168	NC	30
	0.0096	NC	30
	0.0056	NC	30
	0.0032	NC	30
	0.0016	NC	30

Stantec Consulting Ltd.
300 - 1331 Clyde Avenue, Ottawa ON K2C 3G4

January 21, 2025
File: 121626167

Attention: Jacob Elliott Holden, P. Eng
Environmental Engineer
Arcadis Canada Inc.
333 Preston Street, Suite 500
Ottawa, Ontario, Canada, K1S 5N4
Tel: 613-703-3818, C: 613-809-4651
E-mail: Jocob.Holden@arcadis.com

Dear Mr. Holden,

Reference: Standard Proctor Tests Results-ASTM D698, Arcadis Canada Inc., File# 30192375

This letter presents the results of eight Standard Proctor tests results in accordance with ASTM D698 respectively. The test results are summarized below.

Table: Summary of Tests Completed on Selected Samples

Sample ID	Max Dry D- kg/m^3	Corrected Max DD- kg/m^3	As received MC (%)	OMC (%)
BP1-A1	1728	-	2.4	14.6
BP1-A3	1647	-	9.1	15.4
BP2-A1	1782	1840	1.5	13.4/*12.4
BP2-A2	1672	-	3.4	12.0
BP3-A1	1642	-	6.1	15.2
BP3-A2	1718	-	9.2	13.0
BP3-A3	1690	-	2.5	14.0
BP4-A1	2135	2209	5.8	5.0/*4.4

**Corrected OMC*

This letter provides test results only and does not constitute any interpretation or engineering recommendations with respect to material suitability or specification compliance.

We trust the information presented herein meets your present requirements. Should you have any questions or require additional information, please do not hesitate to contact us.

Regards,

STANTEC CONSULTING LTD.

Brian Prevost
Laboratory Supervisor
Direct: 613 722-4420
Mobile: 613 612-5860
Brian.Prevost@stantec.com

Stantec

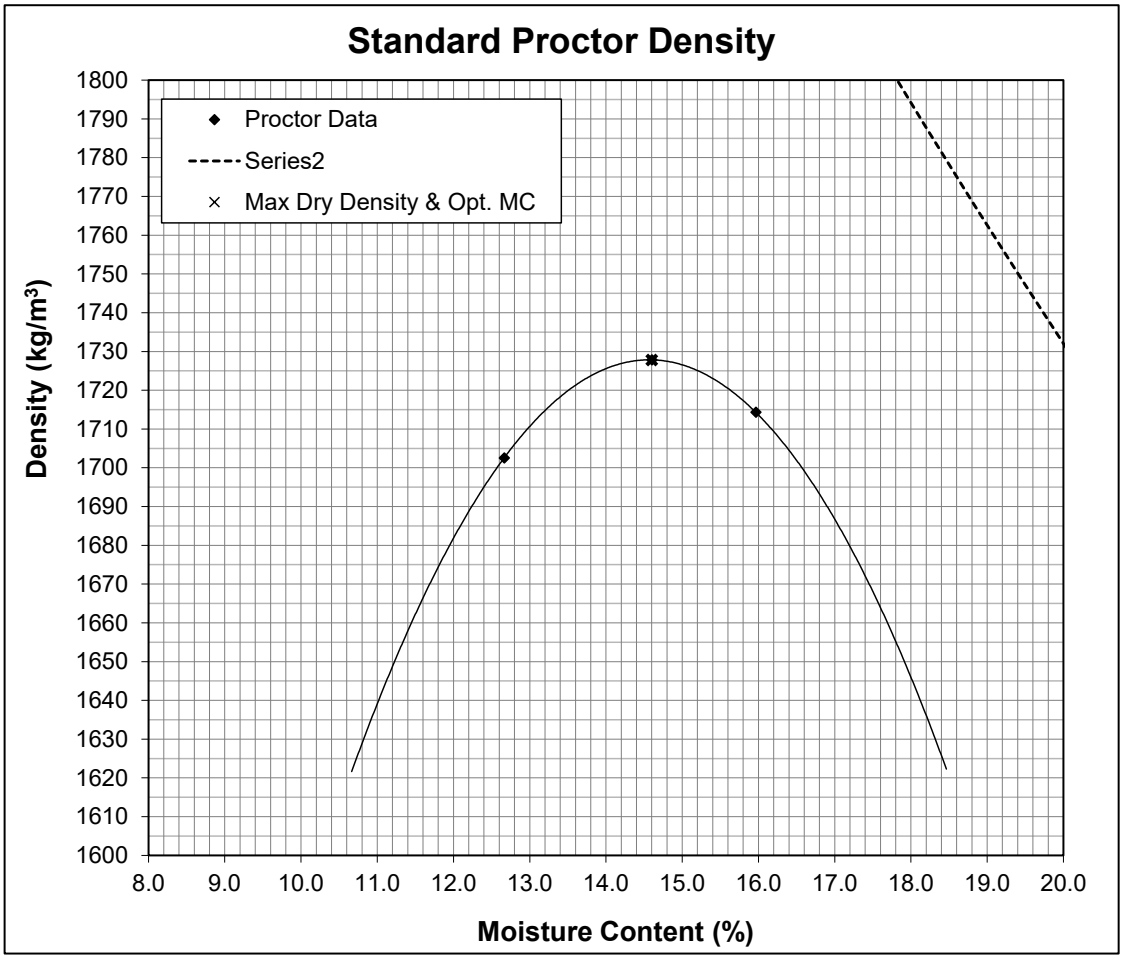
Laboratory Compaction Standard Effort

ASTM D698

Client:	Arcadis Canada Ltd.	Project No.:	121626167
Project:	30192375 Iqaluit TWP Geotech	Supplier:	N/A
Material Description:	Coarse Textured Soil	Source:	Native Material
Sampled From:	BP1-A1	Sample No:	BP1-A1
Sampled By:	Arcadis Canada Ltd.	Date Sampled:	N/A
Tested By:	Daniel Boateng	Date Tested:	December 9, 2024

Test Results

Corrected Maximum Dry Density (kg/m^3):	**N/A**	**Maximum Wet Density (kg/m^3):**	**1980**
Corrected Maximum Dry Density (g/cm^3):	**N/A**	**Maximum Wet Density (g/cm^3):**	**1.980**
Corrected Maximum Dry Unit Weight (kN/m^3):	**N/A**	**Maximum Dry Density (kg/m^3):**	**1728**
Corrected Optimum Moisture Content (%):	**N/A**	**Optimum Moisture Content (%):**	**14.60**



Remarks:

Reviewed By: Brian Prevost (Name) — January 20, 2025 (Date)

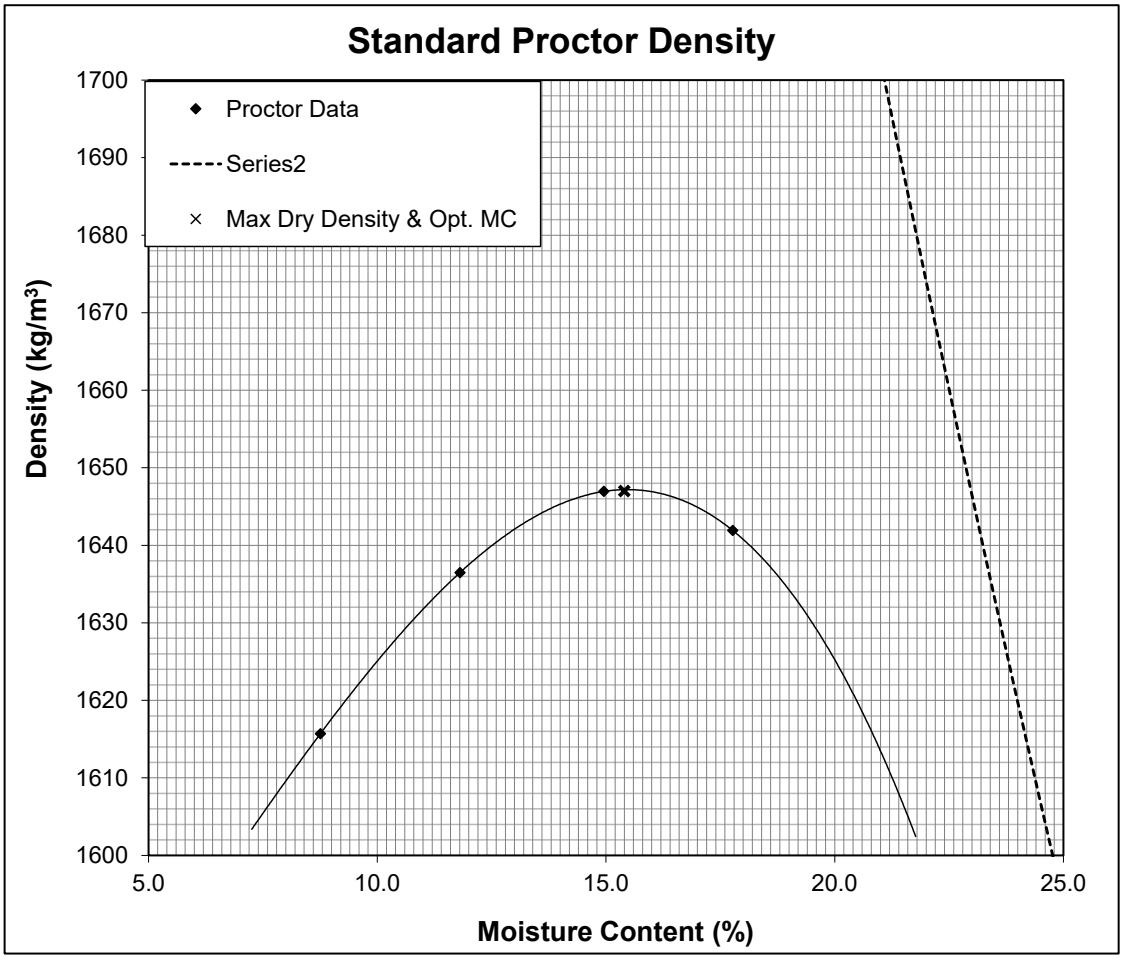
Laboratory Compaction Standard Effort

ASTM D698

Client:	Arcadis Canada Ltd.	Project No.:	121626167
Project:	30192375 Iqaluit TWP Geotech	Supplier:	N/A
Material Description:	Coarse Textured Soil	Source:	Native Material
Sampled From:	BP1-A3	Sample No:	BP1-A3
Sampled By:	Arcadis Canada Ltd.	Date Sampled:	N/A
Tested By:	Daniel Boateng	Date Tested:	December 9, 2024

Test Results

Corrected Maximum Dry Density (kg/m^3):	**N/A**	**Maximum Wet Density (kg/m^3):**	**1901**
Corrected Maximum Dry Density (g/cm^3):	**N/A**	**Maximum Wet Density (g/cm^3):**	**1.901**
Corrected Maximum Dry Unit Weight (kN/m^3):	**N/A**	**Maximum Dry Density (kg/m^3):**	**1647**
Corrected Optimum Moisture Content (%):	**N/A**	**Optimum Moisture Content (%):**	**15.40**



Remarks:

Reviewed By: Brian Prevost (Name) — January 20, 2025 (Date)

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Stantec

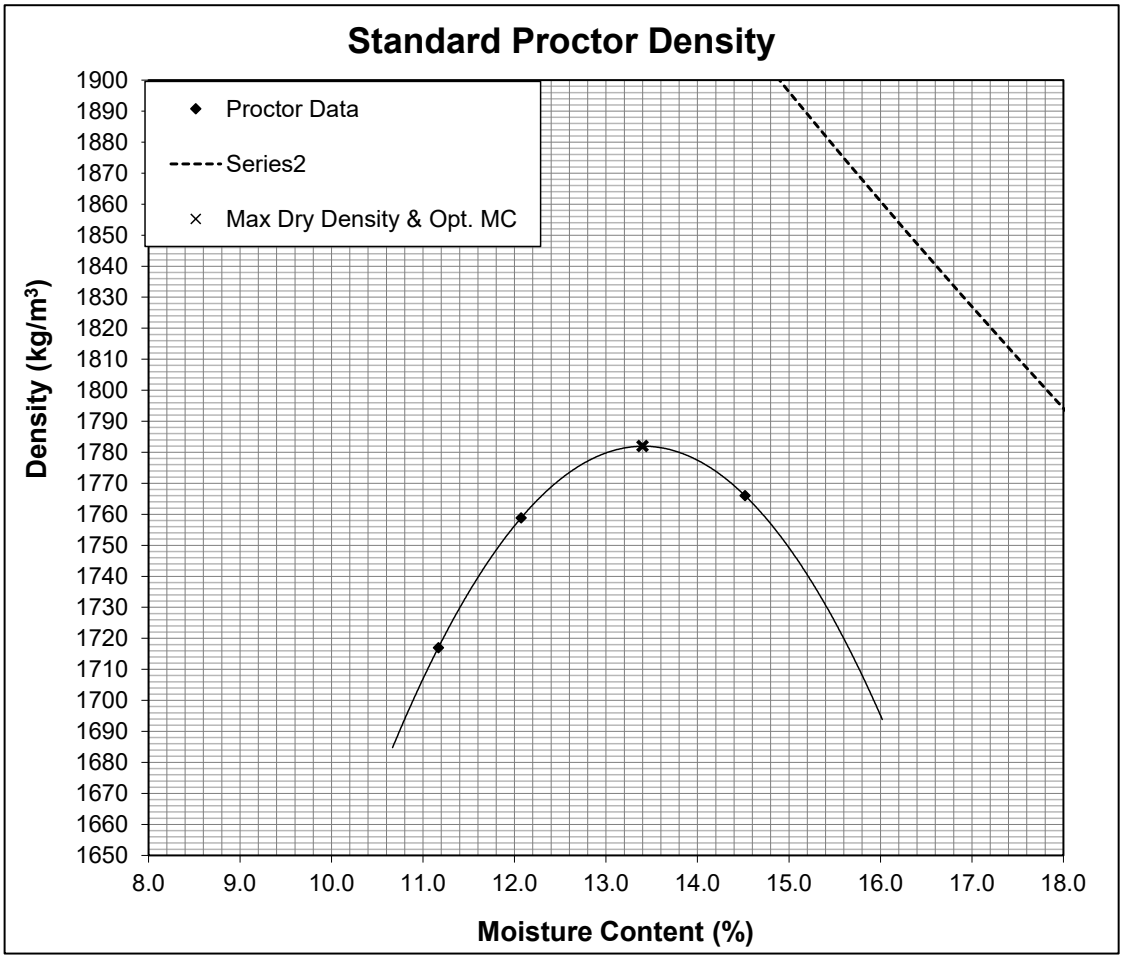
Laboratory Compaction Standard Effort

ASTM D698

Client:	Arcadis Canada Ltd.	Project No.:	121626167
Project:	30192375 Iqaluit TWP Geotech	Supplier:	N/A
Material Description:	Coarse Textured Soil	Source:	Native Material
Sampled From:	BP2-A1	Sample No:	BP2-A1
Sampled By:	Arcadis Canada Ltd.	Date Sampled:	N/A
Tested By:	Daniel Boateng	Date Tested:	December 9, 2024

Test Results

Corrected Maximum Dry Density (kg/m^3):	**1836**	**Maximum Wet Density (kg/m^3):**	**2021**
Corrected Maximum Dry Density (g/cm^3):	**1.836**	**Maximum Wet Density (g/cm^3):**	**2.021**
Corrected Maximum Dry Unit Weight (kN/m^3):	**18.009**	**Maximum Dry Density (kg/m^3):**	**1782**
Corrected Optimum Moisture Content (%):	**12.39**	**Optimum Moisture Content (%):**	**13.40**



Remarks:

Reviewed By: Brian Prevost (Name) — January 20, 2025 (Date)

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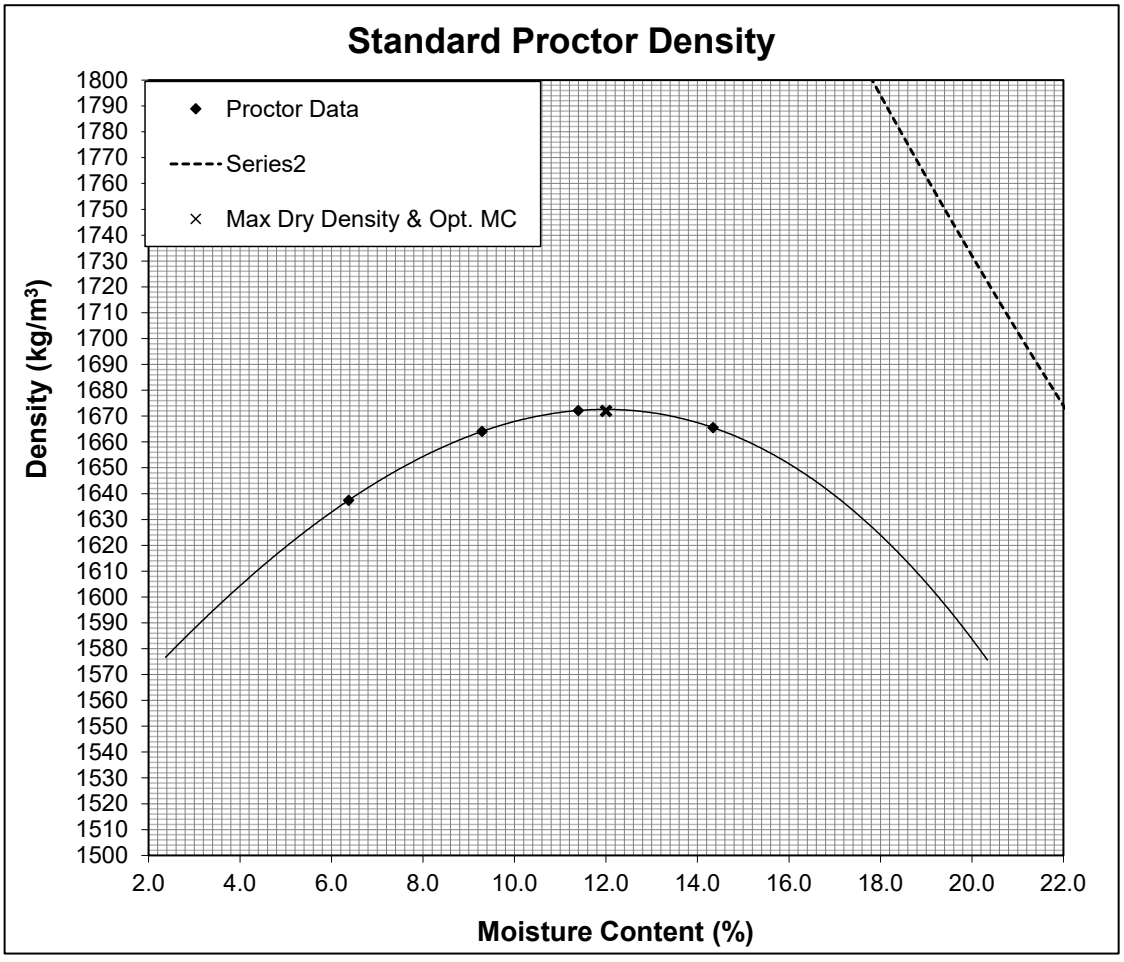
Laboratory Compaction Standard Effort

ASTM D698

Client:	Arcadis Canada Ltd.	Project No.:	121626167
Project:	30192375 Iqaluit TWP Geotech	Supplier:	N/A
Material Description:	Coarse Textured Soil	Source:	Native Material
Sampled From:	BP2-A2	Sample No:	BP2-A2
Sampled By:	Arcadis Canada Ltd.	Date Sampled:	N/A
Tested By:	Daniel Boateng	Date Tested:	December 12, 2024

Test Results

Corrected Maximum Dry Density (kg/m^3):	**N/A**	**Maximum Wet Density (kg/m^3):**	**1873**
Corrected Maximum Dry Density (g/cm^3):	**N/A**	**Maximum Wet Density (g/cm^3):**	**1.873**
Corrected Maximum Dry Unit Weight (kN/m^3):	**N/A**	**Maximum Dry Density (kg/m^3):**	**1672**
Corrected Optimum Moisture Content (%):	**N/A**	**Optimum Moisture Content (%):**	**12.00**



Remarks:

Reviewed By: Brian Prevost (Name) — January 20, 2025 (Date)

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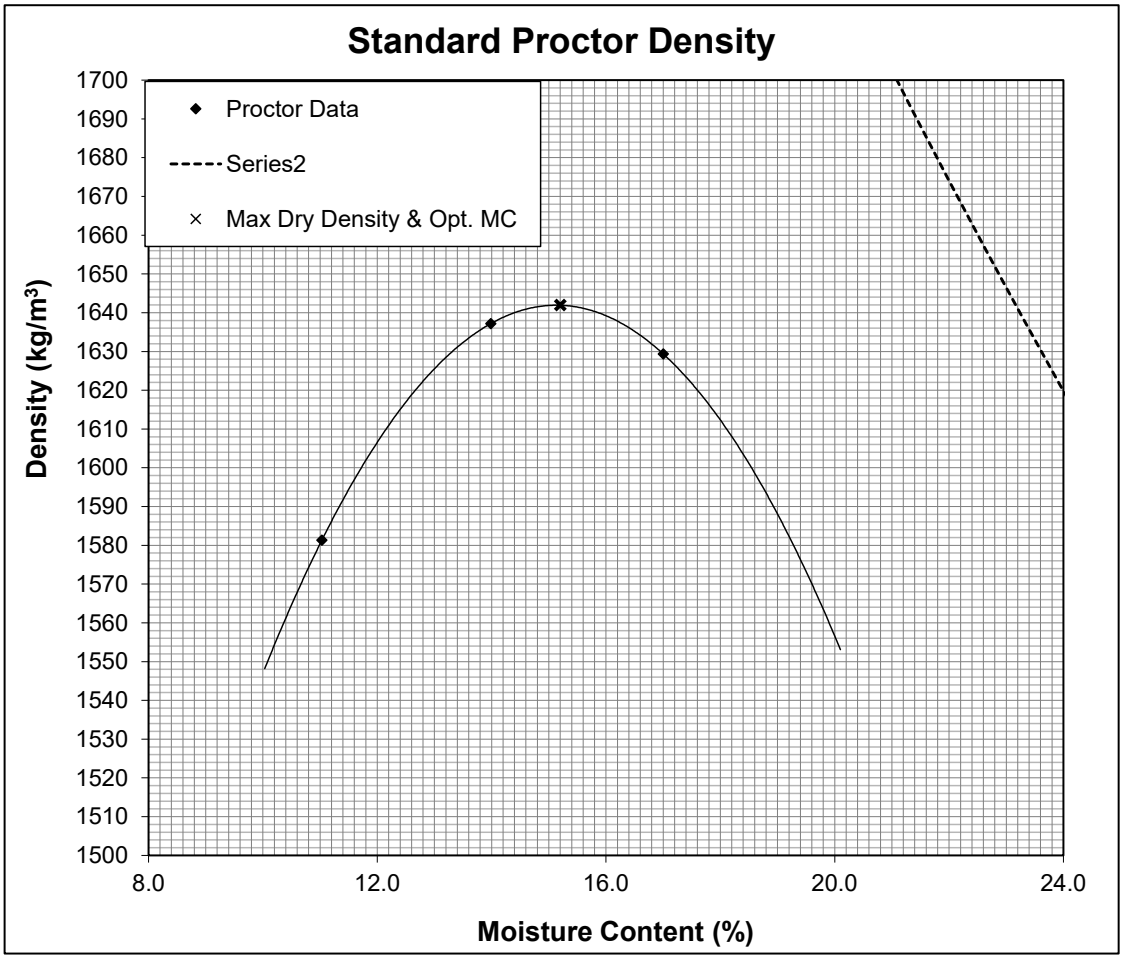
Laboratory Compaction Standard Effort

ASTM D698

Client:	Arcadis Canada Ltd.	Project No.:	121626167
Project:	30192375 Iqaluit TWP Geotech	Supplier:	N/A
Material Description:	Coarse Textured Soil	Source:	Native Material
Sampled From:	BP3-A1	Sample No:	BP3-A1
Sampled By:	Arcadis Canada Ltd.	Date Sampled:	N/A
Tested By:	Daniel Boateng	Date Tested:	December 9, 2024

Test Results

Corrected Maximum Dry Density (kg/m^3):	**N/A**	**Maximum Wet Density (kg/m^3):**	**1892**
Corrected Maximum Dry Density (g/cm^3):	**N/A**	**Maximum Wet Density (g/cm^3):**	**1.892**
Corrected Maximum Dry Unit Weight (kN/m^3):	**N/A**	**Maximum Dry Density (kg/m^3):**	**1642**
Corrected Optimum Moisture Content (%):	**N/A**	**Optimum Moisture Content (%):**	**15.20**



Remarks:

Reviewed By: Brian Prevost (Name) — January 20, 2025 (Date)

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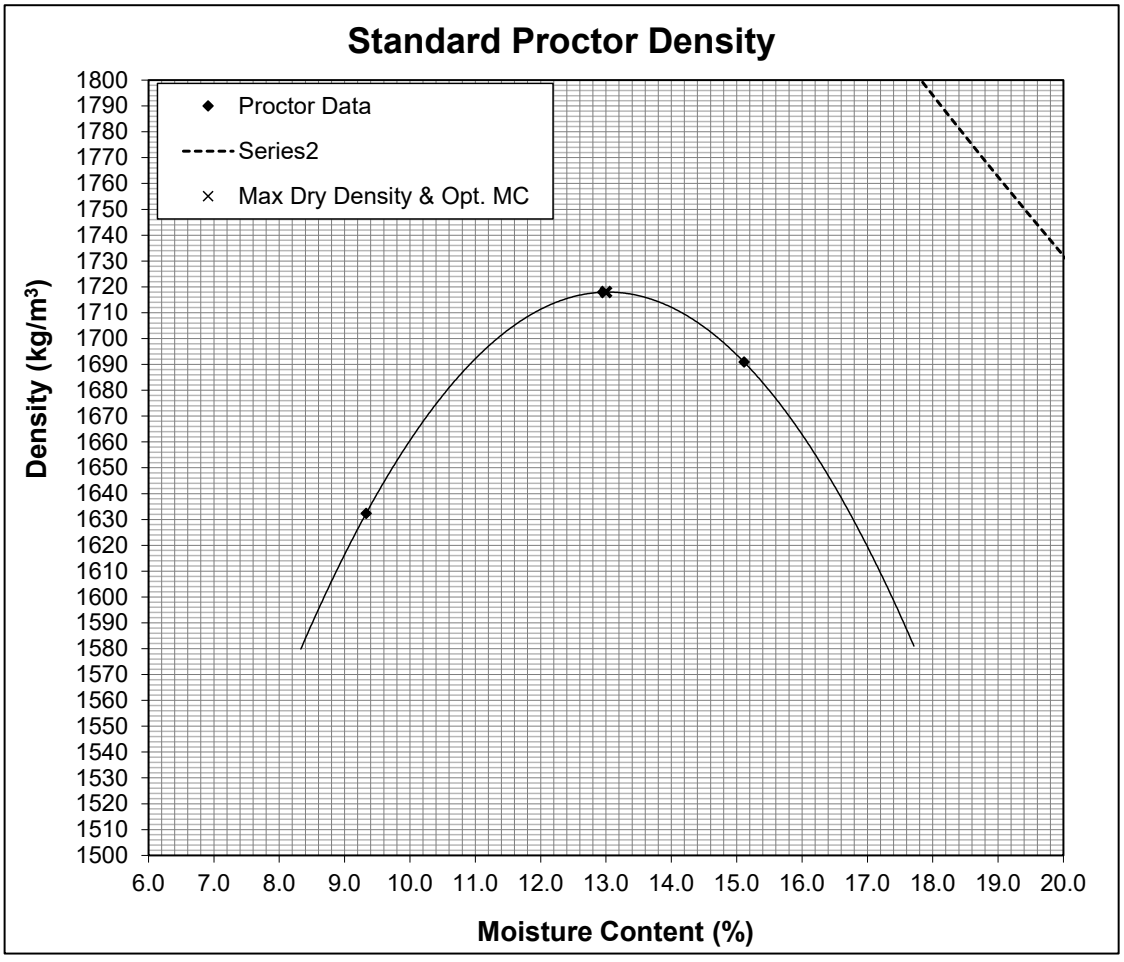
Laboratory Compaction Standard Effort

ASTM D698

Client:	Arcadis Canada Ltd.	Project No.:	121626167
Project:	30192375 Iqaluit TWP Geotech	Supplier:	N/A
Material Description:	Coarse Textured Soil	Source:	Native Material
Sampled From:	BP3-A2	Sample No:	BP3-A2
Sampled By:	Arcadis Canada Ltd.	Date Sampled:	N/A
Tested By:	Daniel Boateng	Date Tested:	December 12, 2024

Test Results

Corrected Maximum Dry Density (kg/m^3):	**N/A**	**Maximum Wet Density (kg/m^3):**	**1941**
Corrected Maximum Dry Density (g/cm^3):	**N/A**	**Maximum Wet Density (g/cm^3):**	**1.941**
Corrected Maximum Dry Unit Weight (kN/m^3):	**N/A**	**Maximum Dry Density (kg/m^3):**	**1718**
Corrected Optimum Moisture Content (%):	**N/A**	**Optimum Moisture Content (%):**	**13.00**



Remarks:

Reviewed By: Brian Prevost (Name) — January 20, 2025 (Date)

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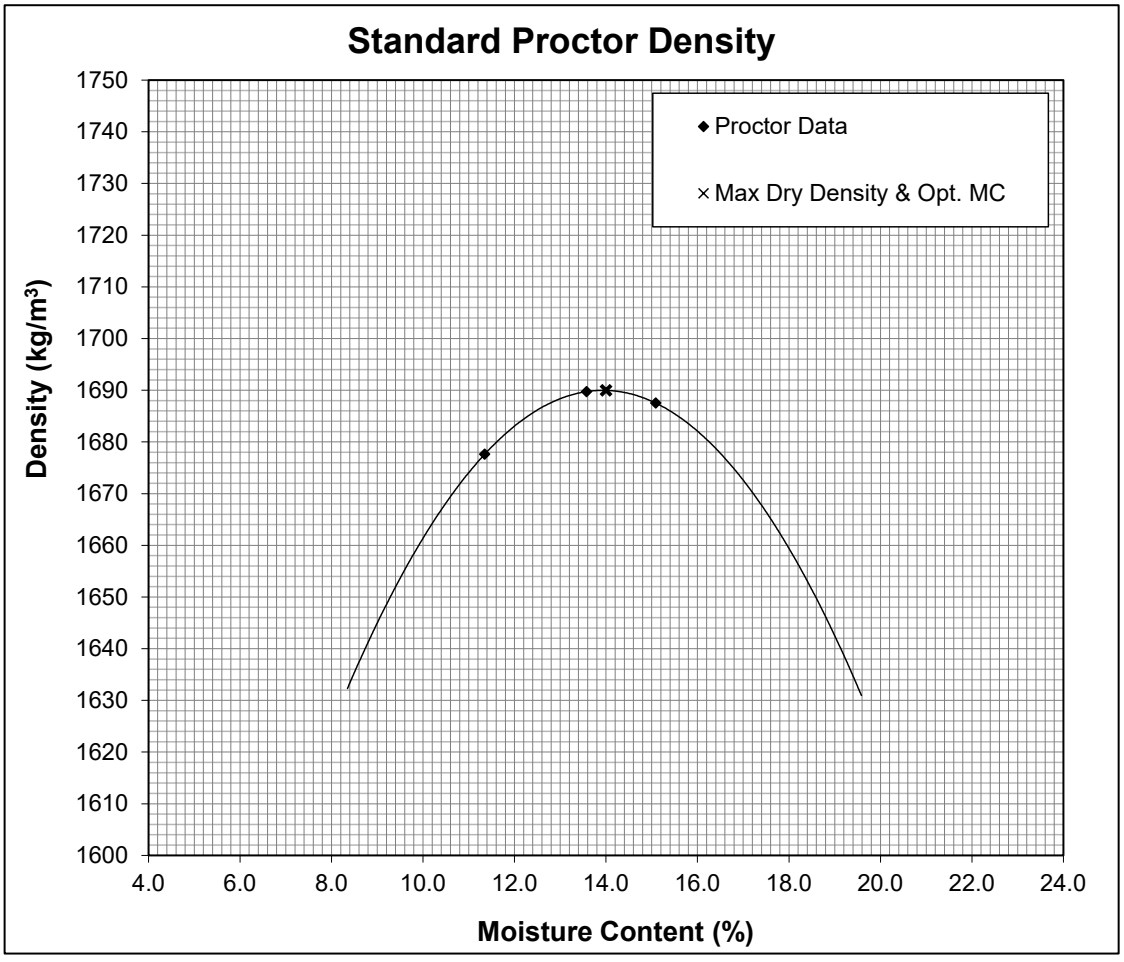
Laboratory Compaction Standard Effort

ASTM D698

Client:	Arcadis Canada Ltd.	Project No.:	121626167
Project:	30192375 Iqaluit TWP Geotech	Supplier:	N/A
Material Description:	Coarse Textured Soil	Source:	Native Material
Sampled From:	BP3-A3	Sample No:	BP3-A3
Sampled By:	Arcadis Canada Ltd.	Date Sampled:	N/A
Tested By:	Daniel Boateng	Date Tested:	January 15, 2025

Test Results

Corrected Maximum Dry Density (kg/m^3):	**N/A**	**Maximum Wet Density (kg/m^3):**	**1927**
Corrected Maximum Dry Density (g/cm^3):	**N/A**	**Maximum Wet Density (g/cm^3):**	**1.927**
Corrected Maximum Dry Unit Weight (kN/m^3):	**N/A**	**Maximum Dry Density (kg/m^3):**	**1690**
Corrected Optimum Moisture Content (%):	**N/A**	**Optimum Moisture Content (%):**	**14.00**



Remarks:

Reviewed By: Brian Prevost (Name) — January 20, 2025 (Date)

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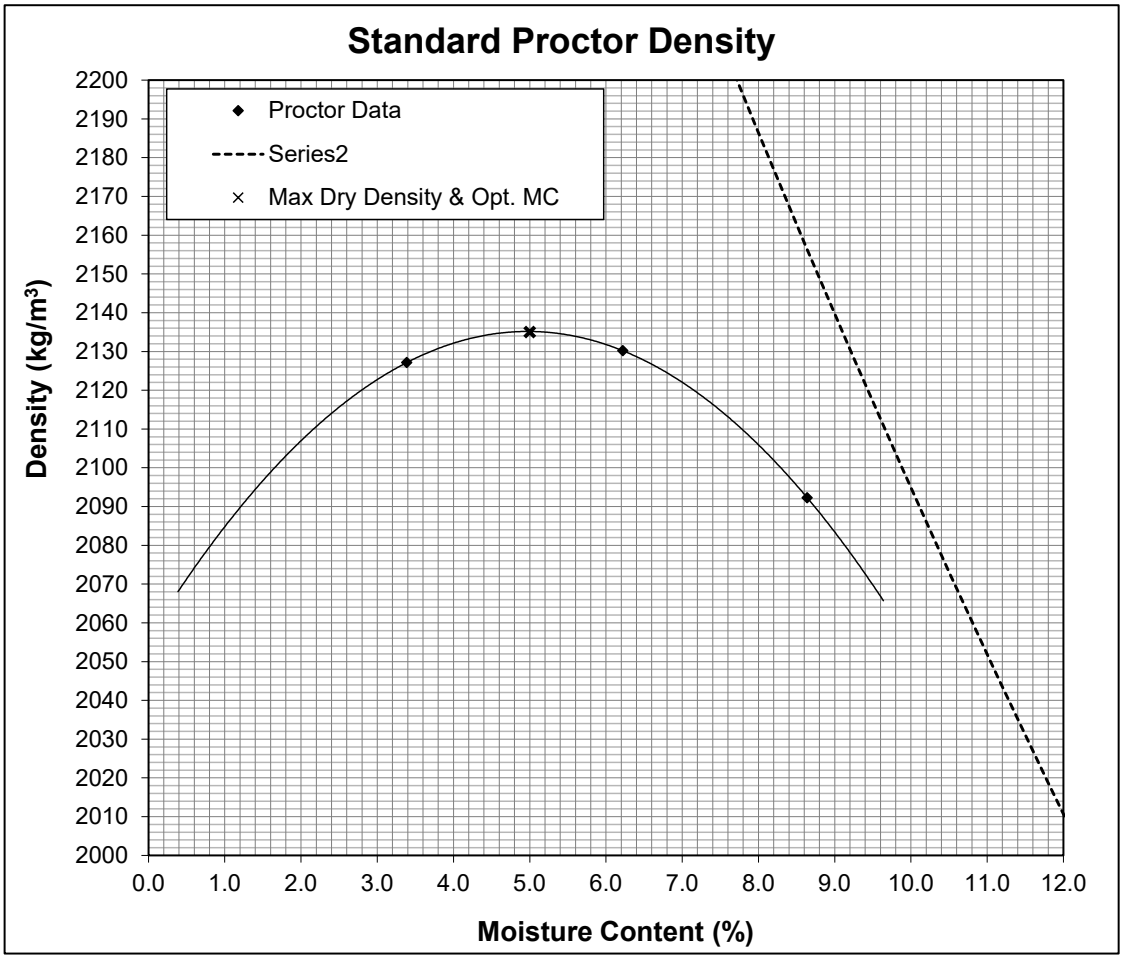
Laboratory Compaction Standard Effort

ASTM D698

Client:	Arcadis Canada Ltd.	Project No.:	121626167
Project:	30192375 Iqaluit TWP Geotech	Supplier:	N/A
Material Description:	Coarse Textured Soil	Source:	Native Material
Sampled From:	BP4-A1	Sample No:	BP4-A1
Sampled By:	Arcadis Canada Ltd.	Date Sampled:	N/A
Tested By:	Daniel Boateng	Date Tested:	December 11, 2024

Test Results

Corrected Maximum Dry Density (kg/m^3):	**2199**	**Maximum Wet Density (kg/m^3):**	**2242**
Corrected Maximum Dry Density (g/cm^3):	**2.199**	**Maximum Wet Density (g/cm^3):**	**2.242**
Corrected Maximum Dry Unit Weight (kN/m^3):	**21.567**	**Maximum Dry Density (kg/m^3):**	**2135**
Corrected Optimum Moisture Content (%):	**4.36**	**Optimum Moisture Content (%):**	**5.00**



Remarks:

Reviewed By: Brian Prevost (Name) — January 20, 2025 (Date)

Stantec Consulting Ltd.
300 - 1331 Clyde Avenue, Ottawa ON K2C 3G4

April 16, 2025
File: 121626167

Attention: Jacob Elliott Holden, P. Eng
Environmental Engineer
Arcadis Canada Inc.
333 Preston Street, Suite 500
Ottawa, Ontario, Canada, K1S 5N4
Tel: 613-703-3818, C: 613-809-4651
E-mail: Jocob.Holden@arcadis.com

Dear Mr. Holden,

Reference: Standard Proctor Tests Results-ASTM D698, Arcadis Canada Inc., File# 30192375

This letter presents the results of four Standard Proctor tests results in accordance with ASTM D698 respectively. The test results are summarized below.

Table: Summary of Tests Completed on Selected Samples

Sample ID	Max Dry D- kg/m^3	Corrected Max DD- kg/m^3	As received MC (%)	OMC (%)
BP1-A2	1748	-	20.0	15.5
BP2-A3	1761	-	13.6	11.2
BP4-A2	2104	2198	7.4	7.1/*6.0
BP4-A3	2010	2118	7.9	8.8/*7.1

**Corrected OMC*

This letter provides test results only and does not constitute any interpretation or engineering recommendations with respect to material suitability or specification compliance.

We trust the information presented herein meets your present requirements. Should you have any questions or require additional information, please do not hesitate to contact us.

Regards,

STANTEC CONSULTING LTD.

Brian Prevost
Laboratory Supervisor
Direct: 613 722-4420
Mobile: 613 612-5860
Brian.Prevost@stantec.com

Stantec

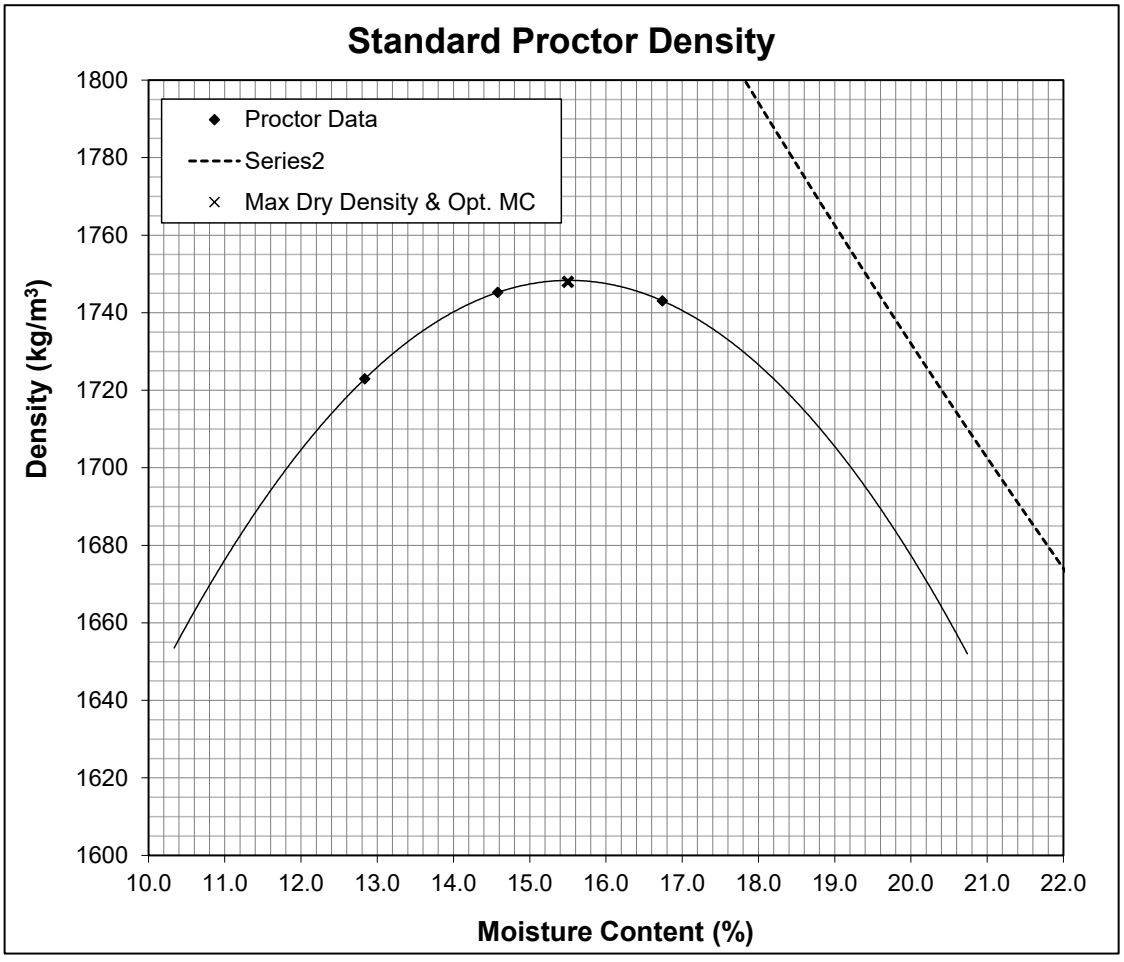
Laboratory Compaction Standard Effort

ASTM D698

Client:	Arcadis Canada Ltd.	Project No.:	121626167
Project:	30192375 Iqaluit TWP Geotech	Supplier:	N/A
Material Description:	Coarse Textured Soil	Source:	Native Material
Sampled From:	BP1-A2	Sample No:	BP1-A2
Sampled By:	Arcadis Canada Ltd.	Date Sampled:	N/A
Tested By:	Denis Rodriguez	Date Tested:	March 17, 2025

Test Results

Corrected Maximum Dry Density (kg/m^3):	**N/A**	**Maximum Wet Density (kg/m^3):**	**2019**
Corrected Maximum Dry Density (g/cm^3):	**N/A**	**Maximum Wet Density (g/cm^3):**	**2.019**
Corrected Maximum Dry Unit Weight (kN/m^3):	**N/A**	**Maximum Dry Density (kg/m^3):**	**1748**
Corrected Optimum Moisture Content (%):	**N/A**	**Optimum Moisture Content (%):**	**15.5**



Remarks: Proctor Method: A

0% Oversize Retained on the 4.75mm Sieve

Reviewed By: Brian Prevost (Name) — April 7, 2025 (Date)

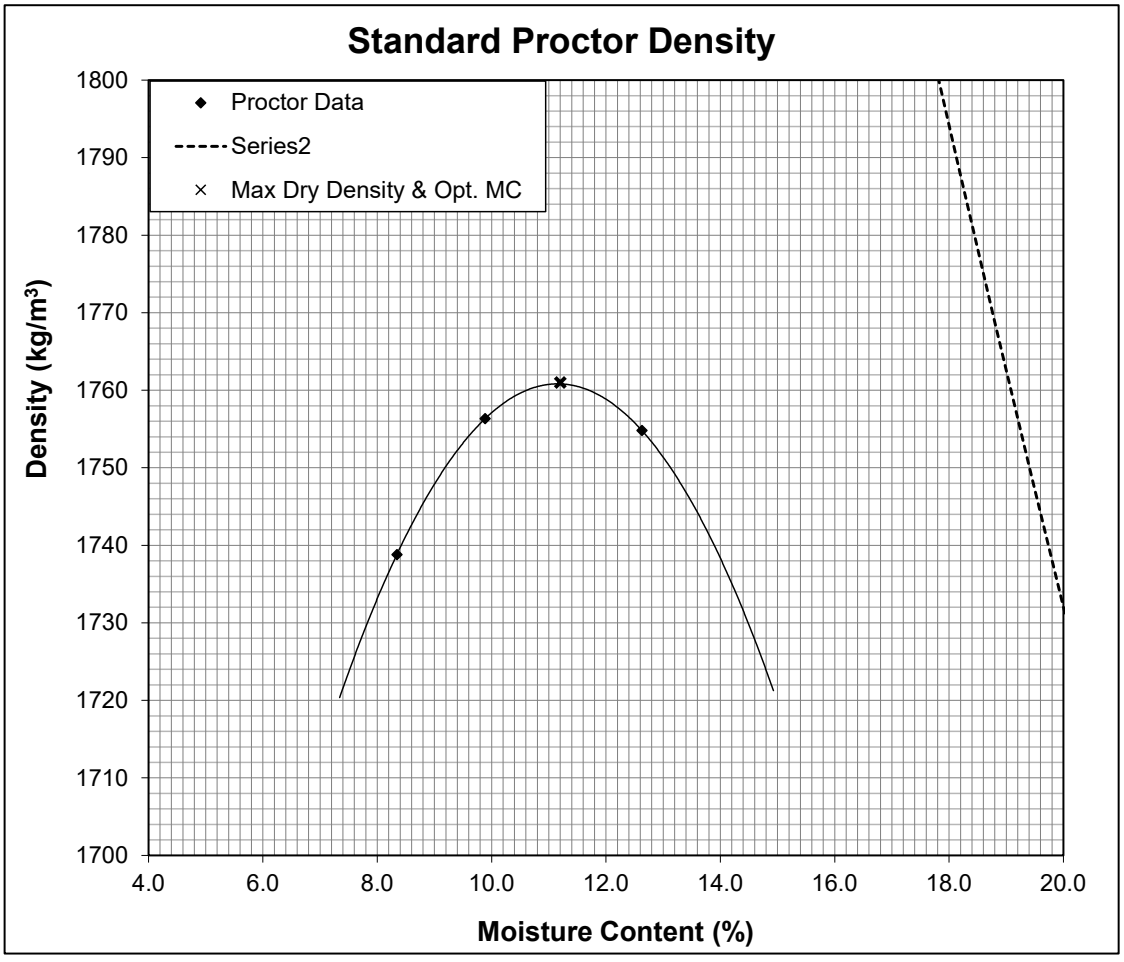
Laboratory Compaction Standard Effort

ASTM D698

Client:	Arcadis Canada Ltd.	Project No.:	121626167
Project:	30192375 Iqaluit TWP Geotech	Supplier:	N/A
Material Description:	Coarse Textured Soil	Source:	Native Material
Sampled From:	BP2-A3	Sample No:	BP2-A3
Sampled By:	Arcadis Canada Ltd.	Date Sampled:	N/A
Tested By:	Denis Rodriguez	Date Tested:	March 17, 2025

Test Results

Corrected Maximum Dry Density (kg/m^3):	**N/A**	**Maximum Wet Density (kg/m^3):**	**1958**
Corrected Maximum Dry Density (g/cm^3):	**N/A**	**Maximum Wet Density (g/cm^3):**	**1.958**
Corrected Maximum Dry Unit Weight (kN/m^3):	**N/A**	**Maximum Dry Density (kg/m^3):**	**1761**
Corrected Optimum Moisture Content (%):	**N/A**	**Optimum Moisture Content (%):**	**11.2**



Remarks: Proctor Method: B

0.3% Oversize Retained on the 9.5mm Sieve

Reviewed By: Brian Prevost (Name) April 7, 2025 (Date)

V:\01216\active\laboratory_standing_offers\2024 Laboratory Standing Offers\121626167 Arcadis Canada Inc\Arcadis Canada Inc, File# 30192375.02\Lab Testing\std proctors\BP2-A3_Standard Proctor Moist Method ASTMD698.xlsx

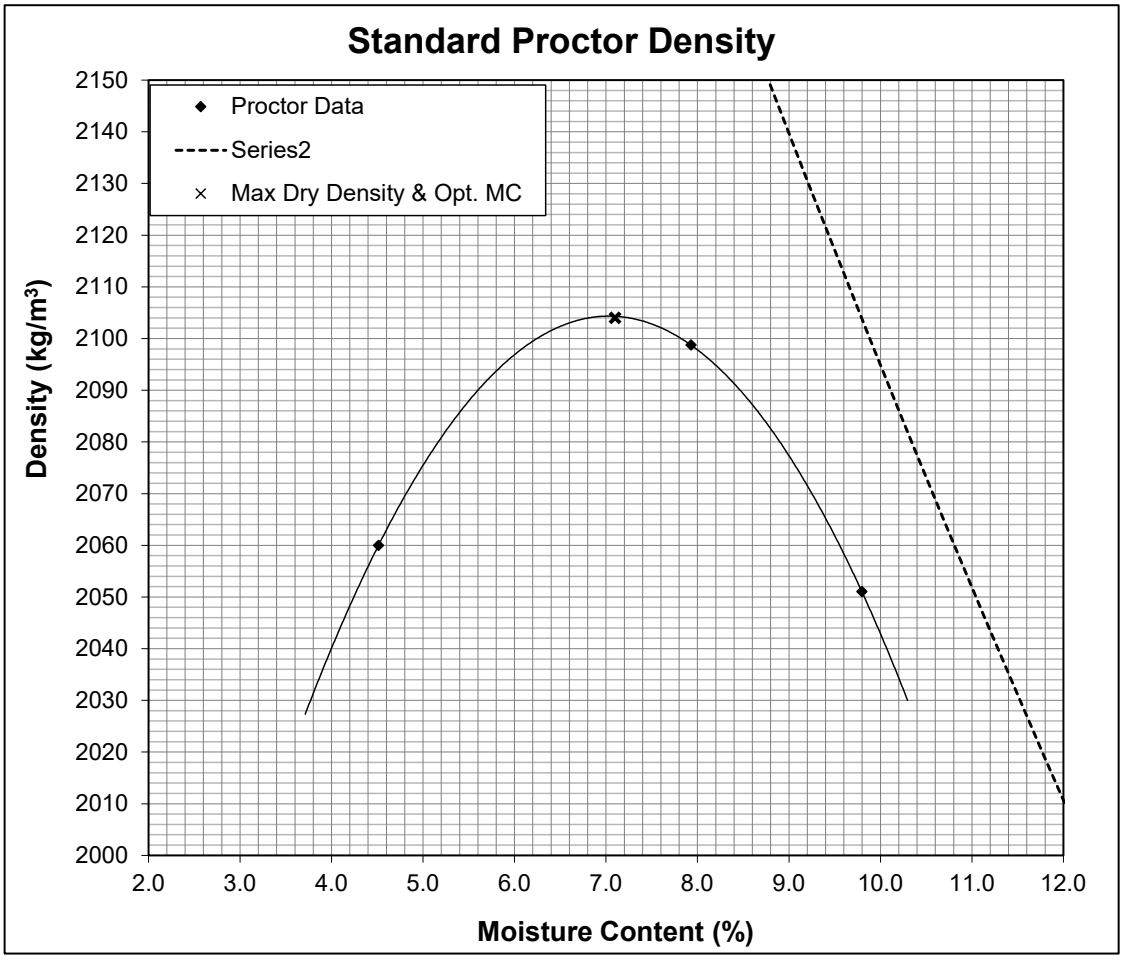
Laboratory Compaction Standard Effort

ASTM D698

Client:	Arcadis Canada Ltd.	Project No.:	121626167
Project:	30192375 Iqaluit TWP Geotech	Supplier:	N/A
Material Description:	Coarse Textured Soil	Source:	Native Material
Sampled From:	BP4-A2	Sample No:	BP4-A2
Sampled By:	Arcadis Canada Ltd.	Date Sampled:	N/A
Tested By:	Denis Rodriguez	Date Tested:	March 17, 2025

Test Results

Corrected Maximum Dry Density (kg/m^3):	**2198**	**Maximum Wet Density (kg/m^3):**	**2253**
Corrected Maximum Dry Density (g/cm^3):	**2.198**	**Maximum Wet Density (g/cm^3):**	**2.253**
Corrected Maximum Dry Unit Weight (kN/m^3):	**21.55**	**Maximum Dry Density (kg/m^3):**	**2104**
Corrected Optimum Moisture Content (%):	**6.0**	**Optimum Moisture Content (%):**	**7.1**



Remarks: Proctor Method: B

20.7% Oversize Retained on the 9.5mm Sieve

Reviewed By: Brian Prevost (Name) — April 7, 2025 (Date)

Stantec

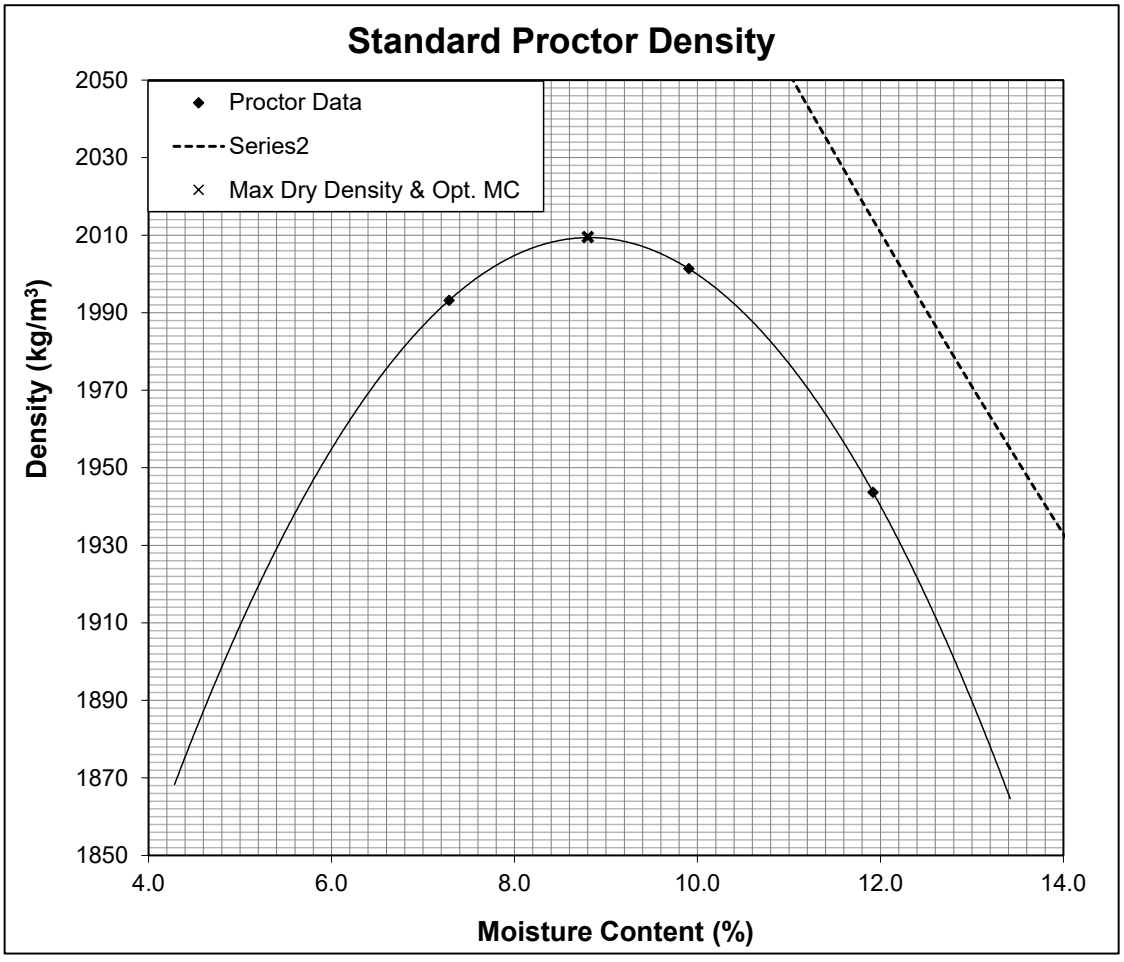
Laboratory Compaction Standard Effort

ASTM D698

Client:	Arcadis Canada Ltd.	Project No.:	121626167
Project:	30192375 Iqaluit TWP Geotech	Supplier:	N/A
Material Description:	Coarse Textured Soil	Source:	Native Material
Sampled From:	BP4-A3	Sample No:	BP4-A3
Sampled By:	Arcadis Canada Ltd.	Date Sampled:	N/A
Tested By:	Denis Rodriguez	Date Tested:	March 17, 2025

Test Results

Corrected Maximum Dry Density (kg/m^3):	**2118**	**Maximum Wet Density (kg/m^3):**	**2187**
Corrected Maximum Dry Density (g/cm^3):	**2.118**	**Maximum Wet Density (g/cm^3):**	**2.187**
Corrected Maximum Dry Unit Weight (kN/m^3):	**20.77**	**Maximum Dry Density (kg/m^3):**	**2010**
Corrected Optimum Moisture Content (%):	**7.1**	**Optimum Moisture Content (%):**	**8.8**



Remarks: Proctor Method: B

21.3% Oversize Retained on the 9.5mm Sieve

Reviewed By: Brian Prevost (Name) — April 7, 2025 (Date)

Stantec Consulting Ltd.
300 - 1331 Clyde Avenue, Ottawa ON K2C 3G4

January 20, 2025
File: 121626167

Attention: Jacob Elliott Holden, P. Eng.
Environmental Engineer
Arcadis Canada Inc.
333 Preston Street, Suite 500
Ottawa, Ontario, Canada, K1S 5N4
Tel: 613-703-3818, C: 613-809-4651
E-mail: Jacob.Holden@arcadis.com

Dear Mr. Holden,

Reference: Direct Shear Tests Results, Arcadis Canada Inc., File # 30192375

This letter presents the results of 12 Direct Shear tests carried out in accordance with ASTM D3080/D3080M. The test results are provided in the attached tables and figures.

Table 1: Summary of Tests Completed

Sample ID	Depth	Test Number
BP1-A1	N/A	1,2,3
BP2-A1	N/A	4,5,6
BP3-A1	N/A	7,8,9
BP4-A1	N/A	10,11,12

This letter provides test results only and does not constitute any interpretation or engineering recommendations with respect to material suitability or specification compliance.

We trust the information presented herein meets your present requirements. Should you have any questions or require additional information, please do not hesitate to contact us.

Regards,

STANTEC CONSULTING LTD.

Ramin Ghassemi Ph.D., P.Eng.
Geotechnical Engineer
Direct: 613 722-4420
Mobile: 437 775-7625
Ramin.ghassemi@stantec.com

Stantec

Stantec Consulting Ltd.

Direct Shear Test of Soils Under Consolidated Drained Conditions
ASTM D3080/D3080M

V:\01216\activelaboratory_standing_offers\2024 Laboratory Standing Offers\121626 January 20, 2025

Prepared by: D. Boateng Date: January 20, 2025

Checked by: R. Ghassemi Date: January 20, 2025

		Test # 1	Test # 2	Test # 3
Specimen Details				
Project Name		*30192375 Iqaluit LTWP_Geotech Testing*		
Project Location		*Iqaluit, Nunavut*		
Bulk Sample		*Coarse Textured Sand*	*Coarse Textured Sand*	*Coarse Textured Sand*
Sample No.		*BP1-A1*	*BP1-A1*	*BP1-A1*
Depth	ft	*N/A*	*N/A*	*N/A*
Sample Date		*N/A*	*N/A*	*N/A*

Soil Description and Classification as provided by the Project Engineer

Coarse Textured Sand

Initial Specimen Conditions				
Height	mm	31.70	31.70	31.70
Diameter	mm	63.50	63.50	63.50
Mass	g	182.30	182.70	182.40
Dry Mass	g	166.87	165.45	162.98
Wet Density	Mg/m^3	1.82	1.82	1.82
Dry Density	Mg/m^3	1.66	1.65	1.62
Moisture Content	%	9.25	10.43	11.91
Degree of Saturation	%	41.5	45.7	50.2
Specific Gravity (Assumed)		2.65	2.65	2.65
Void Ratio		0.59	0.60	0.63

Final Specimen Conditions				
Normal Stress	kPa	5	150	350
Time to Failure	min	23	7	9
Rate of Displacement	mm/min	0.300	0.300	0.300
Peak Shear Stress	kPa	15.3	112.6	296.9
Shear Stress at the end of test	kPa	4.8	92.0	222.9
H. Displacement-Peak	mm	7.0	2.2	2.7
Moisture Content	%	18.42	17.92	18.42

Tests Notes:

1.Testing were completed at 95% of SPMDD

2. Material retained on the 4.75 mm sieve were screened before the direct shear tests

3.Test specmiens were inundated throughout the tests

4. Testing were completed following the desired normal stresses of 0, 150 and 350 kPa respectively provided by the Client

5. 5 kPa normal stress for first point due to placement of the loading cap and the top split-box assembly

6. Specific gravities were assumed

Stantec

Stantec Consulting Ltd.

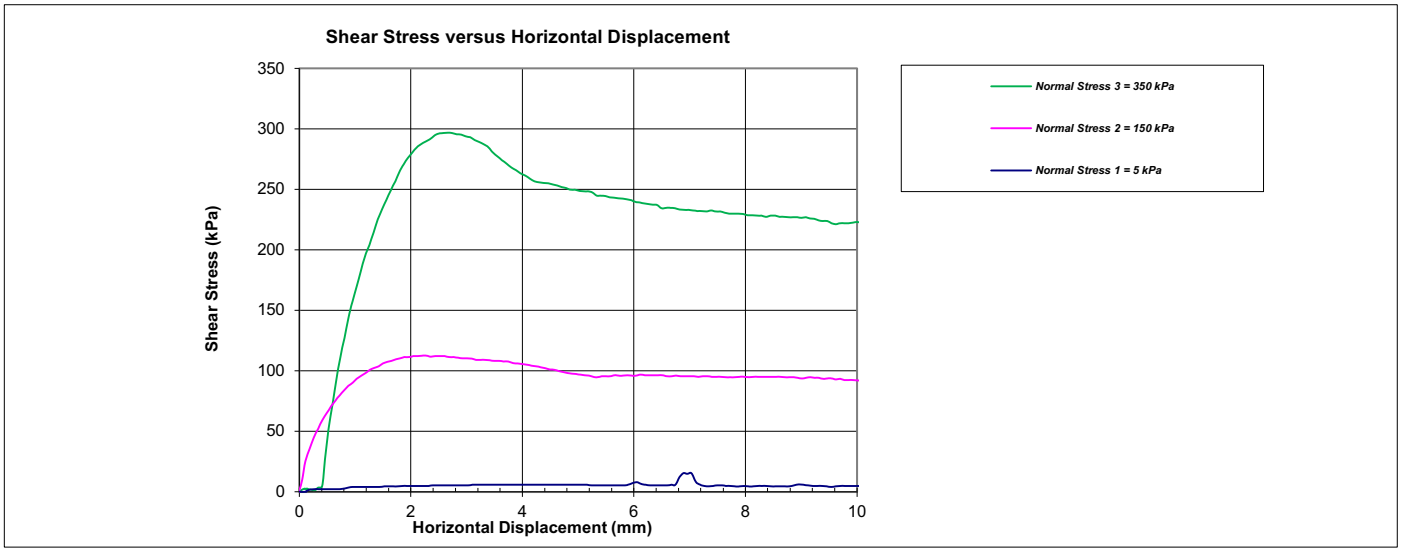
Direct Shear Test of Soils Under Consolidated Drained Conditions
ASTM D3080/D3080M

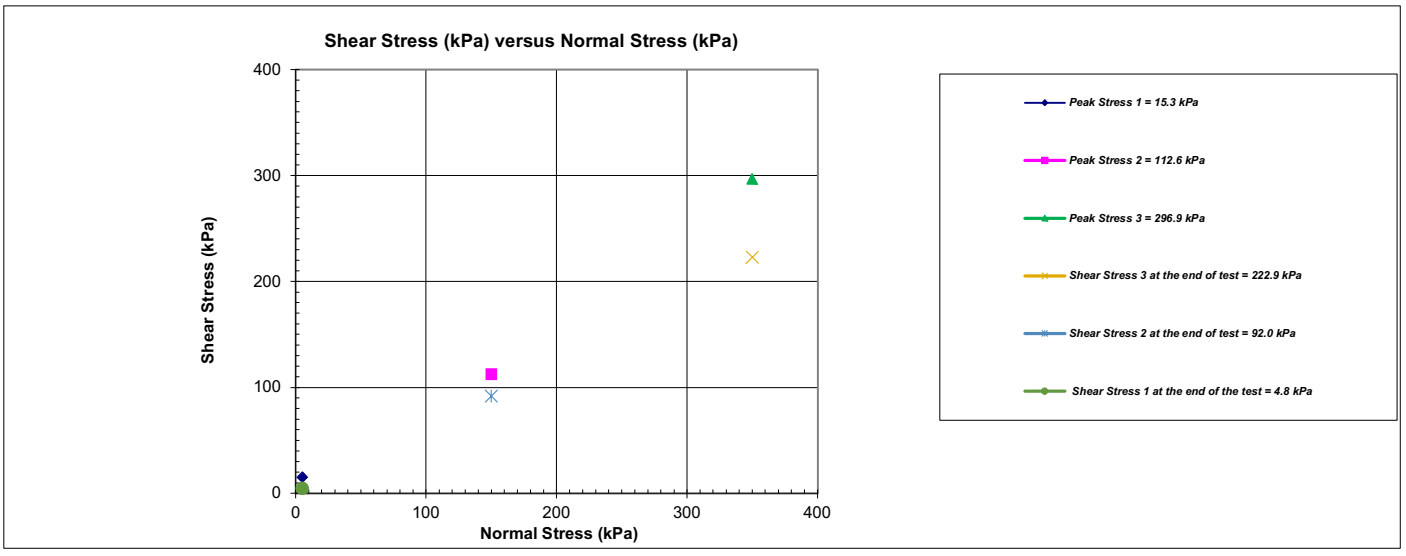
Date: January 20, 2025
Date: January 20, 2025
D. Boateng
R. Ghassemi
Prepared by:
Checked by:
Filename: V:\01216\active\laboratory_standing_offers\2024 Laboratory Standing Offers\12
Date: January 20, 2025

Specimen Details

		Test # 1	Test # 2	Test # 3
Project Name		*30192375 Iqaluit LTWP_Geotech Testing*		
Project Location		*Iqaluit, Nunavut*		
Borehole		*Coarse Textured Sand*	*Coarse Textured Sand*	*Coarse Textured Sand*
Sample No.		*BP1-A1*	*BP1-A1*	*BP1-A1*
Depth	ft	*N/A*	*N/A*	*N/A*
Sample Date		*N/A*	*N/A*	*N/A*

Shearing Stages





Filename: V:\01216\active\laboratory_standing_offers\2024 Laboratory Standing Offers\12
Date: January 20, 2025
Prepared by: D. Boateng
Checked by: R. Ghassemi
Date: January 20, 2025

Stantec Consulting Ltd.

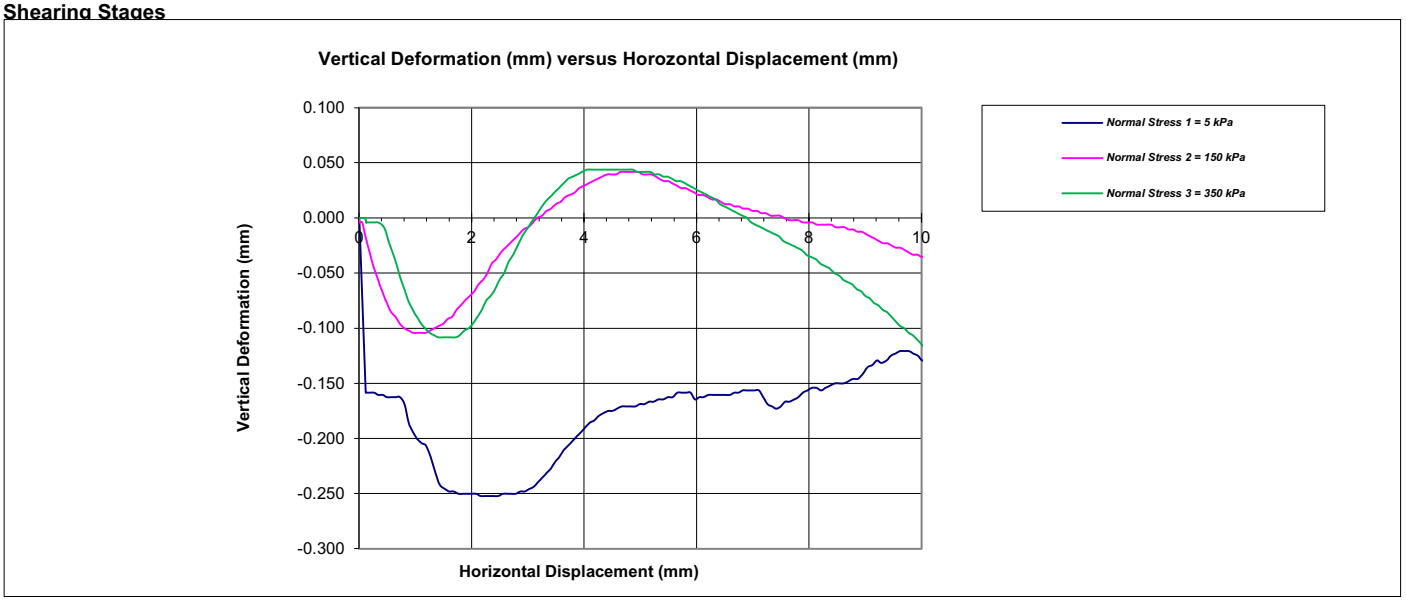
Direct Shear Test of Soils Under Consolidated Drained Conditions

ASTM D3080/D3080M

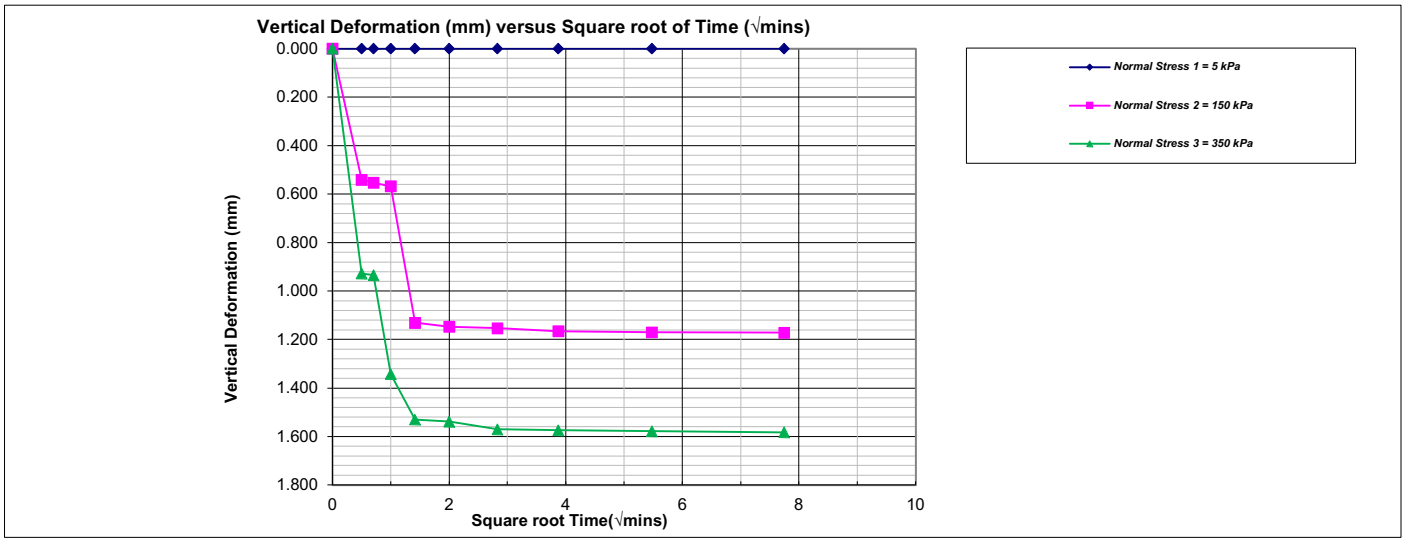
Specimen Details

		Test # 1	Test # 2	Test # 3
Project Name		*30192375 Iqaluit LTWP_Geotech Testing*		
Project Location		*Iqaluit, Nunavut*		
Borehole		*Coarse Textured Sand*	*Coarse Textured Sand*	*Coarse Textured Sand*
Sample No.		*BP1-A1*	*BP1-A1*	*BP1-A1*
Depth	ft	*N/A*	*N/A*	*N/A*
Sample Date		*N/A*	*N/A*	*N/A*

Shearing Stages



Consolidation curves



Stantec	Project No.: 121626167 Project Name: 30192375 Iqaluit TWP Geotech	Photo Log

Photo No.: 1	Borehole: BP1-A1	Test # 3

Photo No.: 2	Borehole: BP1-A1	Test # 3

Stantec

Stantec Consulting Ltd.

Direct Shear Test of Soils Under Consolidated Drained Conditions
ASTM D3080/D3080M

Prepared by: D. Boateng Date: January 20, 2025
Checked by: R. Ghassemi Date: January 20, 2025

V:\01216\activelaboratory_standing_offers\2024 Laboratory Standing Offers\121626 January 20, 2025

		Test # 4	Test # 5	Test # 6
Specimen Details				
Project Name		*30192375 Iqaluit LTWP_Geotech Testing*		
Project Location		*Iqaluit, Nunavut*		
Bulk Sample		*Coarse Textured Sand*	*Coarse Textured Sand*	*Coarse Textured Sand*
Sample No.		*BP2-A1*	*BP2-A1*	*BP2-A1*
Depth	ft	*N/A*	*N/A*	*N/A*
Sample Date		*N/A*	*N/A*	*N/A*

Soil Description and Classification as provided by the Project Engineer

Coarse Textured Sand

Initial Specimen Conditions				
Height	mm	31.70	31.70	31.70
Diameter	mm	63.50	63.50	63.50
Mass	g	196.20	196.20	198.40
Dry Mass	g	177.98	177.01	177.75
Wet Density	Mg/m^3	1.95	1.95	1.98
Dry Density	Mg/m^3	1.77	1.76	1.77
Moisture Content	%	10.24	10.84	11.62
Degree of Saturation	%	55.2	57.5	62.4
Specific Gravity (Assumed)		2.65	2.65	2.65
Void Ratio		0.49	0.50	0.49
Final Specimen Conditions				
Normal Stress	kPa	5	150	350
Time to Failure	min	24	7	11
Rate of Displacement	mm/min	0.300	0.300	0.300
Peak Shear Stress	kPa	9.6	148.0	332.9
Shear Stress at the end of test	kPa	7.0	90.7	234.3
H. Displacement-Peak	mm	7.3	2.0	3.2
Moisture Content	%	19.62	16.76	16.06

Tests Notes:

1.Testing were completed at 95% of corrected SPMDD

2. Material retained on the 4.75 mm sieve were screened before direct shear tests

3.Test specmiens were inundated throughout the tests

4. Testing were completed following the desired normal stresses of 0, 150 and 350 kPa respectively provided by the Client

5. 5 kPa normal stress for first point due to placement of the loading cap and the top split-box assembly

6. Specific gravities were assumed

Stantec

Stantec Consulting Ltd.

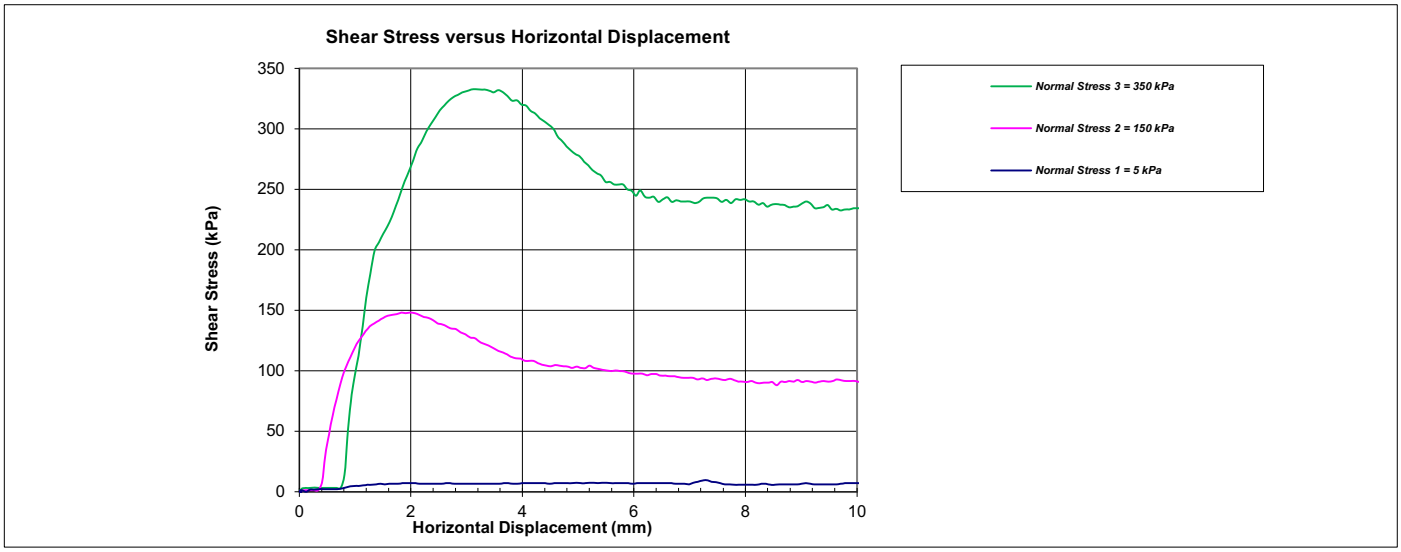
Direct Shear Test of Soils Under Consolidated Drained Conditions
ASTM D3080/D3080M

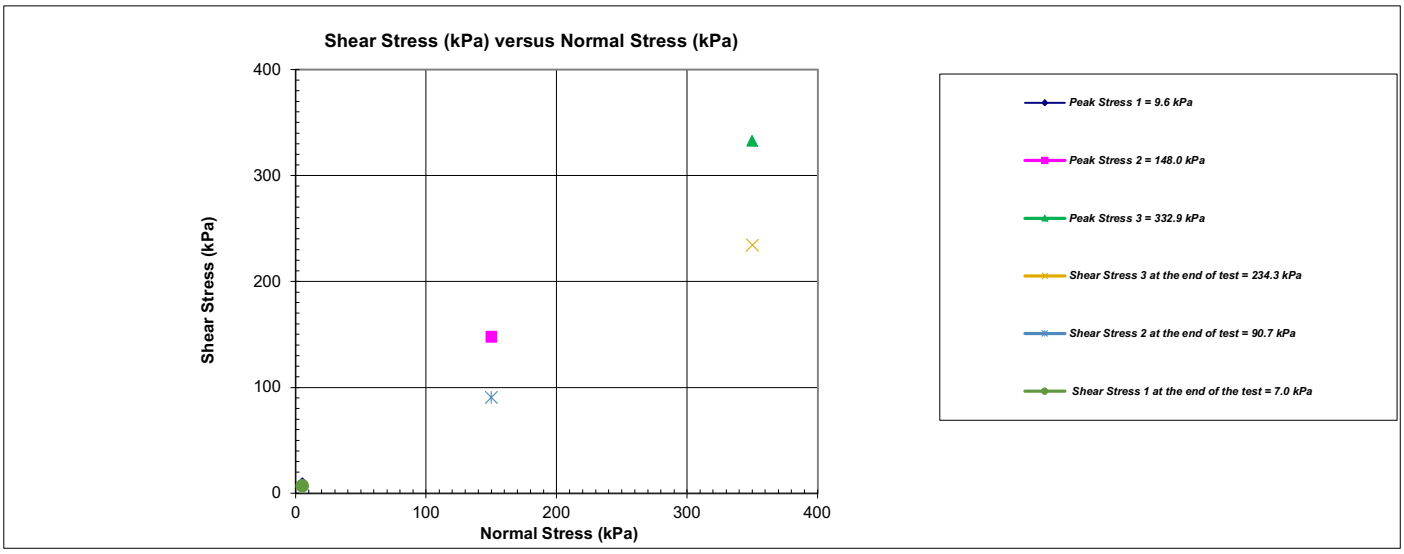
Filename: V:\01216\active\laboratory_standing_offers\2024 Laboratory Standing Offers\12
Date: January 20, 2025
Prepared by: D. Boateng
Checked by: R. Ghassemi
Date: January 20, 2025
Date: January 20, 2025

Specimen Details

		Test # 4	Test # 5	Test # 6
Project Name		*30192375 Iqaluit LTWP_Geotech Testing*		
Project Location		*Iqaluit, Nunavut*		
Borehole		*Coarse Textured Sand*	*Coarse Textured Sand*	*Coarse Textured Sand*
Sample No.		*BP2-A1*	*BP2-A1*	*BP2-A1*
Depth	ft	*N/A*	*N/A*	*N/A*
Sample Date		*N/A*	*N/A*	*N/A*

Shearing Stages





Filename: V:\01216\active\laboratory_standing_offers\2024 Laboratory Standing Offers\12
Date: January 20, 2025
Prepared by: D. Boateng
Checked by: R. Ghassemi
Date: January 20, 2025

Stantec Consulting Ltd.

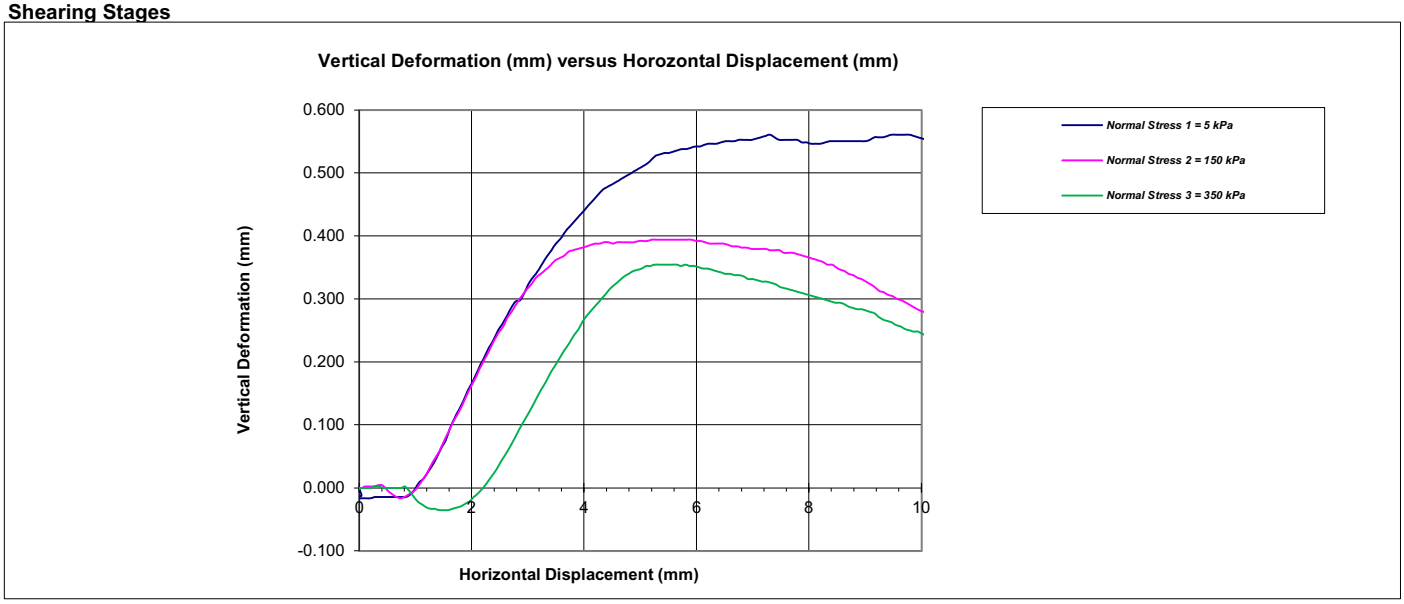
Direct Shear Test of Soils Under Consolidated Drained Conditions

ASTM D3080/D3080M

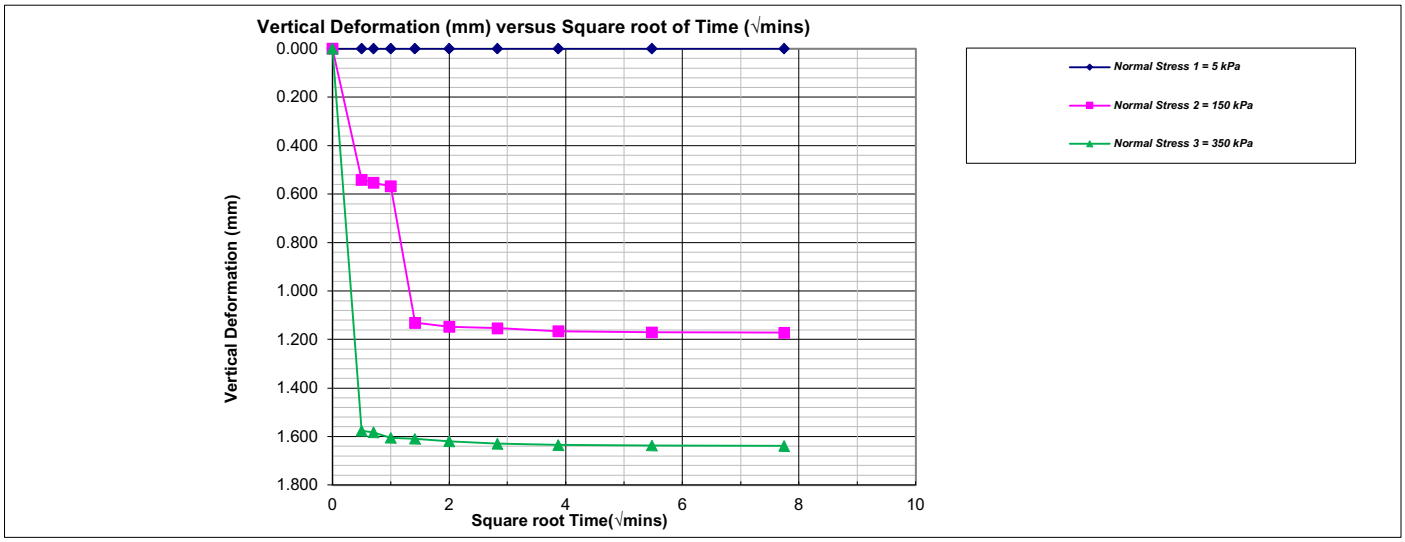
Specimen Details

		Test # 4	Test # 5	Test # 6
Project Name		30192375 Iqaluit LTWP_Geotech Testing		
Project Location		Iqaluit, Nunavut		
Borehole		Coarse Textured Sand	Coarse Textured Sand	Coarse Textured Sand
Sample No.		BP2-A1	BP2-A1	BP2-A1
Depth	ft	N/A	N/A	N/A
Sample Date		N/A	N/A	N/A

Shearing Stages



Consolidation curves



Stantec	Project No.: 121626167 Project Name: 30192375 Iqaluit TWP Geotech	Photo Log

Photo No.: 1	Borehole: BP2-A1	Test # 5

Photo No.: 2	Borehole: BP2-A1	Test # 5

Stantec

Stantec Consulting Ltd.

Direct Shear Test of Soils Under Consolidated Drained Conditions
ASTM D3080/D3080M

V:\01216\activelaboratory_standing_offers\2024 Laboratory Standing Offers\121626 January 20, 2025

Prepared by: D. Boateng Date: January 20, 2025

Checked by: R. Ghassemi Date: January 20, 2025

Specimen Details

		Test # 7	Test # 8	Test # 9
Project Name		*30192375 Iqaluit LTWP_Geotech Testing*		
Project Location		*Iqaluit, Nunavut*		
Bulk Sample		*Coarse Textured Sand*	*Coarse Textured Sand*	*Coarse Textured Sand*
Sample No.		*BP3-A1*	*BP3-A1*	*BP3-A1*
Depth	ft	*N/A*	*N/A*	*N/A*
Sample Date		*N/A*	*N/A*	*N/A*

Soil Description and Classification as provided by the Project Engineer

Coarse Textured Sand

Initial Specimen Conditions

Height	mm	31.70	31.70	31.70
Diameter	mm	63.50	63.50	63.50
Mass	g	173.60	173.80	173.20
Dry Mass	g	158.22	157.10	156.82
Wet Density	Mg/m^3	1.73	1.73	1.73
Dry Density	Mg/m^3	1.58	1.56	1.56
Moisture Content	%	9.72	10.63	10.44
Degree of Saturation	%	38.0	40.8	40.0
Specific Gravity (Assumed)		2.65	2.65	2.65
Void Ratio		0.68	0.69	0.69

Final Specimen Conditions

Normal Stress	kPa	5	150	350
Time to Failure	min	6	7	16
Rate of Displacement	mm/min	0.300	0.300	0.300
Peak Shear Stress	kPa	13.1	131.8	272.9
Shear Stress at the end of test	kPa	8.3	93.3	218.5
H. Displacement-Peak	mm	1.7	2.1	4.7
Moisture Content	%	23.19	22.41	22.18

Tests Notes:

1.Testing were completed at 95% of SPMDD

2. Material retained on the 4.75 mm sieve were screened before the direct shear tests

3.Test specmiens were inundated throughout the tests

4. Testing were completed following the desired normal stresses of 0, 150 and 350 kPa respectively provided by the Client

5. 5 kPa normal stress for first point due to placement of the loading cap and the top cap split-box assembly

6. Specific gravities were assumed

Stantec

Stantec Consulting Ltd.

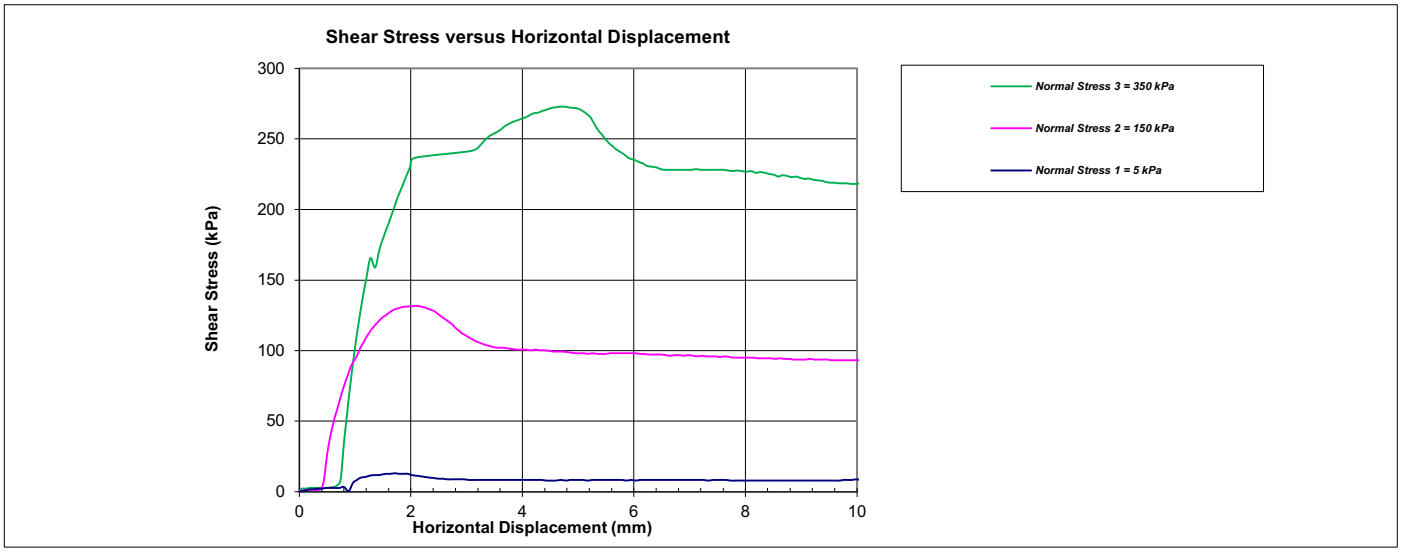
Direct Shear Test of Soils Under Consolidated Drained Conditions
ASTM D3080/D3080M

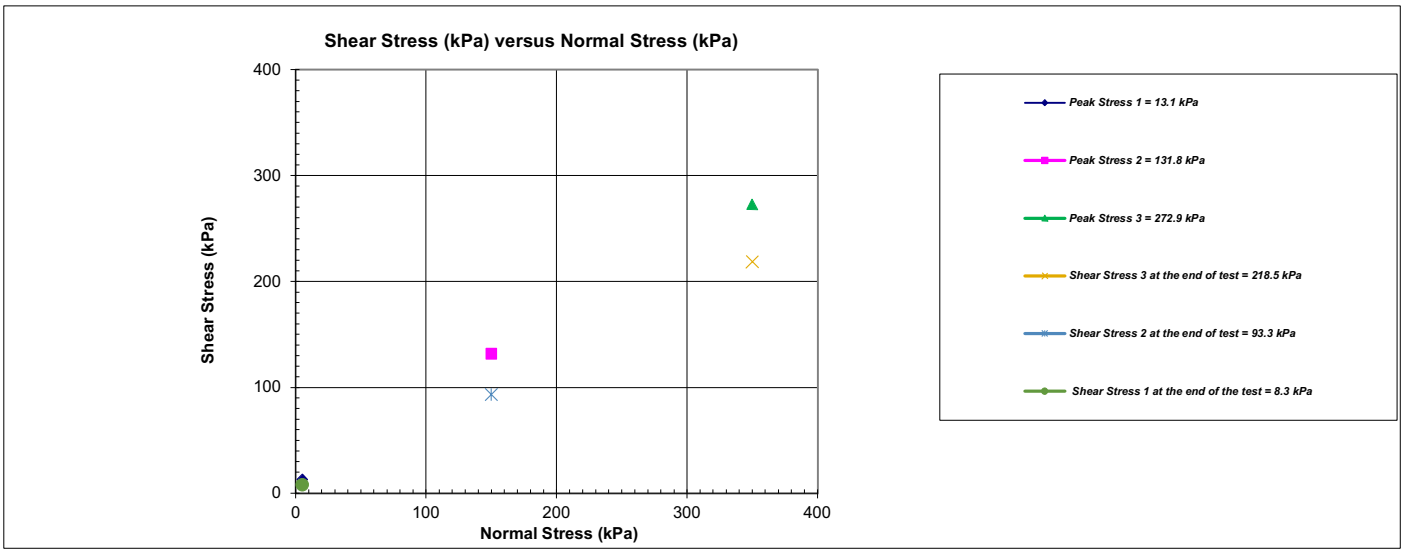
Filename: V:\01216\active\laboratory_standing_offers\2024 Laboratory Standing Offers\12
Date: January 20, 2025
Prepared by: D. Boateng
Checked by: R. Ghassemi
Date: January 20, 2025

Specimen Details

		Test # 7	Test # 8	Test # 9
Project Name		*30192375 Iqaluit LTWP_Geotech Testing*		
Project Location		*Iqaluit, Nunavut*		
Borehole		*Coarse Textured Sand*	*Coarse Textured Sand*	*Coarse Textured Sand*
Sample No.		*BP3-A1*	*BP3-A1*	*BP3-A1*
Depth	ft	*N/A*	*N/A*	*N/A*
Sample Date		*N/A*	*N/A*	*N/A*

Shearing Stages





Filename: V:\01216\active\laboratory_standing_offers\2024 Laboratory Standing Offers\12
Date: January 20, 2025
Prepared by: D. Boateng
Checked by: R. Ghassemi
Date: January 20, 2025

Stantec Consulting Ltd.

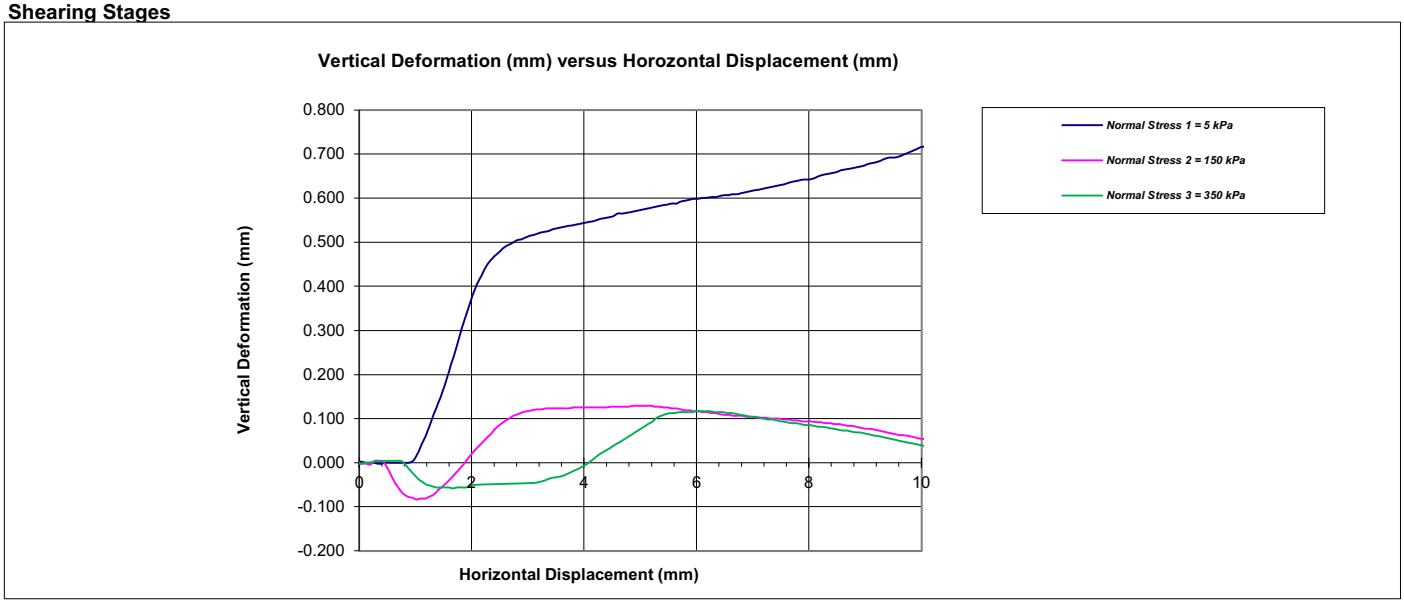
Direct Shear Test of Soils Under Consolidated Drained Conditions

ASTM D3080/D3080M

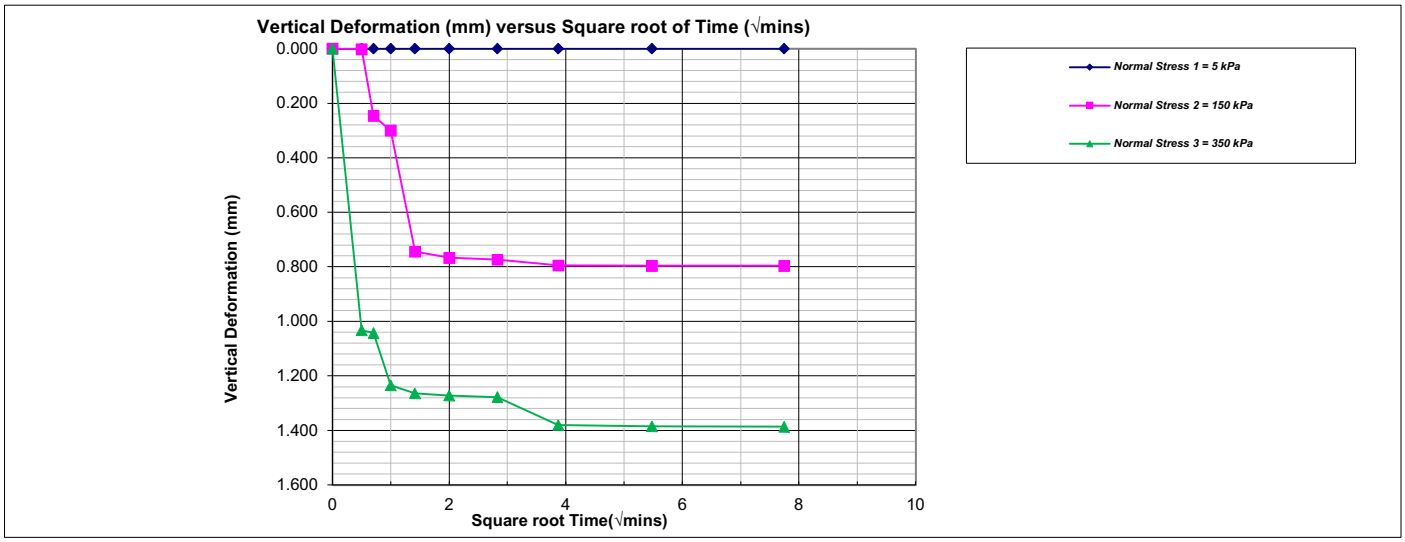
Specimen Details

		Test # 7	Test # 8	Test # 9
Project Name		30192375 Iqaluit LTWP_Geotech Testing		
Project Location		Iqaluit, Nunavut		
Borehole		Coarse Textured Sand	Coarse Textured Sand	Coarse Textured Sand
Sample No.		BP3-A1	BP3-A1	BP3-A1
Depth	ft	N/A	N/A	N/A
Sample Date		N/A	N/A	N/A

Shearing Stages



Consolidation curves



Stantec	Project No.: 121626167 Project Name: 30192375 Iqaluit TWP Geotech	Photo Log

Photo No.: 1	Borehole: BP3-A1	Test # 9

Photo No.: 2	Borehole: BP3-A1	Test # 9

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Stantec Consulting Ltd.

Direct Shear Test of Soils Under Consolidated Drained Conditions
ASTM D3080/D3080M

Prepared by: D. Boateng Date: January 20, 2025
Checked by: R. Ghassemi Date: January 20, 2025

V:\01216\active\laboratory_standing_offers\2024 Laboratory Standing Offers\121626 January 20, 2025

		Test # 10	Test # 11	Test # 12
Specimen Details				
Project Name		*30192375 Iqaluit LTWP_Geotech Testing*		
Project Location		*Iqaluit, Nunavut*		
Bulk Sample		*Coarse Textured Sand*	*Coarse Textured Sand*	*Coarse Textured Sand*
Sample No.		*BP4-A1*	*BP4-A1*	*BP4-A1*
Depth	ft	*N/A*	*N/A*	*N/A*
Sample Date		*N/A*	*N/A*	*N/A*

Soil Description and Classification as provided by the Project Engineer

Coarse Textured Sand

Initial Specimen Conditions				
Height	mm	31.70	31.70	31.70
Diameter	mm	63.50	63.50	63.50
Mass	g	220.00	220.30	219.70
Dry Mass	g	206.04	211.69	210.78
Wet Density	Mg/m^3	2.19	2.19	2.19
Dry Density	Mg/m^3	2.05	2.11	2.10
Moisture Content	%	6.77	4.07	4.23
Degree of Saturation	%	62.3	42.5	43.2
Specific Gravity (Assumed)		2.65	2.65	2.65
Void Ratio		0.29	0.25	0.26

Final Specimen Conditions				
Normal Stress	kPa	5	150	350
Time to Failure	min	33	11	10
Rate of Displacement	mm/min	0.300	0.300	0.300
Peak Shear Stress	kPa	7.4	136.6	338.1
Shear Stress at the end of test	kPa	7.0	120.9	270.7
H. Displacement-Peak	mm	10.0	3.2	3.1
Moisture Content	%	13.81	10.12	9.73

Tests Notes:

1.Testing were completed at 95% of corrected SPMDD
2. Material retained on the 4.75 mm sieve were screened before the direct shear tests
3.Test specmiens were inundated throughout the tests
4. Testing were completed following the desired normal stresses of 0, 150 and 350 kPa respectively provided by the Client
5. 5 kPa normal stress for first point due to placement of the loading cap and the top split-box assembly
6. Specific gravities were assumed

Stantec

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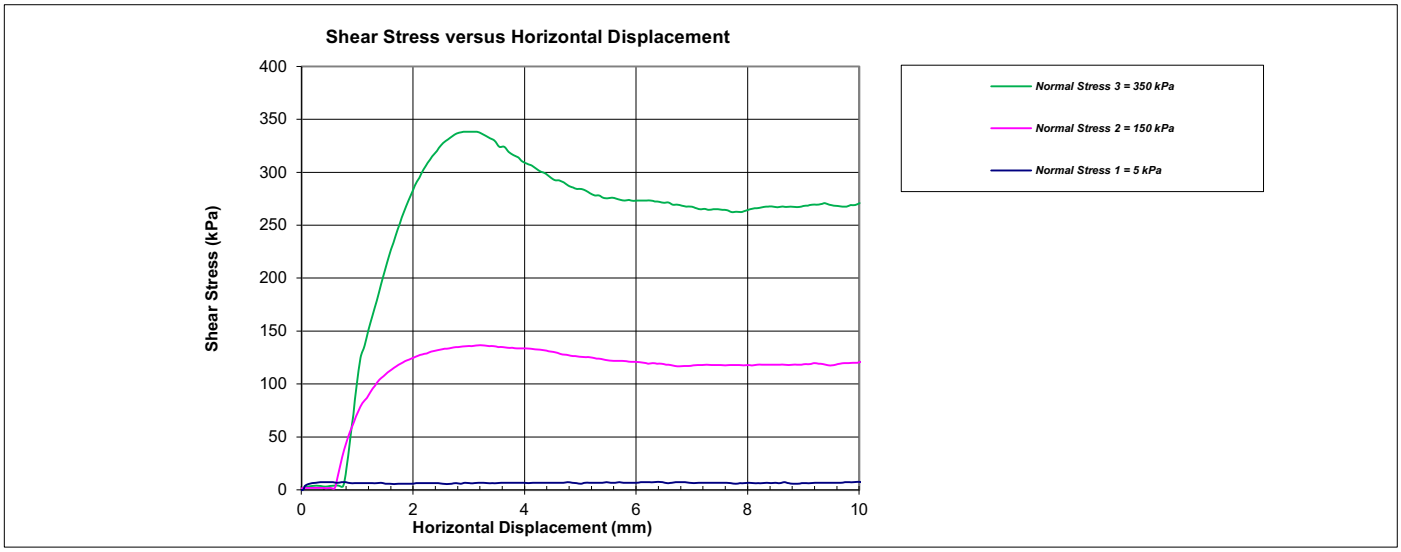
Direct Shear Test of Soils Under Consolidated Drained Conditions
ASTM D3080/D3080M

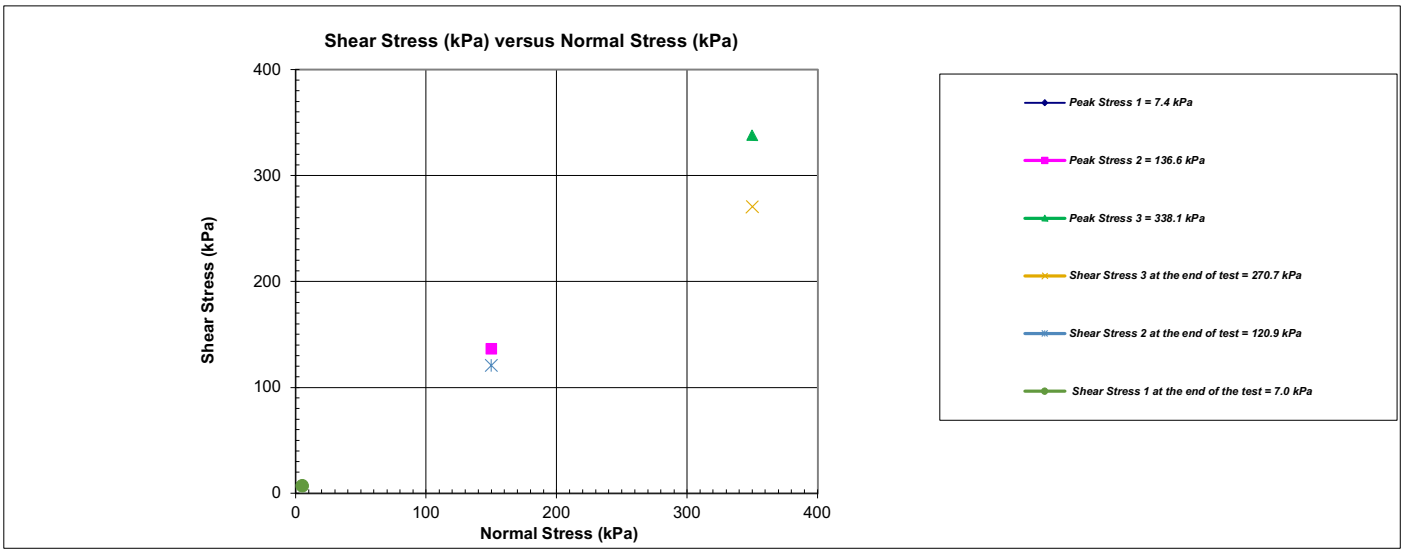
Filename: V:\01216\active\laboratory_standing_offers\2024 Laboratory Standing Offers\12
Date: January 20, 2025
Prepared by: D. Boateng
Checked by: R. Ghassemi
Date: January 20, 2025

Specimen Details

		Test # 10	Test # 11	Test # 12
Project Name		*30192375 Iqaluit LTWP_Geotech Testing*		
Project Location		*Iqaluit, Nunavut*		
Borehole		*Coarse Textured Sand*	*Coarse Textured Sand*	*Coarse Textured Sand*
Sample No.		*BP4-A1*	*BP4-A1*	*BP4-A1*
Depth	ft	*N/A*	*N/A*	*N/A*
Sample Date		*N/A*	*N/A*	*N/A*

Shearing Stages





Filename: V:\01216\active\laboratory_standing_offers\2024 Laboratory Standing Offers\12
Date: January 20, 2025
Prepared by: D. Boateng
Checked by: R. Ghassemi
Date: January 20, 2025

Stantec Consulting Ltd.

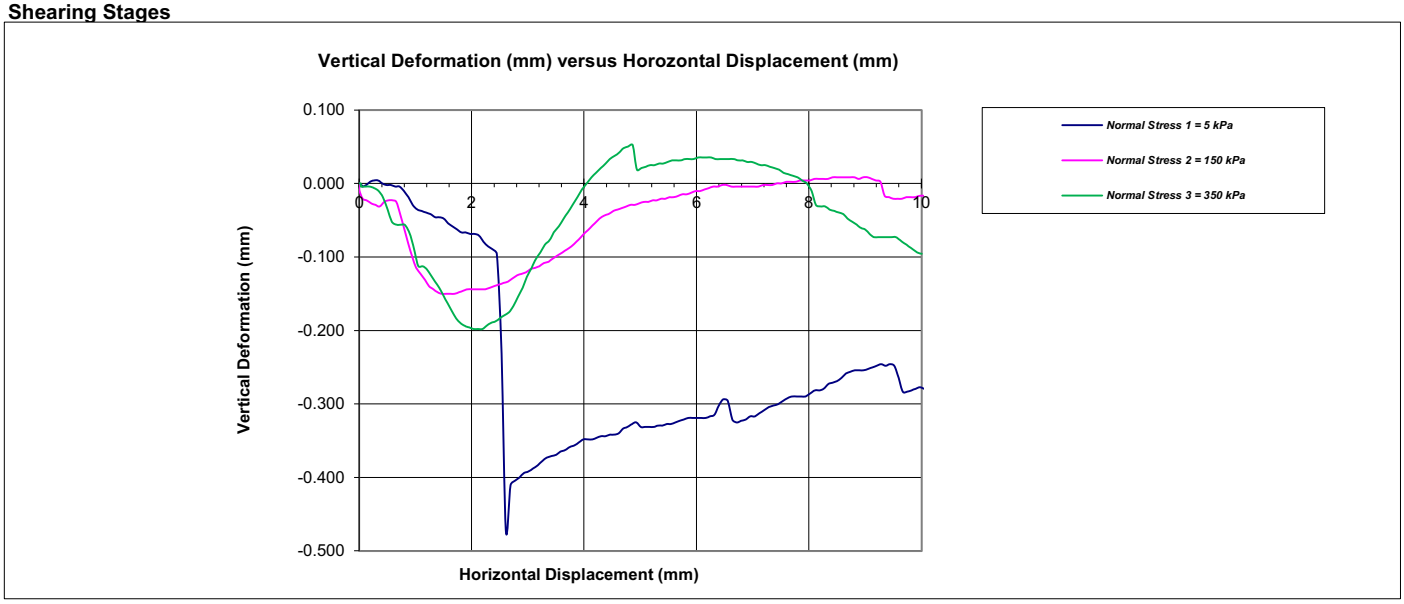
Direct Shear Test of Soils Under Consolidated Drained Conditions

ASTM D3080/D3080M

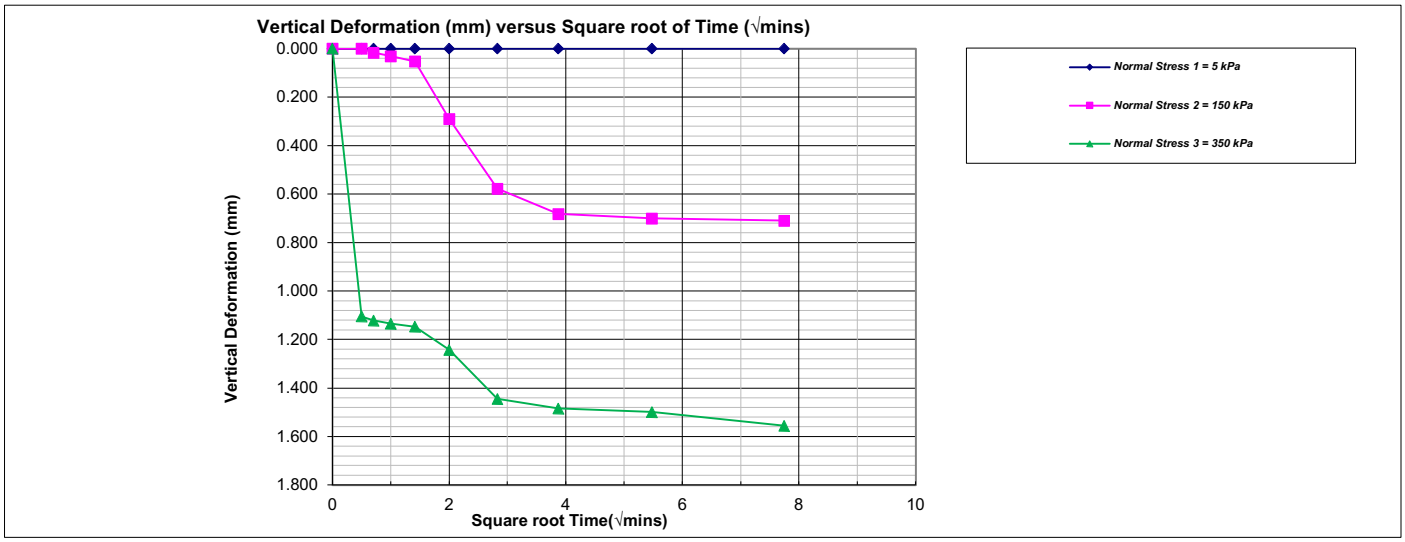
Specimen Details

		Test # 10	Test # 11	Test # 12
Project Name		*30192375 Iqaluit LTWP_Geotech Testing*		
Project Location		*Iqaluit, Nunavut*		
Borehole		*Coarse Textured Sand*	*Coarse Textured Sand*	*Coarse Textured Sand*
Sample No.		*BP4-A1*	*BP4-A1*	*BP4-A1*
Depth	ft	*N/A*	*N/A*	*N/A*
Sample Date		*N/A*	*N/A*	*N/A*

Shearing Stages



Consolidation curves



Stantec	Project No.: 121626167 Project Name: 30192375 Iqaluit TWP Geotech	Photo Log

Photo No.: 1	Borehole: BP4-A1	Test # 12

Photo No.: 2	Borehole: BP4-A1	Test # 12

Stantec Consulting Ltd.
300 - 1331 Clyde Avenue, Ottawa ON K2C 3G4

January 30, 2025
File: 121626167

Attention: Jacob Elliott Holden, P. Eng.
Environmental Engineer
Arcadis Canada Inc.
333 Preston Street, Suite 500
Ottawa, Ontario, Canada, K1S 5N4
Tel: 613-703-3818, C: 613-809-4651
E-mail: Jacob.Holden@arcadis.com

Dear Mr. Holden,

Reference: Measurement of Hydraulic Conductivity of Coarse-Grained Soils, Arcadis Canada Inc., File # 30192375

This letter presents the results of six Hydraulic Conductivity tests carried out in accordance with ASTM D2434. The test results are provided in the attached tables and figures.

Table 1: Summary of Tests Completed

Sample ID	Depth	Test Number
BP1-A1	N/A	1
BP2-A1	N/A	2
BP2-A2	N/A	3
BP3-A1	N/A	4
BP3-A3	N/A	5
BP4-A1	N/A	6

This letter provides test results only and does not constitute any interpretation or engineering recommendations with respect to material suitability or specification compliance.

We trust the information presented herein meets your present requirements. Should you have any questions or require additional information, please do not hesitate to contact us.

Regards,

STANTEC CONSULTING LTD.

Ramin Ghassemi Ph.D., P.Eng.
Geotechnical Engineer
Direct: 613 722-4420Mobile: 437 775-7625
Ramin.ghassemi@stantec.com

HYDRAULIC CONDUCTIVITY OF COARSE-GRAINED SOILS (CONSTANT HEAD) TEST (ASTM D2434)

Figure 1

SPECIMEN IDENTIFICATION

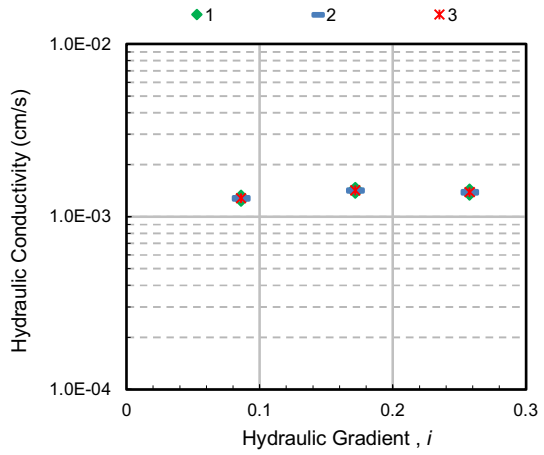
Project:	30192375 Iqaluit TWP Geotech	Borehole/Sample No.:	BP1-A1	
Client:	Arcadis Canada Inc	Sample Depth (-):	N/A	
Sample Type:	Reconstituted	Specific Gravity (G_s):	2.65	*Assumed*
Material Description:	Coarse Textured Sand as provided by Project Engineer			

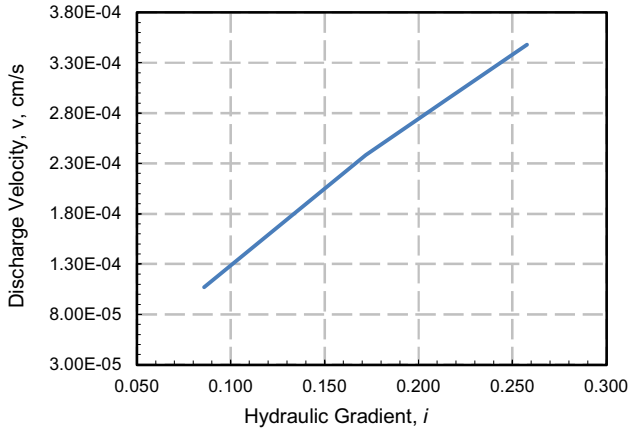
SPECIMEN DIMENSIONS AND PROPERTIES

Specimen Height, (cm)	11.64	Compacted Wet Density (kg/m^3)	1818
Specimen Diameter, (cm)	15.25	Compacted Dry Density (kg/m^3)	1643
Specimen Area, (cm^2)	182.73	Void Ratio, e_o	0.61
Initial Moist Specimen Weight, (g)	3867.8	Initial Water Content, (%)	10.7
		Final Water Content, (%)	16.1

HYDRAULIC CONDUCTIVITY

Test No.	Manometer Readings H1 (cm)	Manometer Readings H2 (cm)	Head, h (cm)	Flow, Q (cm^3)	Time, t (s)	Velocity, v Q/At (cm/s)	i = h/L	Temp. of Water (C°)	Viscosity of Water at Test Temp. (X) (1 x 10^{-6} m^2/s)	Viscosity of Water at 20° C. (Y) (1 x 10^{-6} m^2/s)	Ratio = X/Y	k_{20} (cm/s) corrected
1	4	3	1	3.52	180	1.07E-04	0.086	19.0	1.030	1.003	1.027	1.28E-03
2				7.04	360	1.07E-04		19.0	1.030		1.027	1.28E-03
3				11.73	600	1.07E-04		19.0	1.030		1.027	1.28E-03
1	5	3	2	7.84	180	2.38E-04	0.172	19.0	1.030	1.003	1.027	1.42E-03
2				15.68	360	2.38E-04		19.0	1.030		1.027	1.42E-03
3				26.13	600	2.38E-04		19.0	1.030		1.027	1.42E-03
1	6	3	3	11.45	180	3.48E-04	0.258	19.0	1.030	1.003	1.027	1.39E-03
2				22.90	360	3.48E-04		19.0	1.030		1.027	1.39E-03
3				38.16	600	3.48E-04		19.0	1.030		1.027	1.39E-03





Test Notes: *Sample reconstituted by compaction to 95% of SPMDD*

Average Corrected Hydraulic Conductivity, *k* (cm/s): **1.36E-03**

Project No.: 121626167

Date: January 8, 2025

Stantec

Prepared By: DB

Checked By: RG

HYDRAUALIC CONDUCTIVITY OF COARSE-GRAINED SOILS (CONSTANT HEAD) TEST (ASTM D2434)

Figure 1

SPECIMEN IDENTIFICATION

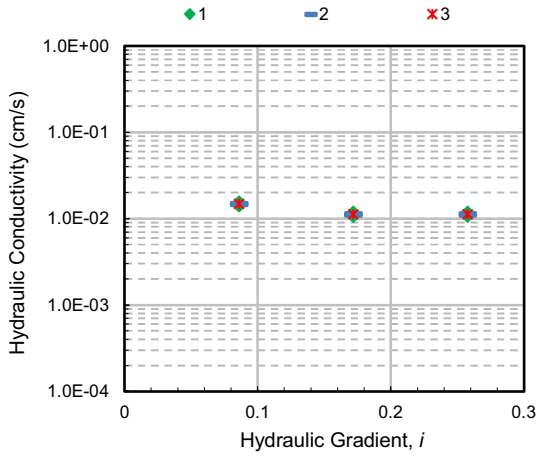
Project:	30192375 Iqaluit TWP Geotech	Borehole/Sample No.:	BP2-A1	
Client:	Arcadis Canada Inc	Sample Depth (-):	N/A	
Sample Type:	Reconstituted	Specific Gravity (G_s):	2.65	*Assumed*
Material Description:	Coarse Textured Sand as provided by the project engineer			

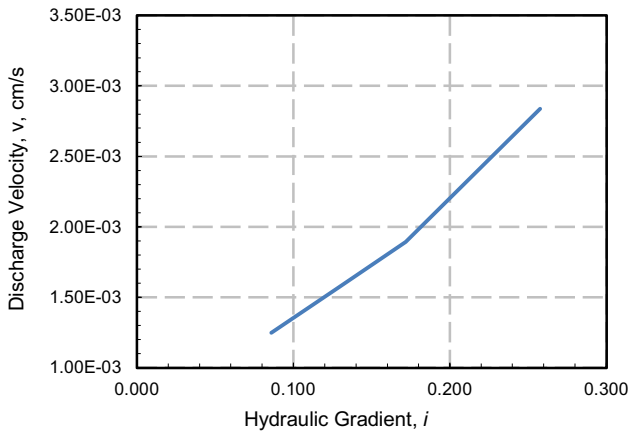
SPECIMEN DIMENSIONS AND PROPERTIES

Specimen Height, (cm)	11.64	Compacted Wet Density (kg/m^3)	1956
Specimen Diameter, (cm)	15.25	Compacted Dry Density (kg/m^3)	1750
Specimen Area, (cm^2)	182.73	Void Ratio, e_o	0.51
Initial Moist Specimen Weight, (g)	4161.0	Initial Water Content, (%)	11.8
		Final Water Content, (%)	16.0

HYDRAULIC CONDUCTIVITY

Test No.	Manometer Readings H1 (cm)	Manometer Readings H2 (cm)	Head, h (cm)	Flow, Q (cm^3)	Time, t (s)	Velocity, v Q/At (cm/s)	i = h/L	Temp. of Water (C^o)	Viscosity of Water at Test Temp. (X) (1 x 10^{-6} m^2/s)	Viscosity of Water at 20° C. (Y) (1 x 10^{-6} m^2/s)	Ratio = X/Y	k_{20} (cm/s) corrected
1	4	3	1	41.02	180	1.25E-03	0.086	19.0	1.030	1.003	1.027	1.49E-02
2				82.04	360	1.25E-03		19.0	1.030		1.027	1.49E-02
3				136.73	600	1.25E-03		19.0	1.030		1.027	1.49E-02
1	5	3	2	62.24	180	1.89E-03	0.172	19.0	1.030	1.003	1.027	1.13E-02
2				124.48	360	1.89E-03		19.0	1.030		1.027	1.13E-02
3				207.47	600	1.89E-03		19.0	1.030		1.027	1.13E-02
1	6	3	3	93.36	180	2.84E-03	0.258	19.0	1.030	1.003	1.027	1.13E-02
2				186.72	360	2.84E-03		19.0	1.030		1.027	1.13E-02
3				311.20	600	2.84E-03		19.0	1.030		1.027	1.13E-02





Test Notes: *Sample reconstituted by compaction to 95% of corrected SPMDD*

Average Corrected Hydraulic Conductivity, *k* (cm/s): **1.25E-02**

Project No.: 121626167
Date January 9, 2025

Stantec

Prepared By: DB
Checked By: RG

HYDRAULIC CONDUCTIVITY OF COARSE-GRAINED SOILS (CONSTANT HEAD) TEST (ASTM D2434)

Figure 1

SPECIMEN IDENTIFICATION

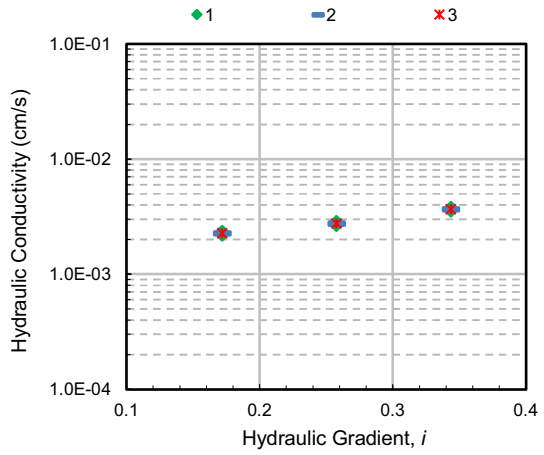
Project:	30192375 Iqaluit TWP Geotech	Borehole/Sample No.:	BP2-A2	
Client:	Arcadis Canada Inc	Sample Depth (-):	N/A	
Sample Type:	Reconstituted	Specific Gravity (G_s):	2.65	*Assumed*
Material Description:	Coarse Textured Sand as provided by the project engineer			

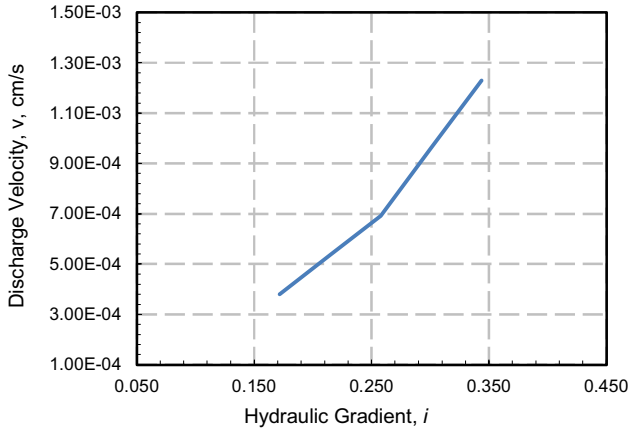
SPECIMEN DIMENSIONS AND PROPERTIES

Specimen Height, (cm)	11.64	Compacted Wet Density (kg/m^3)	1641
Specimen Diameter, (cm)	15.25	Compacted Dry Density (kg/m^3)	1587
Specimen Area, (cm^2)	182.73	Void Ratio, e_o	0.67
Initial Moist Specimen Weight, (g)	3489.5	Initial Water Content, (%)	3.4
		Final Water Content, (%)	17.0

HYDRAULIC CONDUCTIVITY

Test No.	Manometer Readings H1 (cm)	Manometer Readings H2 (cm)	Head, h (cm)	Flow, Q (cm^3)	Time, t (s)	Velocity, v Q/At (cm/s)	i = h/L	Temp. of Water (C^o)	Viscosity of Water at Test Temp. (X) (1 X 10^{-6} m^2/s)	Viscosity of Water at 20° C. (Y) (1 x 10^{-6} m^2/s)	Ratio = X/Y	k_{20} (cm/s) corrected
1	5	3	2	12.52	180	3.81E-04	0.172	19.0	1.030	1.003	1.027	2.27E-03
2				25.04	360	3.81E-04		19.0	1.030		1.027	2.27E-03
3				41.73	600	3.81E-04		19.0	1.030		1.027	2.27E-03
1	6	3	3	22.77	180	6.92E-04	0.258	19.0	1.030	1.003	1.027	2.76E-03
2				45.54	360	6.92E-04		19.0	1.030		1.027	2.76E-03
3				75.90	600	6.92E-04		19.0	1.030		1.027	2.76E-03
1	7	3	4	40.44	180	1.23E-03	0.344	19.0	1.030	1.003	1.027	3.67E-03
2				80.88	360	1.23E-03		19.0	1.030		1.027	3.67E-03
3				134.80	600	1.23E-03		19.0	1.030		1.027	3.67E-03





Test Notes: *Sample reconstituted by compaction to 95% of SPMDD*

Average Corrected Hydraulic Conductivity, *k* (cm/s): 2.90E-03

Project No.: 121626167

Date: January 14, 2025

Stantec

Prepared By: DB

Checked By: RG

HYDRAULIC CONDUCTIVITY OF COARSE-GRAINED SOILS (CONSTANT HEAD) TEST (ASTM D2434)

Figure 1

SPECIMEN IDENTIFICATION

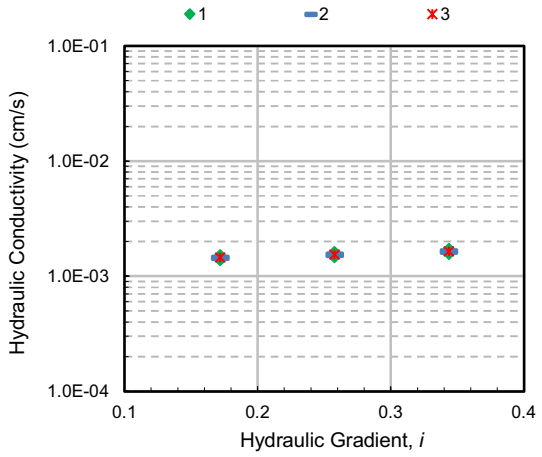
Project:	30192375 Iqaluit TWP Geotech	Borehole/Sample No.:	BP3-A1	
Client:	Arcadis Canada Inc	Sample Depth (-):	N/A	
Sample Type:	Reconstituted	Specific Gravity (G_s):	2.65	*Assumed*
Material Description:	Coarse Textured Sand as provided by the project engineer			

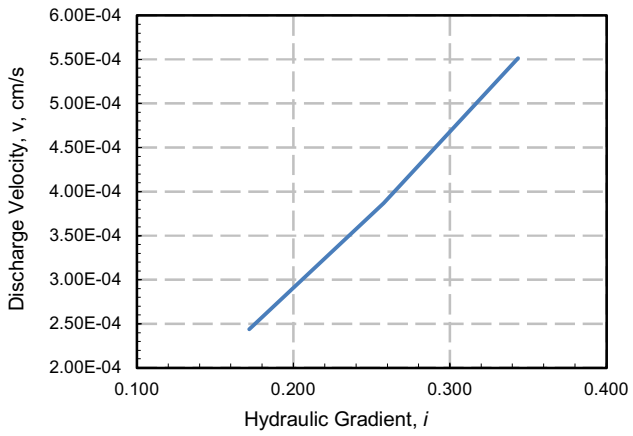
SPECIMEN DIMENSIONS AND PROPERTIES

Specimen Height, (cm)	11.64	Compacted Wet Density (kg/m^3)	1726
Specimen Diameter, (cm)	15.25	Compacted Dry Density (kg/m^3)	1561
Specimen Area, (cm^2)	182.73	Void Ratio, e_o	0.70
Initial Moist Specimen Weight, (g)	3672.0	Initial Water Content, (%)	10.6
		Final Water Content, (%)	21.4

HYDRAULIC CONDUCTIVITY

Test No.	Manometer Readings H1 (cm)	Manometer Readings H2 (cm)	Head, h (cm)	Flow, Q (cm^3)	Time, t (s)	Velocity, v Q/At (cm/s)	i = h/L	Temp. of Water (C^o)	Viscosity of Water at Test Temp. (X) (1×10^{-6} m^2/s)	Viscosity of Water at 20° C. (Y) (1×10^{-6} m^2/s)	Ratio = X/Y	k_{20} (cm/s) corrected
1	5	3	2	8.02	180	2.44E-04	0.172	19.0	1.030	1.003	1.027	1.46E-03
2				16.03	360	2.44E-04		19.0	1.030		1.027	1.46E-03
3				26.72	600	2.44E-04		19.0	1.030		1.027	1.46E-03
1	6	3	3	12.72	180	3.87E-04	0.258	19.0	1.030	1.003	1.027	1.54E-03
2				25.44	360	3.87E-04		19.0	1.030		1.027	1.54E-03
3				42.40	600	3.87E-04		19.0	1.030		1.027	1.54E-03
1	7	3	4	18.14	180	5.52E-04	0.344	19.0	1.030	1.003	1.027	1.65E-03
2				36.28	360	5.52E-04		19.0	1.030		1.027	1.65E-03
3				60.47	600	5.52E-04		19.0	1.030		1.027	1.65E-03





Test Notes: *Sample reconstituted by compaction to 95% of SPMDD*

Average Corrected Hydraulic Conductivity, *k* (cm/s): **1.55E-03**

Project No.: 121626167
Date: January 10, 2025

Stantec

Prepared By: DB
Checked By: RG

HYDRAULIC CONDUCTIVITY OF COARSE-GRAINED SOILS (CONSTANT HEAD) TEST (ASTM D2434)

Figure 1

SPECIMEN IDENTIFICATION

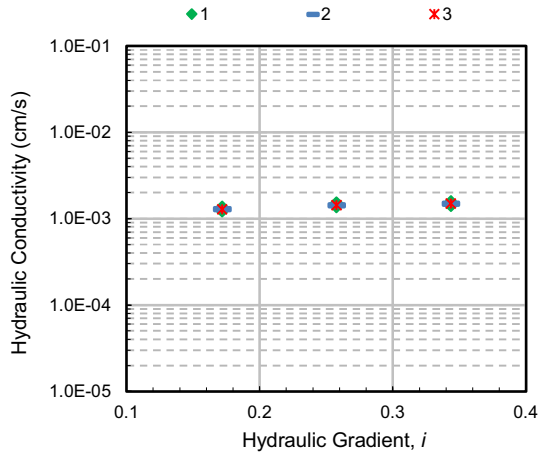
Project:	30192375 Iqaluit TWP Geotech	Borehole/Sample No.:	BP3-A3	
Client:	Arcadis Canada Inc	Sample Depth (-):	N/A	
Sample Type:	Reconstituted	Specific Gravity (G_s):	2.65	*Assumed*
Material Description:	Coarse Textured Sand as provided by the project engineer			

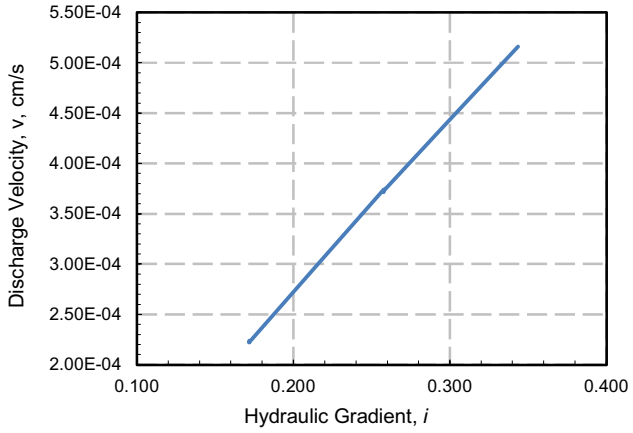
SPECIMEN DIMENSIONS AND PROPERTIES

Specimen Height, (cm)	11.64	Compacted Wet Density (kg/m^3)	1718
Specimen Diameter, (cm)	15.25	Compacted Dry Density (kg/m^3)	1604
Specimen Area, (cm^2)	182.73	Void Ratio, e_o	0.65
Initial Moist Specimen Weight, (g)	3655.0	Initial Water Content, (%)	7.1
		Final Water Content, (%)	17.1

HYDRAULIC CONDUCTIVITY

Test No.	Manometer Readings H1 (cm)	Manometer Readings H2 (cm)	Head, h (cm)	Flow, Q (cm^3)	Time, t (s)	Velocity, v Q/At (cm/s)	i = h/L	Temp. of Water (C^o)	Viscosity of Water at Test Temp. (X) (1 x 10^{-6} m^2/s)	Viscosity of Water at 20° C. (Y) (1 x 10^{-6} m^2/s)	Ratio = X/Y	k_{20} (cm/s) corrected
1	5	3	2	7.37	180	2.24E-04	0.172	20.0	1.000	1.003	0.997	1.30E-03
2				14.63	360	2.22E-04		20.0	1.000		0.997	1.29E-03
3				24.36	600	2.22E-04		20.0	1.000		0.997	1.29E-03
1	6	3	3	12.30	180	3.74E-04	0.258	20.0	1.000	1.003	0.997	1.45E-03
2				24.43	360	3.71E-04		20.0	1.000		0.997	1.44E-03
3				40.86	600	3.73E-04		20.0	1.000		0.997	1.44E-03
1	7	3	4	16.98	180	5.16E-04	0.344	29.0	1.000	1.003	0.997	1.50E-03
2				33.96	360	5.16E-04		20.0	1.000		0.997	1.50E-03
3				56.60	600	5.16E-04		20.0	1.000		0.997	1.50E-03





Test Notes: *Sample reconstituted by compaction to 95% of SPMDD*

Average Corrected Hydraulic Conductivity, *k* (cm/s): 1.41E-03

Project No.: 121626167
Date: January 16, 2025

Stantec

Prepared By: DB
Checked By: RG

HYDRAULIC CONDUCTIVITY OF COARSE-GRAINED SOILS (CONSTANT HEAD) TEST (ASTM D2434)

Figure 1

SPECIMEN IDENTIFICATION

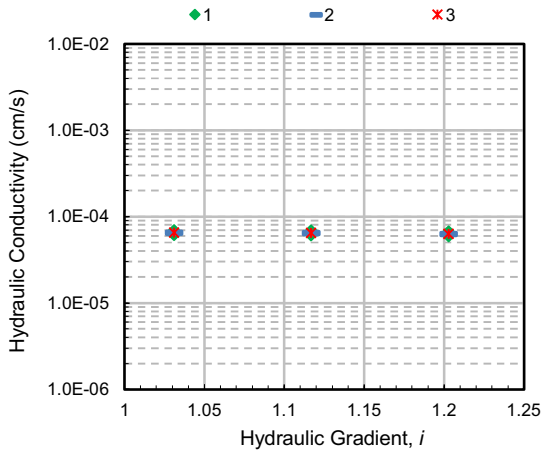
Project:	30192375 Iqualuit TWP Geotech	Borehole/Sample No.:	BP4-A1	
Client:	Arcadis Canada Inc	Sample Depth (-):	N/A	
Sample Type:	Reconstituted	Specific Gravity (G_s):	2.65	*Assumed*
Material Description:	Coarse Textured Sand as provided by the project engineer			

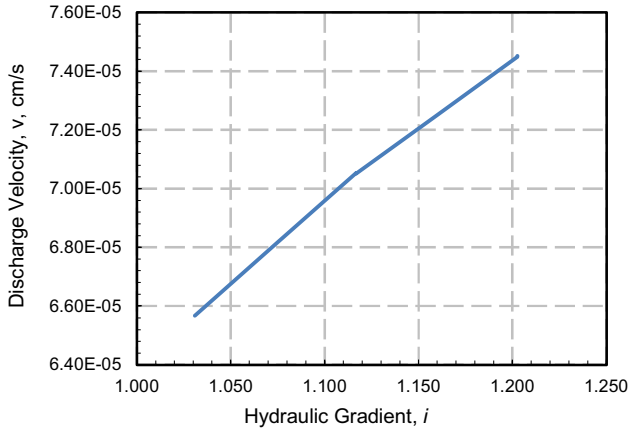
SPECIMEN DIMENSIONS AND PROPERTIES

Specimen Height, (cm)	11.64	Compacted Wet Density (kg/m^3)	2190
Specimen Diameter, (cm)	15.25	Compacted Dry Density (kg/m^3)	2099
Specimen Area, (cm^2)	182.73	Void Ratio, e_o	0.26
Initial Moist Specimen Weight, (g)	4658.2	Initial Water Content, (%)	4.4
		Final Water Content, (%)	9.3

HYDRAULIC CONDUCTIVITY

Test No.	Manometer Readings H1 (cm)	Manometer Readings H2 (cm)	Head, h (cm)	Flow, Q (cm^3)	Time, t (s)	Velocity, v Q/At (cm/s)	i = h/L	Temp. of Water (C°)	Viscosity of Water at Test Temp. (X) (1 x 10^{-6} m^2/s)	Viscosity of Water at 20° C. (Y) (1 x 10^{-6} m^2/s)	Ratio = X/Y	k_{20} (cm/s) corrected
1	15	3	12	2.16	180	6.57E-05	1.031	19.0	1.030	1.003	1.027	6.54E-05
2				4.32	360	6.57E-05		19.0	1.030		1.027	6.54E-05
3				7.20	600	6.57E-05		19.0	1.030		1.027	6.54E-05
1	16	3	13	2.32	180	7.05E-05	1.117	19.0	1.030	1.003	1.027	6.48E-05
2				4.64	360	7.05E-05		19.0	1.030		1.027	6.48E-05
3				7.73	600	7.05E-05		19.0	1.030		1.027	6.48E-05
1	17	3	14	2.45	180	7.45E-05	1.203	19.0	1.030	1.003	1.027	6.36E-05
2				4.90	360	7.45E-05		19.0	1.030		1.027	6.36E-05
3				8.17	600	7.45E-05		19.0	1.030		1.027	6.36E-05





Test Notes: *Sample reconstituted by compaction to 95% of corrected SPMDD*

Average Corrected Hydraulic Conductivity, *k* (cm/s): 6.46E-05

Project No.: 121626167

Date: January 13, 2025

Stantec

Prepared By: DB

Checked By: RG

HYDRAULIC CONDUCTIVITY OF COARSE-GRAINED SOILS (CONSTANT HEAD) TEST (ASTM D2434)

Figure 1

SPECIMEN IDENTIFICATION

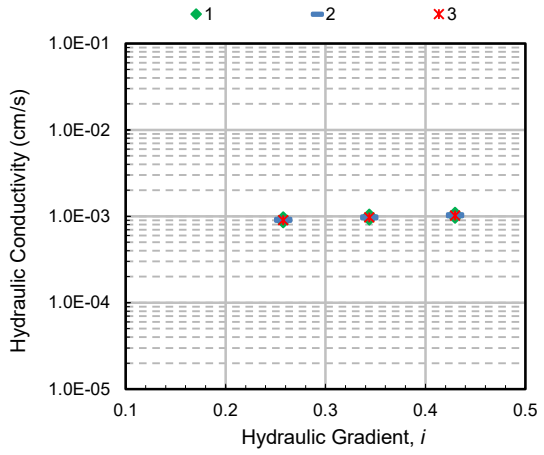
Project:	30192375 Iqaluit TWP Geotech	Borehole/Sample No.:	BP2-A3	
Client:	Arcadis Canada Inc	Sample Depth (-):	N/A	
Sample Type:	Reconstituted	Specific Gravity (G_s):	2.65	*Assumed*
Material Description:	Coarse Textured Sand as provided by the project engineer			

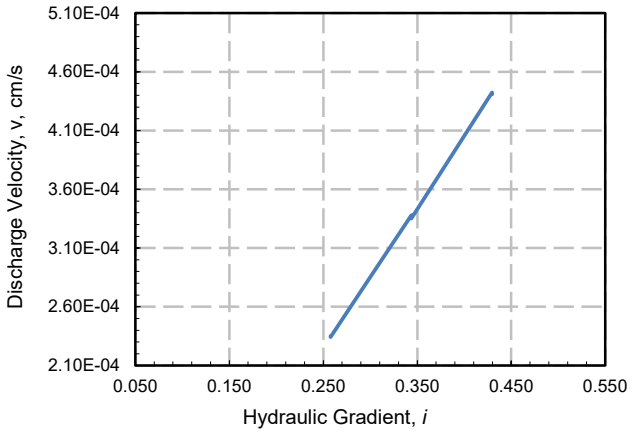
SPECIMEN DIMENSIONS AND PROPERTIES

Specimen Height, (cm)	11.64	Compacted Wet Density (kg/m^3)	1777
Specimen Diameter, (cm)	15.25	Compacted Dry Density (kg/m^3)	1686
Specimen Area, (cm^2)	182.73	Void Ratio, e_o	0.57
Initial Moist Specimen Weight, (g)	3779.6	Initial Water Content, (%)	5.4
		Final Water Content, (%)	16.1

HYDRAULIC CONDUCTIVITY

Test No.	Manometer Readings H1 (cm)	Manometer Readings H2 (cm)	Head, h (cm)	Flow, Q (cm^3)	Time, t (s)	Velocity, v Q/At (cm/s)	i = h/L	Temp. of Water (C^o)	Viscosity of Water at Test Temp. (X) (1 X 10^{-6} m^2/s)	Viscosity of Water at 20° C. (Y) (1 x 10^{-6} m^2/s)	Ratio = X/Y	k_{20} (cm/s) corrected
1	6	3	3	7.73	180	2.35E-04	0.258	20.0	1.003	1.003	1.000	9.12E-04
2				15.44	360	2.35E-04		20.0	1.003		1.000	9.10E-04
3				25.68	600	2.34E-04		20.0	1.003		1.000	9.08E-04
1	7	3	4	11.11	180	3.38E-04	0.344	20.0	1.003	1.003	1.000	9.83E-04
2				22.11	360	3.36E-04		20.0	1.003		1.000	9.78E-04
3				36.74	600	3.35E-04		20.0	1.003		1.000	9.75E-04
1	8	3	5	14.55	180	4.42E-04	0.430	20.0	1.003	1.003	1.000	1.03E-03
2				29.06	360	4.42E-04		20.0	1.003		1.000	1.03E-03
3				48.33	600	4.41E-04		20.0	1.003		1.000	1.03E-03





Test Notes: *Sample reconstituted by compaction to 95% of SPMDD*

Average Corrected Hydraulic Conductivity, *k* (cm/s): 9.72E-04

Project No.: 121626167
Date: April 14, 2025

Stantec

Prepared By: DR
Checked By: RG

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