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Geotechnical Investigation
Proposed New Employee Parking Lots "C" and C1"
The Ottawa Hospital
Riverside Campus
Ottawa, Ontario

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the proposed two new employee parking lots at the Ottawa Hospital, Riverside Campus in Ottawa, Ontario. The purpose of the investigation was to identify the general subsurface and groundwater conditions at the site by means of a limited number of boreholes and monitoring wells. Based on the factual information obtained, preliminary engineering guidelines were to be provided on the geotechnical design aspects of the project, including construction considerations that could influence design decisions.

This investigation was carried out in general accordance with our proposal dated March 19, 2024.

This report is subject to the Conditions and Limitations of This Report which follows the text of the report and which are considered an integral part of the report.

2.0 BACKGROUND

2.1 Project Description

Plans are being prepared for the construction of two new employee parking lots at the Ottawa Hospital, Riverside Campus.

Based on the preliminary site plans provided by Parsons, it is understood that parking lot “C1” is located between Riverside Drive and the Transitway, north of Sarah Billings Place. Parking lot “C” is located between the Transitway and the rail line, south of the existing parking lot. Presently, both areas are grass covered with occasional forested areas throughout. Both proposed parking lots have a varied topography which may require retaining walls to be included in the design.

2.2 Site Geology

A review of surficial geology maps as well as previously completed geotechnical investigations at the site indicate that the site is generally underlain by variable sands and gravels and glacial till over shale bedrock.

Bedrock geology maps in the area of the site indicate that shale bedrock of the Billings formation is present at depths ranging from about 15 to 25 metres below parking lot “C1” and 10 to 15 metres below parking lot “C”.

3.0 METHODOLOGY

The fieldwork for this investigation was carried out on April 18 and 19, 2024. At that time, twelve boreholes (numbered 24-01 to 24-12, inclusive) were advanced at the approximate locations shown on the Site Plan, Figure 1.

The boreholes were advanced using rubber track mount drilling equipment supplied and operated by George Downing Estate Drilling Ltd. of Calumet, Quebec.

The boreholes were advanced to depths of about 2.1 to 5.1 metres below ground surface. Standard penetration tests were carried out where possible in the boreholes within the overburden deposits and samples of the soils encountered were recovered using drive open sampling equipment.

The fieldwork was observed by a member of our engineering staff who directed the drilling operations, observed the in-situ testing, and logged the samples and test holes.

Following the fieldwork, the soil samples were returned to our laboratory for examination by a geotechnical engineer. Selected samples of the soil were tested for water content and grain size distribution testing.

The borehole locations were selected by the GEMTEC personnel in consultation with Parsons and positioned at the site relative to existing site features. The locations and ground surface elevations of the borehole locations were determined using a Trimble R10 GPS survey instrument. The coordinates of the boreholes are referenced to NAD83 (CSRS) Epoch 2010, vertical network CGVD28.

4.0 SUBSURFACE CONDITIONS

Descriptions of the subsurface conditions logged in the boreholes are provided on the Record of Borehole Sheets in Appendix A. The results of the laboratory classification testing are provided on the Record of Borehole sheets and in Appendix B. The approximate locations of the boreholes are shown on the Site Plan on Figure 1.

The following presents an overview of the subsurface conditions encountered in the boreholes advanced during this investigation.

4.1 Topsoil

A layer of topsoil was encountered at the ground surface at the locations of boreholes 24-01, 24-02, 24-03, 24-05, 24-07, and 24-10. The thickness of the topsoil ranges from about 70 to 200 millimetres.

4.2 Fill Material

Fill material was encountered below the topsoil and at the ground surface in boreholes 24-01, 24-02 and 24-04 to 24-12, inclusive. The fill material extends to depths ranging from about 0.2 to 3.6 metres below ground surface. The fill was not penetrated in boreholes 24-07 and 24-12 but was proven to depths of 2.1 m below ground surface. The fill material is generally composed of silty

sand to sand and silt, with varying amounts of gravel. The fill material also includes glass and wood fragments at borehole 24-02.

Standard penetration tests carried out in the fill material gave N values ranging from 1 to 17 blows per 0.3 metres of penetration, which reflect a very loose to compact relative density.

Grain size distribution tests were carried out on three samples of the fill material from boreholes 24-01 and 24-11. The results are provided in Appendix B and summarized in Table 4.1.

Table 4.1 – Summary of Grain Size Distribution Test (Fill Material)

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt and Clay (%)
24-01	1B	0.0 to 0.6	11	53	36
24-01	3	1.5 to 2.1	31	37	31
24-11	1B	0.2 to 0.6	0	76	24

The measured water contents of nine samples of the fill material ranged from about 5 to 11 percent.

4.3 Silty Sand / Sand

A native deposit of silty sand to sand trace silt and clay, with varying amounts of gravel, hereinafter referred to as “silty sand”, was encountered below the fill material, topsoil, and glacial till in boreholes 24-01 to 24-06, inclusive, and 24-09 to 24-11, inclusive.

The silty sand deposit was not fully penetrated in boreholes 24-01, 24-02, 24-05, 24-09, 24-10, and 24-11 but was proven to depths ranging from about 2.1 to 5.1 metres below the existing ground surface. The silty sand deposit in boreholes 24-03, 24-04, and 24-06 extends to depths ranging from about 2.5 to 3.1 metres below the existing ground surface.

Standard penetration tests carried out in the silty sand deposit gave N values ranging from 5 to 27 blows per 0.3 metres of penetration, which reflect a loose to compact relative density.

Grain size distribution tests were carried out on three samples of the silty sand deposit from boreholes 24-04 and 24-11. The results are provided in Appendix B and summarized in Table 4.2.

Table 4.2 – Summary of Grain Size Distribution Test (Silty Sand Deposit)

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt and Clay (%)
24-04	2	0.7 to 1.4	19	56	25
24-04	4	2.3 to 2.9	1	89	10
24-11	2	0.7 to 1.4	1	83	16

The measured water contents of nine samples of the silty sand deposit ranged from about 2 to 7 percent.

4.4 Sand and Gravel

A deposit of silty sand and gravel, hereinafter referred to as “sand and gravel” was encountered below the silty sand deposit and glacial till in boreholes 24-03 and 24-04. The sand and gravel deposit were not fully penetrated but was proven to depths of about 3.6 and 5.1 metres below the existing ground surface.

Standard penetration tests carried out in the sand and gravel deposit gave N values ranging from 27 to 41 blows per 0.3 metres of penetration, which reflect a compact to dense relative density.

The measured water contents of two samples of the sand and gravel deposit were about 5 percent.

4.5 Glacial Till

A native deposit of glacial till was encountered below the silty sand deposit and/or fill material, in boreholes 24-04, 24-05, 24-06 and 24-08. The glacial till was not fully penetrated in boreholes 24-06 and 24-08 but was proven to depths of about 2.1 and 3.6 metres below ground surface. The glacial till in boreholes 24-04 and 24-05 extends to depths of about 3.6 metres below the existing ground surface.

The glacial till is a heterogeneous mixture of all grain sizes, which at this site, can be described as silty sand to sandy silt with varying amount of gravel. Although not encountered in the borehole locations directly, the glacial till deposits in this area are known to contain cobbles and boulders.

Standard penetration tests carried out in the glacial till deposit gave N values ranging from about 7 to 34 blows per 0.3 metres of penetration, which indicates a loose to dense relative density. The higher N values may also be caused by the presence of cobbles or boulders within the glacial till.

The measured water content of one sample of the glacial till deposit was about 5 percent.

4.6 Groundwater Seepage

The boreholes were dry upon completion of drilling and prior to backfilling.

Groundwater conditions may vary seasonally, or because of precipitation and construction activities in the area. Shallow groundwater may also be locally affected by the presence of underground utility corridors, bedrock conditions, building foundations, and / or fill materials.

5.0 DISCUSSIONS AND RECOMMENDATIONS

5.1 Grade Raise

Compressible clays were not encountered at this site and there is no practical limit to the thickness of additional fil that may be placed on the site to raise the grade. GEMTEC should however be consulted if it is anticipated that more than 4 m of additional fil will be placed at the site.

5.2 Proposed Storm Sewers

5.2.1 Overview

Details for storm sewers (if planned) were not available at the time of preparation of this report.

5.2.2 Excavation

Based on the results of the investigation, together with assumed invert levels at 2 to 3 m depth, excavations for the proposed storm sewer will generally be carried out through the topsoil, fill material, glacial till and into the glacial till and silty sand deposits.

These soil units should be excavatable using conventional hydraulic excavation equipment, noting that fill material can contain more problematic material such as construction debris boulders, or other hard material. Frequent boulders may also be encountered within the glacial till unit which may increase excavation effort and cause over-excavation (both laterally and in depth). As such, an allowance should be made for removal of boulders from the glacial till during excavation. Also, additional backfill and bedding material may be required to fill any voids left from the removal of boulders.

5.2.3 Temporary Excavation Side Slopes

The sides of the excavations within overburden soils should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the Act, most of the soils at this site can be classified as Type 3 soils. Therefore, for design purposes, allowance should be made for 1 horizontal to 1 vertical, or flatter, excavation slopes.

As an alternative or where space constraints dictate, the service installations could be carried out within a tightly fitting, braced steel trench box, which is specifically designed for this purpose. In order to advance the trench box, even boulders that partially intrude into the sides of the

excavation must be removed, which may result in a wider excavation than anticipated. Further, additional backfill and bedding material may be required to fill any voids left from the removal of boulders.

It is noted that some unavoidable inward horizontal movement and settlement of the ground behind the trench box should be anticipated, which could affect existing services located behind the trench box. Additional information on impacts to adjacent services is provided in Section 5.2.7.

5.2.4 Groundwater Management

It is anticipated that groundwater seepage / inflow from the overburden deposits (and existing fill materials) into the excavations will be minor. It is not expected that short term pumping during excavation will have a significant effect on nearby structures and services.

5.2.5 Pipe Bedding

The service bedding should be in accordance with City of Ottawa Standard Drawing No's. S6 and S7. The pipe bedding material should consist of well graded crushed stone meeting OPSS requirements for Granular A. The minimum bedding thickness should be 150 millimetres for excavation in overburden and increased to 300 millimetres for excavation within bedrock. In accordance with City of Ottawa standards (refer to S.P. No: F-3147), granular materials used in the service trenches should be composed of virgin (i.e., not recycled) material only. As discussed below, we recommend that a contingency allowance be made in the contract for a subbedding layer in the event that unavoidable disturbance to the glacial till subgrade occurs during construction.

In areas where the subsoil is disturbed, or where unsuitable material exists below the pipe at subgrade level (following inspection by a geotechnical practitioner) the disturbed/unsuitable material should be removed and replaced with a subbedding layer of compacted granular material, such as that meeting OPSS Granular B Type II (50 or 100 millimetre minus crushed stone). The use of clear crushed stone as a bedding or subbedding material should not be permitted. In addition, where boulders are encountered and removed from the glacial till at the base of the trench, additional bedding material may be required to fill any voids left following the removal of boulders.

Cover material, from pipe spring line to at least 300 millimetres above the top of the pipe, should consist of granular material, such as OPSS Granular A.

The subbedding, bedding and cover materials should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor dry density value.

5.2.6 Trench Backfill

Where it is considered preferable to reduce the potential for differential frost heaving between the area over the trench and the adjacent soils (i.e., below pavements), the trench backfill materials within the zone of seasonal frost penetration (i.e., 1.8 metres below finished grade) should match the materials exposed on the trench walls. Backfill below the zone of seasonal frost penetration could consist of either acceptable native material or imported granular material conforming to OPSS Granular B Type I or II.

To minimize future settlement of the backfill, the trench backfill should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density value.

5.2.7 Excavation Adjacent to Existing Services

As previously indicated, some unavoidable inward horizontal movement and settlement of the ground behind any trench boxes used should be anticipated, which could affect existing services located behind the trench box. We recommend that the overburden excavations not encroach within a line extending downwards and outwards at an inclination of 1 vertical to 1 horizontal from the base of the existing services supported in overburden. Where this is not possible, a more rigid shoring system may be required to support the excavation. Additional information could be provided as the design progresses.

5.3 Proposed Retaining Walls

The locations, height and details of the retaining walls were not available at the time of this report. The guidance below should be updated as the design progresses.

5.3.1 Foundation Considerations

5.3.2 Seismic Design

Based on the recorded standard penetration test values, it is our opinion that Site Class D is appropriate for this site according to the 2012 Ontario Building Code (as currently amended).

Based on the increasing SPT values with depth and the depth to the groundwater level (which is greater than 5 metres), it is considered that there is a low potential for liquefaction of the overburden deposits at this site.

5.3.3 Bearing Resistances

The spread footing foundations for the retaining wall should be constructed on the native deposits, or, where required, on a pad of engineered fill material placed above the native deposits. Any topsoil, fill, organic or deleterious material should be removed from beneath the footings.

Spread or strip footings, up to 2 m in maximum width, founded on the (undisturbed) native deposits or on a pad of compacted granular fill may be sized using ULS bearing reaction and ULS bearing resistances of 175 and 125 kPa, respectively. For larger footings a more detailed

assessment of the allowable bearing capacity / geotechnical bearing resistance would be required.

The post construction total and differential settlements should be less than 25 and 15 millimetres respectively, provided that all loose or disturbed soil is removed from the bearing surfaces.

5.3.4 Sliding Resistances

For preliminary design purposes, the resistance to sliding of retaining walls may be calculated using an unfactored interface friction angle of 22 degrees and a friction coefficient of 0.4, assuming that the footings are founded directly on native soil; however, if the footings are founded on a pad of compacted granular material, the unfactored interface friction angle could be increased to 30 degrees with a friction coefficient of 0.58.

5.3.5 Subgrade Preparation

Allowance should be made to remove and replace any fill material, disturbed native deposit with compacted sand and gravel, such as that meeting OPSS Granular A or Granular B Type II, where required.

Granular material, where required, should be compacted to at least 98 percent of the standard Proctor dry density in maximum 200-millimetre-thick lifts using suitable vibratory compaction equipment. In the instance that a pad of engineered fill material is placed below the foundations, the material should extend out at least 0.3 metres beyond the edges of the retaining wall footing and slope downwards from this point at 1 horizontal to 1 vertical, or flatter.

During construction the subgrade surface should be inspected by GEMTEC (prior to placement of any granular material).

5.3.6 Frost Protection

All footings for the retaining wall should be provided with at least 1.8 metres of earth cover for frost protection purposes. If the required depth of earth cover is not practicable a combination of earth cover and polystyrene insulation could be considered. The grade of insulation used, if placed below the footing, should be suitable for the applied foundation loads. Further details regarding the insulation of foundations could be provided upon request.

5.3.7 Retaining Wall Backfill and Drainage

To provide drainage and avoid frost adhesion and possible horizontal frost heaving which could occur behind the wall causing the wall to be pushed or rotated outward, the wall should be backfilled with imported, free-draining, non-frost susceptible granular material meeting OPSS Granular B Type I or II requirements. From a geotechnical point of view, the material encountered on site is not considered suitable for reuse as backfill material due to potential of frost heaving.

The non-frost susceptible backfill material should extend at least 1.8 metres horizontally outward from the back of the retaining wall. The backfill should be placed in maximum 200 millimetre thick lifts and compacted to at least 95 percent of the standard Proctor maximum dry density value using suitable vibratory compaction equipment. Where future landscaped areas will exist next to the proposed structure and if some settlement of the backfill is acceptable, the backfill could be compacted to at least 90 percent of the standard Proctor maximum dry density value.

Based on the underlying sandy soils, the depth to the groundwater level, the paved and relatively impervious surfacing, drains behind the retaining walls are likely not required. This assumes that the parking lot drainage is directed away from the retaining walls and water will not pond in these areas or flow over the retaining wall.

Where areas of hard surfacing (concrete, sidewalk, pavement, etc.) abut the proposed retaining wall, a gradual transition should be provided between those areas of hard surfacing underlain by non-frost susceptible granular wall backfill and those areas underlain by existing frost susceptible materials to reduce the effects of differential frost heaving. It is suggested that granular frost tapers be constructed from the bottom of the excavation, or 1.8 metres below finished grade, whichever is less, to the underside of the granular base/subbase material for the hard surfaced areas. The frost tapers should be sloped at 1 horizontal to 1 vertical, or flatter.

5.3.8 Lateral Earth Pressures

Retaining walls that are backfilled with granular material, such as that meeting OPSS Granular B Type I or II requirements, should be designed to resist static earth pressures calculated using the following formula:

$P = 0.5\ K_a\ \gamma\ H^2$

where;

- P: Static Lateral Load (kN/m)
- γ: Moist material unit weight (kN/m^3)
- K_a: Active earth pressure coefficient (unrestrained walls)
- H: Wall height (m)

Retaining walls are typically unrestrained structures.

Seismic shaking can increase the forces on the retaining wall. The total lateral force acting on the walls during a seismic event (P_t) is composed of a static component (P) and a dynamic component (P_e):

$P_t = P + P_e$

The dynamic thrust component (P_e), which acts only during seismic loading conditions, should be calculated using the following formula:

$P_e = 0.5 (K_{ae} – K_a) \gamma H^2$

where;

- P_e: Dynamic thrust (kN/m)
- γ: Moist material unit weight (kN/m^3)
- K_a "Active" Earth Pressure Coefficient
- K_{ae}: Dynamic earth pressure coefficient
- H: Wall height (m)

The static thrust component (P) acts at a point located H/3 above the base of the wall. During seismic shaking, the dynamic at thrust component (P_t) acts at a point located about 0.6H above the base of the wall.

For design purposes, the parameters provided in Table 5.3 can be used to calculate the thrust forces acting on the wall during static and seismic loading conditions (for a 2475-year earthquake event).

Table 5.3 – Summary of Design Parameters (Retaining Wall)

Parameter	OPSS Granular B Type I	OPSS Granular B Type II
Material Unit Weight, γ (kN/m^3)	21	22
Internal Friction Angle (degrees)	34	38
Active Earth Pressure Coefficient, K_a, assuming horizontal backfill behind the structure	0.28	0.24
Dynamic "At Rest" Earth Pressure Coefficient, K_{oe}, assuming horizontal backfill behind the structure	0.37[1]	0.32[1]

Notes:

1) According to the 2015 National Building Code, the peak ground acceleration (PGA) for the site is 0.282, for firm ground conditions (i.e., for Site Class C) however, the corrected PGA for this site should be taken as 0.302, (i.e., for an assumed Site Class D). The dynamic at rest earth pressure coefficient was calculated using the method suggested by Mononobe and Okabe, assuming a horizontal seismic coefficient, k_h, of 0.151 and assuming that the vertical seismic coefficient, k_v, is zero.

5.4 Proposed Parking Lot

At the time of preparing this draft version of the report some details of the proposed pavements at the site were not available to GEMTEC.

5.4.1 Subgrade Preparation

In preparation for the construction of the access roadway and parking areas at this site, all surficial topsoil, and any loose / soft, wet, organic, debris or deleterious materials should be removed from the proposed subgrade surface. It is not considered necessary to remove all of the fill material from below the roadway / parking areas provided that some settlement of the fill material can be tolerated. Any sub-excavated areas could be filled with compacted earth borrow or imported granular material. The Granular B Type I, II, Select Subgrade Material or earth borrow should be placed in maximum 300-millimetre thick lifts and compacted to at least 95 percent of the standard Proctor maximum dry density value using vibratory compaction equipment.

The subgrade surfaces should be proof rolled with a large steel drum roller (under dry conditions), and shaped, and crowned to promote drainage of the granular materials.

5.4.2 Flexible Pavement Structures for the Parking Areas and Access Roadway

It is suggested that parking areas, be constructed using the following minimum pavement structure for light duty (i.e., primarily passenger vehicles):

- 60 millimetres of asphaltic concrete; over
- 150 millimetres of OPSS Granular A base; over
- 300 millimetres of OPSS Granular B Type II subbase.

The asphaltic concrete should consist of a single 60-millimetre lift of Superpave 12.5 (Traffic Level B) Hot Mix Asphalt (HMA) meeting the requirements of OPSS 1151.

All HMA materials should incorporate PG 58-34 asphaltic cement meeting the requirements of OPSS 1101 and be constructed to the requirements of OPSS 310.

Where the new pavement will abut existing pavement, the depths of the granular materials should taper up or down at 5 horizontal to 1 vertical, or flatter to match the depths of the granular material(s) exposed in the existing pavement.

If the granular pavement materials are to be used by construction traffic, it may be necessary to increase the thickness of the subbase material, install a woven geotextile separator between the roadway subgrade surface and the granular subbase material, or a combination of both, to prevent pumping and disturbance to the subbase material. The contractor should be made responsible for their construction access.

5.4.3 Compaction Requirements

All imported granular materials should be placed in maximum 200-millimetre thick lifts and should be compacted to at least 98 percent of the standard Proctor dry density value using suitable vibratory compaction equipment.

5.4.4 Pavement Drainage

Adequate drainage of the pavement granular materials and subgrade is important for the long-term performance of the pavement at this site. The subgrade surfaces should be shaped to drain to the catch basins to promote drainage of the pavement granular materials. The catch basins should be provided with minimum 3-metre long perforated stub drains which extend in at least two (2) directions from each catch basin at pavement subgrade level.

5.4.5 Pavement Transitions

As part of the parking lot construction the new pavement will abut the existing pavement at various locations where vehicle access will be provided. The following is suggested to improve the performance of the joint between the new and the existing pavements:

- Neatly saw cut the existing asphaltic concrete;
- Remove the asphaltic concrete and slope the bottom of the excavation within the existing granular base and subbase at 1 horizontal to 1 vertical, or flatter, to avoid undermining the existing asphaltic concrete;
- To avoid cracking of the asphaltic concrete due to an abrupt change in the thickness of the roadway granular materials where new pavement areas join with the existing pavements, the granular depths should taper up or down at 5 horizontal to 1 vertical, or flatter, to match the existing pavement structure; and,
- Remove (mill off) 40 to 50 millimetres of the existing asphaltic concrete to a distance of 300 millimetres at the joint and tack coat the asphaltic concrete at the joint in accordance with the requirements in OPSS 310.

6.0 ADDITIONAL CONSIDERATIONS

6.1 City of Ottawa Tree Guidelines

Clay soils were not encountered at the site and there are therefore no geotechnical restrictions for the planting of trees.

6.2 Effects of Construction Induced Vibration

Some of the construction operations (such as granular material compaction, excavation, rock blasting, etc.) will cause ground vibration on and off the site. The vibrations will attenuate with distance from the source but may be felt at nearby structures.

We recommend that preconstruction surveys be carried out on the adjacent structures and that vibration monitoring be carried out during the construction so that any damage claims can be addressed in a fair manner.

6.3 Excess Soil Management Plan

This report does not constitute an excess soil management plan. The disposal requirements for excess soil from the site have not been assessed.

6.4 Design Review and Construction Observation

The details for the proposed construction were not available to us at the time of preparation of this report. It is recommended that the final design drawings be reviewed by the Geotechnical Engineer to ensure that the guidelines provided in this report have been interpreted as intended.

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed excavations do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design. The subgrade surfaces for the site services and roadways should be inspected by experienced geotechnical personnel to ensure that suitable materials have been reached and properly prepared. The placing and compaction of earth fill and imported granular materials should be inspected to ensure that the materials used conform to the grading and compaction specifications.

7.0 CLOSURE

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.

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Principal Geotechnical Engineer

PS/BC

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   Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety, and equipment capabilities.

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8. **Decrease in Property Value:** GEMTEC shall not be responsible for any decrease, real or perceived, of the property or site's value or failure to complete a transaction, as a consequence of the information contained in this report.

9. **Reliance on Provided Information:** The evaluation and conclusions contained in this report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations. information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of misstatements, omissions, misrepresentations. or fraudulent acts of the Client or other persons providing information relied on by us. We are entitled to rely on such representations, information

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10. **Investigation Limitations:** Site investigation programs are a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions but even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions.

    The data derived from the site investigation program and subsequent laboratory testing are interpreted by trained personnel and extrapolated across the site to form an inferred geological representation and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Conditions between and beyond the borehole/test hole locations may differ from those encountered at the borehole/test hole locations and the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies. Accordingly, GEMTEC does not warrant or guarantee the exactness of the subsurface descriptions.

    Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

    In addition, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

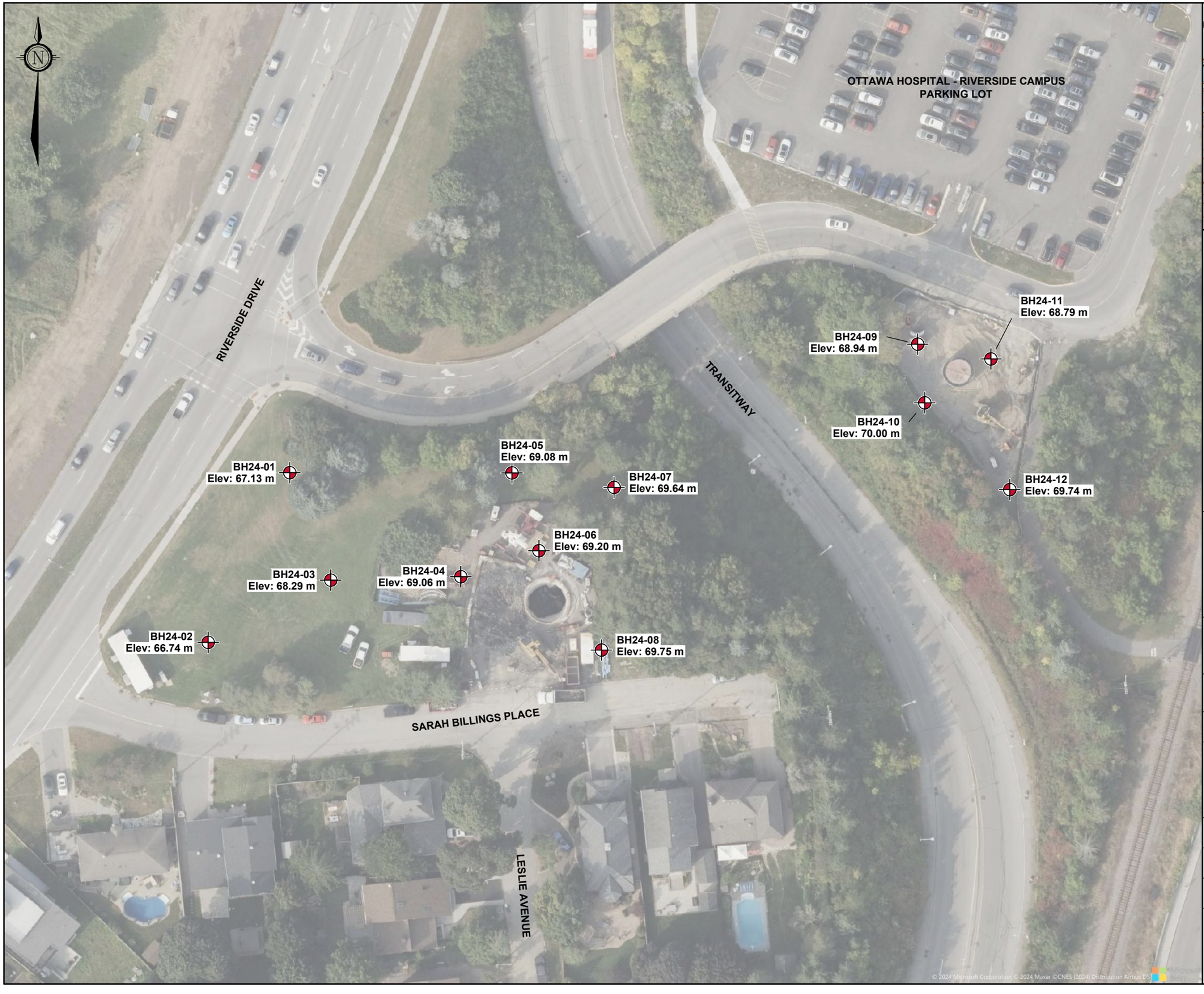
11. **Sample Disposal:** GEMTEC will dispose of all uncontaminated soil and/or rock samples 60 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fill materials or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

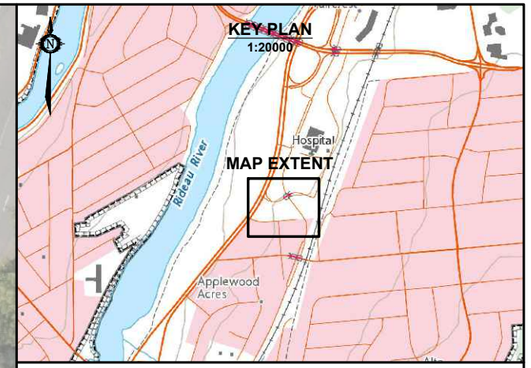
12. **Follow-Up and Construction Services:** All details of the design were not known at the time of submission of GEMTEC's report. GEMTEC should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of GEMTEC's report.

    During construction, GEMTEC should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of GEMTEC's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in GEMTEC's report. Adequate field review, observation and testing during construction are necessary for GEMTEC to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, GEMTEC's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

13. **Changed Conditions:** Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that GEMTEC be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that GEMTEC be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

14. **Drainage:** Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. GEMTEC takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.





LEGEND

BH # ← BOREHOLE/ TEST PIT/ TEST HOLE ID

XX.XX ← GROUND SURFACE ELEVATION, IN METRES

BOREHOLE LOCATION
(current investigation by GEMTEC)

NOTES
1. Coordinate system: NAD83(CSRS) / UTM zone 18N, CGVD28.
2. Survey reference based on ON_Ottawa (Cansel CanNet RTK Base Station - Ottawa).
   Easting: 449919.056m
   Northing: 5025195.069m
   Elevation: 95.230m
3. Contains information licensed under the Open Government Licence – Ontario.

SCALE
1:750
0 15 30 45m

DRAWING
SITE PLAN

CLIENT
PARSONS CORPORATION

PROJECT
GEOTECHNICAL INVESTIGATION,
PROPOSED EMPLOYEE PARKING LOT,
THE OTTAWA HOSPITAL,
RIVERSIDE CAMPUS, OTTAWA, ONTARIO.

DRAWN BY	CHECKED BY
C.H.G.	P.S.
PROJECT NO. 100016.024	REVISION NO. 0
DATE MAY 2024	FIGURE NO. **FIGURE 1**

GEMTEC
Consulting Engineers and Scientists
32 Steacie Drive
Ottawa, ON K2K 2A9
Tel: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca

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APPENDIX A

Record of Boreholes
List of Abbreviations and Symbols
Boreholes 24-01 to 24-12, inclusive

RECORD OF BOREHOLE 24-01

CLIENT: Parsons Corporation
PROJECT: Geitechnical Investigation, Proposed Parking Lot, The Ottawa Hospital, Riverside Campus, Ottawa, Ontario
JOB#: 100016.024
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 18 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		67.13						
0	Power Auger Hollow Stem Auger (210mm OD)	TOPSOIL		0.07						
		Brown sand and silt, some gravel, with glass and rootlets, loose (FILL)			1	SS	280	7	M	
1					2	SS	230	7		
				65.61						
		Grey brown, gravelly silty sand, with rootlets, loose to compact (FILL)		1.52	3	SS	405	6	M	
2					4	SS	355	17		Auger Cuttings
3					5	SS	355	17		
				63.47						
		Grey brown, SILTY SAND, trace gravel		3.66						
4					6	SS	205	21		
				62.71						
		End of Borehole Note: Borehole dry upon completion of drilling		4.42						
5										
6										
7										
8										
9										
10										

SOIL PROFILE | SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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CHECKED: PS

GEO - BOREHOLE LOG 100016.024_BH_LOGS_2024-04-25.GPJ GEMTEC 2018.GDT 5/10/24

RECORD OF BOREHOLE 24-02

CLIENT: Parsons Corporation
PROJECT: Geitechnical Investigation, Proposed Parking Lot, The Ottawa Hospital, Riverside Campus, Ottawa, Ontario
JOB#: 100016.024
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 18 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		66.74							
		TOPSOIL		0.10							
		Brown silty sand, trace gravel, with wood fragments and glass, very loose to loose (FILL)			1	SS	255	4			
1					2	SS	100	3			Auger Cuttings
2					3	SS	100	1			
				64.30							
		Grey brown, SILTY SAND, some gravel		2.44	4	SS	380	10			
3				63.69							
		End of Borehole		3.05							
		Note: Borehole dry upon completion of drilling									
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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CHECKED: PS

GEO - BOREHOLE LOG 100016.024_BH_LOGS_2024-04-25.GPJ GEMTEC 2018.GDT 5/10/24

RECORD OF BOREHOLE 24-03

CLIENT: Parsons Corporation
PROJECT: Geitechnical Investigation, Proposed Parking Lot, The Ottawa Hospital, Riverside Campus, Ottawa, Ontario
JOB#: 100016.024
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 18 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		68.29							
		TOPSOIL		0.10							
	Power Auger Hollow Stem Auger (210mm OD)	Brown SILTY SAND, some gravel, loose			1	SS	205	5			
1					2	SS	510	9			
				66.77							
		Brown, SAND, trace to some silt, trace gravel, loose		1.52	3	SS	460	10			Auger Cuttings
2					4	SS	430	18			
				65.55							
		Grey brown, SAND and GRAVEL, compact to dense		2.74	5	SS	460	30			
3				64.64							
		End of Borehole		3.65							
4		Note: Borehole dry upon completion of drilling									
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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RECORD OF BOREHOLE 24-04

CLIENT: Parsons Corporation
PROJECT: Geitechnical Investigation, Proposed Parking Lot, The Ottawa Hospital, Riverside Campus, Ottawa, Ontario
JOB#: 100016.024
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 18 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		69.06						
0	Power Auger Hollow Stem Auger (210mm OD)	Grey sandy gravel (FILL)		68.89						
		Brown SILTY SAND		0.17	1	SS	460	10		
				68.45						
		Brown SILTY SAND to SAND, trace silt, trace to some gravel, loose		0.61						
1					2	SS	150	5	M	
2					3	SS	405	8		
					4	SS	405	8	M	Auger Cuttings
3				66.01						
		Brown SILTY SAND to SANDY SILT, trace to some gravel, dense (GLACIAL TILL)		3.05	5	SS	405	34		
				65.41						
		Brown silty SAND and GRAVEL, dense to compact		3.65						
4					6	SS	460	41		
5					7	SS	405	27		
				63.88						
		End of Borehole		5.18						
		Note: Borehole dry upon completion of drilling								
6										
7										
8										
9										
10										

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

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RECORD OF BOREHOLE 24-05

CLIENT: Parsons Corporation
PROJECT: Geitechnical Investigation, Proposed Parking Lot, The Ottawa Hospital, Riverside Campus, Ottawa, Ontario
JOB#: 100016.024
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 18 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		69.08							
		TOPSOIL		68.88							
		Brown silty sand, trace gravel (FILL)		0.20	1	SS	230	4			
				68.47							
		Brown SILTY SAND, trace gravel (GLACIAL TILL)		0.61							
1					2	SS	305	5			
				67.87							
		Brown SILTY SAND, some gravel, compact		1.21							
2					3	SS	330	14			
					4	SS	100	13			Auger Cuttings
				66.03							
3		Brown SILTY SAND, loose		3.05	5	SS	280	10			
4					6	SS	405	7			
					7	SS	460	8			
5				63.90							
		End of Borehole Note: Borehole dry upon completion of drilling		5.18							
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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RECORD OF BOREHOLE 24-06

CLIENT: Parsons Corporation
PROJECT: Geitechnical Investigation, Proposed Parking Lot, The Ottawa Hospital, Riverside Campus, Ottawa, Ontario
JOB#: 100016.024
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 18 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		69.20							
		Brown silty sand (FILL)		0.05							
		Grey sand and gravel (FILL)		68.90	1	SS	405	9			
		Brown silty sand, trace gravel (FILL)		0.30							
				68.44							
1		Brown SILTY SAND, trace to some gravel, loose to compact (GLACIAL TILL)		0.76	2	SS	405	7			
											Auger Cuttings
2					3	SS	460	13			
		Brown SAND, trace silt		67.12 2.08							
				66.71	4	SS	355	14			
		Brown SILTY SAND, trace to some gravel, compact (GLACIAL TILL)		2.49							
3					5	SS	460	24			
				65.55							
		End of Borehole		3.65							
4		Note: Borehole dry upon completion of drilling									
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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RECORD OF BOREHOLE 24-07

CLIENT: Parsons Corporation
PROJECT: Geitechnical Investigation, Proposed Parking Lot, The Ottawa Hospital, Riverside Campus, Ottawa, Ontario
JOB#: 100016.024
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 18 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA NATURAL REMOULDED / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		69.64							
0	Power Auger Hollow Stem Auger (210mm OD)	TOPSOIL		0.07							
		Grey sand and gravel (FILL)		69.29	1	SS	150	12			
		Grey brown, silty sand, trace gravel, loose (FILL)		0.35							
1					2	SS	380	7			Auger Cuttings
					3	SS	150	10			
2				67.51							
		End of Borehole		2.13							
		Note: Borehole dry upon completion of drilling									
3											
4											
5											
6											
7											
8											
9											
10											

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RECORD OF BOREHOLE 24-08

CLIENT: Parsons Corporation
PROJECT: Geitechnical Investigation, Proposed Parking Lot, The Ottawa Hospital, Riverside Campus, Ottawa, Ontario
JOB#: 100016.024
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 18 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		69.75							
		Brown silty sand (FILL)			1	SS	305	6			
				69.14							
		Brown, silty sand, trace gravel (FILL)		0.61							
1					2	SS	355	7			Auger Cuttings
		Brown, SILTY SAND, trace to some gravel, compact (GLACIAL TILL)		68.54 1.21							
2					3	SS	255	12			
				67.62							
		End of Borehole		2.13							
		Note: Borehole dry upon completion of drilling									
3											
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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GEO - BOREHOLE LOG 100016.024_BH_LOGS_2024-04-25.GPJ GEMTEC 2018.GDT 5/10/24

RECORD OF BOREHOLE 24-09

CLIENT: Parsons Corporation
PROJECT: Geitechnical Investigation, Proposed Parking Lot, The Ottawa Hospital, Riverside Campus, Ottawa, Ontario
JOB#: 100016.024
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 19 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
		Ground Surface		68.94				
0	Power Auger Hollow Stem Auger (210mm OD)	Grey sand and gravel (FILL)		68.77				
		Grey brown silty sand, some gravel with organics (FILL)		0.17	1	SS	380	5
		Brown SILTY SAND to SANDY SILT		68.18 0.76				
1		Brown SAND, trace silt, compact		0.91	2	SS	460	11
					3	SS	460	17
2				66.81				
		End of Borehole Note: Borehole dry upon completion of drilling		2.13				

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, % (W_P, W, W_L)
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Auger Cuttings

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GEO - BOREHOLE LOG 100016.024_BH_LOGS_2024-04-25.GPJ GEMTEC 2018.GDT 5/10/24

RECORD OF BOREHOLE 24-10

CLIENT: Parsons Corporation
PROJECT: Geitechnical Investigation, Proposed Parking Lot, The Ottawa Hospital, Riverside Campus, Ottawa, Ontario
JOB#: 100016.024
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 19 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		70.00							
		TOPSOIL		69.80							
		Brown silty sand (FILL)		0.20	1	SS	230	2			
				69.39							
1		Brown silty sand, trace clay, trace gravel, loose (FILL)		0.61	2	SS	355	9			
				68.48							
2		Brown SAND, trace to some silt, trace to some gravel, compact		1.52	3	SS	460	11			
					4	SS	405	13			Auger Cuttings
3					5	SS	405	20			
4					6	SS	460	22			
					7	SS	405	23			
5				64.82							
		End of Borehole Note: Borehole dry upon completion of drilling		5.18							
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P, W, W_L
10 20 30 40 50 60 70 80 90

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CHECKED: PS

GEO - BOREHOLE LOG 100016.024_BH_LOGS_2024-04-25.GPJ GEMTEC 2018.GDT 5/10/24

RECORD OF BOREHOLE 24-11

CLIENT: Parsons Corporation
PROJECT: Geitechnical Investigation, Proposed Parking Lot, The Ottawa Hospital, Riverside Campus, Ottawa, Ontario
JOB#: 100016.024
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 19 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		68.79						
0	Power Auger Hollow Stem Auger (210mm OD)	Brown sand and gravel (FILL)		68.59						
		Brown silty sand (FILL)		0.20 / 68.18	1	SS	460	14	M	
		Brown SAND, some silt, trace gravel, compact		0.61	2	SS	460	10	M	
1					3	SS	460	11		Auger Cuttings
2					4	SS	405	16		
3					5	SS	405	27		
		End of Borehole Note: Borehole dry upon completion of drilling		65.14 / 3.65						
4										
5										
6										
7										
8										
9										
10										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, % (W_P, W, W_L)
10 20 30 40 50 60 70 80 90

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LOGGED: ML
CHECKED: PS

GEO - BOREHOLE LOG 100016.024_BH_LOGS_2024-04-25.GPJ GEMTEC 2018.GDT 5/10/24

RECORD OF BOREHOLE 24-12

CLIENT: Parsons Corporation
PROJECT: Geitechnical Investigation, Proposed Parking Lot, The Ottawa Hospital, Riverside Campus, Ottawa, Ontario
JOB#: 100016.024
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 19 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0		Ground Surface		69.74				
	Power Auger Hollow Stem Auger (210mm OD)	Grey sand and gravel (FILL)		69.44	1	SS	205	5
		Grey brown, silty sand, some gravel, loose (FILL)		0.30	2	SS	380	4
2					3	SS	380	7
		End of Borehole		67.61 / 2.13				
		Note: Borehole dry upon completion of drilling						

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Auger Cuttings

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GEO - BOREHOLE LOG 100016.024_BH_LOGS_2024-04-25.GPJ GEMTEC 2018.GDT 5/10/24

ABBREVIATIONS AND TERMINOLOGY USED ON RECORDS OF BOREHOLES AND TEST PITS

SAMPLE TYPES	
AS	Auger sample
CA	Casing sample
CS	Chunk sample
BS	Borros piston sample
GS	Grab sample
MS	Manual sample
RC	Rock core
SS	Split spoon sampler
ST	Slotted tube
TO	Thin-walled open shelby tube
TP	Thin-walled piston shelby tube
WS	Wash sample

SOIL TESTS	
w	Water content
PL, w_p	Plastic limit
LL, w_L	Liquid limit
C	Consolidation (oedometer) test
D_R	Relative density
DS	Direct shear test
G_S	Specific gravity
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	Organic content test
UC	Unconfined compression test
γ	Unit weight

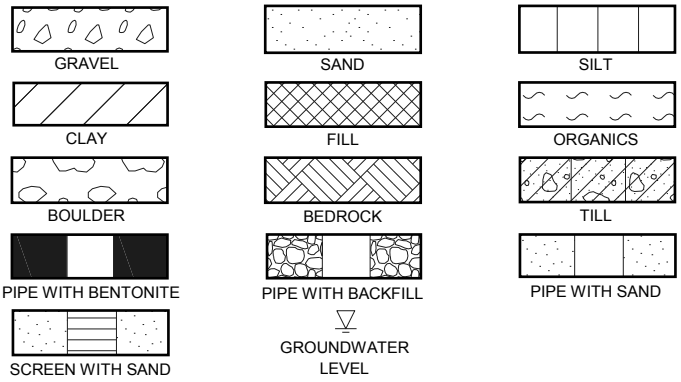
PENETRATION RESISTANCE

Standard Penetration Resistance, N
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 millimetres (30 in.) required to drive a 50 mm split spoon sampler for a distance of 300 mm (12 in.). For split spoon samples where less than 300 mm of penetration was achieved, the number of blows is reported over the sampler penetration in mm.

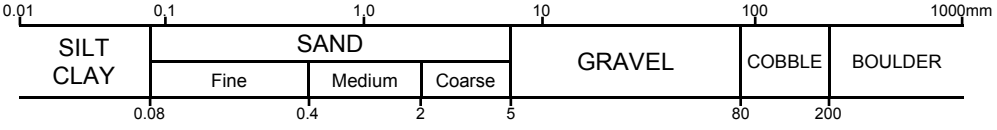
Dynamic Penetration Resistance
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive a 50 mm (2 in.) diameter 60° cone attached to 'A' size drill rods for a distance of 300 mm (12 in.).

WH	Sampler advanced by static weight of hammer and drill rods
WR	Sampler advanced by static weight of drill rods
PH	Sampler advanced by hydraulic pressure from drill rig
PM	Sampler advanced by manual pressure

COHESIONLESS SOIL Compactness		COHESIVE SOIL Consistency	
SPT N-Values	**Description**	**Cu, kPa**	**Description**
0-4	Very Loose	0-12	Very Soft
4-10	Loose	12-25	Soft
10-30	Compact	25-50	Firm
30-50	Dense	50-100	Stiff
>50	Very Dense	100-200	Very Stiff
		>200	Hard

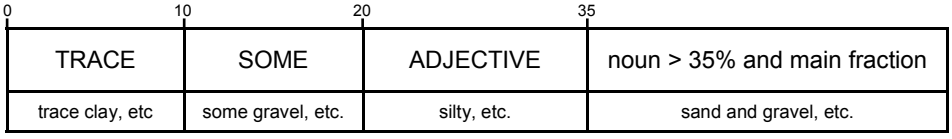


GRAIN SIZE



DESCRIPTIVE TERMINOLOGY

(Based on the CANFEM 4th Edition)



APPENDIX B

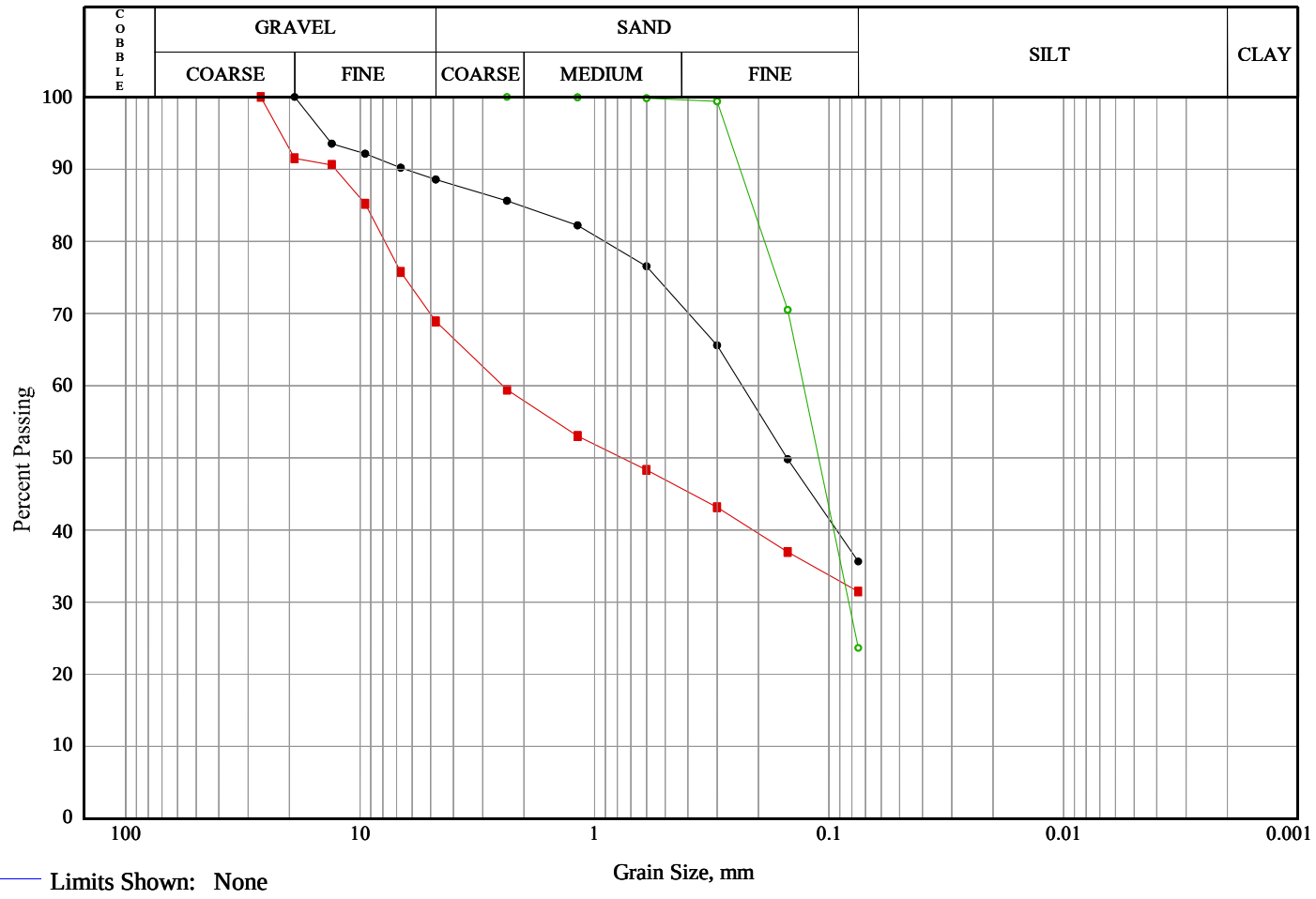
Laboratory Test Results
Grain Size Distribution Results

Report to: Parsons Corporation
Project: 100016.024 (March 13, 2025)

GEMTEC
Consulting Engineers and Scientists

Client:	Parsons Corporation
Project:	Geotechnical Investigation and Pavement Design - Parki
Project #:	100016024

Soils Grading Chart



Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
●—●	FILL MATERIAL	24-01	SA 1B	0.07-0.61	11.4	53.0	35.6	
■—■	FILL MATERIAL	24-01	SA 3	1.52-2.13	31.1	37.4	31.4	
○—○	FILL MATERIAL	24-11	SA 1B	0.20-0.61	0.0	76.4	23.6	

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
●—●	Sand and silt , some gravel	N/A	---	---	---	0.15	0.23	2.09	---
■—■	Gravelly silty sand	N/A	---	---	---	0.77	2.46	9.43	---
○—○	Silty sand	N/A	---	---	0.08	0.11	0.13	0.21	---

Note: More information available upon request

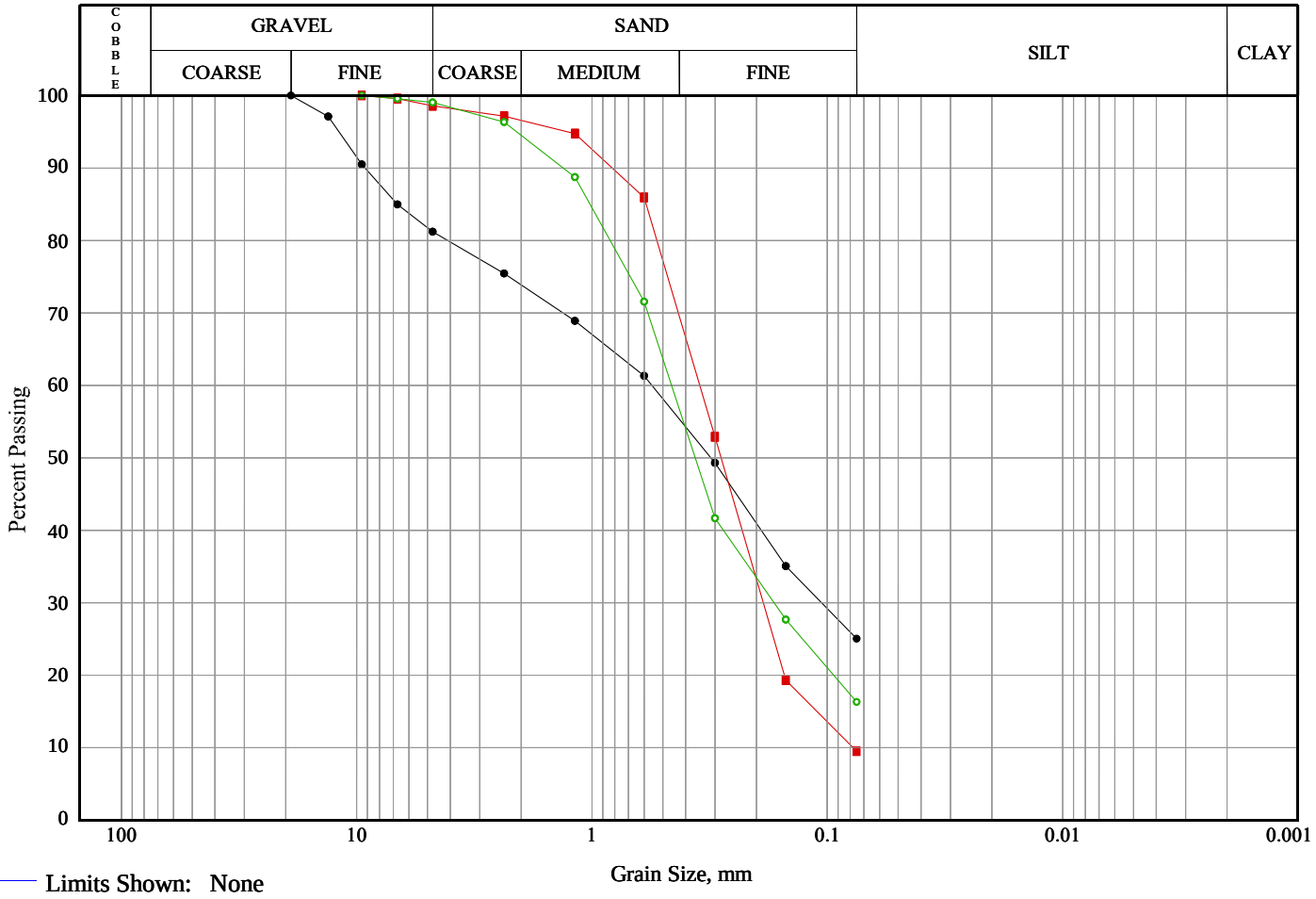
GEMTEC
Consulting Engineers and Scientists

Client: Parsons Corporation

Project: Geotechnical Investigation and Pavement Design - Parki

Project #: 100016024

Soils Grading Chart



Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
●	SILTY SAND	24-04	SA 2	0.76-1.37	18.8	56.2	25.0	
■	SAND	24-04	SA 4	2.28-2.89	1.4	89.1	9.5	
○	SAND	24-11	SA 2	0.76-1.37	1.0	82.8	16.3	

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
●	Silty sand , some gravel	N/A	---	---	0.11	0.31	0.56	6.72	---
■	Sand , trace gravel, trace silt	N/A	0.078	0.111	0.19	0.28	0.35	0.59	---
○	Sand , some silt , trace gravel	N/A	---	---	0.17	0.36	0.46	1.02	---

Note: More information available upon request

experience • knowledge • integrity

civil	civil
geotechnical	géotechnique
environmental	environnementale
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

expérience • connaissance • intégrité