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GEOTECHNICAL INVESTIGATION
Smithville 3A/Block Plan Area 9 - Smithville, ON

July 2, 2024

Prepared for:
Lockbridge Development Inc.

Prepared by:
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1.0 INTRODUCTION

Stantec Consulting Ltd., (Stantec) has been engaged by Lockbridge Development Inc. (Client) to conduct a geotechnical investigation for an approximately 40-hectares agricultural land located in Smithville, within the municipality of West Lincoln, Ontario. The site currently is forming parts of Lots 31 and 32, Concession 6, bounded by Port Davidson Road to the West, Townline Road to the North, agricultural lands to the south and existing residential and agricultural lands to the east. The client has divided the 40-hectares agricultural land into two portions. First portion is comprised of 11-hectares northwestern portion of the land and the second portion is comprised of the remaining 29-hectares. The 29-hectares portion is the focus of this report and is referred to hereafter as the 'Site'. The Site location and layout is shown on **Drawing No. 1 – Borehole Location Plan, Appendix B.**

In accordance with the Client directions, the scope of work for the 11-hectare portion comprised of a geotechnical desktop study. Stantec has conducted this desktop study and provided its findings through a report dated April 8, 2024. The reader is referred to the desktop study for the details.

The scope of work for the remaining 29-hectares lands i.e., the Site comprised of borehole and monitoring well investigations. It is understood that the results of the borehole geotechnical investigation will be used by the Client in preparing the preliminary design in support of the proposed Block Plan of Subdivision for the lands located within the Southern 3A limits of the expansion of the Urban Boundary in Smithville (Township).

The conceptual development plan spread over the Site and the adjacent 4-sided polygon shaped 21-hectare land forming parts of Lots 31 and 32, Concession 6, shows that the development will comprise low to medium density residential units, commercial and institutional facilities, stormwater management pond (SWM), serviced by paved roads, and underground and possibly overhead utilities. The conceptual development plan is shown on **Drawing No. 2 – Conceptual Development Plan**.

The purpose of the geotechnical investigation was to determine the subsurface soil, bedrock, and groundwater conditions at the Site, and to provide the preliminary geotechnical design and construction recommendations for the proposed development.

Stantec is using the geotechnical and groundwater data collected during this investigation to prepare a hydrogeological study for the Site. The results of the Stantec hydrogeological study will be provided under a separate cover.

Limitations associated with this report and its contents are provided in the statement included in **Appendix A**.

2.0 PROJECT AND SITE DESCRIPTION

It is understood that the Client plans to acquire the approximately 29-hectare rectangular Site and develop it in combination with the 11-hectare agricultural property located to its immediate northwest part of **Lot 32, Concession 6**. The Site is bounded by Townline Road from the North and Port Davidson St from the west, by agricultural land from the South and by an abandoned railway line from the East. The Site has several farmhouses, residential homes along Townline road and Port Davidson Road on the

Southern and Western boundary, respectively. It was observed that a gas easement starts on the western boundary of the site, and runs across the site heading West, owned by Westover Express Pipeline Ltd. (WEX). A review of the aerial photos available on the Niagara Navigator dating back to 1934 show that the Site has been under agricultural usage since year 1934. The Site is generally flat with ground elevation ranging from 187 m along its southern limits to 190 m in its northern portion. A tributary to the twenty Mile Creek runs northwards, along the western boundary of the Site. An aerial view of the Site is shown on **Drawing 1 – Borehole Location Plan**.

The conceptual development plan spread over the Site shows that the development will comprise low to medium density residential units, commercial and institutional facilities, stormwater management pond (SWM), serviced by paved roads, and underground and possibly overhead utilities. The conceptual development plan is shown on **Drawing No. 2 – Conceptual Development Plan**.

3.0 REGIONAL GEOLOGY

The Site is located in the approximately 3,500 km^2 physiographic region of the Haldimand Clay Plain, which occupies the Niagara Peninsula between the Niagara Escarpment and Lake Erie. It is bounded by the Niagara River in the east and extends past Highway 6 connecting Hamilton on the Niagara Escarpment to Port Dover on the Lake Erie. The plain was submerged in the waters of the proglacial lakes and is covered with deep water low-permeability glaciolacustrine deposits comprised of silts and clays interspersed by morainic ridges generally in the north along the Niagara Escarpment.

The Quaternary geology map shows that the general Site area is covered with glaciolacustrine silt and clay deposits associated with pro-glacial lakes. These deposits occur as interstratified layers. The glaciolacustrine deposits generally thicken in a north to south direction becoming approximately 20 m thick in the Welland-Caistor Centre corridor, then again decreasing in thickness up to the Onondaga Escarpment. The glaciolacustrine silts sand clays have been described as poorly draining with low infiltration rates, resulting in surface ponding in poor drainage areas and moisture from surface infiltration occupying upper subsoil horizons for lengthy periods of time. Although soils have high water holding capacities, can be droughty during dry periods because of their inability to release sufficient moisture for plant use. With change in moisture these types of heavy clays can undergo significant volume changes, which manifests itself as expansion and desiccation during wet and dry weather conditions, respectively. As the footings are typically placed at depths exceeding 1.2 m for protection against frost, swelling clays are not a significant geotechnical issue, although there are instances where structures have developed wall cracks due to this very issue.

The dolostone bedrock at the Site is a part of the Guelph Formation. According to the bedrock topography map[1], the bedrock elevation ranges from 184 to 181 m across the site, sloping up from south to north, which indicates that the bedrock is approximately 7 m to 10 m below the existing grades across the site.

Carbonate rock units such as dolostone and limestone are considered as most susceptible to karst processes. Karst is also known to be present in the general Site area. Karst is a distinctive bedrock topography in which the landscape is shaped by the dissolving action of CO_2 rich water on carbonate

[1] Feenstra, B.H. (1981): Bedrock Topography of the Grimsby Area, Southern Ontario; Ontario geological Survey Preliminary Map P.240z1, Scale 1:50,000.

bedrock over geological time periods. Karst topography is comprised of features ranging from sinkholes, vertical shafts, disappearing streams, and springs, to complex underground drainage systems and caves.

The logs of water wells in the general area shows that the groundwater is present within the dolostone bedrock. There are indications that the groundwater in the bedrock aquifer could be under 2 to 3 m of artesian pressure.

4.0 SCOPE OF WORK

The scope of work (SOW) carried out for the geotechnical investigation comprised of the following tasks:

- Contact the public utility authorities to confirm the locations of major public utilities.
- Retain a private utility locate firm to scan the intended borehole locations and mark any buried services or utilities within 3 m of the proposed location.
- Advance total thirty-six (36) geotechnical boreholes to the following depths, as shown in the borehole location plan.
  - Twenty-seven (27) boreholes advanced to 6.1 m below ground surface or up to auger refusal, whichever comes first.
  - Nine (9) boreholes equipped with an overburden monitoring well with a 1.5 m well screen;
  - Two (2) boreholes equipped with multi-level monitoring wells to the following depths:
    - One (1) overburden well installed to 6.1 m with a 1.5 m well screen.
    - One (1) bedrock monitoring well installed to 8 m into bedrock with a 1.5 m well screen.
  - One (1) borehole advanced along the proposed sewer alignment will consist of multi-level monitoring well advanced to the following depths:
    - One (1) overburden well installed to 6.1 m with a 1.5 m well screen.
    - One (1) bedrock monitoring well drilled to 13 m total depth including coring minimum 7.0 m of bedrock along the sanitary sewer alignment with a 3 m well screen.
- Monitoring well screen backfilled with sand filter pack to ~0.3 m above screen, followed by bentonite seal to ground surface. All monitoring wells to be covered with lockable, steel monuments.
- Collect soil samples in each borehole at regular intervals by driving a split tube sampler in
- accordance with the methods and procedures described in ASTM D1586. The samples obtained will be placed in moisture-proof containers and transported to our geotechnical materials testing laboratory for classification and testing.
- Extract Four (4) Rock Core samples and perform unconfined compressive strength test.
- Record the presence and depth (where encountered) of free groundwater in the open boreholes.
- The coordinates of the boreholes will be obtained by Stantec personnel using Survey Equipment.

The Boreholes\Monitoring Well Location plan is shown on Drawing No. 1, Appendix B.

4.1 UTILITY LOCATES

Prior to commencing the field investigation, Stantec contacted Ontario One Call to locate the underground public utilities to provide utility clearances. In addition, Stantec retained the services of a utility locate company, Premier Locates, to provide private utility locate services to identify any traceable underground utilities not identified by the public locates.

4.2 FIELDWORK

The borehole drilling component of the geotechnical investigation was carried out from February 27, 2024, to March 5, 2024. Thirty-six (36) boreholes were advanced, BH101-24 to BH124-24 and MW101-24 to MW112-24. Twelve (12) locations include monitoring wells, MW101-24 to MW112-24.

The locations of the boreholes are shown on the borehole location plan included on **Drawing 1 – Borehole Location Plan** and **Drawing No. 2 – Conceptual Development Plan** included in **Appendix B.**

The boreholes were advanced using a track mounted CME75 drill rig equipped with hollow and solid-stem augers. Stantec field personnel recorded the conditions encountered in the boreholes. Soil samples were recovered at regular intervals using a 50 mm (outside diameter) split-tube sampler by conducting Standard Penetration Tests (SPTs) in accordance with the procedures outlined in ASTM Standard D1586. Field shear vane testing was completed in cohesive soils to measure the undrained shear strength in general accordance with ASTM D2573. Soil samples recovered from the boreholes were placed in moisture proof bags. All samples were returned to Stantec's laboratory for geotechnical classification. Groundwater conditions were recorded in the open boreholes upon completion of drilling, as well as in the monitoring wells approximately two weeks following installation.

Rock was inferred to be present when relatively little advancement of borehole advancement was observed. This was considered refusal to augering. Rock coring was carried out at three (3) locations MW101-24, MW105-24, and MW108-24 below the inferred bedrock depths to confirm the presence of bedrock and to investigate the bedrock lithology. Wire line techniques using HQ size cores (96 mm outside diameter and 63.5 mm inside diameter) were used to advance the boreholes into the bedrock. A Stantec field person documented the percentage recovery, thickness, rock quality designation (RQD), the amount of water loss/return, and presence of voids or cavities in the bedrock. The rock cores were placed in partitioned wooden core boxes to keep each core run separate with depths of recovery clearly marked. Pictures of recovered cores have been provided in **Appendix C – Borehole Records**. The percentage core recovery and RQD values are provided on the borehole logs included in **Appendix C – Borehole Records**.

The monitoring wells installed in twelve (12) boreholes MW101-24 to MW112-24 were constructed using a 50 mm inside diameter, Schedule 40 PVC pipe with a No. 10 slot screen (0.01-inch slot) with a tower casing above ground surface. The annular space between the monitoring well pipe and surrounding soils was backfilled with silica sand to a maximum of 0.3 m above the top of the screen and the remainder of the annular space was filled with bentonite. The location of the boreholes constructed as monitoring wells is shown in **Appendix B, Drawing 2 – Borehole Location Plan**. The installation details are shown on the borehole logs included in **Appendix C – Borehole Records.**

Stantec field personnel collected the borehole survey information using a Trimble R12 GPS unit. Ground surface elevations at the borehole locations referenced to a geodetic datum and approximate UTM coordinates (Zone 17 NAD 83) and are shown in Table 4.1 below.

Table 4.1: Borehole Location and Elevation Summary

Borehole No.	UTM Coordinates		Ground Surface Elevation	Borehole depth
	Northing (m)	Easting (m)	(m AMSL)	(m BGS)
BH101-24	618503	4771944	187.84	5.6
BH102-24	618580	4771841	186.94	5.8
BH103-24	618334	4771865	187.95	3.2
BH104-24	618294	4771766	190.27	4.6
BH105-24	618433	4771766	189.43	6.4
BH106-24	618293	4771667	190.50	6.3
BH107-24	618552	4771652	190.18	6.6
BH108-24	618531	4771570	189.85	6.6
BH109-24	618434	4771567	189.55	6.6
BH110-24	618335	4771568	190.14	6.6
BH111-24	618135	4771569	190.27	6.6
BH112-24	618037	4771568	190.59	6.6
BH113-24	618335	4771468	190.01	6.6
BH114-24	618235	4771469	189.71	6.6
BH115-24	618135	4771469	189.37	6.6
BH116-24	618036	4771471	189.69	6.6
BH117-24	618465	4771370	189.65	8.4
BH118-24	618337	4771369	190.57	9.5
BH119-24	618135	4771372	188.39	7.3
BH120-24	618033	4771371	189.23	7.8
BH121-24	617939	4771370	187.21	5.0
BH122-24	618333	4771273	189.01	6.6
BH123-24	618234	4771271	187.98	6.6
BH124-24	618037	4771273	188.77	6.6
MW101-24	618436	4771278	189.88	11.4(1)
MW102-24	618468	4771469	189.65	7.8
MW103-24	618434	4771667	188.98	5.5
MW104-24	618584	4771913	186.81	5.8
MW105-24	618434	4771865	186.73	7.4(1)
MW106-24	618264	4771876	188.52	2.3
MW107-24	618235	4771569	190.14	7.3
MW108-24	618235	4771370	189.85	7.9(2)
MW109-24	617937	4771568	188.67	6.3
MW110-24	617937	4771277	186.90	5.2
MW111-24	618137	4771272	188.44	6.3
MW112-24	618569	4771746	188.14	6.4

(1) Includes 3 m of rock coring.
(2) Includes 5.3 m f rock coring.

4.3 LABORATORY TESTING

All soil samples obtained from the boreholes were subjected to visual and tactile examination on return to the geotechnical and construction materials testing laboratory. The geotechnical laboratory testing was completed on a number of samples, as shown in Table 4.2.

Table 4.2: Geotechnical Laboratory Testing Program

Laboratory Test	Number of Samples Tested
ASTM D2216-10 – Natural Moisture Content	58
ASTM D422-63 (2007) – Grain Size Distribution with Hydrometer	7
ASTM D4318-10 – Atterberg Limits	2
ASTM D7013-04 Rock Compressive Strength	3
Corrosivity Testing	6

The results of the laboratory tests are discussed in the text of this report and are plotted on the respective borehole logs included in **Appendix C.** Figures illustrating the results of the grain size distribution tests and Atterberg Limits tests are included in **Appendix D.**

Unless specific instructions are received to the contrary, the samples will be discarded three (3) months after issue of this report.

5.0 RESULTS OF INVESTIGATION

5.1 FRAME OF REFERENCE

The soils encountered in the boreholes and reported herein have been classified in accordance with the Unified Soil Classification System as defined in ASTM D2487 per Unified Soil Classification System (USCS) and D2488 per visual-manual method.

It should be noted that the internal diameter (I.D.) of the SPT sampler is 38 mm and hence the grain size test results and soil classifications may not reflect the entire gravel size fraction which extends to 75 mm diameter. The presence of cobbles (particles from 75 mm to 300 mm) and boulders (particles > 300 mm) were inferred to be present in specific stratum and are described separately from the gravel content.

It should also be noted that the stratigraphic boundaries shown on the borehole logs are inferred from non-continuous sampling and should be considered approximate only.

5.2 OVERVIEW OF CONDITIONS

The subsurface conditions encountered at the borehole locations are provided on the Borehole Records in **Appendix C**, along with an explanation of the symbols and terms used in the Borehole Records. The subsurface stratigraphy can be summarized as follows:

- Topsoil; underlain by,
- Silty clay underlain by
- Dolostone bedrock.

The following paragraphs provide additional information on the soil strata encountered in the boreholes. The following is intended to summarize the conditions encountered; the Borehole Records provided in **Appendix C** should be used as the primary source of information supplemented by the information provided in the following sections. The soil conditions shown on the records are a direct extraction from the associated boreholes.

5.3 TOPSOIL

Approximately 460 mm thick topsoil was present at the ground surface of thirty-four (34) borehole locations. The topsoil contained rootlets and is comprised of silty sand. The thickness of the topsoil can be attributed to the tilling of the surface for agricultural purposes.

5.4 CLAY (CL)

A deposit of medium plasticity clay (lean clay to sandy silty clay) was encountered below the topsoil layer at all borehole locations and extends to the bedrock encountered or inferred at depths ranging from 2.3 m BGS (Elevation 186.22 m AMSL) to 9.5 m BGS (Elevation 181.07 m AMSL).

It was observed that the brown clay layer starts below the topsoil at approximately 0.46 m BGS and typically extends to approximately 3.0 m to 4.5 m BGS followed by the greyish-brown clay. Select borehole locations encountered a layer of reddish-brown clay layer above the bedrock.

The SPT N-values obtained from the SPTs advanced in the clay layer generally ranged from 5 to 112 blows per 0.3 m penetration, indicating a firm to hard consistency. Field vane shear testing yielded strengths ranging from 158 to 197 kPa indicating a very stiff consistency.

The moisture content of the clay ranged from 8% to 31%.

Grain size distribution and Atterberg Limits tests were completed on select samples. The results of the tests are shown in Table 5.1 below.

Table 5.1: Summary of Grain Size Distribution and Atterberg Limits Analyses Results

Borehole	Depth (m BGS)	Grain Size (%)				Wn (%)	Atterberg Limits (%)				Soil Classification
		Gravel	Sand	Silt	Clay		LL	PL	PI	LI	
BH102-24	2.5	0	4	49	47	24	41	22	19	0.11	Lean Clay (CL)
BH106-24	1.8	2	6	25	67	23	-	-	-	-	Lean Clay (CL)
MW101-24	1.8	0	1	31	68	22	-	-	-	-	Lean Clay (CL)
MW108-24	4.0	1	3	46	50	26	41	23	18	0.17	Lean Clay (CL)
MW108-24	6.3	3	1	50	46	28	-	-	-	-	Lean Clay (CL)
MW109-24	2.5	0	1	43	56	25	-	-	-	-	Lean Clay (CL)
MW110-24	4.0	9	30	35	26	14	-	-	-	-	Sandy Silty Clay (CL-ML)

Notes:
1. Wn denotes the natural water content.
2. LL, PL, and PI denote Liquid Limit, Plastic Limit and Plasticity Index, respectively.
3. LI denotes Liquidity Index = (Wn - PL)/PI
4. Soil classification in accordance with USCS (ASTM D2487 or ASTM D2488)

Based on the results of the test referenced above and visual inspection of the samples, the samples obtained from within the clay deposits are classified as Lean Clay (CL) to Sandy Silty Clay (CL-ML), in accordance with the USCS (ASTM D2487).

5.5 BEDROCK

Bedrock encountered at the site consisted of vuggy dolostone bedrock. The bedrock was noted as being moderately to highly weathered with horizontal to vertical orientation of discontinuities. There were completely weathered rock cores following the intact cores, which is indicative of the karstic processes.

The depth of bedrock at the borehole locations is summarized in Table 5.2.

Table 5.2: Bedrock Depth at Borehole Locations

Borehole No.	Ground Surface Elevation	Borehole Depth	Bedrock		Comment
	(m AMSL)	(m BGS)	Depth (m BGS)	Elevation (m AMSL)	
BH101-24	187.84	5.6	5.6	182.24	Bedrock inferred
BH102-24	186.94	5.8	5.8	181.14	Bedrock inferred
BH103-24	187.95	3.2	3.2	184.75	Bedrock inferred
BH104-24	190.27	4.6	4.6	185.67	Bedrock inferred
BH105-24	189.43	6.4	6.4	183.03	Bedrock inferred
BH106-24	190.50	6.3	6.3	184.20	Bedrock inferred
BH107-24	190.18	6.6	-	-	-
BH108-24	189.85	6.6	-	-	-
BH109-24	189.55	6.6	-	-	-
BH110-24	190.14	6.6	-	-	-
BH111-24	190.27	6.6	-	-	-
BH112-24	190.59	6.6	-	-	-
BH113-24	190.01	6.6	-	-	-
BH114-24	189.71	6.6	-	-	-
BH115-24	189.37	6.6	-	-	-
BH116-24	189.69	6.6	-	-	-
BH117-24	189.65	8.4	8.4	181.25	Bedrock inferred
BH118-24	190.57	9.5	9.5	181.07	Bedrock inferred
BH119-24	188.39	7.3	7.3	181.09	Bedrock inferred
BH120-24	189.23	7.8	7.8	181.43	Bedrock inferred
BH121-24	187.21	5.0	5.0	182.21	Bedrock inferred
BH122-24	189.01	6.6	-	-	-
BH123-24	187.98	6.6	-	-	-
BH124-24	188.77	6.6	-	-	-
MW101-24	189.88	11.4	8.4	181.52	Bedrock cored
MW102-24	189.65	7.8	7.8	181.85	Bedrock inferred

Borehole No.	Ground Surface Elevation	Borehole Depth	Bedrock		Comment
	(m AMSL)	(m BGS)	Depth (m BGS)	Elevation (m AMSL)	
MW103-24	188.98	5.5	5.5	183.48	Bedrock inferred
MW104-24	186.81	5.8	5.8	181.01	Bedrock inferred
MW105-24	186.73	7.4	4.7	182.06	Bedrock cored
MW106-24	188.52	2.3	2.3	186.22	Bedrock inferred
MW107-24	190.14	7.3	7.3	182.84	Bedrock inferred
MW108-24	189.85	7.9	8.1	181.77	Bedrock cored
MW109-24	188.67	6.3	6.3	182.37	Bedrock inferred
MW110-24	186.90	5.2	5.2	181.7	Bedrock inferred
MW111-24	188.44	6.3	6.3	182.14	Bedrock inferred
MW112-24	188.14	6.4	6.4	181.74	Bedrock inferred

Notes:
1. Bedrock inferred – indicates that spoon and auger refusal was encountered.
2. Bedrock cored – indicates that bedrock was proved by coring.

The percentage recovery, rock quality designation (RQD) and strength are summarized in Table 5.3.

Table 5.3: Bedrock Coring Summary

Borehole No.	Core Run		TCR %	SCR%	RQD %	Rock Quality (ASTM D6032)	Uniaxial Compressive Strength MPa
	Run No.	Depth Interval (m BGS)					
MW101-24	1	8.36-10.08	57	22	0	Very Poor	-
	2	10.08-10.72	100	88	18	Poor	131.4
	3	10.72-11.41	100	98	85	Good	-
MW105-24	1	4.67-6.20	100	100	71	Fair	88.2
	2	6.20-7.72	100	100	93	Excellent	-
MW108-24	1	8.08-9.19	100	50	47	Poor	108.6
	2	9.19-9.80	100	100	85	Good	-
	3	9.80-10.85	88	57	0	Very Poor	-
	4	10.85-13.31	100	70	25	Very Poor	81.9

SCR =Solid Core Recovery; TCR = Total Core Recovery

RQD is calculated by adding the lengths of intact rock core pieces equal to or greater than 10 cm in length and dividing this length by total core length multiplied by 100 to convert the fraction to a percentage. RQD provides a measure of quality of rock core and signifies the degree of jointing or fracture in a rock mass.

Based on the RQD results, the rock quality is variable with ‘Very Poor’ to ‘Excellent’ rock encountered. The rock quality improves with depth in MW101-24 and MW105-24. ASTM D6032 – Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core. Photos of rock cores extracted during the investigation can be found in Appendix C.3 – Rock Cores Photos

5.6 GROUNDWATER

A total of twelve (12) monitoring wells were installed in MW101-24 to MW112-24. Three nested monitoring wells in boreholes MW101-24, MW105-24, and MW108-24 where the presence of the bedrock was confirmed through rock coring techniques. The nested wells comprised of a pair of wells, one each set in soil overburden and in the bedrock, respectively. The measured water levels are provided in Table 5.4.

Table 5.4: Measured Groundwater Level

Borehole	Ground surface Elevation (m AMSL)	Bedrock Elevation (m AMSL)	Well Depth (m BGS)	Water Level Monitoring Results	
				Depth (m BGS)	Elevation (m AMSL)
				14-Mar-24	
MW101-24 (OB)	189.88		9.08	7.31	182.6
MW101-24 (BR)	189.88	181.52	11.4	7.49	182.4
MW102-24	189.65		7.78	2.7	186.9
MW103-24	188.98		5.5	5.53	183.4
MW104-24	186.81		5.8	5.16	181.7
MW105-24 (OB)	186.73		4.2	0.53	186.2
MW105-24 (BR)	186.73	182.06	7.4	2.03	184.7
MW106-24	188.52		2.3	Dry	-
MW107-24	190.14		7.3	7	183.1
MW108-24 (OB)	189.85		7.59	6.84	183.0
MW108-24 (BR)	189.85	181.77	13.31	7.28	182.6
MW109-24	188.67		6.3	0.78	187.9
MW110-24	186.90		5.2	1.09	185.8
MW111-24	188.44		6.3	1.65	186.8
MW112-24	188.14		6.4	4.67	183.5

Notes:
1. OB denotes monitoring well set in soil overburden.
2. BR denotes monitoring well set in the bedrock.

A review of the groundwater levels measured in the bedrock monitoring wells shows that the groundwater level is approximately 1 to 2.5 m above the bedrock, indicating that the aquifer in the bedrock is under artesian pressure. The groundwater level in the overburden in approximately 1 m to 7 m below the ground surface at the monitoring well locations. The groundwater levels are subject to seasonal fluctuation and rainfall patterns.

6.0 GEOTECHNICAL ENGINEERING DESIGN AND RECOMMENDATION

It is understood that the proposed development will be a low to medium density residential area and most likely will be constructed with partial or full basements. It is assumed that the commercial developments will comprise of low-rise slab-on-grade structures. Some site grading may be carried out, but no major cut and fill operations are anticipated.

The native soil stratigraphy consisted of the following:

- Topsoil; underlain by,
- Medium plasticity clay generally in a firm to hard state of consistency extending to depths ranging from 2.3 m to 9.5 m BGS, underlain by
- Dolostone bedrock, with potential karst features, generally very poor to good quality, .
- Groundwater measured in boreholes was encountered at depths ranging from 0.5 m to 7.5 m BGS.

The geotechnical comments, discussion, and recommendations are provided in the following sections for the preliminary design and construction of the planned residential/commercial/institutional development. Based on the results of the geotechnical investigation, the subject site is considered suitable for the proposed development from a geotechnical point of view, subject to the recommendations discussed in the following sections.

6.1 GRADING

Topsoil, organic rich or deleterious material should be removed prior to site grading activities and such material should not be used as backfill in settlement sensitive areas. The subgrade soils exposed after the removal of the unsuitable material should consist of approved earth fill or native soil. The subgrade soils should be visually inspected by a geotechnical engineer; compacted and proof rolled where required, using appropriate equipment, compatible with the type of soil.

After approval from the geotechnical engineer, inorganic mineral fill material if required to raise grades, should be placed in thin layers (200 mm thick or less), and compacted to a minimum of 98 percent Standard Proctor Maximum Dry Density SPMDD (SPMDD). On-site inert mineral soils or imported approved select fill or granular material can be used as engineered or pavement subgrade fill.

Drying of excavated soils may be required depending on the weather conditions at the time of construction or the depth of excavation. Any materials with high water content values can be air-dried or mixed with drier material before reuse as compacted fill.

6.2 CONVENTIONAL SHALLOW FOUNDATIONS

The option of shallow foundations is considered suitable for all types of structures at the Site, when constructed in accordance with Part 4 and 9, as applicable, of the 2012 Ontario Building Code (OBC), as amended. The footings of the slab-on-grade structures must be supported on native undisturbed subgrade at a minimum depth of 1.0 m BGS, approved by the geotechnical engineer. The footings supported on the approved native, undisturbed subgrade can be designed for soil bearing resistance of

300 kPa for the factored (Φ=0.5) Ultimate Limit State (ULS) design and soil bearing resistance of 200 kPa for Serviceability Limit State (SLS) design to limit the total and differential settlements to 25 and 19 mm, respectively.

A review of the inferred and confirmed footing depths provided in Table 5.2 show that the bedrock will likely not b encountered for construction of footings, except in the areas of BH103-24, BH104-24, MW105-24, and MW106-24. If encountered during excavation, compaction grouting or other means of karst voids filling may be required, subject to geotechnical inspection, before footings can be constructed on the approved karstic bedrock surface. Footings supported on/into or up to 0.5 m above the bedrock surface can be designed for the soil bearing resistance of 500 kPa for the factored (Φ = 0.5) ULS design. The settlement of the footings, associated with the proposed development, supported on the bedrock will be negligible, therefore the soil resistance bearing for the factored ULS design will govern the design.

The on-Site soils are susceptible to increase in volume change and loss in shear strength upon exposure to moisture, similarly it might undergo desiccation cracking upon drying. Concrete for footings must therefore be placed on the same day as excavation. Should there be a delay in placement of concrete, the footing subgrade should be protected by placing a 50 mm thick mud slab comprised of unshrinkable fill.

Stantec can provide detailed recommendations about the influence of the bedrock on soil bearing resistance once the design depths/elevations of the footings and their preliminary sizes have been determined.

6.3 FLOOR SLABS

6.3.1 Slab-on-Grade

The floor slabs will be set close to the existing ground surface for the structures without any basements and can be constructed as slab-on-grade.

For a shallow construction near the existing ground surface, a slab-on-grade subgrade prepared in accordance with the recommendations provided in Section 6.1 would provide a satisfactory base for the construction of a slab-on-grade floor slab. The prepared subgrade should be proof-rolled in the presence of a geotechnical specialist. Any soft or unsuitable subgrade areas which deflect significantly should be sub-excavated and replaced with suitable approved earth fill material compacted to 98% SPMDD.

It is recommended that a combined moisture barrier and a levelling course, having a minimum thickness of 200 mm and comprised of free draining material such as 20 mm clear stone (OPSS 1004) compacted by vibration to a dense state should be used as a base for the slab-on-grade. The geotextile filter fabric Terrafix 270R or equal should be provided as a separator between the clear-stone course and the soil subgrade.

A modulus of Subgrade Reaction (Ks) of 35 MN/m^3 may be used for the design of the slab in accordance with the recommendations provided above.

The slab-on-grade should be structurally independent of the foundation wall and column footings.

The slab-on-grade should be set at a minimum 200 m above the exterior grades, which should be sloping away from the structure at 2% in paved areas and at 5% in landscaped areas.

6.3.2 Structures with Basements

For a development with a basement level, it is anticipated the floor slab would be at a depth in the order of 2 to 3 m below the existing grades. The design of the floor slab must consider the karstic bedrock conditions and the presence/elevation of the groundwater table, which was encountered as shallow as 1.0 m below the existing grade.

The basement levels should be provided with perimeter foundation drainage systems and water proofing measures in accordance with the 2012 Ontario Building Code, as amended. An under-floor drainage system may also be required, consisting of clear stone backfill and drainpipes that are wrapped in geotextile. The drainpipes will also connect the perimeter drainage pipes. The header pipe directs any accumulated water to a sump pit from which the water can be piped under gravity to a frost-free sum pit, from it the water can be pumped to storm sewers or another approved discharge location.

If a floor slab subgrade is comprised of bedrock, grouting the bedrock may be required to fill the karstic features to prevent formation of load concentrations.

If a “bathtub” approach is adopted, the floor slab must be designed to resist the hydrostatic uplift and the perimeter foundation walls must be designed to resist the full hydrostatic pressure. Continuous monitoring of groundwater levels should be undertaken over the winter, spring, and summer seasons to develop a robust understanding of the water table elevation locally. It is expected that the foundation may need to be designed to resist a water head in the order of 3 m to 3 m. This approach typically requires that the lowest floor slab be thickened, reinforced, tied to the column foundations, or tied down with anchors, or that some combination of these design requirements be adopted. All below-grade infrastructure may need to be water-proofed.

6.4 SEISMIC SITE CLASS

The seismic Site Class value, as defined in Section 4.1.8.4 of the 2012 OBC, as amended, contains a seismic analysis and design methodology which uses a seismic site response and site classification system defined by the average shear stiffness of the upper 30 meters of the ground below the foundation level. Based on the findings of the geotechnical investigation, a Seismic Site Class ‘D’ (stiff soil) can be considered for this site.

A higher Seismic Site Class may be possible, however, on-Site measurement of shear wave velocities to a depth of 30 m would be required.

6.5 DEPTH OF FROST PENETRATION

The design depth of frost penetration in the general Site area is 1.2 m in accordance with the Ontario Provincial Standard Drawing (OPSD) 3090.101. Therefore, a permanent soil cover of at least 1.2 m or its thermal equivalent synthetic insulation is required for frost protection of foundations in unheated areas.

During winter construction, exposed surfaces to support foundations must be protected against freezing by means of loose straw and tarpaulins, heating, etc.

7.0 CONSTRUCTION RECOMMENDATION

7.1 EXCAVATIONS AND BACKFILL

7.1.1 Temporary Excavations – Soil Overburden

Temporary excavations for the proposed development must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA). The native soil classification for excavation as per Table 7.1.

Table 7.1: Soil Types as per OHSA

Soil Type	Above groundwater	Below groundwater
Native Clay	3	4

Where workers must enter a trench or excavation the soil must be suitably sloped and/or braced in accordance with the regulation requirements. The regulation stipulates safe excavation slopes by soil type as per table 7.2.

Table 7.2: Excavation Slopes for Each Soil Type as per OHSA

Soil Type	Base of Slope	Slope inclination
1	Within 1.2 meters of bottom of excavation	1H:1V
2	Within 1.2 meters of bottom of excavation	1H:1V
3	From Bottom of excavation	1H:1V
4	From Bottom of excavation	3H:1V

Any soft/loose soils or soils encountered below the groundwater table should be classified as Type 4 soil. The maximum excavation side slope for a Type 4 soil is 3H:1V (Horizontal: Vertical) in accordance with the OHSA regulation.

Stockpiling of any materials adjacent to excavations should be avoided. Similarly, traffic should not be permitted in proximity to open excavations. For this purpose, it is recommended that all storage of materials and traffic be restricted from a 3 m wide strip around the excavations, measured from the crest of the excavation designed and constructed in accordance with the OH&S Act.

If space is restricted such that the side slope cannot be safely cut back in accordance with the OH&S Act & Regulations, if sloughing and cave-in are encountered in the excavations, or if the excavations are to remain open for a longer period, an engineered shoring system should be used for approximately up to 7 m deep bulk excavation for the proposed below grade levels. To avoid tiebacks, a soldier pile-lagging system would be suitable for up to 7 m deep excavation.

7.1.2 Temporary Excavations – Bedrock

A rock formation with the following characteristics is considered favourable to excavation using conventional rock excavation equipment such as dozers, rippers, and hoe rams:

- Frequent planes of weakness such as fractures, faults, and laminations.

- Weathered rocks.
- Rocks with moisture permeating the formations.
- Highly stratified rocks.
- Brittle rocks.
- Rocks with low shear strength.
- Rocks with low seismic velocities.

The dolostone bedrock at the Site possesses almost all the above characteristics. According to the Caterpillar Handbook of Ripping (8th Edition), sedimentary rocks with seismic velocity of less than 2,000 m/sec are rippable using a D9 Caterpillar tractor.

Based on the above discussion, the bedrock at the site is considered excavatable using a high horsepower excavating equipment equipped with hydraulic ripper and/or high impact tiger teeth. It is recommended that contractors bidding on this project should review the factual data provided in this report and make their own assessment about the excavatibility of the bedrock mass at the Site.

7.1.3 Groundwater Control

Based on the information revealed during the investigation, it is considered that conventional sump pumping should be applicable to control localized seepage that may occur for an excavation into the clayey soils up to 3 m to 5 m deep.

Extensive dewatering may be required for excavations extending into the bedrock. For the bedrock dewatering recommendations, the reader should refer to the Stantec hydrogeological report.

7.2 SHORING SYSTEM – DESIGN PARAMETERS

Excavation is anticipated to extend up to the bedrock encountered at depths of 2.3 to 9.5 m BGS. A shoring system may therefore be required to support the walls of the excavation where a slopes excavation is not possible. The design of the shoring system should be the contractor's responsibility and should be designed by a licensed professional engineer. For the design, unfactored soil design parameters for foundation walls are listed in Table 7.3.

Table 7.3: Unfactored Soil Design Parameters for Foundation Walls

Parameter	Clay
Bulk Unit Weight, g (kN/m^3)	19.0
Effective Friction Angle, f'	32.0
At Rest Earth Pressure (K_o) (Static)	0.47
Active Earth Pressure (K_A) (Static)	0.31
Passive Earth Pressure, (K_P)	3.25

7.3 SITE SERVICING

The predominant subgrade soils beneath the service pipes will consist of firm to hard clays, which would provide suitable support to the proposed service utility pipes. The native soils should be removed and replaced with granular fill (OPSS Granular A or OPSS Granular B Type II) compacted to 100% SMPDD. Prior to installation of the services, the subgrade should be inspected by an experienced geotechnical

specialist. If any very loose or soft areas are detected during inspection, they should be excavated and replaced with compacted granular material such as OPSS.MUNI 1010 Granular A or Granular B Type II.

The pipe bedding for the services should be conventional Class B pipe bedding comprising a minimum 150 mm thick layer of OPSS.MUNI 1010 Granular 'A' aggregate below the pipe invert. The bedding course may be thickened if portions of the subgrade become wet during excavation. OPSS.MUNI 1010 Granular A type aggregate should be provided around the pipe to at least 300 mm above the top, and the bedding should be compacted to 98% SPMDD. Service lines installed outside of heated areas should be provided with a minimum 1.2 m of soil cover or equivalent insulation for frost protection.

The geotextile filter fabric Terrafix 270R or equal should be provided as a separator between the pipe bedding course and the soil subgrade.

Additional specific comment to the design of buried services and utilities in view of the subsurface conditions encountered in the boreholes and in consideration of good industry practice is provided as follows.

7.4 TRENCH BACKFILL

Bedding for services should consist of OPSS Granular 'A' material. In general, a minimum of 150 mm of bedding and 300 mm of cover material is recommended. The bedding and cover material should be compacted to achieve a minimum of 98% of the material's SPMDD. The bedding and cover on each side of the pipe should be completed simultaneously and at no time should the difference from one side of the pipe to the other exceed 200 mm.

These recommendations should be confirmed with the pipe manufacturer and care must be taken to avoid incurring damage to the services. Pipe manufactures may have additional/alternative requirements that should be reviewed by the Designer and Contractor prior to installation of the services.

The trenches above the specified pipe bedding should be backfilled with inorganic soils that are not excessively wet placed in 200 mm thick lifts and compacted to at least 98% SPMDD. Where the service trenches enter the building, the trench backfill must be compacted as structural fill to a minimum of 100% SPMDD. Any trench backfill below a pavement structure should be compacted to 100% SPMDD within 1 m from the top of subgrade level. Based on the results of in-situ moisture content tests carried out on the native overburden deposits, the materials may be suitable for reuse as trench backfill. Any overly wet material may require drying prior to reusing as backfill.

8.0 PAVEMENT DESIGN AND CONSTRUCTION

8.1 SUBGRADE PREPARATION

Based on the borehole findings, and anticipated Site grading, the pavement subgrade for the proposed access roads and parking lots will likely consist of firm to hard clay. The subgrade comprised of native inorganic undisturbed soils or approved compacted fill materials would provide adequate support to the pavement structure of the proposed access roads and parking lots, provided a subgrade is proof-rolled and approved by the geotechnical specialist prior to the construction of the pavement structure.

Where there is existing fill on the site, caution needs to be exercised in the preparation of the subgrade on this material. It is recommended that any subgrades comprising of existing fill be inspected for obvious soft/loose areas and presence of deleterious materials. Should such areas be found, these should be replaced or treated as advised by the geotechnical engineer.

The most severe loading conditions on pavement areas and the subgrade may occur during construction. Consequently, special provisions such as end dumping and forward spreading of sub-base fills, restricted construction lanes, and half-loads during paving may be required, especially if construction is carried out during wet weather conditions.

8.2 DRAINAGE

Control of surface water is an important factor in achieving a good pavement life. The subgrade must be free of depressions and sloped (preferably at a minimum grade of 2 percent) to provide effective drainage toward edges and catch basins. Grading adjacent to parking areas should be designed to ensure that water is not allowed to pond adjacent to the outside edges.

Continuous subdrains comprised of 100 mm diameter perforated pipes, wrapped in filter cloth, and surrounded by 150 mm of 19-mm clear stone should be provided and connected to catch basins to facilitate drainage of granular materials. The subdrain invert should be maintained at least 0.1 metres below subgrade level. To minimize the problems of differential movement between the pavement and catch basins / manhole due to frost action, the backfill around the structures should consist of free-draining granular material.

8.3 RECOMMENDED FLEXIBLE PAVEMENT STRUCTURE

The following flexible pavement thickness (Table 8.1) may be used for the design of the potential driveways and parking areas. The pavement designs include a Heavy Duty for access routes and a Standard Duty for car parking areas and are based on providing a maximum design life of 20 years.

Table 8.1: Recommended Pavement – Component Thickness

Pavement Layer	Compaction Requirements	Collector Road Pavement Design	Local Road Pavement Design
Surface Course Asphaltic Concrete HL3 (OPSS 1150)	97% Maximum Relative Density (OPSS 310)	50 mm	50 mm
Base Course Asphaltic Concrete HL8 (OPSS 1150)	97% Maximum Relative Density (OPSS 310)	65 mm	60 mm
Base Course: Granular 'A' (19mm Crusher Run)	100% Standard Proctor Maximum Dry Density (ASTM-D698)	150 mm	150 mm
Subbase Course: Granular B (50mm Crusher Run)		500 mm	300 mm

9.0 SOIL AGGRESSIVENESS

9.1 CORROSION POTENTIAL OF DUCTILE IRON

To determine the corrosion potential of the buried and ductile iron pipe and its components, analyses were carried out on five soil samples in accordance with American National Standards Institute (ANSI)/ American Water Works Association Standard ANSI/AWWA C105/A21.5. The analyses are comprised of testing the soil samples for soil resistivity, Redox potential, pH, sulfide content and moisture content and assigning points per the guidelines provided in the standard. A sample with 10 or more points is considered to represent a soil that would be corrosive to the buried ductile iron pipe and its components. The detailed results are provided in **Appendix D** and are summarized in Table 9.1.

Table 9.1: Summary of Corrosiveness Analyses

Borehole Sample No.	Depth	(m BGS)	Resistivity (Ohm-cm)	Moisture (%)	Redox Potential (mV)	pH	Sulfides (mg/kg)
MW109-24	SS3	1.5 – 2.0	3220	19.1	296	7.81	0.90
Total Points		**4**	0	2	0	0	2
MW110-24	SS4	2.3 – 2.7	2300	19.2	305	7.84	0.85
Total Points		**6**	2	2	0	0	2
MW101-24	SS4	2.3 – 2.7	1300	20.4	307	7.88	0.50
Total Points		**14**	10	2	0	0	2
MW108-24	SS5	3.0 – 3.5	4830	20.8	290	7.80	1.11
Total Points		**4**	0	2	0	0	2
BH101-24	SS3	1.5 – 2.0	5990	19.3	283	7.76	0.68
Total Points		**4**	0	2	0	0	2
BH104-24	SS5	3.0 – 3.5	1040	21.2	291	7.71	<0.26
Total Points		**14**	10	2	0	0	2

Based on the test results the soils at the general locations of MW101-24 and BH104-24 are considered corrosive to the buried ductile and grey-iron pipes. Any ductile and grey-iron pipes and their components buried in the general area of these boreholes should be completely wrapped in polyethylene sheets as per the manufacturer's recommendations.

9.2 SULPHATE ATTACK ON CONCRETE

The potential for sulphate attack on concrete (class of exposure) is determined using Table 3 of the Canadian Standards Association (CSA) document A23.1 19/A23.2 19 'Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete', which divides the degree of exposure into the following three classes (Table 9.2).

Table 9.2: Concrete Exposure Class

Degree (Class) of Exposure	Water Soluble Sulphate (SO4) in Soil Sample (%)
Very Severe (S1)	> 2.0
Severe (S2)	0.20 – 2.0
Moderate (S3)	0.10 – 0.20

Laboratory testing for soluble sulphate content was carried out on five (5) soil samples. The detailed results are provided in **Appendix D** and are summarized in the Table 9.3.

Table 9.3: Summary of Sulfate Content Analyses

Borehole	Sample No.	Depth (m BGS)	SO_4		Severity	Cement Type
			Mg/kg	%		
MW109-24	SS3	1.5 – 2.0	211	0.0211	Low	Normal
MW110-24	SS4	2.3 – 2.7	336	0.0336	Low	Normal
MW101-24	SS4	2.3 – 2.7	913	0.0913	Low	Normal
MW108-24	SS5	3.0 – 3.5	67	0.0067	Low	Normal
BH101-24	SS3	1.5 – 2.0	<20	<0.002	Low	Normal
BH104-24	SS5	3.0 – 3.5	1010	0.1010	Moderate	Table 3 CSA A23.1-19

A review of the analytical test results provided in **Appendix D** shows that the measured soluble sulphate content in the tested soil samples ranged from less than 20 mg/kg (0.0020 percent) to 1010 mg/kg (0.1010 percent), indicative of a below ‘Moderate’ to ‘Moderate’ degree of exposure of buried concrete to sulphate attack. Normal Type 10 Portland cement could be used in construction concrete mixes for below grade structures in contact with soil at the Site, except at the general location of BH104-24, where sulfate resisting cement meeting the requirements of Table 3 of CSA A23.1:19 should be used.

Addition testing should be carried out at the detailed design stage to refine the rest results.

10.0 CLOSURE

Use of this report is subject to the Statement of General Conditions provided in **Appendix A**. It is the responsibility of Lockbridge Development Inc. who is identified as “the Client” within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec Consulting Ltd. Should any of these not be satisfied. The Statement of General Conditions addresses the following:

- Use of the report.
- Basis of the report.
- Standard of care.
- Interpretation of site conditions.
- Varying or unexpected site conditions; and,
- Planning, design, or construction.

This report has been prepared by Katurah Firdawsi and Raid Khamis and reviewed by Ron Howieson.

Respectfully Submitted,

STANTEC CONSULTING LTD.

APPENDIX A

A.1 STATEMENT OF GENERAL CONDITIONS

Stantec

STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This professional work product ("hereinafter referred to as the Report") has been prepared for the sole benefit of the Client in accordance with Stantec's contract with the Client. While the Report may be provided by the Client to applicable authorities having jurisdiction and to other third parties in connection with the project, Stantec disclaims any legal duty based upon warranty, reliance, or any other theory to any third party, and will not be liable to such third party for any damages or losses of any kind that may result.

BASIS OF THIS REPORT: This Report relates solely to the site-specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The information, opinions, conclusions and/or recommendations made in this Report are in accordance with Stantec's present understanding of the site-specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time the scope of work was conducted and do not take into account any subsequent changes. If the proposed site-specific project differs or is modified from what is described in this Report or if the site conditions are altered, this Report is no longer valid unless Stantec is requested by the Client to review and revise the Report to reflect the differing or modified project specifics and/or the altered site conditions. This Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose or site, and any unauthorized use or reliance is at the recipient's own risk.

STANDARD OF CARE: Preparation of this Report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

PROVIDED INFORMATION: Stantec has assumed all information received from the Client and third parties in the preparation of this Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this Report are based on site conditions encountered by Stantec at the time of the scope of work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behaviour. Extrapolation of in-situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

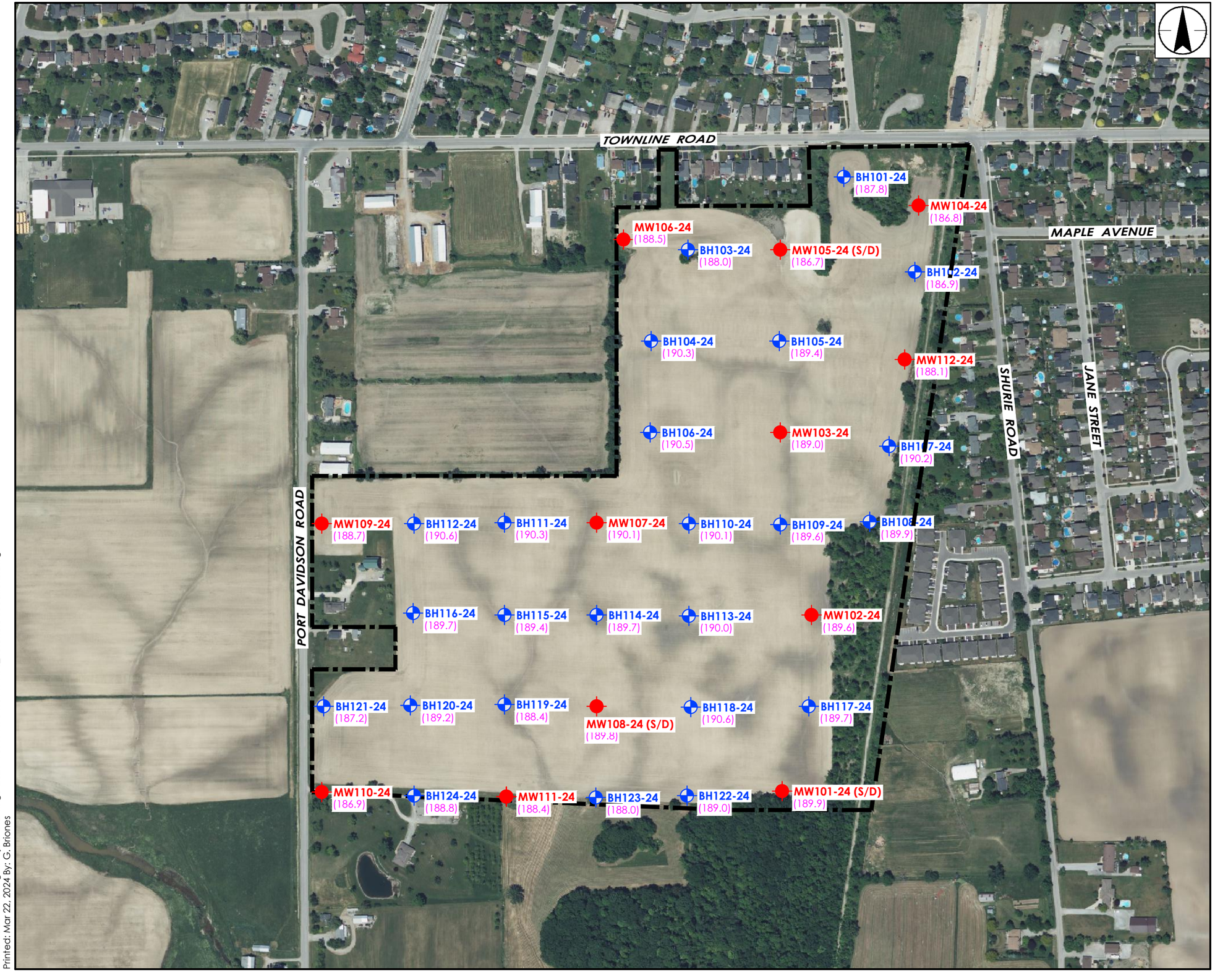
VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this Report or encountered at the test and/or sample locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the Report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or subsurface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec geotechnical engineers, sufficiently ahead of initiating the next project stage (e.g., property acquisition, tender, construction, etc.), to confirm that this Report completely addresses the elaborated project specifics and that the contents of this Report have been properly interpreted. Specialty quality assurance services (e.g., field observations and testing) during construction are a necessary part of the evaluation of subsurface conditions and site work. Site work relating to the recommendations included in this Report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present.

APPENDIX B

B.1 BOREHOLE LOCATIONS PLAN

B.2 CONCEPT DEVELOPMENT PLAN



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Ottawa, ON, Canada K2C 3G4
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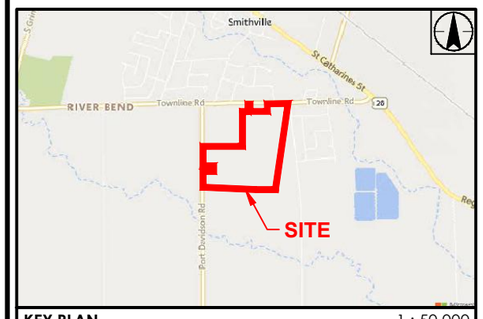
LEGEND

- BOREHOLE (STANTEC, 2024)
- MONITORING WELL (STANTEC, 2024)
- (186.9) BOREHOLE ELEVATION (METERS)
- APPROXIMATE PROPERTY BOUNDARY



KEY PLAN 1 : 50 000

NOTES

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MARCH 2024
Project No. 161414473

Client/Project
LOCKBRIDGE DEVELOPMENT INC.
GEOTECHNICAL INVESTIGATION
BLOCK 9, SMITHVILLE, ONTARIO

Drawing No.
1

Title
BOREHOLE LOCATION PLAN

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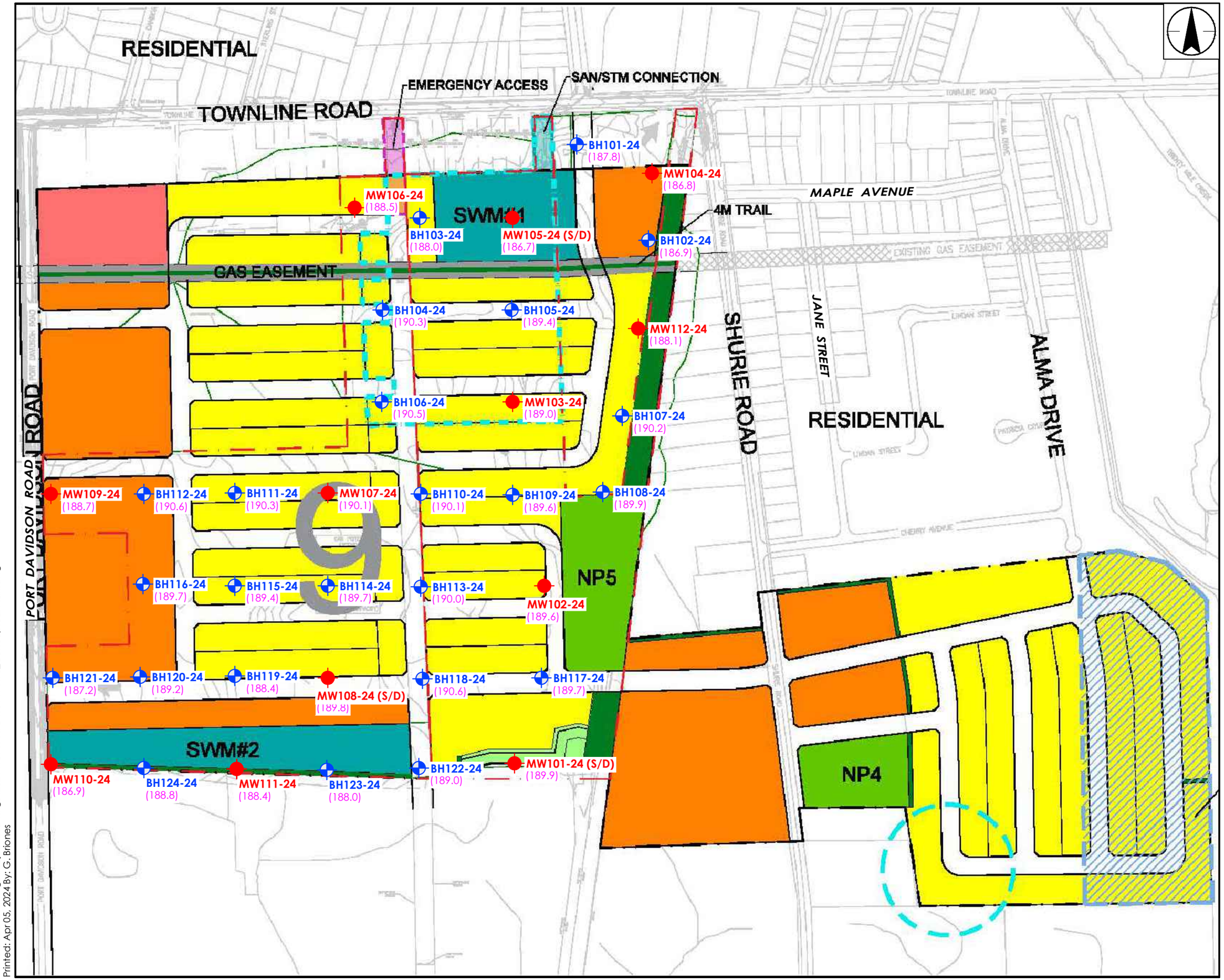

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Printed: Apr 05, 2024 By: G. Briones

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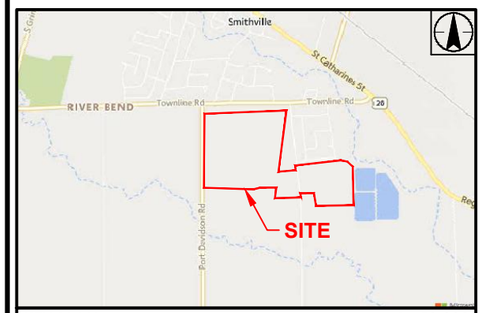
LEGEND

- BOREHOLE (STANTEC, 2024)
- MONITORING WELL (STANTEC, 2024)
- (186.9) BOREHOLE ELEVATION (METERS)
- BLOCK PLAN AREA 9
- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- COMMERCIAL
- PARK LAND / OPEN SPACE / NP4, NP5
- NATURAL HERITAGE SYSTEMS (NHS) - TRAILS
- NATURAL FEATURES AND 15m BUFFER
- PROPOSED S.W.M. FACILITY
- PHASE 1
- S.W.M. LOCATION
- LAGOON BUFFER



KEY PLAN 1 : 50 000

NOTES

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APRIL 2024
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BLOCK 9, SMITHVILLE, ONTARIO

Drawing No.
2

Title
CONCEPTUAL DEVELOPMENT PLAN

APPENDIX C

C.1 SYMBOLS AND TERMS USED ON BOREHOLES

C.2 BOREHOLE LOGS

C.3 ROCK CORE PHOTOS

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Rootmat	- vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil	- mixture of soil and humus capable of supporting vegetative growth
Peat	- mixture of visible and invisible fragments of decayed organic matter
Till	- unstratified glacial deposit which may range from clay to boulders
Fill	- material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	- having cracks, and hence a blocky structure
Varved	- composed of regular alternating layers of silt and clay
Stratified	- composed of alternating successions of different soil types, e.g. silt and sand
Layer	- > 75 mm in thickness
Seam	- 2 mm to 75 mm in thickness
Parting	- < 2 mm in thickness

Terminology describing soil types:
The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):
Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils:
The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on page 3. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Shear Strength		Approximate SPT N-Value
	kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25 - 0.5	12.5 - 25	2-4
Firm	0.5 - 1.0	25 - 50	4-8
Stiff	1.0 - 2.0	50 – 100	8-15
Very Stiff	2.0 - 4.0	100 - 200	15-30
Hard	>4.0	>200	>30

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	*Very Poor Quality*
25-50	*Poor Quality*
50-75	*Fair Quality*
75-90	*Good Quality*
90-100	*Excellent Quality*

Alternate (Colloquial) Rock Mass Quality	
Very Severely Fractured	*Crushed*
Severely Fractured	*Shattered or Very Blocky*
Fractured	*Blocky*
Moderately Jointed	*Sound*
Intact	*Very Sound*

RQD (Rock Quality Designation) denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

SCR (Solid Core Recovery) denotes the percentage of solid core (cylindrical) retrieved from a borehole of any orientation. All pieces of solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock with respect to discontinuity and bedding spacing:

Spacing (mm)	Discontinuities	Bedding
>6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

Terminology describing rock strength:

Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

Terminology describing rock weathering:

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.

Boulders Cobbles Gravel | Sand | Silt | Clay | Organics | Asphalt | Concrete | Fill | Igneous Bedrock | Meta-morphic Bedrock | Sedi-mentary Bedrock

SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

WATER LEVEL MEASUREMENT

measured in standpipe, piezometer, or well

inferred

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_u	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

BOREHOLE RECORD

BH101-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **March 5, 2024**

BH COORDINATES [NAD83] 618503.0N 4771944.0E
WATER LEVEL: **4.88**

PROJECT NO. : **161414473**
BH ELEVATION: **187.843m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	187.8	Topsoil						
	187.4	Brown, stiff, moist SILTY CLAY		SS	1	610	15	
1		Brown to grey, stiff to very stiff, moist, SILTY CLAY		SS	2	400	22	
2				SS	3	375	21	
				SS	4	610	18	
3				SS	5	610	14	
4	183.3			SS	6	450	12	
		Reddish-brown, hard, moist, SANDY CLAY to SILTY SAND - frequent gravel and rock fragments		SS	7	610	43	
5	182.2							
		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 5.6 m Water level encountered at 4.9 m upon completion of drilling						
6								
7								
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 187 186 185 184 183 182 181 180

BACKFILL SYMBOL
ASPHALT GROUT CONCRETE
BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor:
Drilling Method:
Completion Depth: 5.61 m

Logged By:
Reviewed By:
Page 1 of 1

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BOREHOLE RECORD

BH102-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **March 5, 2024**

BH COORDINATES [NAD83] 618580.0N 4771841.0E
WATER LEVEL: **5.79**

PROJECT NO. : **161414473**
BH ELEVATION: **186.943m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	186.9	Topsoil						
	186.5	Brown, stiff, moist SILTY CLAY		SS	1	375	12	
1		Brown to grey, stiff to very stiff, moist, LEAN CLAY (CL) - trace gravel		SS	2	325	17	
				SS	3	600	21	
2				SS	4	450	17	Sieve/Hydro at 2.5 m G 0% S 4% M 49% C 47%
3				SS	5	600	17	
4	182.4			SS	6	550	9	
		Grey-brown, stiff, moist, LEAN CLAY (CL) - with fine sand		SS	7		10	
5	181.2							
6		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 5.8 m Water level encountered at 5.8 m upon completion of drilling						
7								
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 186 185 184 183 182 181 180 179

BACKFILL SYMBOL
ASPHALT GROUT CONCRETE
BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 5.79 m	Page 1 of 1

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BOREHOLE RECORD

BH103-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **187.951m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618334.0N 4771865.0E | DATUM: **Geodetic**

DATE BORED: **March 5, 2024** | WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	188.0	Topsoil						
0	187.5	Brown, very stiff, moist silty clay TOPSOIL with rootlets		SS	1	400	16	
1		Brown to grey, stiff to very stiff, moist, SILTY CLAY - trace sand		SS	2	425	17	
2				SS	3	400	16	
				SS	4	375	15	
3	184.9							
	184.8	Reddish-brown, very stiff, moist, SILTY CLAY frequent gravel and rock fragments		SS	5			
		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 3.2 m						

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m ●

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

187 186 185 184 183 182 181 180

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: | Logged By:

Drilling Method: | Reviewed By:

Completion Depth: 3.2 m | Page 1 of 1

Stantec

BOREHOLE RECORD

BH104-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **March 5, 2024**

BH COORDINATES [NAD83] 618294.0N 4771766.0E
WATER LEVEL: **N/A**

PROJECT NO. : **161414473**
BH ELEVATION: **190.271m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	190.3	Topsoil						
	189.8	Brown, stiff, dry, silty clay TOPSOIL with rootlets		SS	1	400	11	
1		Brown to grey, stiff to very stiff, moist, SILTY CLAY - trace sand, gravel and rootlets		SS	2	400	19	
2				SS	3	425	25	
		Greyish-brown		SS	4	450	21	
3				SS	5	450	18	
4	185.7			SS	6	450	18	
		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 4.6 m						
5								
6								
7								
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 190 189 188 187 186 185 184 183

BACKFILL SYMBOL
ASPHALT GROUT CONCRETE
BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor:
Drilling Method:
Completion Depth: 4.57 m

Logged By:
Reviewed By:
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BOREHOLE RECORD

BH105-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **189.429m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618433.0N 4771766.0E | DATUM: **Geodetic**

DATE BORED: **March 5, 2024** | WATER LEVEL: **5.79**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	189.4	Topsoil						
0		Brown, stiff, moist, silty clay TOPSOIL with rootlets		SS	1	400	13	
	189.0	Brown to grey, stiff to very stiff, moist, SILTY CLAY - trace sand						
1				SS	2	425	19	
				SS	3	425	23	
2				SS	4	450	21	
3				SS	5	450	15	
4				SS	6	450	13	
5				SS	7	450	18	
6	183.3							
	183.0	Reddish-brown, hard, wet, SILTY CLAY - frequent gravel and rock fragments		SS	8			
		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 6.4 m Water level encountered at 5.8 m upon completion of drilling						
7								
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

189 188 187 186 185 184 183 182

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: | Logged By:

Drilling Method: | Reviewed By:

Completion Depth: 6.4 m | Page 1 of 1

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BOREHOLE RECORD

BH106-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **190.503m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618293.0N 4771667.0E | DATUM: **Geodetic**

DATE BORED: **March 4, 2024** | WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	190.5	Topsoil						
0	190.0	Brown, firm, moist, silty clay TOPSOIL with rootlets		SS	1	325	8	
1		Brown, stiff to very stiff, moist, LEAN CLAY (CL) - trace gravel and sand		SS	2	375	24	
2				SS	3	425	28	Sieve/Hydro at 1.8 m G 2% S 6% M 25% C 67%
				SS	4	450	23	
3		Greyish-brown		SS	5	450	18	
4				SS	6	450	11	
5		Brown		SS	7	450	12	
6	184.4							
	184.3	Brown to reddish-brown, hard, moist, LEAN CLAY (CL) - frequent rock fragments		SS	8		50	
7		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 6.3 m						
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

190 189 188 187 186 185 184 183

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 6.25 m	Page 1 of 1

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BOREHOLE RECORD

BH107-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **190.175m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618552.0N 4771652.0E | DATUM: **Geodetic**

DATE BORED: **March 4, 2024** | WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	190.2	Topsoil						
0		Brown, firm, moist, silty sand TOPSOIL with rootlets		SS	1	400	7	
	189.7	Brown to brownish-grey, stiff to very stiff, moist, SILTY CLAY - trace gravel and sand						
1				SS	2	425	17	
				SS	3	450	29	
2				SS	4	450	21	
3		Greyish-brown		SS	5	450	20	
4				SS	6	450	13	
	185.4			SS	7	450	13	
5		Brown to reddish-brown, stiff to very stiff, moist, SILTY CLAY - frequent gravel and rock fragments						
6				SS	8		29	
	183.6	End of Borehole at 6.5 m						
7								
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m ●

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 190 189 188 187 186 185 184 183

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 6.55 m	Page 1 of 1

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BOREHOLE RECORD

BH108-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **189.851m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618531.0N 4771570.0E | DATUM: **Geodetic**

DATE BORED: **March 1, 2024** | WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	189.9	Topsoil						
0	189.4	Brown, firm, wet, silty sand TOPSOIL with rootlets		SS	1	425	8	
1		Brown to greyish-brown, stiff to hard, moist, SILTY CLAY - trace gravel, sand and rootlets		SS	2	375	27	
2				SS	3	450	31	
3				SS	4	425	21	
4		Greyish-brown		SS	5	450	21	
5				SS	6	450	13	
6	183.8			SS	7	450	15	
	183.3	Brown to reddish-brown, very stiff, moist, SILTY CLAY - frequent gravel		SS	8	425	30	
7		End of Borehole at 6.5 m						
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m ●

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

189 188 187 186 185 184 183 182

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: | Logged By:

Drilling Method: | Reviewed By:

Completion Depth: 6.55 m | Page 1 of 1

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BOREHOLE RECORD

BH109-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **March 1, 2024**

BH COORDINATES [NAD83] 618434.0N 4771567.0E
WATER LEVEL: **N/A**

PROJECT NO. : **161414473**
BH ELEVATION: **189.553m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	189.6	Topsoil						
	189.1	Brown, stiff, dry, silty sand TOPSOIL with rootlets		SS	1	375	10	
1		Brown, stiff to very stiff, moist, SILTY CLAY - trace gravel and sand		SS	2	425	22	
2				SS	3	425	27	
				SS	4	450	18	
3		Greyish-brown		SS	5	375	20	
4				SS	6	450	12	
5				SS	7	450	10	
6	183.5							
	183.0	Brownish-grey, stiff, moist, SILTY CLAY - trace sand		SS	8	450	12	
7		End of Borehole at 6.5 m						
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 189, 188, 187, 186, 185, 184, 183, 182

BACKFILL SYMBOL
ASPHALT GROUT CONCRETE
BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor:
Drilling Method:
Completion Depth: 6.55 m

Logged By:
Reviewed By:
Page 1 of 1

Printed Apr 10 2024 11:51:14 STANTEC GEO 2016 161414473_SMITHVILLE_3A_NEW.GPJ GINT_1233_SOIL_2018_DATA_TEMP_REV2.GDT 4/10/24

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BOREHOLE RECORD

BH110-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **190.135m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618335.0N 4771568.0E | DATUM: **Geodetic**

DATE BORED: **March 4, 2024** | WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	190.1	Topsoil						
0		Brown, stiff, moist, silty sand TOPSOIL with rootlets		SS	1	400	9	
	189.7	Brown to greyish-brown, very stiff to hard, dry to moist, SILTY CLAY - trace gravel and sand						
1				SS	2	425	24	
				SS	3	400	33	
2				SS	4	425	23	
3		Greyish-brown		SS	5	450	20	
4				SS	6	450	17	
5				SS	7	450	15	
6				SS	8		10	
	183.7							
	183.6	Grey, stiff, moist, SILTY CLAY - trace gravel						
		End of Borehole at 6.5 m						
7								
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m ●

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

190 189 188 187 186 185 184 183

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: | Logged By:

Drilling Method: | Reviewed By:

Completion Depth: 6.55 m | Page 1 of 1

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BOREHOLE RECORD

BH111-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **190.265m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618135.0N 4771569.0E | DATUM: **Geodetic**

DATE BORED: **March 4, 2024** | WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	190.3	Topsoil						
0	189.8	Brown, stiff, dry, silty sand TOPSOIL with rootlets		SS	1	375	10	
1		Brown to greyish-brown, stiff to very stiff, moist to wet, SILTY CLAY - trace gravel and sand		SS	2	425	21	
2				SS	3	450	28	
				SS	4	450	19	
3		Greyish-brown		SS	5	450	16	
4				SS	6	450	12	
5				SS	7	450	13	
6	184.2							
	183.7	Greyish-brown, stiff, wet, SILTY CLAY - frequent gravel, sand and rock fragments		SS	8		20	
7		End of Borehole at 6.5 m						
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

190 189 188 187 186 185 184 183

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: | Logged By:

Drilling Method: | Reviewed By:

Completion Depth: 6.55 m | Page 1 of 1

Stantec

BOREHOLE RECORD

BH112-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **190.586m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618037.0N 4771568.0E | DATUM: **Geodetic**

DATE BORED: **March 4, 2024** | WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	190.6	Topsoil						
0	190.1	Brown, firm, moist, silty sand TOPSOIL with rootlets		SS	1	400	7	
1		Brown to greyish-brown, stiff to very stiff, dry to moist, SILTY CLAY - trace sand		SS	2	375	20	
2				SS	3	400	25	
3				SS	4	400	20	
4		Greyish-brown		SS	5	450	15	
5	186.0	Grey to reddish-brown, stiff, moist to wet, SILTY CLAY		SS	6	375	11	
6	184.1			SS	7	450	14	
7		End of Borehole at 6.5 m		SS	8		8	
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m ●

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

190 189 188 187 186 185 184 183

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: | Logged By:

Drilling Method: | Reviewed By:

Completion Depth: 6.55 m | Page 1 of 1

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BOREHOLE RECORD

BH113-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **March 1, 2024**

BH COORDINATES [NAD83] 618335.0N 4771468.0E
WATER LEVEL: **N/A**

PROJECT NO. : **161414473**
BH ELEVATION: **190.008m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	190.0	Topsoil						
0		Brown, firm, moist, silty sand TOPSOIL with rootlets		SS	1	400	7	
	189.5	Brown to greyish-brown, stiff to very stiff, dry to moist, SILTY CLAY - trace sand						
1				SS	2	375	21	
				SS	3	450	19	
2				SS	4	450	18	
3				SS	5	450	16	
		Greyish-brown		SS	6	450	12	
4				SS	7	450	11	
5								
6	183.9							
		Grey, firm, moist, SILTY CLAY		SS	8	450	6	
	183.2							
7		End of Borehole at 6.5 m						
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 190 189 188 187 186 185 184 183

BACKFILL SYMBOL
ASPHALT GROUT CONCRETE
BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor:
Drilling Method:
Completion Depth: 6.85 m

Logged By:
Reviewed By:
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Stantec

BOREHOLE RECORD

BH114-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **March 1, 2024**

BH COORDINATES [NAD83] 618235.0N 4771469.0E
WATER LEVEL: **N/A**

PROJECT NO. : **161414473**
BH ELEVATION: **189.707m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	189.7	Topsoil						
	189.2	Brown, firm, moist, silty sand TOPSOIL with rootlets		SS	1	425	6	
		Brown to greyish-brown, stiff to very stiff, dry to moist, SILTY CLAY - trace sand		SS	2	450	15	
1				SS	3	425	25	
2				SS	4	450	17	
3		Greyish-brown		SS	5	450	18	
4				SS	6	450	18	
5				SS	7	450	18	
6	183.6							
	183.2	Grey, firm, moist, SILTY CLAY		SS	8	450	18	
7		End of Borehole at 6.5 m Borehole caved in at 5.8 m upon completion of drilling						
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 189, 188, 187, 186, 185, 184, 183, 182

BACKFILL SYMBOL
ASPHALT GROUT CONCRETE
BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor:
Drilling Method:
Completion Depth: 6.55 m

Logged By:
Reviewed By:
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Stantec

BOREHOLE RECORD

BH115-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **March 1, 2024**

BH COORDINATES [NAD83] 618135.0N 4771469.0E
WATER LEVEL: **N/A**

PROJECT NO. : **161414473**
BH ELEVATION: **189.366m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	189.4	Topsoil						
	188.9	Brown, stiff, moist, silty sand TOPSOIL with rootlets		SS	1	425	9	
1		Brown to greyish-brown, stiff to very stiff, dry to moist, SILTY CLAY - trace sand		SS	2	400	22	
2				SS	3	425	22	
3				SS	4	450	12	
4				SS	5	450	14	
5		Greyish-brown		SS	6	450	11	
6	183.3			SS	7	450	14	
	182.8	Grey, stiff, moist, SILTY CLAY		SS	8		10	
7		End of Borehole at 6.5 m						
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 189, 188, 187, 186, 185, 184, 183, 182

BACKFILL SYMBOL
ASPHALT GROUT CONCRETE
BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 6.55 m	Page 1 of 1

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Stantec

BOREHOLE RECORD

BH116-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **March 1, 2024**

BH COORDINATES [NAD83] 618036.0N 4771471.0E
WATER LEVEL: **N/A**

PROJECT NO. : **161414473**
BH ELEVATION: **189.686m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	189.7	Topsoil						
	189.2	Brown, stiff, moist, silty sand TOPSOIL with rootlets		SS	1	425	12	
1		Brown, stiff to very stiff, dry to moist, SILTY CLAY		SS	2	450	23	
2				SS	3	425	24	
				SS	4	450	16	
3				SS	5	450	13	
4				SS	6	425	12	
5				SS	7	450	11	
6	183.6							
		Brownish-grey, firm, moist, SILTY CLAY - Field vane max at 6.85 m		SS	8	450	7	
	182.8							
7		End of Borehole at 6.5 m						
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 189, 188, 187, 186, 185, 184, 183, 182

BACKFILL SYMBOL
ASPHALT GROUT CONCRETE
BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 6.85 m	Page 1 of 1

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BOREHOLE RECORD

BH117-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **189.65m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618465.0N 4771370.0E | DATUM: **Geodetic**

DATE BORED: **February 28, 2024** | WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	189.7	Topsoil						
0	189.2	Brown, stiff, dry, silty sand TOPSOIL with rootlets - some gravel		SS	1	457	15	
1		Brown to brownish-grey, very stiff to hard, dry to moist, SILTY CLAY - trace sand		SS	2	457	31	
2				SS	3	432	26	
3				SS	4	406	27	
4	185.8	Grey, firm, moist to wet, SILTY CLAY - trace gravel		SS	5	457	15	
5				SS	6	102	8	
6				SS	7	381	7	
7				SS	8	457	5	
8				SS	9	457	7	

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 189 188 187 186 185 184 183 182

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: | Logged By:

Drilling Method: | Reviewed By:

Completion Depth: 8.38 m | Page 1 of 2

BOREHOLE RECORD

BH117-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **February 28, 2024**

BH COORDINATES [NAD83] 618465.0N 4771370.0E
WATER LEVEL: **N/A**

PROJECT NO. : **161414473**
BH ELEVATION: **189.65m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
8	181.6	Grey, firm, moist to wet, SILTY CLAY - frequent rock fragments						
	181.3	End of Borehole Spoon and Auger Refusal due to inferred bedrock at 8.4 m		SS	10	0	50	
9								
10								
11								
12								
13								
14								
15								
16								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 181 180 179 178 177 176 175 174

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:
Drilling Method:
Completion Depth: 8.38 m

Logged By:
Reviewed By:

BOREHOLE RECORD

BH118-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **February 28, 2024**

BH COORDINATES [NAD83] 618337.0N 4771369.0E
WATER LEVEL: **N/A**

PROJECT NO. : **161414473**
BH ELEVATION: **190.57m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	190.6	Topsoil						
	190.1	Brown, stiff, moist, silty sand TOPSOIL with rootlets		SS	1	457	13	
1		Brown to brownish-grey, very stiff, dry to moist, SILTY CLAY - trace sand		SS	2	457	27	
				SS	3	432	27	
2				SS	4	457	21	
3				SS	5	457	19	
4				SS	6	457	17	
		Brownish-grey		SS	7	406	15	
5	185.6	Grey, stiff to very stiff, moist to wet, SILTY CLAY - frequent gravel and rock fragments below 7.6 m						
6				SS	8	381	11	
7								
8				SS	9	381	21	

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 190, 189, 188, 187, 186, 185, 184, 183

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:
Drilling Method:
Completion Depth: 9.45 m

Logged By:
Reviewed By:

Stantec

BOREHOLE RECORD

BH118-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **February 28, 2024**

BH COORDINATES [NAD83] 618337.0N 4771369.0E
WATER LEVEL: **N/A**

PROJECT NO. : **161414473**
BH ELEVATION: **190.57m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
8								
9	181.1			SS	10	152	50	
		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 9.5 m						
10								
11								
12								
13								
14								
15								
16								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 182 181 180 179 178 177 176 175

BACKFILL SYMBOL
ASPHALT GROUT CONCRETE
BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor:
Drilling Method:
Completion Depth: 9.45 m

Logged By:
Reviewed By:
Page 2 of 2

BOREHOLE RECORD

BH119-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **188.393m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618135.0N 4771372.0E | DATUM: **Geodetic**

DATE BORED: **February 27, 2024** | WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	188.4	Topsoil						
0	187.9	Brown, stiff, dry, silty sand TOPSOIL with rootlets		SS	1	381	10	
1		Brown, stiff to very stiff, moist, SILTY CLAY - trace sand		SS	2	356	17	
2				SS	3	432	22	
				SS	4	457	16	
3				SS	5	457	14	
	184.6							
4	184.2	Brown, stiff, moist, SILTY CLAY		SS	6	457	13	
		Grey to brownish-grey, firm to stiff, moist, SILTY CLAY		SS	7	457	10	
5								
6				SS	8	457	7	
7	181.1			SS	9	0	50	
		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 7.3 m						
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 188 187 186 185 184 183 182 181

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 7.32 m	Page 1 of 1

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BOREHOLE RECORD

BH120-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **189.233m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618033.0N 4771371.0E | DATUM: **Geodetic**

DATE BORED: **February 27, 2024** | WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	189.2	Topsoil						
0	188.8	Brown, very stiff, dry, silty sand TOPSOIL with rootlets		SS	1	381	18	
1		Brown to grey, stiff to very stiff, dry to moist, SILTY CLAY - trace sand		SS	2	406	22	
2				SS	3	432	24	
3				SS	4	457	22	
4				SS	5	356	17	
5				SS	6	457	12	
6	183.1			SS	7	432	19	
7		Brownish-grey, stiff, moist, SILTY CLAY		SS	8	457	10	
8	181.5	End of Borehole		SS	9	152	50	

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 189 188 187 186 185 184 183 182

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: | Logged By:

Drilling Method: | Reviewed By:

Completion Depth: 7.77 m | Page 1 of 2

Stantec

BOREHOLE RECORD

BH120-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **189.233m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618033.0N 4771371.0E | DATUM: **Geodetic**

DATE BORED: **February 27, 2024** | WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES: TYPE	SAMPLES: NUMBER	SAMPLES: RECOVERY (mm) or TCR %	SAMPLES: N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL / MONITOR WELL / PIEZOMETER	ELEVATION (m)
8		Spoon and Auger Refusal due to inferred bedrock at 7.8 m								181
9										180
10										179
11										178
12										177
13										176
14										175
15										174
16										

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m ●

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: | Logged By:

Drilling Method: | Reviewed By:

Completion Depth: 7.77 m | Page 2 of 2

Stantec

BOREHOLE RECORD

BH121-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **187.21m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 617939.0N 4771370.0E | DATUM: **Geodetic**

DATE BORED: **February 27, 2024** | WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	187.2	Topsoil						
0	186.8	Brown, stiff, dry, silty sand TOPSOIL with rootlets - some gravel		SS	1	356	13	
1		Brown to grey, stiff to very stiff, dry to moist, SILTY CLAY - trace sand		SS	2	356	20	
				SS	3	381	11	
2				SS	4	457	14	
3				SS	5	457	14	
	183.4							
4	182.6	Brown to grey, firm, moist, SILTY CLAY		SS	6	432	7	
	182.2	Brown to grey, firm, moist, SILTY CLAY - frequent rock fragments		SS	7	381	29	
5		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 5.0 m						
6								
7								
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m ●

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

187 186 185 184 183 182 181 180

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 5 m	Page 1 of 1

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BOREHOLE RECORD

BH122-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **189.005m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618333.0N 4771273.0E | DATUM: **Geodetic**

DATE BORED: **February 28, 2024** | WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	189.0	Topsoil						
0		Brown, stiff, dry, silty sand TOPSOIL with rootlets		SS	1	400	8	
	188.5	Brown, stiff to very stiff, dry to moist, SILTY CLAY - trace sand, gravel and rootlets						
1				SS	2	425	18	
				SS	3	450	18	
2				SS	4	450	16	
3				SS	5	450	14	
4				SS	6	450	15	
5				SS	7	375	14	
6				SS	8	450	28	
	182.5	End of Borehole at 6.5 m						
7								
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

189 188 187 186 185 184 183 182

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: | Logged By:

Drilling Method: | Reviewed By:

Completion Depth: 6.55 m | Page 1 of 1

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BOREHOLE RECORD

BH123-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **187.983m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618234.0N 4771271.0E | DATUM: **Geodetic**

DATE BORED: **February 29, 2024** | WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	188.0	Topsoil						
0	187.5	Brown, stiff, dry, silty sand TOPSOIL with rootlets		SS	1	450	8	
1		Brown to greyish-brown, stiff to hard, dry to moist, SILTY CLAY - trace sand and gravel		SS	2	450	22	
				SS	3	450	22	
2				SS	4	450	16	
3				SS	5	450	15	
4	183.4	Greyish-brown		SS	6	450	12	
5		Brown, stiff to hard, dry to moist, SILTY CLAY (POSSIBLE TILL) - frequent gravel		SS	7	450	14	
6	181.5			SS	8	375	55	
7		End of Borehole at 6.5 m						
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

187 186 185 184 183 182 181 180

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: | Logged By:

Drilling Method: | Reviewed By:

Completion Depth: 6.55 m | Page 1 of 1

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Stantec

BOREHOLE RECORD

BH124-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **February 29, 2024**

BH COORDINATES [NAD83] 618037.0N 4771273.0E
WATER LEVEL: **N/A**

PROJECT NO. : **161414473**
BH ELEVATION: **188.768m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	188.8	Topsoil						
	188.3	Brown, stiff, dry, silty sand TOPSOIL with rootlets		SS	1	450	9	
		Brown to greyish-brown, stiff to very stiff, dry to moist, SILTY CLAY - trace sand		SS	2	400	19	
1				SS	3	450	23	
2				SS	4	425	18	
3				SS	5	450	17	
4				SS	6	450	18	
		Greyish-brown		SS	7	450	12	
5								
6	182.2	Brown, stiff, wet, SILTY CLAY - frequent gravel		SS	8	400	15	
		End of Borehole at 6.5 m Borehole caved in at 5.5 m upon completion of drilling						
7								
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 188, 187, 186, 185, 184, 183, 182, 181

BACKFILL SYMBOL
ASPHALT GROUT CONCRETE
BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor:
Drilling Method:
Completion Depth: 6.55 m

Logged By:
Reviewed By:
Page 1 of 1

BOREHOLE RECORD

MW101-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **189.876m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618436.0N 4771278.0E | DATUM: **Geodetic**

DATE BORED: **February 29, 2024** | WATER LEVEL: **7.3 m on March 14, 2024**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	189.9	Topsoil						
	189.4	Brown, stiff, dry, silty sand TOPSOIL with rootlets		SS	1	375	9	
1		Brown to greyish-brown, stiff to very stiff, dry to moist, LEAN CLAY (CL) - trace sand		SS	2	400	22	
		Greyish-brown		SS	3	400	23	Sieve/Hydro at 1.8 m G 0% S 1% M 31% C 68%
2				SS	4	450	19	
3				SS	5	300	17	
4				SS	6	375	12	
				SS	7	450	12	
5	184.8	Brown to grey, stiff to hard, moist, SILTY CLAY - frequent gravel and rock fragments						
6				SS	8	450	8	
7								
				SS	9	450	31	
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m ●

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

189 188 187 186 185 184 183 182

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 11.4 m	Page 1 of 2

BOREHOLE RECORD

MW101-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **189.876m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618436.0N 4771278.0E | DATUM: **Geodetic**

DATE BORED: **February 29, 2024** | WATER LEVEL: **7.3 m on March 14, 2024**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
8	181.5	Spoon and Auger Refusal due to inferred bedrock at 9.6 m						
9		Very poor to good quality grey DOLOSTONE BEDROCK - highly to moderately weathered, flat to vertical orientation, rough irregular undulating to smooth undulating UCS = 131.4 MPa at 10.1 m		HQ	1	57%	0%	
10				HQ	2	100%	18%	
11	178.5			HQ	3	100%	85%	
12		End of Borehole at 11.4 m Water level encountered at 9.3 m upon completion of drilling						
13								
14								
15								
16								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m ●

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

181 180 179 178 177 176 175 174

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 11.4 m	Page 2 of 2

BOREHOLE RECORD

MW102-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **March 1, 2024**

BH COORDINATES [NAD83] 618468.0N 4771469.0E
WATER LEVEL: **2.7 m on March 14, 2024**

PROJECT NO. : **161414473**
BH ELEVATION: **189.646m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	189.6	Topsoil						
0	189.2	Brown, stiff, dry, silty sand TOPSOIL with rootlets		SS	1	425	10	
		Brown to greyish-brown, stiff to very stiff, dry to moist, SILTY CLAY - trace sand		SS	2	400	21	
1				SS	3	450	21	
2				SS	4	450	17	
3		Greyish-brown		SS	5	450	14	
4				SS	6	225	13	
5				SS	7	400	13	
6				SS	8	425	9	
7	182.0							
	181.9	Grey, firm, wet, SILTY CLAY frequent gravel and rock fragments						
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 189, 188, 187, 186, 185, 184, 183, 182

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:
Drilling Method:
Completion Depth: 7.77 m

Logged By:
Reviewed By:

Stantec

BOREHOLE RECORD

MW102-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **189.646m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618468.0N 4771469.0E | DATUM: **Geodetic**

DATE BORED: **March 1, 2024** | WATER LEVEL: **2.7 m on March 14, 2024**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES: TYPE	SAMPLES: NUMBER	SAMPLES: RECOVERY (mm) or TCR %	SAMPLES: N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL / MONITOR WELL / PIEZOMETER	ELEVATION (m)
8		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 7.8 m								181
9										180
10										179
11										178
12										177
13										176
14										175
15										174
16										

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m ●

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: | Logged By:

Drilling Method: | Reviewed By:

Completion Depth: 7.77 m | Page 2 of 2

BOREHOLE RECORD

MW103-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **188.976m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618434.0N 4771667.0E | DATUM: **Geodetic**

DATE BORED: **March 4, 2024** | WATER LEVEL: **5.5 m on March 14, 2024**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	189.0	Topsoil						
0		Brown, stiff, moist, silty sand TOPSOIL with rootlets		SS	1	400	8	
	188.5	Brown to greyish-brown, stiff to very stiff, moist, SILTY CLAY - trace sand - some gravel below 4.6 m		SS	2	425	17	
1				SS	3	425	19	
2				SS	4	450	15	
3				SS	5	450	17	
		Greyish-brown		SS	6	450	14	
4				SS	7	450	16	
5	183.5							
		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 5.5 m						
6								
7								
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m ●

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

188 187 186 185 184 183 182 181

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 5.49 m	Page 1 of 1

BOREHOLE RECORD

MW104-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **March 5, 2024**

BH COORDINATES [NAD83] 618584.0N 4771913.0E
PROJECT NO. : **161414473**
BH ELEVATION: **186.81m**
DATUM: **Geodetic**
WATER LEVEL: **5.2 m on March 14, 2024**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	186.8	Topsoil						
	186.4	Brown, stiff, moist, silty clay TOPSOIL with rootlets		SS	1	600	12	
1		Brown to reddish-brown, stiff to very stiff, moist, SILTY CLAY - trace sand, gravel and rootlets - frequent gravel and rock fragments below 4.6 m		SS	2	500	17	
2				SS	3	600	19	
3				SS	4	400	16	
4				SS	5	600	15	
5				SS	6	600	13	
	181.0	Reddish-brown		SS	7	375	16	
6		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 5.8 m Water level encountered at 5.5 m upon completion of drilling						
7								
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 186 185 184 183 182 181 180 179

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 5.79 m	Page 1 of 1

BOREHOLE RECORD

MW105-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **186.732m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618434.0N 4771865.0E | DATUM: **Geodetic**

DATE BORED: **March 5, 2024** | WATER LEVEL: **0.5 m on March 14, 2024**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	186.7	Topsoil						
0	186.3	Brown, stiff, moist, silty clay TOPSOIL with rootlets		SS	1	400	9	
1		Brown grey, stiff, moist, SILTY CLAY - trace sand, gravel and rootlets		SS	2	450	11	
2				SS	3	450	11	
				SS	4	400	9	
3	183.7	Brown grey, stiff, moist, SILTY CLAY - frequent gravel and rock fragments		SS	5	275		
4	182.6			SS	6	375		
	182.1	Spoon and Auger Refusal due to inferred bedrock at 4.2 m						
5		Fair to excellent grey DOLOSTONE BEDROCK - highly weathered, flat orientation, very wide spacing, smooth undulating UCS = 88.2 MPa at 5.6 m		HQ	1	100%	71%	
6								
7	179.3			HQ	2	100%	93%	
		End of Borehole at 7.4 m						
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m ●

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

186 185 184 183 182 181 180 179

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 7.44 m	Page 1 of 1

Stantec

BOREHOLE RECORD

MW106-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **188.523m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618264.0N 4771876.0E | DATUM: **Geodetic**

DATE BORED: **March 5, 2024** | WATER LEVEL: **March 14, 2024**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	188.5	Topsoil						
0	188.1	Brown, stiff, moist, silty clay TOPSOIL with rootlets		SS	1	375	27	
1		Grey to reddish-brown, stiff, dry to moist, SILTY CLAY - trace sand and gravel		SS	2	450	19	
2	186.2			SS	3	450	21	
		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 2.3 m						

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m ●

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 188, 187, 186, 185, 184, 183, 182, 181

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 2.26 m	Page 1 of 1

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BOREHOLE RECORD

MW107-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **March 4, 2024**

BH COORDINATES [NAD83] 618235.0N 4771569.0E
PROJECT NO. : **161414473**
BH ELEVATION: **190.142m**
DATUM: **Geodetic**
WATER LEVEL: **7.0 m on March 14, 2024**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	190.1	Topsoil						
0		Brown, stiff, moist, silty clay TOPSOIL with rootlets		SS	1	400	8	
	189.7	Brown to greyish-brown, very stiff, moist, SILTY CLAY - trace sand, gravel and rootlets		SS	2	375	23	
1								
		Greyish-brown		SS	3	425	28	
2				SS	4	450	29	
	187.1	Brownish-grey, stiff, moist, SILTY CLAY - trace sand		SS	5	450	15	
3				SS	6	450	12	
4	185.6	Brown to brownish-grey, very stiff, moist, SILTY CLAY - some sand		SS	7	450	18	
5								
		Brownish-grey		SS	8	450	15	
6								
7	182.8	End of Borehole Spoon and Auger Refusal due to inferred bedrock at 7.3 m						
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ■
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 190 189 188 187 186 185 184 183

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 7.32 m	Page 1 of 1

BOREHOLE RECORD

MW108-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **189.848m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618235.0N 4771370.0E | DATUM: **Geodetic**

DATE BORED: **February 28, 2024** | WATER LEVEL: **6.8 m on March 14, 2024**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	189.8	Topsoil						
0	189.4	Brown, stiff, moist, silty clay TOPSOIL with rootlets		SS	1	356	12	
1		Brown to greyish-brown, stiff to very stiff, moist, LEAN CLAY (CL) - trace sand, gravel and rootlets		SS	2	330	23	
2				SS	3	356	29	
				SS	4	381	19	
3				SS	5	381	12	
4				SS	6	406	13	Sieve/Hydro at 4.0 m G 1% S 3% M 46% C 50%
5				SS	7	457	14	
6	183.8							
		Brown to greyish-brown, stiff, moist, LEAN CLAY (CL) - frequent rock fragments below 7.6 m		SS	8	457	8	Sieve/Hydro at 6.3 m G 3% S 1% M 50% C 46%
7								
	181.9			SS	9	330	50	
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

189 188 187 186 185 184 183 182

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 7.92 m	Page 1 of 2

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BOREHOLE RECORD

MW108-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **189.848m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 618235.0N 4771370.0E | DATUM: **Geodetic**

DATE BORED: **February 28, 2024** | WATER LEVEL: **6.8 m on March 14, 2024**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
8	181.8	Spoon and Auger Refusal due to inferred bedrock at 7.9 m						
		Very poor to good quality grey DOLOSTONE BEDROCK - highly to moderately weathered, flat to vertical orientation, very close to close spacing, rough irregular undulating to smooth undulating UCS = 108.6 MPa at 8.2 m		HQ	1	100%	47%	
9		UCS = 81.9 MPa at 12.9 m		HQ	2	100%	85%	
10				HQ	3	88%	0%	
11								
12				HQ	4	100%	25%	
13	176.5	End of Borehole at 13.3 m						
14								
15								
16								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m ●

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

181 180 179 178 177 176 175 174

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 7.92 m	Page 2 of 2

BOREHOLE RECORD

MW109-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **March 4, 2024**

BH COORDINATES [NAD83] 617937.0N 4771568.0E
PROJECT NO. : **161414473**
BH ELEVATION: **188.67m**
DATUM: **Geodetic**
WATER LEVEL: **0.8 m on March 14, 2024**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	188.7	Topsoil						
0	188.2	Brown, stiff, moist, silty clay TOPSOIL with rootlets		SS	1	350	11	
1		Brown to greyish-brown, stiff to very stiff, dry to wet, LEAN CLAY (CL) - trace sand, gravel and rootlets - frequent rock fragments below 6.0 m		SS	2	400	17	
2				SS	3	450	20	
3				SS	4	450	15	Sieve/Hydro at 2.5 m G 0% S 1% M 43% C 56%
4		Greyish-brown		SS	5	450	23	
5				SS	6	450	10	
6	182.4			SS	7	450	17	
7		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 6.3 m		SS	8			
8								

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 188, 187, 186, 185, 184, 183, 182, 181

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:
Drilling Method:
Completion Depth: 6.25 m

Logged By:
Reviewed By:
Page 1 of 1

BOREHOLE RECORD

MW110-24

CLIENT: **Lockbridge Development Inc** | BH COORDINATES | PROJECT NO. : **161414473**

PROJECT: **Smithville 3A Block 9** | [NAD83] | BH ELEVATION: **186.902m**

LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON** | 617937.0N 4771277.0E | DATUM: **Geodetic**

DATE BORED: **February 28, 2024** | WATER LEVEL: **1.1 m on March 14, 2024**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	186.9	Topsoil						
	186.4	Brown, stiff, moist, silty clay TOPSOIL with rootlets		SS	1	457	10	
1		Brown to reddish-brown, stiff to hard, dry to moist, Sandy SILTY CLAY (CL-ML) - trace sand, gravel and rootlets - frequent rock fragments below 4.6 m		SS	2	457	22	
				SS	3	457	17	
2				SS	4	406	18	
3				SS	5	279	16	
4				SS	6	457	32	Sieve/Hydro at 4.0 m G 9% S 30% M 35% C 26%
				SS	7	229	23	
5	181.7			SS	8	178	50	
		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 5.2 m Water level encountered at 3.7 m upon completion of drilling						
6								
7								
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

186 185 184 183 182 181 180 179

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 5.18 m	Page 1 of 1

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BOREHOLE RECORD

MW111-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **February 29, 2024**

BH COORDINATES [NAD83] 618137.0N 4771272.0E
PROJECT NO. : **161414473**
BH ELEVATION: **188.444m**
DATUM: **Geodetic**
WATER LEVEL: **1.7 m on March 14, 2024**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
	188.4	Topsoil						
0	188.0	Brown, stiff, dry, silty sand TOPSOIL with rootlets		SS	1	425	10	
		Brown to greyish-brown, stiff to very stiff, moist, SILTY CLAY - trace sand, gravel and rootlets - frequent gravel below 6.1 m		SS	2	425	19	
1								
		Greyish-brown		SS	3	450	19	
2				SS	4	450	13	
3				SS	5	450	15	
4				SS	6	450	9	
		Brown		SS	7	450	15	
5								
6	182.2			SS	8			
		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 6.3 m						
7								
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 188, 187, 186, 185, 184, 183, 182, 181

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 6.25 m	Page 1 of 1

BOREHOLE RECORD

MW112-24

CLIENT: **Lockbridge Development Inc**
PROJECT: **Smithville 3A Block 9**
LOCATION: **Smithville 3A / Block Plan 9, Smithville, ON**
DATE BORED: **March 5, 2024**

BH COORDINATES [NAD83] 618569.0N 4771746.0E
WATER LEVEL: **4.7 m on March 14, 2024**

PROJECT NO. : **161414473**
BH ELEVATION: **188.143m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	188.1	Topsoil						
	187.7	Brown, stiff, moist, silty sand TOPSOIL with rootlets		SS	1	375	7	
1		Brown to reddish-brown, stiff to very stiff, moist to wet, SILTY CLAY - trace sand, gravel and rootlets - frequent gravel below 6.1 m		SS	2	400	15	
2				SS	3	425	22	
				SS	4	450	20	
3				SS	5	450	20	
4				SS	6	450	11	
				SS	7	425	14	
5								
6	181.7			SS	8			
		End of Borehole Spoon and Auger Refusal due to inferred bedrock at 6.4 m						
7								
8								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 188 187 186 185 184 183 182 181

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor:	Logged By:
Drilling Method:	Reviewed By:
Completion Depth: 6.4 m	Page 1 of 1

Stantec	Project No.: 161414473 Project Name: Smithville Block 9	Photos

Photo No. 1C:	MW101-24 -– Bedrock, Run 1: 8.36 m – 10.08 m, Run 2: 10.08 m to 10.71 m, Run 3: 10.71 m to 11.41 m

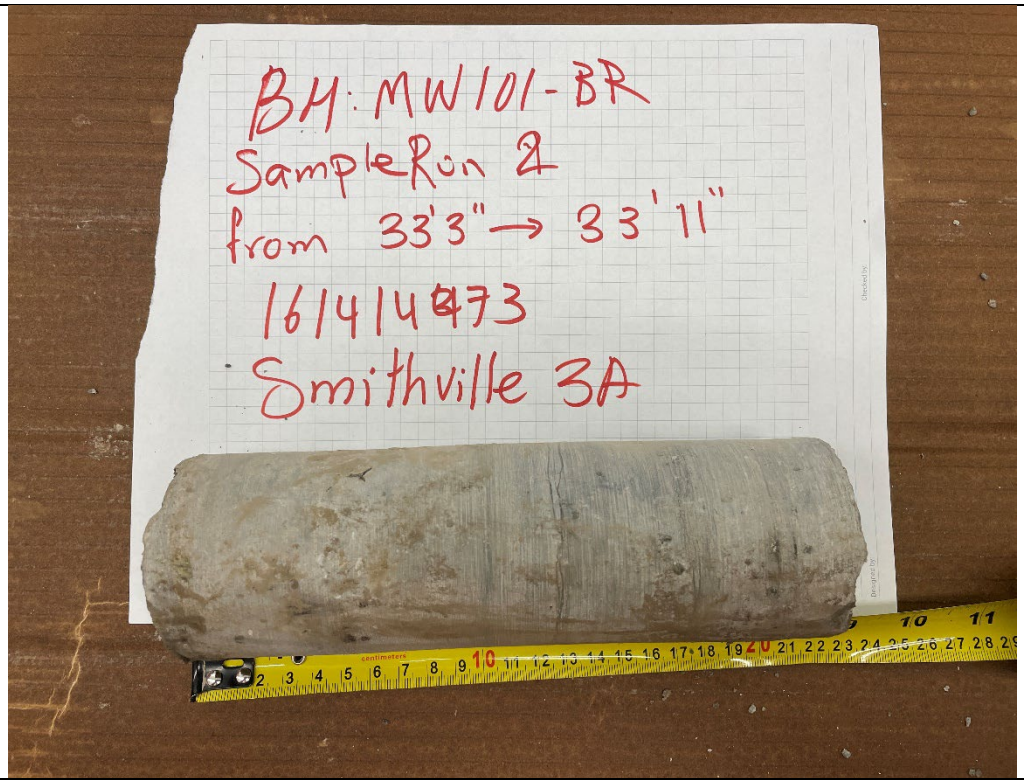


Photo No. 2C:	MW101-24 – Bedrock, Core Sample Extracted from Run 2, from 10.13 m to 10.33 m

Stantec	Project No.: 161414473 Project Name: Smithville Block 9	Photos

Photo No. 3C:	MW105-24– Bedrock, Run 1: 4.67 m – 6.19 m, Run 2: 6.19 m to 7.72 m

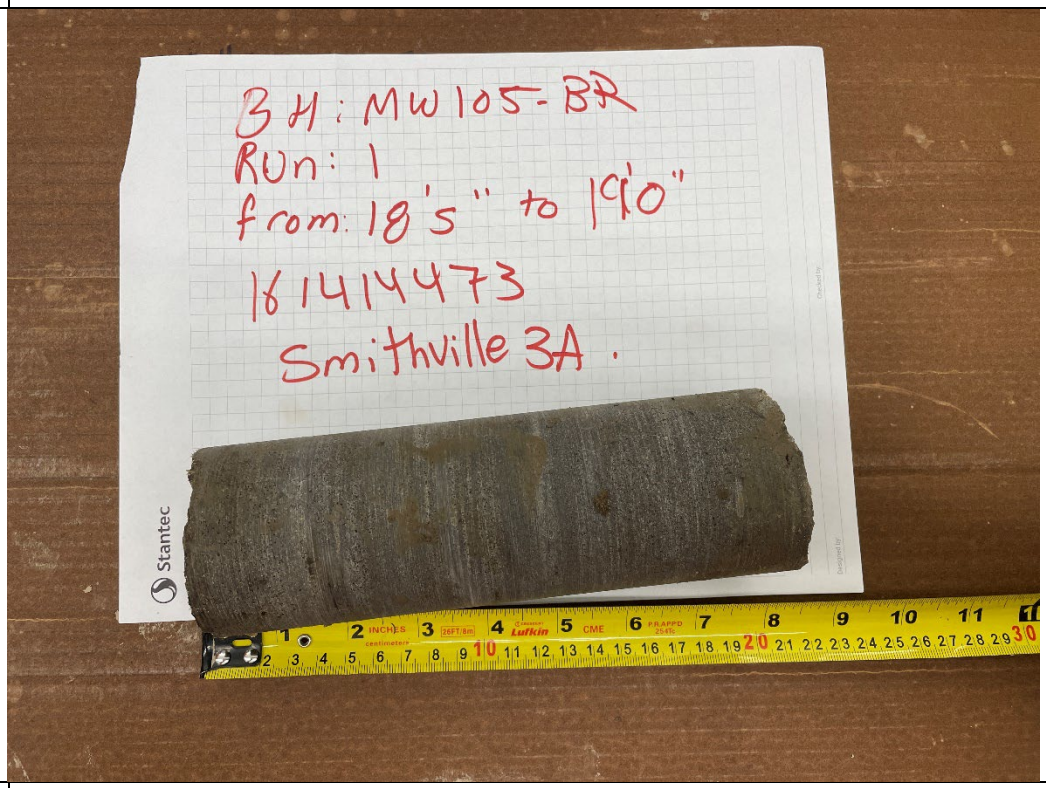


Photo No. 4C:	MH105-24 – Bedrock, Core Sample from Run 1, from 5.61 m to 5.79 m

Stantec	Project No.: 161414473	Photos
	Project Name: Smithville Block 9	

Photo No. 4C:	MW108-24 – Bedrock, Run1: 8.07 m – 9.19 m, Run 2: 9.19 m to 9.80 m

Photo No. 5C:	MW108-24 – Bedrock, Run 3: 9.80 m – 10.84 m, Run 4: 10.84 m to 11.07 m

Stantec	Project No.: 161414473 Project Name: Smithville Block 9	Photos

Photo No. 6C:	MW108-24 – Bedrock, Run 4 (continued): 11.07 m to 13.13 m

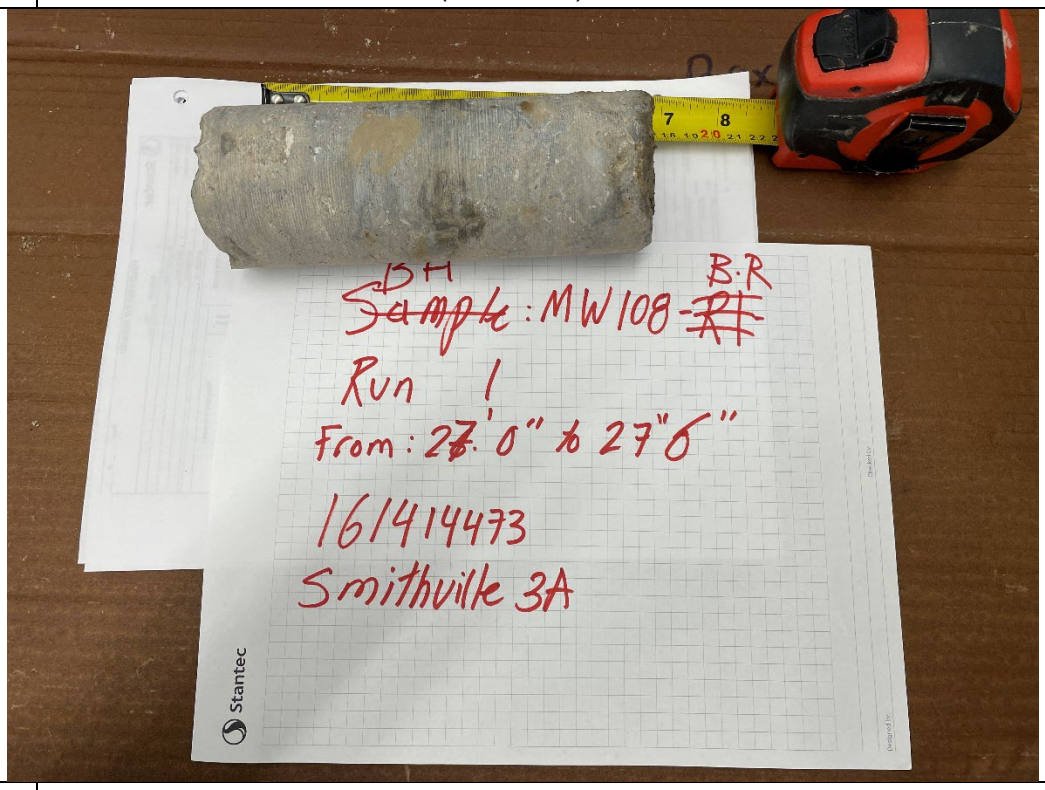


Photo No. 7C:	MH108-23 – Bedrock, Core Sample from Run 1, from 5.61 m to 5.79 m

Stantec	Project No.: 161414473	Photos
	Project Name: Smithville Block 9	

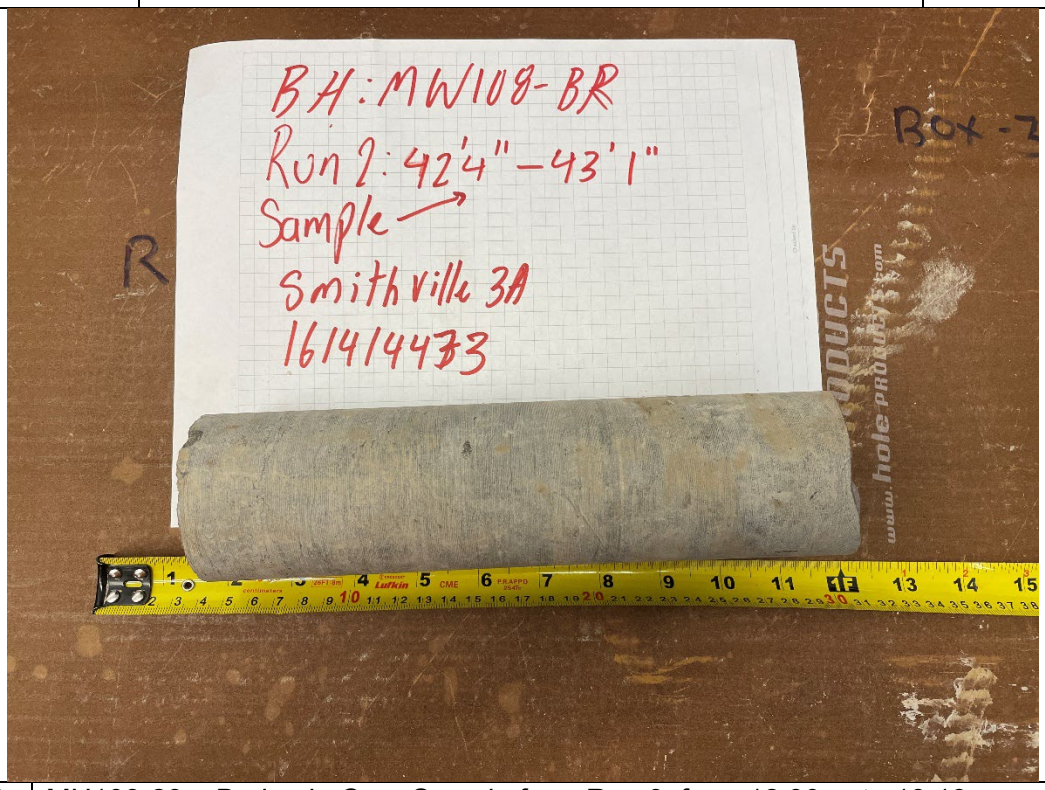
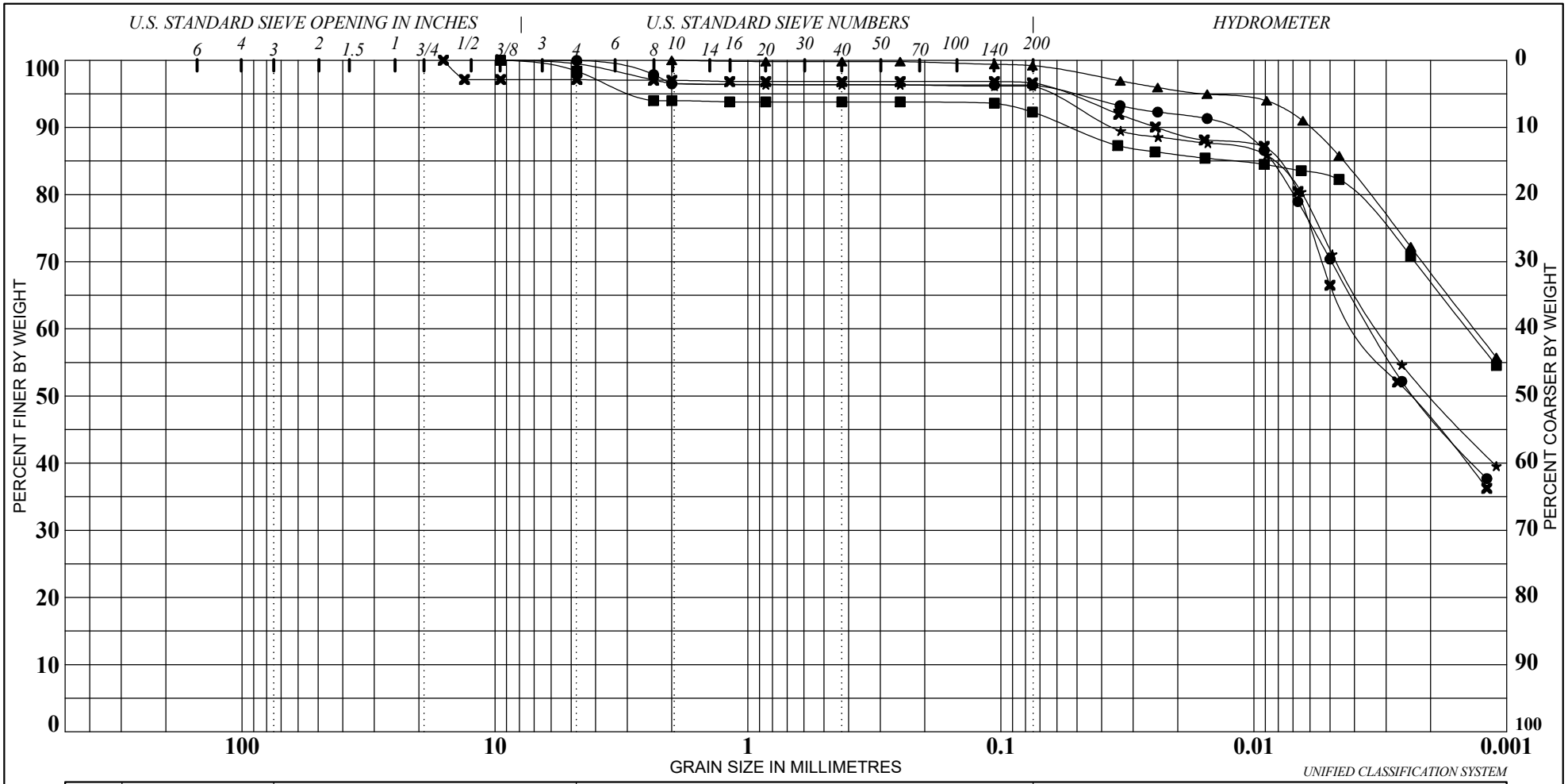


Photo No. 9C:	MH108-23 – Bedrock, Core Sample from Run 3, from 12.90 m to 13.13 m

APPENDIX D

D.1 LABORATORY TESTING RESULTS



UNIFIED CLASSIFICATION SYSTEM

BLDs	COBBLES	GRAVEL		SAND			SILT & CLAY	
		coarse	fine	coarse	medium	fine	SILT	CLAY

Sample		Depth (m)	Description	W%	W_L	W_P	I_P	%Gravel	%Sand	%Silt	%Clay
●	BH102-24	2.5	LEAN CLAY(CL)	24	41	22	19	0	4	49	47
■	BH106-24	1.8	LEAN CLAY(CL)	23				2	6	25	67
▲	MW101-24	1.8	LEAN CLAY(CL)	22				0	1	31	68
★	MW108-24	4.0	LEAN CLAY(CL)	26	41	23	18	1	3	46	50
✖	MW108-24	6.3	LEAN CLAY(CL)	28				3	1	50	46

Stantec

Project: Smithville Phase 3A / Block Plan

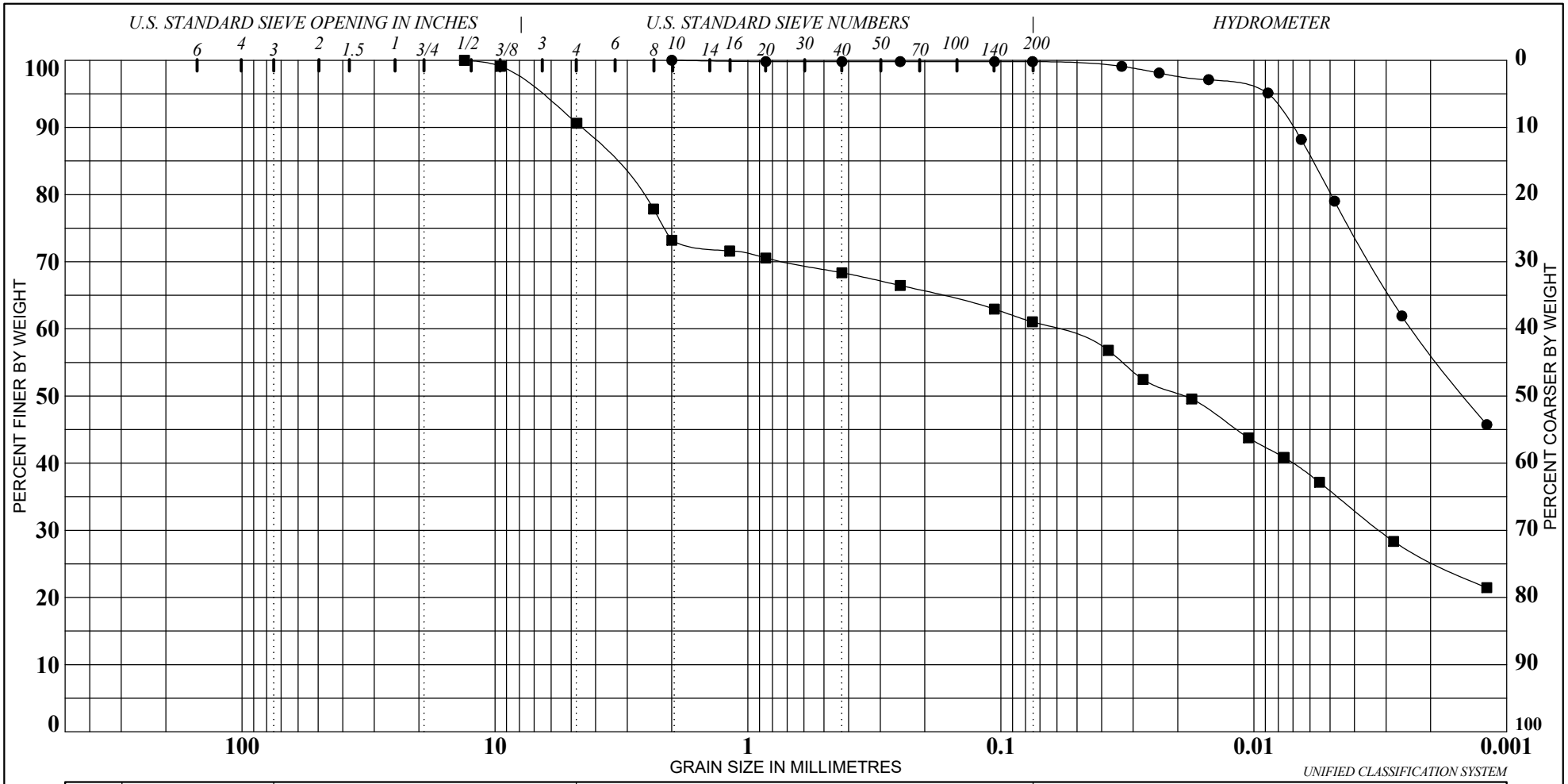
Location: Smithville Ontario

Project No.: 161414473

GRADATION CURVE (ASTM D422)

Figure: 1

Remarks:



BLDs	COBBLES	GRAVEL		SAND			SILT & CLAY	
		coarse	fine	coarse	medium	fine	SILT	CLAY

Sample	Depth (m)	Description	W%	W_L	W_P	I_P	%Gravel	%Sand	%Silt	%Clay
● MW109-24	2.5	LEAN CLAY(CL)	25				0	1	43	56
■ MW110-24	4.0	SANDY SILTY CLAY(CL-ML)	14				9	30	35	26

Stantec

Project: Smithville Phase 3A / Block Plan

Location: Smithville Ontario

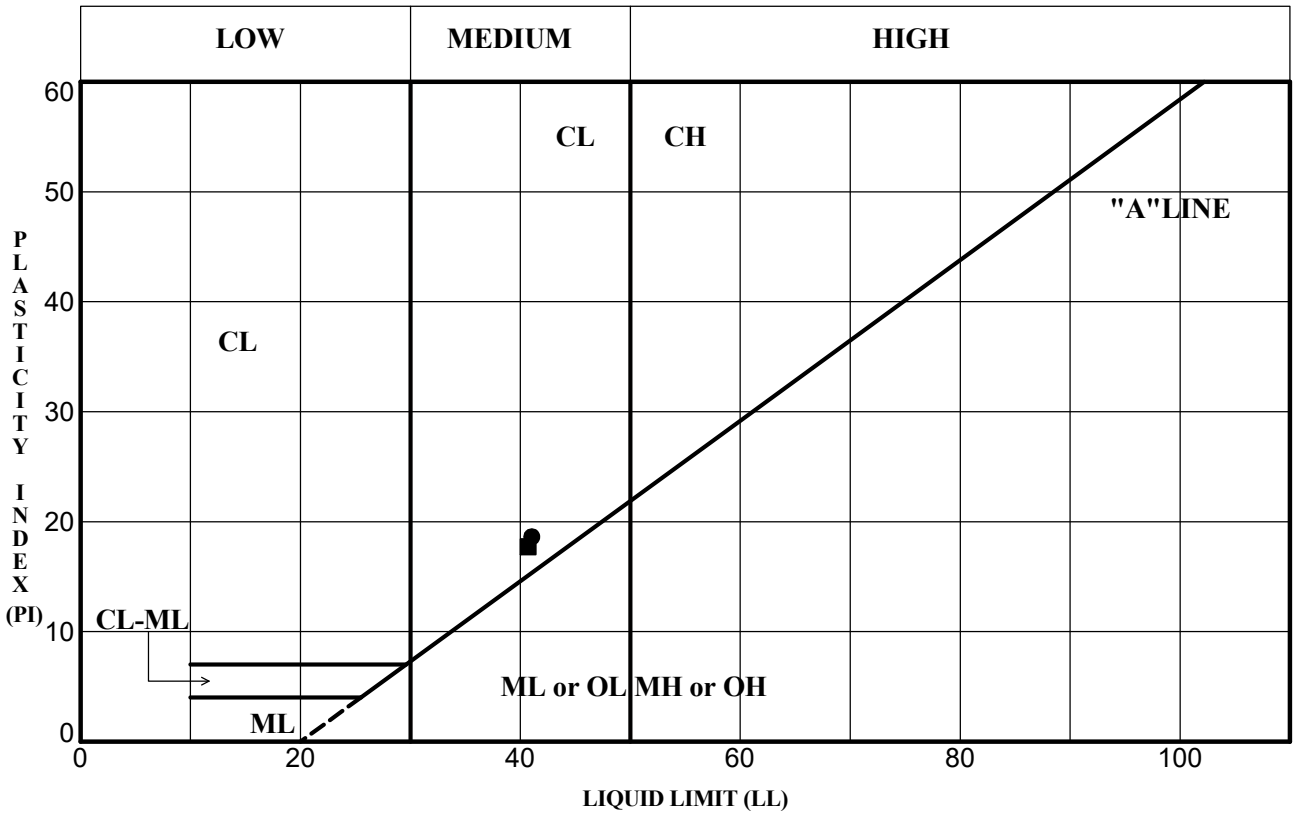
Project No.: 161414473

GRADATION CURVE (ASTM D422)

Figure: 2

Remarks:

PLASTICITY CHART



	Specimen	Depth (m)	LL	PL	PI	Fines	W%	Classification
●	BH102-24	2.5	41	22	19	96	24	LEAN CLAY(CL)
■	MW108-24	4.0	41	23	18	96	26	LEAN CLAY(CL)

Stantec

Project: Smithville Phase 3A / Block Plan

Location: Smithville Ontario

Project No.: 161414473

ATTERBERG LIMITS
(ASTM D4318)

Figure: 3

Remarks:

PROJECT # 161414473

LAB#: 1303

DATE: Mar.22,2024

PROJECT: **Smithville Phase 3/A**

MOISTURE CONTENT

BH	DEPTH (ft)	SAMPLE	Moisture Content %
MW109-24	0.75	1	26.8
MW109-24	3.25	2	24.3
MW109-24	5.75	3	N/A
MW109-24	8.25	4	25.3
MW109-24	10.75	5	23.5
MW109-24	13.25	6	26.2
MW109-24	15.75	7	12.1
MW109-24	20.75	8	8.1
BH102-24	0.75	1	26.4
BH102-24	3.25	2	22.1
BH102-24	5.75	3	24.0
BH102-24	8.25	4	23.8
BH102-24	10.75	5	26.0
BH102-24	13.25	6	30.4
BH102-24	15.5	7a	28.0
BH102-24	16	7b	31.1
MW110-24	0.75	1	25.3
MW110-24	3.25	2	18.6
MW110-24	5.75	3	22.9
MW110-24	8.25	4	N/A
MW110-24	10.75	5	10.6
MW110-24	13.25	6	14.2
MW110-24	15.75	7	10.7
MW108-24	0.75	1	25.7
MW108-24	3.25	2	24.1
MW108-24	5.75	3	22.7
MW108-24	8.25	4	28.3
MW108-24	10.75	5	N/A
MW108-24	13.25	6	25.8
MW108-24	15.75	7	22.9
MW108-24	20.75	8	28.1

PROJECT # 161414473

LAB#: 1303

DATE: Mar.22,2024

PROJECT: **Smithville Phase 3/A**

MOISTURE CONTENT

BH	DEPTH (ft)	SAMPLE	Moisture Content %
MW108-24	25.75	9	9.7
BH109-24	0.75	1	27.0
BH109-24	3.25	2	22.6
BH109-24	5.75	3	22.5
BH109-24	8.25	4	22.7
BH109-24	10.75	5	24.2
BH109-24	13.25	6	26.9
BH109-24	15.75	7	29.9
BH109-24	20.75	8	31.1
MW101-24	0.75	1	30.0
MW101-24	3.25	2	22.7
MW101-24	5.75	3	21.6
MW101-24	8.25	4	N/A
MW101-24	10.75	5	24.9
MW101-24	13.25	6	22.9
MW101-24	15.75	7	10.5
MW101-24	20.75	8	26.8
MW101-24	25.75	9	23.5
MW101-24	30.75	10	9.8
BH106-24	0.75	1	27.2
BH106-24	3.25	2	22.0
BH106-24	5.75	3	22.9
BH106-24	8.25	4	24.9
BH106-24	10.75	5	25.1
BH106-24	13.25	6	28.9
BH106-24	15.75	7	26.9
BH106-24	20.75	8	13.6

Stantec

ROCK CORE UNCONFINED COMPRESSIVE STRENGTH

Client:
Project:
Material Description:
Date Tested: Mar.22,2024

Project No.: 161414473
Lab No.: 1303
Tested By: N. Amirtharaj

MW108-24(BR)	Run1	27'-27'6"
		Average
LENGTH (mm)	129.2	129.6
	129.8	
	129.7	
DIAMETER (mm)	63.2	63.1
	62.9	
	63.1	
L/D	2.05	
Area m^2	0.0031223	
WEIGHT (kg)	1.126	
Volume (m^3)	0.0004045	
Unit Weight (kg/m^3)	2783	
LOAD	(lb)	76198
	N	338944.0
	MPa	**108.6**

MW108-24(BR)	Run2	42'4"-43'1"
LENGTH (mm)	128.8	128.6
	128.4	
	128.7	
DIAMETER (mm)	63.3	63.2
	63.2	
	63.2	
L/D	2.03	
Area m^2	0.0031388	
WEIGHT (kg)	1.099	
Volume (m^3)	0.0004038	
Unit Weight (kg/m^3)	2723	
LOAD	(lb)	57819
	N	257190.5
	MPa	**81.9**

MW105-24(BR)	Run1	18'5"-19'
		Average
LENGTH (mm)	131.7	131.6
	131.3	
	131.9	
DIAMETER (mm)	63.3	63.2
	63.2	
	63.2	
L/D	2.08	
Area m^2	0.00313879	
WEIGHT (g)	1.086	
Volume (m3)	0.00041317	
Unit Weight (kg/m3)	2628	
LOAD	(lb)	62209
	N	276718.1
	MPa	**88.2**

Stantec

ROCK CORE UNCONFINED COMPRESSIVE STRENGTH

Client:
Project:
Material Description:
Date Tested: Mar.22,2024

Project No.: 161414473
Lab No.: 1303
Tested By: N. Amirtharaj

MW101-24(BR)	**Run2**	**33'3"-33'11"**
		Average
LENGTH (mm)	131.1	130.8
	130.2	
	131	
DIAMETER (mm)	63.3	63.2
	63.1	
	63.2	
L/D	2.07	
Area m²	0.0031355	
WEIGHT (kg)	1.126	
Volume (m³)	0.00041	
Unit Weight (kg/m³)	2746	
LOAD	(lb)	92642
	N	412090.2
	MPa	**131.4**

		Average
LENGTH (mm)		#DIV/0!
DIAMETER (mm)		#DIV/0!
L/D	#DIV/0!	
Area m²	#DIV/0!	
WEIGHT (kg)		
Volume (m³)	#DIV/0!	
Unit Weight (kg/m³)	#DIV/0!	
LOAD	(lb)	
	N	0.0
	MPa	**#DIV/0!**

		Average
LENGTH (mm)		#DIV/0!
DIAMETER (mm)		#DIV/0!
L/D	#DIV/0!	
Area m²	#DIV/0!	
WEIGHT (g)		
Volume (m3)	#DIV/0!	
Unit Weight (kg/m3)	#DIV/0!	
LOAD	(lb)	
	N	0.0
	MPa	**#DIV/0!**

CERTIFICATE OF ANALYSIS

Work Order	: **WT2405341**	Page	: 1 of 4
Client	: **Stantec Consulting Ltd.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Essa Nimer	Account Manager	: Mathy Mahadeva
Address	: 100-300 Hagey Blvd. Waterloo ON Canada N2L 0A4	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: ----	Telephone	: +1 519 886 6910
Project	: 161414473.800.1	Date Samples Received	: 11-Mar-2024 08:00
PO	: ----	Date Analysis Commenced	: 12-Mar-2024
C-O-C number	: ----	Issue Date	: 19-Mar-2024 21:10
Sampler	: CLIENT		
Site	: ----		
Quote number	: Stantec 2024-2027 Standing Offer		
No. of samples received	: 6		
No. of samples analysed	: 6		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Greg Pokocky	Manager - Inorganics	Inorganics, Waterloo, Ontario
Josphin Masihi	Analyst	Centralized Prep, Waterloo, Ontario
Nik Perkio	Inorganics Analyst	Inorganics, Waterloo, Ontario

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
µS/cm	microsiemens per centimetre
mg/kg	milligrams per kilogram
mV	millivolts
ohm cm	ohm centimetres (resistivity)
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	MW109-24-S3-5'-6.5'	MW110-24-S4-7.5'-9'	MW101-24-S4-7.5'-9'	MW108-24-S5-10'-11.5'	BH101-24-S3-5'-6.5'
					Client sampling date / time	04-Mar-2024 10:30	28-Feb-2024 10:00	29-Feb-2024 11:00	28-Feb-2024 12:00	05-Mar-2024 13:30
						WT2405341-001	WT2405341-002	WT2405341-003	WT2405341-004	WT2405341-005
						Result	Result	Result	Result	Result
Physical Tests										
Conductivity (1:2 leachate)	----	E100-L/WT	5.00	µS/cm		310	435	768	207	167
Moisture	----	E144/WT	0.25	%		19.1	19.2	20.4	20.8	19.3
Oxidation-reduction potential [ORP]	----	E125/WT	0.10	mV		296	305	307	290	283
pH (1:2 soil:CaCl2-aq)	----	E108A/WT	0.10	pH units		7.81	7.84	7.88	7.80	7.76
Resistivity	----	EC100R/WT	100	ohm cm		3220	2300	1300	4830	5990
Inorganics										
Sulfides, acid volatile	----	E396-L/WT	0.20	mg/kg		0.90	0.85	0.50	1.11	0.66
Leachable Anions & Nutrients										
Chloride, soluble ion content	16887-00-6	E236.Cl/WT	5.0	mg/kg		6.6	5.3	<5.0	<5.0	<5.0
Sulfate, soluble ion content	14808-79-8	E236.SO4/WT	20	mg/kg		211	336	913	67	<20

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: Soil (Matrix: Soil/Solid)					Client sample ID	BH104-24-S5-1 0'-11.5'	----	----	----	----
					Client sampling date / time	05-Mar-2024 08:30	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		WT2405341-006	--------	--------	--------	--------
						Result	----	----	----	----
Physical Tests										
Conductivity (1:2 leachate)	----	E100-L/WT	5.00	µS/cm		959	----	----	----	----
Moisture	----	E144/WT	0.25	%		21.2	----	----	----	----
Oxidation-reduction potential [ORP]	----	E125/WT	0.10	mV		291	----	----	----	----
pH (1:2 soil:CaCl2-aq)	----	E108A/WT	0.10	pH units		7.71	----	----	----	----
Resistivity	----	EC100R/WT	100	ohm cm		1040	----	----	----	----
Inorganics										
Sulfides, acid volatile	----	E396-L/WT	0.20	mg/kg		<0.26	----	----	----	----
Leachable Anions & Nutrients										
Chloride, soluble ion content	16887-00-6	E236.Cl/WT	5.0	mg/kg		<5.0	----	----	----	----
Sulfate, soluble ion content	14808-79-8	E236.SO4/WT	20	mg/kg		1010	----	----	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

ALS Canada Ltd.

right solutions.
right partner.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WT2405341**	Page	: 1 of 11
Client	: **Stantec Consulting Ltd.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Essa Nimer	Account Manager	: Mathy Mahadeva
Address	: 100-300 Hagey Blvd. Waterloo ON Canada N2L 0A4	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: ----	Telephone	: +1 519 886 6910
Project	: 161414473.800.1	Date Samples Received	: 11-Mar-2024 08:00
PO	: ----	Issue Date	: 19-Mar-2024 21:11
C-O-C number	: ----		
Sampler	: CLIENT		
Site	: ----		
Quote number	: Stantec 2024-2027 Standing Offer		
No. of samples received	: 6		
No. of samples analysed	: 6		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- Duplicate outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Inorganics	WT2405341-005	BH101-24-S3-5'-6.5'	Sulfides, acid volatile	----	E396-L	0.66 % DUP-H	Diff <2x LOR	Low Level DUP DQO exceeded (difference > 2 LOR).

Result Qualifiers

Qualifier	Description
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / **Container / Client Sample ID(s)**	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
			Preparation Date	*Holding Times* Rec	*Holding Times* Actual	*Eval*	*Analysis Date*	*Holding Times* Rec	*Holding Times* Actual	*Eval*
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
LDPE bag MW109-24-S3-5'-6.5'	E396-L	04-Mar-2024	15-Mar-2024	0 hrs	267 hrs	× UCP	15-Mar-2024	0 hrs	267 hrs	× UCP
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
LDPE bag BH101-24-S3-5'-6.5'	E396-L	05-Mar-2024	19-Mar-2024	0 hrs	339 hrs	× UCP	19-Mar-2024	0 hrs	339 hrs	× UCP
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
LDPE bag BH104-24-S5-10'-11.5'	E396-L	05-Mar-2024	19-Mar-2024	0 hrs	344 hrs	× UCP	19-Mar-2024	0 hrs	344 hrs	× UCP
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
LDPE bag MW101-24-S4-7.5'-9'	E396-L	29-Feb-2024	15-Mar-2024	0 hrs	363 hrs	× UCP	15-Mar-2024	0 hrs	363 hrs	× UCP
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
LDPE bag MW108-24-S5-10'-11.5'	E396-L	28-Feb-2024	15-Mar-2024	0 hrs	386 hrs	× UCP	15-Mar-2024	0 hrs	386 hrs	× UCP
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
LDPE bag MW110-24-S4-7.5'-9'	E396-L	28-Feb-2024	15-Mar-2024	0 hrs	388 hrs	× UCP	15-Mar-2024	0 hrs	388 hrs	× UCP
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
LDPE bag BH101-24-S3-5'-6.5'	E236.Cl	05-Mar-2024	19-Mar-2024	30 days	14 days	✓	19-Mar-2024	28 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
LDPE bag BH104-24-S5-10'-11.5'	E236.Cl	05-Mar-2024	19-Mar-2024	30 days	14 days	✓	19-Mar-2024	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
LDPE bag MW109-24-S3-5'-6.5'	E236.Cl	04-Mar-2024	19-Mar-2024	30 days	15 days	✓	19-Mar-2024	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
LDPE bag MW101-24-S4-7.5'-9'	E236.Cl	29-Feb-2024	19-Mar-2024	30 days	19 days	✓	19-Mar-2024	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
LDPE bag MW108-24-S5-10'-11.5'	E236.Cl	28-Feb-2024	19-Mar-2024	30 days	20 days	✓	19-Mar-2024	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
LDPE bag MW110-24-S4-7.5'-9'	E236.Cl	28-Feb-2024	19-Mar-2024	30 days	20 days	✓	19-Mar-2024	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
LDPE bag BH101-24-S3-5'-6.5'	E236.SO4	05-Mar-2024	19-Mar-2024	30 days	14 days	✓	19-Mar-2024	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
LDPE bag BH104-24-S5-10'-11.5'	E236.SO4	05-Mar-2024	19-Mar-2024	30 days	14 days	✓	19-Mar-2024	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
LDPE bag MW109-24-S3-5'-6.5'	E236.SO4	04-Mar-2024	19-Mar-2024	30 days	15 days	✓	19-Mar-2024	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
LDPE bag MW101-24-S4-7.5'-9'	E236.SO4	29-Feb-2024	19-Mar-2024	30 days	19 days	✓	19-Mar-2024	28 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
LDPE bag										
MW108-24-S5-10'-11.5'	E236.SO4	28-Feb-2024	19-Mar-2024	30 days	20 days	✓	19-Mar-2024	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
LDPE bag										
MW110-24-S4-7.5'-9'	E236.SO4	28-Feb-2024	19-Mar-2024	30 days	20 days	✓	19-Mar-2024	28 days	0 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
LDPE bag										
BH101-24-S3-5'-6.5'	E100-L	05-Mar-2024	18-Mar-2024	30 days	12 days	✓	18-Mar-2024	30 days	13 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
LDPE bag										
BH104-24-S5-10'-11.5'	E100-L	05-Mar-2024	18-Mar-2024	30 days	13 days	✓	18-Mar-2024	30 days	13 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
LDPE bag										
MW109-24-S3-5'-6.5'	E100-L	04-Mar-2024	18-Mar-2024	30 days	14 days	✓	18-Mar-2024	30 days	14 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
LDPE bag										
MW101-24-S4-7.5'-9'	E100-L	29-Feb-2024	18-Mar-2024	30 days	18 days	✓	18-Mar-2024	30 days	18 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
LDPE bag										
MW108-24-S5-10'-11.5'	E100-L	28-Feb-2024	18-Mar-2024	30 days	18 days	✓	18-Mar-2024	30 days	19 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
LDPE bag										
MW110-24-S4-7.5'-9'	E100-L	28-Feb-2024	18-Mar-2024	30 days	19 days	✓	18-Mar-2024	30 days	19 days	✓
Physical Tests : Moisture Content by Gravimetry										
LDPE bag										
MW101-24-S4-7.5'-9'	E144	29-Feb-2024	----	----	----		12-Mar-2024	----	12 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag MW108-24-S5-10'-11.5'	E144	28-Feb-2024	----	----	----		12-Mar-2024	----	13 days	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag MW110-24-S4-7.5'-9'	E144	28-Feb-2024	----	----	----		12-Mar-2024	----	13 days	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BH101-24-S3-5'-6.5'	E144	05-Mar-2024	----	----	----		12-Mar-2024	----	7 days	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BH104-24-S5-10'-11.5'	E144	05-Mar-2024	----	----	----		12-Mar-2024	----	7 days	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag MW109-24-S3-5'-6.5'	E144	04-Mar-2024	----	----	----		12-Mar-2024	----	8 days	
Physical Tests : ORP by Electrode										
LDPE bag BH101-24-S3-5'-6.5'	E125	05-Mar-2024	15-Mar-2024	180 days	10 days	✓	18-Mar-2024	180 days	13 days	✓
Physical Tests : ORP by Electrode										
LDPE bag BH104-24-S5-10'-11.5'	E125	05-Mar-2024	15-Mar-2024	180 days	10 days	✓	18-Mar-2024	180 days	13 days	✓
Physical Tests : ORP by Electrode										
LDPE bag MW109-24-S3-5'-6.5'	E125	04-Mar-2024	15-Mar-2024	180 days	11 days	✓	18-Mar-2024	180 days	14 days	✓
Physical Tests : ORP by Electrode										
LDPE bag MW101-24-S4-7.5'-9'	E125	29-Feb-2024	15-Mar-2024	180 days	15 days	✓	18-Mar-2024	180 days	18 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : ORP by Electrode										
LDPE bag MW108-24-S5-10'-11.5'	E125	28-Feb-2024	15-Mar-2024	180 days	16 days	✓	18-Mar-2024	180 days	19 days	✓
Physical Tests : ORP by Electrode										
LDPE bag MW110-24-S4-7.5'-9'	E125	28-Feb-2024	15-Mar-2024	180 days	16 days	✓	18-Mar-2024	180 days	19 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
LDPE bag BH101-24-S3-5'-6.5'	E108A	05-Mar-2024	15-Mar-2024	30 days	10 days	✓	18-Mar-2024	30 days	13 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
LDPE bag BH104-24-S5-10'-11.5'	E108A	05-Mar-2024	15-Mar-2024	30 days	10 days	✓	18-Mar-2024	30 days	13 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
LDPE bag MW109-24-S3-5'-6.5'	E108A	04-Mar-2024	15-Mar-2024	30 days	11 days	✓	18-Mar-2024	30 days	14 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
LDPE bag MW101-24-S4-7.5'-9'	E108A	29-Feb-2024	15-Mar-2024	30 days	15 days	✓	18-Mar-2024	30 days	18 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
LDPE bag MW108-24-S5-10'-11.5'	E108A	28-Feb-2024	15-Mar-2024	30 days	16 days	✓	18-Mar-2024	30 days	19 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
LDPE bag MW110-24-S4-7.5'-9'	E108A	28-Feb-2024	15-Mar-2024	30 days	16 days	✓	18-Mar-2024	30 days	19 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1372120	2	19	10.5	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1367552	1	13	7.6	5.0	✓
Moisture Content by Gravimetry	E144	1363719	1	19	5.2	5.0	✓
ORP by Electrode	E125	1368353	1	16	6.2	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1367727	1	20	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1371133	1	14	7.1	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	1371134	1	14	7.1	5.0	✓
Laboratory Control Samples (LCS)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1372120	2	19	10.5	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1367552	2	13	15.3	10.0	✓
Moisture Content by Gravimetry	E144	1363719	1	19	5.2	5.0	✓
ORP by Electrode	E125	1368353	1	16	6.2	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1367727	1	20	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1371133	2	14	14.2	10.0	✓
Water Extractable Sulfate by IC	E236.SO4	1371134	2	14	14.2	10.0	✓
Method Blanks (MB)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1372120	2	19	10.5	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1367552	1	13	7.6	5.0	✓
Moisture Content by Gravimetry	E144	1363719	1	19	5.2	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1371133	1	14	7.1	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	1371134	1	14	7.1	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L ALS Environmental - Waterloo	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Conductance is measured in the fluid that is observed in the upper layer.
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A ALS Environmental - Waterloo	Soil/Solid	MECP E3530	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) and is carried out in accordance with procedures described in the Analytical Protocol (prescriptive method). A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling, or decanting and then analyzed using a pH meter and electrode. This method is equivalent to ASTM D4972 and is acceptable for topsoil analysis.
ORP by Electrode	E125 ALS Environmental - Waterloo	Soil/Solid	APHA 2580 (mod)	Oxidation Redution Potential (ORP) is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed in the analysis, measured in mV.
Moisture Content by Gravimetry	E144 ALS Environmental - Waterloo	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Water Extractable Chloride by IC	E236.Cl ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Water Extractable Sulfate by IC	E236.SO4 ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L ALS Environmental - Waterloo	Soil/Solid	APHA 4500S2J	This analysis is carried out in accordance with the method described in APHA 4500 S2-J. After extraction the Acid Volatile Sulphide is determined colourimetrically.
Resistivity Calculation for Soil Using E100-L	EC100R ALS Environmental - Waterloo	Soil/Solid	APHA 2510 B	Soil Resistivity (calculated) is determined as the inverse of the conductivity of a 2:1 water:soil leachate (dry weight). This method is intended as a rapid approximation for Soil Resistivity. Where high accuracy results are required, direct measurement of Soil Resistivity by the Wenner Four-Electrode Method (ASTM G57) is recommended.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 ALS Environmental - Waterloo	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Leach 1:2 Soil : 0.01CaCl2 - As Received for pH	EP108A ALS Environmental - Waterloo	Soil/Solid	MOEE E3137A	A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
Preparation of ORP by Electrode	EP125 ALS Environmental - Waterloo	Soil/Solid	APHA 2580 (mod)	Field-moist sample is extracted in a 1:2 ratio with DI water and then analyzed by ORP meter.
Anions Leach 1:10 Soil:Water (Dry)	EP236 ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	5 grams of dried soil is mixed with 50 grams of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.
Distillation for Acid Volatile Sulfide in Soil	EP396-L ALS Environmental - Waterloo	Soil/Solid	APHA 4500S2J	Acid Volatile Sulfide is determined by colourimetric measurement on a sediment sample that has been treated with hydrochloric acid within a purge and trap system, where the evolved hydrogen sulfide gas is carried into a basic solution by argon gas for analysis.

QUALITY CONTROL REPORT

Work Order	: **WT2405341**	Page	: 1 of 6
Client	: Stantec Consulting Ltd.	Laboratory	: ALS Environmental - Waterloo
Contact	: Essa Nimer	Account Manager	: Mathy Mahadeva
Address	: 100-300 Hagey Blvd. Waterloo ON Canada N2L 0A4	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	:	Telephone	: +1 519 886 6910
Project	: 161414473.800.1	Date Samples Received	: 11-Mar-2024 08:00
PO	: ----	Date Analysis Commenced	: 12-Mar-2024
C-O-C number	: ----	Issue Date	: 19-Mar-2024 21:11
Sampler	: CLIENT ----		
Site	: ----		
Quote number	: Stantec 2024-2027 Standing Offer		
No. of samples received	: 6		
No. of samples analysed	: 6		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Greg Pokocky	Manager - Inorganics	Waterloo Inorganics, Waterloo, Ontario
Josphin Masihi	Analyst	Waterloo Centralized Prep, Waterloo, Ontario
Nik Perkio	Inorganics Analyst	Waterloo Inorganics, Waterloo, Ontario

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 1363719)											
VA24A4790-003	Anonymous	Moisture	----	E144	0.25	%	7.32	7.28	0.488%	20%	----
Physical Tests (QC Lot: 1367552)											
WT2405341-001	MW109-24-S3-5'-6.5'	Conductivity (1:2 leachate)	----	E100-L	5.00	µS/cm	310	312	0.643%	20%	----
Physical Tests (QC Lot: 1367727)											
WT2403953-004	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108A	0.10	pH units	8.23	8.26	0.364%	5%	----
Physical Tests (QC Lot: 1368353)											
WT2405341-001	MW109-24-S3-5'-6.5'	Oxidation-reduction potential [ORP]	----	E125	0.10	mV	296	297	0.337%	25%	----
Inorganics (QC Lot: 1367697)											
WT2405332-004	Anonymous	Sulfides, acid volatile	----	E396-L	0.22	mg/kg	0.29	0.30	0.01	Diff <2x LOR	----
Inorganics (QC Lot: 1372120)											
WT2405341-005	BH101-24-S3-5'-6.5'	Sulfides, acid volatile	----	E396-L	0.25	mg/kg	0.66	# <0.25	0.66	Diff <2x LOR	DUP-H
Leachable Anions & Nutrients (QC Lot: 1371133)											
WT2405336-001	Anonymous	Chloride, soluble ion content	16887-00-6	E236.Cl	5.0	mg/kg	14.4	14.8	0.3	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1371134)											
WT2405336-001	Anonymous	Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	178	180	1.18%	30%	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 1363719)						
Moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 1367552)						
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	<5.00	----
Inorganics (QCLot: 1367697)						
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	<0.20	----
Inorganics (QCLot: 1372120)						
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	<0.20	----
Leachable Anions & Nutrients (QCLot: 1371133)						
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	<5.0	----
Leachable Anions & Nutrients (QCLot: 1371134)						
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	<20	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 1363719)									
Moisture	----	E144	0.25	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 1367552)									
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	1409 µS/cm	97.7	90.0	110	----
Physical Tests (QCLot: 1367727)									
pH (1:2 soil:CaCl2-aq)	----	E108A	----	pH units	7 pH units	100	98.0	102	----
Inorganics (QCLot: 1367697)									
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	1.6 mg/kg	97.5	70.0	130	----
Inorganics (QCLot: 1372120)									
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	1.6 mg/kg	88.8	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1371133)									
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	5000 mg/kg	100	80.0	120	----
Leachable Anions & Nutrients (QCLot: 1371134)									
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	5000 mg/kg	100	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

Reference Material (RM) Report									
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method					
Physical Tests (QCLot: 1367552)									
	RM	Conductivity (1:2 leachate)	----	E100-L	1384 µS/cm	96.2	70.0	130	----
Physical Tests (QCLot: 1368353)									
	RM	Oxidation-reduction potential [ORP]	----	E125	475 mV	102	90.0	110	----
Leachable Anions & Nutrients (QCLot: 1371133)									
	RM	Chloride, soluble ion content	16887-00-6	E236.Cl	601 mg/kg	82.1	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1371134)									
	RM	Sulfate, soluble ion content	14808-79-8	E236.SO4	172 mg/kg	92.3	70.0	130	----

S07-41

Chain of Custody (COC) / Analytical Request Form

COC Number: 24-01

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Environmental Division Waterloo

Work Order Reference WT2405341

Telephone : +1 519 886 6910

Report To	Contact and company name below will appear on the final report	Reports / Recipients	Turnaround Time (TAT) Requested
Company:	Stantec Consulting	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	☑ Routine [R] if received by 3pm M-F - no surcharges appl
Contact:	Essa Nimer	Merge QC/QCI Reports with COA ☐ YES ☐ NO ☐ N/A	☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharg
Phone:	226-338-0812	☐ Compare Results to Criteria on Report - provide details below if box checked	☐ 3 day [P3] if received by 3pm M-F - 25% rush surchar
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	☐ 2 day [P2] if received by 3pm M-F - 50% rush surchar
Street:	100-300 Hagey Blvd	Email 1 or Fax Raid.Khamis@stantec.com	☐ 1 day [E] if received by 3pm M-F - 100% rush surcha
City/Province:	Waterloo, ON	Email 2 Essa.Nimer@stantec.com	☐ Same day [E2] if received by 10am M-S - 200% rush
Postal Code:	N2L 0A4	Email 3	Additional fees may apply to rush requests or
Invoice To	Same as Report To ☑ YES ☐ NO	**Invoice Recipients**	Date and Time Required for all E&P TATs:
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	For all tests with rush TATs request
Company:		Email 1 or Fax Raid.Khamis@stantec.com	
Contact:		Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	161414473.800.1	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (ALS use only): WT2405341 AP — **ALS Contact:** Mathy — **Sampler:**

Analysis Request

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Corrosivity packagae	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	MW109-24-S3 - 5'-6.5'	4-Mar-24	10:30	Soil	1	R				
	MW110-24-S4-7.5'-9'	28-Feb-24	10:00	Soil	1	R				
	MW101-24-S4-7.5'-9'	29-Feb-24	11:00	Soil	1	R				
	MW108-24-S5-10'-11.5'	28-Feb-24	12:00	Soil	1	R				
	BH101-24-S3-5'-6.5	5-Mar-24	13:30	Soil	1	R				
	BH104-24-S5-10'-11.5'	5-Mar-24	8:30	Soil	1	R				

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☑ NO

Are samples for human consumption/ use? ☐ YES ☑ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☑ NONE ☐ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				9.9			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (ALS use only)			FINAL SHIPMENT RECEPTION (ALS use only)		
Released by: Essa Nimer	Date: 3/10/2024	Time: 9:00 PM	Received by:	Date:	Time:	Received by: AP	Date: 7-MAR-24	Time: 8:00

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

FEB 2022 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.