PRI ENGINEERING

Geotechnical Investigation Report – Final

Proposed Residential Development – Heritage Line Subdivision, Keene, Ontario

Prepared for D.M.Wills Associsates Limited
150 Jameson Dr, Peterborough ON K9J 0B9

July 4, 2022

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Emailed to:

Subject: **Geotechnical Investigation Report – Final REV01**
Proposed Heritage Line Subdivision, Keene, Ontario
PRI Project No. 21-049

Dear Mr. Ames,

We are pleased to submit the following geotechnical investigation report, describing subsurface conditions and recommendations for the design and construction of the Proposed Subdivision Development adjacent to Heritage Line, in Keene, Ontario. It is understood that the geotechnical work is required to support the design of the roadway construction, installation of a new watermain, roadside ditches and use of Low Impact Development (LID) stormwater features and localized on-site septic systems, and residential foundation construction.

This report presents the results of the subsurface investigation for the subject site, which was supervised by D.M. Wills Associates Limited (DMW) on May 3 to 5, 2021, and includes our comments and recommendations as they relate to the proposed civil works, including site preparation, excavations, construction dewatering, water and sewer servicing, road construction and foundation design considerations for residential structures. Borehole logs, site maps and field and laboratory test results from the investigation are appended for reference.

We trust that the information is straightforward and meets with your present requirements. Please contact us if you have any questions.

Yours truly,
PRI Engineering Corp.

Arash Yazdani, P.Eng.
Director of Engineering Services.

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List of Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
ANSI	American National Standards Institute
AWWA	American Water Works Association
CCIL	Canadian Council of Independent Laboratories
CFEM	Canadian Foundation Engineering Manual
CPT	Cone Penetration Test
CSA	Canadian Standards Association
DMW	D.M. Wills Associates Limited
mBGS	Metres Below Ground Surface
mbeg	Metres Below Existing Grade
OBC	Ontario Building Code
OHS	Occupational Health and Safety
PRI	PRI Engineering Corp.
SGS	SGS Canada Inc.
SPMDD	Standard Proctor Maximum Dry Density
SPT	Standard Penetration Test
USCS	Unified Soil Classification System

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1 Introduction

As requested by DMW, PRI Engineering Corp. (PRI) is pleased to submit the following Geotechnical Investigation Report for the proposed Heritage Line Subdivision Development located in Keene, ON. The purpose of this report is to provide subsurface information as it relates to the proposed civil works, including site preparation, excavations, construction dewatering, water and sewer servicing, road construction and foundation design considerations for residential structures. The project is located in Keene, ON (the "Site"), located east of Heritage Line. The total site area is approximately 4.6 Ha in size which currently consists of vacant field with periodic tree coverage specifically along the west border of the Site. The proposed conceptual site layout with test locations and updated servicing and grading plan noted was provided by DMW and has been included in Appendix A.

We have reviewed the Preliminary Servicing and Grading Plan prepared by DMW dated July 8, 2021 and it is understood that the proposed development will consist of the following:

- Sixteen (16) Single Detached Residential Properties;
- The dwellings are to consist of single family residential with basements;
- Site grades are to stay relatively as is (ie. no change greater than 0.2 m);
- A single dedicated street to be completed as pavement roadway structure;

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- On-site sewage disposal systems and municipal watermain services; and
- Ditches and Low Impact Development (LID) features for storm water management.

The geotechnical investigation was completed in conjunction with the Hydrogeological Investigation (HI) completed by DMW, through the completion of boreholes. Recommendations that are related to hydrogeological properties of the encountered subsurface materials should reference the HI prepared by DMW (ie. on-site sewage, ditches, LID features etc.). DMW oversaw the field investigation and drilling operations and prepared the final borehole logs which were referenced to determine recommendations.

This report summarizes the completed geotechnical field investigation, findings, laboratory results, and a summary of comments and recommendations for construction and design considerations as it relates to the proposed development.

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2 Geotechnical Investigation Procedures

2.1 Field Investigation Program

Prior to the field investigation, underground utility locates, including water, electrical, sewer, gas, telephone, cable, etc., were completed using Ontario One Call services by DMW. Borehole locations were finalized in the field based on utility clearance and other obstructions (i.e. trees, overhead lines, vehicles, equipment, etc.) observed at the time of the investigation.

A borehole and test pit program was carried out on April 28, 2021 and May 3 to 5, 2021 under the supervision of DMW, test locations are noted on the attached Sheet No. 500 prepared by DMW (Project No. 21-10985). Eighteen (18) boreholes, designated as BH21-01 through BH21-18, were advanced in accessible areas for the proposed buildings, roadways and landscaping areas, to sampling termination within overburden or practical refusal to a depth of 2.0 m below ground surface (mBGS) to 6.55 mBGS. Four (4) groundwater monitoring wells were installed at boreholes BH21-02, BH21-09, BH21-15 and BH21-16 designated as MW21-02, MW21-09, MW21-15 and MW21-16, respectively. At borehole locations where monitoring wells were not installed, the boreholes were backfilled with bentonite. The boreholes were advanced using a track-mounted drill rig equipped with Standard Penetration Testing (SPT) split-spoon samplers, using a 625 N (140 lb) auto-hammer, and continuous flight augers. PRI field personnel supervised the drilling operations and recorded the subsurface conditions encountered in the boreholes. Soil samples were recovered at approximately 0.75 m intervals using a 51 mm outside diameter split-spoon sampler, driven in accordance with the SPT procedures (i.e. ASTM D1586). The results of the SPTs in terms of N values are referred to in this report to determine consistency for cohesive soils and relative density for non-cohesive materials. Eight (8) test pits designated as TP21-01 through TP21-08 were completed across the site and were completed to develop a better understanding of subsurface conditions and identify stratigraphic layers, no in-situ testing to develop geotechnical design parameters were completed.

Borehole locations were selected at predetermined locations by DMW personnel and are noted on the attached figures in **Appendix A**. Recovered soil samples were inspected and logged in the field using visual and tactile methods, with soil samples being placed in moisture proof containers for transportation to the laboratory for review and selected testing. Subsurface conditions including groundwater seepage and stability were logged, prior to backfilling.

2.2 Laboratory Testing Program

Soil samples from the field investigation program were recovered and retained in containers for further review, selected testing, and storage. Selected samples were transported and submitted to PRI's Canadian Council of Independent Laboratories (CCIL) and SGS laboratories for the tests below.

- Particle Size Distribution Analysis per ASTM D422;

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- Natural Moisture Content Analysis per ASTM D2216; and
- Corrosion Parameters Tests for soils including chlorides, sulphates, and sulphide concentration, pH, electrical conductivity/resistivity, and soil redox potential.

Results from the Natural Moisture Content Analysis are summarized on the borehole logs with Particle Size Distribution Curves attached as **Appendix B**. A summary of corrosivity analyses as per the ANSI/AWWA rating system is discussed in the section below. The Certificate of Analysis and ANSI/AWWA rating system are attached as **Appendix C**.

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3 Subsurface Conditions

The inferred subsurface profiles are based on the borehole logs from the field investigation program. While we believe conditions are representative of actual site conditions, if findings during construction deviate from those encountered at the completed boreholes, we should be consulted to revise our recommendations based on actual conditions at the time of construction. The following are the specific subsurface conditions encountered at borehole locations.

Based on the completed borehole logs (attached as **Appendix A**) and laboratory particle size analyses (attached as **Appendix B**) the site generally consists of a thin layer of surficial topsoil ranging in thickness from 0.3 m to 0.75 m, underlying this material a layer of coarse-grained sand to sandy gravel was encountered at some locations, at other locations a finer grained soil of silty sand to sandy silt material was encountered. Underlying the coarse-grained material, the finer material or the topsoil, a layer of glacial till deposits were noted and all of the deeper boreholes were terminated in this material. The glacial till ranged from sand to silty gravelly sand to silty sand, based on particle size analysis completed by PRI, which are attached. Groundwater was encountered throughout the site at varying depths, but appeared to be prominent in areas where coarser deposits were noted. Investigation depths varied from 2.0 mBGS to 6.55 mBGS, with exact borehole depths noted on the borehole logs.

3.1 Topsoil

The inferred subsurface profiles are based on the borehole logs from the field investigation program. While we believe conditions are representative of actual site conditions, if findings during construction deviate from those encountered at the completed boreholes, we should be consulted to revise our recommendations based on actual conditions at the time of construction. The following are the specific subsurface conditions encountered at borehole locations.

Based on the completed borehole logs (attached as **Appendix A**) and laboratory particle size analyses (attached as **Appendix B**) the site generally consists of a thin layer of surficial topsoil ranging in thickness from 0.3 m to 0.75 m, underlying this material a layer of coarse-grained sand to sandy gravel was encountered at some locations, at other locations a finer grained soil of silty sand to sandy silt material was encountered. Underlying the coarse-grained material, the finer material or the topsoil, a layer of glacial till deposits were noted and all of the deeper boreholes were terminated in this material. The glacial till ranged from sand to silty gravelly sand to silty sand, based on particle size analysis completed by PRI, which are attached. Groundwater was encountered throughout the site at varying depths, but appeared to be prominent in areas where coarser deposits were noted. Investigation depths varied from 2.0 mBGS to 6.55 mBGS, with exact borehole depths noted on the borehole logs.

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3.2 Silty Sand to Sandy Silt

Light brown silty sand to sandy silt material was encountered underlying the topsoil material at boreholes MW21-02, BH21-07, MW21-09, BH21-12 and BH21-14 to BH21-18, at a depth of approximately 0.75 mBGS extending up to 3.8 mBGS; boreholes BH21-07 and BH21-14 are terminated in this material. The material was described as having trace to some gravel/clay and with occasional cobbles. The observed material was generally described as moist at the time of investigation; however thinner sand seams were noted within the material which were described as wet. The material was described as loose to compact on the basis of SPT 'N' values ranging from 7 to greater than 50 per 305 mm of penetration, however the values above 50 are inferred to have been refused on cobbles. An SPT 'N' value of 0 was noted at boreholes BH21-16 and it is possible this sample was disturbed during sampling or occasional loose layers may be present.

Four (4) laboratory particle size distribution analysis were completed on selected silty sand to sandy silt samples. The test results are attached in **Appendix B** and are summarized in **Table 3** as follows, as per Unified Soils Classification System (USCS):

Table 1: Summary of Laboratory Particle Size Analyses for Silty Sand to Sandy Silt Samples

Borehole Id	Sample No.	Depth (Mbgs)	Gravel	Sand	Silt	Clay	Soil Classification
BH21-07	SS2	0.75	6 %	47 %	30 %	17 %	Silty Sand
MW21-09	SS3	1.5	2 %	25 %	57 %	16 %	Sandy Silt
MW21-16	SS3	1.5	5 %	46 %	35 %	14 %	Sand and Silt
BH21-17	SS5	3.0	10 %	35 %	38 %	17 %	Sandy Silt

3.3 Sand to Gravelly Sand

Light brown gravelly sand to sand material was encountered underlying the topsoil material at boreholes BH21-01, BH21-03, BH21-04, BH21-05, BH21-06, BH21-08, BH21-10, BH21-11 and BH21-13 at depths of 0.3 mBGS to 0.75 mBGS extending to borehole termination at BH21-03 through BH21-06 and to a depth of 2.0 mBGS to 3.0 mBGS at the remaining boreholes. The material was described as having trace silt to being silty, up to some clay and with occasional cobbles. The material was generally noted as being moist to saturated and had a laboratory moisture content of 8 % to 12 %. The relative density of the material is loose to compact on the basis of SPT 'N' values ranging from 7 to 30 blows per 305 mm of penetration.

One (1) laboratory particle size distribution analyses was completed on a selected sample of the gravelly sand. The test results are attached in **Appendix B** and are summarized in **Table 4** as follows, as per USCS:

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Table 2: Summary of Laboratory Particle Size Analyses for Sand to Gravelly Sand Samples

Borehole Id	Sample No.	Depth (Mbgs)	Gravel	Sand	Silt	Clay	Soil Classification
BH21-08	SS2	0.75	28 %	43 %	17 %	12 %	Gravelly Sand

3.4 Silty Sand to Sand Glacial Till

Light brown to light grey sand to silty sand to sand glacial till was encountered at all of the deeper boreholes, specifically MW21-02, BH21-08, MW21-09, BH21-11, BH21-12, MW21-15, MW21-16. BH21-17 and BH21-18. The material contained variable amounts of gravel, sand, silt and clay and was generally described as moist on the basis of natural moisture contents of 5 % to 15 % with occasional wetter seams containing primarily sand materials. The material was described as compact to very dense with SPT 'N' Values ranged from 20 to greater than 50 blows per 305 mm of penetration.

Three (3) laboratory particle size distribution analyses were completed on selected samples of the till material. The test results are attached in **Appendix B** and are summarized in **Table 5** as follows, as per USCS:

Table 3: Summary of Particle Size Analyses for Till Samples

Borehole Id	Sample No.	Depth (mBGS)	Gravel	Sand	Silt	Clay	Soil Classification
BH21-01	SS6	3.8	21 %	41 %	25 %	13 %	Silty Sand
BH21-11	SS6	3.8	19 %	48 %	19 %	14 %	Sand
BH21-12	SS6	3.8	14 %	50 %	21 %	15 %	Sand

3.5 Groundwater and Borehole Stability Observations

Groundwater seepage was encountered upon completion of drilling at twelve (12) of eighteen (18) borehole locations at depths ranging from 0.7 mBGS to 4.6 mBGS; specific boreholes which encountered groundwater are list in **Table 6** below. All other boreholes were noted to be open and dry upon completion of drilling. It should be noted that groundwater levels may fluctuate seasonally and in response to major precipitation events.

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Table 4: Summary of Groundwater and Borehole Stability Observations

Borehole ID	Groundwater Level Measurements (at the end of drilling)	Groundwater Level Measurements (May 11, 2021)	Borehole Stability Upon Completion of Drilling
	Depth (mBGS/mASL)	Depth (mBGS/mASL)	
BH21-02/MW21-02	-	0.7/224.8	Open to Termination Depth
BH21-03	1.3/223.8	-	Open to Termination Depth
BH21-05	1.2/223.6	-	Open to Termination Depth
BH21-08	2.7/219.8	-	Open to 3.7 mBGS
BH21-09/MW21-09	-	4.0/209.24	Open to Termination Depth
BH21-11	4.6/219.1	-	Open to Termination Depth
BH21-12	2.1/223.2	-	Open to 2.1 mBGS
BH21-13	1.2/222.8	-	Open to Termination Depth
BH21-15/MW21-15	-	0.9/224.4	Open to Termination Depth
BH21-16/MW21-16	-	1.75/221.1	Open to Termination Depth
BH20-17	4.0/216.5	-	Open to 4.0 mBGS
BH20-18	4.6/219.1	-	Open to 4.6 mBGS

3.6 Corrosivity Analysis

Three (3) samples were analyzed for chloride, sulphate, sulphide concentrations, pH, electrical conductivity/resistivity, and redox potential at the Site. Laboratory data were compared to the ANSI/AWWA corrosivity rating system (Attached in **Appendix C**) to determine the corrosive nature of the tested materials. A sample scoring greater than 10 points is considered to represent a corrosive environment with respect to grey or cast-iron alloys, other considerations including use of de-icing salts or stray electrical currents, to name a few have not been considered. Additional analysis or testing may be required for alternative material types (i.e. Copper, aluminum, etc.). **Table 7** below summarizes the results for the subject site and the total allotted points based on the rating system.

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Table 5: Corrosivity Analytical Result Summary

Parameter	BH21-03 SS2	ANSI/AWWA Point Rating	BH21-06 SS3	ANSI/AWWA Point Rating	BH21-08 SS3	ANSI/AWWA Point Rating
Resistivity (Ω.cm)	5,880	0	7,410	0	6,940	0
pH	8.47	0	8.31	0	8.58	3
Redox Potential (mV)	332	0	329	0	298	0
Sulphides (%)	<0.04	0	<0.04	0	<0.04	0
Moisture Content (%)	9.0	2	10.6	2	10.9	2
Total Points		**2**		**2**		**5**

Based on the test results, corrosion conditions at the Site do not appear to be significant. It is noted that there may be overriding factors in assessments of corrosion potential, such as the application and leaching of de-icing salts and stray electrical currents, to name a few. PRI recommends that the structural engineer should consider corrosivity potential for the Site based on final design and provide considerations for buried utilities and reinforcement rebar.

Laboratory test results for water-soluble sulphate concentration were 3.1 µg/g, 2.3 µg/g and 5.2 µg/g respectively. Results were compared to Table 3 of CSA A23.1-09 to determine the risk of sulphate attack on cementitious materials. Type GU cement should be appropriate for most structural components used in concrete mix designs, with final design considerations to be determined by the structural engineer.

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4 Geotechnical Recommendations

The following recommendations are intended for design and construction of the proposed residential development and site servicing. Recommendations are based on the borehole information described in **Section 3**. While we believe our findings are representative, conditions may vary beyond the investigated locations. If significant differences in the subsurface conditions described above are found later, particularly during construction or as more information becomes available, PRI should be contacted immediately to revise our findings and recommendations, as necessary.

Recommendations are intended for Designers and are not intended as instructions to Contractors, who should perform their own investigations to confirm any conditions that may affect construction schedules, costs and selected methodologies. Recommendations in this report must not be used by third parties without the express written consent of PRI.

4.1 General

4.1.1 Site Preparation

Prior to grading and earthworks operations, any organics and otherwise deleterious material should be stripped from beneath proposed structures, grading fill areas, walkways and access roads. It is anticipated that site the site is a vacant site that there will be no existing structures, driveways and buried structural components, however if encountered, unless determined otherwise it should be assumed that these features will need to be removed from site. Buried utilities should be decommissioned and removed prior to any excavation activities being completed. The subgrade should be proof-rolled using a non-vibratory smooth drum roller with a minimum static weight of 8 tons, passed a minimum six times. Proof-rolling should be completed in the presence of the Geotechnical Engineer or qualified personnel working under the direct supervision of the Geotechnical Engineer. Loose or soft subsoils which have not been adequately densified during proof-rolling, if any, should be removed and replaced with approved fill that is texturally consistent with the existing subgrade and shall be placed and compacted as per **Section 4.1.5** below. If excessive rutting, loose areas or unexpected quantities of organic materials are identified during the proof rolling, a geotextile separator (e.g. Terrafix 270R or approved equivalent) may be an option to limit the depth of any sub-excavation. Approval for specific use of geotextiles shall be approved by the Geotechnical Engineer.

4.1.2 Excavations and Dewatering

Excavations should be constructed in accordance with the most recent version of the Occupational Health and Safety Act (OHSA). The existing overburden soils above the groundwater table can be classified as Type 3 material in accordance with O.Reg. 213/91 s.226 under the OHSA. Thus, temporary excavation side-slopes within the soils should be sloped at 1 Horizontal to 1 Vertical (1H:1V) from the base of the excavation, or they must be properly supported (shored). Soils below

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the groundwater table are considered Type 4 and should be sloped at a minimum grade of 3H:1V from the excavation bottom. Excavations should be protected from exposure to precipitation and associated ground surface runoff and should be inspected regularly for signs of instability. If localized instability is noted during excavation, or if wet conditions are encountered, side slopes should be flattened or supported, as required by regulations, to maintain safe working conditions. All excavations should comply with applicable local, provincial, and federal safety regulations, including the current OHSA Excavation and Trench Safety Standards.

Temporary shoring may be needed when excavating close to utilities, existing sidewalks, property boundaries and any constructed features, to prevent soil materials from sloughing and undermining these features. The Contractor shall be responsible to maintain stable excavations for the project.

Based on the expected excavation depth, to be taken as 221.5 mASL for the basements and no deeper for the site servicing, for site developments it is anticipated that groundwater seepage is expected, for dewatering requirements please refer to the Hydrogeological report prepared by DMW.

4.1.3 Service Trenches

It is anticipated that only shallow service trenches will be required for the facility, however the full stormwater management design was not available at the time of this report, but to date no storm sewers were being proposed. Trench excavations should follow the recommendations of Section 4.1.2 of this report. Service pipes can be installed with Class B bedding in accordance with OPSD 802.010. Pipe bedding should be compacted to at least 95 % of Standard Proctor Maximum Dry Density (SPMDD) or as specified in Section 4.1.4 of this report.

Pipe bedding materials specifications for underground utilities is recommended to be in accordance with the manufacturer's and/or the designer's recommendations. Granular bedding materials are considered to be adequate for service installations for the proposed Site development. It is suggested that the bedding material be placed around the service pipes with a minimum of 300 mm cover on all sides, as per OPSD 802.010.

Service trench backfill may consist of approved portions of the native soils, subject to the constraints and limitations stated above with respect to reuse. Alternatively, imported materials, such as OPSS 1010 Granular 'B' Type I, Select Subgrade Materials (SSM), or approved equivalent may be used. If soils are to be exported from the Site, confirmatory field screening and chemical soil analyses should be completed at the time of export to verify acceptance to the standards of the receiving Site.

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4.1.4 Material Reuse, Backfill and Compaction

Potential fill materials containing deleterious material (e.g. topsoil, rootlets, etc.) are not considered suitable for reuse as backfill or for supporting foundations, nor should they be used for any of the pavement base or sub-base materials.

If consideration is given to reuse excavated soils at the time of construction, it is recommended that all materials designated for reuse be inspected by the Geotechnical Engineer prior to and/or during construction, to confirm that no deleterious material are present. Cobbles and boulders content within reused material should be less than 5 % by mass. No boulders should be allowed in any fill materials and cobbles should be screened to remove all material greater than 60 mm, or an approved equivalent must be used.

Prior to placing any fill, all subgrade surfaces must be approved by the Geotechnical Engineer as noted in **Section 4.1.1** above. Materials used for fill should be placed in maximum 200 mm loose lifts and compacted to 100 % of the SPMDD below foundations and structural components, 98 % of the SPMDD beneath access roads, and 95 % of the SPMDD in general fill areas. Compaction operations should be completed using a self-propelled vibratory compactor or jumping-jack plate tamper where access is limited. Backfill loose lift thicknesses may need to be reduced to achieve the above noted compaction values based on compaction equipment utilized (i.e. small tampers or jumping-jack).

It is recommended that foundation backfill consist of free-draining, non-frost susceptible granular fill material, such as Ontario Provincial Standard and Specifications (OPSS) 1010 Granular 'B' Type I materials or approved equivalent.

4.1.5 Frost Considerations

Based on OPSD 3090.101, the frost penetration depth for the Site area is 1.5 m below final exterior grades. High density Styrofoam insulation, or an approved equivalent, should be considered to provide equivalent frost protection where sufficient soil cover does not exist of foundation elements or adequate resistance to frost heave is not anticipated.

4.2 Seismic Site Class

Section 4.1.8.4 of the 2012 Ontario Building Code (OBC 2012) summarizes site classifications with respect to seismic site response. Based on the encountered ground conditions, bedrock and average SPT N values to a depth of 6.6 mBGL and further geological mapping which suggests the site is within the Peterborough Drumlin Physiographic Region and therefore it is inferred that the stiff soil conditions will extend to a depth of 30 m, a seismic Site Class "D" (stiff soil) may be considered for site designs. MASW testing or Refraction-Microtremor Survey is required to justify higher classifications and is beyond the scope of the current program.

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4.3 Foundation Design

It is understood that residential dwellings with basements are proposed for the development site. The loadings imposed by housing structures are modest and based on anticipated excavation depths, will be founded upon compact to very dense overburden material. Conventional spread footing foundations with a slab-on-grade floor slab is considered the preferred option. Exterior footings for the buildings should be founded below the design frost penetration depth (taken as 1.5 mBGS as noted in **Section 4.2**) relative to the final site grades. Interior footings (minimum 1.5 m from the edge of the building) could be founded 0.5 m below the final grade if the building is heated. Since it is understood that the buildings will have a basement, it is anticipated that the foundations would be founded at a depth of at least 3.0 m below the ground surface at the time of the investigation and at these depths it is anticipated that the subgrade would consist of compact to very dense glacial till materials of varying composition. Occasional very loose to loose deposits were noted and are inferred to be reworked glacial till materials at the site, if these materials are encountered at the proposed founding depth they may need to be removed and recompacted to achieve appropriate densification values or remove and replaced with an alternative material if they are deemed not suitable. Alternative materials should be texturally consistent with the existing subsurface materials or as a minimum consist of a Suitable Subgrade Material (SSM per OPSS 1010) or a Granular B Type I per OPSS 1010.

Footings constructed upon densified site materials or engineered fill extending to the compact glacial till material subgrade, may be designed for an allowable bearing capacity of 150 kPa at ultimate limit state (ULS) and 100 kPa at serviceability limit state (SLS). Settlement potential at the SLS loading should be less than 25 mm and differential settlement should be less than 10 mm. The quality of the foundation subgrade should be inspected by the Geotechnical Engineer, prior to placement of the forms for construction of the footings, to confirm adequate bearing capacity. All fill materials should be placed in accordance with **Section 4.1.4** of this report. It should be noted that buried utilities, over-head lines and the existing structures prevented the advancement of boreholes near the proposed structure in the northeast corner of the Site. However due to the generally consistent subsurface conditions encountered at other borehole locations; it is inferred that these findings are representative across the Site.

Since a shallow groundwater (as shallow as 1.0 mBGS) has been encountered the foundation wall and footing should be equipped with adequate foundation waterproofing and subdrains, which meet or exceed the requirements of the most recent version of the Ontario Building Code.

4.4 Slab-On-Grade

A modulus of vertical reaction, K_t, of 15 MN/m^3 may be used for the design of the floor slab constructed with the area prepared in accordance with **Section 4.1.1**. This value should be modified for foundation shape factor, when they are available. It is expected that the concrete slabs will be placed against the foundation walls founded on engineered fill materials or competent clayey silt material. A minimum of 200 mm of approved OPSS 1010 Granular 'A' or equivalent compacted to

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100 % of the SPMDD is required below the floor slab areas. If concentrated loads are anticipated on the slab-on-grade, sub-excavations may be required to the compacted material, similar to that needed for the footings. It is recommended that perimeter foundation drainage, consisting of 100 mm diameter geotextile wrapped perforated pipe, embedded in 19 mm clear stone wrapped in geotextile, be installed along the bottom perimeter of all foundation walls. Also, subdrains should be installed below the floor slab to provide groundwater relief, additionally the slab should be designed to assume a hydrostatic surcharge at the base of the slab. In areas, where gravity drainage is not feasible, foundation subdrains should be connected to a sump with battery backup. Sumps or other outlets from the subdrains should discharge to an approved frost-free outlet.

4.5 Soil Retaining Structures

The lateral earth pressures acting on the rigid walls of the buried structures or retaining walls that may be required during detail design of the subdivision features within the soil overburden over the groundwater table may be calculated from the following expression:

$$P = K(\gamma h+q)$$

Where:

- P = lateral earth pressure acting at depth 'h' in kPa
- K_o (at rest) = 0.52
- K_a (active) = 0.35
- K_p (passive) = 2.9
- γ = bulk unit weight of granular fills = 22.5 kN/m^3 (Granular A or Granular B Type I)
- h = depth to point of interest in metres
- q = equivalent value of surcharge on the ground surface in kPa

While it is PRI's recommendation that subdrain system are utilized, however if a perimeter and subfloor drainage system is not installed, then to the foregoing earth pressure, the hydrostatic water pressure is to be added. In this case, the unit weight of soil below the water level should be taken as the submerged unit weight (12.5 kN/m3).

4.6 Driveway and Pavement Structure

It is assumed that the majority of traffic will consist of light duty vehicles (including periodic loading with garbage trucks, snowplows and fire trucks) for the design of the internal roadway within the development and the following roadway structures should be considered.

4.6.1 Local Roadway

- 40 mm minimum OPSS HL3 (SP 12.5) Surface Course Compacted to 92.5 % to 97.5% Maximum Relative Density (MRD);

205 St George Street, Unit 2 | Lindsay, ON K9V 5Z9 | 705.702.3921

- 50 mm minimum OPSS HL8 (SP 19) Base Course Compacted to 92.5 % to 97.5 % MRD;
- 150 mm minimum OPSS 1010 Granular 'A' Base Compacted to 98 % of SPMDD; and
- 300 mm minimum OPSS 1010 Granular 'B' Base Compacted to 98 % of SPMDD.

4.6.2 Driveways

- 50 mm minimum OPSS HL3 (SP 12.5) Surface Course Compacted to 92.5 % to 97.5% MRD; and; and
- 150 mm minimum OPSS 1010 Granular 'A' Base Compacted to 98 % of SPMDD.

The thickness of the granular base material could be increased at the discretion of the Engineer, or granular subbase layers could be added, to accommodate site conditions at the time of the construction.

The existing overburden material on site are not suitable for the proposed base or subbase construction and should be disposed appropriately or placed beneath an approved granular material as outlined above. It is recommended that within the area of the pavement, excavation be performed to remove any encountered organics and loose soils and the grade be restored using properly compacted engineered fill.

It is notable that a relatively high groundwater table was observed at the Site which may aggravate the potential for frost heaving. As such, maintenance requirements for pavements may increase and/or life expectancy could be reduced. Good drainage is key and considerations should be made to install subdrains below the proposed base or subbase layer. Subdrains should consist of 150 mm diameter geotextile-wrapped perforated pipe backfilled with a free draining Granular 'B' material and should outlet to storm sewer catch basins or other suitable frost-free outlets. Annual maintenance inspections should be done, and cracks should be sealed regularly. The surface of driveway should be sloped at 2 % or greater to promote runoff to designated surface drainage features. Furthermore, the final asphalt profile should match existing catch basin grade elevations, curb lines, adjacent pavements and outlets to maintain positive drainage throughout the Site.

4.7 Inspections and Testing

During construction, a qualified geotechnical engineer should be contacted to review and comment on the foundation and pavement design details to confirm that the geotechnical requirements stated in this report are addressed.

Geotechnical inspections are critical during construction operations for quality control and assurance (QA/QC). Inspection and testing services should include verification of subgrade soil conditions below bases, slabs, footings, and parking areas, monitoring of the placement of engineered fill, and general testing of geotechnical materials including engineered fill, concrete, and asphalt.

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5 Construction and Supervision and Limitations

The data, conclusions and recommendations which are presented in this geotechnical report, and the quality thereof, are based on a scope of work authorized by the Client. While we believe the borehole information to be representative of Site conditions in the investigated areas, subsurface conditions between and beyond sampled locations may vary. If significant differences in any of the subsurface conditions described in this report are found, PRI should be contacted immediately to revise our findings and recommendations, if necessary.

Our comments on construction considerations are provided, but are not intended as instructions to Contractors, nor shall they be interpreted as specifications for construction. Contractors bidding shall make their own interpretations of factual information to determine how subsurface conditions may affect their methods, costs and schedules.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. PRI accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust this meets your current requirement, please do not hesitate to contact the undersigned if you have any questions.

Yours truly,
PRI Engineering Corp.

Arash Yazdani, P.Eng.
Director of Engineering

LICENSED PROFESSIONAL ENGINEER
A. YAZDANI
100173202
PROVINCE OF ONTARIO

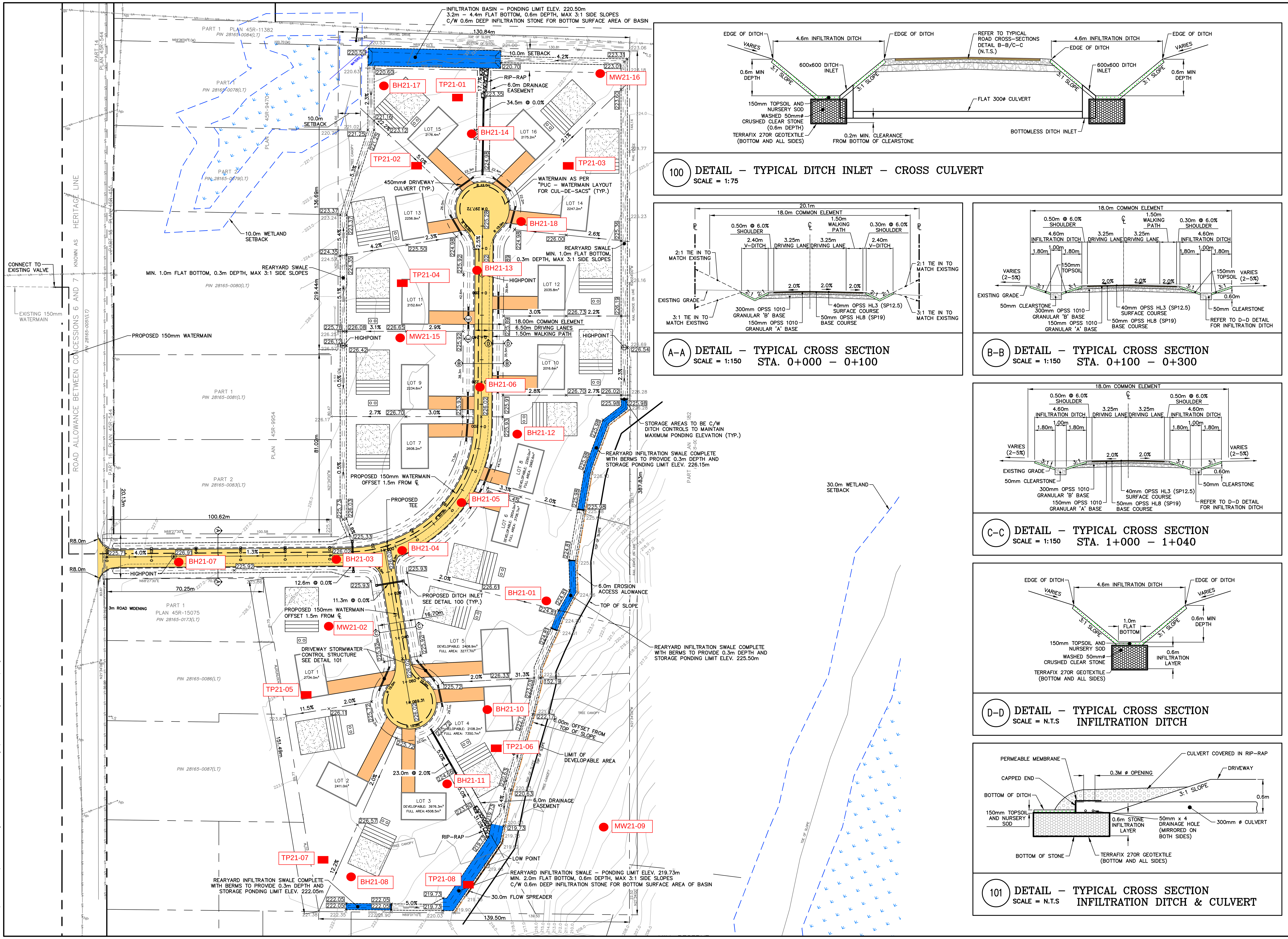
Reviewed by:

Greg Kuepfer, P.Eng.
Geotechnical Engineer

205 St George Street, Unit 2 | Lindsay, ON K9V 5Z9 | 705.702.3921

Appendix A

Borehole Location Testing Plan



BM1 – 206.93m
N: 4902490.35m
E: 726461.29m
KEENE PUBLIC SCHOOL, TABLET IN NORTHEAST FACE OF CONCRETE FOUNDATION WALL

TRUE NORTH

KEY PLAN

REVISIONS

No.	Description	Date
1	ZBA – 2ND SUBMISSION	22/06/29
1	ZBA – 1ST SUBMISSION	21/09/02

METRIC — Dimensions are in METRES and/or MILLIMETRES unless otherwise shown

LEGEND — TO BE READ IN CONJUNCTION WITH OPSD 100 SERIES

- PROPOSED HEAVY DUTY ASPHALT
- PROPOSED MEDIUM DUTY ASPHALT
- PROPOSED DRAINAGE STORAGE AREA
- PROPOSED GRASS/LANDSCAPED
- UNEVALUATED WETLAND
- EX. BUILDING
- EX./PR. EDGE OF PAVEMENT
- EX./PR. ROAD CENTERLINE
- EX./PR. EDGE OF SHOULDER/GRAVEL
- EX./PR. WATER VALVE
- EXISTING HYDRO POLE
- EX. OVERHEAD HYDRO
- EX. UNDERGROUND HYDRO
- EX./PR. DITCH
- PR. SWALE
- PR. CULVERT
- PR. CATCH BASIN
- EX./PR. WATERMAIN
- R.O.W
- PROPERTY LINE
- EXISTING VEGETATION
- TEE
- PROPOSED HOUSE WITH 2 CAR GARAGE
- SEPTIC TANK
- TILE FIELD AND MANTLE
- x 214.00 x 214.00 EX./PR. ELEVATION

WILLS
D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario
Canada K9J 0B9
P. 705.742.2297
F. 705.748.9944
E. wills@dmwills.com

Project Name/Location
HERITAGE LINE RESIDENTIAL
KEENE, ONTARIO

Drawing Title
PRELIMINARY SERVICING AND GRADING PLAN

Drawn By: M.B.	SCALE: Horz. 1:750	Vert. –	
Designed By: M.B.	Issue Date: JUNE 27, 2022		
Checked By: J.D.F.	Project No.: 21–10985		Sht. No.:
Engineer: A.M.	Dwg File No.: 10985–SP		500

NOT FOR CONSTRUCTION

Appendix B

Borehole Explanation Form,
Borehole Logs

BOREHOLE LOG EXPLANATION FORM

This explanatory section provides the background to assist in the use of the borehole logs. Each of the headings used on the borehole log, is briefly explained.

DEPTH

This column gives the depth of interpreted geologic contacts in metres below ground surface.

STRATIGRAPHIC DESCRIPTION

This column gives a description of the soil based on a tactile examination of the samples and/or laboratory test results. Each stratum is described according to the following classification and terminology.

Soil Classification*		Terminology	Proportion
Silt & Clay	< 0.075 mm	"trace" (e.g. trace sand)	<10%
Sand	0.075 to 4.75 mm	"some" (e.g. some sand)	10% - 20%
Gravel	4.75 to 75 mm	adjective (e.g. sandy)	20% - 35%
Cobbles	75 to 300 mm	"and" (e.g. and sand)	35% - 50%
Boulders	>300 mm	noun (e.g. sand)	>50%

* Extension of USCS Classification system unless otherwise noted.

The use of the geologic term "till" implies that both disseminated coarser grained (sand, gravel, cobbles or boulders) particles and finer grained (silt and clay) particles may occur within the described matrix.

The compactness of cohesionless soils and the consistency of cohesive soils are defined by the following:

COHESIONLESS SOIL		COHESIVE SOIL	
Compactness	Standard Penetration Resistance "N", Blows / 0.3 m	Consistency	Standard Penetration Resistance "N", Blows / 0.3 m
Very Loose	0 to 4	Very Soft	0 to 2
Loose	4 to 10	Soft	2 to 4
Compact	10 to 30	Firm	4 to 8
Dense	30 to 50	Stiff	8 to 15
Very Dense	Over 50	Very Stiff	15 to 30
		Hard	Over 30

The moisture conditions of cohesionless and cohesive soils are defined as follows.

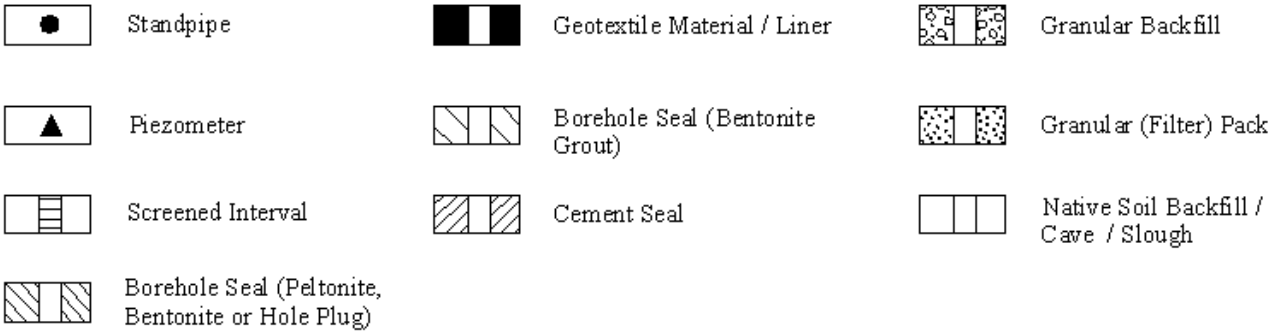
COHESIONLESS SOILS	COHESIVE SOILS		
Dry	DTPL	-	Drier Than Plastic Limit
Moist	APL	-	About Plastic Limit
Wet	WTPL	-	Wetter Than Plastic Limit
Saturated	MWTPL	-	Much Wetter Than Plastic Limit

STRATIGRAPHY

Symbols may be used to pictorially identify the interpreted stratigraphy of the soil and rock strata.

MONITOR DETAILS

This column shows the position and designation of standpipe and/or piezometer ground water monitors installed in the borehole. Also the water level may be shown for the date indicated.



Where monitors are placed in separate boreholes, these are shown individually in the "Monitor Details" column. Otherwise, monitors are in the same borehole. For further data regarding seals, screens, etc., the reader is referred to the summary of monitor details table.

SAMPLE

These columns describe the sample type and number, the "N" value, the water content, the percentage recovery, and Rock Quality Designation (RQD), of each sample obtained from the borehole where applicable. The information is recorded at the approximate depth at which the sample was obtained. The legend for sample type is explained below.

SS	=	Split Spoon	GB	=	Grab Sample
ST	=	Thin Walled Shelby Tube	CS	=	Channel Sample
AS	=	Auger Flight Sample	WS	=	Wash Sample
CC	=	Continuous Core	RC	=	Rock Core

$$\% \text{ Recovery} = \frac{\text{Length of Core Recovered Per Run}}{\text{Total Length of Run}} \times 100$$

Where rock drilling was carried out, the term RQD (Rock Quality Designation) is used. The RQD is an indirect measure of the number of fractures and soundness of the rock mass. It is obtained from the rock cores by summing the length of core recovered, counting only those pieces of sound core that are 100 mm or more in length. The RQD value is expressed as a percentage and is the ratio of the summed core lengths to the total length of core run. The classification based on the RQD value is given below.

RQD Classification	RQD (%)
Very poor quality	< 25
Poor quality	25 - 50
Fair quality	50 - 75
Good quality	75 - 90
Excellent quality	90 - 100

TEST DATA

The central section of the log provides graphs which are used to plot selected field and laboratory test results at the depth at which they were carried out. The plotting scales are shown at the head of the column.

Dynamic Penetration Resistance - The number of blows required to advance a 51 mm diameter, 60º steel cone fitted to the end of 45 mm OD drill rods, 0.3 m into the subsoil. The cone is driven with a 63.5 kg hammer over a fall of 750 mm.

Standard Penetration Resistance - Standard Penetration Test (SPT) "N" Value - The number of blows required to advance a 51 mm diameter standard split-spoon sampler 300 mm into the subsoil, driven by means of a 63.5 kg hammer falling freely a distance of 750 mm. In cases where the split spoon does not penetrate 300 mm, the number of blows over the distance of actual penetration in millimetres is shown as $\frac{x Blows}{mm}$

Water Content - The ratio of the mass of water to the mass of oven-dry solids in the soil expressed as a percentage.

W_P - Plastic Limit of a fine-grained soil expressed as a percentage as determined from the Atterberg Limit Test.

W_L - Liquid Limit of a fine-grained soil expressed as a percentage as determined from the Atterberg Limit Test.

REMARKS

The last column describes pertinent drilling details, field observations and/or provides an indication of other field or laboratory tests that were performed.

BORING NUMBER BH21-01

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/3/21 **COMPLETED** 5/3/21
GROUND ELEVATION 225.24 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING ---
EASTING 726565 **NORTHING** 4903233
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION	
	SS 1	69	2-2-2-3 (4)			Topsoil: Dark brown silty sand topsoil, trace gravel, moist, very loose	
						0.75	224.49
1	SS 2	93	6-9-5 (14)			Silty Gravelly Sand: Light brown silty gravelly sand, some clay, occasional cobble, moist, compact	
	SS 3	85	3-4-6 (10)				
2						2.30	222.94
	SS 4	96	4-5-14 (19)			Till: Light brown silty gravelly sand till, some clay, occasional cobble, moist to wet, compact	
3							
	SS 5	89	8-18-27 (45)			-Grey, dense to very dense	
				GSA SS-6: Gravel: 21% Sand: 41% Silt: 25% Clay: 13%			
4	SS 6	59	18-35-50 (85)				
	SS 7	100	18-35-38 (73)				
5							
6							
	SS 8	22	50			-Light brown	
						6.55	218.69
						Borehole terminated at 6.55 meters below grade in silty gravelly sand till. Borehole open, no ponded water prior to backfill.	

WELL NUMBER MW21-02

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/3/21 **COMPLETED** 5/3/21
GROUND ELEVATION 225.48 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING ---
EASTING 726472 **NORTHING** 4903186
AFTER DRILLING 0.70 m / Elev 224.78 m

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 1	62	0-1-3-4 (4)	MC = 33%		Topsoil: Dark brown silty sand topsoil, trace clay, moist, very loose	
						0.75 ▼ 224.73	
1	SS 2	72	10-13-24 (37)	MC = 8%		Silty Sand: Light brown silty sand, some clay, trace to some gravel, occasional cobble, moist, dense	Bentonite
	SS 3	100	1-1-2 (3)	MC = 10%		-Wet to saturated, very loose	Riser
2						2.30 223.18	
	SS 4	78	5-7-13 (20)	MC = 8%		Till: Light brown silty sand till, some clay, trace gravel, occasional cobble, saturated, compact to very dense	
3							
	SS 5	100	8-11-24 (35)	MC = 7%			
4	SS 6	65	14-50	MC = 15%			Sand
							Screen
5	SS 7	65	14-50	MC = 10%			
6				Split spoon refusal at 5.33 m. Augered to 6.55 m approximately 1 m west.			
	SS 8	52	11-50	MC = 5%		-Grey	
						6.55 218.93	
						Borehole terminated at 6.55 meters below grade in silty sand till. Static groundwater in monitoring well at 0.70 meters below grade on May 11, 2021.	

GENERAL BH / TP / WELL 10985 GINT BH LOGS.GPJ GINT STD CANADA LAB.GDT 7/21/21

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

BORING NUMBER BH21-03

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/3/21 **COMPLETED** 5/3/21
GROUND ELEVATION 225.11 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING 1.32 m / Elev 223.79 m
EASTING 726456 **NORTHING** 4903212
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	
	SS 1	79	1-1-1-2 (2)		Topsoil: Dark brown silty sand topsoil, moist, very loose	
					0.75	224.36
1	SS 2	91	6-12-12 (24)		Gravelly Sand: Light brown gravelly sand, some silt, some clay, occasional cobble, wet to saturated, compact	
	SS 3	92	1-5-6 (11)			
2					2.00	223.11

Borehole terminated at 2.0 meters below grade in gravelly sand till. Borehole open, groundwater at 1.3 meters below grade following completion.

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

BORING NUMBER BH21-04

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/3/21 **COMPLETED** 5/3/21
GROUND ELEVATION 224.39 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING ---
EASTING 726491 **NORTHING** 4903229
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	
	SS 1	69	1-1-1-2 (2)		Topsoil: Dark brown silty sand topsoil, moist, very loose	
					0.75	223.64
1	SS 2	93	5-4-7 (11)		Gravelly Sand: Light brown/grey gravelly sand, some silt, some clay, orange-brown mottles, moist to wet, compact	
	SS 3	75	7-6-5 (11)			
2					2.00	222.39
					Borehole terminated at 2.0 meters below grade in gravelly sand till. Borehole open, no ponded water prior to backfill.	

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

BORING NUMBER BH21-05

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/3/21 **COMPLETED** 5/3/21
GROUND ELEVATION 224.78 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING 1.20 m / Elev 223.58 m
EASTING 726511 **NORTHING** 4903260
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	
	SS 1	75	0-0-2-3 (2)		Topsoil: Dark brown silty sand topsoil, moist, very loose	
					0.40	224.38
					Gravelly Sand: Light brown gravelly sand, some silt, some clay, moist, loose	
1	SS 2	74	5-5-2 (7)		-Wet to saturated	
					-Grey, silty, some gravel, compact	
2	SS 3	90	4-5-7 (12)		2.00	222.78

Borehole terminated at 2.0 meters below grade in gravelly sand till. Borehole open, groundwater at 1.2 meters below grade following completion.

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

BORING NUMBER BH21-06

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/3/21 **COMPLETED** 5/3/21
GROUND ELEVATION 224.77 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING ---
EASTING 726496 **NORTHING** 4903309
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	
	SS 1	70	0-0-2-3 (2)		Topsoil: Dark brown silty sand topsoil, moist, very loose	
					0.75	224.02
1	SS 2	93	5-7-10 (17)		Gravelly Sand: Light brown gravelly sand, some silt, some clay, moist, compact	
	SS 3	52	3-7-10 (17)			
2					2.00	222.77
					Borehole terminated at 2.0 meters below grade in gravelly sand till. Borehole open, no ponded water prior to backfill.	

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

BORING NUMBER BH21-07

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/3/21 **COMPLETED** 5/3/21
GROUND ELEVATION 227.56 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING ---
EASTING 726403 **NORTHING** 4903191
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION	
	SS 1	44	1-2-1-2 (3)			Topsoil: Dark brown silty sand topsoil, trace gravel, moist, very loose	
						0.75	226.81
1	SS 2	80	4-6-25 (31)	GSA SS-2: Gravel: 6% Sand: 47% Silt: 30% Clay: 17%		Silty Sand: Light brown silty sand, some clay, trace gravel, moist, dense	
	SS 3	71	4-4-7 (11)			-Light brown/grey, gravely, occasional cobble, compact	
2						2.00	225.56

Borehole terminated at 2.0 meters below grade in silty sand till. Borehole open, no ponded water prior to backfill.

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

BORING NUMBER BH21-08

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/4/21 **COMPLETED** 5/4/21
GROUND ELEVATION 222.49 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING 2.70 m / Elev 219.79 m
EASTING 726523 **NORTHING** 4903086
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION
	SS 1	52	0-1-0-1 (1)	MC = 20%		Topsoil: Dark brown silty sand topsoil, moist, very loose
				GSA SS-2: Gravel: 28% Sand: 43% Silt: 17% Clay: 12%		0.75 221.74
1	SS 2	59	7-4-7 (11)	MC = 10%		Gravelly Sand: Light brown gravelly sand, some silt, some clay, moist, compact
	SS 3	33	3-3-3 (6)	MC = 12%		-Light brown/grey, wet to saturated, loose
2						
	SS 4	89	4-5-10 (15)	MC = 8%		-Compact
3						3.05 219.44
	SS 5	100	7-15-27 (42)	MC = 10%		Till: Light brown/grey gravelly sand till, some silt, some clay, wet to saturated, dense
4	SS 6	54	23-50	MC = 10%		-Very dense
	SS 7	33	50	MC = 10%		-Occasional cobble
5						
6						
	SS 8	43	20-50	MC = 7%		6.55 215.94

Borehole terminated at 6.55 meters below grade in gravelly silty sand till.
Borehole caved to 3.7 meters below grade, groundwater at 2.7 meters below grade.

WELL NUMBER MW21-09

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/4/21 **COMPLETED** 5/4/21
GROUND ELEVATION 213.23 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING ---
EASTING 726615 **NORTHING** 4903148
AFTER DRILLING 3.99 m / Elev 209.25 m

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION
	SS 1	54	0-1-1-2 (2)	MC = 19%		Topsoil: Dark brown silty sand topsoil, trace gravel, moist, very loose
						0.76 / 212.47
1	SS 2	80	4-6-4 (10)	MC = 14%		Sandy Silt: Light brown sandy silt, some clay, trace to some gravel, moist to wet, compact
				GSA SS-3: Gravel: 2% Sand: 25% Silt: 57% Clay: 16%		
2	SS 3	100	3-5-6 (11)	MC = 14%		
						2.29 / 210.94
	SS 4	100	4-7-15 (22)	MC = 15%		Till: Light brown sandy silt till, some clay, trace to some gravel, moist to wet, compact
3						
	SS 5	100	10-14-15 (29)	MC = 10%		
4	SS 6	100	13-17-21 (38)	MC = 13%		-Dense
5	SS 7	100	23-26-26 (52)	MC = 15%		-Very dense
6						
	SS 8	100	45-37-50 (87)	MC = 12%		-Grey, saturated
						6.55 / 206.68

Borehole terminated at 6.55 meters below grade in sandy silt till. Static groundwater level in monitoring well at 4.0 meters below grade on May 11, 2021.

WELL DIAGRAM
Casing Top Elev: 214.23 (m)
Casing Type: Monument
Riser
Bentonite
Sand
Screen

GENERAL BH / TP / WELL 10985 GINT BH LOGS.GPJ GINT STD CANADA LAB.GDT 7/21/21

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

BORING NUMBER BH21-10

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/4/21 **COMPLETED** 5/4/21
GROUND ELEVATION 224.3 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING ---
EASTING 726552 **NORTHING** 4903179
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	
	SS 1	61	1-1-1-3 (2)		Topsoil: Dark brown silty sand topsoil, moist, very loose	
					0.75	223.55
1	SS 2	100	8-11-10 (21)		Gravelly Sand: Light brown gravelly sand, some silt, some clay, moist, compact	
	SS 3	75	2-2-5 (7)		-Loose	
2					2.00	222.30
					Borehole terminated at 2.0 meters below grade in gravelly sand till. Borehole open, no ponded water prior to backfill.	

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

BORING NUMBER BH21-11

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/4/21 **COMPLETED** 5/4/21
GROUND ELEVATION 223.7 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING 4.60 m / Elev 219.10 m
EASTING 726548 **NORTHING** 4903141
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION
	SS 1	41	1-1-1-6 (2)			Topsoil: Dark brown silty sand topsoil, trace gravel, moist, very loose
						0.75 222.95
1	SS 2	78	6-23-7 (30)			Sand: Light brown sand, some gravel, some silt, some clay, occasional cobble, moist, compact
	SS 3	100	1-5-5 (10)			-Wet
2						2.30 221.40
	SS 4	100	4-10-13 (23)			Till: Light brown sand till, some gravel, some silt, some clay, occasional cobble, moist to wet, compact
3	SS 5	89	10-23-18 (41)			-Dense
4	SS 6	83	13-20-37 (57)	GSA SS-6: Gravel: 19% Sand: 48% Silt: 19% Clay: 14%		-Very dense
	SS 7	69	9-22-50 (72)			-Light brown/grey
5						5.05 218.65
						Borehole terminated at 5.05 meters below grade on assumed boulder material. Borehole open, groundwater at 4.6 meters below grade following completion.

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

BORING NUMBER BH21-12

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/4/21 **COMPLETED** 5/4/21
GROUND ELEVATION 225.31 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING 2.10 m / Elev 223.21 m
EASTING 726526 **NORTHING** 4903296
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION
	SS 1	67	1-1-1-3 (2)	MC = 17%		Topsoil: Dark brown silty sand topsoil, moist, very loose
						0.75 224.56
1	SS 2	72	4-5-2 (7)	MC = 10%		Silty Sand: Light brown silty sand, some clay, trace gravel, occasioanl cobble, wet, loose
	SS 3	61	2-2-7 (9)	MC = 9%		
2						▼
						2.30 223.01
	SS 4	93	3-10-15 (25)	MC = 8%		Till: Light brown silty sand till, some clay, trace gravel, occasional cobble, wet, compact
3						
	SS 5	28	50	MC = 9%		-Very dense
				GSA SS-6: Gravel: 14% Sand: 50% Silt: 21% Clay: 15%		
4	SS 6	93	17-31-50 (81)	MC = 7%		-Some gravel, moist
	SS 7	83	23-20-50 (70)	MC = 8%		-Moist to wet
5						
6						
	SS 8	89	3-8-50 (58)	MC = 10%		-Light brown/grey, wet
						6.55 218.76
						Borehole terminated at 6.55 meters below grade in silty sand till. Borehole caved to 2.1 meters below grade, groundwater at 2.1 meters below grade following completion.

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

BORING NUMBER BH21-13

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/4/21 **COMPLETED** 5/4/21
GROUND ELEVATION 224.05 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING 1.22 m / Elev 222.83 m
EASTING 726477 **NORTHING** 4903356
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	
	SS 1	87	0-1-1-1 (2)		Topsoil: Dark brown silty sand topsoil, moist, very loose	
				0.30		223.75
					Gravelly Sand: Light brown gravelly sand, some silt, some clay, moist, loose	
1	SS 2	104	1-2-3 (5)		-Moist to wet	
					-Compact	
	SS 3	88	3-8-10 (18)			
2				2.00		222.05

Borehole terminated at 2.0 meters below grade in gravelly sand till. Borehole open, groundwater at 1.2 meters below grade following completion.

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

BORING NUMBER BH21-14

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/4/21 **COMPLETED** 5/4/21
GROUND ELEVATION 222.71 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING ---
EASTING 726452 **NORTHING** 4903413
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	
	SS 1	59	0-1-3-2 (4)		Topsoil: Dark brown silty sand topsoil, moist, very loose	
					0.75	221.96
1	SS 2	80	7-7-7 (14)		Silty Sand: Light brown silty sand, some clay, trace gravel, occasional cobbles, moist, compact	
	SS 3	92	2-3-7 (10)			
2					2.00	220.71

Borehole terminated at 2.0 meters below grade in silty sand till. Borehole open, no ponded water prior to backfill.

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

WELL NUMBER MW21-15

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/5/21 **COMPLETED** 5/5/21
GROUND ELEVATION 225.34 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING ---
EASTING 726456 **NORTHING** 4903318
AFTER DRILLING 0.91 m / Elev 224.44 m

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 1	64	0-2-2-4 (4)		Topsoil: Dark brown silty sand topsoil, moist, very loose	Casing Top Elev: 226.28 (m) Casing Type: Monument
					0.76 / 224.58	
1	SS 2	74	12-15-50 (65)		Silty Sand: Light brown silty sand, some gravel, occasional cobbles, moist, very dense	Riser
						Bentonite
2	SS 3	96	2-2-3 (5)		-Trace gravel, wet, loose	
					2.29 / 223.05	
3	SS 4	83	6-9-16 (25)		Till: Light brown silty sand till, some gravel, trace clay, occasional cobbles, wet, compact	
	SS 5	91	11-14-20 (34)		-Dense	
4	SS 6	100	12-21-25 (46)		-Light brown/grey, trace to some gravel, moist to wet	Sand
						Screen
5	SS 7	74	12-26-50 (76)		-Some gravel, very dense	
6						
	SS 8	63	20-28-50 (78)		-Light grey	
					6.55 / 218.79	
					Borehole terminated at 6.55 meters below grade in silty sand till. Static groundwater level in monitoring well at 0.9 meters below grade on May 11, 2021.	

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

WELL NUMBER MW21-16

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/5/21 **COMPLETED** 5/5/21
GROUND ELEVATION 222.81 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING ---
EASTING 726499 **NORTHING** 4903461
AFTER DRILLING 1.74 m / Elev 221.07 m

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS 1	87	0-1-1-1 (2)	MC = 18%		Topsoil: Dark brown silty sand topsoil, moist, very loose	Casing Top Elev: 223.69 (m) Casing Type: Monument
						0.76 / 222.05	
1	SS 2	100	4-3-5 (8)	MC = 10%		Silty Sand: Light brown silty sand, some clay, trace gravel, occasional cobble, moist, loose	Riser
				GSA SS-3: Gravel: 5% Sand: 46% Silt: 35% Clay: 14% MC = 16%			Bentonite
2	SS 3	63	1-0-0 (0)			-Moist to wet, very loose	
				Split spoon refusal at 2.29m. Augered to 2.29 m approximately 1 m west.		2.29 / 220.52	
	SS 4	61	9-23-50 (73)	MC = 11%		Till: Brown silty sand till, some gravel, some clay, occasional cobble, wet, very dense	
3							
	SS 5	91	12-17-50 (67)	MC = 6%		-Trace gravel	
4	SS 6	80	25-25-50 (75)	MC = 9%		-Moist to wet	Sand
							Screen
5	SS 7	65	15-31-50 (81)	MC = 7%		-Light brown, some gravel, wet	
6							
	SS 8	93	7-24-50 (74)	MC = 7%		-Trace gravel, moist	
						6.55 / 216.26	
						Borehole terminated at 6.55 meters below grade in silty sand till. Static groundwater level in monitoring well at 1.75 meters below grade on May 11, 2021.	

GENERAL BH / TP / WELL 10985 GINT BH LOGS.GPJ GINT STD CANADA LAB.GDT 7/21/21

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

BORING NUMBER BH21-17

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/5/21 **COMPLETED** 5/5/21
GROUND ELEVATION 220.53 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING 4.00 m / Elev 216.53 m
EASTING 726401 **NORTHING** 4903421
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION
	SS 1	48	0-0-1-2 (1)	MC = 20%		Topsoil: Dark brown silty sand topsoil, trace clay, moist to wet, very loose
						0.75 219.78
1	SS 2	85	6-6-2 (8)	MC = 12%		Sandy Silt: Light brown sandy silt, some clay, trace gravel, occasional cobble, wet, loose
	SS 3	89	3-5-6 (11)	MC = 11%		-Compact
2						
	SS 4	41	7-7-8 (15)	MC = 9%		
3				GSA SS-5: Gravel: 10% Sand: 35% Silt: 38% Clay: 17%		
	SS 5	85	5-5-4 (9)	MC = 10%		-Light grey, moist to wet, loose
						3.80 216.73
4	SS 6	65	18-27-50 (77)	MC = 7%		Till: Light grey sandy silt till, some clay, trace gravel, occasional cobble, moist, very dense
						-Wet
	SS 7	54	23-22-50 (72)	MC = 6%		
5						
6						
	SS 8	83	15-29-50 (79)	MC = 15%		-Very dense
						6.55 213.98
						Borehole terminated at 6.55 meters below grade in silty sand till. Borehole caved to 4.0 meters below grade, groundwater at 4.0 meters below grade.

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, ON K9J 0B9

BORING NUMBER BH21-18

CLIENT Alina Stewart and Shawn Elmhirst
PROJECT NAME Heritage Line
PROJECT NUMBER 21-10985
PROJECT LOCATION 1197 Heritage Line, Keene ON
DATE STARTED 5/5/21 **COMPLETED** 5/5/21
GROUND ELEVATION 223.69 m **HOLE SIZE** 6'
DRILLING CONTRACTOR Canadian Environmental Drilling
GROUND WATER LEVELS:
DRILLING METHOD 6" O.D. Solid stem augers and split spoon samplers
AT TIME OF DRILLING ---
LOGGED BY IM **CHECKED BY** IA
AT END OF DRILLING 4.60 m / Elev 219.09 m
EASTING 726487 **NORTHING** 4903388
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION
	SS 1	77	0-1-2-3 (3)		Topsoil: Dark brown silty sand topsoil, trace gravel, moist, very loose
					0.75 222.94
1	SS 2	20	5-6-6 (12)		Silty Sand: Light brown silty sand, trace clay, trace gravel, occasional cobble, moist, compact
2	SS 3	100	5-9-11 (20)		
3	SS 4	100	12-12-9 (21)		
					3.05 220.64
	SS 5	54	5-50		Till: Light brown silty sand till, trace clay, trace gravel, occasional cobble, moist, very dense
4	SS 6	59	8-33-50 (83)		-Moist to wet
5	SS 7	33	50		-Some gravel
6					
	SS 8	78	10-32-50 (82)		-Wet
					6.55 217.14

Borehole terminated at 6.55 meters below grade in silty sand till. Borehole caved to 4.6 meters below grade, groundwater at 4.6 meters.

WILLS

Test Pit Log – TP21-01

Depth (mbg)	Soil Description
0.0 – 0.4	Brown silty sand topsoil, rootlets, moist.
0.4 - 0.6	Light brown silty sand, trace to some clay, moist.
0.6 – 3.0	Grey silty sand till, some gravel, trace clay, occasional cobble, wet to saturated.

Grab Sample Summary

- GS-01 collected at approximately 0.4 mbg.
- CGS-02 collected between 0.6 mbg – 3.0 mbg.

Groundwater

- Minor and isolated groundwater seepage between 1.0 and 1.6 mbg.

Additional Notes

- Caving below 0.6 mbg.
- Test pit terminated at 3.0 mbg in till.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

D.M. Wills Associates Limited
150 Jameson Drive, Peterborough, Ontario, Canada K9J 0B9
P. 705.742.2297 **F**. 705.748.9944 **E**. wills@dmwills.com

WILLS

Test Pit Log – TP21-02

Depth (mbg)	Soil Description
0.0 – 0.3	Brown silty sand topsoil, rootlets, moist.
0.3 - 0.5	Light brown silty sand, moist.
0.5 – 3.3	Grey gravelly silty sand till, trace clay, occasional cobble.

Grab Sample Summary

- GS-01 collected at approximately 0.3 mbg.
- CGS-02 collected between 0.6 mbg – 3.3 mbg.

Groundwater

- Groundwater not encountered.

Additional Notes

- Minor caving between 0.6 mbg and 1.6 mbg.
- Test pit terminated at 3.3 mbg in till.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

D.M. Wills Associates Limited
150 Jameson Drive, Peterborough, Ontario, Canada K9J 0B9
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WILLS

Test Pit Log – TP21-03

Depth (mbg)	Soil Description
0.0 – 0.3	Brown silty sand topsoil, rootlets, moist.
0.3 - 0.5	Light brown silty sand, moist.
0.5 – 3.3	Grey silty sand till, some gravel, trace clay, occasional cobble and boulder, moist.

Grab Sample Summary

- GS-01 collected at approximately 0.4 mbg.
- CGS-02 collected between 0.5 mbg – 3.3 mbg.

Groundwater

- Groundwater not encountered

Additional Notes

- Test pit terminated at 3.3 mbg in till.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

D.M. Wills Associates Limited
150 Jameson Drive, Peterborough, Ontario, Canada K9J 0B9
P. 705.742.2297 **F**. 705.748.9944 **E**. wills@dmwills.com

WILLS

Test Pit Log – TP21-04

Depth (mbg)	Soil Description
0.0 – 0.3	Brown silty sand topsoil, rootlets, moist.
0.3 - 0.4	Light brown silty sand, moist.
0.4 – 3.3	Grey silty sand till, some clay, trace gravel, occasional cobble and boulder.

Grab Sample Summary

- GS-01 collected at approximately 0.3 mbg.
- CGS-02 collected between 0.4 mbg – 3.3 mbg.

Groundwater

- Minor and isolated groundwater seepage at 1.8 mbg.

Additional Notes

- Caving below 1.8 mbg.
- Test pit terminated at 3.3 mbg in till.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

D.M. Wills Associates Limited
150 Jameson Drive, Peterborough, Ontario, Canada K9J 0B9
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WILLS

Test Pit Log – TP21-05

Depth (mbg)	Soil Description
0.0 – 0.4	Brown silty sand topsoil, rootlets, moist
0.4 - 0.5	Light brown silty sand, moist
0.5 – 3.0	Grey silty sand till, some clay, trace gravel, occasional cobble and boulder, moist to wet.

Grab Sample Summary

- GS-01 collected at approximately 0.5 mbg.
- GS-02 collected at approximately 2.0 mbg.

Groundwater

- Minor and isolated groundwater seepage at 1.3 mbg.

Additional Notes

- Caving below 0.5 mbg.
- Test pit terminated at 3.0 mbg in till.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

D.M. Wills Associates Limited
150 Jameson Drive, Peterborough, Ontario, Canada K9J 0B9
P. 705.742.2297 **F**. 705.748.9944 **E**. wills@dmwills.com

WILLS

Test Pit Log – TP21-06

Depth (mbg)	Soil Description
0.0 – 0.2	Brown silty sand topsoil, rootlets, moist.
0.2 - 0.4	Light brown silty sand, moist.
0.4 – 3.0	Grey silty sand till, some gravel, trace clay, occasional cobble and boulder, moist.

Grab Sample Summary

- GS-01 collected at approximately 0.3 mbg.
- GS-02 collected at approximately 1.5 mbg.
- GS-03 collected at approximately 2.5 mbg.

Groundwater

- Groundwater not encountered.

Additional Notes

- Test pit terminated at 3.0 mbg in till.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

D.M. Wills Associates Limited
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WILLS

Test Pit Log – TP21-07

Depth (mbg)	Soil Description
0.0 – 0.3	Brown silty sand topsoil, rootlets, moist.
0.3 - 0.5	Light brown silty sand, moist.
0.5 – 3.3	Grey silty sand till, some gravel, trace to some clay, occasional cobble and boulder, moist to wet.

Grab Sample Summary

- GS-01 collected at approximately 0.4 mbg.
- CGS-02 collected at approximately 1.0 – 2.0 mbg.

Groundwater

- Minor and isolated groundwater seepage at 2.0 mbg.

Additional Notes

- Caving below 0.5 mbg.
- Test pit terminated at 3.3 mbg in till.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

D.M. Wills Associates Limited
150 Jameson Drive, Peterborough, Ontario, Canada K9J 0B9
P. 705.742.2297 **F**. 705.748.9944 **E**. wills@dmwills.com

WILLS

Test Pit Log – TP21-08

Depth (mbg)	Soil Description
0.0 – 0.3	Brown silty sand topsoil, rootlets, moist.
0.3 - 0.4	Light brown silty sand, moist.
0.4 – 3.3	Grey silty sand till, some gravel, trace clay, occasional cobble and boulder.

Grab Sample Summary

- GS-01 collected at approximately 0.3 mbg.
- CGS-02 collected between 0.4 mbg – 3.3 mbg.

Groundwater

- Minor and isolated groundwater seepage throughout till.

Additional Notes

- Caving below 2.0 mbg.
- Test pit terminated at 3.3 mbg in till.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

D.M. Wills Associates Limited
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Appendix C

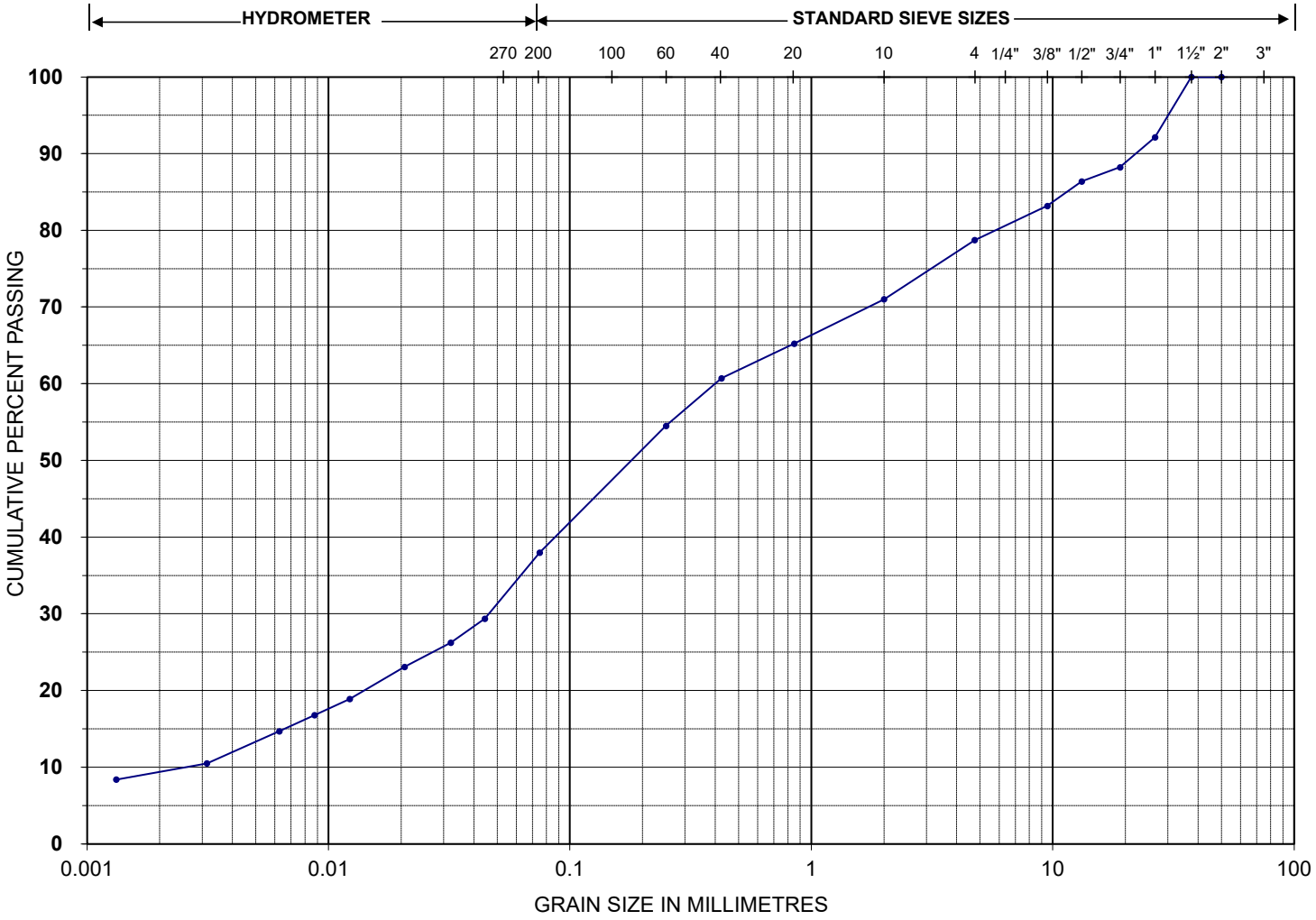
Geotechnical Laboratory Results

PRI ENGINEERING
1 William Street S, Suite 4, Lindsay, ON, K9V 3A3
(705) 702-3921
info@priengineering.com
www.priengineering.com

PARTICLE SIZE DISTRIBUTION
LS - 702

Project Name: Heritage Line **Project No.:** 21-049 **Sample Date:** 3-May-21

Borehole/Test Pit ID.: BH21-01 **Sample No./Depth:** SS6 @ 3.80m to 4.26m **Test Date:** 25-May-21



Silt or Clay	Sand	Gravel

Sieve Size (mm)	% Passing
37.5	100.0
26.5	92.1
19.0	88.2
13.2	86.4
9.5	83.2
4.750	78.7
2.000	71.0
0.850	65.2
0.425	60.7
0.250	54.5
0.075	38.0

Hydrometer (mm)	% Passing
0.044	29.4
0.032	26.2
0.021	23.1
0.012	18.9
0.009	16.8
0.006	14.7
0.003	10.5
0.001	8.4

PRI ENGINEERING
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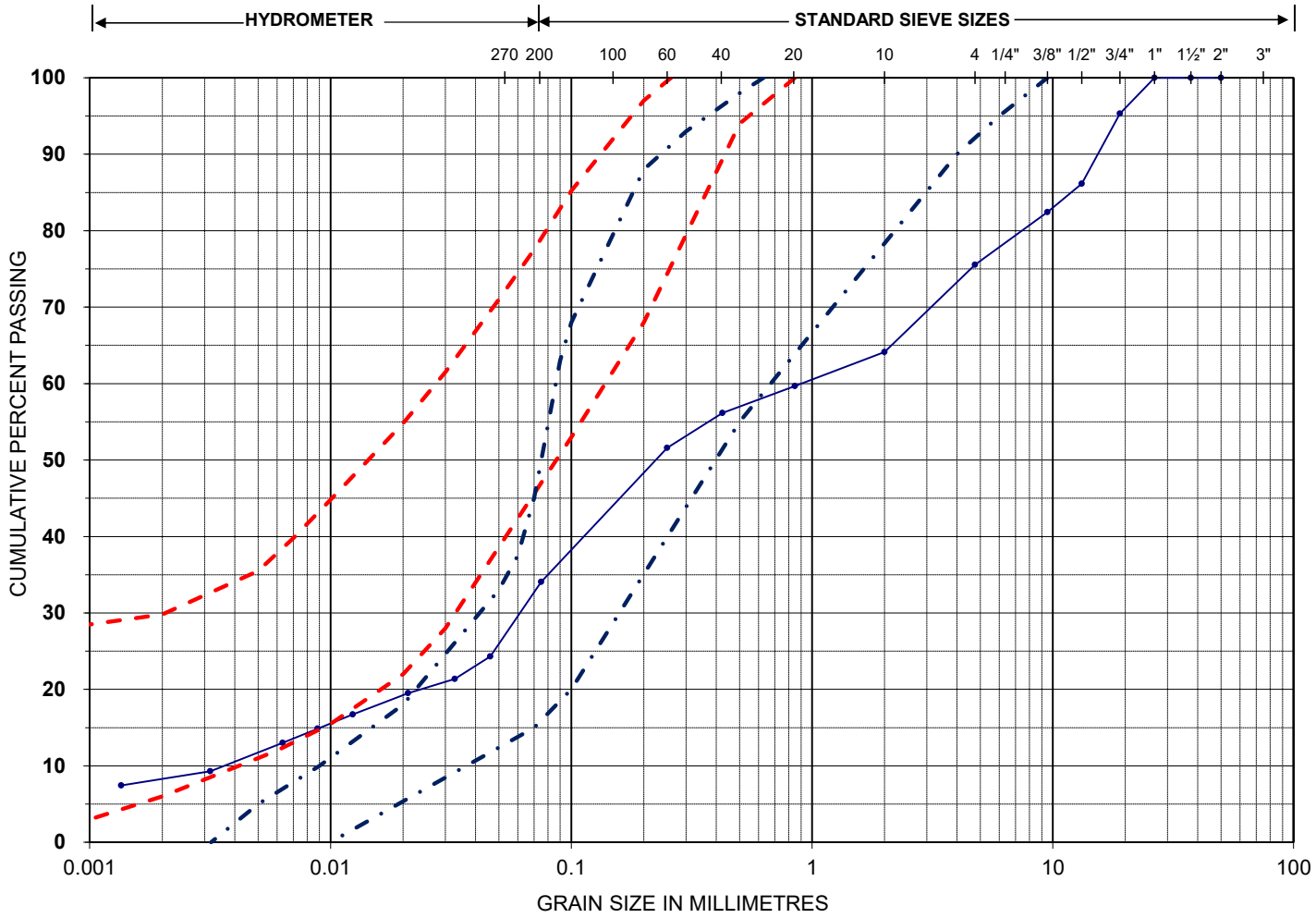
PARTICLE SIZE DISTRIBUTION
LS - 702

Project Name: Heritage Line **Project No.:** 21-049 **Date:** 25-May-21

Borehole/Test Pit ID.: TP21-02 **Sample No./Depth:** GS-02 @ 0.6 - 3.3 m



Silt or Clay	Sand	Gravel

sm envelope T = 8 - 20 min/cm
ml envelope T = 20 - 50 min/cm

Estimated T = 15 min/cm

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	95.3
13.2	86.1
9.5	82.4
4.750	75.5
2.000	64.1
0.850	59.7
0.425	56.2
0.250	51.6
0.075	34.1

Hydrometer (mm)	% Passing
0.046	24.3
0.033	21.4
0.021	19.5
0.012	16.7
0.009	14.9
0.006	13.0
0.003	9.3
0.001	7.4

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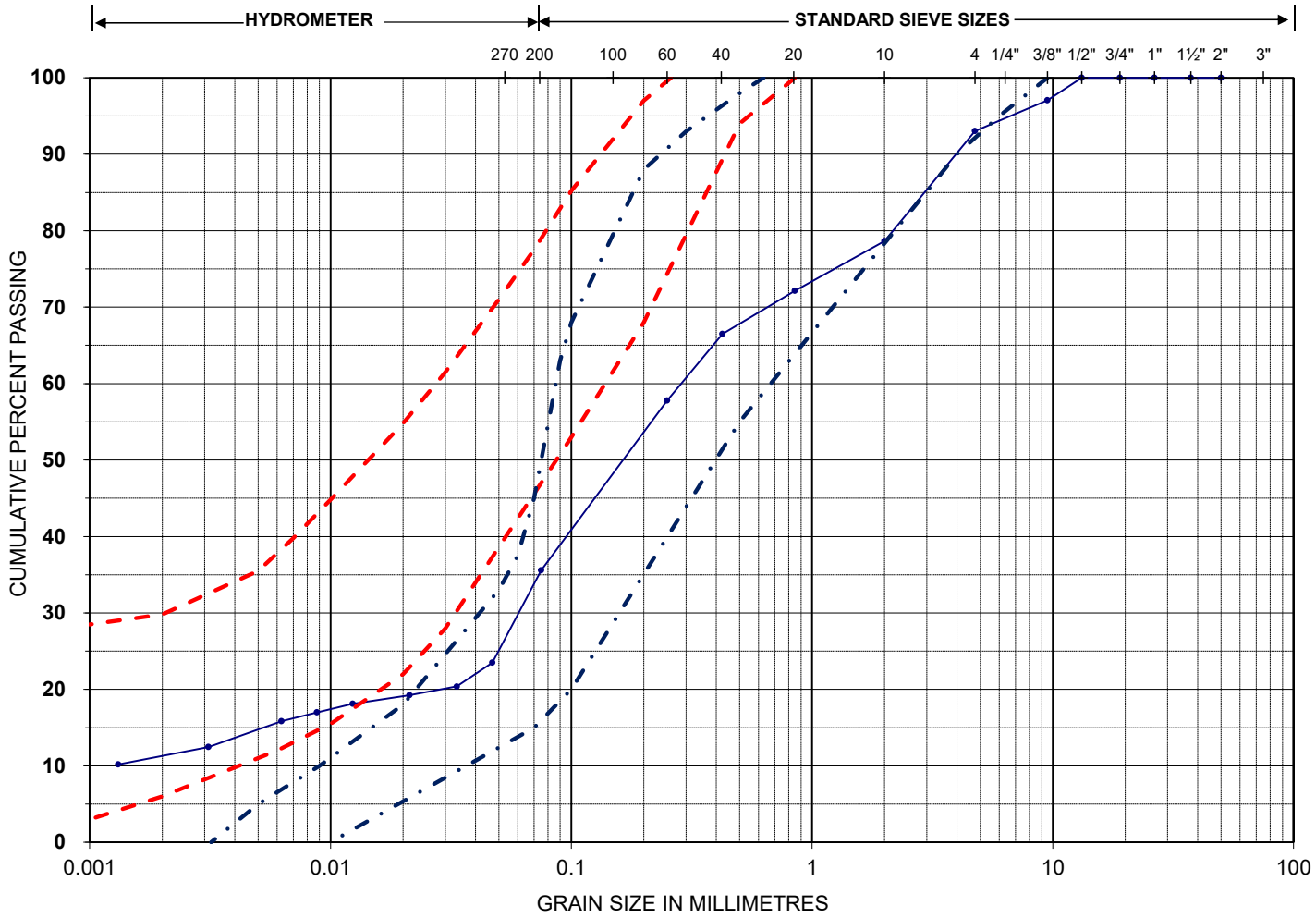
Project Name: Heritiage Line **Project No.:** 21-049 **Date:** 28-Apr-21

Borehole/Test Pit ID.: TP21-04 **Sample No./Depth:** GS2@ 0.4 - 3.3m



Silt or Clay	Sand	Gravel

sm envelope T = 8 - 20 min/cm
ml envelope T = 20 - 50 min/cm

Estimated T = 13 min/cm

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	100.0
9.5	97.0
4.750	93.0
2.000	78.6
0.850	72.1
0.425	66.5
0.250	57.8
0.075	35.6

Hydrometer (mm)	% Passing
0.047	23.5
0.033	20.4
0.021	19.3
0.012	18.1
0.009	17.0
0.006	15.9
0.003	12.5
0.001	10.2

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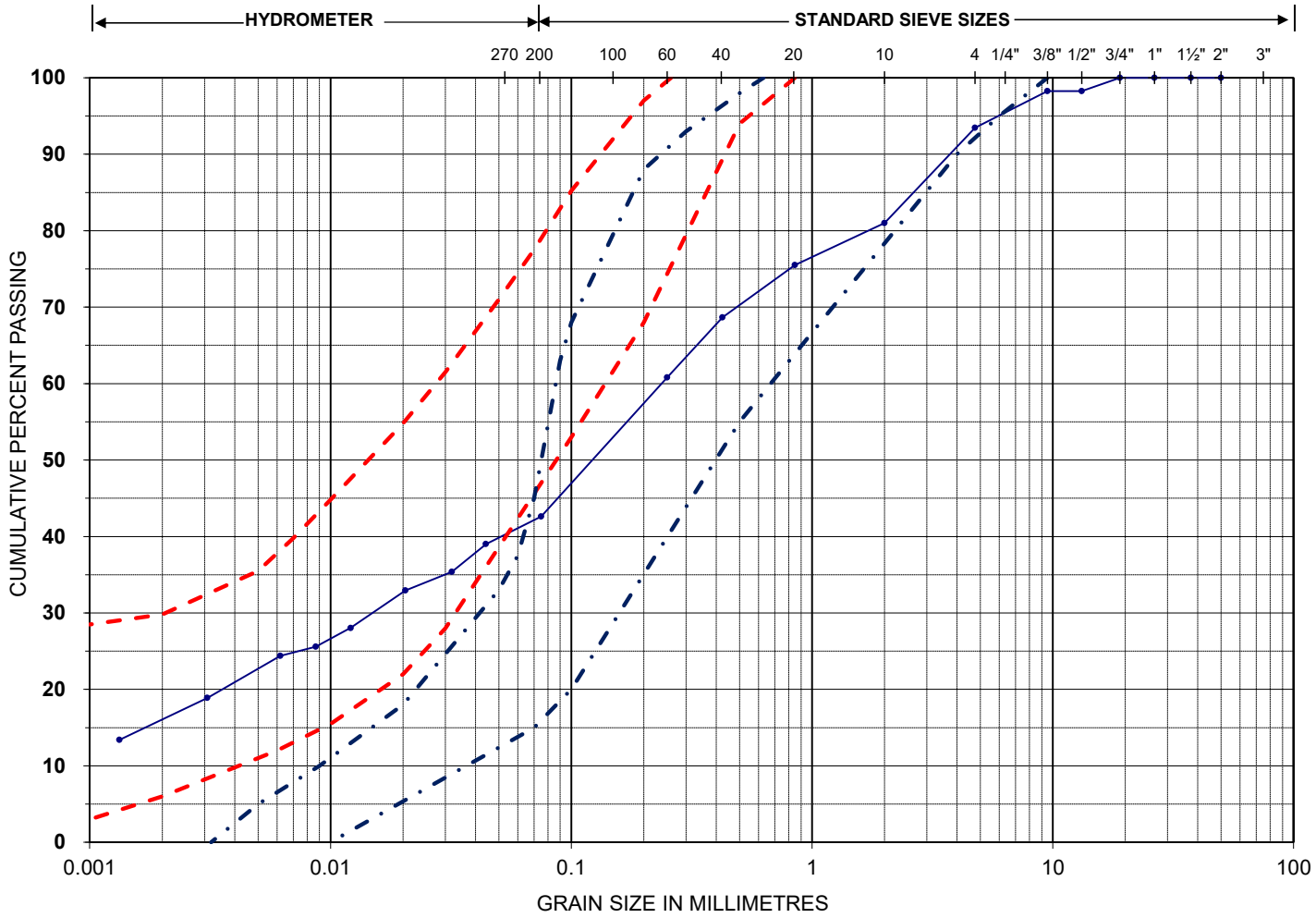
Project Name: Heritage Line **Project No.:** 21-049 **Date:** 25-May-21

Borehole/Test Pit ID.: TP21-05 **Sample No./Depth:** GS-2 @ 2m



Silt or Clay	Sand	Gravel

sm envelope T = 8 - 20 min/cm
ml envelope T = 20 - 50 min/cm

Estimated T = 20 min/cm

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	98.3
9.5	98.3
4.750	93.5
2.000	81.0
0.850	75.5
0.425	68.6
0.250	60.8
0.075	42.6

Hydrometer (mm)	% Passing
0.044	39.0
0.032	35.4
0.020	32.9
0.012	28.0
0.009	25.6
0.006	24.4
0.003	18.9
0.001	13.4

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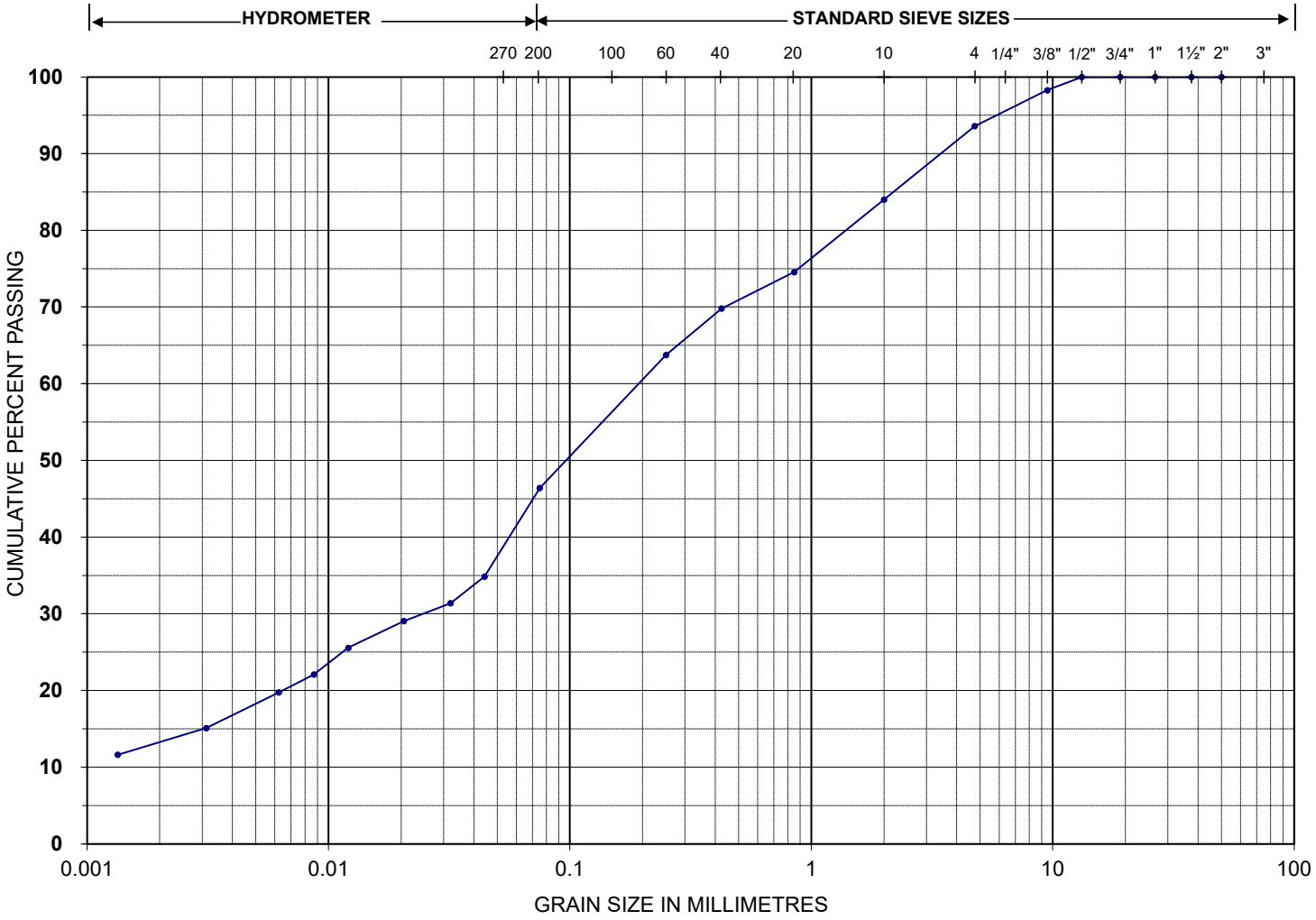
Project Name: Heritage Line **Project No.:** 21-049 **Sample Date:** 3-May-21

Borehole/Test Pit ID.: BH21-07 **Sample No./Depth:** SS2 @ 0.8 - 1.2 m **Test Date:** 25-May-21



Silt or Clay	Sand	Gravel

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	100.0
9.5	98.3
4.750	93.6
2.000	84.0
0.850	74.6
0.425	69.8
0.250	63.7
0.075	46.4

Hydrometer (mm)	% Passing
0.044	34.9
0.032	31.4
0.021	29.1
0.012	25.6
0.009	22.1
0.006	19.8
0.003	15.1
0.001	11.6

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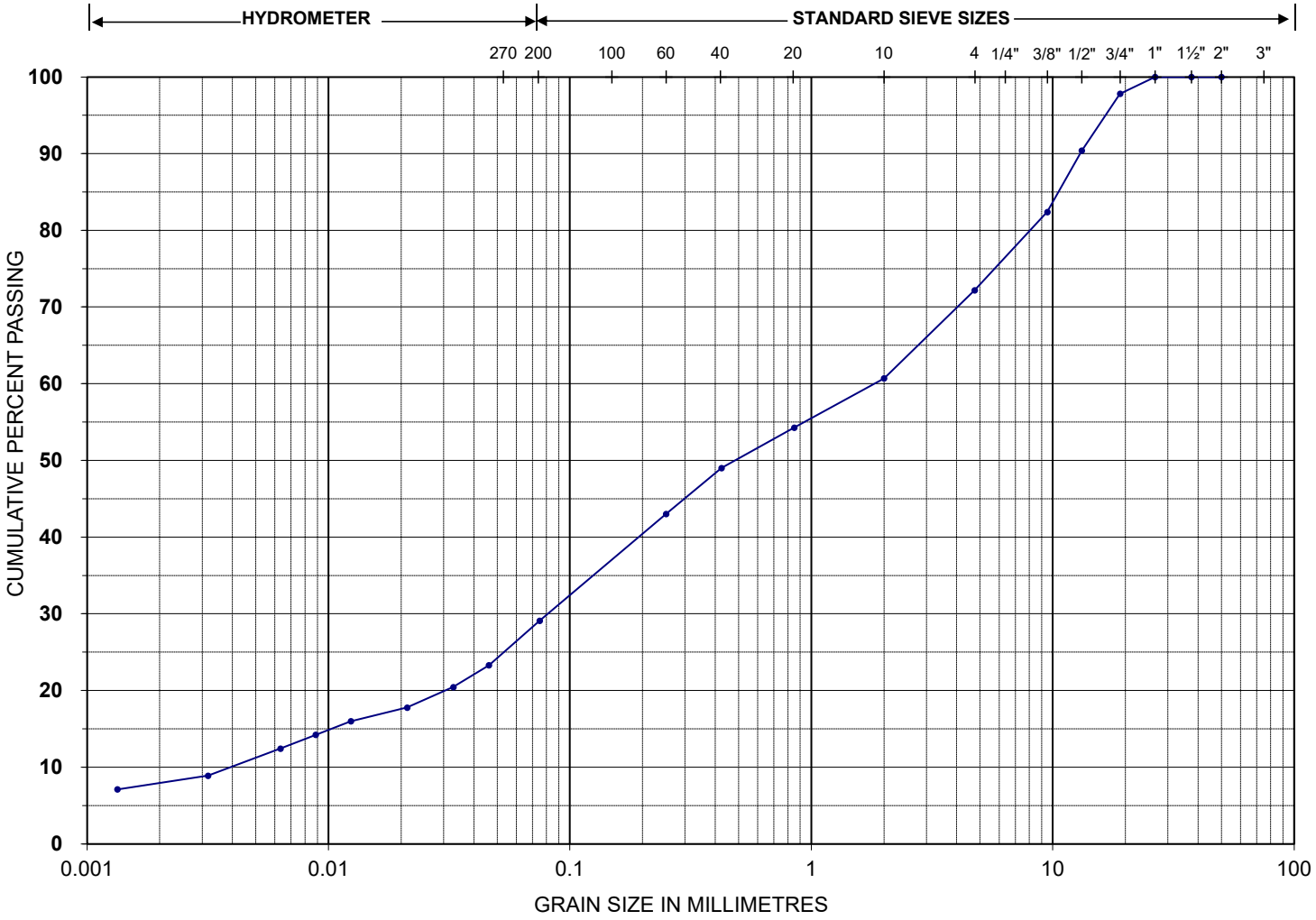
Project Name: Heritage Line **Project No.:** 21-049 **Sample Date:** 3-May-21

Borehole/Test Pit ID.: BH21-08 **Sample No./Depth:** SS2 @ 2.3 - 2.7 m **Test Date:** 25-May-21



Silt or Clay	Sand	Gravel

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	97.8
13.2	90.4
9.5	82.4
4.750	72.2
2.000	60.7
0.850	54.3
0.425	49.0
0.250	43.0
0.075	29.1

Hydrometer (mm)	% Passing
0.046	23.3
0.033	20.4
0.021	17.8
0.012	16.0
0.009	14.2
0.006	12.4
0.003	8.9
0.001	7.1

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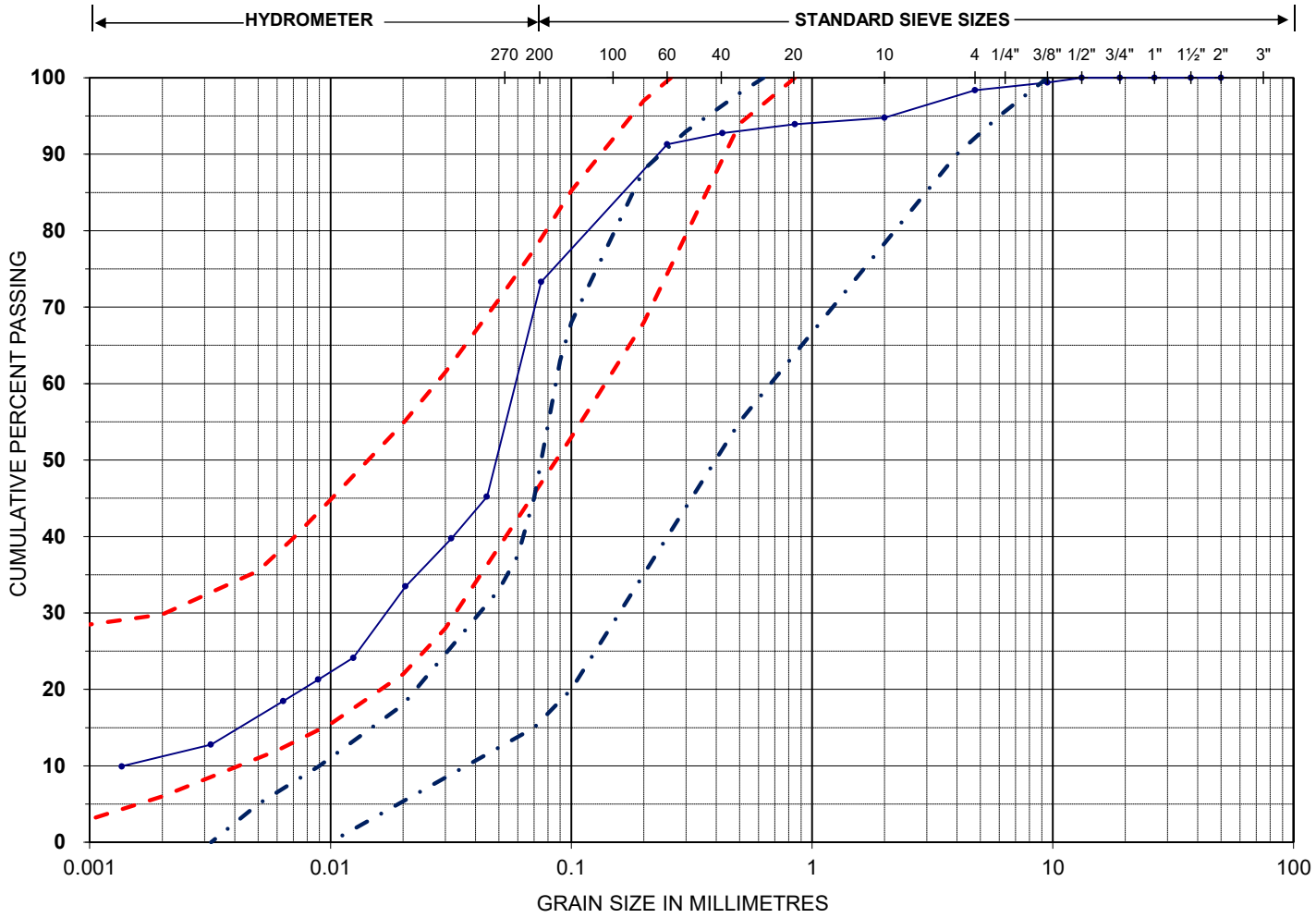
Project Name: Heritage Line **Project No.:** 21-049 **Date:** May 25 2021

Borehole/Test Pit ID.: BH21-09 **Sample No./Depth:** SS3 @ 1.5 - 1.9 m



Silt or Clay	Sand	Gravel

sm envelope T = 8 - 20 min/cm
ml envelope T = 20 - 50 min/cm

Estimated T = 30 min/cm

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	100.0
9.5	99.4
4.750	98.4
2.000	94.8
0.850	93.9
0.425	92.7
0.250	91.3
0.075	73.3

Hydrometer (mm)	% Passing
0.045	45.2
0.032	39.8
0.021	33.5
0.012	24.1
0.009	21.3
0.006	18.5
0.003	12.8
0.001	9.9

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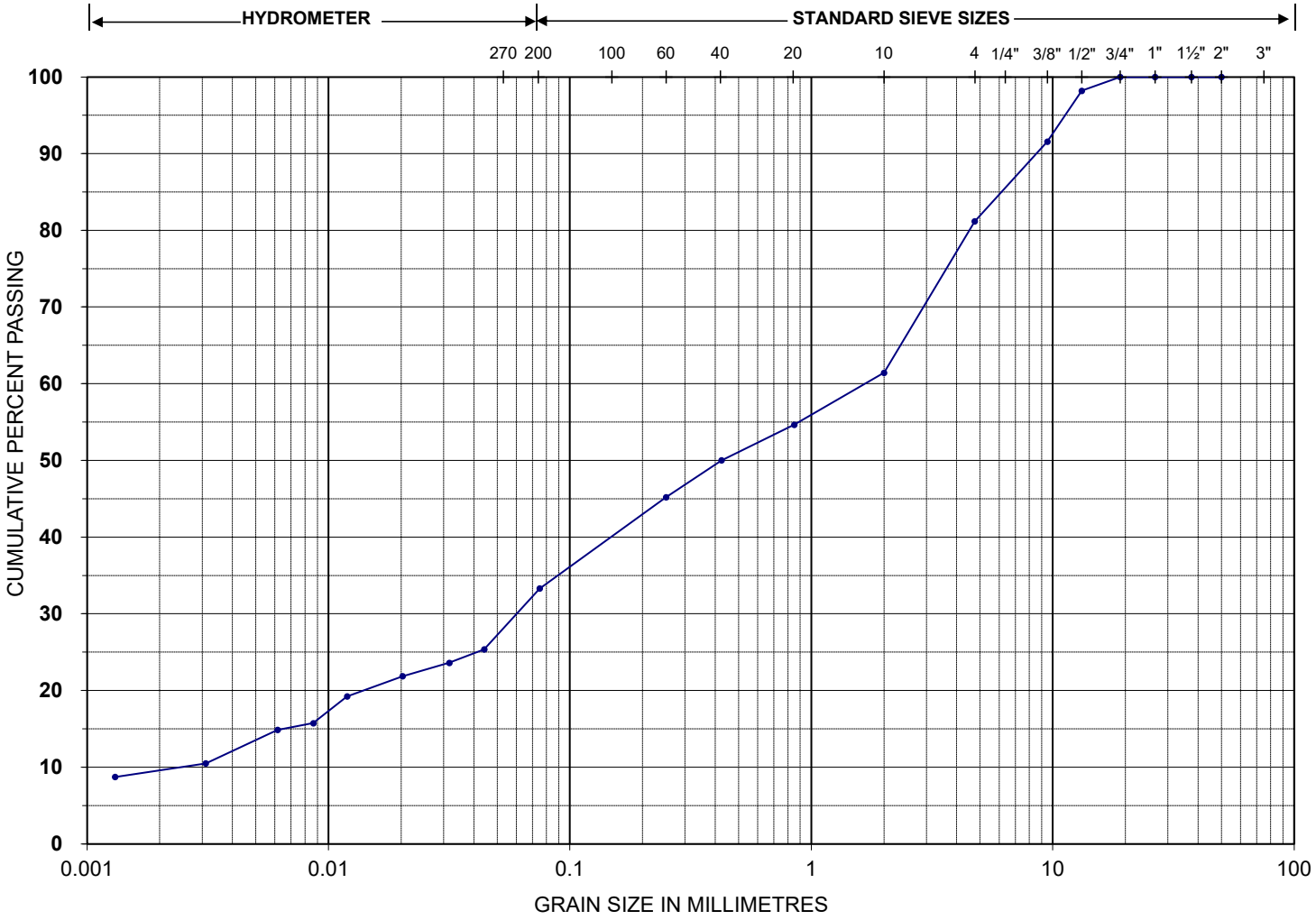
Project Name: Heritiage Line **Project No.:** 21-049 **Sample Date:** 4-May-21

Borehole/Test Pit ID.: BH21-11 **Sample No./Depth:** SS6 @ 3.8m to 4.3m **Test Date:** 25-May-21



Silt or Clay	Sand	Gravel

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	98.2
9.5	91.6
4.750	81.2
2.000	61.4
0.850	54.7
0.425	50.0
0.250	45.2
0.075	33.3

Hydrometer (mm)	% Passing
0.044	25.4
0.032	23.6
0.020	21.9
0.012	19.2
0.009	15.7
0.006	14.9
0.003	10.5
0.001	8.7

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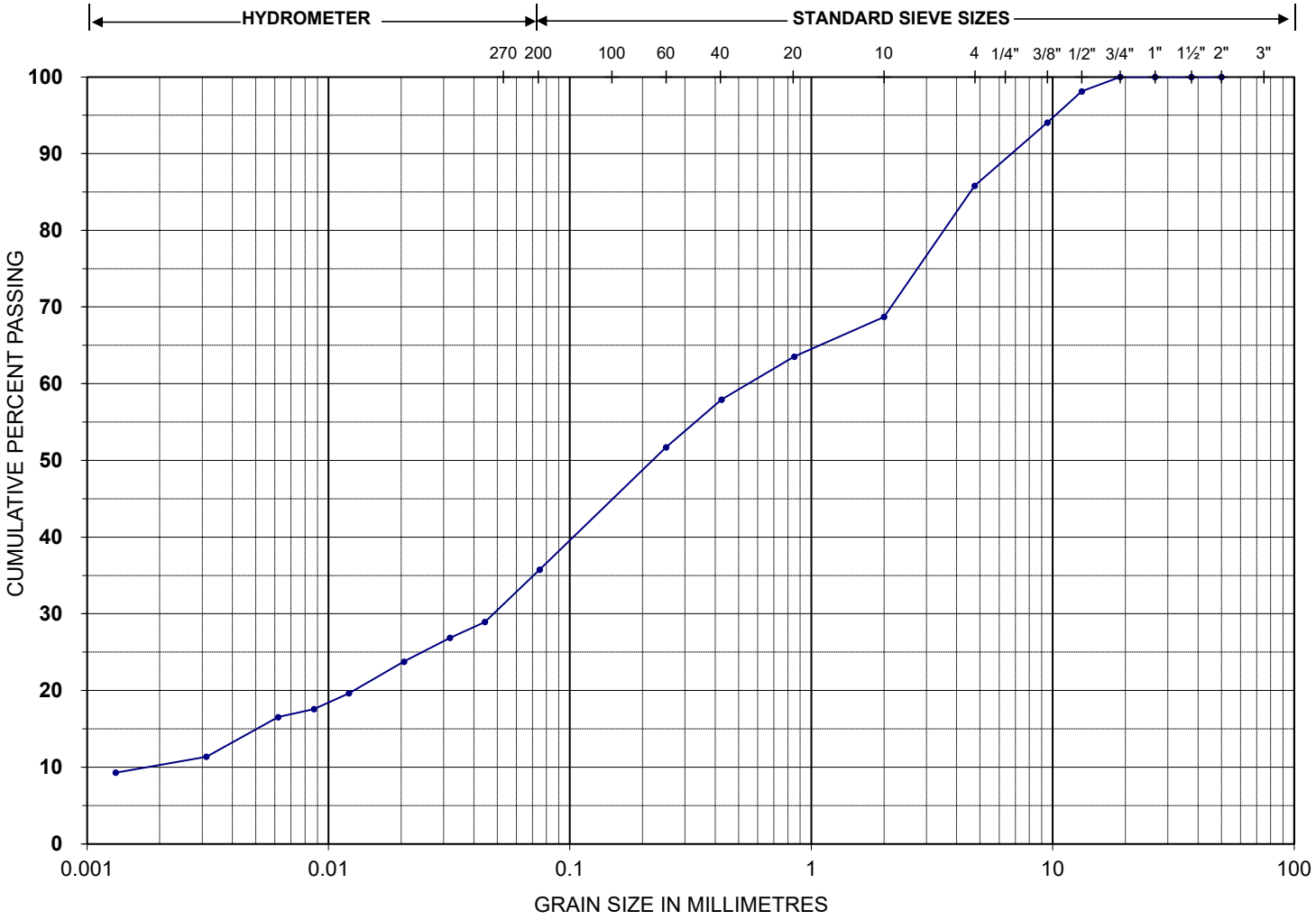
Project Name: Heritiage Line **Project No.:** 21-049 **Sample Date:** 4-May-21

Borehole/Test Pit ID.: BH21-12 **Sample No./Depth:** SS6 @ 3.8 - 4.3 m **Test Date:** 25-May-21



Silt or Clay	Sand	Gravel

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	98.1
9.5	94.0
4.750	85.8
2.000	68.7
0.850	63.5
0.425	57.9
0.250	51.7
0.075	35.8

Hydrometer (mm)	% Passing
0.044	28.9
0.032	26.9
0.021	23.8
0.012	19.6
0.009	17.6
0.006	16.5
0.003	11.4
0.001	9.3

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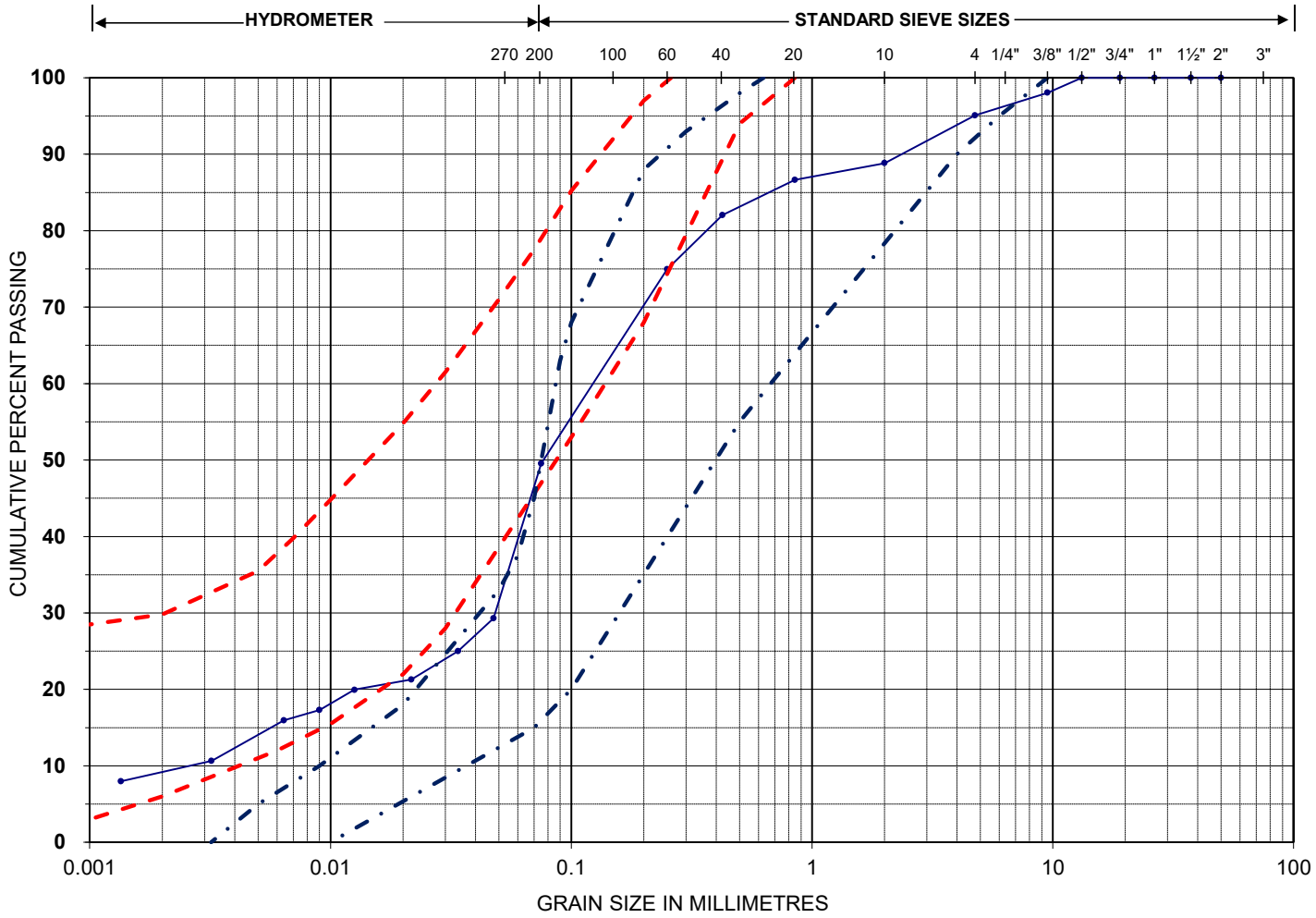
Project Name: Heritiage Line **Project No.:** 21-049 **Date:** 5-May-21

Borehole/Test Pit ID.: BH21-16 **Sample No./Depth:** SS3 @ 1.5 - 2.0 m



Silt or Clay	Sand	Gravel

sm envelope T = 8 - 20 min/cm
ml envelope T = 20 - 50 min/cm

Estimated T = 20 min/cm

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	100.0
9.5	98.0
4.750	95.1
2.000	88.8
0.850	86.7
0.425	82.0
0.250	75.0
0.075	49.5

Hydrometer (mm)	% Passing
0.048	29.3
0.034	25.0
0.022	21.3
0.013	20.0
0.009	17.3
0.006	16.0
0.003	10.6
0.001	8.0

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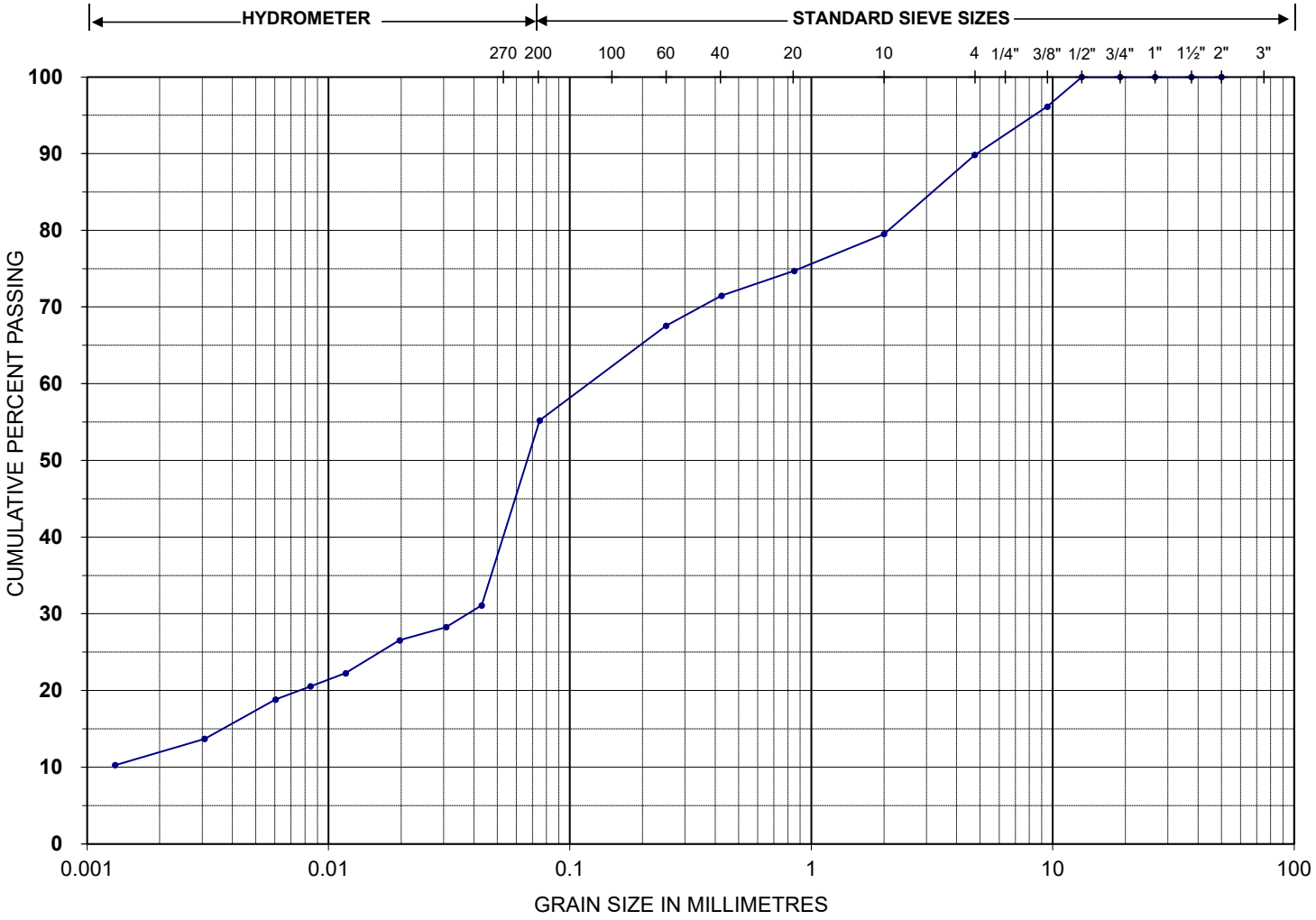
Project Name: Heritage Line **Project No.:** 21-049 **Sample Date:** 3-May-21

Borehole/Test Pit ID.: BH21-17 **Sample No./Depth:** SS5 @ 3.0 - 3.5 m **Test Date:** 25-May-21



Silt or Clay	Sand	Gravel

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	100.0
9.5	96.1
4.750	89.8
2.000	79.5
0.850	74.7
0.425	71.5
0.250	67.5
0.075	55.2

Hydrometer (mm)	% Passing
0.043	31.1
0.031	28.3
0.020	26.5
0.012	22.3
0.008	20.6
0.006	18.8
0.003	13.7
0.001	10.3

Appendix D

Corrosivity Laboratory Results, ANSI/AWWA Soil Corrosivity Scoring System

FINAL REPORT

CA14777-MAY21 R1

21-10985

Prepared for

D.M. Wills -Peterborough

FINAL REPORT

CA14777-MAY21 R1

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	D.M. Wills -Peterborough	Project Specialist	Brad Moore Hon. B.Sc
		Laboratory	SGS Canada Inc.
Address	150 Jameson Drive Peterborough, ON K9J 0B9. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Harriet Walker	Telephone	705-652-2143
Telephone	289-356-3692	Facsimile	705-652-6365
Facsimile	705-741-3568	Email	brad.moore@sgs.com
Email	hwalker@dmwills.com;iames@dmwills.com	SGS Reference	CA14777-MAY21
Project	21-10985	Received	05/20/2021
Order Number		Approved	05/28/2021
Samples	Soil (3)	Report Number	CA14777-MAY21 R1
		Date Reported	05/28/2021

COMMENTS

Temperature of Sample upon Receipt: 8 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:NA

Corrosivity Index is based on the American Water Works Corrosivity Scale according to AWWA C-105. An index greater than 10 indicates the soil matrix may be corrosive to cast iron alloys.

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

FINAL REPORT

CA14777-MAY21 R1

Client: D.M. Wills -Peterborough
Project: 21-10985
Project Manager: Harriet Walker
Samplers: Harriet Walker

PACKAGE: **- Corrosivity Index** (SOIL)

Sample Number	5	6	7
Sample Name	S-10985-BH21-0 3-SS2-05-03-21	S-10985-BH21-0 6-SS3-05-03-21	S-10985-BH21-0 8-SS3-05-03-21
Sample Matrix	Soil	Soil	Soil
Sample Date	03/05/2021	03/05/2021	03/05/2021

Parameter	Units	RL		Result	Result	Result
Corrosivity Index						
Corrosivity Index	none	1		1	1	4
Soil Redox Potential	mV	-		322	329	298
Sulphide (Na2CO3)	%	0.04		< 0.04	< 0.04	< 0.04
pH	pH Units	0.05		8.47	8.31	8.58
Resistivity (calculated)	ohms.cm	-9999		5880	7410	6940

PACKAGE: **- General Chemistry** (SOIL)

Sample Number	5	6	7
Sample Name	S-10985-BH21-0 3-SS2-05-03-21	S-10985-BH21-0 6-SS3-05-03-21	S-10985-BH21-0 8-SS3-05-03-21
Sample Matrix	Soil	Soil	Soil
Sample Date	03/05/2021	03/05/2021	03/05/2021

Parameter	Units	RL		Result	Result	Result
General Chemistry						
Conductivity	uS/cm	2		170	135	144

PACKAGE: **- Metals and Inorganics** (SOIL)

Sample Number	5	6	7
Sample Name	S-10985-BH21-0 3-SS2-05-03-21	S-10985-BH21-0 6-SS3-05-03-21	S-10985-BH21-0 8-SS3-05-03-21
Sample Matrix	Soil	Soil	Soil
Sample Date	03/05/2021	03/05/2021	03/05/2021

Parameter	Units	RL		Result	Result	Result
Metals and Inorganics						
Moisture Content	%	0.1		9.0	10.6	10.9

Client: D.M. Wills -Peterborough
Project: 21-10985
Project Manager: Harriet Walker
Samplers: Harriet Walker

PACKAGE: **- Metals and Inorganics** (SOIL)

Sample Number			5	6	7
Sample Name			S-10985-BH21-03-SS2-05-03-21	S-10985-BH21-06-SS3-05-03-21	S-10985-BH21-08-SS3-05-03-21
Sample Matrix			Soil	Soil	Soil
Sample Date			03/05/2021	03/05/2021	03/05/2021
Parameter	**Units**	**RL**	**Result**	**Result**	**Result**
Metals and Inorganics (continued)					
Sulphate	µg/g	0.4	3.1	2.3	5.2

PACKAGE: **- Other (ORP)** (SOIL)

Sample Number			5	6	7
Sample Name			S-10985-BH21-03-SS2-05-03-21	S-10985-BH21-06-SS3-05-03-21	S-10985-BH21-08-SS3-05-03-21
Sample Matrix			Soil	Soil	Soil
Sample Date			03/05/2021	03/05/2021	03/05/2021
Parameter	**Units**	**RL**	**Result**	**Result**	**Result**
Other (ORP)					
Chloride	µg/g	0.4	2.3	1.2	2.1

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO0484-MAY21	µg/g	0.4	<0.4	3	20	97	80	120	109	75	125
Sulphate	DIO0484-MAY21	µg/g	0.4	<0.4	8	20	96	80	120	86	75	125

Carbon/Sulphur

Method: ASTM E1915-07A | Internal ref.: ME-CA-[ENV]ARD-LAK-AN-020

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide (Na2CO3)	ECS0065-MAY21	%	0.04	< 0.04	ND	20	111	80	120			

Conductivity

Method: SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0517-MAY21	uS/cm	2	< 2	1	20	101	90	110	NA		

QC SUMMARY

pH

Method: SM 4500 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0517-MAY21	pH Units	0.05	NA	0		100			NA		

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.
RL Reporting Limit.
↑ Reporting limit raised.
↓ Reporting limit lowered.
NA The sample was not analysed for this analyte
ND Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

SGS Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No: Page _____ of _____

Laboratory Information Section - Lab use only

Received By: CAYLIN GRAHAM Received By (signature): _____
Received Date: 05 20 21 (mm/dd/yy) Custody Seal Present: Yes ☐ No ☑ Cooling Agent Present: Yes ☑ No ☐ Type: Ice
Received Time: 13:45 (hr : min) Custody Seal Intact: Yes ☐ No ☑ Temperature Upon Receipt (°C) 6.8.10 LAB LIMS #: CA 14777-MAY21

REPORT INFORMATION	INVOICE INFORMATION
Company: D.M. Wills	☐ (same as Report Information)
Contact: Harriet Walker	Company:
Address: 150 Jameson Dr Peterborough ON	Contact:
Phone: (289) 356-3692	Address:
Fax: hwalker@dmwills.com	Phone:
Email: james@dmwills.com	Email: accounts@dmwills.com

Quotation #: _____ P.O. #: _____
Project #: 21-10985 Site Location/ID:

TURNAROUND TIME (TAT) REQUIRED

☒ Regular TAT (5-7days) TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: _____ NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

Regulation 153/04: ☐ Table 1 ☐ Table 2 ☐ Table 3 ☐ Table ____ ☐ Res/Park ☐ Ind/Com ☐ Agri/Other Soil Texture: ☐ Coarse ☐ Medium/Fine

Other Regulations: ☐ Reg 347/558 (3 Day min TAT) ☐ PWQO ☐ MMER ☐ CCME ☐ Other: ☐ MISA

Sewer By-Law: ☐ Sanitary ☐ Storm Municipality: _____

RECORD OF SITE CONDITION (RSC) ☐ YES ☒ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES (Ziplock Bags)	MATRIX	M&I: Field Filtered (Y/N)	M&I: Metals & Inorganics incl CrVI, CN, Hg pH, (B(HWS), EC, SAR-soil) (Cl, Na-water)	M&I: Full Metals Suite (ICP metals plus B(HWS-soil only) Hg, CrVI	M&I: ICP Metals only Sb,As,Ba,Be,B,Cd,Cr,Co,Cu,Pb,Mo,Ni, Se,Ag,Ti,U,V,Zn	SVOC: PAHs only	SVOC: SVOCs all incl PAHs, ABNs, CPs	PCB: PCBs Total ☐ Aroclor ☐	PHC: F1-F4 + BTEX	PHC: F1-F4 only no BTEX	VOC: VOCs all incl BTEX	VOC: BTEX only	Pest: Pesticides Organochlorine or specify other	Other: Corrosivity	Other: Sewer Use: Specify pkg:	Other: Water Characterization Pkg ☐ General ☐ Extended	TCLP: Specify TCLP tests ☐ M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ gnit.	COMMENTS:
1	S-10985-BH21-03-SS2-05-03-21	05-03-21	2:09 PM	1	S	N												X				
2	S-10985-BH21-06-SS3-05-03-21	05-03-21	3:25 PM	1	S	N												X				
3	S-10985-BH21-08-SS3-05-03-21	05-03-21	~~3:45 PM~~ 3:50 PM	1	S	N												X				
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						

*full Corrosivity Package each Sample

Observations/Comments/Special Instructions

Sampled By (NAME): Harriet Walker Signature: _____ Date: 05/20/21 (mm/dd/yy)
Relinquished by (NAME): Harriet Walker Signature: _____ Date: 05/20/21 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

Revision #: 1.3
Date of Issue: 13 Oct, 2019

AWWA Soil Corrosiveness Scoring System

Soil characteristics	Points*
Resistivity† **(Ω·cm)**	
<700	10
700–1000	8
1000–1200	5
1200–1500	2
1500–2000	1
>2000	0
pH	
0–2	5
2–4	3
4–6.5	0
6.5–7.5	0‡
7.5–8.5	0
>8.5	3
Redox potential	
> +100 mV	0
+50 to +100 mV	3.5
0 to +50 mV	4
Negative	5
Sulphides	
Positive	3.5
Trace	2
Negative	0
Moisture	
Poor drainage, continuously wet	2
Fair drainage, generally moist	1
Good drainage, generally dry	0

*Ten points means that soil is corrosive to grey or ductile cast iron pipe; protection is indicated.

†Based on single-probe at pipe depth or water-saturated soil box.

‡If sulphides are present and low or negative redox-potential results are obtained, give three points for this range.