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Preliminary Geotechnical Investigation
Proposed YMCA
555 Bayview Drive
Barrie, Ontario

GEMTEC Project: 100876.050

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Submitted to:

YMCA Simcoe/Muskoka
1-7315 Yonge Street
Innisfil, Ontario
L9S 4V7

Preliminary Geotechnical Investigation
Proposed YMCA
555 Bayview Drive
Barrie, Ontario

September 19, 2023
GEMTEC Project: 100876.050

experience • knowledge • integrity

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September 19, 2023 File: 100876.050 – Rev0

YMCA Simcoe/Muskoka
1-7315 Yonge Street
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Attention: Karen Pulla

Re: Preliminary Geotechnical Investigation
Proposed YMCA
555 Bayview Drive, Barrie, Ontario

Enclosed is our Preliminary Geotechnical Investigation Report for the proposed YMCA in the city of Barrie, Ontario. The report herein is based on the scope of work summarized in our proposal dated June 30, 2023. This report was prepared by Robert Nugent and Doug Chisholm, P.Eng., and reviewed by John Hagan, P.Eng.

Doug Chisholm, P.Eng.
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DC/JH/rn/af

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1.0 INTRODUCTION

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) has been requested by Tatham Engineering Limited (Tatham) to carry out a geotechnical site investigation to support the proposed YMCA building at 555 Bayview Drive in the City of Barrie, Ontario, herein referred to as the "Site".

The purpose of the geotechnical investigation was to identify the general subsurface conditions at the Site by means of a limited number of boreholes and based on the factual data obtained, to provide engineering comments and recommendations on the geotechnical design aspects of the project (building foundations, site servicing and pavement structure), including construction considerations that could influence design decisions. The recommendations contained herein should be considered preliminary in nature and will need to be reviewed and updated as the design of the project advances.

In addition, monitoring wells were installed in three of the boreholes during our investigation to support a hydrogeological investigation and subsequent reporting to be carried out by Tatham.

Geo-environmental services (observations, recording, testing or assessment of the environmental conditions of the soil and ground water) including excess soil management in accordance with Ontario Regulation 406/19 were completed by Tatham concurrently and will be reported under separate cover.

2.0 PROJECT DESCRIPTION

2.1 Background

The subject property is approximately four acres located north of the existing Paul Sadlon Arena (555 Bayview Drive) within the existing parking lot northeast of the intersection of Mapleview Drive East and Bayview Drive. The proposed development consists of a two-storey Centre of Community and associated parking.

The currently proposed building footprint is about 32,000 sq. ft.

2.2 Site Geology and Topography

A review of surficial geology maps of the area indicates that the site geology is comprised of foreshore glaciolacustrine sediments, consisting predominantly of sands and gravels with minor silts and clays. The results of the drilling investigation are generally consistent with the geological mapping.

The topography of the site is sloping from a west boundary to the east boundary of the site. An unnamed watercourse is located to the south connecting Lovers Creek located about 2 km east of the project site.

3.0 METHODOLOGY

The field work for the site investigation was carried out on August 1, and 2, 2023. A total of five boreholes (noted as Boreholes BH23-1 to BH23-5) were advanced through the existing parking lot surface into the underlying soil to depths of approximately 6.7 m below existing ground surface (bgs). The approximately locations of the boreholes are shown on the enclosed Borehole Location Plan (refer to Figure 1 in Appendix B).

Co-ordination for clearances of underground utilities was provided by GEMTEC. The boreholes were drilled cognizant of the identifiable underground utilities.

The boreholes were advanced with a truck mounted drill rig using hollow stem augers supplied and operated by Walker Drilling Limited of Utopia, Ontario.

Standard Penetration Tests (SPT) were carried out in the boreholes and samples of the soils encountered were recovered using conventional 38-milimeter (mm) internal diameter split spoon sampling equipment driven by an automatic hammer in accordance with the SPT procedures outlined in ASTM International Standard D1586. The split-spoon samplers used in the investigation limits the maximum particle size that can be sampled and tested to about 38 mm. Therefore, particles or objects that may exist within the soils that are larger than this dimension were not sampled or represented in the grain size distributions. The results of the in situ field tests (i.e., SPT “N”-values), as presented on the Record of Borehole sheets (Appendix C) and in subsequent sections of this report, are the values measured directly in the field and are unfactored / uncorrected.

The boreholes were backfilled and sealed upon completion in accordance with the requirements detailed in the Revised Regulations of Ontario (R.R.O.) 1990, Regulation 903 (as amended) of the Ontario Resources Act.

The fieldwork was supervised throughout by a member of GEMTEC’s engineering staff who directed the drilling operations, logged the samples, and observed the in situ testing. Following the fieldwork, the soil samples were returned to GEMTEC’s laboratory for examination by a geotechnical engineer. Selected samples of the soil were tested for water content and grain size distribution, as applicable.

Descriptions of the subsurface conditions observed in the boreholes are provided on the Record of Borehole sheets in Appendix C. The results of the laboratory tests on soil samples are also provided on the Record of Borehole sheets (Appendix C), and detailed laboratory testing results are presented in Appendix D.

The borehole locations were identified using existing site features and should be considered approximate. The borehole elevations were advanced from existing ground surface and elevations were estimated based on drawings provided by Tatham.

4.0 SUBSURFACE CONDITIONS

As previously indicated, the soil, and groundwater conditions identified in the boreholes are presented on the Record of Borehole sheets in Appendix C. The Record of Borehole sheets indicate the subsurface conditions at the specific borehole locations only. Boundaries between zones on the Record of Borehole sheets are often not distinct, but rather are transitional and have been interpreted from discontinuous drilling observations. The precision with which subsurface conditions are indicated depends on the method of drilling, the frequency and recovery of samples, the method of sampling, and the uniformity of the subsurface conditions. Subsurface conditions at locations other than the boreholes may vary from the conditions encountered in the boreholes, both laterally and with depth. In addition to soil variability, fill of variable physical and chemical composition is present across the site area which is associated with the previous construction of the existing parking lot.

The groundwater conditions described in this report refer only to those observed at the place and time of observation, as noted in the report. These conditions may vary seasonally or as a result of construction activities in the area.

The soil and rock descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil and rock involves judgement and GEMTEC does not guarantee descriptions as exact but infers accuracy to the extent that is common in current geotechnical practice.

The subsurface soil conditions at the site generally comprise of pavement, near-surface fill materials associated with the roadway structure, underlain by a native sand to silty sand deposits. The following presents an overview of the subsurface conditions encountered in the boreholes advanced during this investigation.

4.1 Asphalt

The existing asphaltic concrete pavement thickness recorded at the Site was approximately 60 mm.

Granular thickness below the asphalt ranged from about 450 mm to 600 mm thickness. It should be noted that a distinguishable granular base or subbase layer was not present in any of the boreholes.

4.2 Fill

Below the asphalt in all the boreholes, a fill unit was encountered comprised of sand with varying gravel and silt contents to silty sand. The fill extended to depths ranging from 1.4 to 2.4 m bgs and was penetrated in all boreholes.

SPT carried out in the fill materials resulted in SPT N-values ranging from 14 to 58 blows per 0.3 m of penetration, which indicates a compact to very dense state. The natural water content values measured on samples of the fill ranged from about 3 to 11 percent.

A grain size distribution tests was undertaken on one of the samples of the fill from Borehole BH23-2. The results are provided in Appendix D and summarized in Table 4.2 below.

Table 4.2 – Summary of Grain Size Distribution Test (Fill Material)

Location	Sample Number	Sample Depth (m)	Gravel (%)	Sand (%)	Silt / Clay (%)
BH23-2	1	0.06 – 0.6	42.8	51.3	5.9

4.3 Silty Sand

Underlying the fill unit, a native silty sand deposit was present in Borehole BH23-3. The silty sand deposit was encountered at a depth of about 1.5 m bgs. The silty sand layer had an approximate thickness of 0.7 m and was fully penetrated at about 2.2 m depth bgs.

A single SPT was carried out in the silty sand deposit and resulted in a SPT N-value of 20 blows per 0.3 m of penetration, which indicates a compact state. The natural water content value measured on the sample of the silty sand was about 8 percent.

A grain size distribution tests were undertaken on one of the samples of the silty sand from Borehole BH23-3. The results are provided in Appendix D and summarized in Table 4.3 below.

Table 4.3 – Summary of Grain Size Distribution Test (Silty Sand)

Location	Sample Number	Sample Depth (m)	Gravel (%)	Sand (%)	Silt / Clay (%)
BH23-3	3	1.5 – 2.2	6.2	49.4	44.4

4.4 Sand

Underlying the fill unit in Boreholes BH23-1, BH23-2, BH23-4 and BH23-5 and the silty sand deposit in Borehole BH23-3, a native sand deposit was present. The sand deposit was encountered at depths ranging from 1.4 m to 2.4 m bgs. Thickness of the sand layer ranged from 4.3 m to 5.3 m. All Boreholes were terminated within the native sand deposit.

SPT carried out in the sand deposit resulted in SPT N-values ranging from 6 blows per 0.3 m of penetration to 50 blows per 0.1 m of penetration, which indicates a loose to very dense state. The natural water content values measured on samples of the sand ranged from about 2 to 5 percent.

Grain size distribution tests were undertaken on four of the samples of the sand from Boreholes BH23-1, BH23-3, BH23-4 and BH23-5. The results are provided in Appendix D and summarized in Table 4.4 below.

Table 4.4 – Summary of Grain Size Distribution Test (Sand)

Location	Sample Number	Sample Depth (m)	Gravel (%)	Sand (%)	Silt / Clay (%)
BH23-1	5	3.0 – 3.7	1.4	94.0	4.6
BH23-3	7	4.6 – 5.2	1.7	92.0	6.3
BH23-4	6	3.8 – 4.4	8.3	82.1	9.6
BH23-5	8	6.1 – 6.7	0.1	92.9	7.0

4.5 Groundwater Levels

Upon completion of drilling, groundwater was not encountered in any of the boreholes.

From discussion with the Tatham hydrogeological team, it is understood that the wells were observed to be during a subsequent site visit as part of Tatham's hydrogeological investigation.

It should be noted that groundwater levels will fluctuate with seasonal changes and may be higher during wet periods of the year such as the early spring or following periods of heavy precipitation.

5.0 GEOTECHNICAL RECOMMENDATIONS AND CONSIDERATIONS

The following sections of the report provide guidance on the geotechnical engineering design aspects of the project based on our interpretation of the boreholes advanced as part of the site investigation. It is stressed that the information in the following sections is provided for the guidance of the designers and is intended for this project only. If the project is modified in concept, location or elevation, or if the project is not initiated within eighteen months of the date of the report, GEMTEC should be given an opportunity to confirm that the recommendations are still valid. Once the actual development plans and design details are available, the results of the preliminary investigation should be reviewed, and an additional / detailed geotechnical / hydrogeological site investigation should be carried out as required.

Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety, and equipment capabilities. GEMTEC will not assume any responsibility for construction-related decisions made by contractors on the basis of this report.

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at this Site. The presence or implications of possible surface and/or subsurface contamination resulting from previous uses or activities of this site or adjacent properties, and/or resulting from the introduction onto the site from materials from offsite sources are outside the terms of reference for this report and have not been investigated or addressed herein.

5.1 Site Preparation and Grading

The existing topography was observed to be varied in elevation, ranging from elevation EL. 284.0 to 286.5 m and, in this regard, there is potential that engineered fill may be required to raise grades locally to achieve the proposed finished elevations.

Recommendations for engineered fill can be provided during the detailed design stage. Preliminary comments are with respect to general site grading and engineered fill are provided below.

- All surficial asphalt, vegetation, topsoil, and existing fill should be carefully removed within the proposed building area down to competent native soils, subject to geotechnical review at the time of construction.
    - Asphalt thicknesses were measured at five locations and was 60 mm and the actual thicknesses across the site may vary from those measured.
    - Material that has been reworked and disturbed by maintenance activities or site clearing must also be stripped / removed and, if appropriate, can be reused (i.e., not containing organic matter, deleterious material or moisture contents above optimum for compaction).
- The excavated inorganic soil will generally comprise of existing silty sand to sand fill and native sand which are considered suitable for reuse as engineered fill. Excavated materials should be segregated and stockpiled separately, based on geotechnical review.
- The exposed subgrade soils should be heavily proofrolled to target 100 percent Standard Proctor Maximum Dry Density (SPMDD) for building areas and 95 percent SPMDD for paved areas while under geotechnical review.
    - It should be noted that localized areas of softer / loose soil conditions may be present on site in areas with lower grades where surface water is or may have naturally collected or travelled (i.e., ditched, swales).
- Following geotechnical review and approval of the subgrade, the approved engineered fill material should be placed in maximum 200 mm loose lift thick and compacted to 100 percent SPMDD for building areas and 95 percent SPMDD for paved areas. Imported material to raise grades should comprise of either Granular B Type I or Select Subgrade Material (SSM) in accordance with OPSS.MUNI 1010. If wet subgrade conditions are present, the use of Granular B Type II may be required. An increased initial lift thickness may also be required, subject to geotechnical review.

- Engineered fill construction should be carried out under full-time field supervision by GEMTEC to approve subgrade preparation, backfill materials, placement and compaction procedures, and to verify that the minimum specified degree of compaction is achieved throughout.

5.2 Foundation Design

It is understood that the proposed site development includes a new YMCA building. Based on our understanding and for the purposes of this report, the proposed YMCA building is anticipated to be two stories and the founding depth is currently unknown. However, Tatham noted that Martin Simmons Sweers Architects provided that the building is anticipated to be shallow footings with a maximum excavation depth of 3.6 m bgs.

It should be noted that our foundation recommendations are based on the assumption that no former excavation, existing underground utility or structure is within, or intercepts, the zone of influence of the proposed footings. The zone of influence for the proposed footings can be described as any line drawn from the underside edge of the footing downward and outward at an inclination of 1 horizontal to 1 vertical (45 degrees to the horizontal). Consideration should be given to maintaining a horizontal buffer of 0.5 m from the face of the footing.

Complete removal of any existing or remaining foundations, if encountered, from either previous structures or underground utilities or lowering of the founding elevation (if appropriate) may be required, subject to review by GEMTEC at the time of construction. Consideration should be given to providing GEMTEC the proposed construction drawings for review prior to construction to aid in mitigating potential construction issues and delay claims.

Construction of stepped footings should be in accordance with the current Ontario Building Code, or as designed by a structural engineer.

5.2.1 Frost Depth

The foundations for the proposed building should be provided with at least 1.6 m of earth cover for frost protection purposes. Alternatively, the required frost protection could be provided by means of a combination of earth cover and extruded polystyrene insulation. Further details regarding insulation of foundations can be provided at the detailed design stage, if necessary.

5.2.2 Shallow Foundations

The proposed development will require site clearing and potentially engineered fill to support footings. The existing fill materials including, if encountered, topsoil and deleterious materials are not considered suitable for the support of foundations and should be removed from the proposed building footprint.

Based on the topographic plan provided, ground surface elevations within the building footprint range from about elevation El. 284.0 m to El. 286.5 m (averaging about El. 285.0 m).

Based on the anticipated nominal footing depth of 1.6 m bgs, conventional shallow footing construction would result in underside of footing at about elevations of El. 282.4 to 284.9 m. Footings should be extended down to native non-cohesive (silty sand / sand) deposits capable of providing the required bearing capacity and / or footings sized appropriately to suit the available bearing capacity. Alternatively, footings can be founded on engineered fill constructed as noted above.

It is understood that only minor grade adjustments will be completed / required for the proposed building.

Conventional shallow footing construction would be feasible on the native non-cohesive sand deposits and / or engineered fill constructed as noted above at about elevations El. 282.4 to 284.9 m (assuming minimum 1.6 m bgs). Based on the anticipated subsurface conditions, a recommended factored Ultimate Limit State (ULS) bearing resistance of 225 kPa and unfactored Serviceability Limit State (SLS) bearing reaction of 150 kPa (based on 25 mm of settlement) can be used for preliminary design.

It is understood through discussion with the Tatham project team that excavation depth may extend up to 3.6 m bgs (about elevations El. 280.4 to 282.9 m). Based on the anticipated subsurface conditions at this depth, a recommended factored Ultimate Limit State (ULS) bearing resistance of 450 kPa and unfactored Serviceability Limit State (SLS) bearing reaction of 300 kPa (based on 25 mm of settlement) can be used for preliminary design. Increased bearing capacity is available at greater depths and be assessed by GEMTEC upon request.

The provided factored ULS bearing resistance value is based on the limit state resistance factor of 0.5. The geotechnical reaction at SLS provided are based on anticipated maximum total and differential settlement of 25 mm and 19 mm, respectively. The recommended bearing resistances and reactions provided above are based on a minimum equivalent footing width of 600 mm.

5.2.3 Seismic Considerations

The seismic site classification presented below is based on the physical borehole information obtained at depths of less than 30 m and on general knowledge of the local geology and physiography. In this regard, GEMTEC's drilling program included boreholes drilled to depths up to about 6.7 m below the existing ground surface. Based on the results of the current geotechnical site investigation and the local geological conditions, a Site Class D is appliable for Seismic Site Response classification for the site based on Table 4.1.8.4.A of the Ontario Building Code (2012).

Should optimization of the site class be recommended by the structural engineer, in situ geophysical testing should be carried out at the site, although a higher site class cannot be guaranteed.

5.3 Floor Slab

Based on the exterior grades, a minor grade raise will be required for the proposed building. The grade raise should be constructed as engineered fill as detailed above.

Floor slab-on-grade construction is feasible on the native soils and/or engineered fill.

A minimum 200 mm thick base layer of crushed stone with a nominal aggregate size of 19 mm (OPSS.MUNI 1010 Granular A) is recommended directly under the slab. The material should be compacted to a 100 percent SPMDD while under geotechnical review. A polyethylene vapour barrier sheet should be incorporated under the ground floor slab if a vapour sensitive floor finish is planned.

Exterior grades should be established to promote surface drainage away from the building.

5.4 Pavement Structure

The pavement subgrade is assumed to be sand to silty sand which is considered low frost susceptible. The surface of the material at subgrade level should be heavily proofrolled under the supervision of GEMTEC personnel to identify any soft, loose or otherwise deleterious areas requiring sub-excavation and replacement with suitable fill.

Site-specific traffic information was not available at the time of preparation of this report. Based on the provided concept plan, majority of the paved areas which are anticipated to be visitor and staff parking areas which will only be used by passenger vehicles and other lightly loaded vehicles.

Based on the results of this investigation and the anticipated frost-susceptibility characteristics of the subgrade soils, the recommended flexible pavement designs are as follows:

Table 5.4 – Recommended Pavement Structures

Material	Light Duty (mm)	Heavy Duty / Fire Route (mm)
Asphalt – Surface Course (HL3 or SP12.5)	40	50
Asphalt – Binder Course (HL8 or SP19.0)	60	80
Granular A Base	150	150
Granular B Type I Subbase	300	450
Total Thickness	**550**	**730**

The proposed asphaltic concrete pavement mixtures should be designed with Performance Graded Asphalt Cement (PGAC) 58-28.

The above pavement design is based on the assumption that the pavement subgrade has been adequately prepared and construction will be carried out during the dry time of the year. Adequate preparation of the subgrade includes trench backfill and any subgrade fill has been compacted to the specified compaction, the subgrade is graded with the required crossfall, drainage of the subgrade soils is provided, and the subgrade surface has not been disturbed by construction operations or precipitation. Further, construction should be carried out in the dry and not during periods of inclement weather. Depending on the actual conditions of the pavement subgrade at the time of construction, it may be necessary for additional sub-excavation, increased granular thickness, and / or the use of a geogrid reinforcement, subject to geotechnical review.

The proposed granular subbase and base should comprise of material conforming to OPSS.MUNI 1010 requirements for Granular B Type I and Granular A, respectively, and compacted to 100 percent SPMDD. Compaction of the granular materials should be carried out at a moisture content that is generally within about 2 percent of the material's optimum moisture content. The asphalt should be compacted in accordance with OPSS.MUNI 310 requirements. Laboratory testing of granular material and asphalt should be carried out by a Canadian Council of Independent Laboratories (CCIL) certified laboratory.

The new pavement structure thickness should be tapered at 10 horizontal to 1 vertical to match the existing pavement structure at tie in locations and transitions from light duty to heavy duty pavement structure. The transverse joints in the asphalt should be keyed in accordance with OPSS.MUNI 310 Clause 310.07.11.03 with a minimum 0.5 m wide stepped joint (where existing asphalt thickness permits).

5.5 Pavement Drainage Considerations

It should be noted that for the pavement to function properly, it is critical that provisions be made for water to drain out of and not collect in or below the pavement structure.

From a pavement design perspective, it is recommended that subdrains be incorporated in the design in conjunction with crowning of the final subgrade to promote drainage towards the pavement edge. Subdrains should be installed a minimum 300 mm below the design subgrade level. Reference should be made to OPSD 216.010, OPSD 216.020 and OPSD 216.021 for details relating to pipe location, filter fabric or sock, bedding and cover materials. To aid with minimizing potential differential frost movement between catch basins or maintenance holes and pavement structure, the catch basins/maintenance holes should be backfilled with free draining material with frost tapers.

5.6 Temporary Excavations

The overburden excavations for the proposed building construction and associated servicing will be carried out through the existing fill materials and into the native silty sand and sand deposits.

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 (1H:1V), or flatter, excavation slopes.

Conventional hydraulic excavation equipment would be expected to be suitable for excavation in the overburden soils; however, the soils are compact to very dense and may be difficult to excavate with smaller pieces of equipment. The native soils are glacially derived and as such should be expected to contain cobbles and boulders, which could affect excavations for the building and site servicing. The contractor should be made aware of the potential presence of cobbles and / or boulders within the overburden soils.

Excavation of the native soils above the groundwater are not anticipated to present any excavation constraints. In contrast, excavation in the native sand below the groundwater level could present challenges. Groundwater inflow from the sand deposits could cause sloughing of the sides of the excavation and disturbance to the soils at the bottom of the excavation. Flatter side slopes, of 3H:1V, may be required if excavation is required below the groundwater level. All excavated material should be stockpiled well away (i.e., minimum 2 m) from the sides of the excavation.

If there is insufficient space to excavate temporary open cuts, it is recommended that a shoring system consisting of braced steel sheet piles or potentially a slide rail system designed by a Professional Engineer including assessment of the potential for basal heave be utilized. If shoring is implemented at the Site, the requirements of OPSS.MUNI 539 should be followed. The design of temporary works is (entirely) the responsibility of the contractor.

5.7 Installation of Underground Services

The following comments are provided based on the assumption that the underground service excavations will extend to a maximum depth of about 4 m bgs following final grading.

5.7.1 Pipe Bedding and Cover

The native silty sand and sand deposits are anticipated at the invert level which is generally considered satisfactory for pipe support. Where soft / loose soil or other deleterious materials are encountered at the design invert level, it may be necessary to sub-excavate and replace, re-compact or increase the granular bedding thickness, subject to geotechnical field review and approval.

The bedding and cover for the proposed utilities should consist of least 150 mm of OPSS.MUNI 1010 Granular A backfill placed in accordance with the applicable OPSD for the type of underground utility installed.

Bedding, and cover materials should be placed in lifts not exceeding 200 mm thick and compacted to at least 95 percent SPMDD.

The use of clear crushed stone or high-performance bedding materials as a bedding layer shall not be permitted anywhere on this project since fine particles from the fill materials and native deposits could potentially migrate into the voids of the material and cause loss of lateral pipe support and pipe / ground settlement.

5.7.2 Trench Backfill

It is anticipated that most of the inorganic overburden materials (fill and native non-cohesive soils) encountered during the subsurface investigation will be acceptable for reuse as trench backfill. Topsoil, organic, wet, frozen, oversized (greater than 150 mm in diameter) or other deleterious material should be wasted from the trench. In addition, any boulders or cobbles should be removed from the trench backfill materials. Backfilling operations during cold weather should avoid inclusions of frozen lumps of material, any frozen soil, snow and ice.

In order to reduce the potential for differential frost heaving between the area over the trench and the adjacent hard surfaced area, it is recommended that the backfill material match the soil exposed on the trench walls. The depth of frost penetration in exposed areas can normally be taken as 1.6 m bgs. Backfill below the zone of seasonal frost penetration could consist of either acceptable excavated soil or imported granular material conforming to OPSS.MUNI 1010 Select Subgrade Material (SSM).

To minimize future settlement of the backfill and achieve an acceptable subgrade for the areas of hard surfacing, the trench backfill should be placed in maximum 300 mm loose lifts and uniformly compacted to at least 95 per cent of the material's SPMDD. Where the backfill forms the subgrade for access roadways or parking areas, the upper 1 m of backfill below the pavement structure should be within 2 percent of the material's optimum moisture content in order to achieve the specified compaction and mitigate potential subgrade instability issues.

The specified density for compaction of the backfill materials may be reduced where the trench backfill is not located below or in close proximity to existing or future areas of hard surfacing and/or structures, provided that some settlement above the trench is acceptable.

The actual water content of the soil at the time of placement and compaction may differ from the soils natural state. The contractor should have contingency plans for wetting or drying backfill soils as needed to achieve the required compaction.

5.8 Potential Impacts of Groundwater

Groundwater was not observed in the open boreholes during the site investigation and not reported by Tatham during a subsequent site visit. Based on an assumed maximum excavation depth of about 3.6 m, significant groundwater inflow into excavations is not anticipated.

At this time, it is not anticipated that temporary construction dewatering may be required, however, in-excavation water controls (i.e., localized sump pumping techniques) may be necessary to manage incidental precipitation and potential perched water conditions. Following detailed design and construction plans for servicing have been finalized, the dewatering requirements for the site should be re-assessed and, if necessary, a formal discharge and monitoring plan developed. It is understood that this will be completed by Tatham through the hydrogeological assessment for the Site.

As excavation activities are anticipated to occur above the observed water table, no impacts are expected to occur to the groundwater levels at the site due to the construction operations.

It is noted that groundwater levels may be higher during wet periods of the year, such as the early spring or following periods of precipitation. It is recommended that the seasonally high groundwater levels are confirmed following the spring freshet. This will also aid with determining potential impact to the groundwater levels at the site.

6.0 ADDITIONAL CONSIDERATIONS

6.1 Effects of Construction Induced Vibration

Some of the construction operations (such as granular material compaction, excavation, etc.) will cause ground vibration on and off of the Site. The vibrations will attenuate with distance from the source but may be felt at nearby structures. The magnitude of the vibrations will be much less than that required to cause damage to the nearby structures or services in good condition. Construction vibration monitoring can be discussed further prior to construction or following a vibration related complaint.

6.2 Corrosivity Considerations

Consideration should be given to performing analytical testing on the fill and native soils to assess the potential for corrosion of ductile iron and sulphate attack on concrete. Alternatively, allowance should be made within the design and/or contract specifications for protection of concrete and steel elements which will be in contact with the fill and native soil materials.

6.3 Monitoring Well Abandonment

All monitoring wells installed as part of this investigation should be decommissioned by a licensed well technician. The well abandonment could be carried out in advance of, or during construction.

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.

Regards,

GEMTEC Consulting Engineers and Scientists Limited

Doug Chisholm, P.Eng.
Manager, Materials Testing - Barrie

John Hagan, P.Eng.
Branch Manager, Senior Geotechnical Engineer

APPENDIX A

Conditions and Limitations of this Report

GEMTEC
Consulting Engineers and Scientists

Conditions and Limitations of This Report

1. **Standard of Care:** GEMTEC has prepared this report in a manner consistent with generally accepted engineering or environmental consulting practice in the jurisdiction in which the services are provided at the time of the report. No other warranty, expressed or implied is made.
2. **Copyright:** The contents of this report are subject to copyright owned by GEMTEC, save to the extent that copyright has been legally assigned by us to another party or is used by GEMTEC under license. To the extent that GEMTEC owns the copyright in this report, it may not be copied without our prior written agreement for any purpose other than the purpose indicated in this report. The methodology (if any) contained in this report is provided to the Client in confidence and must not be disclosed or copied to third parties without the prior written agreement of GEMTEC. Disclosure of that information may constitute an actionable breach of confidence or may otherwise prejudice our commercial interests.
3. **Complete Report:** This report is of a summary nature and is not intended to stand alone without reference to the instructions given to GEMTEC by the Client, communications between GEMTEC and the Client and to any other reports prepared by GEMTEC for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. GEMTEC can not be responsible for use of portions of the report without reference to the entire report.
4. **Basis of Report:** This Report has been prepared for the specific site, development, design objectives and purposes that were described to GEMTEC by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document, subject to the limitations provided herein, are only valid to the extent that this report expressly addresses the proposed development, design objectives and purposes. Any change of site conditions, purpose or development plans may alter the validity of the report and GEMTEC cannot be responsible for use of this report, or portions thereof, unless GEMTEC is requested to review any changes and, if necessary, revise the report.
5. **Time Dependence:** If the proposed project is not undertaken by the Client within 18 months following the issuance of this report, or within the timeframe understood by GEMTEC to be contemplated by the Client, the guidance and recommendations within the report should not be considered valid unless reviewed and amended or validated by GEMTEC in writing.
6. **Use of This Report:** The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without GEMTEC's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, GEMTEC may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process.

   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.
7. **No Legal Representations:** GEMTEC makes no representations whatsoever 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 change. Such interpretations and regulatory changes should be reviewed with legal counsel.

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 and instructions and are not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
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 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, fills 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

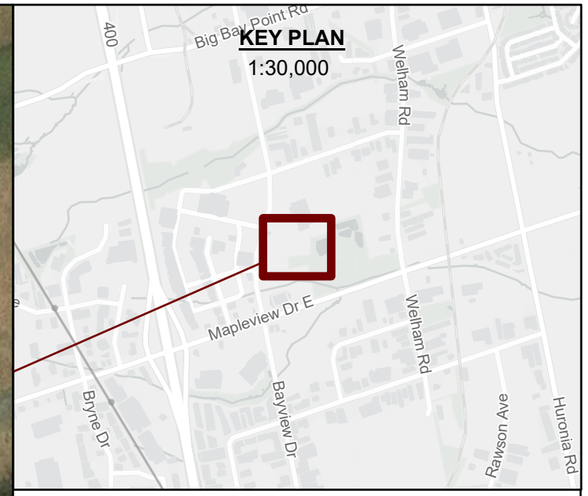
materially differ from those interpreted conditions considered in the preparation of GEMTEC's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in GEMTEC's report. Adequate field review, observation and testing 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.

APPENDIX B

Site Figures

Borehole Location Plan



Legend

BH # ◄—— BOREHOLE ID

APPROXIMATE BOREHOLE LOCATION

APPROXIMATE MONITORING WELL LOCATION

APPROXIMATE SITE BOUNDARY

NOTES:

1. Coordinate system: NAD83/ UTM zone 17N.
2. Geographic dataset source: Ontario GeoHub.
3. Contains information licensed under the Open Government Licence – Ontario.
4. Service Layer Credits: World Imagery: Maxar, Microsoft
Light Grey Canvas Background: City of Barrie, Province of Ontario, York Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

Scale:
1:1,150
0 15 30 60 90 Meters

Drawing
SITE PLAN

Client:
TATHAM ENGINEERING LIMITED

Project
PROPOSED YMCA
555 BAYVIEW DRIVE
BARRIE, ONTARIO

Drwn By:	S.J.	Chkd By:	R.N.
Project No.	100876.050	Revision No.	0
Date	SEPTEMBER 2023	**FIGURE: 1**	

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john.hagan@gemtec.ca

Folder: N:\Projects\100800\100876.050\Drafting\1. Drawings\GeoTechnicalInvestigation\100876_050_GeoTechInvestigation_YMCA_R0_2023_09_01\

APPENDIX C

Record of Boreholes

Abbreviations and Terminology Used on
Records of Boreholes
Record of Borehole Sheets BH23-1 to BH23-5

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

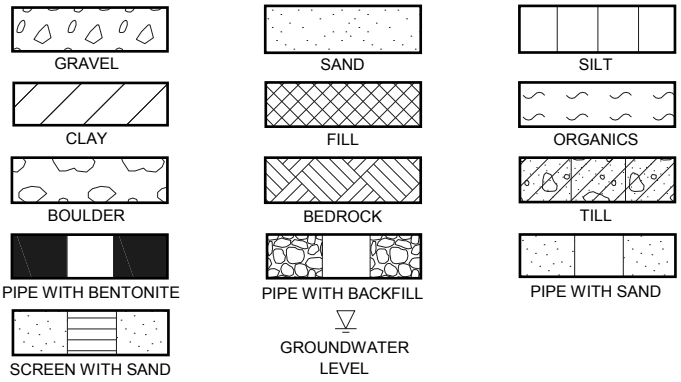
PENETRATION RESISTANCE

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.

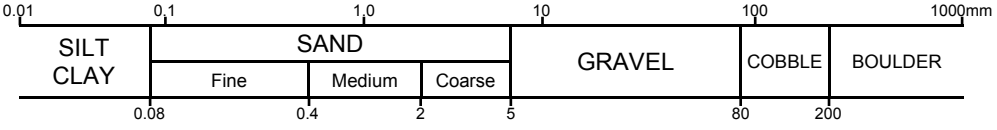
Dynamic Penetration Resistance
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive a 50 mm (2 in.) diameter 60° cone attached to 'A' size drill rods for a distance of 300 mm (12 in.).

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

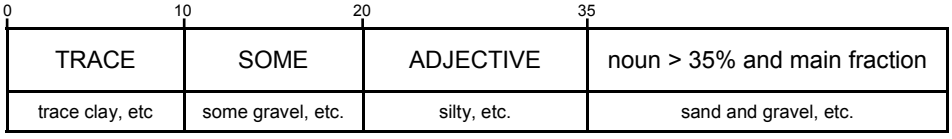


GRAIN SIZE



DESCRIPTIVE TERMINOLOGY

(Based on the CANFEM 4th Edition)



RECORD OF BOREHOLE BH23-1

CLIENT: Tatham Engineering Limited
PROJECT: Proposed YMCA, 555 Bayview Drive, Barrie, Ontario
JOB#: 100876.050
LOCATION: See Borehole Location plan

SHEET: 1 OF 1
DATUM: Unknown
BORING DATE: Aug 2 2023

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		284.00						
0		ASPHALT		0.06						
		FILL - (SP) SAND, some gavel, trace fines; brown; non-cohesive, moist			1	AS	0	-		
				283.31						
		FILL - (SM) SILTY SAND, trace gravel, trace plastic fines; brown; non-cohesive, moist, compact		0.69	2	SS	533	14		
1				282.55						
		(SP) SAND, trace gravel, trace non-plastic fines; brown to light brown; non-cohesive, moist, loose to very dense		1.45	3	SS	356	6		
2					4	SS	483	9		
	Power Auger / Hollow Stem Auger (OD)				5	SS	559	30	M	
3										
					6	SS	610	61		
4										
					7	SS	610	63		
5										
6					8	SS	559	52		
				277.29						
		End of Borehole		6.71						
7		Notes: 1. Borehole dry upon completion of drilling. 2. No cave upon the completion of drillng. 3. Borehole backfilled with mixture of bentonite and cuttings.								
8										

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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LOGGED: AW
CHECKED: RN

GEO - BOREHOLE LOG 100876.050_GEOTECH_GINT_R0_2023_08_11.GPJ GEMTEC 2018.GDT 9/1/23

RECORD OF BOREHOLE BH23-2

CLIENT: Tatham Engineering Limited
PROJECT: Proposed YMCA, 555 Bayview Drive, Barrie, Ontario
JOB#: 100876.050
LOCATION: See Borehole Location plan

SHEET: 1 OF 1
DATUM: Unknown
BORING DATE: Aug 1 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger / Hollow Stem Auger (OD)	Ground Surface		285.70				
		ASPHALT		0.06				
		FILL - (SP) SAND, some gravel to gravelly, trace non-plastic fines; brown; non-cohesive, dry, compact			1	AS	0	-
1		- becoming sand and gravel			2	SS	406	26
		FILL - (SM-SP) SILTY SAND to SAND, some gravel; brown; non-cohesive, dry, dense		284.25 1.45	3	SS	559	35
2		(SP) SAND, trace non-plastic fines; light brown; non-cohesive, very dense, dry		283.49 2.21	4	SS	508	60
3					5	SS	533	50
4					6	SS	559	61
5					7	SS	584	55
6					8	SS	0	84
				278.99				
7		End of Borehole		6.71				
8		Notes: 1. Borehole dry upon completion of drilling. 2. Piezometer installed as shown upon the completion of drilling.						

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: M

PIEZOMETER OR STANDPIPE INSTALLATION

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CHECKED: RN

GEO - BOREHOLE LOG 100876.050_GEOTECH_GINT_R0_2023_08_11.GPJ GEMTEC 2018.GDT 9/1/23

RECORD OF BOREHOLE BH23-3

CLIENT: Tatham Engineering Limited
PROJECT: Proposed YMCA, 555 Bayview Drive, Barrie, Ontario
JOB#: 100876.050
LOCATION: See Borehole Location plan

SHEET: 1 OF 1
DATUM: Unknown
BORING DATE: Aug 2 2023

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		285.40						Flush Mount
0	Power Auger / Hollow Stem Auger (OD)	ASPHALT		0.06						
		FILL - (SP) GRAVELLY SAND, trace to some non-plastic fines; brown; non-cohesive, moist, compact			1	AS	0	-		
					2	SS	610	26		
1				283.95						
		(SM) SILTY SAND, some gravel, some plastic fines; brown; non-cohesive, moist, compact		1.45	3	SS	483	20	MH	
2				283.19						Bentonite
		(SP) SAND, trace gravel, trace non-plastic fines; brown; non-cohesive, moist, dense to very dense		2.21	4	SS	508	58		
					5	SS	559	63		
3										
					6	SS	559	48		
4										Filter Sand
					7	SS	584	44	M	
5										50 mm dia. well screen
6					8	SS	584	54		
				278.69						
		End of Borehole		6.71						
7		Notes: 1. Borehole dry upon completion of drilling. 2. Piezometer installed as shown upon the completion of drilling.								
8										

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: RN

GEO - BOREHOLE LOG 100876.050_GEOTECH_GINT_R0_2023_08_11.GPJ GEMTEC 2018.GDT 9/1/23

RECORD OF BOREHOLE BH23-4

CLIENT: Tatham Engineering Limited
PROJECT: Proposed YMCA, 555 Bayview Drive, Barrie, Ontario
JOB#: 100876.050
LOCATION: See Borehole Location plan

SHEET: 1 OF 1
DATUM: Unknown
BORING DATE: Aug 1 2023

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
0	Power Auger / Hollow Stem Auger (OD)	Ground Surface		285.10						
		ASPHALT		0.06	1	AS	0	-		
		FILL - (SW) GRAVELLY SAND, trace non-plastic fines; brown; non-cohesive, dry		284.41						
1		FILL - (SM) SILTY SAND, trace to some gravel, trace plastic fines; brown; non-coheisve, moist, compact to very dense		0.69	2	SS	584	15		
					3	SS	483	58		
2				282.74						
		(SP) SAND, trace to some silt, trace gravel; light brown, non-cohesive, moist, very dense		2.36	4	SS	559	70		
3					5	SS	584	57		
4					6	SS	610	65	M	
5					7	SS	610	52		
6					8	SS	610	64		
				278.39						
7		End of Borehole		6.71						
8		Notes: 1. Borehole dry upon completion of drilling. 2. Borehole backfilled with mixture of bentonite and cuttings. 3. No cave upon the completion of drillng.								

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: RN

GEO - BOREHOLE LOG 100876.050_GEOTECH_GINT_R0_2023_08_11.GPJ GEMTEC 2018.GDT 9/1/23

RECORD OF BOREHOLE BH23-5

CLIENT: Tatham Engineering Limited
PROJECT: Proposed YMCA, 555 Bayview Drive, Barrie, Ontario
JOB#: 100876.050
LOCATION: See Borehole Location plan

SHEET: 1 OF 1
DATUM: Unknown
BORING DATE: Aug 1 2023

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		284.30						Flush Mount
0	Power Auger, Hollow Stem Auger (OD)	ASPHALT		0.06						
		FILL - (SP) SAND, some gravel to gravelly, trace non-plastic fines; brown; non-coheisve, compact			1	AS	0	-		
1					2	SS	483	27		
				282.93						
		(SP) SAND, no to trace gravel, trace non-plastic fines; light brown; non-coheisve, very dense		1.37						
2					3	SS	533	50 / 0.13		Bentonite
					4	SS	610	50 / 0.13		
3					5	SS	610	80		
4					6	SS	559	56		Filter Sand
					7	SS	584	51		
5										50 mm dia. well screen
6					8	SS	584	65	M	
				277.59						
		End of Borehole		6.71						
7		Notes: 1. Borehole dry upon completion of drilling. 2. Piezometer installed as shown upon the completion of drilling.								
8										

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: RN

GEO - BOREHOLE LOG 100876.050_GEOTECH_GINT_R0_2023_08_11.GPJ GEMTEC 2018.GDT 9/1/23

APPENDIX D

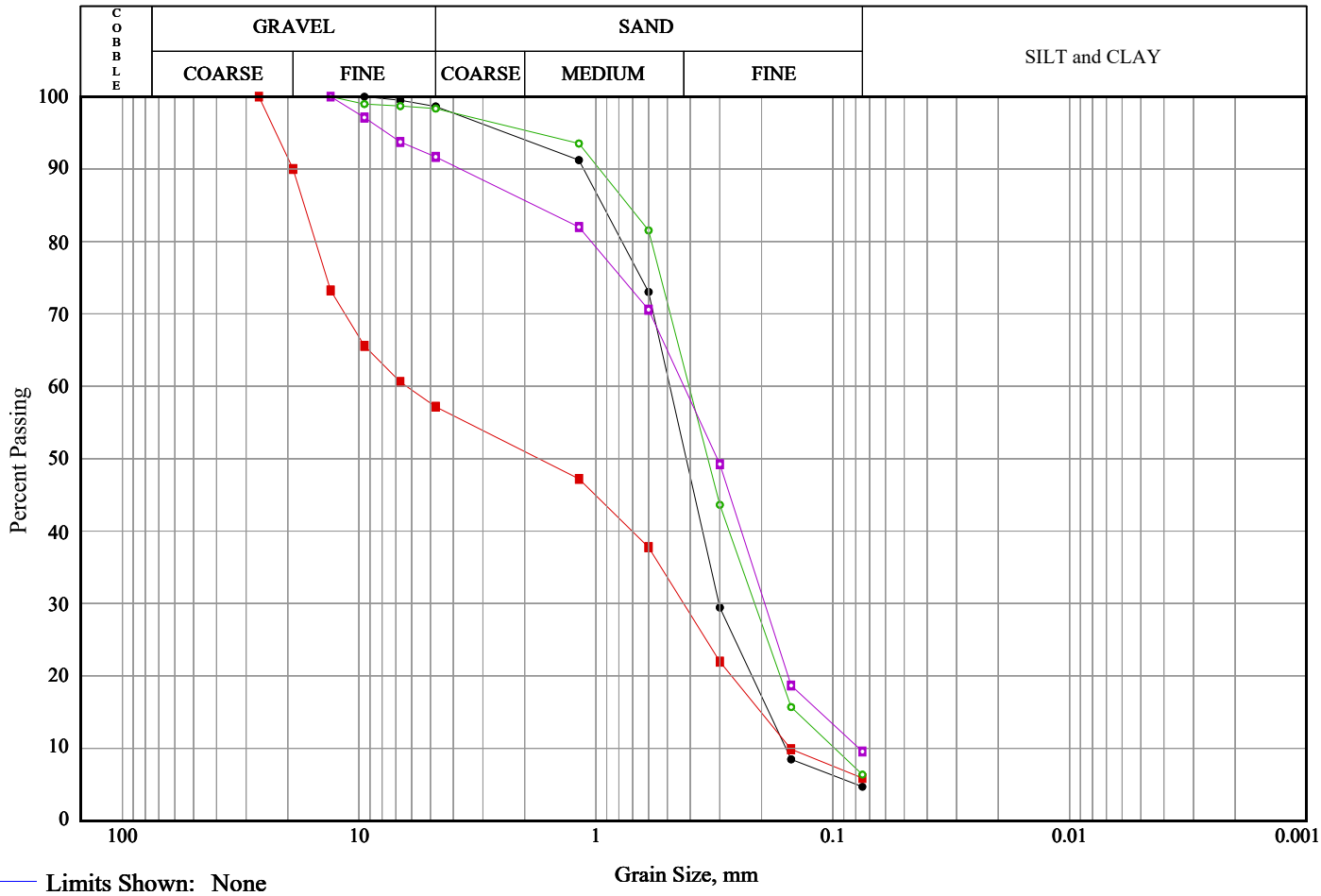
Laboratory Testing Figures

Soils Grading Chart

Plasticity Chart

GEMTEC Consulting Engineers and Scientists	Client: Tatham Engineering Limited	Soils Grading Chart
	Project: Proposed YMCA, 555 Bayview Drive, Barrie, Ontario	
	Project #: 100876050	

Note: More information available upon request



Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt and Clay
	(SP) SAND	BH23-1	SA-5	3.0 - 3.7	1.4	94.0	4.6
	(SP) SAND	BH23-2	SA-1	0 - 0.6	42.8	51.3	5.9
	(SP) SAND	BH23-3	SA-7	4.6 - 5.2	1.7	92.0	6.3
	(SP) SAND	BH23-4	SA-6	3.8 - 4.4	8.3	82.1	9.6

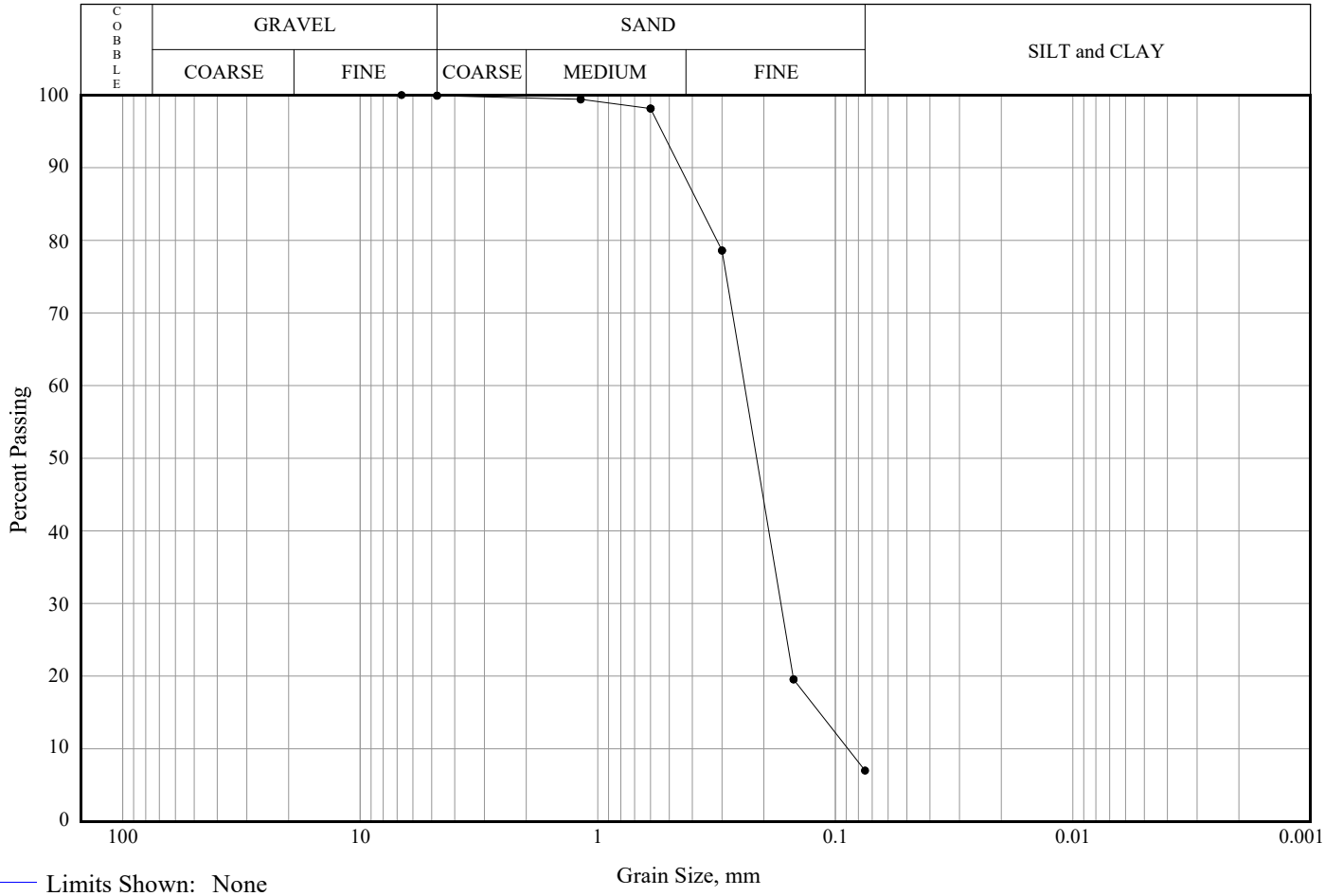
Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
	Sand , trace gravel, trace silt	N/A	0.16	0.19	0.30	0.42	0.49	0.94	---
	Sand and gravel , trace silt	N/A	0.15	0.20	0.43	1.74	6.31	17.05	---
	Sand , trace gravel, trace silt	N/A	0.10	0.14	0.21	0.34	0.40	0.73	---
	Sand , trace gravel, trace silt	N/A	0.08	0.11	0.19	0.31	0.43	1.82	---

GEMTEC
Consulting Engineers and Scientists

Client:	Tatham Engineering Limited
Project:	Proposed YMCA, 555 Bayview Drive, Barrie, Ontario
Project #:	100876050

Soils Grading Chart

Note: More information available upon request



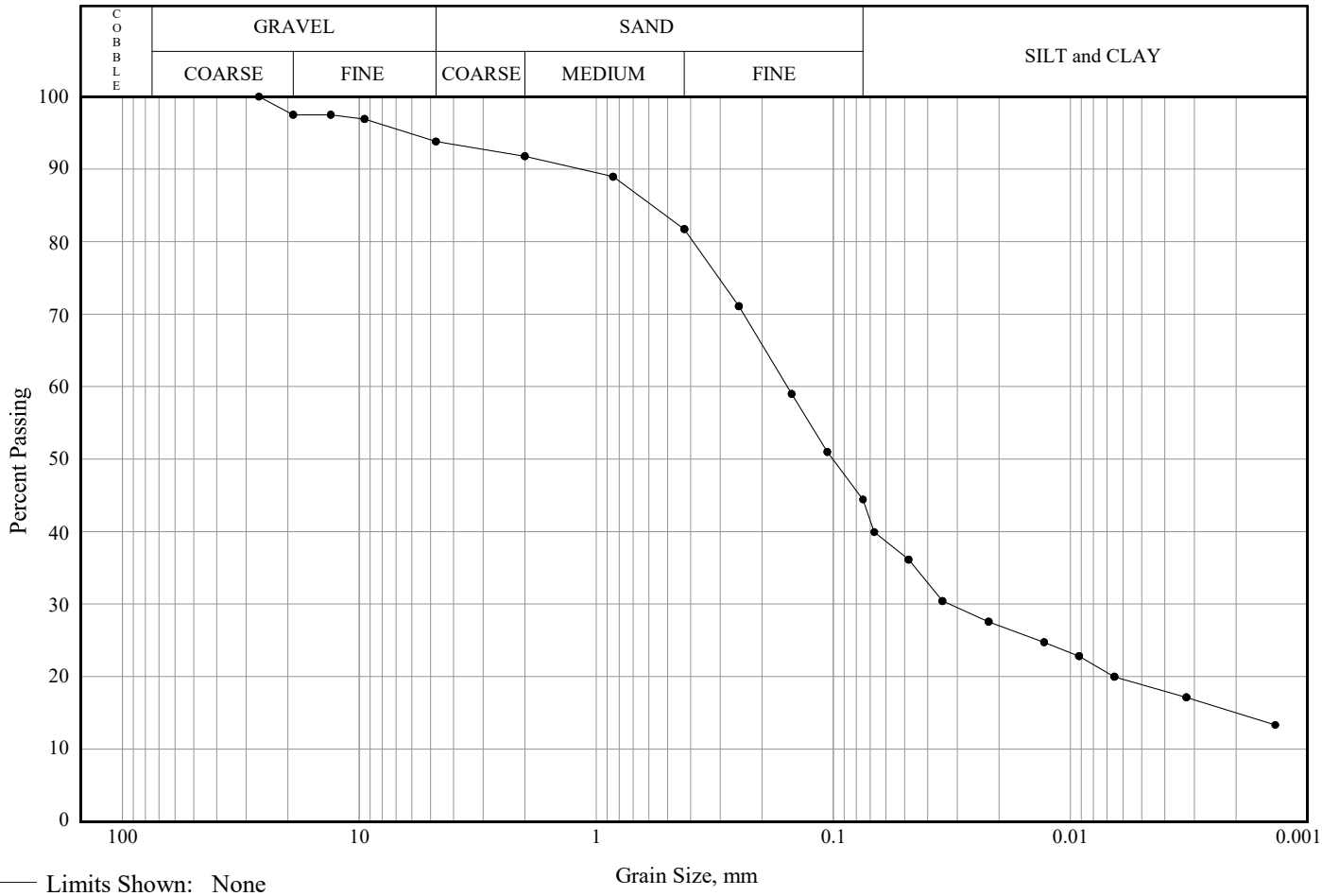
Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt and Clay
—●—	(SP) SAND	BH23-5	SA-8	6.1 - 6.7	0.1	92.9	7.0

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
—●—	Sand , trace gravel, trace silt	N/A	0.09	0.12	0.17	0.21	0.24	0.38	---

GEMTEC Consulting Engineers and Scientists	Client: Tatham Engineering Limited	Soils Grading Chart (T88)
	Project: Proposed YMCA, 555 Bayview Drive, Barrie, Ontario	
	Project #: 100876050	

Note: More information available upon request



Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt and Clay
—●—	(SM) SILTY SAND	BH23-3	SA-3	1.5 - 2.1	6.2	49.4	44.4

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
—●—	Silty sand , some clay , trace gravel	N/A	---	0.00	0.03	0.10	0.16	0.58	25.5

experience • knowledge • integrity

civil	civil
geotechnical	géotechnique
environmental	environnement
structural	structures
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

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