Subsurface Investigation Report

1364, 1368 and 1370 Stittsville Main St., Ottawa, ON, K2S 1V4

Abstract

This report presents the findings of a Subsurface Investigation completed at the 1364, 1368 and 1370 Stittsville Main St. parcels, in the City of Ottawa, ON and issue recommendations for a proposed 4 storey apartment building development. It provides technical information about the subsurface conditions at 6 borehole locations compiled from field sampling and testing. All boreholes were advanced to auger refusals suggesting bedrock depths increasing from the back of the property at 2 m depth to the front at roughly 6 m. The majority of the soil profile consists on dense well graded sand and gravel. The water table was found at approximately 3 m depth. The borehole locations are shown in figure 1 in page 9. The information reviewed also includes boreholes by others, readily available geologic information from the Geological Survey of Canada (GSC) and local climate data from Environment Canada.

Yuri Mendez M. Eng., P. Eng.

Licensed Professional Engineer
June 20, 2022
Y. MENDEZ ZARATE
100148573
Province of Ontario

Report number: 53-BSI-R1[1]
June 20, 2022

YME
Yuri Mendez
Engineering

196 Britannia Road
Ottawa, On. K2B 5W9

Phone: 613-899-0834
e-mail: yuri@ymendez.ca

PO Box 74087
RPO Beechwood
Ottawa, ON, K1M 2H9

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[1] For the account of Bayview Stittsville Inc. (BSI) as per proposal in email dated February 24, 2022 and subject to the user agreement in page 17 .

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1 Introduction

This document reports the findings of a subsurface investigation completed at 1364, 1368 and 1370 Stittsville Main St., in the City of Ottawa, ON, K2S 1V4, having extents and geometry shown in figure 1 in page 9. The geotechnical materials in Ottawa and the surrounding areas are largely influenced by a history of glaciation, glacio-fluvial activity and the Champlain Sea. Common overburden materials include clay, very sensitive silty clay, till, boulder till, clean sand and silty sand overlying sedimentary rocks. Igneous and metamorphic rocks are also present. Organic materials have also influenced numerous soil deposits.

The investigation was carried out by advancing 6 boreholes through overburden soils and by proving bedrock depth by available exploration techniques for engineering purposes. The information compiled from the exploration and sampling and testing completed in the boreholes and a subsequent laboratory testing program of soils is to assist in the design and construction of a proposed 4 storey apartment building development. The information reviewed also includes boreholes by others, readily available geologic information from the Geological Survey of Canada (GSC), and local climate data from Environment Canada.

2 Report Organization

The body of this report and its appendices constitute the entire report. The discussion presented under sections in the body may refer to further information and/or background and/or details in the appendices. The reader is responsible of reviewing the information in the appendices. Other references may be presented as footnotes.

Future revisions to this report will be referred to as “53-BSI-R#”, where # is the consecutive number of the revision. Additions and/or alterations and/or inclusions to the information provided in this report at the request of any institution and/or body with authority to request the additions and/or alterations and/or inclusion will be provided in a separate “Response to ” (RT) section at the end of the report, before the appendices. The RT section shall state the section that is added and/or altered, the name of the person making the request and the reason. The section altered and or portions added will be provided in full as a subsection of the RT section. Any subsection added under the RT section will be considered a replacement to the original section.

Part I

Investigation

3 Sampling and Testing

The field and laboratory program set out in our proposal is guided by the following standards:

- ASTM D 420-98 Standard Guide to Site Characterization for Engineering Design and Construction Purposes,
- ASTM D5434 - 12 Standard Guide for Field Logging of Subsurface Explorations of Soil and Rock,
- ASTM D1586 - 11 Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils,

The ASTM D1586 tests were completed using an “auto safety” hammer rated at 60% energy.

The field program consisted in sampling the subsurface profile using boreholes located as shown in fig. 1 in page 9 along with field review, assessments and classification of samples.

The program also included an elevation survey referenced to the top of MH-S located in front of 1364 Stittsville Main St. which is understood to have a 118.14 m geodetic elevation. The program included in addition a laboratory review of samples recovered from the field.

The laboratory testing, soil sampling and field testing at each location are shown in the soil profile testing and sampling logs (BH) in the appendices.

Part II

Findings

4 Physical Settings, Strata and Topography

The site is presently relatively flat grass and topsoil covered area within a city block in Ottawa. It consists on the 1364, 1368 and 1370 Stittsville Main St. parcels in the City of Ottawa, ON. Figure 1 in page 9 shows a plan view of the site displaying the approximate test hole locations, elevations and depth.

Auger refusals suggest that the site is underlain by bedrock at depths varying between 2 and 6 m from the back of the property to the front respectively. The overburden materials were found to consistently consist on dense to very dense brown well graded sand and gravel throughout the site. A relatively thin near surface brown fine silty sand fill layer was also found at a few locations.

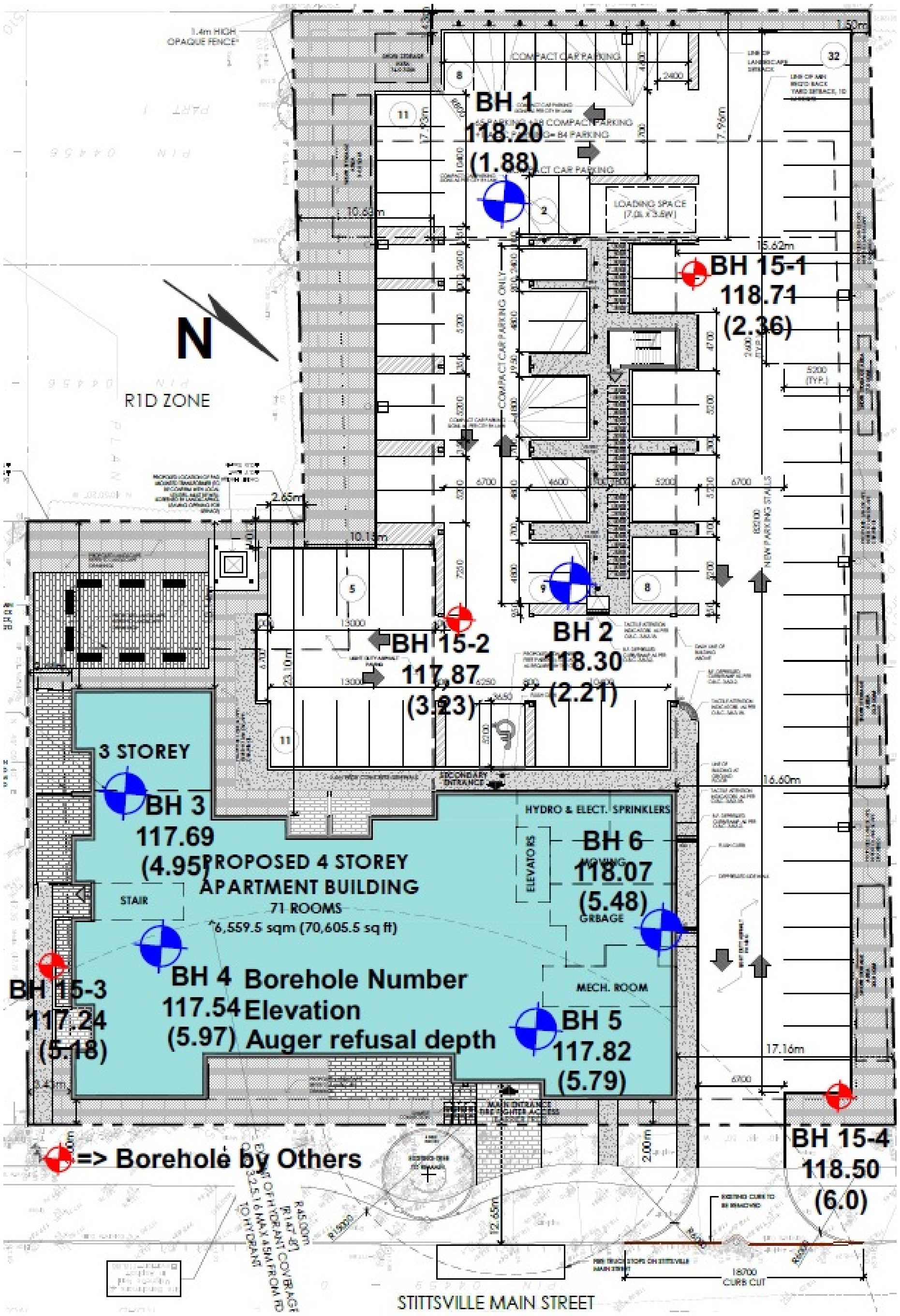

Figure 1: Test hole Locations Plan

The geology data base by Belanger J. R. 1998 suggests 3 to 10 m of overburden soils underlain by interbeddeded limestone and dolomite bedrock at this site.

4.1 Groundwater and Moisture

The water level was measured on April 02, 2022 in stand pipes installed in BH4 and BH6 at 2.65 and 3.2 m depth respectively and shown in the borehole logs. Ground water measurements in stand pipe installations often require numerous assessments in combination with borehole data.

Field observations of soils as extracted in the field in the sampler, measurements, coloration and stiffness suggest that the permanent water is at approximately 3.0 m depth. Moisture contents vary above the ground water table.

4.2 Freezing Index, Frost Depth and Frost Susceptibility

It is generally assumed that the frost depth for the 1,000 degree Celsius-days freezing index applicable to Ottawa will reach no deeper than 1.8 m on bare ground (snow free) or pavement. It is also assumed that frost depth will reach no deeper than 1.5 m on snow covered ground.

Materials here classified as dense brown well graded sand and gravel are not frost susceptible.

Part III

Recommendations

The following set of the recommendations result from sampling and testing outlined in section 3 and from geotechnical engineering evaluation and assessments.

It is understood that the proposed development will consist of a 4 storey apartment building with an at grade slab and no basement.

5 Foundations General

Generally speaking, code compliant Part 9 and Part 4 residential buildings founded on spread footings can be considered for the proposed 4 storey apartment building.

5.1 Load and Resistance Factors

For the purpose of computations related to the service (SLS) and strength limits (ULS) note:

- A resistance factor is applied to the computed or estimated (nominal) bearing resistance from field or lab tests to obtain the strength limit for factored loads (ULS). The value of the resistance factor is stated for each option.

- An average load factor of 1.5 is assumed to compute the service limit (SLS).

5.2 Bearing Capacity of Strip and/or Pad Footings

Based on the findings of this investigation and geotechnical assessments, the following bearing capacity can be used *for strip footings up to 1.5 m wide and pad footings up to 3 m wide placed on undisturbed native dense brown well graded sand and gravel soils encountered in the testholes*:

- 300 kPa at service limit (SLS).
- 450 kPa for factored loads (ULS).

5.3 Settlements

For the footing loads provided in section 5.2 building settlements for foundations on undisturbed very stiff silty clay are not to exceed service limit values (SLS) of 25 mm and 20 mm total and differential settlements respectively at this site.

5.4 Foundation Wall Dampproofing and Drainage

Foundation walls dampproofing and foundation drainage are not required for foundations serving buildings of slab on grade construction not having floor levels lower than the finished grade on the perimeter.

Elevatior shafts often require drainage along their exterior perimeter. Appendix E.1 presents page 2 of NRC Construction Evaluation Reports CCMC 12658-R showing dampproofing and foundation wall drainage system details satisfying the provisions under OBC 2012 and suitable for drainage along the perimeter of elevator shafts. Other available similar systems having the components shown in CCMC 12658-R may be used. Foundation drainage must be provided to daylight or a positive outlet, or sump.

6 Site Class for Seismic Design

At this site, the geotechnical testing completed are indicative of a Vs(30) exceeding 360 m/s. As such, site class C is assigned under the provisions in section 4.1.8.4 of the Ontario Building Code 2012 (OBC 2012) for seismic design.

7 Roadbed Soils and Pavement Structure

The flexible pavement structures supplied in this report follow the guidelines set out in AASHTO 1993 Guide for Design of Pavement Structures (AASHTO) for climatic Region III. Under AASHTO pavements are designed to withstand 20 year accumulated design Equivalent Single Axle 80 kN (18,000 pounds) load applications (ESALs). ESALs are a measure of mix traffic loads including vehicle loads and truck loads. The number of ESALs applications depend on traffic class and use.

Roadbed denotes the materials beneath pavement structures. The term pavement is used to denote the layered structure that forms a road carriageway or vehicle parking. *The general quality of the near surface undisturbed soil to serve as foundation for pavement structure (Roadbed soil) are assumed to be fair* as defined in the AASHTO guide. It is hence recommended to refer to the following information in appendix D:

- *Yuri Mendez Engineering's pavement catalog in appendix D.1 to select pavement structures* for traffic classes on the fair roadbed soils encountered at this site.

- Appendix D.2 for guidelines regarding frost heave.

- Appendix D.3 for frost protection recommendations for manholes and catch basin construction.

8 Excavations, Open Cuts, Trenches and Safety

Typically, the main concern when excavating soils or rock is the stability of the sides of excavations. The stability of the sides is achieved by either cutting the sides to safe slopes or by providing shoring. It is also an issue of safety because of imminent hazards to the safety of workers and to property. As such, excavations are governed by the provisions in the Occupational Health and Safety Act of Ontario (O. Reg. 213/91). The application of O. Reg. 213/91 requires a classification of soils in one or several of four types (type I to type IV).

At this site for soils can be considered type II under O. Reg. 213/91. As such, the following key aspects of O. Reg. 213/91 are applicable to excavations:

- Safe open cut is 1 vertical to 1 horizontal.

- Within 1.2 m of the bottom of open cut areas or trenches, the soil can be cut vertical.

Where the safe open cut is not provided, either the shoring systems described in O. Reg. 213/91 or engineered shoring systems need be used. Information regarding physical and mechanical properties of subsurface materials which will be required for shoring design are provided in this report.

8.1 Conditions Requiring Engineered Shoring

O. Reg. 213/91 describe the conditions in which engineered shoring systems are required. Some key aspects of O.Reg. 213/91 regarding the conditions in which an engineered shoring system is required are:

- Where soils are type I to III and the prescribed safe open cuts are not provided and
  - The excavation is not a trench or
  - The excavation is a trench either deeper than 6 m or wider than 3.6 m or both
- For trench excavations or open cut, where soils are type IV and the safe open cuts are not provided.

Note that along with the descriptions in O. Reg. 213/91 for soils type IV, any difficult soil having significant seepage and/or strength loss upon excavation such as caving soils can be rendered as type IV.

Note also that since excavation and safety are usually in control of the contractor, *shoring design and construction is done by the contractor.*

9 Reinstatement of Excavated Soils

Soils consisting of brown clean sand and/or brown dense well graded sand and gravel encountered at this site could be reinstated and compacted provided:

- Materials are sort out to ensure that only the brown clean sand and/or brown dense well graded sand and gravel is stock piled for re-use;
- Develop Proctor moisture density curves for compaction;
- Where the latter requirement is not completed the expected proctor density could also be estimated;
- the recommendations in appendix F are followed;
- Use accepted placement procedures, standards and passes of equipment.

To the extent they are needed, suitable material from the excavations that are not frozen can be used in the construction of required permanent earthfill.

10 Underground Corrosion

For the resistivity, PH and soluble ions concentrations found at this site and shown in the Paracel Laboratories certificate of analysis in appendix C.1, the soils are mildly corrosive. Resistivity, PH and soluble ions testing was completed in a representative sample at 2.6 m depth in BH 1. After Romanoff (1957)[2], the following corrosion rates can be used:

1. For carbon steel:
   - 16 μm/year for the first 2 years,
   - 12 μm/year, thereafter.
2. For galvanized metal:
   - 4.6 μm/year for the first 2 years,
   - 3.2 μm/year until depletion of zinc,
   - 12 μm/year for carbon steel.

11 Potential of Sulphate Attack to Concrete

For the sulphate content less than 0.1% in soil encountered at this site, there are no restrictions to the cement type which can be used for underground structures. This refers to restrictions associated with sulphate attack only.

12 Stripping, Excavation to Undisturbed Soils and rock, Earth and Rock Fill Placement. Asphalt Placement and Compaction

Appendix F presents recommended geotechnical specifications and guidelines for stripping, earth excavation to undisturbed surfaces, earth and rock fill placement, asphalt placement, compacted lifts thicknesses for equipment type and compaction for different placements.

12.1 Winter Construction

In situ undisturbed materials consisting of brown clean sand and/or brown dense well graded sand and gravel encountered at this site are not sensitive to freezing temperatures. Construction during winter is still a challenging task due to the presence of frost, snow and ice. Snow and ice should be cleared from any geotechnical material present at this site prior to any backfill or placement of any structure. Concrete placement on frozen soils is not acceptable.

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[2] Romanoff's work for the U. S. National Bureau of Standards is authoritative in underground corrosion

13 Responses to Comments from the City of Ottawa

This section provides information to amend this report in response to comments made under City of Ottawa (C of O) file No.: D07-12-22-0059 “Site Plan Control Application 1364-1370 Stittsville Main Street - 1st Review” dated June 14, 2022.

13.1 Replacement to Section 1 Introduction

This document reports the findings of a subsurface investigation completed at 1364, 1368 and 1370 Stittsville Main St., in the City of Ottawa, ON, K2S 1V4, having extents and geometry shown in figure 1 in page 9. The geotechnical materials in Ottawa and the surrounding areas are largely influenced by a history of glaciation, glacio-fluvial activity and the Champlain Sea. Common overburden materials include clay, very sensitive silty clay, till, boulder till, clean sand and silty sand overlying sedimentary rocks. Igneous and metamorphic rocks are also present. Organic materials have also influenced numerous soil deposits.

The investigation was carried out by advancing 6 boreholes through overburden soils and by proving bedrock depth by available exploration techniques for engineering purposes. The information compiled from the exploration and sampling and testing completed in the boreholes and a subsequent laboratory testing program of soils is to assist in the design and construction of a proposed 4 storey apartment building development. The information reviewed also includes boreholes and laboratory tests by others, readily available geologic information from the Geological Survey of Canada (GSC), and local climate data from Environment Canada.

13.2 Replacement to Section 13.2 Sampling and Testing

The field and laboratory program set out in our proposal is guided by the following standards:

- ASTM D 420-98 Standard Guide to Site Characterization for Engineering Design and Construction Purposes,
- ASTM D5434 - 12 Standard Guide for Field Logging of Subsurface Explorations of Soil and Rock,
- ASTM D1586 - 11 Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils,

The ASTM D1586 tests were completed using an “auto safety” hammer rated at 60% energy.

The field program consisted in sampling the subsurface profile using boreholes located as shown in fig. 1 in page 9 along with field review, assessments and classification of samples.

The program also included an elevation survey referenced to the top of MH-S located in front of 1364 Stittsville Main St. which is understood to have a 118.14 m geodetic elevation. The program included in addition a laboratory review of samples recovered from the field and one sample submitted to a local laboratory to investigate soluble ions concentration, PH and resistivity.

The soil sampling and field testing at each location are shown in the soil profile testing and sampling logs (BH) in the appendices.

13.3 Inclusion of section "Water Inflow Within Excavations and Water Takings"

Water inflow within excavations in soils is influenced by the depth of excavations relative to the water table and flow behavior of water in soils as controlled by the permeability of soils. Due to the proposed founding depth and in view of the assessments under section 4.1 and information seen in the borehole logs, water inflow is expected to be low and controllable by pumping from open sumps. Service trenches deeper than about 3.4 may require short term pumping from well points to prevent caving.

13.3.1 Water Takings and Permits

Water takings from the environment, including groundwater in excavations, are regulated under Ontario Water Resources Act, R.S.O. 1990, c. O.40. (OWRA). The OWRA is enforced by the Ministry of Environment (MOE). Under the OWRA. a Permit to Take Water (PTTW) is required for pumping from excavations exceeding 400 cubic meters per day. Along with the consideration of ground water from excavations, PTTW applications require in addition the consideration of precipitation. The excavations at this site are subject to OWRA and this section is intended to provide criteria indicative of whether a PTTW may be required or not.

Given the size (area) of the proposed excavations, precipitation data in Ottawa and the soil conditions assessed under section 4.1 pumping from excavations is not expected to exceed the threshold of 400 cubic meters per day so that *the requirement of a PTTW may not apply to the proposed development.*

Metered outlets must be maintained and recorded as proof for confirmation in case that OWRA requires it. Note that PTTWs are issued after months of the first filing of documents.

Disclaimer

Bayview Stittsville Inc. BSI and other professionals understand that soils and groundwater information in this report has been collected in boreholes guided by standards and practice guidelines generally accepted for engineering characterization of ground conditions in Ontario and in no case borehole data and

Element	Frequency (Hz)	PPV (mm/s)
Structures and Pipelines	<=40	20
Structures and Pipelines	>40	50
Concrete < 72 hours from placement	N/A	10

Table 1: OPSS>MUNI 120 table 1 showing threshold vibration limits.

their interpretation warrant understanding of conditions away from the borehole locations. BSI accepts that as development will have spread away from the boreholes other designers will need the best opinion from the geotechnical consultant based on the findings of the investigation so that any statements which could be implicitly or explicitly depart from the conditions at borehole may be given to fulfill this need in good faith as best available opinion with the information available at the time without any warranties.

User Agreement

Acknowledgment of Duties

In this 53-BSI-R1 report, Yuri Mendez Engineering (YME) has pursued to fulfill every aspect of the obligations of professional engineers. As a part of those duties, from field work, operations, testing, analyses, application of knowledge and report, YME has ensured that it meats a high standard of Geotechnical engineering practice and care in the province of Ontario. Obligations under R.R.O. 1990, Reg. 941: Professional Engineers Act, R.S.O. 1990, c. P.28, further referred to as Reg. 941 which are of immediate interest to this service are:

"77. 7. A practitioner shall,

i. act towards other practitioners with courtesy and good faith,

ii. not accept an engagement to review the work of another practitioner for the same employer except with the knowledge of the other practitioner or except where the connection of the other practitioner with the work has been terminated,

iii. not maliciously injure the reputation or business of another practitioner,

8. A practitioner shall maintain the honour and integrity of the practitioners profession and without fear or favour expose before the proper tribunals unprofessional, dishonest or unethical conduct by any other practitioner."

Communications

53-BSI-R1 is to be used solely in connection with the 4 storey apartment building by Bayview Stittsville Inc. (BSI) and thus subject of communications amongst other professionals (OP), government bodies and authorities, and BSI for that purpose. YME demands great care in precluding damage to the integrity of this professional work which may arise from careless communications from engineers of Canada. OP and BSI acknowledge understanding that where any such communication occur in connection with this report, they are bound by this agreement as an extension to the standard of care embodied in R.R.O. 1990, Reg. 941 and thus accept that any correspondence from OP or the public seen to add any bad connotations to the breadth, depth, typesetting, typography, formal semantics and scope of this report or otherwise diminish the breadth of services and knowledge delivered in this report which in any way raise concerns or insecurities to the qualities and/or the *reasonable completeness* delivered to BSI in this report will be forwarded to YME.

Reasonable Completeness

OP and Bayview Stittsville Inc. acknowledge understanding that said care and said standard has been applied equality to the reasonable completeness of this report relative to the information available from the field program and acknowledge understanding that is neither feasible nor possible to convey geotechnical information in this report that would cover for every possible consideration by OP and/or BSI and that upon issuance it will be subject to reviews which may trigger the need to add information which at the discretion of YME will be added when considered within the practice obligations under Reg. 941. The geotechnical information here provided is thus envisioned as to cover for the scope and breadth of design figures and assessments generally foreseeable as needed by other designers at the time of issuance and which could be amended as needed within the context of services provided by other designers. YME agrees to issue revised versions of this 53-BSI-R1 report by adding R# to each revision where # is the number of the revision. OP covenant to conduct all communications in connection with these reviews following great care to preclude the suggestion of a breach to the reasonable completeness acknowledged herein. Written communications which may trigger reviews under this agreement will be acknowledged as requests for "review under the 53-BSI-R1 report user agreement". This reasonable completeness is also relative to the scope of services generally accepted in geotechnical engineering work in Ontario

Errors

Where errors are found during reviews under the 53-BSI-R1 report user agreement, OP covenant great care in communications to preclude the suggestion of a breach to the duties acknowledge herein which could induce damages to YME. Communications triggered by errors or any such communication which would render the person doing the request in a position of technical authority above the author implies an unauthorized review and constitute a serious breach of the code of ethics under Reg. 941 and damages to YME and so subject to disciplinary measures and/or liability for damages to YME. BSI is thus acquainted that correction of errors will be made and acknowledged by YME as they may arise in any professional work but in no way OP will purport or render such corrections as omissions departing away from the correction of errors set forth in this agreement. Where communications in connection with the correction of errors process set forth in this agreement raise concerns or insecurities to the qualities and/or the reasonable completeness delivered to BSI in this report occur, BSI covenants to inform YME. BSI is acquainted that such corrections are part of the natural processes associated with the applied sciences nature of this report and so typified explicitly in this agreement to protect YME from inappropriate manipulation of those processes by OP and others.

Part IV

Appendices

A Borehole Logs

Report 53-BSI-R1
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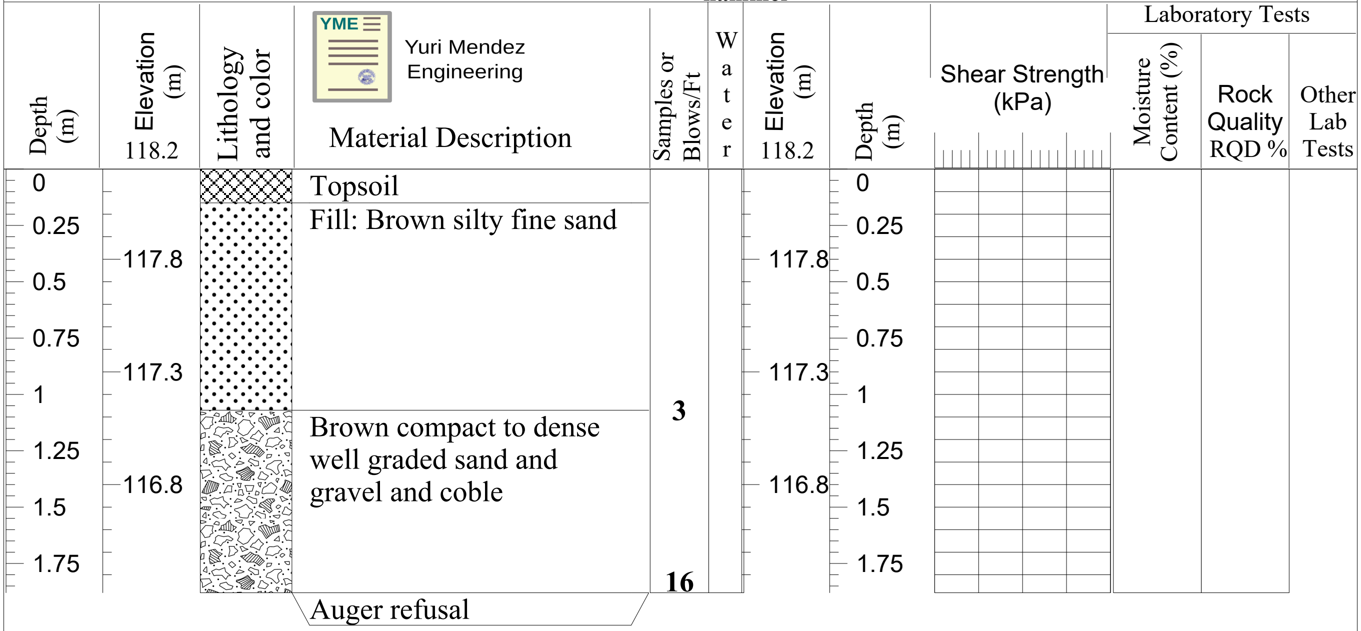
Project: **Proposed 4 Storey Building**		YME Yuri Mendez Engineering.
Location: **1364 to 1370 Stittsville Main St.**	Client: **Bayview Stittsville Inc.**	**Test Hole No.: BH1 of 6**
Job No.: **53-BSI**	Test Hole Type: **8" OD Auger.**	Date: **March 28, 2022**
"7" OD Auger."	SPT Hammer Type: **Safety auto hammer**	Logged By: **Yuri Mendez**



Topsoil

Fill: Brown silty fine sand

Brown compact to dense well graded sand and gravel and coble

Auger refusal

S = Sample for lab review and moisture content

▼ Measured water level

Project: **Proposed 4 Storey Building**

YME Yuri Mendez Engineering.

Location: **1364 to 1370 Stittsville Main St.**

Client: **Bayview Stittsville Inc.**

Test Hole No.: BH2 of 6

Job No.: **53-BSI**

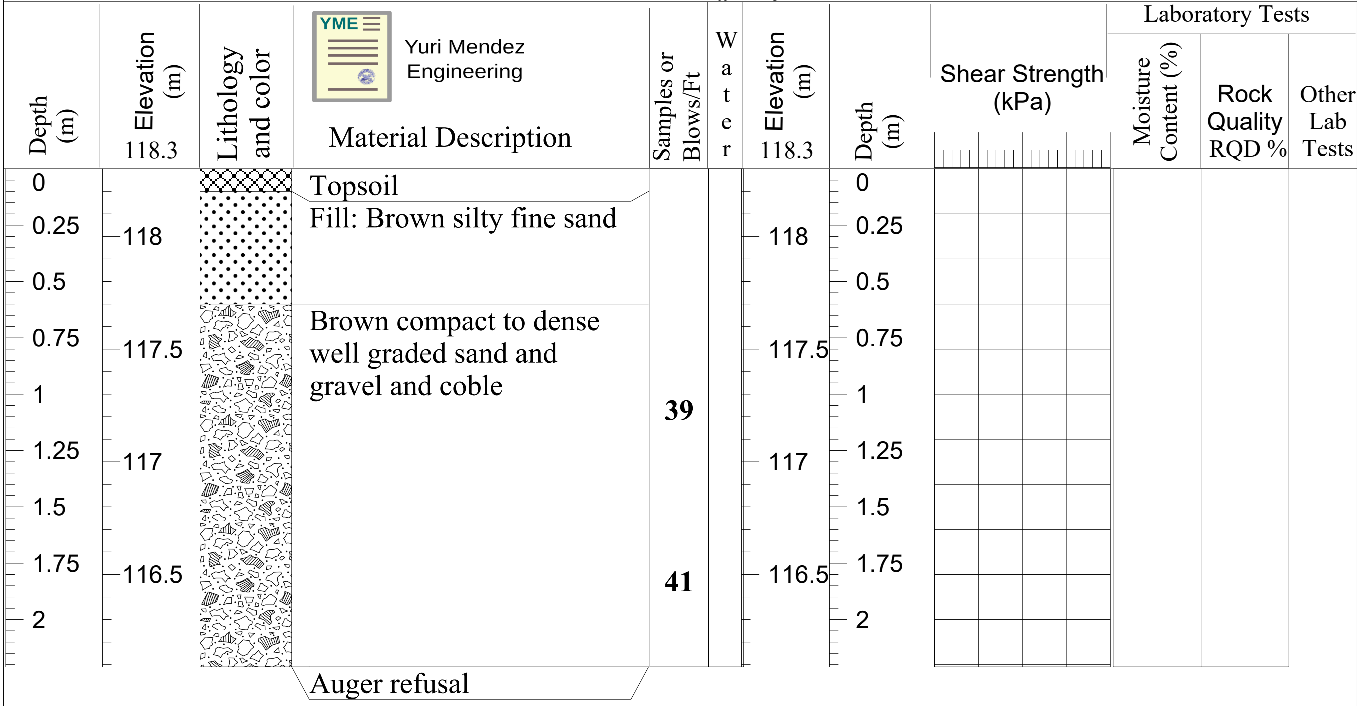
Test Hole Type: **8" OD Auger.**

Date: **March 28, 2022**

"7" OD Auger."

SPT Hammer Type: **Safety auto hammer**

Logged By: **Yuri Mendez**



Topsoil

Fill: Brown silty fine sand

Brown compact to dense well graded sand and gravel and coble

39

41

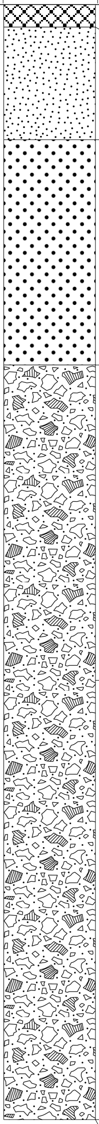
Auger refusal

S = Sample for lab review and moisture content

▼ Measured water level

Project: **Proposed 4 Storey Building**		YME Yuri Mendez Engineering.
Location: **1364 to 1370 Stittsville Main St.**	Client: **Bayview Stittsville Inc.**	**Test Hole No.: BH3 of 6**
Job No.: **53-BSI**	Test Hole Type: **8" OD Auger.**	Date: **March 28, 2022**
"7" OD Auger."	SPT Hammer Type: **Safety auto hammer**	Logged By: **Yuri Mendez**

Yuri Mendez Engineering



Depth (m)	Elevation (m) 117.69	Material Description	Samples or Blows/Ft	Water	Elevation (m) 117.69	Depth (m)	Shear Strength (kPa)	Laboratory Tests Moisture Content (%)	Rock Quality RQD %	Other Lab Tests
0		Topsoil				0				
0.25	117.4	Fill: Brown silty sand with trace clay			117.4	0.25				
0.5						0.5				
0.75	116.9	Brown silty fine sand			116.9	0.75				
1			**5**			1				
1.25	116.4				116.4	1.25				
1.5						1.5				
1.75	115.9	Brown compact to dense well graded sand and gravel and coble	**27**		115.9	1.75				
2						2				
2.25	115.4				115.4	2.25				
2.5			**52**			2.5				
2.75	114.9				114.9	2.75				
3		As above. Water table in borehole at approximately 3 m depth.				3				
3.25	114.4		**10**		114.4	3.25				
3.5						3.5				
3.75	113.9				113.9	3.75				
4			**22**			4				
4.25	113.4				113.4	4.25				
4.5						4.5				
4.75	112.9		**36**		112.9	4.75				
		Auger refusal								

S = Sample for lab review and moisture content

▼ Measured water level

Project: **Proposed 4 Storey Building**

YME Yuri Mendez Engineering.

Location: **1364 to 1370 Stittsville Main St.**

Client: **Bayview Stittsville Inc.**

Test Hole No.: BH4 of 6

Job No.: **53-BSI**

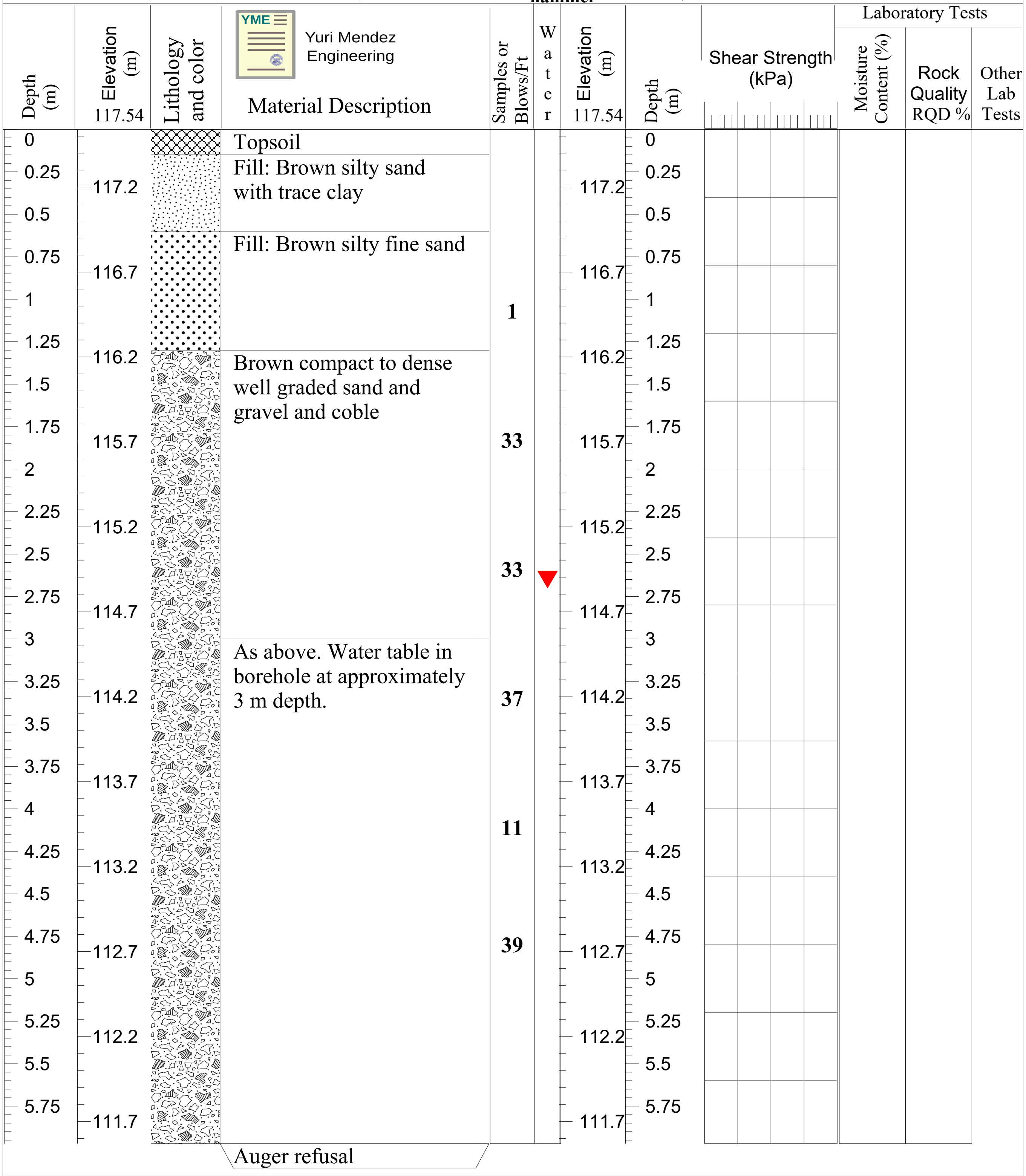
Test Hole Type: **8" OD Auger.**

Date: **March 28, 2022**

"7" OD Auger."

SPT Hammer Type: **Safety auto hammer**

Logged By: **Yuri Mendez**



Topsoil

Fill: Brown silty sand with trace clay

Fill: Brown silty fine sand

Brown compact to dense well graded sand and gravel and coble

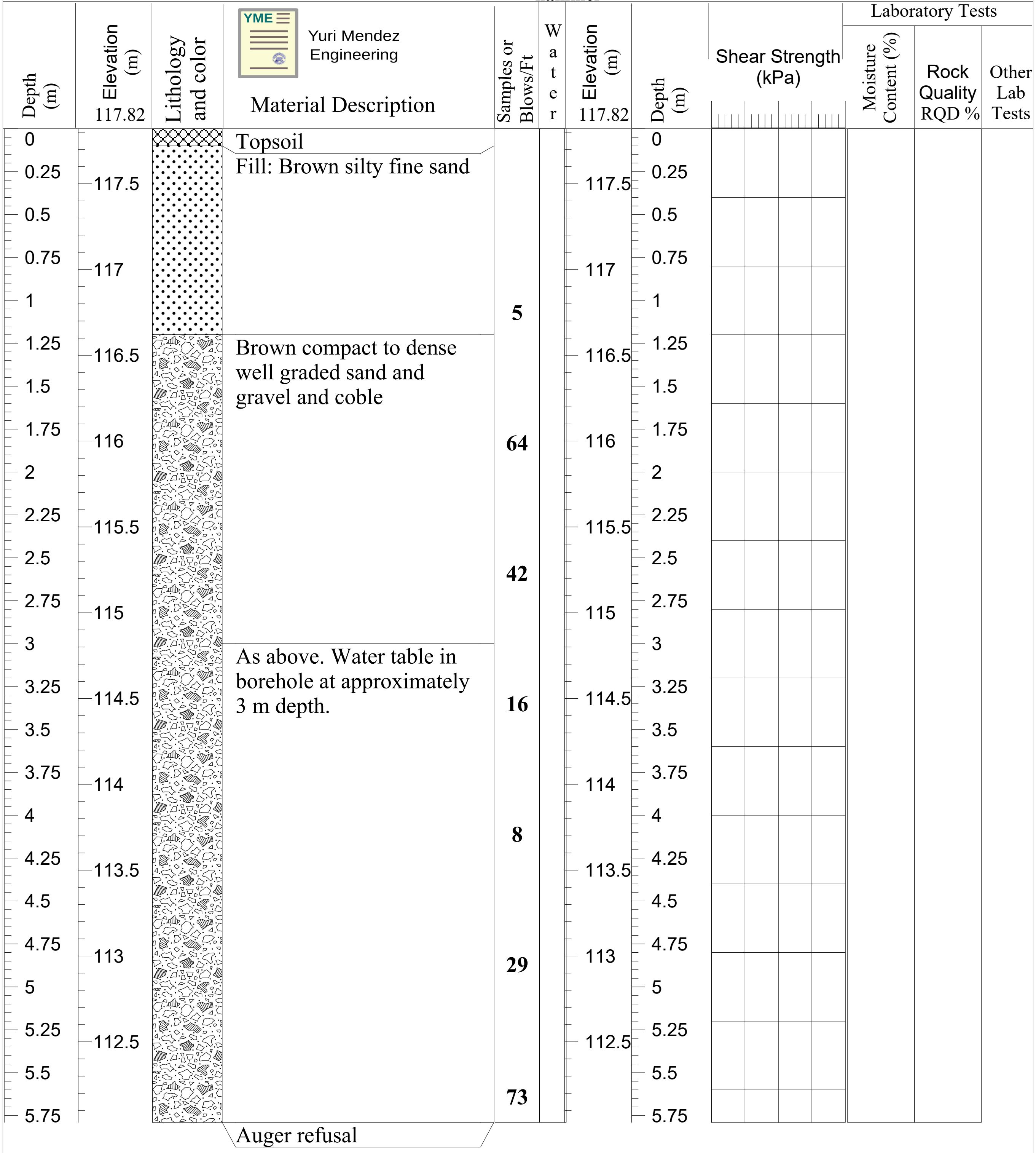
As above. Water table in borehole at approximately 3 m depth.

Auger refusal

S = Sample for lab review and moisture content

▼ Measured water level

Project: **Proposed 4 Storey Building**		YME Yuri Mendez Engineering.
Location: **1364 to 1370 Stittsville Main St.**	Client: **Bayview Stittsville Inc.**	**Test Hole No.: BH5 of 6**
Job No.: **53-BSI**	Test Hole Type: **8" OD Auger.**	Date: **March 28, 2022**
"7" OD Auger."	SPT Hammer Type: **Safety auto hammer**	Logged By: **Yuri Mendez**



Topsoil

Fill: Brown silty fine sand

Brown compact to dense well graded sand and gravel and coble

As above. Water table in borehole at approximately 3 m depth.

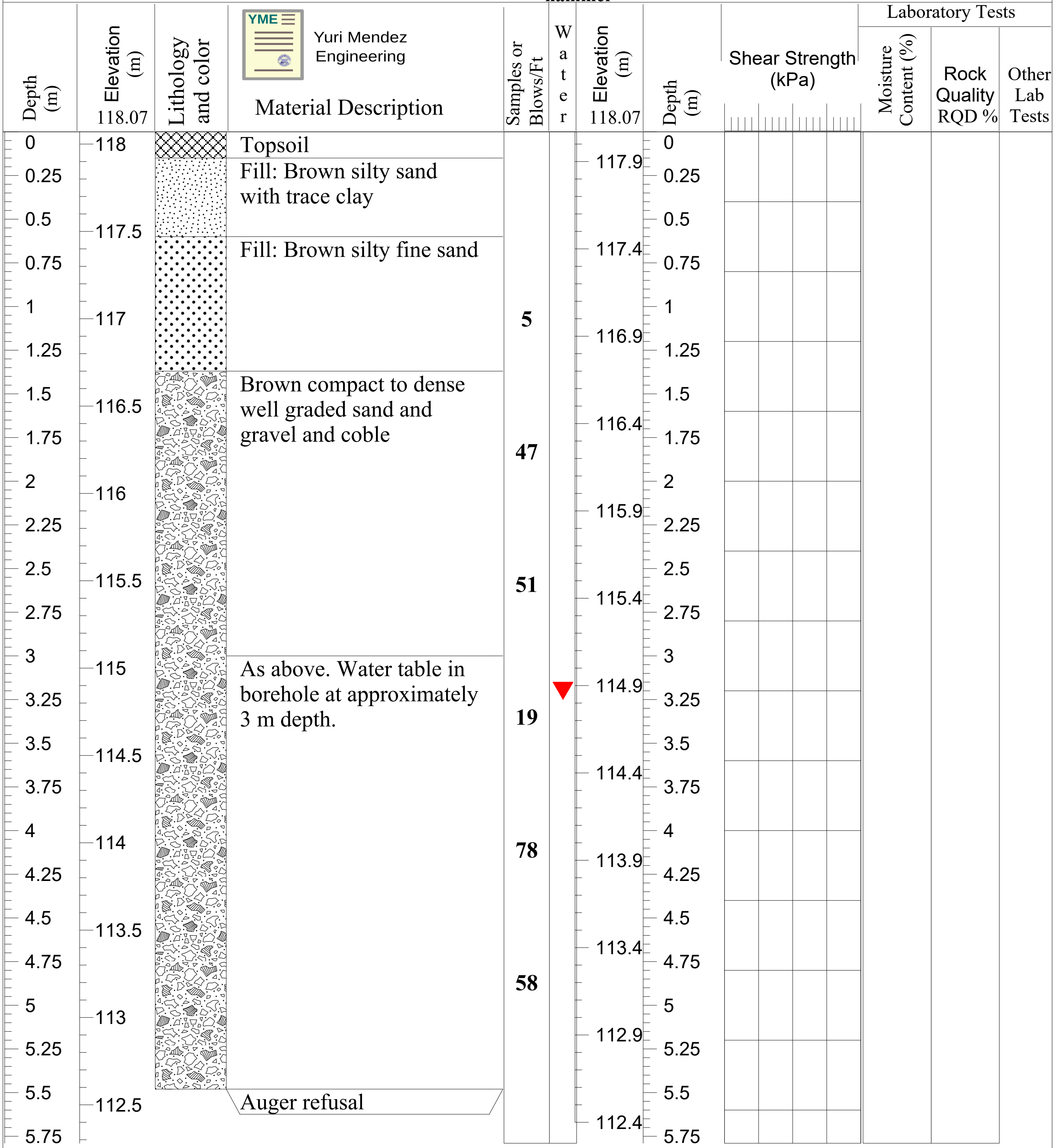
Auger refusal

Samples or Blows/Ft: **5**, **64**, **42**, **16**, **8**, **29**, **73**

S = Sample for lab review and moisture content

▼ Measured water level

Project: **Proposed 4 Storey Building**		YME Yuri Mendez Engineering.
Location: **1364 to 1370 Stittsville Main St.**	Client: **Bayview Stittsville Inc.**	**Test Hole No.: BH6 of 6**
Job No.: **53-BSI**	Test Hole Type:	Date: **March 28, 2022**
"7" OD Auger."	SPT Hammer Type: **Safety auto hammer**	Logged By: **Yuri Mendez**



Topsoil

Fill: Brown silty sand with trace clay

Fill: Brown silty fine sand

Brown compact to dense well graded sand and gravel and coble

As above. Water table in borehole at approximately 3 m depth.

Auger refusal

S = Sample for lab review and moisture content

▼ Measured water level

PROJECT: 15-095

RECORD OF BOREHOLE 15-1

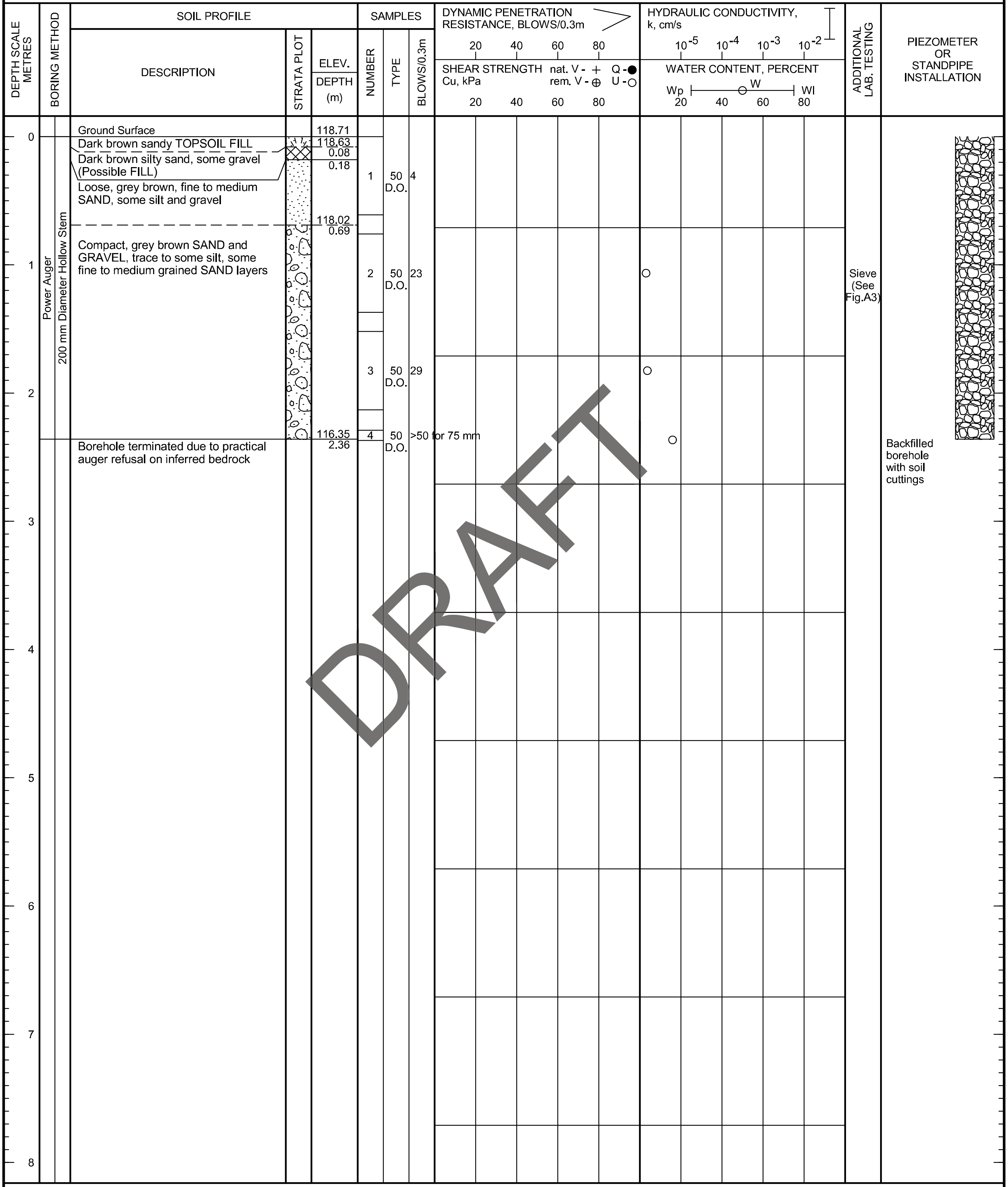
SHEET 1 OF 1

LOCATION: See Borehole Location Plan, Figure 2

DATUM: Geodetic

BORING DATE: May 7 2015

SPT HAMMER: 63.5 kg; drop 0.76 m



Description	Elev. / Depth (m)	Number	Type	Blows/0.3m	Additional Lab. Testing	Piezometer or Standpipe Installation
Ground Surface	118.71					
Dark brown sandy TOPSOIL FILL	118.63 0.08					
Dark brown silty sand, some gravel (Possible FILL)	0.18					
Loose, grey brown, fine to medium SAND, some silt and gravel		1	50 D.O.	4		
Compact, grey brown SAND and GRAVEL, trace to some silt, some fine to medium grained SAND layers	118.02 0.69	2	50 D.O.	23	Sieve (See Fig.A3)	
		3	50 D.O.	29		
	116.35 2.36	4	50 D.O.	>50 for 75 mm		
Borehole terminated due to practical auger refusal on inferred bedrock						Backfilled borehole with soil cuttings

DEPTH SCALE

1 to 40

Houle Chevrier Engineering

LOGGED: M.L.

CHECKED:

RECORD OF BOREHOLE 15-2

PROJECT: 15-095

LOCATION: See Borehole Location Plan, Figure 2

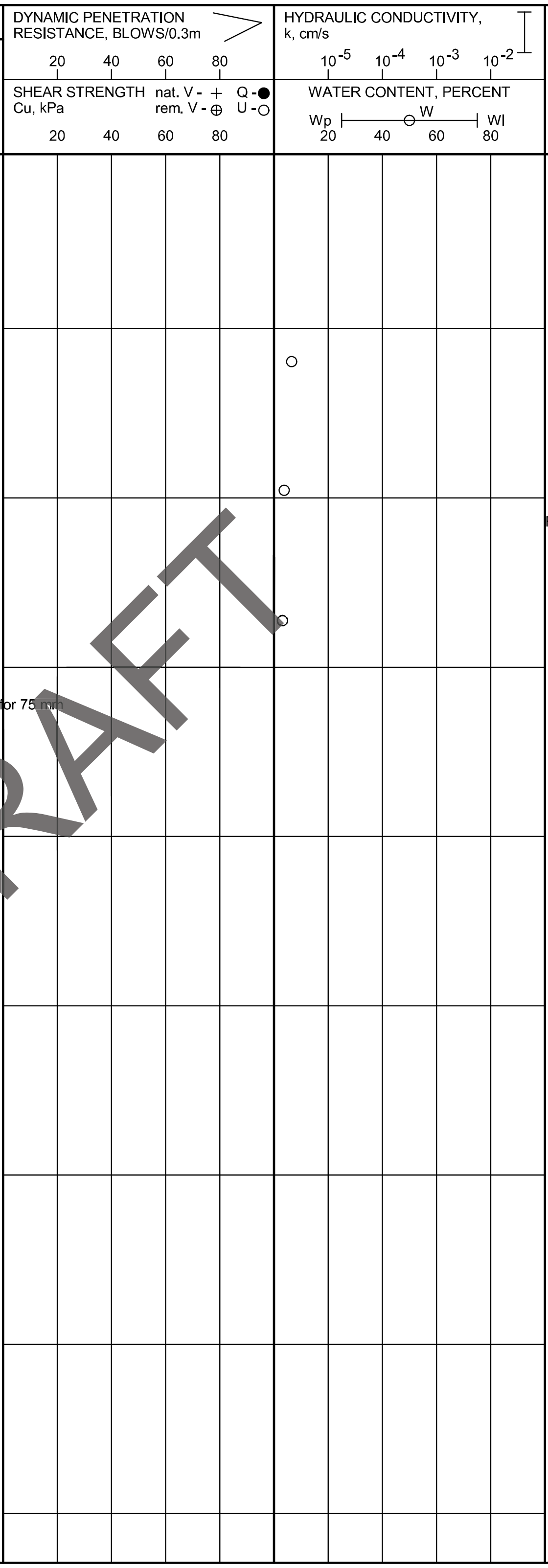
BORING DATE: May 8 2015

SHEET 1 OF 1

DATUM: Geodetic

SPT HAMMER: 63.5 kg; drop 0.76 m

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger 200 mm Diameter Hollow Stem	Ground Surface		117.87					
		TOPSOIL FILL		0.04					
		Loose, dark grey brown silty sand and gravel (Possible FILL)		117.27 0.60	1	50 D.O.	5		
1		Compact to very dense, grey brown SAND and GRAVEL, trace to some silt with cobbles and boulders			2	50 D.O.	13		
2					3	50 D.O.	48	Sieve (See Fig.A3)	
					4	50 D.O.	72		
3				114.64 3.23	5	50 D.O.	>50 for 75 mm		
		Borehole terminated due to practical auger refusal on inferred bedrock							Backfilled borehole with soil cuttings
4									
5									
6									
7									
8									



DEPTH SCALE

1 to 40

Houle Chevrier Engineering

LOGGED: M.L.

CHECKED:

PROJECT: 15-095

RECORD OF BOREHOLE 15-3A

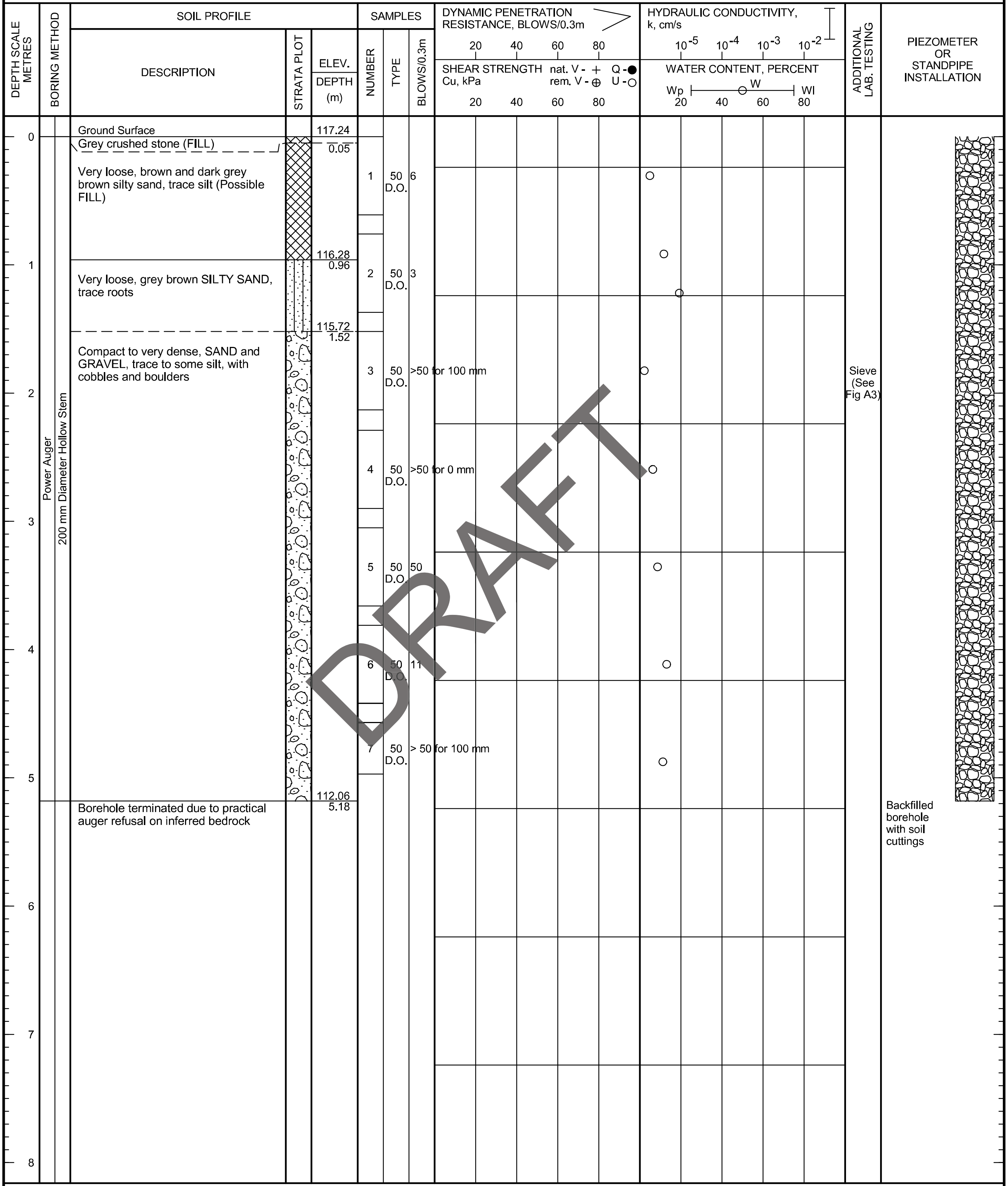
SHEET 1 OF 1

LOCATION: See Borehole Location Plan, Figure 2

DATUM: Geodetic

BORING DATE: May 8 2015

SPT HAMMER: 63.5 kg; drop 0.76 m



DESCRIPTION	ELEV. DEPTH (m)
Ground Surface	117.24
Grey crushed stone (FILL)	0.05
Very loose, brown and dark grey brown silty sand, trace silt (Possible FILL)	116.28 0.96
Very loose, grey brown SILTY SAND, trace roots	115.72 1.52
Compact to very dense, SAND and GRAVEL, trace to some silt, with cobbles and boulders	112.06 5.18
Borehole terminated due to practical auger refusal on inferred bedrock	

NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING
1	50 D.O.	6	
2	50 D.O.	3	
3	50 D.O.	>50 for 100 mm	Sieve (See Fig A3)
4	50 D.O.	>50 for 0 mm	
5	50 D.O.	50	
6	50 D.O.	11	
7	50 D.O.	> 50 for 100 mm	

Backfilled borehole with soil cuttings

DEPTH SCALE

1 to 40

Houle Chevrier Engineering

LOGGED: M.L.

CHECKED:

PROJECT: 15-095

RECORD OF BOREHOLE 15-4

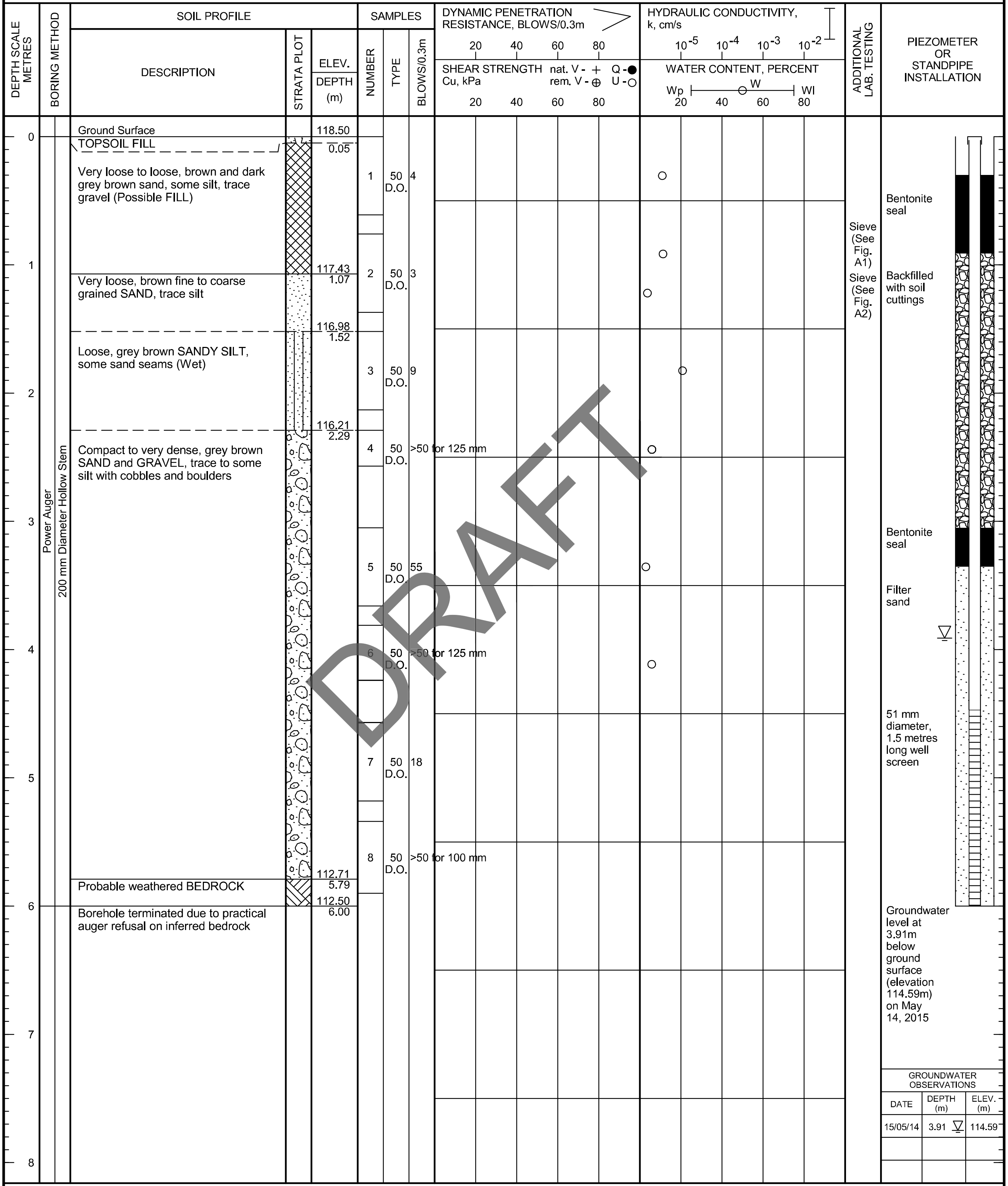
SHEET 1 OF 1

LOCATION: See Borehole Location Plan, Figure 2

DATUM: Geodetic

BORING DATE: May 7 2015

SPT HAMMER: 63.5 kg; drop 0.76 m



DESCRIPTION	ELEV. DEPTH (m)
Ground Surface	118.50
TOPSOIL FILL	0.05
Very loose to loose, brown and dark grey brown sand, some silt, trace gravel (Possible FILL)	117.43 1.07
Very loose, brown fine to coarse grained SAND, trace silt	116.98 1.52
Loose, grey brown SANDY SILT, some sand seams (Wet)	116.21 2.29
Compact to very dense, grey brown SAND and GRAVEL, trace to some silt with cobbles and boulders	112.71 5.79
Probable weathered BEDROCK	112.50 6.00
Borehole terminated due to practical auger refusal on inferred bedrock	

NUMBER	TYPE	BLOWS/0.3m
1	50 D.O.	4
2	50 D.O.	3
3	50 D.O.	9
4	50 D.O.	>50 for 125 mm
5	50 D.O.	55
6	50 D.O.	>50 for 125 mm
7	50 D.O.	18
8	50 D.O.	>50 for 100 mm

ADDITIONAL LAB. TESTING:
Sieve (See Fig. A1)
Sieve (See Fig. A2)

PIEZOMETER OR STANDPIPE INSTALLATION:
Bentonite seal
Backfilled with soil cuttings
Bentonite seal
Filter sand
51 mm diameter, 1.5 metres long well screen
Groundwater level at 3.91m below ground surface (elevation 114.59m) on May 14, 2015

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
15/05/14	3.91 ▽	114.59

DEPTH SCALE

1 to 40

Houle Chevrier Engineering

LOGGED: M.L.

CHECKED:

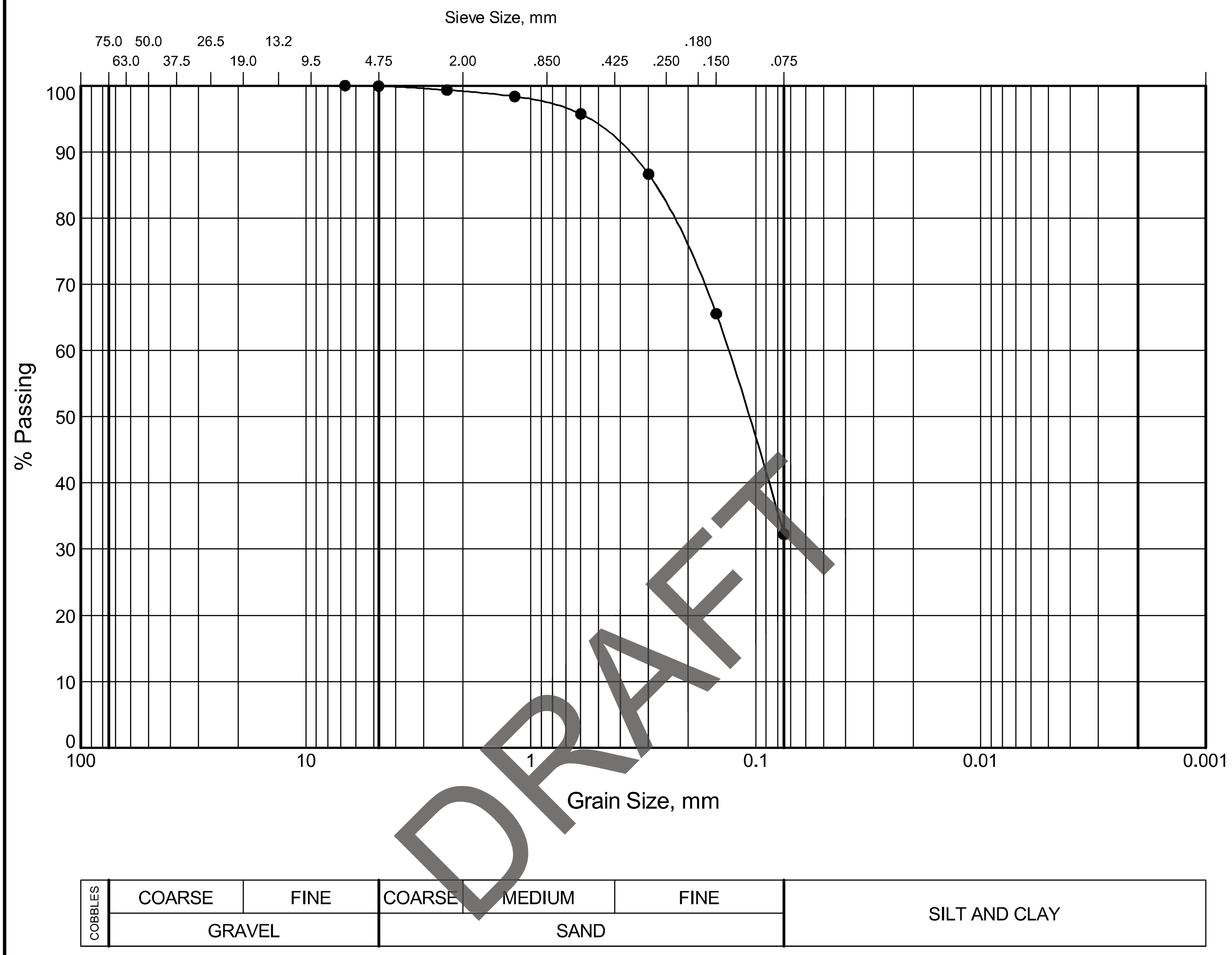
Appendix

B Laboratory Tests

GRAIN SIZE DISTRIBUTION

FILL MATERIAL

FIGURE A1



Legend	Borehole	Sample	Depth (m)	% Gravel	% Sand	% Silt & Clay
●	15-4	2A	0.8 - 1.1	0	68	32

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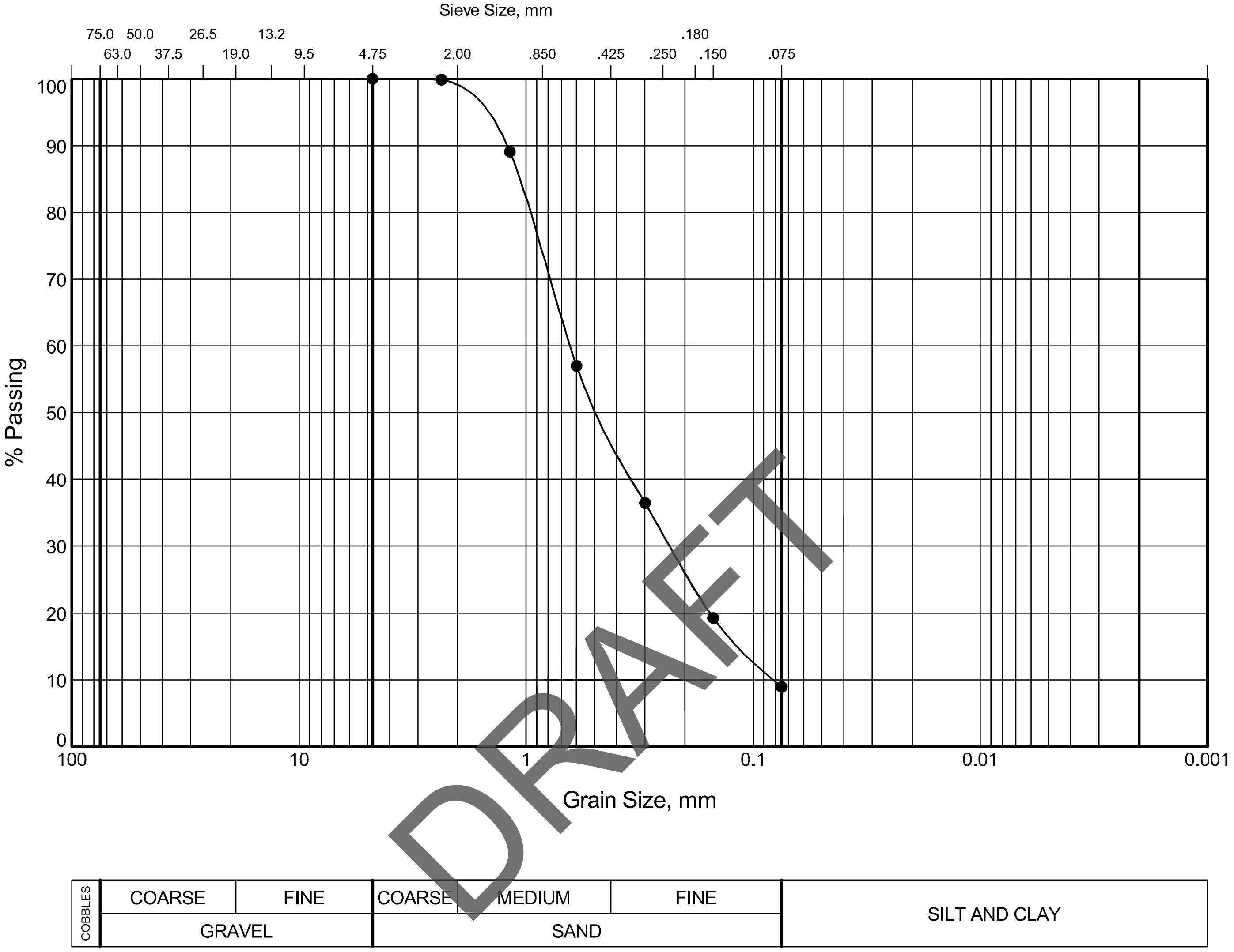
Date: May 2015

Project: 15-095

GRAIN SIZE DISTRIBUTION

SAND

FIGURE A2



Legend	Borehole	Sample	Depth (m)	% Gravel	% Sand	% Silt & Clay
●	15-4	2B	1.1 - 1.4	0	91	9

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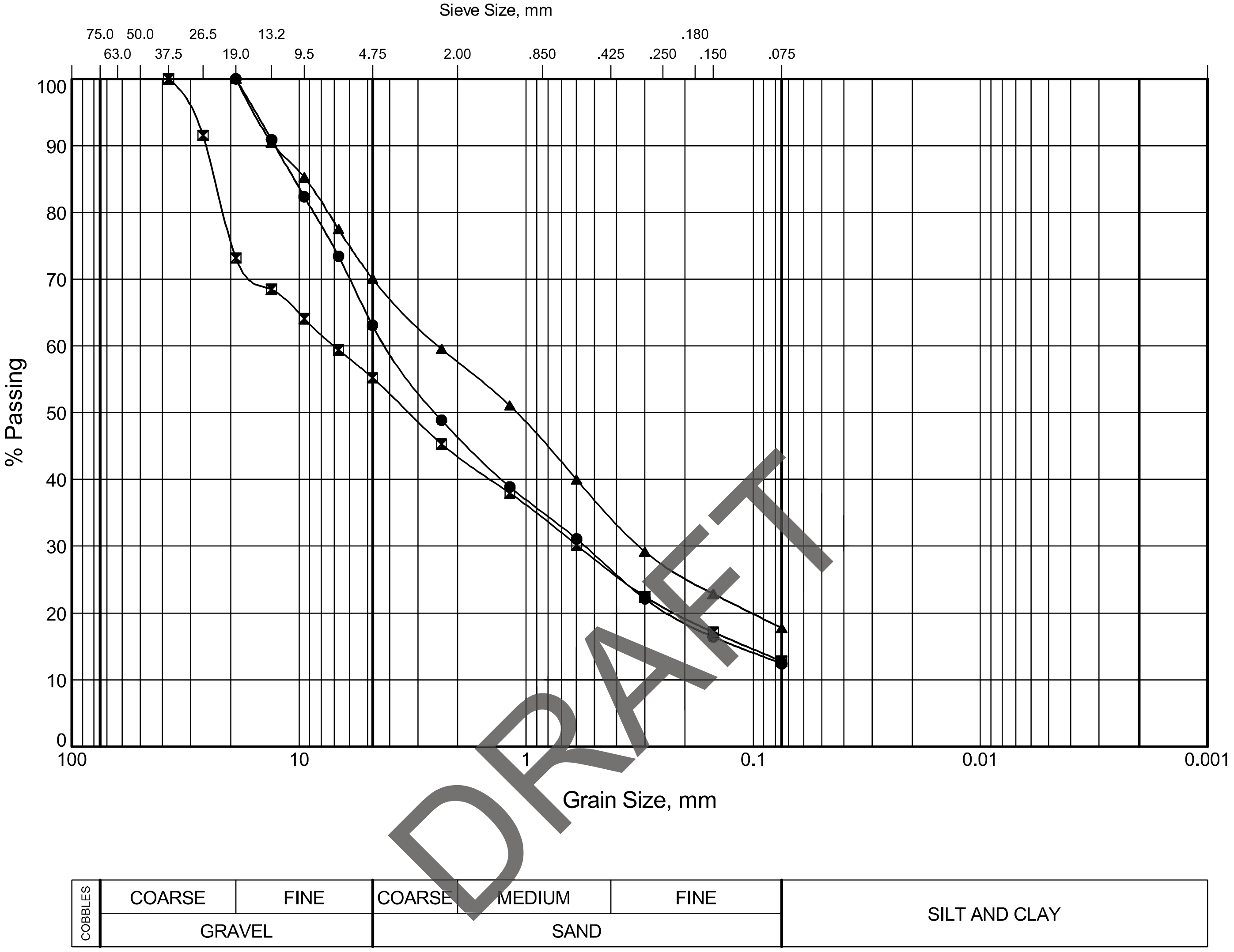
Date: May 2015

Project: 15-095

GRAIN SIZE DISTRIBUTION

SAND AND GRAVEL

FIGURE A3



Legend	Borehole	Sample	Depth (m)	% Gravel	% Sand	% Silt & Clay
●	15-1	2	0.8 - 1.4	37	51	12
☒	15-2	3	1.5 - 2.1	45	42	13
▲	15-3A	3	1.5 - 2.1	30	52	18

Houle
Chevrier
Engineering

Date: May 2015

Project: 15-095

Appendix

C Resistivity, PH and Soluble Salts Test

Certificate of Analysis

Client: **Geoseismic**

Client PO:

Report Date: 06-May-2022

Order Date: 2-May-2022

Project Description: 1364 Stittsville

	Client ID:	BH1 SS4	-	-	-
	Sample Date:	28-Mar-22 09:00	-	-	-
	Sample ID:	2219163-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	95.4	-	-	-
General Inorganics					
pH	0.05 pH Units	8.03 [1]	-	-	-
Resistivity	0.10 Ohm.m	66.0	-	-	-
Anions					
Chloride	5 ug/g dry	33 [1]	-	-	-
Sulphate	5 ug/g dry	19 [1]	-	-	-

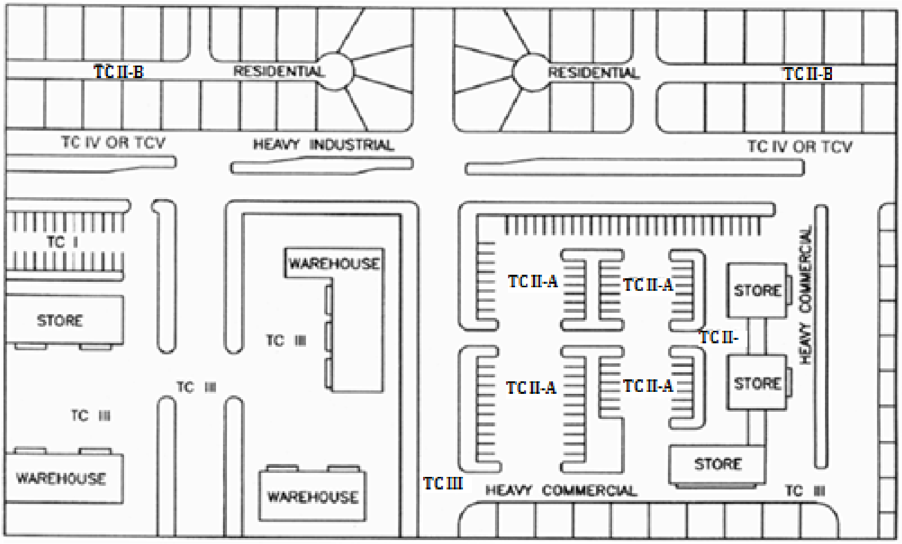


Figure 2: Traffic Classes

Appendix

D Pavement

D.1 Traffic Classes and Pavement Catalog

Figure 2 in page 37 presents a schematic site plan differentiating example uses for five traffic classes developed by the Wisconsin Asphalt Pavement Association and presented in their Design Guide May, 2001.

1. Refer to figure 2 in page 37 to differentiate pavement classes for the proposed 4 storey apartment building.
2. Refer to table 2 in page 38 for additional information and design ESALs.
3. Refer to Tables 3, 4 and 5 in page 38 to select pavement structures for each traffic class on fair soils encountered at this site.

Consult Yuri Mendez Engineering for pavement structures on roadbed consisting of newly placed engineered fill, underground parking or as required, where the roadbed is not the near surface fair soil encountered at this site.

D.2 Frost Heave in Pavements

Frost heave of founding materials for pavement induces reduction (serviceability losses) of the performance period (along with traffic ESALs) for which the structure was designed. Generally speaking, AASHTO 1993 does not provide for an increase in thicknesses (structural number) for reduction of losses, as such increase has very small influence in the detrimental effects of frost heave. Frost heave affects pavements by roughness induced by differential

Ontario Category	Classes	ESALs	Uses
A	I	50,000	Residential dead end and parking lots 50 stalls or less.
A	II-A	100,000	Parking lots 51 to 500 stalls.
A	II-B	200,000	Residential streets, parking lots more than 500 stalls.
B	III	600,000	Minor colectors, local streets and light industrial lots.
B	IV	900,000	Collector Streets and heavy industrial parking lots.
B	V	2,200,000	Minor Arterial.

Table 2: Design ESALs (20 years) and uses for traffic classes

		Thicknesses			
Material	Specification	Class I		Class II-A	
Class		mm	in	mm	in
Surface course	OPSS 1151 Superpave 9.5	50.8	2	50.8	2
Surface course	OPSS 1151 Superpave 12.5				
Binder course	OPSS 1151 Superpave 19.0				
Base	OPSS 1010 Granular A	152.4	6	152.4	6
Subbase	OPSS 1010 Granular B Type II	127.0	5	203.2	8
Subgrade	Undisturbed In situ Soil				

Table 3: Flexible Pavement Structure Classes I and II-A

		Thicknesses			
Material	Specification	Class II-B		Class III	
Class		mm	in	mm	in
Surface course	OPSS 1151 Superpave 9.5				
Surface course	OPSS 1151 Superpave 12.5	63.5	2.5	76.2	3
Binder course	OPSS 1151 Superpave 19.0				
Base	OPSS 1010 Granular A	152.4	6	152.4	6
Subbase	OPSS 1010 Granular B Type II	228.6	9	304.8	12
Subgrade	Undisturbed In situ Soil				

Table 4: Flexible Pavement Structure Classes II-B and III

		Thicknesses			
Material	Specification	Class IV		Class V	
Class		mm	in	mm	in
Surface course	OPSS 1151 Superpave 9.5	31.8	1.25		
Surface course	OPSS 1151 Superpave 12.5				
Binder course	OPSS 1151 Superpave 19.0	57.2	2.25		
Base	OPSS 1010 Granular A	152.4	6		
Subbase	OPSS 1010 Granular B Type II	330.2	13		
Subgrade	Undisturbed In situ Soil				

Table 5: Flexible Pavement Structure Classes IV and V

frost heave, i.e., if the longitudinal vertical alignment is all equally frost susceptible, there is negligible detrimental effect. This is difficult to achieve in urban developments in which services trenches are backfilled with non frost susceptible materials. For long lasting pavements on frost susceptible soils, the general guideline is, where possible; ensure that all soils serving as pavement foundation are equally frost susceptible. This could be achieved by providing frost susceptible backfill within 1.4 m of the pavement foundation in service trenches. Where measures to mitigate the effect of frost heave are not undertaken, decrease of the performance period is accepted to occur.

D.3 Frost Protection for Manholes, Catch Basins and Others

Manholes and catch basin type structures provide a cold bridge to a deeper portion of the soil profile and create localized areas prompt to pavement failure by excessive frost heave roughness in frost susceptible soils. This can be prevented by providing insulation extending downward around the structure and horizontally outward to create a transition from the varying pavement elevation to the more stable catch basin elevation. On the alternative, non frost susceptible backfill can be provided tapered outward from the structure to the surrounding pavement.

Report 53-BSI-R1
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Appendix

E Foundation Drainage

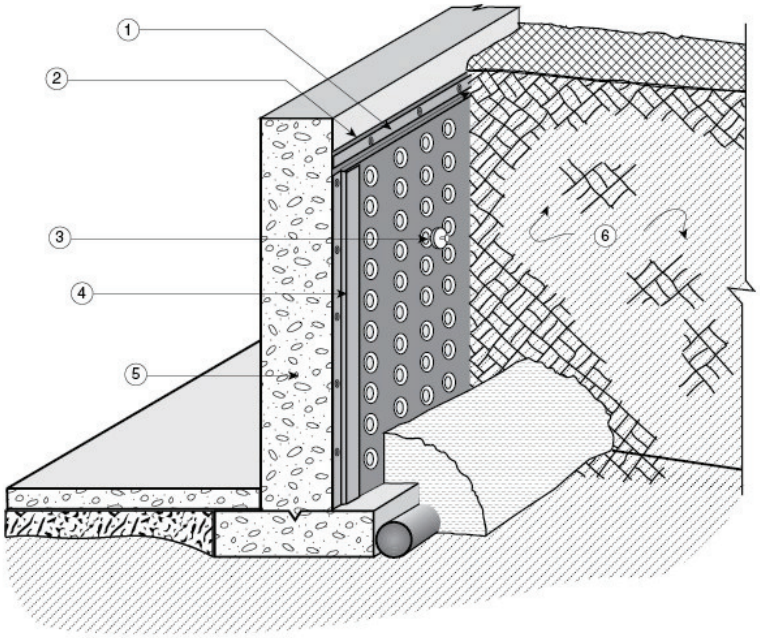

Figure 1. “Cosella-Dörken DELTA®-MS and DELTA®-MS CLEAR Dampproofing Membranes” – face in contact with the soil

1. **termination bar**
2. **caulking (behind membrane)**
3. **fastener**
4. **mould strip**
5. **concrete foundation**
6. **backfill**

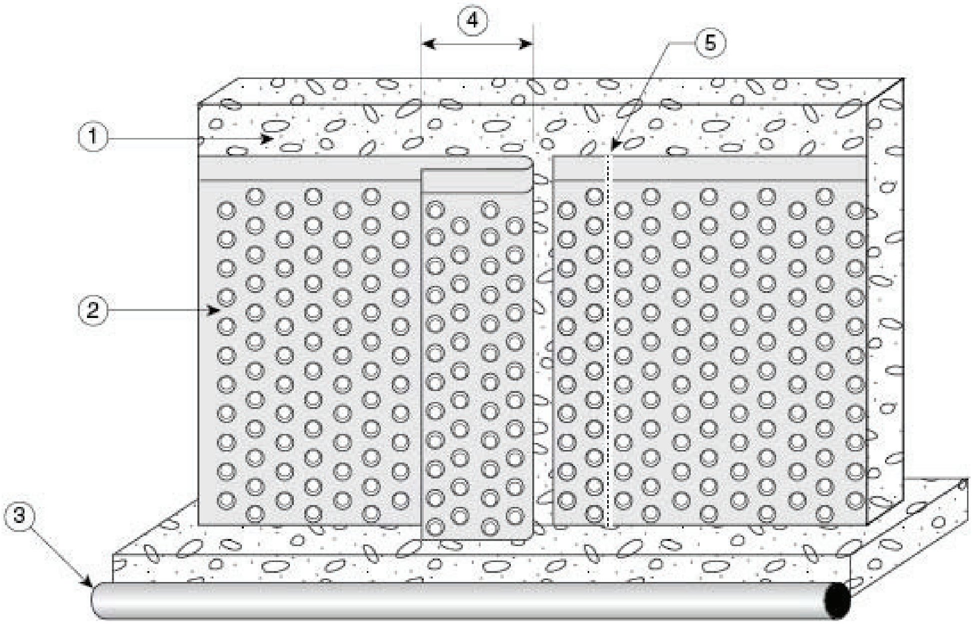

Figure 2. “Cosella-Dörken DELTA®-MS and DELTA®-MS CLEAR Dampproofing Membranes” – face in contact with the wall

1. **concrete foundation**
2. **membrane**
3. **drainage tile**
4. **minimum 6" overlap**
5. **caulking**

Appendix

F Construction Recommendations for Stripping, Earth and Rock Excavation to Undisturbed Soils, Earth and Rock Fill Placement, Asphalt Placement and Compaction

In the event that any of the following recommendations conflict with municipal and or provincial specifications, the most restrictive applies. For the case when products involving ground conditions are used, the manufacturer's specifications take precedence.

The contractor shall be prepared to proceed as directed by the geotechnical consultant within the framework of these recommendations. Construction methods will abide to these recommendations and/or be discussed and agreed upon with the consultant on site in real time or as expressed in writing.

F.1 Field Briefings

At any time in which the geotechnical consultant is required in the field for inspections, the contractor shall brief the consultant in real time about any work in progress or work to proceed at the time requiring excavation, rock excavation, placement, hauling in or out, re-working, compaction equipment weight and nature, equipment passes, moisture, stock piling, sorting of materials, stock piling, etc. of geotechnical materials. The briefing will sick approval of the methods and materials and will involve discussions regarding the source, nature and/or specifications of any source of materials brought or removed, and/or placed and/or stock piled and/or excavated from the site and discussions to meet geotechnical requirements. The consultant may choose to instate a log book in the field which may include the persons having authority to log as representative of the contractor.

F.2 Removal of Water

Removal and diversion of surface water and ground water will be planed prior to all earthwork within the scope of these recommendations. All surfaces in which to commence construction will be maintained dry and free of muddy conditions.

F.3 Earth Excavation

Earth excavations are subject to the provisions in O. Reg. 213/91: Construction Projects under Occupational Health and Safety Act. Refer to section 8 for key aspect of O. Reg. 213/91 applicable to the findings in testholes at this site.

For the purpose of these recommendations earth materials will be refer to as one or more of the general material classes: topsoil and organic soils, non engineered fill, granular fill, native soils and rock. Topsoil and organic soils and non engineered fill are the subject of striping in subsection F.3.3.

F.3.1 Suitability of Earth Materials

The suitability of material for specific purposes is determined by the geotechnical engineer. To the extent they are needed, suitable material from the excavations can be used in the construction of required permanent earthfill or rockfill.

F.3.2 Stockpiling and Sorting

Stockpiling is not an acceptable mean to build up the subgrade beneath the perimeter of structures of any kind. For stock piling, with the exception of native soils, material will be sorted in piles belonging exclusively to each material class. For native soils, sorting will be as determined by the geotechnical engineer. Mixed materials will be rendered unusable for uses other than the buildup of the subgrade in landscaped areas.

F.3.3 Striping

Topsoil and/or organic soils and/or existing fill must be removed from the perimeter of all proposed structures, including retaining wall, buildings, pavement, parking areas and earth or fill banks for grading.

F.3.4 Excavation to Undisturbed Soil Surface

All soil surfaces in which to commence construction for all structures are to be preserved in undisturbed condition (Undisturbed Soil Surface (USS)).

F.4 Foundations Placement

Place foundations on undisturbed brown well graded dense sand and gravel that is not frozen.

F.5 Imported Materials

Materials to be imported are subject to prior approval by the geotechnical engineer. The exceptions are granular materials having 12 % or less fines including clean sands. Fines are materials passing the # 200 sieve (70 μm).

F.6 Overexcavation

Excavation in earth beyond the specified lines and grades shall be corrected by filling the resulting voids with approved, compacted earthfill.

F.7 Earthfill

The type of Earthfill materials will be as indicated in plans and specifications. Suitability of earth materials will be determined by the geotechnical engineer.

Earthfill materials shall contain no frozen soil, sod, brush, roots, or other perishable material. Rock particles larger than 2/3 of the maximum approved lift thickness shall be removed prior to compaction of the fill.

For the purpose of this subsection all suitable materials will belong to one of the following two classes: *granular earthfill* and *select earthfill*. Granular eathfill will be any natural or crushed earth materials containing 12% or less passing the #200 sieve (70 μm). Select earthfill will be materials for which more than 12% passes the #200 sieve *and* have water content close to the optimum *and* have been rendered as suitable by the geotechnical engineer.

F.7.1 Granular Earthfill Placement

F.7.1.1 Moisture for Granular Earthfill

For granular earthfill it is to be assumed that moisture will be added for placement. Compaction in wet of optimum condition is preferred for granulars.

F.7.1.2 Compacted Lifts Thicknesses Equipment and Passes for Granular Eathfill

Compacted lifts will not exceed 250 mm. Subject to test trials a maximum compacted lift of 300 mm may be accepted provided vibratory compaction equipment rated at 60,000 lb-f (27,300 kg-f) of dynamic force is used.

For road construction passes are to overlap by 300 mm for full coverage.

Where non vibratory pneumatic compactors with ballast an tire pressure of 100 psi (7 kg/cm2) are used (9 or 13 ply) the compacted lift thicknesses will not exceed 150 mm for granular.

For services and culvert trenches, when using rammers and light vibratory plates weighing less than 115 kg (250 lbs) the compacted lift thicknesses will not exceed 100 and 125 mm respectively. For heavier trench equipment the compacted lifts will not exceed 250 mm.

No heavy equipment will be operated above the crown of pipes or culverts unless 1.2 m of fill has been placed or the subgrade elevation has been reached.

For all trenches below the water table, trench foundation not less than 200 mm will be provided as per materials and specification in Table 6 in page 47.

Materials lift placement beneath foundations, slabs or any placement not specified above must abide to the above specifications as they relate to the equipment being used.

F.7.2 Select Earthfill Placement

It is to be assumed that suitable select fill will be materials that will be excavated from the bank to be put directly on hauling equipment transported and dumped directly for spreading in lifts by push tractors, be added water and compacted. Stockpiling at the source or on site is not acceptable.

F.7.2.1 Moisture for Select Earthfill

It is to be assumed that moisture will be added for placement.

F.7.2.2 Compacted Lifts Thicknesses Equipment and Passes for Select Earthfill

Compacted lifts will not exceed 200 mm for heavy sheep foot rollers. Suitability of smooth vibratory rollers for the materials will be determined by the geotechnical engineer.

For road construction passes are to overlap by 300 mm for full coverage.

Where non vibratory pneumatic compactors with ballast an tire pressure of 100 psi (7 kg/cm2) are used (9 or 13 ply) the compacted lift thicknesses will not exceed 150 mm.

For services and culvert trenches, when using rammers and light vibratory plates weighing less than 115 kg (250 lbs) the compacted lift thicknesses will not exceed 100 and 125 mm respectively. For heavier trench equipment the compacted lifts will not exceed 200 mm.

No heavy equipment will be operated above the crown of pipes or culverts unless 1.2 m of fill has been placed or the subgrade elevation has been reached.

For all trenches below the water table, trench foundation not less than 200 mm will be provided as per materials and specification in Table 6 in page 47.

Materials lift placement beneath foundations, slabs or any placement not specified above must abide to the above specifications as they relate to the equipment being used.

F.7.3 Compaction Guide for Passes and Level of Compaction

The contents of this section are provided as guidelines for construction. The resulting compaction densities and compacted lift thicknesses can only be verified by actual testing and field trials respectively.

For equipment passes the contractor may consider not less than 4, 5 or 6 passes for 95, 98 or 100 % Proctor Standard compaction.

For granular materials loose lifts may be approximately 150, 175 and 235 mm for compacted lift thicknesses 125, 150 and 200 mm respectively.

For select earthfill materials loose lifts may be approximately 125 and 190 mm for compacted lift thicknesses 100 and 150 mm respectively.

F.8 Compaction General

It is to be assumed that water will be added for compaction and that the required maximum grain size shall be 3/4 of the compacted lift thickness.

Obtain the approximate loose lift thickness by dividing the compacted lift by 0.88. Compacted lifts are approximately 12% less than the loose lift thickness.

Each lift shall be compacted by the specified number of passes of the approved type and weight of roller or other equipment.

Table 6 in page 47 presents Proctor Standard (PS) compaction requirements for specified placement and materials.

F.9 Compaction Specific

F.9.1 Compaction Along Basement Walls, Retaining Walls and Structures

No heavy compaction equipment is to be operated within 0.9 m of any structure. The consolidation zone is defined as the zone within 0.9 m of the exterior edge of basements or the interior edge of retaining walls or any structure. Only light to very light compaction is to be applied along the consolidation zone with no more than 2 passes of light vibratory equipment.

F.9.2 Self Compacting Materials

There are no self compacting materials. Total fill thickness of 200 mm of granular materials consisting of more than 90% of one nominal size referred to as crushed stone are acceptable without compaction under concrete slabs.

F.9.3 Settlement Allowance and Overfill

The settlement (consolidation) of lightly compacted earthfill can be excessive. Overfill to compensate for settlement allowance will be discussed with the geotechnical engineer.

F.9.4 Compaction Quality Control

Provide moisture density relationships for Standard Proctor compaction for the proposed materials and source. Conduct one in situ test at randomly selected locations per 60 m3 of fill. This is approximately one test, each 300 m2 of lift in place. Nuclear or non-nuclear density probes testing can be used. Density probes will only measure the density within 0.12 m depth at the point of the measurement.

F.10 Asphalt Pavement

Place asphalt mix only when base course, or previous course is dry and air temperature is 7 degrees C and increasing.

Asphalt pavement mix temperatures at the time of placement will be within the range of 120 to 160 degrees C.

Do not place asphalt on a surface which is wet or covered by snow or ice or if the ground is frozen.

Material Placement	Material Description	% PS
Base	OPSS.MUNI 1010 Granular A	100
Subbase	OPSS.MUNI 1010 Granular B Type II	100
Subgrade	Granular earthfill (with 12 % or less fines) and 100% passing 106 mm sieve	95
	Select earthfill	95
Backfill for trenches under pavement	Granular earthfill (with 12 % or less fines) and 100% passing 106 mm sieve.	95
	Select earthfill	95
Under sidewalks top 200 mm	Any OPSS.MUNI 1010 Granular specification for which 100% passes the 26.5 mm sieve	95
Under foundations	OPSS.MUNI 1010 Granular B type 2 with 12% or less fines and for which 100% passes the 106 mm sieve	98
Backfill under slabs on grade	Cohesionless (with 12 % or less fines) and 100% passing 106 mm sieve.	100
	Select earthfill	100
Top 100 mm under slabs	Crushed stone 9.5 to 19 mm (use one or several sizes).	90
Pipe bedding and cover (150 mm for bedding to 150 mm above the crown)	Any OPSS.MUNI 1010 Granular specification for which 100% passes the 26.5 mm sieve	95
Trench foundation (stabilization minimum 200 mm)	Any OPSS 1010.MUNI Granular specification for which 100% passes the 106 mm sieve except Granular B Type I	95
Backfill for non building, non traffic and/or non parking areas	Granular (with 12 % or less fines) and 100% passing 106 mm sieve	90
	Select earthfill	90
Placement not specified above	Granular (with 12% or less fines) and 100% passing 106 mm sieve	95
	Select earthfill	95

Table 6: Proctor Standard (PS) compaction requirements for specified placement and materials.

F.10.1 Surface Preparation for Asphalt Pavement

It is to be assumed that rough grading and fine grading shall take place before asphalt placement. Rough grading will be completed to within ± 25 mm of the underside of asphalt and tested to meet the specified density. Fine grading and rolling will completed by the paving contractor. The granular material for fine grading will meet OPSS.MUNI 1010 Granular M.

F.10.2 Proof Rolling Prior to Asphalt Pavement

Conduct proof rolling using a single pass of a tandem-axle dump truck or a tri-axle dump truck with the third axle raised loaded to a minimum gross vehicle weight of 26 metric tons at walking speed. Rutting in excess of 25 mm is considered failure. Where proof rolling reveals areas of defective subgrade, Remove base, Sub-base and subgrade material to depth and extent and width that will allow reconstruction using the available equipment or as directed by the Consultant.

F.10.3 Asphalt compaction

The compacted lifts are accepted to be 80% of the loose lift thickness (the loose lift reduces thickness by 20% when compacted). Divide the compacted lift thickness by 0.8 to obtain the thickness of the loose lift.

Compaction will consist on at least three passes at approximately walking speed (5.4 km/hr) as follows: *break down rolling* using a vibratory steel drum roller, *intermediate rolling* with a static (non-vibrating) roller or a pneumatic roller and *finish rolling* with a smooth static roller.