FINAL

Preliminary Geotechnical Investigation – Proposed Residential Development

1887 St Joseph Boulevard, Ottawa, Ontario

Prepared for:

Sobeys Inc.
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1.0 INTRODUCTION AND SCOPE

Pinchin Ltd. (Pinchin) was retained by Sobeys Inc. (Client) to conduct a Preliminary Geotechnical Investigation and provide subsequent geotechnical design recommendations for the proposed residential development to be located at 1887 St Joseph Boulevard, Ottawa, Ontario (Site). The Site location is shown on Figure 1.

It is Pinchin's understanding that the Client is looking to rezone the property from industrial to residential; as such, in order to meet the City of Ottawa's rezoning requirements, the Client has requested Pinchin perform a Preliminary Geotechnical Investigation at the Site to provide preliminary geotechnical design recommendations for a proposed residential development.

The Client provided Pinchin with the following conceptual Site Plan for the purpose of developing a suitable preliminary scope of work:

- *"1887 St. Joseph Boulevard, Ottawa, Concept Plan*" prepared by Fotenn Planning & Design, drawing number P5, dated October 2, 2022 (Concept Plan).

The Concept Plan includes a total of six (6) multi-storey residential apartment buildings ranging from six (6) to eighteen (18) stories in height. The proposed development will also reportedly include a single level underground parking garage which will presumably occupy the majority of the Site footprint. It is noted that once the Site is rezoned and a finalized development plan has been completed, additional geotechnical investigation work will be required to supplement the preliminary recommendations provided in this report.

Pinchin's geotechnical comments and recommendations are based on the results of the Preliminary Geotechnical Investigation and our understanding of the project scope.

The purpose of the Preliminary Geotechnical Investigation was to delineate the subsurface conditions and soil engineering characteristics by advancing a total of six (6) sampled boreholes (Boreholes BH1 to BH6), at the Site.

Based on a desk top review and the results of the Preliminary Geotechnical Investigation, the following geotechnical data and engineering design recommendations are provided herein:

- A detailed description of the soil and groundwater conditions;
- Site preparation recommendations;
- Open cut excavations;
- Anticipated groundwater management;
- Site service trench design;

- Foundation design recommendations including soil and bedrock bearing resistances at Ultimate Limit States (ULS) and Serviceability Limit States (SLS) design;
- Potential total and differential settlements;
- Foundation frost protection and engineered fill specifications and installation;
- Seismic Site classification for seismic Site response;
- Underground parking garage design;
- Concrete floor slab support recommendations;
- Asphaltic concrete pavement structure design for parking areas and access roadways; and,
- Potential construction concerns.

Abbreviations, terminology, and principal symbols commonly used throughout the report, borehole logs and appendices are enclosed in Appendix I.

2.0 SITE DESCRIPTION AND GEOLOGICAL SETTING

The Site is located on the north side of St. Joseph Boulevard, approximately 500 m southwest of the intersection of Jeanne D'Arc Boulevard and Highway 174 in Ottawa, Ontario. The Site is currently developed with a single-storey multi-tenant commercial building and a large asphalt surfaced parking area. The lands adjacent to the Site are predominantly developed with a combination of commercial buildings and residential dwellings.

Data obtained from the Ontario Geological Survey Maps, as published by the Ontario Ministry of Natural Resources, indicates that the Site is located on a fine textured glaciomarine deposit consisting of massive to well laminated silt and clay with minor sand and gravel deposits (Ontario Geological Survey 2010. Surficial geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128-REV). The underlying bedrock at this Site is of the Shadow Lake Formation consisting of limestone, dolostone, shale, arkose, and sandstone (Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release---Data 126-Revision 1).

3.0 GEOTECHNICAL FIELD INVESTIGATION AND METHODOLOGY

Pinchin completed a field investigation at the Site from May 19 to 29, 2023 by advancing a total of six (6) sampled boreholes throughout the Site. The boreholes were advanced to sampled depths ranging from approximately 15.5 to 15.9 metres below existing ground surface (mbgs). Below the sampled depth within Boreholes BH1 and BH4, Dynamic Cone Penetration Tests (DCPT) were advanced to refusal depths ranging from approximately 47.9 to 50.9 mbgs to further assess the consistency of the subgrade soil with depth, as well as to estimate the approximate depth to bedrock. The approximate spatial locations of the boreholes advanced at the Site are shown on Figure 2.

The boreholes were advanced with the use of a track mounted drill rigs which were equipped with standard soil sampling equipment. Soil samples were collected at 0.76 and 1.52 m intervals using a 51 mm outside diameter (OD) split spoon barrel in conjunction with Standard Penetration Tests (SPT) “N” values (ASTM D1586). The SPT “N” values were used to assess the compactness condition of the non-cohesive soil. Approximate shear strengths of the cohesive soil were measured using the field vane test (ASTM D2573) and the results are presented on the appended borehole logs.

Upon completion of drilling, the boreholes were backfilled to a depth of approximately 6.0 mbgs and then instrumented with monitoring wells to allow for measurement of groundwater levels. The monitoring wells were constructed using flush-threaded 50 mm diameter Trilock pipe with 3.0 meter long 10-slot well screens, delivered to the Site in pre-cleaned individually sealed plastic bags. The screen and riser pipes were not allowed to come into contact with the ground or drilling equipment prior to installation.

A completed well record was submitted to the property owner and the Ministry of the Environment, Conservation and Parks for Ontario (MECP) as per Ontario Regulation 903, as amended. A licensed well technician must properly decommission the monitoring wells prior to construction according to Regulation 903 of the Ontario Water Resources Act.

Groundwater observations and measurements were obtained from the open boreholes during and upon completion of drilling. Groundwater levels were measured in the monitoring wells on June 2, 2023. The groundwater observations and measurements recorded are included on the appended borehole logs.

The borehole locations and ground surface elevations were located at the Site by Pinchin personnel. The ground surface elevation at each borehole location was referenced to the following temporary benchmark as shown on Figure 2:

- TBM: Top of the northwest corner of the concrete transformer pad, at the approximate location shown on Figure 2; and
- Elevation: 100.00 (Local Datum).

The field investigation was monitored by experienced Pinchin personnel. Pinchin logged the drilling operations and identified the soil samples as they were retrieved. The recovered soil samples were sealed into plastic bags and carefully transported to an independent and accredited materials testing laboratory for detailed analysis and testing. All soil samples were classified according to visual and index properties by the project engineer.

The field logging of the soil and groundwater conditions was performed to collect geotechnical engineering design information. The borehole logs include textural descriptions of the subsoil in accordance with a modified Unified Soil Classification System (USCS) and indicate the soil boundaries inferred from non-continuous sampling and observations made during the borehole advancement. These boundaries reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The modified USCS classification is explained in further detail in Appendix I. Details of the soil and groundwater conditions encountered within the boreholes are included on the Borehole Logs within Appendix II.

Select soil samples collected from the boreholes were submitted to a material testing laboratory to determine the grain size distribution and the Atterberg Limits of the soil. A copy of the laboratory analytical reports is included in Appendix III. In addition, the collected samples were compared against previous geotechnical information from the area, for consistency and calibration of results.

4.0 SUBSURFACE CONDITIONS

4.1 Borehole Soil Stratigraphy

In general, the soil stratigraphy at the Site comprises either surficial organics, surficial asphalt or surficial sand fill overlying a combination of granular fill, sandy silt and silty clay to the maximum sampled borehole depth of approximately 15.9 mbgs. The appended borehole logs provide detailed soil descriptions and stratigraphies, results of SPT and field vane testing, details of monitoring well installations, and groundwater measurements.

Surficial asphalt was encountered in Boreholes BH2, BH3, BH5 and BH6 and was measured to be approximately 100 mm thick.

The surficial organics were encountered within Borehole BH4 and were measured to be approximately 100 mm thick.

The sand fill was encountered at the surface within Borehole BH1 and underlying the surficial organics within Borehole BH4. The sand fill was observed to extend to depths ranging from approximately 1.1 to 3.1 mbgs and typically contained trace to some silt that was damp at the time of sampling. The sand fill had a very loose to loose relative density based on SPT ‘N’ values of 0 to 8 blows per 300 mm penetration of a split spoon sampler.

Granular fill was encountered underlying the surficial asphalt within Boreholes BH2, BH3, BH5, and BH6 and extended to between approximately 0.5 and 0.6 mbgs. The granular fill typically consisted of sand and gravel containing trace to some silt that was grey and damp at the time of sampling. The granular fill had a loose to compact relative density based on SPT ‘N’ values of between 9 and 24 blows per 300 mm penetration of a split spoon sampler. The result of one particle size distribution analysis performed on a sample of the material indicates that the sample contains approximately 48% gravel, 39% sand, and 13% silt sized particles.

Sandy silt containing some clay was encountered underlying the sand fill in Boreholes BH1 and BH4 and underlying the granular fill in Boreholes BH2, BH3, BH5 and BH6. The sandy silt was noted to extend to depths ranging between approximately 2.6 and 4.6 mbgs. The sandy silt has a very loose to compact relative density based on SPT ‘N’ values of 0 to 15 blows per 300 mm penetration of a split spoon sampler. The result of one particle size distribution analysis performed on a sample of the material indicates that the sample contains 32% sand, 51% silt and 17% clay sized particles. The moisture content of the sample tested was 23.1% indicating the material was in a moist to wet condition at the time of sampling.

Silty clay was encountered underlying the sandy silt material in all boreholes and extended to the maximum borehole sampled depth of approximately 15.9 mbgs. Pinchin notes that based on the results of the DCPTs completed in Boreholes BH1 and BH4, the silty clay is likely to extend to the majority of the way down to the underlying probable bedrock surface encountered between approximately 47.9 and 50.9 mbgs. The silty clay material was noted to typically contain trace sand and was grey in colour at the time of sampling. The material had a soft to very stiff consistency based on shear strengths measured with a shear vane of between 21 and 175 kPa. The remoulded shear strength of the soil ranged from 6 to 45 kPa, resulting in a sensitivity of between 1.7 and 6.0. It is noted that the measured shear strengths greater than 100 kPa were generally limited to the approximate upper 5.0 mbgs. The results of three particle size distribution analyses performed on samples of the material indicate that the samples contain 0 to 1% sand, 29 to 35% silt and 65 to 71% clay sized particles. Atterberg Limit testing indicates that the material has a liquid limit of between 65 and 69%, a plastic limit of between 29 and 33%, and a plasticity index of between 35 and 36%, indicating the material is high plastic clay. The moisture content of the samples tested ranged between 36.5 and 63.9%, indicating the material tested was wetter than plastic limit (WTPL) at the time of sampling.

4.2 Bedrock

DCPT refusal was encountered on probable bedrock in Boreholes BH1 and BH4 between approximately 47.9 and 50.9 mbgs. It is noted that no bedrock cores were advanced to confirm the presence of bedrock or to evaluate the Rock Quality Designation (RQD).

4.3 Groundwater Conditions

Groundwater observations and measurements were obtained in the open boreholes at the completion of drilling and are summarized on the appended borehole logs. The groundwater levels within the monitoring wells were measured on June 2, 2023, and ranged between approximately 1.3 and 3.1 mbgs.

Seasonal variations in the water table should be expected, with higher levels occurring during wet weather conditions in the spring and fall and lower levels occurring during dry weather conditions.

Pinchin's Hydrogeological Investigation Report should be reviewed for further clarification on the groundwater conditions at the Site.

5.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

5.1 General Information

The recommendations presented in the following sections of this report are based on the information available regarding the proposed construction, the results obtained from the geotechnical investigation, and Pinchin's experience with similar projects. Since the investigation only represents a portion of the subsurface conditions, it is possible that conditions may be encountered during construction that are substantially different than those encountered during the investigation. If these situations are encountered, adjustments to the design may be necessary. A qualified geotechnical engineer should be on-Site during the foundation preparation to ensure the subsurface conditions are the same/similar to what was observed during the investigation.

As previously mentioned, the Concept Plan for the Site includes a total of six (6) multi-storey residential apartment buildings ranging from six (6) to eighteen (18) stories in height. The proposed development will also reportedly include a single level underground parking garage which will presumably occupy the majority of the Site footprint. It is noted that once the Site is rezoned and a finalized development plan has been completed, additional geotechnical investigation work will be required to supplement the preliminary recommendations provided in this report.

At the time of preparing this report the proposed depth to the underside of the footings for the underground parking garage level is unknown. As such, for the purpose of this report, Pinchin has assumed an approximate depth of 3.0 mbgs to the underside of the footings for the proposed underground parking garage level.

5.2 Site Preparation

The existing surficial organics, sand fill and asphalt are not considered suitable to remain below the proposed development and will need to be removed. In calculating the approximate quantity of surficial organics to be stripped, we recommend that the surficial organic thicknesses provided on the individual borehole logs be increased by 50 mm to account for variations and some stripping of the mineral soil below.

Pinchin recommends that any engineered fill required at the Site be compacted in accordance with the criteria stated in the following table:

Type of Engineered Fill	Maximum Loose Lift Thickness (mm)	Compaction Requirements	Moisture Content (Percent of Optimum)
Structural fill to support foundations and floor slabs	200	100% SPMDD	Plus 2 to minus 4
Subgrade fill beneath parking lots and access roadways	300	98% SPMDD	Plus 2 to minus 4

Prior to placing any fill material at the Site, the subgrade should be inspected by a qualified geotechnical engineer and loosened/soft pockets should be sub excavated and replaced with engineered fill.

It is recommended that any fill required at the Site comprise imported Ontario Provincial Standards and Specifications (OPSS) 1010 Granular ‘B’ Type I or II material. If the work is carried out during very dry weather, water may have to be added to the material to improve compaction. Grade raises are not recommended; however, if proposed, they should be reviewed by Pinchin to confirm they do not impact the geotechnical design recommendations provided in this report. Grade raises could potentially cause long-term consolidation settlement of the silty clay soils underlying the Site.

A qualified geotechnical engineering technician should be on site to observe fill placement operations and perform field density tests at random locations throughout each lift, to indicate the specified compaction is being achieved.

5.3 Open Cut Excavations

It is anticipated that excavations for the proposed development will extend upwards of 3.0 mbgs to accommodate the proposed single level underground parking garage.

Based on the subsurface information obtained from within the boreholes, it is anticipated that the excavated material will predominately consist of sand fill, granular fill, sandy silt, and silty clay materials. Groundwater was measured to be between approximately 1.3 and 3.1 mbgs on June 2, 2023, and is expected to be encountered during excavations for the proposed development.

Where workers must enter trench excavations deeper than 1.2 m, the trench excavations should be suitably sloped and/or braced in accordance with the Occupational Health and Safety Act (OHSA), Ontario Regulation 213/91, Construction Projects, July 1, 2011, Part III - Excavations, Section 226.

Alternatively, the excavation walls may be supported by either closed shoring, bracing, or trench boxes complying with sections 235 to 239 and 241 under O. Reg. 231/91, s. 234(1). The use of trench boxes can most likely be used for temporary support of vertical side walls. The appropriate trench should be designed/confirmed for use in this soil deposit.

Based on the OHSA, the natural silty clay soils would be classified as Type 3 soil and temporary excavations in these soils must be sloped at an inclination of 1 horizontal to 1 vertical (H to V) from the base of the excavation. Excavations extending below the groundwater table would be classified as a Type 4 soil and temporary excavations will have to be sloped back at 3 H to 1 V from the base of the excavation.

In addition to compliance with the OHSA, the excavation procedures must also comply to any potential other regulatory authorities, such as federal and municipal safety standards.

5.4 Anticipated Groundwater Management

As previously mentioned, Groundwater was measured to be between approximately 1.3 and 3.1 mbgs on June 2, 2023, and is expected to be encountered during excavations for the proposed development. It is noted that Pinchin completed a Hydrogeological Investigation for the proposed development under a separate cover, and the following recommendations will be further expanded on within that report.

Moderate groundwater inflow through the silty clay material is expected where the excavations extend less than 0.60 m below the groundwater table. It is believed that this groundwater inflow can be controlled using a gravity dewatering system with perimeter interceptor ditches and high-capacity pumps.

For excavations extending more than 0.6 m below the stabilized groundwater table, a dewatering system installed by a specialist dewatering contractor may be required to lower the groundwater level prior to excavation. The design of the dewatering system should be left to the contractor’s discretion, and the system should meet a performance specification to maintain and control the groundwater at least 0.30 m below the excavation base.

Seasonal variations in the water table should be expected, with higher levels occurring during wet weather conditions in the spring and fall and lower levels occurring during dry weather conditions. If construction commences during wet periods (typically spring or fall), there is a greater potential that the groundwater elevation could be higher and/or perched groundwater may be present. Any potential precipitation of perched groundwater should be able to be controlled from pumping from filtered sumps.

Prior to commencing excavations, it is critical that all existing surface water and potential surface water is controlled and diverted away from the Site to prevent infiltration and subgrade softening. At no time should excavations be left open for a period of time that will expose them to precipitation and cause subgrade softening.

All collected water is to discharge a sufficient distance away from the excavation to prevent re-entry. Sediment control measures, such as a silt fence should be installed at the discharge point of the dewatering system. The utmost care should be taken to avoid any potential impacts on the environment.

It is the responsibility of the contractor to propose a suitable dewatering system based on the groundwater elevation at the time of construction. The method used should not adversely impact any nearby structures. A Permit to Take Water (PTTW) or a submission to the Environmental Activity and Sector Registry (EASR) would be required if the daily water takings exceed 50,000 L/day. It is the responsibility of the contractor to make this application if required.

5.5 Site Services

5.5.1 Pipe Bedding and Cover Materials for Flexible and Rigid Pipes

The subgrade soil conditions beneath the Site services will comprise either sandy silt or silty clay materials. No support problems are anticipated for flexible or rigid pipes founded on the sandy silt or silty clay materials. Service pipes require an adequate base to ensure proper pipe connection and positive flow is maintained post construction. As such, pipe bedding should be placed to be of uniform thickness and compactness. The pipe bedding and cover material should conform to OPSD 802.010 and 802.013 specifications for flexible pipes and to OPSD 802.031 to 802.033 with Class “B” bedding for rigid pipes.

The pipe bedding material should consist of a minimum thickness of 150 mm Granular “A” (OPSS 1010) below the pipe and extend up the sides to the spring line. However, the bedding thickness may have to be increased depending on the pipe diameter or if wet or weak subgrade conditions are encountered. The pipe cover material from the spring line should consist of a Granular “B” Type I (OPSS 1010) and should extend to a minimum of 300 mm above the top of the pipe. All granular fill material is to be placed in maximum 200 mm thick loose lifts compacted to a minimum of 98% SPMDD.

The bedding material, pipe and cover material should be installed as soon as practically possible after the excavation subgrade is exposed. The longer the excavated subgrade soil remains open to weather conditions and groundwater seepage, the greater the chance for construction problems to occur.

Where it is difficult to stabilize the subgrade due to groundwater or the material is higher than the optimum moisture content, a Granular “B” Type II material may be required. Alternatively, if constant groundwater infiltration becomes an issue, then an approximate 150 mm granular pad consisting of 19 mm clear stone gravel (OPSS 1004) wrapped in a non-woven geotextile (Terrafix 270R or equivalent) should be considered to maintain the integrity of the natural subgrade soils. The clear stone should contain a minimum of 50% crushed particles. Water collected within the stone should be controlled through sumps and filtered pumps.

5.5.2 Trench Backfill

The trench backfill should be compacted in maximum 300 mm thick lifts to 98% SPMDD within 4% of the optimum moisture content. Based on the observed moisture content of the natural overburden deposits, it may be difficult to achieve the specified density on all of the trench backfill. Nevertheless, it is recommended that the natural soils be used as backfill in the trenches to prevent problems with differential frost heaving of imported subgrade material.

If necessary, compensation for wet trench backfill conditions can be made with additional Granular ‘B’ in the pavement structure. It should be noted, however, that the wet backfill material must be compacted to at least 90% SPMDD or post-construction settlements could occur.

Portions of the silty clay may have a blocky/lumpy texture. If the large interclump voids are not closed completely by thorough compaction, then long-term softening/settlement will occur. The trench backfill should be placed in thin lifts (less than 300 mm) and compacted with a sheepsfoot roller. Particular attention must be made to backfilling service connections where the trenches are narrow.

All stockpiled material should be protected from deleterious materials, additional moisture and be kept from freezing.

Quality control will be the utmost importance when selecting the material. The selection of the material should be done as early in the contract as possible to allow sufficient time for gradation and proctor testing on representative samples to ensure it meets the project specifications.

Where the natural soil will be exposed, adequate compaction may prove difficult if the material becomes wet (i.e., above the optimum moisture content). Depending on the moisture content of the natural materials at the time of construction, they may either require moisture to be added or stockpiled and left to dry to achieve moisture content within plus 2% to minus 4% of optimum. The natural soil at this Site is subject to moisture content increase during wet weather. As such, stockpiles should be protected to help minimize moisture absorption during wet weather.

Alternatively, an imported drier material of similar gradation as the soil (i.e., silt clay) may be mixed to decrease the overall moisture content and bring it to within plus 2% to minus 4% of optimum. Depending on weather conditions at the time of construction, an imported material may be required regardless to achieve adequate compaction. If the imported material is not the same/similar to the soil observed on the side walls of the excavation, then a horizontal transition between the materials should be sloped as per frost heave taper OPSD 205.60. Any natural material is to be placed in maximum 300 mm thick lifts compacted to 95% SPMDD within plus 2% to minus 4% optimum moisture content. Imported material should consist of a Granular “A”, Granular “B” Type I, or Select Subgrade Material (OPSS 1010). Heavy construction equipment and truck traffic should not cross any pipe until at least 1 m of compacted soil is placed above the top of the pipe.

Post compaction settlement of finer grained soil can be expected, even when placed to compaction specifications. As such, fill materials should be installed as far in advance as possible before finishing the roadway in order to mitigate post compaction settlements.

5.5.3 Frost Protection

The frost penetration depth in Ottawa, Ontario is estimated to extend to approximately 1.8 mbgs in open roadways cleared of snow. As such, it is recommended to place water services at a minimum depth of 300 mm below this elevation with the top of the pipe located at 2.1 mbgs or lower as dictated by municipal service requirements. If a minimum of 2.1 m of soil cover cannot be provided, then the pipe should be insulated with a rigid polystyrene insulation (DOW Styrofoam HI40, or equivalent) or a pre-insulated pipe be utilized.

The insulation design configuration may either consist of placing horizontal insulation to a specified design distance beyond the outside edge of the pipe or an inverted “U” surrounding the top and sides of the pipe. Any method chosen requires suitable design and installation in accordance with the manufacture’s recommendations. To accommodate the placement of horizontal insulation a wider excavation trench may be required.

5.6 Foundation Design

5.6.1 Shallow Foundations Bearing on Sandy Silt and/or Silty Clay

For conventional shallow strip and spread footings established on the undisturbed sandy silt and/or silty clay material encountered approximately 3.0 mbgs, a bearing resistance for 25 mm of settlement of 95 kPa at Serviceability Limit States (SLS), and a factored geotechnical bearing resistance of 175 kPa at Ultimate Limit States (ULS) may be used for design purposes. As the actual service loads were not known at the time of this report, these should be reviewed by the project structural engineer to determine if SLS or ULS governs the footing design. The above-noted bearing resistances are limited to strip footings with a maximum width of 1.5 m, and spread footings with a maximum size of 2.4 x 2.4 m.

In order to achieve the above recommended bearing resistances, the material must be compacted to a minimum of 100% Standard Proctor Maximum Dry Density (SPMDD) prior to installing the concrete formwork. Any soft/loose areas which are not able to achieve the recommended 100% SPMDD are to be removed and replaced with a low strength concrete.

Pinchin notes that a qualified geotechnical engineering consultant should be on-Site during the proof roll and foundation preparation activities to verify the recommended level of compaction is achieved and to verify the design assumptions and recommendations. This is especially critical with respect to the recommended soil bearing pressures. If variations occur in the soil conditions between the borehole locations, site verification and site review by Pinchin is recommended to provide appropriate recommendations at that time.

The natural subgrade soil is sensitive to change in moisture content and can become loose/soft if subjected to additional water or precipitation. As well, it could be easily disturbed if travelled on during construction. Once it becomes disturbed it is no longer considered adequate to support the recommended design bearing pressures. **It is recommended that a working slab of lean concrete (mud slab) be placed in the footing areas immediately after excavation and inspection to protect the founding soils during placement of formwork and reinforcing steel.**

In addition, to ensure and protect the integrity of the subgrade soil during construction operations, the following is recommended:

- Prior to commencing excavations it is critical that all existing surface water, potential surface water and perched groundwater are controlled and diverted away from the work Site to prevent infiltration and subgrade softening. At no time should excavations be left open for a period of time that will expose them to inclement weather conditions and cause subgrade softening;
- The subgrade should be sloped to a sump outside the excavation to promote surface drainage and the collected water pumped out of the excavation. Any potential precipitation or seepage entering the excavations should be pumped away immediately (not allowed to pond);
- The footing areas should be cleaned of all deleterious materials such as topsoil, organics, fill, disturbed, caved materials or loosened bedrock pieces; and
- If the excavated subgrade soil remains open to weather conditions and groundwater seepage, sidewall stability and suitability of the subgrade soil will need to be verified prior to construction.

If construction proceeds during freezing weather conditions, adequate temporary frost protection for the footing bases and concrete must be provided and maintained above freezing at all times.

5.6.1.1 Foundation Transition Zones

Excessive differential settlements can occur where the subgrade support material types differ below the underside of continuous strip footings, (i.e., sandy silt to silty clay). As such, where strip footings transition from one material to another the transition between the materials should be suitably sloped or benched to mitigate differential settlements.

Pinchin also recommends the following transition precautions to mitigate/accommodate potential differential settlements:

- For strip footings, the transition zones should be adequately reinforced with additional reinforced steel lap lengths or widened footings;
- Steel reinforced poured concrete foundation walls; and
- Control joints throughout the transition zone(s).

The above recommendations should be reviewed by the structural engineer and incorporated into the design as necessary.

Where strip footings are founded at different elevations, the subgrade soil is to have a maximum slope of 2 H to 1 V, with the concrete footing having a maximum rise of 600 mm and a minimum run of 600 mm between each step, as detailed in the 2012 Ontario Building Code (OBC). The lower footing should be installed first to mitigate the risk of undermining the upper footing.

Individual spread footings are to be spaced a minimum distance of one and a half times the largest footing width apart from each other to avoid stress bulb interaction between footings. This assumes the footings are at the same elevation.

Foundations may be placed at a higher elevation relative to one another provided that the slope between the outside face of the foundations are separated at a minimum slope of 2 H to 1 V with an imaginary line drawn from the underside of the foundations. The lower footing should be installed first to mitigate the risk of undermining the upper footing.

5.6.2 Raft Slab Foundation or Larger Shallow Foundations Bearing on Sandy Silt and Silty Clay

Due to the relatively low bearing capacity of the natural soil, there is a potential for very large strip and spread footings to be required to support the proposed development. Installing large footings at the Site will cause stress bulb interaction within the subgrade soils due to the size and proximity of the footings to one another. As such, the foundation system may have to be designed as a raft. For both large footings and raft foundations, additional analysis would be needed on the potential for the soft clay soils below the Site to have excessive settlements due to long term consolidation settlement. Additional investigation including obtaining samples for laboratory consolidation testing would be needed in order for Pinchin to provide design parameters for larger footings or raft slabs.

5.6.3 Cast-in-Place Concrete Caissons End Bearing on Probable Bedrock

Should the above foundation options not be suitable for the proposed development, deep foundations consisting of cast-in-place concrete caissons founded on the underlying bedrock surface may be used to support the proposed building foundation system. Based on the current investigation, bedrock is expected to be at approximately 48 to 51 mbgs.

For cast-in-place concrete caissons founded on the probable bedrock surface located between approximately 47.9 and 50.9 mbgs, a factored geotechnical bearing resistance of 1,000 kPa at ULS may be used for foundation design purposes. It is noted that in order to achieve the recommended bearing resistance, the cast-in-place concrete caissons must be socketed into the sound bedrock a minimum of 2 times the caisson diameter. Higher bearing resistances may be available on the underlying bedrock; however, the bedrock should be cored to confirm this recommendation.

Pinchin notes that there is a potential for the concrete caissons to be terminated within the silty clay deposit where they will develop the majority of their geotechnical axial capacity from frictional shaft resistance (i.e., skin friction); however, it is recommended to complete this analysis once a more refined development has been completed as the length of the caissons required will be a function of the proposed building sizes. Any proposed grade raises could create negative skin friction on caissons which would have to be considered as part of the caisson capacity assessment.

5.6.3.1 Construction Installation Comments and Recommendations

Based on the results of the Geotechnical Investigation, groundwater is expected to be encountered between approximately 1.3 and 3.1 mbgs and will impact the installation of the caissons below this depth. A steel liner will be required to ensure the sidewalls of the caisson excavation do not cave in. If groundwater is found to be present in the completed excavation, concrete for caisson construction should be placed from the bottom up, by tremie. To alleviate soil basal heave at the bottom of the augured hole in the event that a water bearing sandy deposit or seam were encountered in the bottom of the caisson at termination, a drilling slurry should be utilized to maintain pressure at the base of the excavation as well as side wall support. Drilling slurry would not be required for caissons extending to bedrock deriving their capacity from end-bearing only.

Prior to auguring, it is critical that all existing and potential surface water be controlled and diverted away from the work site to prevent infiltration.

Augured cast-in-place concrete caissons are to be installed by an experienced contractor familiar with the auger-cast process and soil conditions.

The installation of the caissons should be monitored on a full-time basis by a qualified geotechnical consultant.

5.6.3.2 Load Testing

Given the soil conditions encountered, the vertical, horizontal, and uplift capacity should be verified by load testing on at least one caisson.

5.6.4 Driven Piles End Bearing on Bedrock

As an alternative to cast-in-place concrete caissons, steel H-section piles end bearing on the probable bedrock surface encountered between approximately 47.9 and 50.9 mbgs may be used to support the proposed building foundation system.

Preliminary design resistances for two H-section pile types HP310x110 and HP310x125, driven to practical refusal, are provided below. Additional calculations will be required for different piles sizes. The H-section piles should be designed to ULS design. SLS design does not apply for end bearing steel HP piles, since the founding medium is considered to be non-yielding and the loads required for unacceptable settlements to occur would be much larger than the factored resistance at ULS.

HP Pile Type	Factored Geotechnical Axial Pile Capacity (ULS)
HP310 x 110	1,750 kN
HP310 x 125	2,000 kN

The factored geotechnical axial pile capacities at ULS are based on a yield stress of the steel (F_y) of 350 MPa and a geotechnical resistance factor of 0.4.

A geotechnical resistance of 0.4 is based on a dynamic analysis in compression utilizing a pile driving hammer with a specified energy and set criterion sufficient to develop the design capacity of the pile selected. The set criterion will depend on the pile section chosen and the type of pile driving hammer used by the contractor to install the piles. Once the set criterion is established, it must be substantiated on a representative number of piles with a Pile Driving Analyzer (PDA) during the initial pile driving. The PDA determines the ultimate axial pile capacity through CAPWAP analysis. The factored geotechnical axial resistance of the pile at ULS design can be taken as the vertical ultimate pile capacity obtained by the dynamic testing with the PDA multiplied by the geotechnical resistance factor of 0.4.

It is noted that the piles must be driven to a minimum depth of between 47.9 and 50.9 mbgs to ensure they have reached the underlying bedrock surface. Additional bedrock probes should be considered prior to completing the pile design to obtain a more accurate representation of the underlying bedrock surface profile.

The piles should be spaced at a minimum distance of 2.5 times the pile diameter. Normal tolerances during pile driving of 2% plumb and 42 mm in location should not be exceeded.

The pile installation should be monitored on a full-time basis by the designer. All pile driving techniques should be reviewed and approved prior to the installation of the piles. The set criterion for each pile should be confirmed by a full-time qualified piling inspector.

H-Section piles should be fitted with either driving shoes or OSLO points to set the piles in the bedrock, and to minimize pile tip damage to reduce the risk of horizontal pile movement during driving on sloping bedrock.

5.6.4.1 Pile Driving in Close Proximity of Existing Structures

Driving piles with impact hammers will induce ground vibrations within the surrounding soil. These ground vibrations can have detrimental effects on any nearby structures. Where the piles for this project are driven in close proximity to existing buildings, careful monitoring of the pile driving installation will need to be performed by the piling contractor. As such, Pinchin recommends that a preconstruction survey of all neighbouring properties be undertaken prior to pile driving to avoid any unjustified claims from adjacent building owners. At the start of the pile driving operations and periodically during them, the piling contractor should inspect adjacent buildings to ensure that damage is not being done to existing foundations due to vibrations through the ground.

5.6.5 Estimated Settlement

The foundations should be founded on uniform subgrade soils, reviewed, and approved by a licensed geotechnical engineer.

Foundations installed in accordance with the recommendations outlined in the preceding sections are not expected to exceed total settlements of 25 mm and differential settlements of 19 mm.

5.6.6 Building Drainage

To assist in maintaining the building dry from surface water seepage, it is recommended that exterior grades around the buildings be sloped away at a 2% gradient or more, for a distance of at least 2.0 m. Roof drains should discharge a minimum of 1.5 m away from the structure to a drainage swale or appropriate storm drainage system.

5.6.7 Shallow Foundations Frost Protection & Foundation Backfill

In the Ottawa, Ontario area, exterior perimeter foundations require a minimum of 1.8 m of soil cover above the underside of the footing to provide soil cover for frost protection.

Where the foundations do not have the minimum 1.8 m of soil cover frost protection, they should be protected from frost with a combination of soil cover and rigid polystyrene insulation, such as Dow Styrofoam or equivalent product. If required, Pinchin can provide appropriate foundation frost protection recommendations as part of the design review.

To minimize potential frost movements from soil frost adhesion, the perimeter foundation backfill should consist of a free draining granular material, such as a Granular 'B' Type I (OPSS 1010) or an approved sand fill, extending a minimum lateral distance of 600 mm beyond the foundation. The existing silty clay material is too wet for reuse and not considered suitable for reuse as foundation wall backfill. Backfill must be brought up evenly on both sides of walls not designed to resist lateral earth pressure. All backfill material is to be placed in maximum 300 mm thick lifts compacted to a minimum of 100% SPMDD below the interior of building and exterior hard landscaping areas; and 95% SPMDD below exterior soft landscaping areas. It is recommended that inspection and testing be carried out during construction to confirm backfill quality, thickness and to ensure compaction requirements are achieved.

5.7 Site Classification for Seismic Site Response & Soil Behaviour

The following information has been provided to assist the building designer from a preliminary geotechnical perspective only. These preliminary geotechnical seismic design parameters should be reviewed in detail by the structural engineer and be incorporated into the design as required.

The seismic site classification has been based on the 2012 OBC. The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4.A of the OBC. The site classification is based on the average shear wave velocity in the top 30 m of the site stratigraphy. If the average shear wave velocity is not known, the site class can be estimated from energy corrected Standard Penetration Resistance (N60) and/or the average undrained shear strength of the soil in the top 30 m.

The boreholes advanced at this Site extended to a maximum sampled depth of approximately 15.9 mbgs and a maximum DCPT refusal depth of approximately 50.9 mbgs. SPT "N" values within the subgrade soil located below the assumed foundation depth of approximately 3.0 mbgs ranged between 0 and 8 blows per 300 mm, while DCPT values in the upper 30.0 mbgs ranged between 0 and 34 blows per 300 mm. As such, based on Table 4.1.8.4.A of the OBC, this Site has been classified as Class E. A Site Class E has an average shear wave velocity (Vs) of less than 180 m/s.

5.8 Underground Parking Garage Design

It is understood that the proposed development will include a single level of underground parking that will occupy the majority of the Site footprint. As previously mentioned, for the purpose of this report, Pinchin has assumed a depth of approximately 3.0 mbgs to the underside of the footings for the parking garage level. The groundwater levels within the monitoring wells were measured on June 2, 2023, and ranged between approximately 1.3 and 3.1 mbgs.

As such, depending on the proposed final grades, there is a potential for the buildings to have to be designed to either resist hydrostatic uplift or to be provided with underfloor and foundation wall drainage systems connected to a suitable frost-free outlet due to the groundwater levels at the Site.

The magnitude of the hydrostatic uplift may be calculated using the following formula:

$$P = \gamma \times d$$

Where:

P = hydrostatic uplift pressure acting on the base of the structure (kPa)

γ = unit weight of water (9.8 kN/m^3)

d = depth of base of structure below the design high water level (m)

The resistance of gross uplift of the structure can be increased by simply increasing the mass of the structure, incorporating oversize footings into the structure or by installing soil anchors.

As an alternative to designing the building for hydrostatic uplift, exterior perimeter foundation drains can be installed where subsurface walls are exposed to the interior. The foundation drains should consist of a minimum 150 mm diameter fabric wrapped perforated drainage tile surrounded by 19 mm diameter clear stone (OPSS 1004) with a minimum cover of 150 mm on top and sides and 50 mm below the drainage tile. Since the natural soil contains a significant amount of silt sized particles, the clear stone gravel should be wrapped in a non-woven geotextile (Terrafix 270R or equivalent). The water collected from the weeping tile should be directed away from the building to appropriate drainage areas; either through gravity flow or interior sump pump systems. All subsurface walls should be waterproofed.

An underfloor drainage system should also be installed beneath the slab, in addition to the installation of perimeter weeping tiles at the footing level. The floor slab sub drains should be constructed in a similar fashion to the foundation drains and be connected to a suitable frost-free outlet or sump.

The walls must also be designed to resist lateral earth pressure. Depending on the design of the building the earth pressure computations must consider the groundwater level at the Site. For calculating the lateral earth pressure, the coefficient of at-rest earth pressure (K_0) may be assumed at 0.5 for non-cohesive sandy silt soil. The bulk unit weight of the retained backfill may be taken as 20 kN/m^3 for well compacted soil. An appropriate factor of safety should be applied.

5.9 Floor Slabs

The soils below any floor slabs more than 3.0 mbgs will be bearing on the natural silty clay soils. It is recommended that these floors slabs be constructed as structural slabs, supported by the foundation system. The natural subgrade soil is to be proof roll compacted with a minimum 10 tonne non-vibratory steel drum roller to observe for weak/soft spots. It is noted that some locations will not be accessible by the steel drum roller; as such, these locations can be proof roll compacted with a minimum 450 kg vibratory plate compactor. Any soft area(s) encountered during proof rolling should be excavated and replaced with a similar soil type.

Once the subgrade soil is exposed it is to be inspected and approved by a qualified geotechnical engineering consultant to ensure that the material conforms to the soil type and consistency observed during the subsurface investigation work.

Based on the in-situ soil conditions, it is recommended to establish the concrete floor slab on a minimum 300 mm thick layer of Granular “A” (OPSS 1010) compacted to 100% SPMDD. Alternatively, consideration may also be given to using a 300 mm thick layer of uniformly compacted 19 mm clear stone placed over the approved subgrade. Any required up-fill should consist of a Granular “B” Type I or Type II (OPSS 1010).

The following table provides the unfactored modulus of subgrade reaction values:

Material Type	**Modulus of Subgrade Reaction (kN/m^3)**
Granular A (OPSS 1010)	85,000
Granular “B” Type I (OPSS 1010)	75,000
Granular “B” Type II (OPSS 1010)	85,000
Sandy Silt/Silty Clay	15,000

The values in the table above are for loaded areas of 0.3 m x 0.3 m.

5.10 Asphaltic Concrete Pavement Structure Design for Parking Lot and Driveways

5.10.1 Discussion

Parking areas and driveway access will be constructed around the proposed buildings and there is a potential for some of these areas to extend beyond the proposed underground parking garage footprint. The in-situ sandy silt and silty clay soils are considered sufficient bearing materials for an asphaltic concrete pavement structure provided all organics, existing asphalt and deleterious materials are removed prior to installing the engineered fill material.

At this time Pinchin is unaware of the proposed final grades for the parking areas and access roadways/driveway. As such, provided the pavement structure overlies the in-situ sandy silt and/or silty clay materials, the following pavement structure is recommended.

5.10.2 Pavement Structure

The following table presents the minimum specifications for a flexible asphaltic concrete pavement structure:

Pavement Layer	**Compaction Requirements**	**Parking Areas**	**Driveways**
Surface Course Asphaltic Concrete HL-3 (OPSS 1150)	92% MRD as per OPSS 310	40 mm	40 mm
Binder Course Asphaltic Concrete HL-8 (OPSS 1150)	92 % MRD as per OPSS 310	55 mm	80 mm
Base Course: Granular “A” (OPSS 1010)	100% Standard Proctor Maximum Dry Density (ASTM-D698)	150 mm	150 mm
Subbase Course: Granular “B” Type I (OPSS 1010)	100% Standard Proctor Maximum Dry Density (ASTM D698)	300 mm	450 mm

Notes:

I. Prior to placing the pavement structure, the subgrade soil is to be proof rolled with a smooth drum roller without vibration to observe weak spots and the deflection of the soil; and

II. The recommended pavement structure may have to be adjusted according to the City of Ottawa standards. Also, if construction takes place during times of substantial precipitation and the subgrade soil becomes wet and disturbed, the granular thickness may have to be increased to compensate for the weaker subgrade soil. In addition, the granular fill material thickness may have to be temporarily increased to allow heavy construction equipment to access the Site, in order to avoid the subgrade from “pumping” up into the granular material.

Performance grade PG 58-28 asphaltic concrete should be specified for Marshall mixes.

5.10.3 Pavement Structure Subgrade Preparation and Granular up Fill

The proper placement of base and subbase fill materials becomes very important in addressing the proper load distribution to provide a durable pavement structure.

The pavement subgrade materials should be thoroughly proof-rolled prior to placement of the Granular ‘B’ subbase course. If any unstable areas are noted, then the Granular ‘B’ thickness may need to be increased to support pavement construction traffic. This should be left as a field decision by a qualified geotechnical engineer at the time of construction, but it is recommended that additional Granular ‘B’ be carried as a provisional item under the construction contract.

Where fill material is required to increase the grade to the underside of the pavement structure it should consist of Granular 'B' Type I (OPSS 1010). The up fill material is to be placed in maximum 300 mm thick lifts compacted to 98% SPMDD within 4% of the optimum moisture content.

Samples of both the Granular 'A' and Granular 'B' Type I aggregates should be tested for conformance to OPSS 1010 prior to utilization on Site and during construction. All stockpiled material should be protected from deleterious materials, additional moisture and be kept from freezing.

Post compaction settlement of fine grained soil can be expected, even when placed to compaction specifications. As such, fill material should be installed as far in advance as possible before finishing the parking lot and access roadways for best grade integrity.

Where the subgrade material types differ below the underside of the pavement structure, the transition between the materials should be sloped as per frost heave taper OPSD 205.60.

5.10.4 Drainage

Control of surface water is a critical factor in achieving good pavement structure life. The pavement thickness designs are based on a drained pavement subgrade via sub-drains or ditches.

The silty clay soils have poor natural drainage and therefore it is recommended that pavement subdrains be installed in the lower areas and be connected to the catch basins. Pavement subdrains should comprise 150 mm diameter perforated pipe in filter sock, bedded in concrete sand. The upper limit of the concrete sand bedding should be at the lower limit of the pavement subbase, with the subgrade below the subbase sloped towards the subdrain.

The surface of the roadways should be free of depressions and be sloped at a minimum grade of 1% in order to drain to appropriate drainage areas. Subgrade soil should slope a minimum of 3% toward stormwater collection points. Positive slopes are very important for the proper performance of the drainage system. The granular base and subbase materials should extend horizontally to any potential ditches or swales.

In addition, routine maintenance of the drainage systems will assist with the longevity of the pavement structure. Ditches, culverts, sewers and catch basins should be regularly cleared of debris and vegetation.

6.0 SOIL CORROSIVITY AND SULPHATE ATTACK ON CONCRETE

A soil sample from Borehole BH6 was submitted to assess the corrosivity of the soil and potential for sulphate attack on concrete. The assessment was completed using the 10-point soil evaluation procedure, provided in the Appendix to the American Water Work Association A21.5 Standard, as recommended by the Ductile Iron Pipe Research Association (DIPRA). The soil samples were evaluated for the following parameters: soil resistivity, pH, redox potential, sulfides, and moisture. Each parameter is assessed and assigned a point value, and the points are totalled. If the total is equal or greater than 10, the soil is considered corrosive to ductile iron pipe. In this case, protective measure must be undertaken. The following table summarizes the 10-point soil evaluation for the tested samples:

Borehole and Sample No.	Resistivity (ohm-cm)	Points	pH	Points	Redox Potential (mv)	Points	Sulfides	Points	Moisture	Points	Total Points
BH6 SS4 @ 7.5 – 9.5 ft	10900	0	7.36	0	442	0	Trace	2	Poor drainage, continuously wet	2	4.0

In summary, the tested sample indicates a low potential for soil corrosivity, and additional protective measures are not required. The results of the sulphate testing indicate that the Site possesses moderate sulphate exposure, indicating that S-3 concrete should be used for the proposed structures at the Site. The results should be reviewed by the structural engineer to ensure conformance to the concrete exposures.

7.0 SITE SUPERVISION & QUALITY CONTROL

It is recommended that all geotechnical aspects of the project be reviewed and confirmed under the appropriate geotechnical supervision, to routinely check such items. This includes but is not limited to inspection and confirmation of the undisturbed natural subgrade material prior to subgrade preparation, pouring any foundations or footings, backfilling, or engineered fill installation to ensure that the actual conditions are not markedly different than what was observed at the borehole locations and geotechnical components are constructed as per Pinchin’s recommendations. Compaction quality control of engineered fill material (full-time monitoring) is recommended as standard practice, as well as regular sampling and testing of aggregates and concrete, to ensure that physical characteristics of materials for compliance during installation and satisfies all specifications presented within this report.

8.0 TERMS AND LIMITATIONS

This Preliminary Geotechnical Investigation was performed for the exclusive use of Sobeys Inc. (Client) in order to evaluate the subsurface conditions at 1887 St Joseph Boulevard, Ottawa, Ontario. It is noted that once the Site is rezoned and a finalized development plan has been completed, additional geotechnical investigation work will be required to supplement the preliminary recommendations. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practises in the field of geotechnical engineering for the Site. Classification and identification of soil, and geologic units have been based upon commonly accepted methods employed in professional geotechnical practice. No warranty or other conditions, expressed or implied, should be understood. Conclusions derived are specific to the immediate area of study and cannot be extrapolated extensively away from sample locations.

Performance of this Preliminary Geotechnical Investigation to the standards established by Pinchin is intended to reduce, but not eliminate, uncertainty regarding the subgrade soil at the Site, and recognizes reasonable limits on time and cost.

Regardless how exhaustive a Geotechnical Investigation is performed, the investigation cannot identify all the subsurface conditions. Therefore, no warranty is expressed or implied that the entire Site is representative of the subsurface information obtained at the specific locations of our investigation. If during construction, subsurface conditions differ from then what was encountered within our test location and the additional subsurface information provided to us, Pinchin should be contacted to review our recommendations. This report does not alleviate the contractor, owner, or any other parties of their respective responsibilities.

This report has been prepared for the exclusive use of the Client and their authorized agents. 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 the third parties. If additional parties require reliance on this report, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this report should not be construed as legal advice.

The liability of Pinchin or our officers, directors, shareholders or staff will be limited to the lesser of the fees paid or actual damages incurred by the Client. Pinchin will not be responsible for any consequential or indirect damages. Pinchin will only be liable for damages resulting from the negligence of Pinchin. Pinchin will not be liable for any losses or damage if the Client has failed, within a period of two years following the date upon which the claim is discovered (Claim Period), to commence legal proceedings against Pinchin to recover such losses or damage unless the laws of the jurisdiction which governs the Claim Period which is applicable to such claim provides that the applicable Claim Period is greater than two years and cannot be abridged by the contract between the Client and Pinchin, in which case the Claim Period shall be deemed to be extended by the shortest additional period which results in this provision being legally enforceable.

Pinchin makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and these interpretations may change over time. Please refer to Appendix IV, Report Limitations and Guidelines for Use, which pertains to this report.

Specific limitations related to the legal and financial and limitations to the scope of the current work are outlined in our proposal, the attached Methodology and the Authorization to Proceed, Limitation of Liability and Terms of Engagement which accompanied the proposal.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

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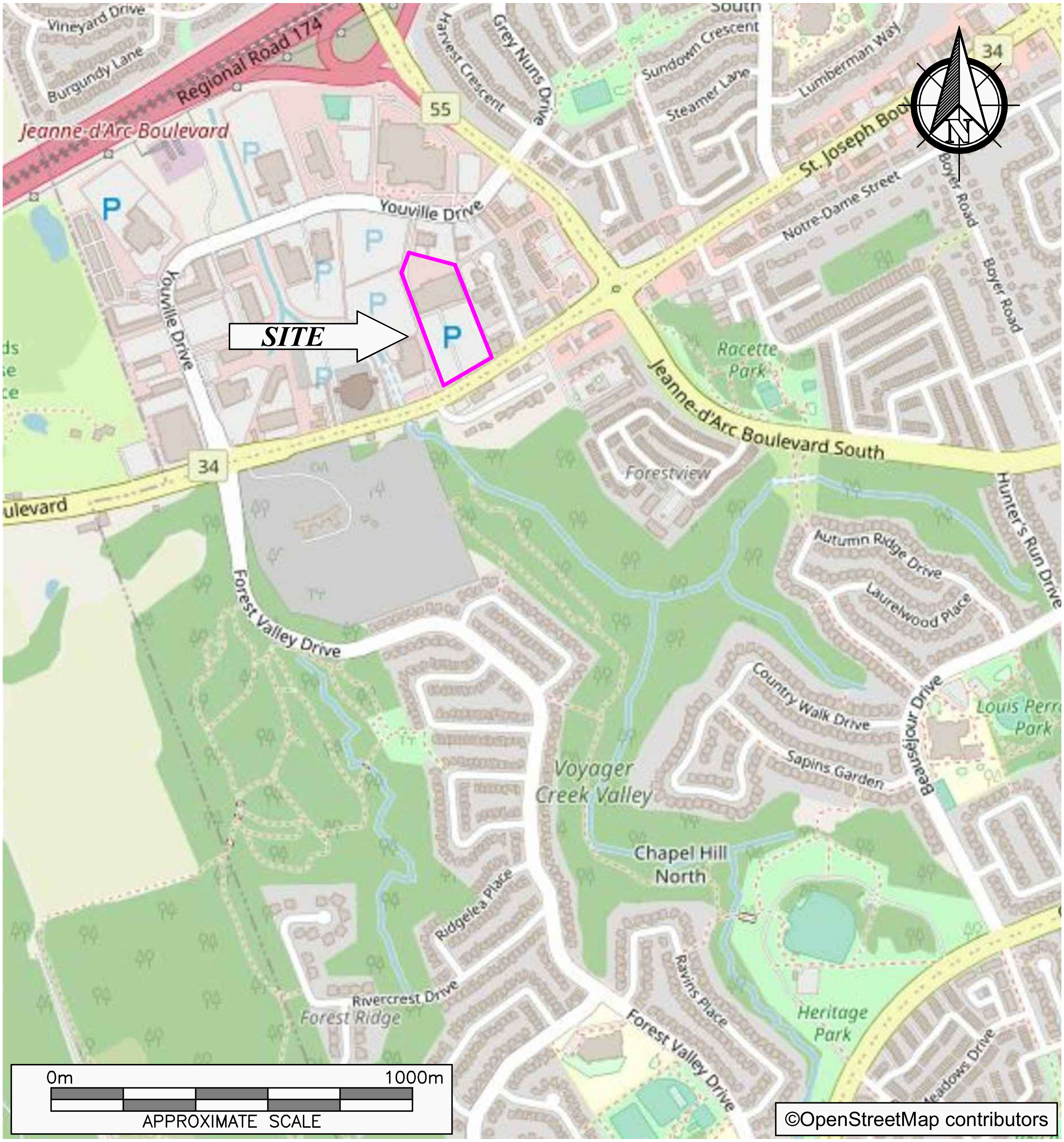
Template: Master Geotechnical Investigation Report – Ontario, GEO, September 2, 2021

FIGURES



PINCHIN

PROJECT NAME
GEOTECHNICAL INVESTIGATION

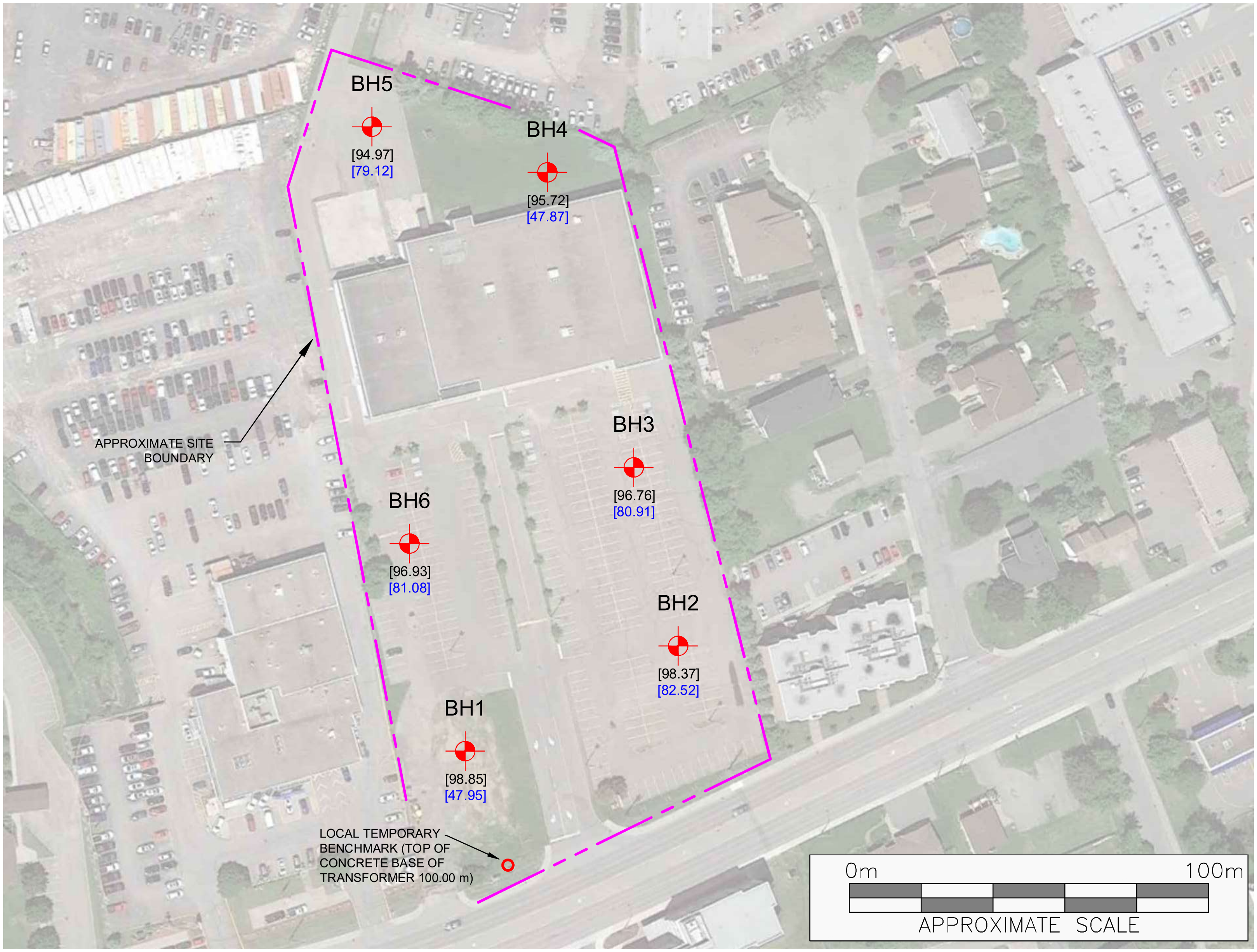
CLIENT NAME
SOBEYS INC.

PROJECT LOCATION
1887 ST JOSEPH BOULEVARD, OTTAWA, ONTARIO

FIGURE NAME
KEY MAP

FIGURE NO.
1

APPROXIMATE SCALE	PROJECT NO.	DATE
AS SHOWN	324269.001	JUNE 2023



LEGEND

⌖	BOREHOLE / MONITORING WELL LOCATION
[XX.XX]	APPROXIMATE LOCAL GROUND ELEVATION (m)
[XX.XX]	APPROXIMATE LOCAL TERMINATION ELEVATION (m)

PINCHIN

PROJECT NAME
GEOTECHNICAL INVESTIGATION

CLIENT NAME
SOBEYS INC.

PROJECT LOCATION
1887 ST JOSEPH BOULEVARD,
OTTAWA, ONTARIO

FIGURE NAME
BOREHOLE/MONITORING WELL
LOCATION PLAN

APPROXIMATE SCALE
AS SHOWN

PROJECT NO.
324269.001

DATE
JUNE 2023

FIGURE NO.
2

APPENDIX I

Abbreviations, Terminology and Principle Symbols used in Report and Borehole Logs

ABBREVIATIONS, TERMINOLOGY & PRINCIPAL SYMBOLS USED

Sampling Method

AS	Auger Sample	**w**	Washed Sample
SS	Split Spoon Sample	**HQ**	Rock Core (63.5 mm diam.)
ST	Thin Walled Shelby Tube	**NQ**	Rock Core (47.5 mm diam.)
BS	Block Sample	**BQ**	Rock Core (36.5 mm diam.)

In-Situ Soil Testing

Standard Penetration Test (SPT), "N" value is the number of blows required to drive a 51 mm outside diameter spilt barrel sampler into the soil a distance of 300 mm with a 63.5 kg weight free falling a distance of 760 mm after an initial penetration of 150 mm has been achieved. The SPT, "N" value is a qualitative term used to interpret the compactness condition of cohesionless soils and is used only as a very approximation to estimate the consistency and undrained shear strength of cohesive soils.

Dynamic Cone Penetration Test (DCPT) is the number of blows required to drive a cone with a 60 degree apex attached to "A" size drill rods continuously into the soil for each 300 mm penetration with a 63.5 kg weight free falling a distance of 760 mm.

Cone Penetration Test (CPT) is an electronic cone point with a 10 cm2 base area with a 60 degree apex pushed through the soil at a penetration rate of 2 cm/s.

Field Vane Test (FVT) consists of a vane blade, a set of rods and torque measuring apparatus used to determine the undrained shear strength of cohesive soils.

Soil Descriptions

The soil descriptions and classifications are based on an expanded Unified Soil Classification System (USCS). The USCS classifies soils on the basis of engineering properties. The system divides soils into three major categories; coarse grained, fine grained and highly organic soils. The soil is then subdivided based on either gradation or plasticity characteristics. The classification excludes particles larger than 75 mm. To aid in quantifying material amounts by weight within the respective grain size fractions the following terms have been included to expand the USCS:

Soil Classification		Terminology	Proportion
Clay	< 0.002 mm		
Silt	0.002 to 0.06 mm	“trace”, trace sand, etc.	1 to 10%
Sand	0.075 to 4.75 mm	“some”, some sand, etc.	10 to 20%
Gravel	4.75 to 75 mm	Adjective, sandy, gravelly, etc.	20 to 35%
Cobbles	75 to 200 mm	And, and gravel, and silt, etc.	>35%
Boulders	>200 mm	Noun, Sand, Gravel, Silt, etc.	>35% and main fraction

Notes:

- Soil properties, such as strength, gradation, plasticity, structure, etcetera, dictate the soils engineering behaviour over grain size fractions; and
- With the exception of soil samples tested for grain size distribution or plasticity, all soil samples have been classified based on visual and tactile observations. The accuracy of visual and tactile observation is not sufficient to differentiate between changes in soil classification or precise grain size and is therefore an approximate description.

The following table outlines the qualitative terms used to describe the compactness condition of cohesionless soil:

Cohesionless Soil	
Compactness Condition	**SPT N-Index (blows per 300 mm)**
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

The following table outlines the qualitative terms used to describe the consistency of cohesive soils related to undrained shear strength and SPT, N-Index:

Cohesive Soil

Consistency	Undrained Shear Strength (kPa)	SPT N-Index (blows per 300 mm)
Very Soft	<12	<2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

Note: Utilizing the SPT, N-Index value to correlate the consistency and undrained shear strength of cohesive soils is only very approximate and needs to be used with caution.

Soil & Rock Physical Properties

General

W	Natural water content or moisture content within soil sample
γ	Unit weight
γ'	Effective unit weight
γ_d	Dry unit weight
γ_{sat}	Saturated unit weight
ρ	Density
ρ_s	Density of solid particles
ρ_w	Density of Water
ρ_d	Dry density
ρ_{sat}	Saturated density e Void ratio
n	Porosity
S_r	Degree of saturation
E_{50}	Strain at 50% maximum stress (cohesive soil)

Consistency

W_L	Liquid limit
W_P	Plastic Limit
I_P	Plasticity Index
W_S	Shrinkage Limit
I_L	Liquidity Index
I_C	Consistency Index
e_{max}	Void ratio in loosest state
e_{min}	Void ratio in densest state
I_D	Density Index (formerly relative density)

Shear Strength

C_u, S_u	Undrained shear strength parameter (total stress)
C'_d	Drained shear strength parameter (effective stress)
r	Remolded shear strength
τ_p	Peak residual shear strength
τ_r	Residual shear strength
ø’	Angle of interface friction, coefficient of friction = tan ø’

Consolidation (One Dimensional)

C_C	Compression index (normally consolidated range)
C_r	Recompression index (over consolidated range)
C_S	Swelling index
m_V	Coefficient of volume change
c_V	Coefficient of consolidation
T_V	Time factor (vertical direction)
U	Degree of consolidation
σ'_O	Overburden pressure
σ'_p	Preconsolidation pressure (most probable)
OCR	Overconsolidation ratio

Permeability

The following table outlines the terms used to describe the degree of permeability of soil and common soil types associated with the permeability rates:

Permeability (k cm/s)	Degree of Permeability	Common Associated Soil Type
> 10^{-1}	Very High	Clean gravel
10^{-1} to 10^{-3}	High	Clean sand, Clean sand and gravel
10^{-3} to 10^{-5}	Medium	Fine sand to silty sand
10^{-5} to 10^{-7}	Low	Silt and clayey silt (low plasticity)
>10^{-7}	Practically Impermeable	Silty clay (medium to high plasticity)

Rock Coring

Rock Quality Designation (RQD) is an indirect measure of the number of fractures within a rock mass, Deere et al. (1967). It is the sum of sound pieces of rock core equal to or greater than 100 mm recovered from the core run, divided by the total length of the core run, expressed as a percentage. If the core section is broken due to mechanical or handling, the pieces are fitted together and if 100 mm or greater included in the total sum.

RQD is calculated as follows:

$$\text{RQD (\%)} = \frac{\Sigma \text{ Length of core pieces} > 100 \text{ mm x } 100}{\text{Total length of core run}}$$

The following is the Classification of Rock with Respect to RQD Value:

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

APPENDIX II

Pinchin's Borehole Logs

Log of Borehole: BH1

Project #: 324269.001 **Logged By:** MK

Project: Geotechnical Investigation

Client: Sobey's Inc.

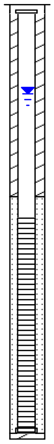
Location: 1887 St. Joseph's Boulevard, Ottawa, ON

Drill Date: May 19, 2023 **Project Manager:** WT

SUBSURFACE PROFILE

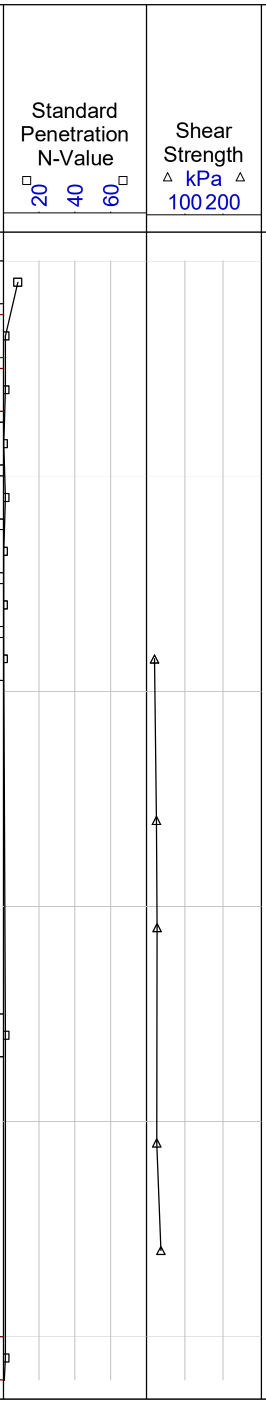
Depth (m)	Symbol	Description	Elevation (m)
0		Ground Surface	98.85
0–0.76	▨	**Sand Fill** Sand, some silt, trace organics, brown, damp, loose	98.09
0.76–3.05	▨	No organics, very loose	95.80
3.05–4.57		**Sandy Silt** Sandy silt, some clay, grey, moist to wet, very loose	94.28
4.57–9.14		**Silty Clay** Silty clay, trace sand, grey, APL to WTPL, very soft to soft	89.71
9.14–15.85		Firm	83.00

Monitoring Well Details: Groundwater level = 1.27 mbgs, as measured on June 2, 2023.



SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	60	8				
SS	2	100	1				
SS	3	90	1				
SS	4	10	0				VOC PHC
SS	5	40	1				
SS	6	90	0				
SS	7	80	0				
SS	8	100	0				
SS	9	100	1				
SS	10	100	1				
	1		0				



Contractor: Strata Drilling Group **Grade Elevation:** 98.85 m

Drilling Method: Direct Push/Split Spoon Sample **Top of Casing Elevation:** 99.65 m

Well Casing Size: 38 mm **Sheet:** 1 of 4

Log of Borehole: BH1

Project #: 324269.001 **Logged By:** MK

Project: Geotechnical Investigation

Client: Sobey's Inc.

Location: 1887 St. Joseph's Boulevard, Ottawa, ON

Drill Date: May 19, 2023 **Project Manager:** WT

SUBSURFACE PROFILE

Depth (m): 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31

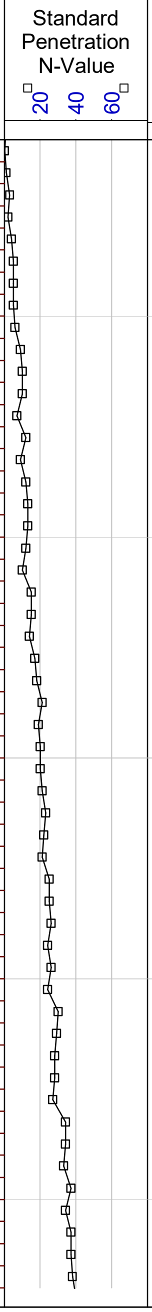
Description:

Dynamic Cone Penetration Test

Probable silty clay

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value
DCPT	1		0
DCPT	2		1
DCPT	3		3
DCPT	4		2
DCPT	5		4
DCPT	6		5
DCPT	7		5
DCPT	8		5
DCPT	9		6
DCPT	10		9
DCPT	11		10
DCPT	12		10
DCPT	13		7
DCPT	14		12
DCPT	15		9
DCPT	16		12
DCPT	17		13
DCPT	18		13
DCPT	19		12
DCPT	20		10
DCPT	21		15
DCPT	22		15
DCPT	23		14
DCPT	24		17
DCPT	25		18
DCPT	26		21
DCPT	27		19
DCPT	28		20
DCPT	29		20
DCPT	30		21
DCPT	31		23
DCPT	32		22
DCPT	33		21
DCPT	34		25
DCPT	35		25
DCPT	36		26
DCPT	37		24
DCPT	38		26
DCPT	39		24
DCPT	40		30
DCPT	41		29
DCPT	42		28
DCPT	43		28
DCPT	44		27
DCPT	45		34
DCPT	46		34
DCPT	47		33
DCPT	48		37
DCPT	49		34
DCPT	50		37
DCPT	51		37
DCPT	52		38
	53		40



Shear Strength △ kPa △ 100 200

Water Content (%)

Sample ID

Soil Vapour Concentration (ppm)

Laboratory Analysis

Contractor: Strata Drilling Group **Grade Elevation:** 98.85 m

Drilling Method: Direct Push/Split Spoon Sample **Top of Casing Elevation:** 99.65 m

Well Casing Size: 38 mm **Sheet:** 2 of 4

Log of Borehole: BH1

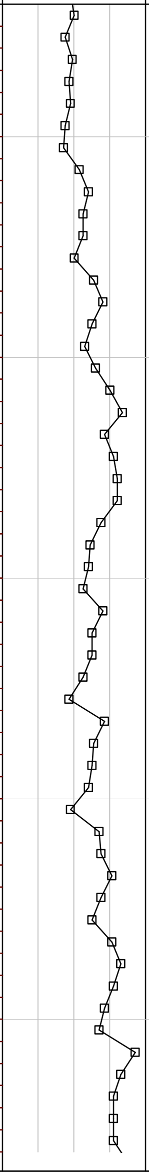
Project #: 324269.001 **Logged By:** MK

Project: Geotechnical Investigation

Client: Sobey's Inc.

Location: 1887 St. Joseph's Boulevard, Ottawa, ON

Drill Date: May 19, 2023 **Project Manager:** WT



SUBSURFACE PROFILE					SAMPLE									
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value ◻ 20 40 60 ◻	Shear Strength △ kPa △ 100 200	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
32					DCPT	53		40						
					DCPT	54		35						
					DCPT	55		39						
					DCPT	56		37						
33					DCPT	57		38						
					DCPT	58		35						
					DCPT	59		34						
34					DCPT	60		43						
					DCPT	61		48						
					DCPT	62		45						
35					DCPT	63		45						
					DCPT	64		40						
					DCPT	65		51						
					DCPT	66		56						
36					DCPT	67		50						
					DCPT	68		46						
					DCPT	69		52						
37					DCPT	70		60						
					DCPT	71		67						
					DCPT	72		57						
38					DCPT	73		62						
					DCPT	74		64						
					DCPT	75		64						
39					DCPT	76		55						
					DCPT	77		49						
					DCPT	78		48						
					DCPT	79		45						
40					DCPT	80		56						
					DCPT	81		50						
					DCPT	82		50						
41					DCPT	83		45						
					DCPT	84		37						
					DCPT	85		57						
42					DCPT	86		51						
					DCPT	87		50						
					DCPT	88		48						
					DCPT	89		38						
43					DCPT	90		54						
					DCPT	91		55						
					DCPT	92		61						
44					DCPT	93		55						
					DCPT	94		50						
					DCPT	95		61						
45					DCPT	96		66						
					DCPT	97		62						
					DCPT	98		57						
46					DCPT	99		54						
					DCPT	100		74						
					DCPT	101		66						
					DCPT	102		62						
47					DCPT	103		62						
					DCPT	104		62						
						105		70						

Contractor: Strata Drilling Group **Grade Elevation:** 98.85 m

Drilling Method: Direct Push/Split Spoon Sample **Top of Casing Elevation:** 99.65 m

Well Casing Size: 38 mm **Sheet:** 3 of 4

Log of Borehole: BH1

Project #: 324269.001 **Logged By:** MK

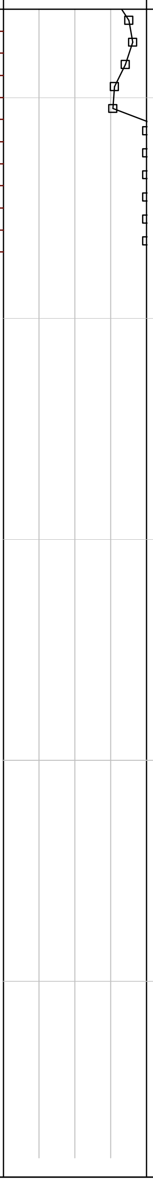
Project: Geotechnical Investigation

Client: Sobey's Inc.

Location: 1887 St. Joseph's Boulevard, Ottawa, ON

Drill Date: May 19, 2023 **Project Manager:** WT

SUBSURFACE PROFILE					SAMPLE									
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value □ 20 40 60 □	Shear Strength △ kPa △ 100 200	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
					DCPT	105		70						
48					DCPT	106		72						
					DCPT	107		68						
					DCPT	108		62						
49					DCPT	109		61						
					DCPT	110		94						
					DCPT	111		90						
50					DCPT	112		99						
					DCPT	113		92						
					DCPT	114		115						
			47.95		DCPT	115		108						
51		End of Borehole												
52														
53		Borehole terminated at 50.9 m due to refusal on probable bedrock.												
54														
55														
56														
57														
58														
59														
60														
61														
62														
63														



Contractor: Strata Drilling Group **Grade Elevation:** 98.85 m

Drilling Method: Direct Push/Split Spoon Sample **Top of Casing Elevation:** 99.65 m

Well Casing Size: 38 mm **Sheet:** 4 of 4

Log of Borehole: BH2

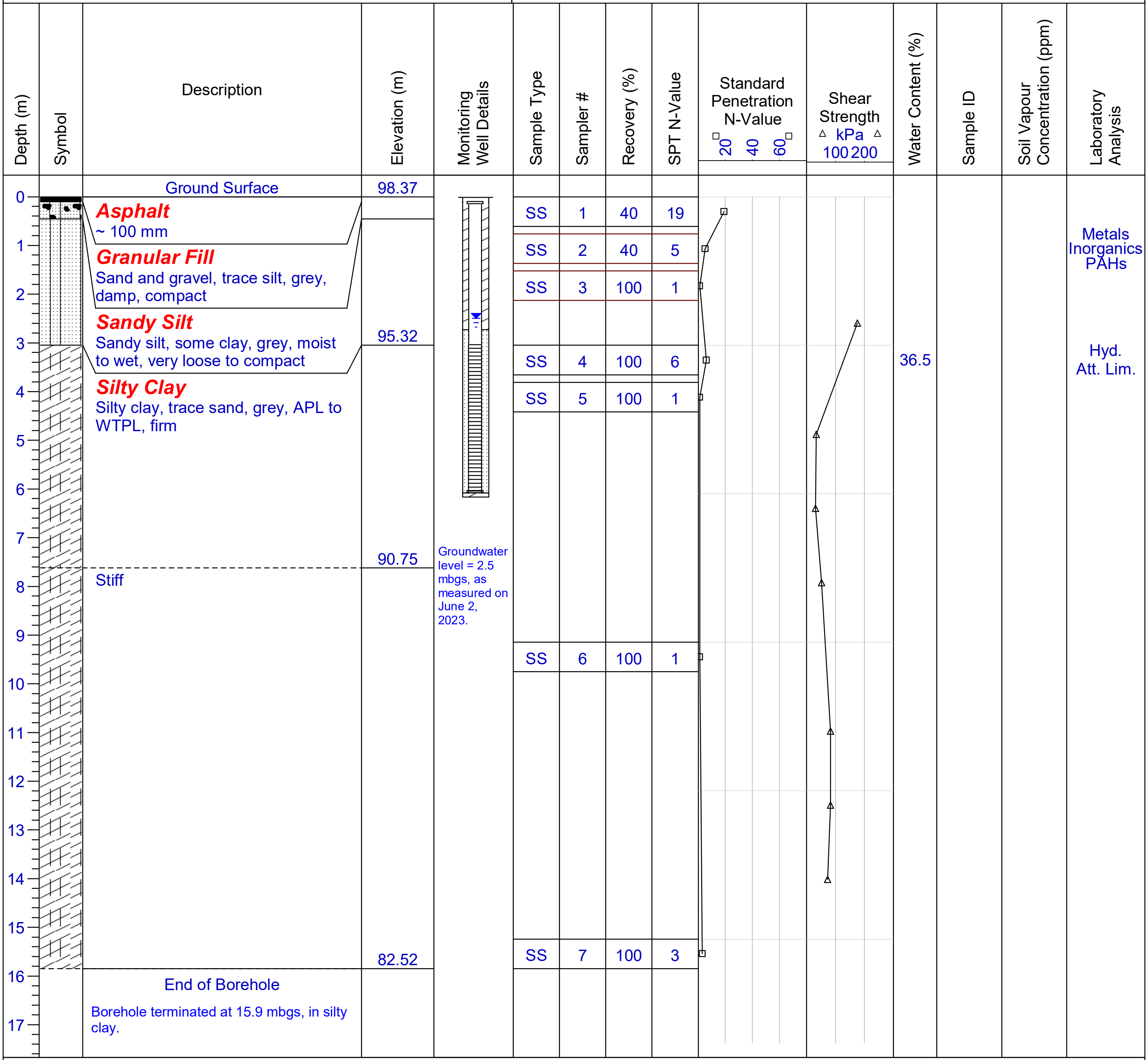
Project #: 324269.001 **Logged By:** MK

Project: Geotechnical Investigation

Client: Sobey's Inc.

Location: 1887 St. Joseph's Boulevard, Ottawa, ON

Drill Date: May 24, 2023 **Project Manager:** WT



SUBSURFACE PROFILE

Description	Elevation (m)
Ground Surface	98.37
Asphalt ~ 100 mm	
Granular Fill Sand and gravel, trace silt, grey, damp, compact	
Sandy Silt Sandy silt, some clay, grey, moist to wet, very loose to compact	95.32
Silty Clay Silty clay, trace sand, grey, APL to WTPL, firm	
Stiff	90.75
End of Borehole Borehole terminated at 15.9 mbgs, in silty clay.	82.52

Groundwater level = 2.5 mbgs, as measured on June 2, 2023.

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	40	19				
SS	2	40	5				Metals Inorganics PAHs
SS	3	100	1				
SS	4	100	6	36.5			Hyd. Att. Lim.
SS	5	100	1				
SS	6	100	1				
SS	7	100	3				

Contractor: Strata Drilling Group **Grade Elevation:** 98.37 m

Drilling Method: Direct Push/Split Spoon Sample **Top of Casing Elevation:** 98.23 m

Well Casing Size: 38 mm **Sheet:** 1 of 1

Log of Borehole: BH3

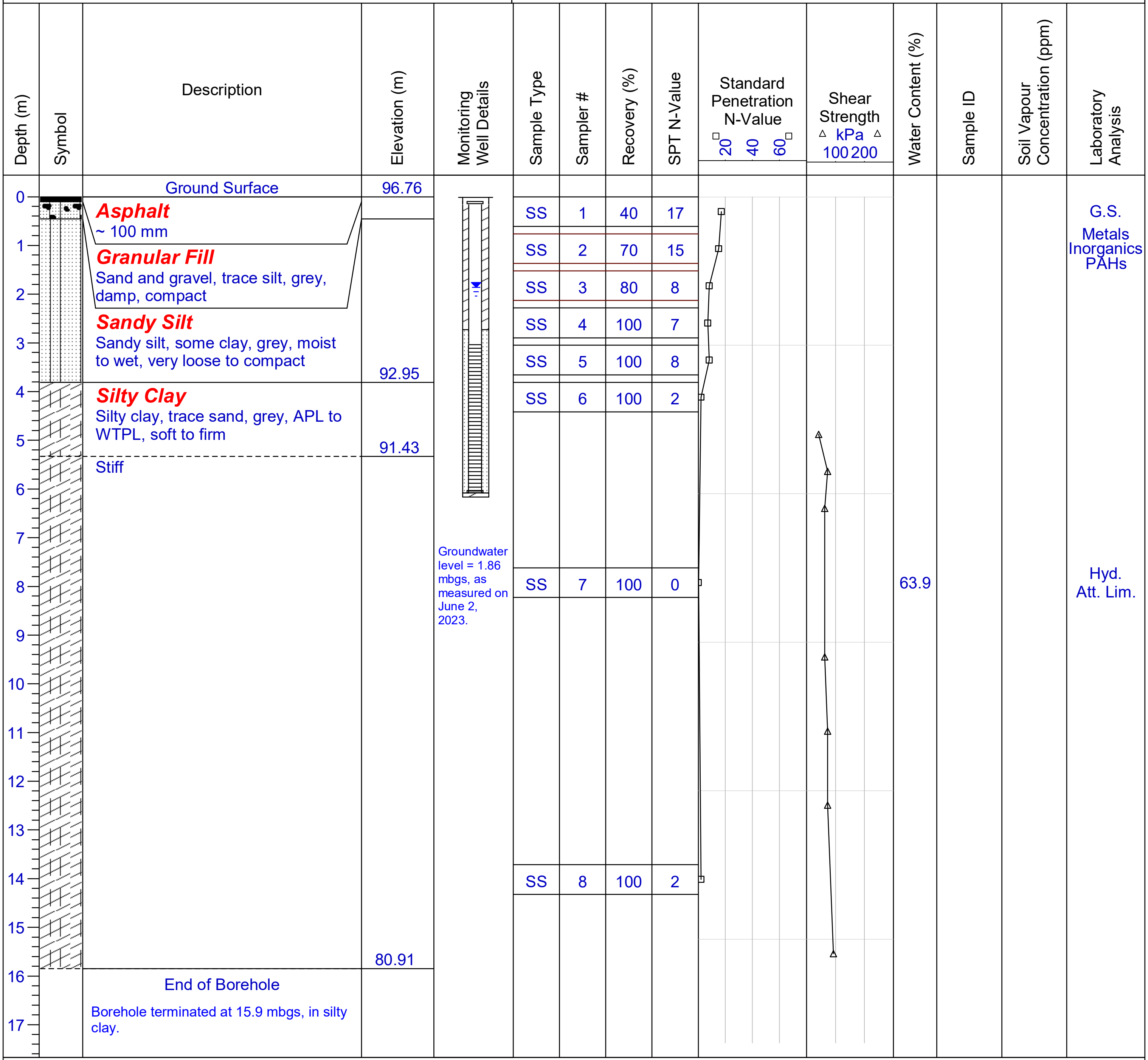
Project #: 324269.001 **Logged By:** MK

Project: Geotechnical Investigation

Client: Sobey's Inc.

Location: 1887 St. Joseph's Boulevard, Ottawa, ON

Drill Date: May 25, 2023 **Project Manager:** WT



Description	Elevation (m)
Ground Surface	96.76
Asphalt ~ 100 mm	
Granular Fill Sand and gravel, trace silt, grey, damp, compact	
Sandy Silt Sandy silt, some clay, grey, moist to wet, very loose to compact	92.95
Silty Clay Silty clay, trace sand, grey, APL to WTPL, soft to firm	91.43
Stiff	80.91
End of Borehole Borehole terminated at 15.9 mbgs, in silty clay.	

Groundwater level = 1.86 mbgs, as measured on June 2, 2023.

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	40	17				G.S. Metals Inorganics PAHs
SS	2	70	15				
SS	3	80	8				
SS	4	100	7				
SS	5	100	8				
SS	6	100	2				
SS	7	100	0	63.9			Hyd. Att. Lim.
SS	8	100	2				

Contractor: Strata Drilling Group **Grade Elevation:** 96.76 m

Drilling Method: Direct Push/Split Spoon Sample **Top of Casing Elevation:** 96.71 m

Well Casing Size: 38 mm **Sheet:** 1 of 1

PINCHIN

Log of Borehole: BH4

Project #: 324269.001 **Logged By:** MK

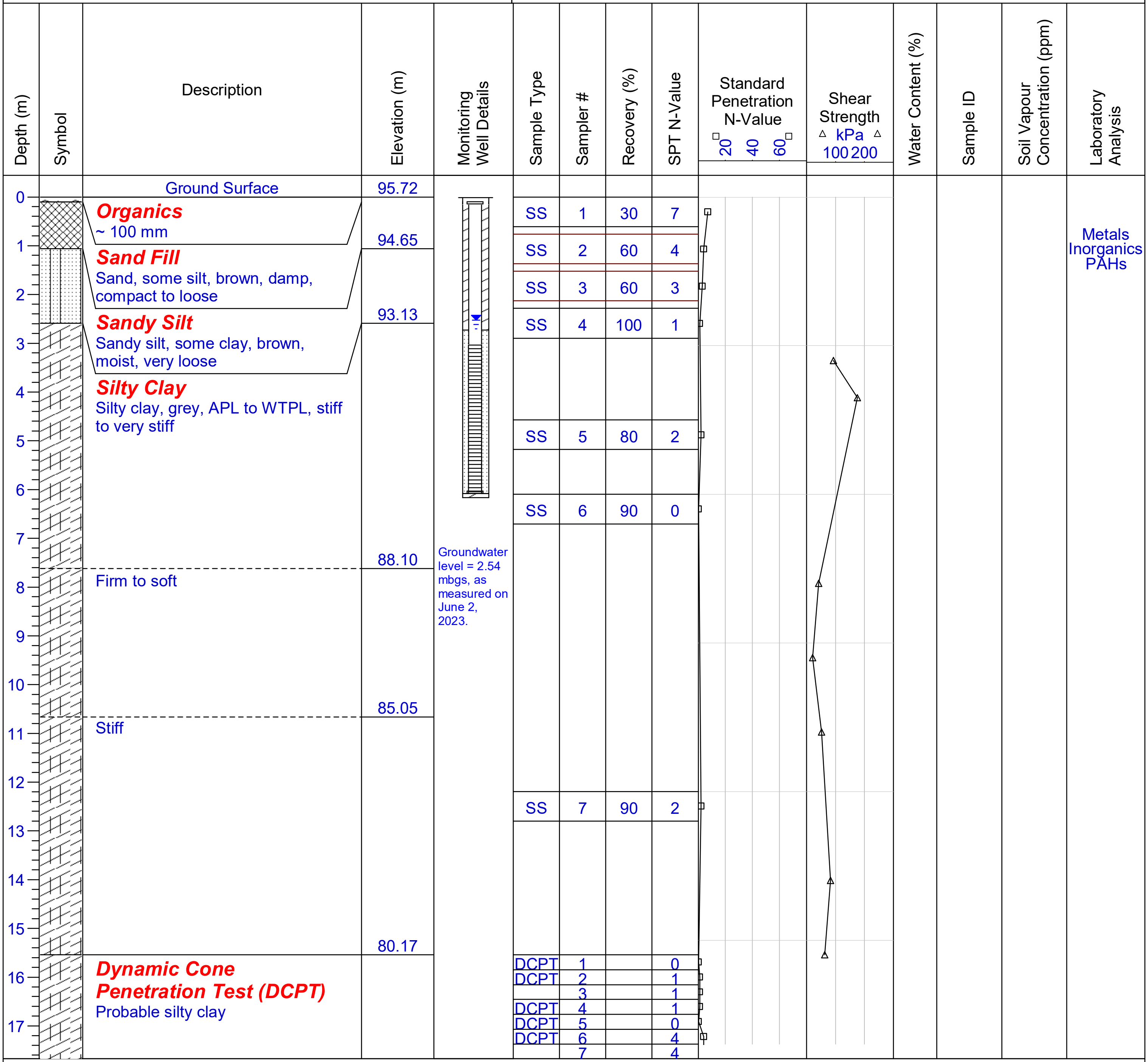
Project: Geotechnical Investigation

Client: Sobey's Inc.

Location: 1887 St. Joseph's Boulevard, Ottawa, ON

Drill Date: May 25, 2023 **Project Manager:** WT

SUBSURFACE PROFILE | SAMPLE



Description	Elevation (m)
Ground Surface	95.72
Organics ~ 100 mm	94.65
Sand Fill Sand, some silt, brown, damp, compact to loose	93.13
Sandy Silt Sandy silt, some clay, brown, moist, very loose	
Silty Clay Silty clay, grey, APL to WTPL, stiff to very stiff	88.10
Firm to soft	85.05
Stiff	80.17
Dynamic Cone Penetration Test (DCPT) Probable silty clay	

Groundwater level = 2.54 mbgs, as measured on June 2, 2023.

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	30	7				
SS	2	60	4				Metals Inorganics PAHs
SS	3	60	3				
SS	4	100	1				
SS	5	80	2				
SS	6	90	0				
SS	7	90	2				
DCPT	1		0				
DCPT	2		1				
	3		1				
DCPT	4		1				
DCPT	5		0				
DCPT	6		4				
	7		4				

Contractor: Strata Drilling Group

Grade Elevation: 95.72 m

Drilling Method: Direct Push/Split Spoon Sample

Top of Casing Elevation: 96.65 m

Well Casing Size: 38 mm

Sheet: 1 of 3

Log of Borehole: BH4

Project #: 324269.001 **Logged By:** MK

Project: Geotechnical Investigation

Client: Sobey's Inc.

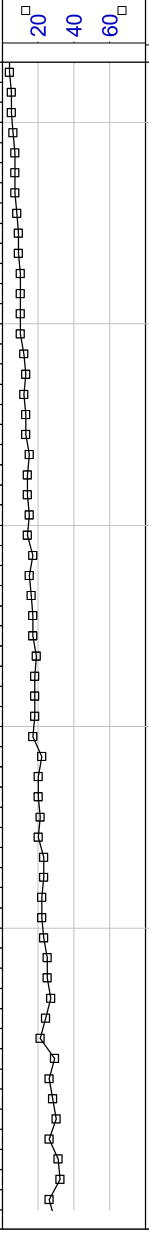
Location: 1887 St. Joseph's Boulevard, Ottawa, ON

Drill Date: May 25, 2023 **Project Manager:** WT

SUBSURFACE PROFILE | **SAMPLE**

Depth (m): 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34

Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value	Shear Strength kPa	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
					DCPT	7		4						
					DCPT	8		5						
					DCPT	9		5						
					DCPT	10		6						
					DCPT	11		7						
					DCPT	12		7						
					DCPT	13		7						
					DCPT	14		8						
					DCPT	15		9						
					DCPT	16		9						
					DCPT	17		10						
					DCPT	18		10						
					DCPT	19		10						
					DCPT	20		10						
					DCPT	21		12						
					DCPT	22		13						
					DCPT	23		12						
					DCPT	24		13						
					DCPT	25		13						
					DCPT	26		15						
					DCPT	27		14						
					DCPT	28		14						
					DCPT	29		15						
					DCPT	30		14						
					DCPT	31		17						
					DCPT	32		15						
					DCPT	33		16						
					DCPT	34		17						
					DCPT	35		17						
					DCPT	36		19						
					DCPT	37		18						
					DCPT	38		18						
					DCPT	39		18						
					DCPT	40		17						
					DCPT	41		22						
					DCPT	42		20						
					DCPT	43		20						
					DCPT	44		21						
					DCPT	45		20						
					DCPT	46		23						
					DCPT	47		23						
					DCPT	48		22						
					DCPT	49		22						
					DCPT	50		23						
					DCPT	51		25						
					DCPT	52		25						
					DCPT	53		27						
					DCPT	54		24						
					DCPT	55		21						
					DCPT	56		29						
					DCPT	57		26						
					DCPT	58		28						
					DCPT	59		30						
					DCPT	60		26						
					DCPT	61		31						
					DCPT	62		32						
					DCPT	63		26						
						64		29						



Shear Strength △ kPa △ 100 200

Contractor: Strata Drilling Group **Grade Elevation:** 95.72 m

Drilling Method: Direct Push/Split Spoon Sample **Top of Casing Elevation:** 96.65 m

Well Casing Size: 38 mm **Sheet:** 2 of 3

Log of Borehole: BH4

Project #: 324269.001 **Logged By:** MK

Project: Geotechnical Investigation

Client: Sobey's Inc.

Location: 1887 St. Joseph's Boulevard, Ottawa, ON

Drill Date: May 25, 2023 **Project Manager:** WT

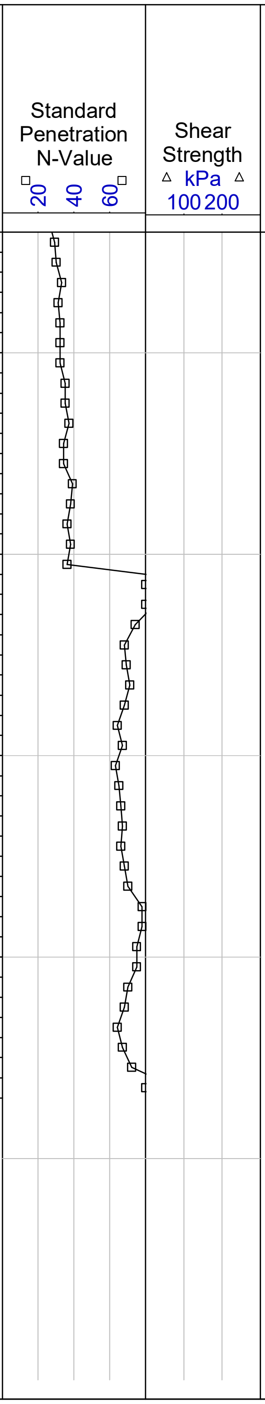
SUBSURFACE PROFILE

Depth (m): 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52

Description	Elevation (m)	Monitoring Well Details
	47.87	
End of Borehole Borehole terminated at 47.9 mbgs on probable bedrock.		

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
DCPT	64		29				
DCPT	65		30				
DCPT	66		33				
DCPT	67		31				
DCPT	68		32				
DCPT	69		32				
DCPT	70		32				
DCPT	71		35				
DCPT	72		35				
DCPT	73		37				
DCPT	74		34				
DCPT	75		34				
DCPT	76		39				
DCPT	77		38				
DCPT	78		36				
DCPT	79		38				
DCPT	80		36				
DCPT	81		126				
DCPT	82		85				
DCPT	83		74				
DCPT	84		68				
DCPT	85		69				
DCPT	86		71				
DCPT	87		68				
DCPT	88		64				
DCPT	89		67				
DCPT	90		63				
DCPT	91		65				
DCPT	92		66				
DCPT	93		67				
DCPT	94		66				
DCPT	95		68				
DCPT	96		70				
DCPT	97		78				
DCPT	98		78				
DCPT	99		75				
DCPT	100		75				
DCPT	101		70				
DCPT	102		68				
DCPT	103		64				
DCPT	104		67				
DCPT	105		72				
DCPT	106		97				



Contractor: Strata Drilling Group **Grade Elevation:** 95.72 m

Drilling Method: Direct Push/Split Spoon Sample **Top of Casing Elevation:** 96.65 m

Well Casing Size: 38 mm **Sheet:** 3 of 3

Log of Borehole: BH5

Project #: 324269.001 ***Logged By:*** MK

Project: Geotechnical Investigation

Client: Sobey's Inc.

Location: 1887 St. Joseph's Boulevard, Ottawa, ON

Drill Date: May 26, 2023 ***Project Manager:*** WT

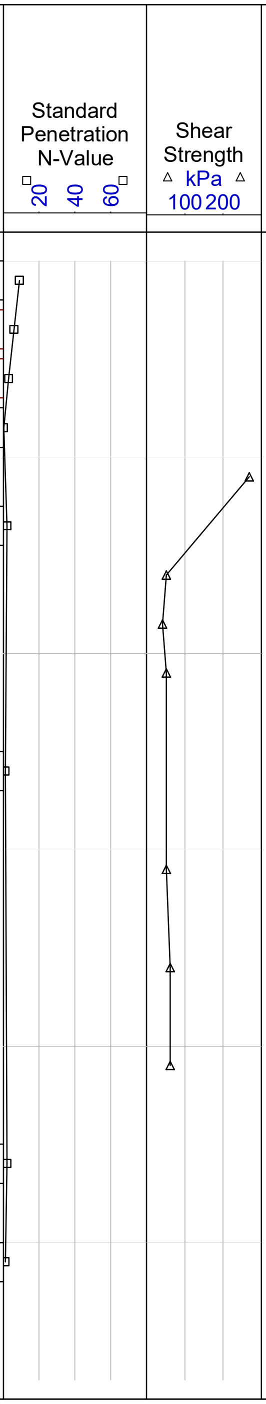
SUBSURFACE PROFILE

Description	Elevation (m)
Ground Surface	94.97
Asphalt ~ 100 mm	
Granular Fill Sand and gravel, trace silt, grey, damp, loose	
Sandy Silt Sandy silt, some clay, grey, moist to wet, very loose to loose	91.16
Silty Clay Silty clay, trace sand, grey, APL to WTPL, firm to stiff	79.12
End of Borehole Borehole terminated at 15.9 mbgs, in silty clay.	

Monitoring Well Details: Groundwater level = 3.09 mbgs, as measured on June 2, 2023.

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	30	9				
SS	2	20	6				
SS	3	50	3				
SS	4	60	0				
SS	5	100	2				
SS	6	100	1				
SS	7	100	2				
SS	8	100	1		63.0		Hyd. Att. Lim.



Depth (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Contractor: Strata Drilling Group ***Grade Elevation:*** 94.97 m

Drilling Method: Direct Push/Split Spoon Sample ***Top of Casing Elevation:*** 94.86 m

Well Casing Size: 38 mm ***Sheet:*** 1 of 1

Log of Borehole: BH6

Project #: 324269.001 **Logged By:** MK

Project: Geotechnical Investigation

Client: Sobey's Inc.

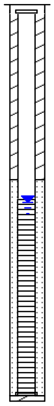
Location: 1887 St. Joseph's Boulevard, Ottawa, ON

Drill Date: May 29, 2023 **Project Manager:** WT

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
0	Ground Surface	96.93
0	**Asphalt** ~ 100 mm	
0.1	**Granular Fill** Sand and gravel, trace silt, grey, damp, compact	
	Sandy Silt Sandy silt, some clay, grey, moist to wet, very loose to compact	
3.05	**Silty Clay** Silty clay, trace sand, grey, APL to WTPL, firm	93.88
10.67	Stiff	86.26
15.85	End of Borehole Borehole terminated at 15.9 mbgs, in silty clay.	81.08

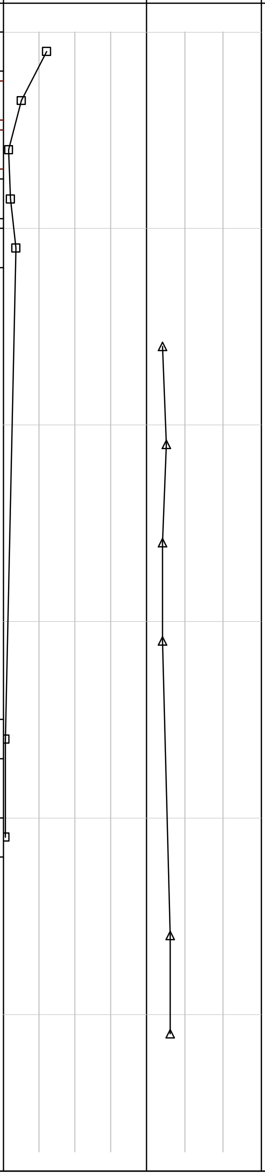
Monitoring Well Details



Groundwater level = 3.09 mbgs, as measured on June 2, 2023.

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-Value	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
SS	1	50	24				
SS	2	50	10				
SS	3	80	3		23.1		Hyd. Att. Lim.
SS	4	100	4				Corr.
SS	5	100	7				
SS	6	100	1				
SS	7	100	1				



Contractor: Strata Drilling Group **Grade Elevation:** 96.93 m

Drilling Method: Direct Push/Split Spoon Sample **Top of Casing Elevation:** 96.81 m

Well Casing Size: 38 mm **Sheet:** 1 of 1

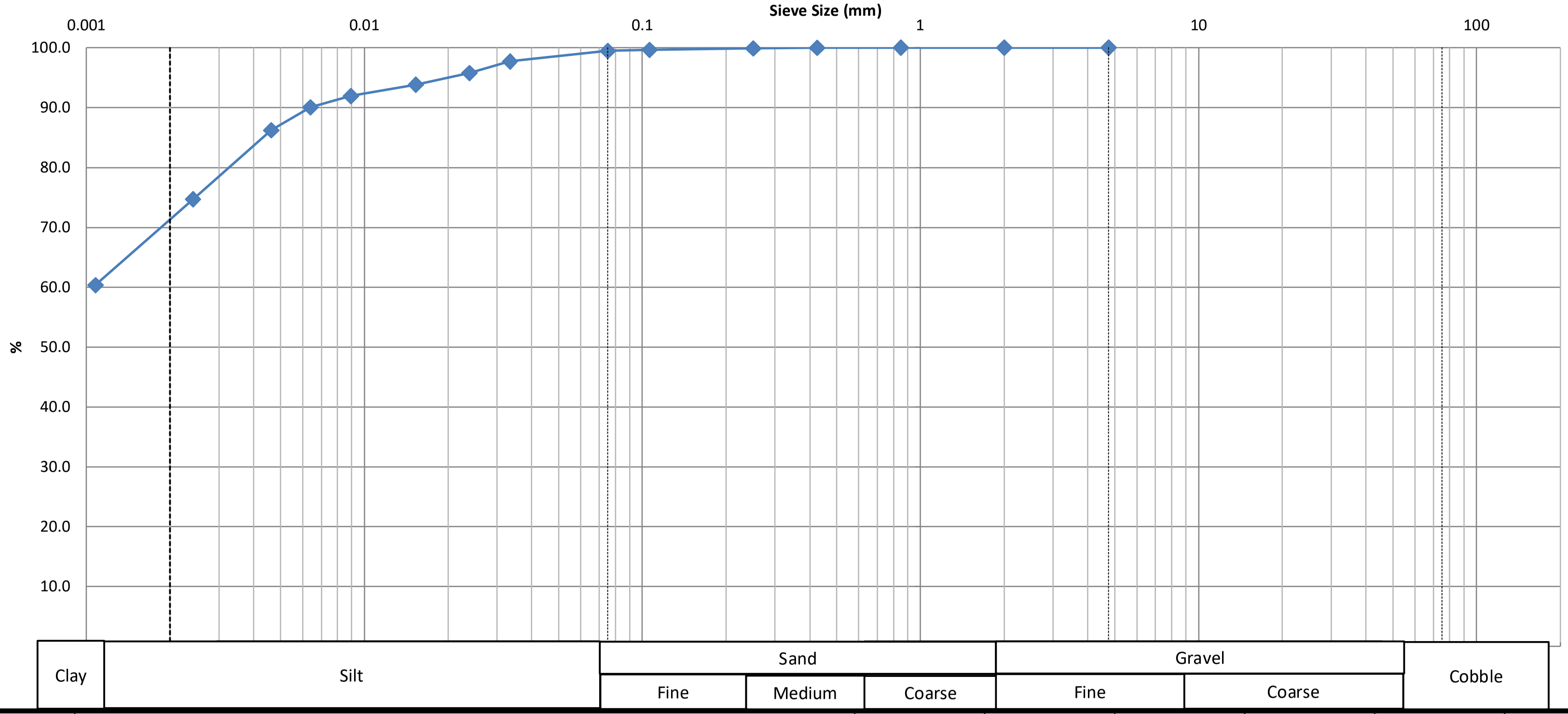
APPENDIX III

Laboratory Testing Reports for Soil Samples

PATERSON GROUP

SIEVE ANALYSIS
ASTM C136

CLIENT:	Pinchin	DEPTH:	10' - 12'	FILE NO:	PM4184
CONTRACT NO.:		BH OR TP No.:	BH2 SS4	LAB NO:	43079
PROJECT:	324269.001			DATE RECEIVED:	29-May-23
				DATE TESTED:	31-May-23
DATE SAMPLED:	29-May-23			DATE REPORTED:	7-Jun-23
SAMPLED BY:	Client			TESTED BY:	DK



Identification	Soil Classification				MC(%)	LL	PL	PI	Cc	Cu
					36.5					
	D100	D60	D30	D10	Gravel (%)	Sand (%)	Silt (%)	Clay (%)		
					0.0	0.5	28.5	71.0		

Comments:

REVIEWED BY:	Curtis Beadow	Joe Forsyth, P. Eng.

PATERSON GROUP

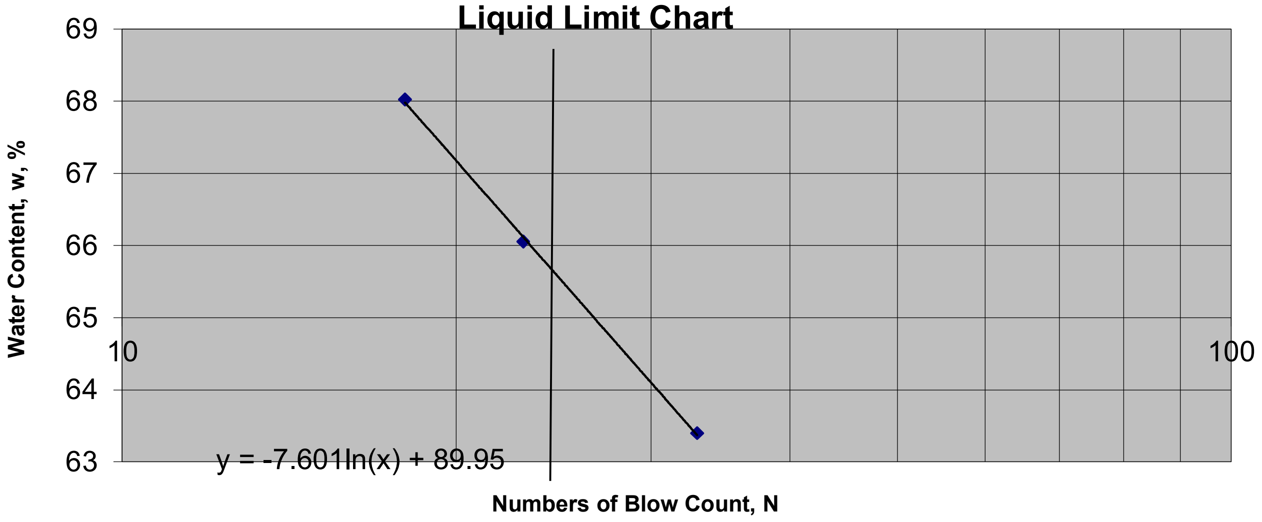
ATTERBERG LIMITS
LS-703/704

CLIENT:	Pinchin	FILE NO.:	PM4184
PROJECT:	324269.001	DATE SAMPLED:	29-May
LOCATION:	BH2 SS4	DATE REPORTED:	7-Jun

CAN NO.	**67**	**70**	**87**				
WT. OF CAN	7.24	7.13	7.24				
WT. OF SOIL & CAN	18.43	17.89	17.73				
WT. OF DRY SOIL & CAN	13.90	13.61	13.66				
WT. OF MOISTURE	4.53	4.28	4.07				
WT. OF DRY SOIL & CAN	6.66	6.48	6.42				
WATER CONTENT, w, %	**68.02**	**66.05**	**63.4**				
NO. OF BLOWS, N	18	23	33				

CAN NO.	**2**	**3**
WT. OF CAN	19.9	19.38
WT. OF SOIL & CAN	29.39	28.43
WT. OF DRY SOIL & CAN	27.20	26.28
WT. OF MOISTURE	2.19	2.15
WT. OF DRY SOIL & CAN	7.3	6.9
WATER CONTENT, w, %	**30**	**31.16**

RESULTS	
LIQUID LIMIT	**66**
PLASTIC LIMIT	**31**
PLASTICITY INDEX	**35**

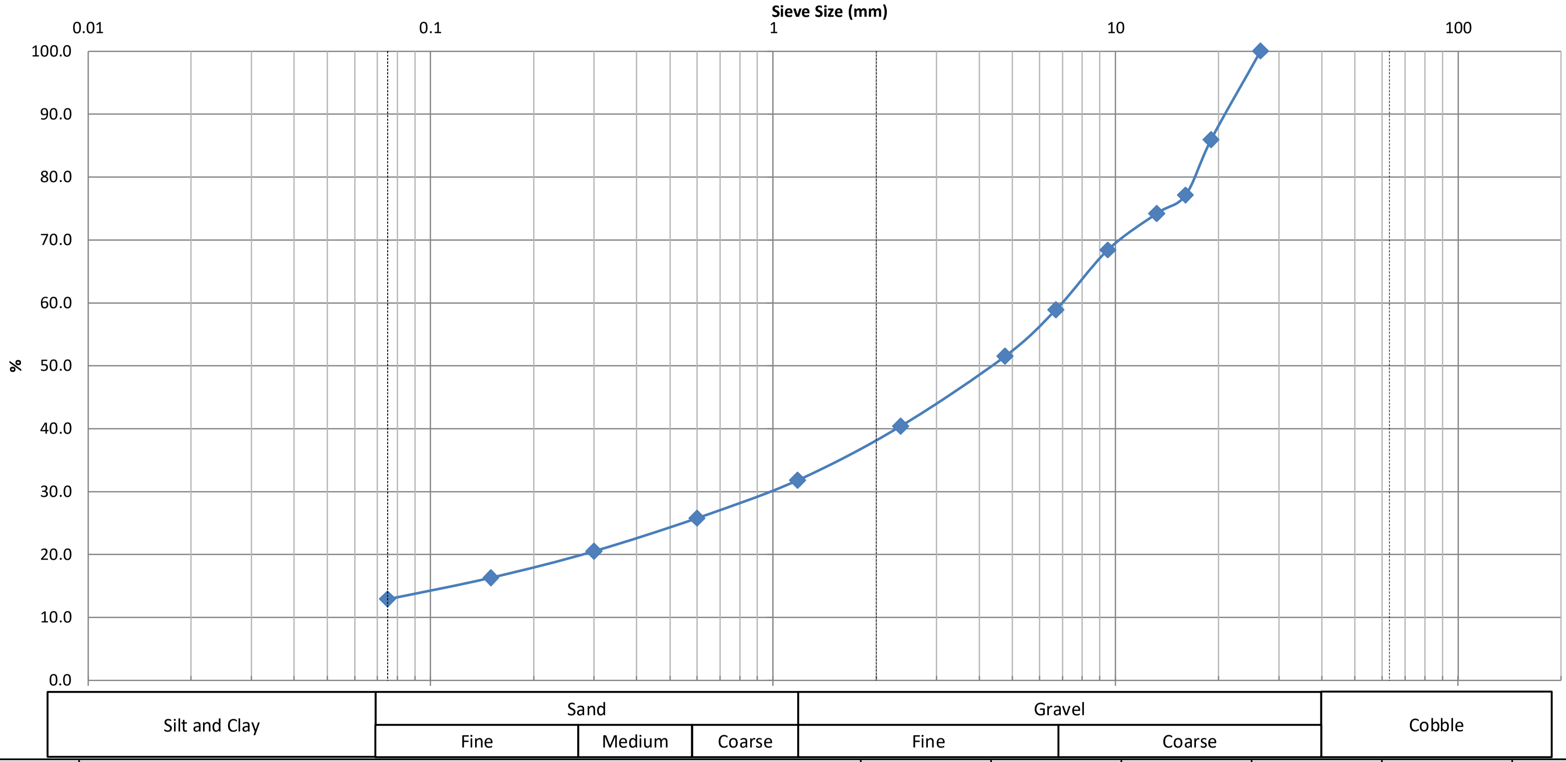


TECHNICIAN: CP	**REVIEWED BY:**	**C. Beadow**	**J. Forsyth, P. Eng.**

PATERSON GROUP

SIEVE ANALYSIS
ASTM C136

CLIENT:	Pinchin	DESCRIPTION:	Silty Sand w Gravel	FILE NO:	PM4184
CONTRACT NO.:	-	SPECIFICATION:	**Soil**	LAB NO:	43077
PROJECT:	324269.001	INTENDED USE:	-	DATE RECEIVED:	29-May-23
		PIT OR QUARRY:	-	DATE TESTED:	5-Jun-23
DATE SAMPLED:	-	SOURCE LOCATION:	BH3 - SS1	DATE REPORTED:	8-Jun-23
SAMPLED BY:	Client	SAMPLE LOCATION:	0' - 2'	TESTED BY:	CP



Identification	**Soil Classification**				**MC(%)**	**LL**	**PL**	**PI**	**Cc**	**Cu**
									3.24	152.2
	D100	D60	D30	D10	Gravel (%)	Sand (%)	Silt (%)		Clay (%)	
	26.5	6.85	1	0.045	48.5	38.6	12.9			

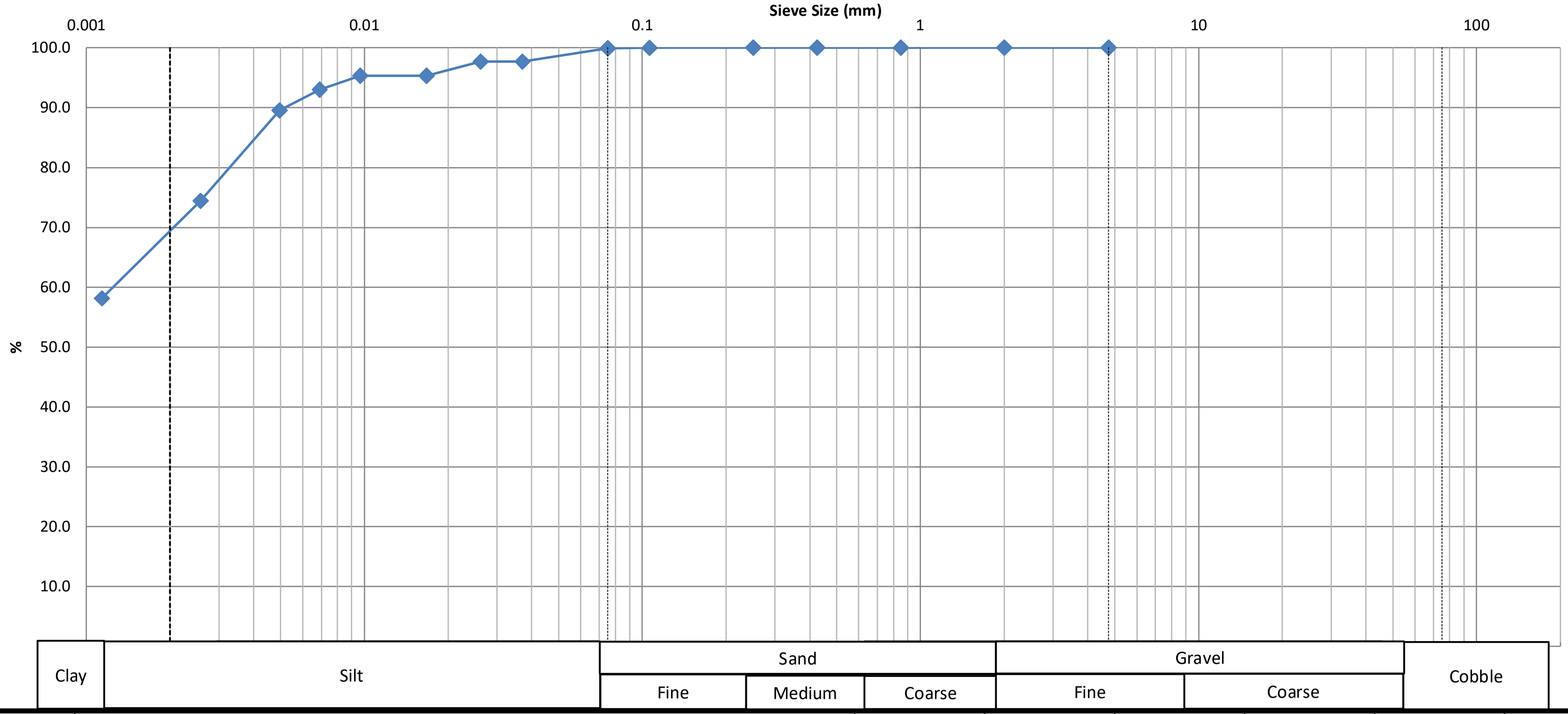
Comments:

REVIEWED BY:	**Curtis Beadow**	**Joe Fosyth, P. Eng.**

PATERSON GROUP

SIEVE ANALYSIS
ASTM C136

CLIENT:	Pinchin	DEPTH:	25' - 27'	FILE NO:	PM4184
CONTRACT NO.:		BH OR TP No.:	BH3 SS7	LAB NO:	43080
PROJECT:	324269.001			DATE RECEIVED:	29-May-23
				DATE TESTED:	31-May-23
DATE SAMPLED:	29-May-23			DATE REPORTED:	7-Jun-23
SAMPLED BY:	Client			TESTED BY:	DK



Identification	Soil Classification				MC(%)	LL	PL	PI	Cc	Cu
					63.9					
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)
					0.0	0.1		30.4		69.5

Comments:

REVIEWED BY:	Curtis Beadow	Joe Forsyth, P. Eng.

PATERSON GROUP

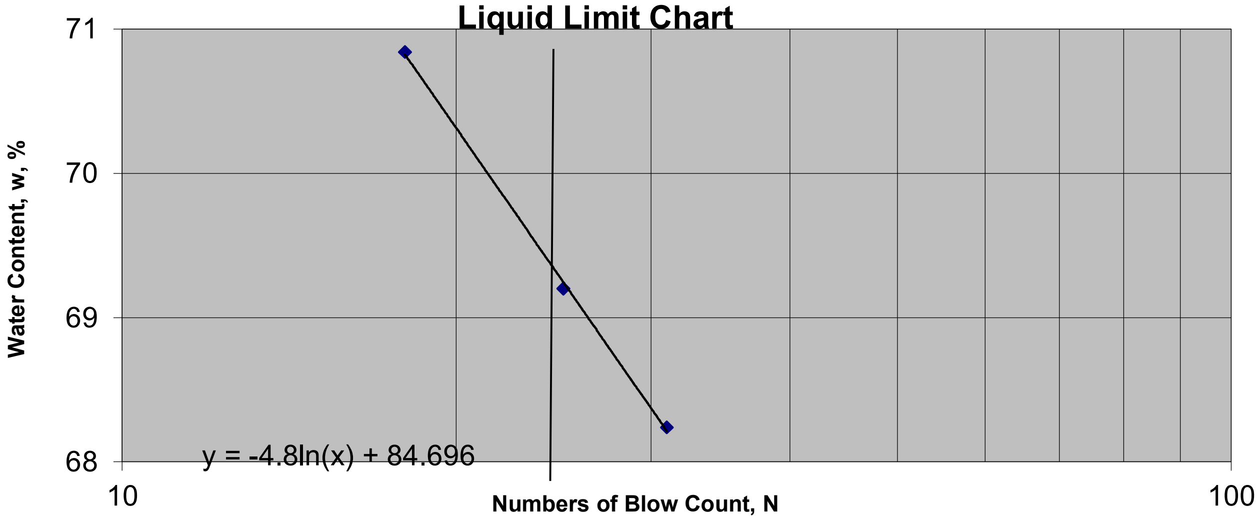
ATTERBERG LIMITS
LS-703/704

CLIENT:	Pinchin	FILE NO.:	PM4184
PROJECT:	324269.001	DATE SAMPLED:	29-May
LOCATION:	BH3 SS7	DATE REPORTED:	7-Jun

CAN NO.	**70**	**67**	**87**				
WT. OF CAN	7.14	7.25	7.25				
WT. OF SOIL & CAN	15.87	16.59	17.21				
WT. OF DRY SOIL & CAN	12.25	12.77	13.17				
WT. OF MOISTURE	3.62	3.82	4.04				
WT. OF DRY SOIL & CAN	5.11	5.52	5.92				
WATER CONTENT, w, %	**70.84**	**69.2**	**68.24**				
NO. OF BLOWS, N	18	25	31				

CAN NO.	**12**	**9**
WT. OF CAN	16.74	19.35
WT. OF SOIL & CAN	24.47	27.02
WT. OF DRY SOIL & CAN	22.58	25.12
WT. OF MOISTURE	1.89	1.9
WT. OF DRY SOIL & CAN	5.84	5.77
WATER CONTENT, w, %	**32.36**	**32.93**

RESULTS	
LIQUID LIMIT	**69**
PLASTIC LIMIT	**33**
PLASTICITY INDEX	**36**

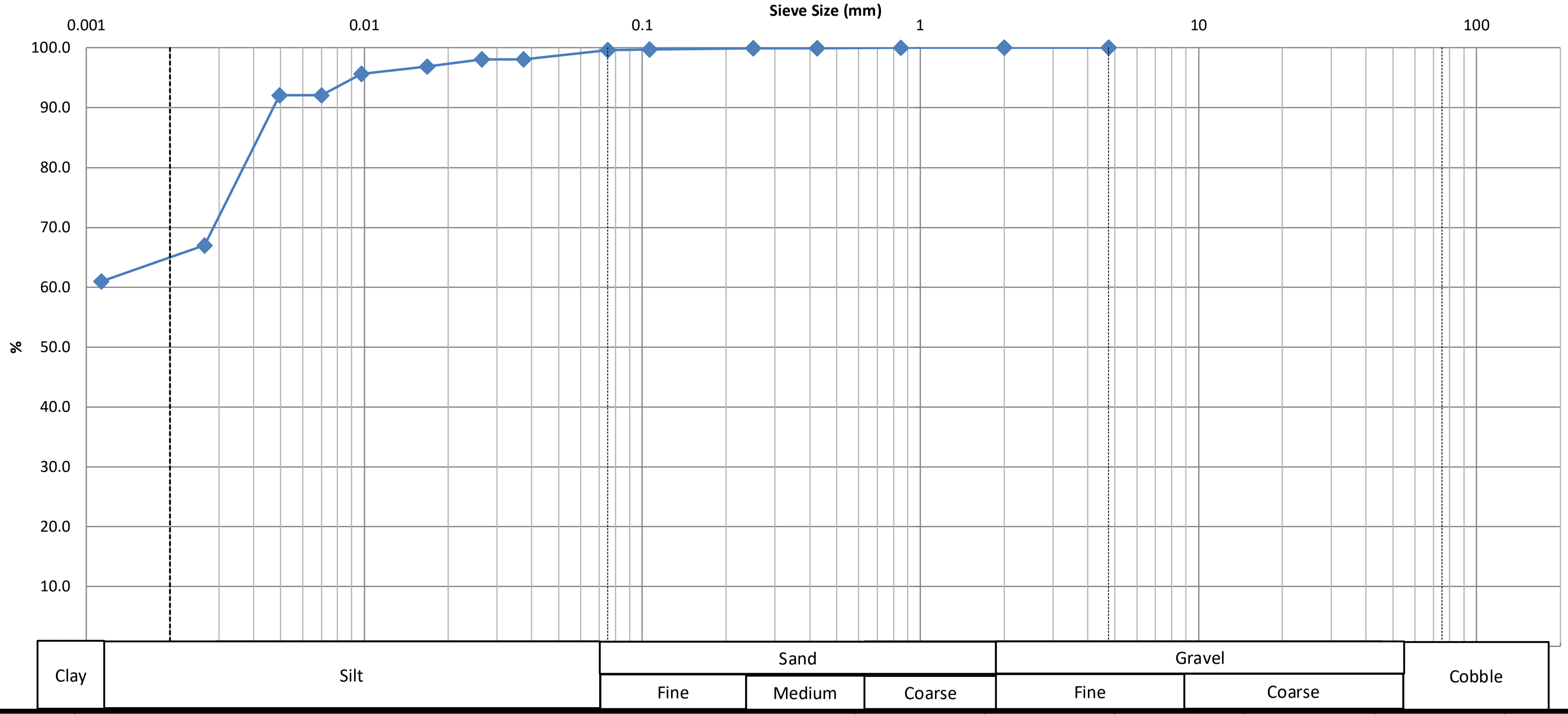


TECHNICIAN: CP	**REVIEWED BY:**	**C. Beadow**	**J. Forsyth, P. Eng.**

PATERSON GROUP

SIEVE ANALYSIS
ASTM C136

CLIENT:	Pinchin	DEPTH:	50' - 52'	FILE NO:	PM4184
CONTRACT NO.:		BH OR TP No.:	BH5 SS8	LAB NO:	43081
PROJECT:	324269.001			DATE RECEIVED:	29-May-23
				DATE TESTED:	31-May-23
DATE SAMPLED:	29-May-23			DATE REPORTED:	7-Jun-23
SAMPLED BY:	Client			TESTED BY:	DK



Identification	Soil Classification				MC(%)	LL	PL	PI	Cc	Cu
					63.0					
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)
					0.0	0.4		34.6		65.0

Comments:

REVIEWED BY:	**Curtis Beadow**	**Joe Forsyth, P. Eng.**

PATERSON GROUP

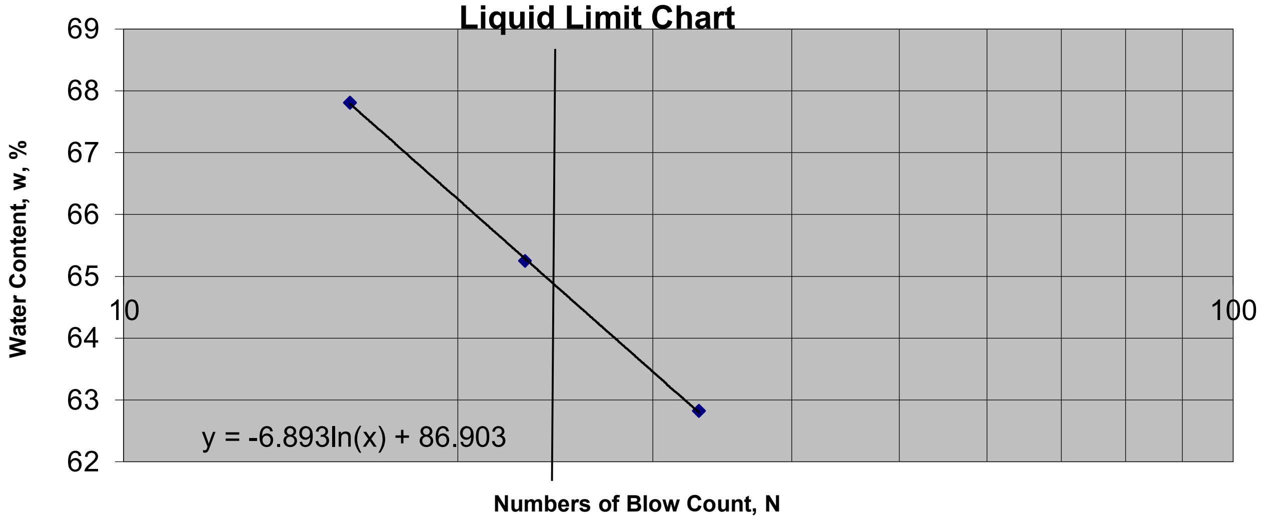
ATTERBERG LIMITS
LS-703/704

CLIENT:	Pinchin	FILE NO.:	PM4184
PROJECT:	324269.001	DATE SAMPLED:	29-May
LOCATION:	BH5 SS8	DATE REPORTED:	7-Jun

CAN NO.	**11**	**3**	**16**				
WT. OF CAN	8.69	8.72	8.71				
WT. OF SOIL & CAN	20.47	18.42	18.17				
WT. OF DRY SOIL & CAN	15.71	14.59	14.52				
WT. OF MOISTURE	4.76	3.83	3.65				
WT. OF DRY SOIL & CAN	7.02	5.87	5.81				
WATER CONTENT, w, %	**67.81**	**65.25**	**62.82**				
NO. OF BLOWS, N	16	23	33				

CAN NO.	**4**	**15**
WT. OF CAN	19.93	19.89
WT. OF SOIL & CAN	29.03	28.50
WT. OF DRY SOIL & CAN	27.00	26.60
WT. OF MOISTURE	2.03	1.9
WT. OF DRY SOIL & CAN	7.07	6.71
WATER CONTENT, w, %	**28.71**	**28.32**

RESULTS	
LIQUID LIMIT	**65**
PLASTIC LIMIT	**29**
PLASTICITY INDEX	**36**

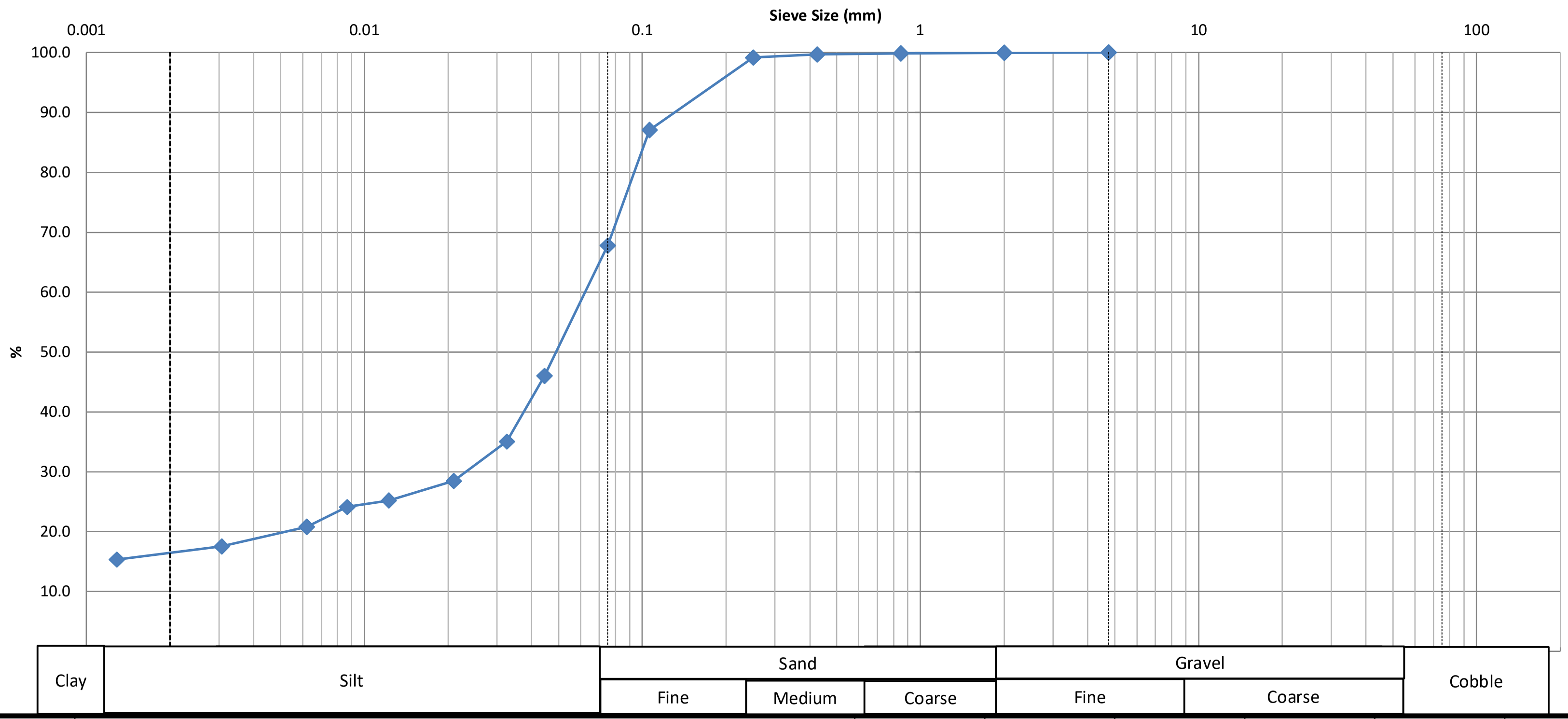


TECHNICIAN: CP	**REVIEWED BY:**	**C. Beadow**	**J. Forsyth, P. Eng.**

PATERSON GROUP

SIEVE ANALYSIS
ASTM C136

CLIENT:	Pinchin	DEPTH:	5' - 7'	FILE NO:	PM4184
CONTRACT NO.:		BH OR TP No.:	BH6 SS3	LAB NO:	43078
PROJECT:	324269.001			DATE RECEIVED:	29-May-23
				DATE TESTED:	31-May-23
DATE SAMPLED:	29-May-23			DATE REPORTED:	7-Jun-23
SAMPLED BY:	Client			TESTED BY:	DK



Identification	Soil Classification				MC(%)	LL	PL	PI	Cc	Cu
					23.1					
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)
					0.0	32.2		50.8		17.0

Comments:

REVIEWED BY:	Curtis Beadow	Joe Forsyth, P. Eng.

Certificate of Analysis

Pinchin Ltd. (Ottawa)

1 Hines Road, Suite 200
Kanata, ON K2K 3C7
Attn: Megan Keon

Client PO:
Project: 324269.001
Custody: 39137

Report Date: 2-Jun-2023
Order Date: 29-May-2023

Order #: 2322190

This Certificate of Analysis contains analytical data applicable to the following samples as submitted :

Paracel ID	**Client ID**
2322190-01	BH6 SS4 7.5-9.5 ft

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	1-Jun-23	1-Jun-23
Conductivity	MOE E3138 - probe @25 °C, water ext	1-Jun-23	1-Jun-23
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	30-May-23	31-May-23
Resistivity	EPA 120.1 - probe, water extraction	1-Jun-23	1-Jun-23
Solids, %	CWS Tier 1 - Gravimetric	31-May-23	1-Jun-23

Certificate of Analysis

Client: **Pinchin Ltd. (Ottawa)**

Client PO:

Report Date: 02-Jun-2023

Order Date: 29-May-2023

Project Description: 324269.001

	Client ID:	BH6 SS4 7.5-9.5 ft	-	-	-
	Sample Date:	29-May-23 12:00	-	-	-
	Sample ID:	2322190-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	73.3	-	-	-
General Inorganics					
Conductivity	5 uS/cm	915	-	-	-
pH	0.05 pH Units	7.36	-	-	-
Resistivity	0.1 Ohm.m	10.9	-	-	-
Anions					
Chloride	10 ug/g dry	462	-	-	-
Sulphate	10 ug/g dry	162	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	10	ug/g						
Sulphate	ND	10	ug/g						
General Inorganics									
Conductivity	ND	5	uS/cm						
Resistivity	ND	0.1	Ohm.m						

Certificate of Analysis
Client: **Pinchin Ltd. (Ottawa)**
Client PO:

Report Date: 02-Jun-2023
Order Date: 29-May-2023
Project Description: 324269.001

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	37.2	10	ug/g	35.1			6.0	35	
Sulphate	40.2	10	ug/g	39.2			2.4	35	
General Inorganics									
Conductivity	425	5	uS/cm	423			0.5	5	
pH	6.22	0.05	pH Units	6.25			0.5	2.3	
Resistivity	23.5	0.1	Ohm.m	23.7			0.5	20	
Physical Characteristics									
% Solids	84.0	0.1	% by Wt.	84.6			0.8	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	137	10	ug/g	35.1	102	82-118			
Sulphate	141	10	ug/g	39.2	102	80-120			

Qualifier Notes:

Login Qualifiers :

Sample - One or more parameter received past hold time - Redox potential.

Applies to samples: BH6 SS4 7.5-9.5 ft

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.
NC: Not Calculated

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

PARACEL
LABORATORIES

Paracel ID: 2322190

Head Office
300-2319 St. Laurent Blvd.
Ottawa, Ontario K1G 4J8
p: 1-800-749-1947
e: paracel@paracellabs.com

Chain of Custody
(Lab Use Only)
№ 39137

Page ___ of ___

Client Name: Pinchin Ltd.
Contact Name: Megan Keon
Address: 1 Hines Rd. Kanata, ON
Telephone: 613-592-3387

Project Reference: 324269.001
Quote #
PO #
Email Address: mKeon@pinchin.com

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☑ Regular
Date Required: ____________

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ________ ☐ Other: ________

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number:

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken		corrosivity	redox	sulfides	conductivity							
					Date	Time											
1	BH6 SS4 7.5-9.5ft.	S		1	May 29/23	PM.											
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Comments:

Method of Delivery: Walk in

Relinquished By (Sign): MeganKeon
Relinquished By (Print): Megan Keon
Date/Time: May 29/23 4:30pm

Received by Driver/Depot: 4:38
Date/Time: May29/23 Pm
Temperature: 25.3 °C

Received at Lab: Juneparm Bhmai
Date/Time: May 30, 2023 12.25
Temperature: 12.5 °C

Verified By:
Date/Time: May 30 2023 1444
pH Verified [ ] By:

Chain of Custody (Blank) - Rev 0.4 Feb 2016

Subcontracted Analysis

Pinchin Ltd. (Ottawa)
1 Hines Road, Suite 200
Kanata, ON K2K 3C7

Attn: Megan Keon

Paracel Report No.	**2322190**
Client Project(s):	**324269.001**
Client PO:	
Reference:	**2023 Standing Offer - ENV**
CoC Number:	**39137**

Order Date:	29-May-23
Report Date:	9-Jun-23

Sample(s) from this project were subcontracted for the listed parameters. A copy of the subcontractor’s report is attached

Paracel ID	Client ID	Analysis
2322190-01	BH6 SS4 7.5-9.5 ft	Redox potential, soil Sulphide, solid

TESTMARK Laboratories Ltd.
Committed to Quality and Service

CERTIFICATE OF ANALYSIS

Client: Dale Robertson
Company: Paracel Laboratories Ltd. - Ottawa
Address: 300-2319 St. Laurent Blvd.
Ottawa, ON, K1G 4J8
Phone/Fax: (613) 731-9577 / (613) 731-9064
Email: drobertson@paracellabs.com

Work Order Number: 500886
PO #:
Regulation: [No Reg - Always Include Reg Report]
Project #: 2322190
DWS #:
Sampled By:

Date Order Received: 5/31/2023
Arrival Temperature: 17 °C

Analysis Started: 6/1/2023
Analysis Completed: 6/1/2023

WORK ORDER SUMMARY

ANALYSES WERE PERFORMED ON THE FOLLOWING SAMPLES. THE RESULTS RELATE ONLY TO THE ITEMS TESTED.

Sample Description	Lab ID	Matrix	Type	Comments	Date Collected	Time Collected
BH6 SS4 7.5-9.5 ft	1886693	Soil	None		5/29/2023	

METHODS AND INSTRUMENTATION

THE FOLLOWING METHODS WERE USED FOR YOUR SAMPLE(S):

Method	Lab	Description	Reference
RedOx - Soil (T06)	Mississauga	Determination of RedOx Potential of Soil	Modified from APHA-2580B

REPORT COMMENTS

Sample received past hold time for redox, proceed with analysis as per comments TJ 05/31/23

This report has been approved by:

Marc Creighton
Laboratory Director

CERTIFICATE OF ANALYSIS

Paracel Laboratories Ltd. - Ottawa

Work Order Number: 500886

WORK ORDER RESULTS

Sample Description	**BH6 SS4 7.5 - 9.5 ft**
Sample Date	5/29/2023
Lab ID	1886693

General Chemistry	Result	MDL	Units	Criteria: [No Reg - Always Include Reg Report]
RedOx (vs. S.H.E.)	442	N/A	mV	~

LEGEND

Dates: Dates are formatted as mm/dd/year throughout this report.

MDL: Method detection limit or minimum reporting limit.

~: In a criteria column indicates the criteria is not applicable for the parameter row.

Quality Control: All associated Quality Control data is available on request.

Field Data: Reports containing Field Parameters represent data that has been collected and provided by the client. Testmark is not responsible for the validity of this data which may be used in subsequent calculations.

Sample Condition Deviations: A noted sample condition deviation may affect the validity of the result. Results apply to the sample(s) as received.

Reproduction of Report: Report shall not be reproduced, except in full, without the approval of Testmark Laboratories Ltd.

ICPMS Dustfall Insoluble: The ICPMS Dustfall Insoluble Portion method analyzes only the particulate matter from the Dustfall Sampler which is retained on the analysis filter during the Dustfall method.

Regulation Comparisons: Disclaimer: Please note that regulation criteria are provided for comparative purposes, however the onus on ensuring the validity of this comparison rests with the client.

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

09-June-2023

Paracel Laboratories
Attn : Dale Robertson

300-2319 St.Laurent Blvd.
Ottawa, ON
K1G 4K6, Canada

Phone: 613-731-9577
Fax:613-731-9064

Date Rec. : 31 May 2023
LR Report: **CA19966-MAY23**
Reference: Project#: 2322190

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Sample ID	Sample Date & Time	Sulphide (Na2CO3) %
1: Analysis Start Date		08-Jun-23
2: Analysis Start Time		16:26
3: Analysis Completed Date		08-Jun-23
4: Analysis Completed Time		17:38
5: QC - Blank		< 0.04
6: QC - STD % Recovery		115%
7: QC - DUP % RPD		ND
8: RL		0.02
9: BH6 SS4 7.5-9.5 ft	29-May-23	< 0.04

RL - SGS Reporting Limit
ND - Not Detected

Kimberley Didsbury
Project Specialist,
Environment, Health & Safety

OnLine LIMS

0003360290

APPENDIX IV

Report Limitations and Guidelines for Use

REPORT LIMITATIONS & GUIDELINES FOR USE

This information has been provided to help manage risks with respect to the use of this report.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

This report was prepared for the exclusive use of the Client and their authorized agents, subject to the conditions and limitations contained within the duly authorized work plan. 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 the third parties. If additional parties require reliance on this report, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this report should not be construed as legal advice.

SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical report is based on the existing conditions at the time the study was performed, and Pinchin's opinion of soil conditions are strictly based on soil samples collected at specific test hole locations. The findings and conclusions of Pinchin's reports may be affected by the passage of time, by manmade events such as construction on or adjacent to the Site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations.

LIMITATIONS TO PROFESSIONAL OPINIONS

Interpretations of subsurface conditions are based on field observations from test holes that were spaced to capture a 'representative' snap shot of subsurface conditions. Site exploration identifies subsurface conditions only at points of sampling. Pinchin reviews field and laboratory data and then applies professional judgment to formulate an opinion of subsurface conditions throughout the Site. Actual subsurface conditions may differ, between sampling locations, from those indicated in this report.

LIMITATIONS OF RECOMMENDATIONS

Subsurface soil conditions should be verified by a qualified geotechnical engineer during construction. Pinchin should be notified if any discrepancies to this report or unusual conditions are found during construction.

Sufficient monitoring, testing and consultation should be provided by Pinchin during construction and/or excavation activities, to confirm that the conditions encountered are consistent with those indicated by the test hole investigation, and to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated. In addition, monitoring, testing and consultation by Pinchin should be completed to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining Pinchin for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions. However, please be advised that any construction/excavation observations by Pinchin is over and above the mandate of this geotechnical evaluation and therefore, additional fees would apply.

MISINTERPRETATION OF GEOTECHNICAL ENGINEERING REPORT

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having Pinchin confer with appropriate members of the design team after submitting the report. Also retain Pinchin to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having Pinchin participate in pre-bid and preconstruction conferences, and by providing construction observation. Please be advised that retaining Pinchin to participation in any ‘other’ activities associated with this project is over and above the mandate of this geotechnical investigation and therefore, additional fees would apply.

CONTRACTORS RESPONSIBILITY FOR SITE SAFETY

This geotechnical report is not intended to direct the contractor's procedures, methods, schedule or management of the work Site. The contractor is solely responsible for job Site safety and for managing construction operations to minimize risks to on-Site personnel and to adjacent properties. It is ultimately the contractor’s responsibility that the Ontario Occupational Health and Safety Act is adhered to, and Site conditions satisfy all ‘other’ acts, regulations and/or legislation that may be mandated by federal, provincial and/or municipal authorities.

SUBSURFACE SOIL AND/OR GROUNDWATER CONTAMINATION

This report is geotechnical in nature and was not performed in accordance with any environmental guidelines. As such, any environmental comments are very preliminary in nature and based solely on field observations. Accordingly, the scope of services do not include any interpretations, recommendations, findings, or conclusions regarding the, assessment, prevention or abatement of contaminants, and no conclusions or inferences should be drawn regarding contamination, as they may relate to this project. The term "contamination" includes, but is not limited to, molds, fungi, spores, bacteria, viruses, PCBs, petroleum hydrocarbons, inorganics, pesticides/insecticides, volatile organic compounds, polycyclic aromatic hydrocarbons and/or any of their by-products.

Pinchin will not be responsible for any consequential or indirect damages. Pinchin will only be held liable for damages resulting from the negligence of Pinchin. Pinchin will not be liable for any losses or damage if the Client has failed, within a period of two years following the date upon which the claim is discovered within the meaning of the Limitations Act, 2002 (Ontario), to commence legal proceedings against Pinchin to recover such losses or damage.