Geotechnical Investigation

Client:
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Geotechnical Investigation
Proposed Addition to Canadian Tire Store 442
2501 Greenbank Road, Ottawa, ON

Project Number:

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Executive Summary

EXP Services Inc. (EXP) is pleased to present the results of the geotechnical investigation completed for the proposed building addition to Canadian Tire Store 442 (Barrhaven), located at 2501 Greenbank Road, Ottawa, Ontario (Figure 1). The terms and conditions of this assignment were outlined in EXP's proposal OTT-23002900-A0 dated February 28, 2023. Authorization to proceed with this work was provided by Canadian Tire Real Estate Limited (CTREL).

It is understood that a 20 m by 59 m addition to Canadian Tire Store (CTS) No. 442 is to be located at the south end of the existing Canadian Tire Store, within the existing paved outdoor garden center area. The proposed addition will be a single storey slab-on-grade building with no basement. The elevation of the floor slab of the addition will match the elevation of the floor slab of the existing building at Elevation 100.50 m. The elevation of the floor slab of the existing store was provided on the architectural Site Plan, Drawing No. A01 (Revision No. 4 dated May 4,2009) made available by CTREL.

The fieldwork for the geotechnical investigation was completed on March 15 and 16, 2023 and consists of five (5) boreholes (Borehole Nos. BH-1 to BH-5) advanced to auger refusal and termination depths ranging from 3.1 m to 5.8 m below the existing ground surface. The fieldwork was supervised on a full-time basis by a representative of EXP.

The borehole information indicates that beneath the pavement structure, the site of the proposed addition consists of fill to 1.1 m and 1.4 m depths (Elevation 99.3 m to elevation 98.9 m) underlain by native very stiff clay and silt and loose to very dense glacial till followed by bedrock contacted at a 4.3 m depth (Elevation 96.1 m). A 300 mm thick clayey silt layer was encountered between the fill and the silty clay in Borehole No. 4. The groundwater level was measured at a 4.2 m depth (Elevation 96.2 m).

Based on a review of the borehole information with Table 4.1.8.4.A of the 2012 Ontario Building Code (OBC) as amended May 2,2019, the site classification for seismic site response is estimated to be **Class C**.

The subsurface soils are not considered to be liquefiable during a seismic event.

There are no restrictions to raising the grades at the site from a geotechnical perspective.

It is our understanding that the design elevation of the floor slab for the addition will match that of the existing store at Elevation 100.5 m. Based on a review of the borehole information, it is considered feasible to support the proposed building addition on conventional strip and spread footings founded on the native silt and clay and glacial till contacted at a 1.4 m depth (Elevation 99.1 m to Elevation 98.9 m). The existing fill and clayey silt layer are not suitable to support the foundations for the proposed building addition.

Strip footings having a maximum width of 1.5 m and square pad footings having maximum width and length of 3.0 m, founded on the very stiff silt and clay in Borehole Nos. 1 to 3 and on the dense to very dense glacial till in Borehole Nos. 4 and 5, at a 1.5 m depth below existing grade, may be designed for a bearing pressure at serviceability limit state (SLS) of 150 kPa and factored geotechnical resistance at ultimate limit state (ULS) of 225 kPa. The factored geotechnical resistance at ULS includes a geotechnical resistance factor of 0.5. Settlement of footings designed for the above SLS bearing pressure are expected to be within tolerable limits of 25 mm total and 19 differential movement.

A minimum of 1.5 m of earth cover should be provided to the footings to protect them from damage due to frost penetration. The frost cover should be increased to 2.1 m for unheated structures if snow will not be removed from their vicinity. If snow will be removed from the vicinity of the unheated structures, the frost cover should be increased to 2.4 m. Rigid insulation thermally equivalent to the required soil cover may be used instead of the soil cover. Alternatively, a combination of rigid insulation and soil cover may be used to achieve the required frost protection for the footings.

The floor slab for the proposed addition may be designed and constructed as a slab-on-grade set on an engineered fill pad constructed on the native undisturbed very stiff silt and clay and dense to very dense glacial till. It may be possible to construct the engineered fill pad on the existing fill after 0.6 m of fill has been removed, pending the results of proofrolling. Perimeter and underfloor drainage systems are not required. However, if drainage systems from the existing building are encountered during the construction of the new addition, the existing drainage systems should be extended into the addition area.

Excavations within the soils may be undertaken using heavy equipment capable of removing cobbles, boulders and possible large debris within the fill and cobbles and boulders within the glacial till.

The excavation for the proposed new building addition may be undertaken as open cut in accordance with the current Occupational Health and Safety Act (OHSA). Based on the definitions provided in OHSA, the subsurface soils are considered to be Type 3 soil and the excavation side slopes within Type 3 soil must be cut back at 1H:1 V from the bottom of the excavation. Excavation side slopes below the groundwater level and within zones of persistent seepage are anticipated to slough and eventually stabilize at a gradient of 2H:1V to 3H:1V.

It is anticipated that the majority of fill required for construction will have to be imported to the site and conform to the Ontario Provincial Standard Specification (OPSS) requirements for Granular B Type II and Select Subgrade Material (SSM).

The above and other related considerations are discussed in greater detail in the main body of this report.

1. Introduction

EXP Services Inc. (EXP) is pleased to present the results of the geotechnical investigation completed for the proposed building addition to Canadian Tire Store 442 (Barrhaven), located at 2501 Greenbank Road, Ottawa, Ontario (Figure 1). The terms and conditions of this assignment were outlined in EXP's proposal OTT-23002900-A0 dated February 28, 2023. Authorization to proceed with this work was provided by Canadian Tire Real Estate Limited (CTREL).

It is understood that a 20 m by 59 m addition to Canadian Tire Store (CTS) No. 442 is to be located at the south end of the existing Canadian Tire Store, within the existing paved outdoor garden center area. The proposed addition will be a single storey slab-on-grade building with no basement. The elevation of the floor slab of the addition will match the elevation of the floor slab of the existing building at Elevation 100.50 m. The elevation of the floor slab of the existing store was provided on the architectural Site Plan, Drawing No. A01 (Revision No. 4 dated May 4,2009) made available by CTREL.

This geotechnical investigation was undertaken to:

a) Establish the subsurface soil and groundwater conditions at five (5) boreholes located at the site,

b) Provide classification of the site for seismic design in accordance with requirements of the 2012 Ontario Building Code (OBC) as amended May 2,2019 and assess the liquefication potential of the subsurface soils during a seismic event,

c) Provide recommendations on the most suitable type of foundations, founding depth and Serviceability Limit State (SLS) bearing pressures and Ultimate Limit State (ULS) factored geotechnical resistances as well as anticipated total and differential settlements,

d) Comment on grade raise restrictions,

e) Discuss slab-on-grade construction and provide comments regarding perimeter and underfloor drainage systems,

f) Discuss excavation conditions and dewatering requirements during construction,

g) Comment on backfilling requirements and suitability of the on-site soils for backfilling purposes; and

h) Discuss subsurface concrete and steel requirements.

The comments and recommendations given in this report are based on the assumption that the above-described design concepts will proceed into construction. If changes are made either in the design phase or during construction, this office must be retained to review these modifications. The result of this review may be a modification of our recommendations, or it may require additional field or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

2. Site Description

The site of the proposed addition is located at the south end of the existing Canadian Tire Store and within the existing paved outdoor garden center. Based on the topographic survey plan prepared by Annis, O'Sullivan and Vollebekk Ltd. (AOV) (dated November 14,2022) of the entire existing Canadian Tire Store development including the location of the proposed addition, the topography of the addition area is relatively flat with approximate ground surface elevations in the order of Elevation 100.3 m to Elevation 100.5 m.

3. Geology of the Site

3.1 Surficial Geology Maps

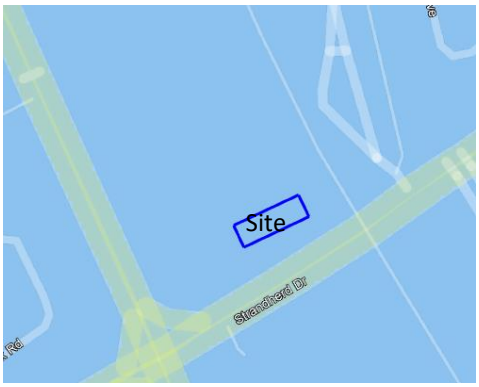
The surficial geology was reviewed via the Google Earth applications published by the Ontario Ministry of Energy, Northern Development and Mines available le via www.mndm.gov.on.ca/en/mines-and-minerals/applications/ogsearth/surficial-geology and was last modified on May 23, 2017. is underlain by stone-poor, sandy silt to silty sand-textured glacial till. The surficial deposits are shown in Image 1 below.

Glacial Till: Stone-poor, sandy silt to silty sand-textured till on

Image 1 – Surficial Geology

3.2 Bedrock Geology Maps

The bedrock was reviewed via the Google Earth applications published by the Ontario Ministry of Energy, Northern Development and Mines available le via http://www.geologyontario.mndm.gov.on.ca/mines/data/google/MRD219/geohttp://www.geologyontario.mndm.gov.on.ca/mines/data/google/MRD219/geology/doc.kmlgy/doc. The map indicates the site is underlain by sandstone, dolostone or dolomitic sandstone of the March formation. The bedrock geology is show in Image 2 below.



March Formation: Sandstone, dolomitic, and dolostone sandstone

Image 2 – Bedrock Geology

4. Available Information

The following geotechnical reports and letter regarding the design and construction of the existing Canadian Tire Store were made available to EXP for use as reference material in the preparation of this geotechnical report:

- Geotechnical Report for the Proposed Store # 442, Barrhaven, Nepean, Ontario dated January 31,2000 and prepared by Jacques, Whitford and Associates Limited (JWAL) (Project No. 11297)
- Corrosion and Sulphate Attack Potential, Proposed Canadian Tire, Barrhaven dated September 9, 1990, and prepared by Jacques, Whitford Limited (File No. 10161)
- Proposed Barrhaven Development, Greenbank Road and Strandherd Road, Nepean, Ontario dated August 10,1990 and prepared by Jacques, Whitford Limited (Project No. 10161)

The JWAL geotechnical reports indicate that beneath fill, the native soils consist of stiff to very stiff silty clay to clayey silt underlain by compact to dense glacial till with loose and very dense zones within the glacial till.

The 2000 JWAL geotechnical report indicates that a former house existed in the west portion of the proposed addition area near the west limit of the addition area. It is assumed that the foundations and subsurface floor of the former house were excavated and removed as part of the original Canadian Tire development.

5. Procedure

5.1 Fieldwork

The fieldwork for the geotechnical investigation was completed on March 15 and 16, 2023 and consists of five (5) boreholes (Borehole Nos. BH-1 to BH-5) advanced to auger refusal and termination depths ranging from 3.1 m to 5.8 m below the existing ground surface. The fieldwork was supervised on a full-time basis by a representative of EXP.

The borehole locations were established in the field by EXP. The geodetic elevations of the boreholes were estimated from the spot elevations provided on the AOV topographical survey plan and therefore, should be considered approximate. The borehole locations and elevations are shown on the Borehole Location Plan, Figure 2.

Prior to the fieldwork, the locations of the boreholes were cleared of public and private underground services. The boreholes were drilled using a CME-75 truck-mounted drill rig supplied with continuous flight hollow-stem augers and soil sampling and rock coring equipment. Auger samples were taken from below the asphaltic concrete surface to a 0.6 m depth below the existing ground surface. Standard penetration tests (SPTs) were performed in the boreholes below the auger samples on a continuous basis to a 1.1 m depth spacing or interval, with samples retrieved by the split-barrel sampler. The undrained shear strength of the clayey soils was measured by conducting penetrometer tests. The subsurface soil conditions in each borehole were logged and each soil sample was placed in a labelled plastic bag.

The presence of bedrock was proven in one (1) borehole by conventional rock coring techniques using the N-size core barrel. A field record of wash water return, colour of wash water and any sudden drops of the core barrel were kept during rock coring operations. The recovered rock cores were also logged and stored in core boxes and identified.

Thirty-two (32) mm diameter monitoring wells with slotted section were installed in selected boreholes for long-term monitoring of the groundwater levels. The wells were installed in accordance with EXP standard practice, and the installation configuration is documented on the respective borehole logs. The boreholes were backfilled upon completion of drilling and the installation of the monitoring wells

5.2 Laboratory Testing Program

The soil samples and rock cores were visually examined in the laboratory by a geotechnical engineer. The soil samples were classified in accordance with the Unified Soil Classification System (USCS) and the modified Burmister Soil Classification System (as per the 2006 Fourth Edition Canadian Foundation Engineering Manual (CFEM)).

A summary of the soil laboratory testing program is shown in Table I.

Table I: Summary of the Soil Laboratory Testing Program	
Type of Test	Number of Tests Completed
Moisture Content Determination	33
Unit Weight Determination	5
Grain Size Analysis	4
Atterberg Limit Determination	1
Chemical Tests (pH, sulphate, chloride and resistivity)	3

6. Subsurface Conditions and Groundwater Levels

A detailed description of the subsurface conditions and groundwater levels determined from the boreholes are given on the attached Borehole Logs, Figures 3 and 7. The borehole logs and related information depict subsurface conditions only at the specific locations and times indicated. Subsurface conditions and water levels at other locations may differ from conditions at the locations where sampling was conducted. The passage of time also may result in changes in the conditions interpreted to exist at the locations where sampling was conducted.

Boreholes were drilled to provide representation of subsurface conditions as part of a geotechnical exploration program and are not intended to provide evidence of potential environmental conditions.

It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling operations. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The "Note on Sample Descriptions" preceding the borehole logs form an integral part of this report and should be read in conjunction with this report.

A review of the borehole logs indicates the following subsurface conditions with depth and groundwater levels.

6.1 Pavement Structure

All five (5) boreholes are located within a paved area with the pavement structure consisting of a 90 mm to 110 mm thick asphaltic concrete layer underlain by a 120 mm to 240 mm thick granular base layer consisting of sand and crushed gravel. The moisture content of the granular fill base layer is 2 percent to 5 percent.

6.2 Fill

Fill was contacted below the pavement structure and extends to depths of 1.1 m and 1.4 m (Elevation 99.3 m to Elevation 98.9 m). This corresponds to 0.8 m to 1.2 m thickness. The fill consists of sand and gravel. The fill is in a compact to dense state based on standard penetration test (SPT) N-values ranging from 12 to 33. In Borehole No. 1, the augers were grinding within the fill indicating that the fill may contain cobbles, boulders or debris. Brick fragments were noted in the fill from Borehole No. 3. The moisture content of the fill ranges from 3 percent to 10 percent.

The results from the grain-size analysis conducted on one (1) sample of the fill is summarized in Table II. The grain-size distribution curve is shown in Figure 8.

Table II: Summary of Results from Grain-Size Analysis – Fill Sample

Borehole No. (BH)– Auger Sample No. (AS)	Depth (m)	Grain-Size Analysis (%)			Soil Classification (USCS)	Modified Burmister Soil Classification System
		Gravel	Sand	Fines (Silt and Clay)		
BH3-AS1	0.3-0.6	37	47	16	Silty Sand with Gravel (SM)	Sand and Gravel, Some Silt

6.2 Clayey Silt

A 300 mm thick clayey silt layer was encountered beneath the fill in Borehole No. 4, extending to a 1.4 m depth (Elevation 99.0 m). This layer contains trace organics.

6.3 Silt and Clay

The fill and clayey silt from Borehole Nos. 1 to 3 are underlain by a cohesive silt and clay that extends to 2.6 m and 3.0 m depths (Elevation 97.8 m to Elevation 97.3 m).

The undrained shear strength of the clay ranges from 130 kPa to 180 kPa indicating the silt and clay has a very stiff consistency. The natural moisture content and unit weight of the silt and clay ranges from 20 percent to 41 percent and 18.6 kN/m^3 to 19.0 kN/m^3, respectively.

The results from the grain-size analysis and Atterberg limits determination of one (1) sample of the silt and clay are summarized in Table III. The grain-size distribution curve is shown in Figure 9.

Table III: Summary of Results from Grain-Size Analysis and Atterberg Limit Determination – Silt and Clay Sample

Borehole No. (BH) – Sample No. (SS)	Depth (m)	Grain-Size Analysis (%)				Atterberg Limits (%)			Soil Classification (USCS)	Soil Classification Burmister Soil Classification System
		Gravel	Sand	Silt	Clay	Liquid Limit	Plastic Limit	Plasticity Index		
BH2-SS3	1.5 - 2.1	0	13	41	46	22	46	24	Clay of Medium Plasticity (CL)	Silt and Clay, Some Sand

6.4 Glacial Till

A silty sand glacial till was contacted beneath the silt and clay from Borehole Nos. 1 to 3, the clayey silt layer in Borehole No. 4 and the fill from Borehole No. 5. at 1.4 m to 3.0 m depths (Elevation 99.1 m to Elevation 97.3 m). The glacial till extends to a 4.3 m depth (Elevation 96.1 m) in Borehole No. 4. The glacial till contains cobbles and boulders. Conventional rock coring techniques were used to advance Borehole Nos. 4 and 5 beyond the cobbles/boulders within the glacial till. The SPT N-values of the glacial till range from 7 to 76 indicating the glacial till is in a loose to very dense state. The upper portion of the glacial till in Borehole No. 2 has a loose zone (N=7). Higher N values with low sampler penetration such as N equal to 50 for 100 mm sampler penetration in the glacial till are likely the result of the split spoon sampler making contact with a cobble or boulder within the glacial till. The natural moisture content of the glacial till ranges from 4 percent to 14 percent.

The results from the grain-size analysis conducted on two (2) samples of the glacial till are summarized in Table IV. The grain-size distribution curves are shown in Figures 10 and 11.

Table IV: Summary of Results from Grain-Size Analysis -Glacial Till Samples

Borehole No. (BH)– Sample No. (SS)	Depth (m)	Grain-Size Analysis (%)				Soil Classification USCS	Soil Classification Burmister Soil Classification System
		Gravel	Sand	Silt	Clay		
BH2-SS6	3.8 - 4.4	20	44	28	8	Silty Sand with Gravel (SM)	Silty Sand, Gravelly to Some Gravel, Trace Clay
BH5-SS5	2.5 - 3.1	15	43	33	9	Silty Sand with Gravel (SM)	Silty Sand, Some Gravel, Trace Clay

6.5 Bedrock

Auger refusal was encountered in Borehole Nos. 1 to 3 at 3.7 m to 5.0 m depth (Elevation 96.7 m to Elevation 95.4 m) and may have occurred on inferred cobbles and boulders or on bedrock.

The presence of the bedrock was proven by coring the bedrock in Borehole No. 4. The bedrock was encountered beneath the glacial till at a 4.3 m depth (Elevation 96.1 m). A 1.5 m length of the bedrock was cored to the borehole termination depth of 5.8 m (Elevation 94.6 m). Based on examination of the recovered bedrock core, the bedrock is sandstone. The Total Core Recovery (TCR) of the bedrock core is 100 percent and the Rock Quality Designation (RQD) of the bedrock is 83 percent indicating the bedrock is of good quality. Photographs of the rock core are shown in Figure 12.

6.6 Groundwater Level Measurements

A summary of the groundwater level measurement taken in the boreholes equipped with monitoring wells on March 24, 2023 is shown in Table V.

Table V: Summary of Groundwater Level Measurements

Borehole No. (BH)	Ground Surface Elevation (m)	Elapsed Time in Days from Date of Installation	Depth Below Ground Surface (Elevation), m
BH-01	100.3	9 days	Dry (Dry)
BH-04	100.4	8 days	4.2 (96.2)

The groundwater level was measured at 4.2 m (Elevation 96.2 m) below the existing ground surface in Borehole No. 4. The monitoring well in Borehole No. 1 was found to be dry.

The groundwater levels were determined in the boreholes at the time and under the condition stated in the report. Note that fluctuations in the level of groundwater may occur due to a seasonal variation such as precipitation, snowmelt, rainfall activities, and other factors not evident at the time of measurement and therefore may be at a higher level during wet weather periods.

7. Site Classification for Seismic Site Response and Liquefaction Potential of Soils

7.1 Site Classification for Seismic Site Response

Based on a review of the borehole information with Table 4.1.8.4.A of the 2012 Ontario Building Code (OBC) as amended May 2,2019, the site classification for seismic site response is estimated to be **Class C**.

7.2 Liquefaction Potential of Soils

The subsurface soils are not considered to be liquefiable during a seismic event.

8. Grade Raise Restrictions

For the proposed building addition, there are no restrictions to raising the grades at the site from a geotechnical perspective.

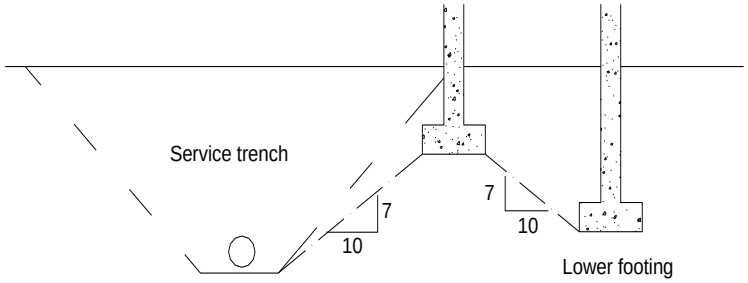
9. Foundation Considerations

It is our understanding that the design elevation of the floor slab for the addition will match that of the existing store at Elevation 100.5 m. Based on a review of the borehole information, it is considered feasible to support the proposed building addition on conventional strip and spread footings founded on the native silt and clay and glacial till contacted at a 1.4 m depth (Elevation 99.1 m to Elevation 98.9 m). The existing fill and clayey silt layer are not suitable to support the foundations for the proposed building addition.

Strip footings having a maximum width of 1.5 m and square pad footings having maximum width and length of 3.0 m, founded on the very stiff silt and clay in Borehole Nos. 1 to 3 and on the dense to very dense glacial till in Borehole Nos. 4 and 5, at a 1.5 m depth below existing grade, may be designed for a bearing pressure at serviceability limit state (SLS) of 150 kPa and factored geotechnical resistance at ultimate limit state (ULS) of 225 kPa. The factored geotechnical resistance at ULS includes a geotechnical resistance factor of 0.5. Settlement of footings designed for the above SLS bearing pressure are expected to be within tolerable limits of 25 mm total and 19 differential movement.

To minimize the need for underpinning, the footings for the addition located along the exterior south wall of the existing store should be founded at the same depth as the footings of the existing south wall, provided they are founded on the native soil capable of supporting the above noted SLS and factored ULS values.

Footings founded in soils at different elevations should be located such that the higher footings are set below a line drawn up at 10 horizontal to 7 vertical (10H:7V) from the near edge of the lower footing, as shown below. This concept should also be applied to service excavation, etc. to ensure that undermining is not a problem.



FOOTINGS NEAR SERVICE TRENCHES OR AT DIFFERENT ELEVATIONS

All footing beds should be examined by a geotechnical engineer to ensure that the founding surfaces are capable of supporting the design bearing pressure at SLS and that the footing beds have been properly prepared.

The exposed silt and clay and glacial till subgrade surfaces are susceptible to disturbance due to movement of workers and construction traffic and the prevailing weather conditions during construction. To prevent disturbance to the soil subgrade, the approved footing beds should be covered or protected with a 50 mm thick concrete mud slab within the same day of approval. The concrete mud slab may be a provisional item.

A minimum of 1.5 m of earth cover should be provided to the footings to protect them from damage due to frost penetration. The frost cover should be increased to 2.1 m for unheated structures if snow will not be removed from their vicinity. If snow will be removed from the vicinity of the unheated structures, the frost cover should be increased to 2.4 m. Rigid insulation thermally equivalent to the required soil cover may be used instead of the soil cover. Alternatively, a combination of rigid insulation and soil cover may be used to achieve the required frost protection for the footings.

The recommended bearing pressure at SLS and factored geotechnical resistance at ULS have been calculated by EXP from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of underground conditions becomes available. For example, more specific information is available with respect to conditions between boreholes when foundation construction is underway. The interpretation between boreholes and the recommendations of this report must therefore be checked through field monitoring provided by an experienced geotechnical engineer to validate the information for use during the construction stage.

10. Floor Slab and Drainage Requirements

The floor slab for the proposed addition may be designed and constructed as a slab-on-grade set on an engineered fill pad constructed on the native undisturbed very stiff silt and clay and dense to very dense glacial till. The existing fill and clayey silt layer are not considered suitable to support the slab-on-grade and should be excavated and removed down to the native silt and clay or glacial till within the floor slab footprint. The exposed glacial till and silt and clay subgrades should be examined by a geotechnical engineer or technician working under the direction of a geotechnical engineer. Any loose/soft areas identified should be excavated, removed and replaced with Ontario Provincial Standard Specification (OPSS) Granular B Type II material compacted to 95 percent standard Proctor maximum dry density (SPMDD).

It may be possible to excavate and remove only the upper 0.6 m of the existing fill, approximately half of the fill/clayey silt layer thickness, rather than excavating to the underlying native soils. The upper 0.6 m of the fill should be removed and the underlying subgrade proofrolled in the presence of a geotechnical engineer or technician working under the direction of a geotechnical engineer. Any loose/soft areas identified from the proofrolling operation should be excavated, removed and replaced with Ontario Provincial Standard Specification (OPSS) Granular B Type II material compacted to 95 percent standard Proctor maximum dry density (SPMDD). It is noted that a former house existed in the west portion of the proposed addition area near the west limit of the addition area. It is assumed that the foundations and subsurface floor of the former house were excavated and removed as part of the original Canadian Tire development. If the foundations and subsurface floor of the former house were not previously excavated and removed, they will require excavation and removal for the construction of the proposed addition and the floor slab for the proposed addition.

The slab-on-grade for the proposed building addition may be set on a bed of well compacted 19 mm sized clear stone at least 200 mm thick placed on a minimum 300 mm thick engineered fill pad placed on the approved existing fill or native soil subgrades. The engineered fill pad should consist of Ontario Provincial Standard Specification (OPSS) Granular B Type II material compacted to a minimum of 98 percent standard Proctor maximum dry density (SPMDD). The clear stone would minimize the capillary rise of moisture from the sub-soil to the floor slab. As an alternative for the clear stone layer, the floor slab may be cast on a 200 mm thick bed of Ontario Provincial Standard Specification (OPSS) Granular A compacted to 98 percent SPMDD that is placed on the engineered fill pad and is overlain by a vapour barrier. Adequate saw cuts should be provided in the floor slabs to control cracking.

Perimeter and underfloor drainage systems are not required. However, if drainage systems from the existing building are encountered during the construction of the new addition, the existing drainage systems should be extended into the addition area.

The finished floor slab should be set at least 150 mm higher than the finished exterior grade.

The finished exterior grade should be sloped away from the building addition to prevent ponding of surface water close to the exterior walls of the building addition.

11. Excavations and De-Watering Requirements

11.1 Excess Soil Management

Ontario Regulation 406/19 specifies protocols that are required for the management and disposal of excess soils. As set forth in the regulation, specific analytical testing protocols need to be implemented and followed based on the volume of soil to be managed and the requirements of the receiving site. The testing protocols are specific as to whether the soils are stockpiled or in situ. In either scenario, the testing protocols are far more onerous than have been historically carried out as part of standard industry practices. These decisions should be factored in and accounted for prior to the initiation of the project-defined scope of work. EXP would be pleased to assist with the implementation of a soil management and testing program that would satisfy the requirements of Ontario Regulation 406/19.

11.2 Excavations

Excavations for the footings of the proposed building addition are expected to extend through the asphaltic concrete, fill, clayey silt and into the silt and clay and glacial till to an approximate 1.5 m depth below the existing ground surface. Based on the groundwater level in the boreholes, the excavation is anticipated to be above the groundwater level.

Excavations within the soils may be undertaken using heavy equipment capable of removing cobbles, boulders and possible large debris within the fill and cobbles and boulders within the glacial till.

The excavation for the proposed new building addition may be undertaken as open cut in accordance with the current Occupational Health and Safety Act (OHSA). Based on the definitions provided in OHSA, the subsurface soils are considered to be Type 3 soil and the excavation side slopes within Type 3 soil must be cut back at 1H:1 V from the bottom of the excavation. Excavation side slopes below the groundwater level and within zones of persistent seepage are anticipated to slough and eventually stabilize at a gradient of 2H:1V to 3H:1V.

The silt and clay and glacial till subgrades at the site are susceptible to disturbance due to the movement of construction equipment and personnel on its surface. It is therefore recommended that the excavation at the site should be undertaken by equipment that does not need to travel on the excavated surface, such as a gradall or a mechanical shovel. Extra care should be exercised during the excavation close to the existing building to prevent the undermining of the existing footings.

Many geologic materials deteriorate rapidly upon exposure to meteorological elements. Unless otherwise specifically indicated in this report, walls and floors of excavations must be protected from moisture, desiccation, and frost action throughout the course of construction.

11.3 De-Watering Requirements

It should be possible to collect surface and subsurface water entering the excavations at low points and to remove it by conventional pumping techniques. In areas of high infiltration such as within the sand and gravel fill or in areas where more permeable soil layers may exist, a higher seepage rate should be anticipated. Therefore, in this case, high-capacity pumps may be required to keep the excavation dry.

For construction dewatering, an Environmental Activity and Sector Registry (EASR) approval may be obtained for water takings greater than 50 m^3 and less than 400 m^3 per day. If more than 400 m^3 per day of groundwater are generated for dewatering purposes, then a Category 3 Permit to Take Water (PTTW) must be obtained from the Ministry of the Environment, Conservation and Parks (MECP). A Category 3 PTTW would require a complete hydrogeological assessment and would take at least 90 days for the MECP to process once the application is submitted.

Although this investigation has estimated the groundwater levels at the time of the fieldwork, and commented on dewatering and general construction problems, conditions may be present which are difficult to establish from standard boring and excavating techniques and which may affect the type and nature of dewatering procedures used by the contractor in practice. These conditions include local and seasonal fluctuations in the groundwater table, erratic changes in the soil profile, thin layers of soil with large or small permeabilities compared with the soil mass, etc. Only carefully controlled tests using pumped wells and observation wells will yield the quantitative data on groundwater volumes and pressures that are necessary to adequately engineer construction dewatering systems.

12. Backfilling Requirements and Suitability of On-Site Soils for Backfilling Purposes

The soils to be excavated from the site are anticipated to consist of asphaltic concrete pavement, fill, clayey silt, silt and clay, and glacial till. From a geotechnical perspective, the fill, clayey silt, silt and clay, and glacial till are not considered suitable for reuse as backfill material within the proposed building addition or against foundation walls. Portions of the fill (free of debris, cobbles and boulders), clayey silt, silt and clay, and glacial till (free of cobbles and boulders) above the groundwater level may be reused outside the footprint of the proposed building addition in landscaped areas, subject to additional examination and testing at time of construction. However, these soils are subject to moisture absorption due to precipitation and must be protected at all times from the weather.

Therefore, it is anticipated that the majority of the material required for backfilling purposes in the interior and exterior of the proposed building addition will need to be imported and should preferably conform to the following specifications:

- Engineered underfloor fill inside the building addition - OPSS Granular B Type II placed in 300 mm thick lifts with each lift compacted to 98 percent SPMDD,
- Backfill against exterior subsurface walls of the building addition - OPSS Granular B Type II placed in 300 mm thick lifts and compacted to 95 percent SPMDD,
- Trench backfill outside the building addition area - OPSS Select Subgrade Material (SSM), free of organics, debris and with a natural moisture content within 2 percent of the optimum moisture content. It should be placed in 300 mm thick lifts compacted to minimum 95 percent SPMDD; and
- Landscaped areas - Clean fill that is free of organics and deleterious material and is placed in 300 mm thick lifts with each lift compacted to 92 percent of the SPMDD.

13. Corrosion Potential

Chemical tests limited to pH, sulphate, chloride and resistivity were undertaken on three (3) soil samples. A summary of the results is shown in Table VI. The laboratory certificate of analysis is shown in Appendix A.

Table VI: Chemical Test Results – Soil Samples

Borehole No. - Sample No. (SS)	Depth (m)	Soil/Bedrock Type	pH	Sulphate (%)	Chloride (%)	Resistivity (ohm-cm)
BH1-SS2	1.5 - 2.1	Silt and Clay	7.49	0.0613	0.0013	1230
BH4-SS4	2.3 - 2.8	Glacial Till	8.44	0.0137	0.0009	3380
BH5-SS4	1.9 - 2.5	Glacial Till	8.66	0.063	0.0166	2120

The results indicate the soil has a negligible sulphate attack on subsurface concrete. The concrete should be in accordance with the most recent CSA A.23.1.

The results of the resistivity test indicate the silt and clay is corrosive to bare steel and the glacial till is mildly corrosive to bare steel as per the National Association of Corrosion Engineers (NACE). Appropriate measures should be undertaken to protect buried steel elements from corrosion.

14. General Comments

The comments given in this report are intended only for the guidance of design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be much greater than has been carried out for the design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

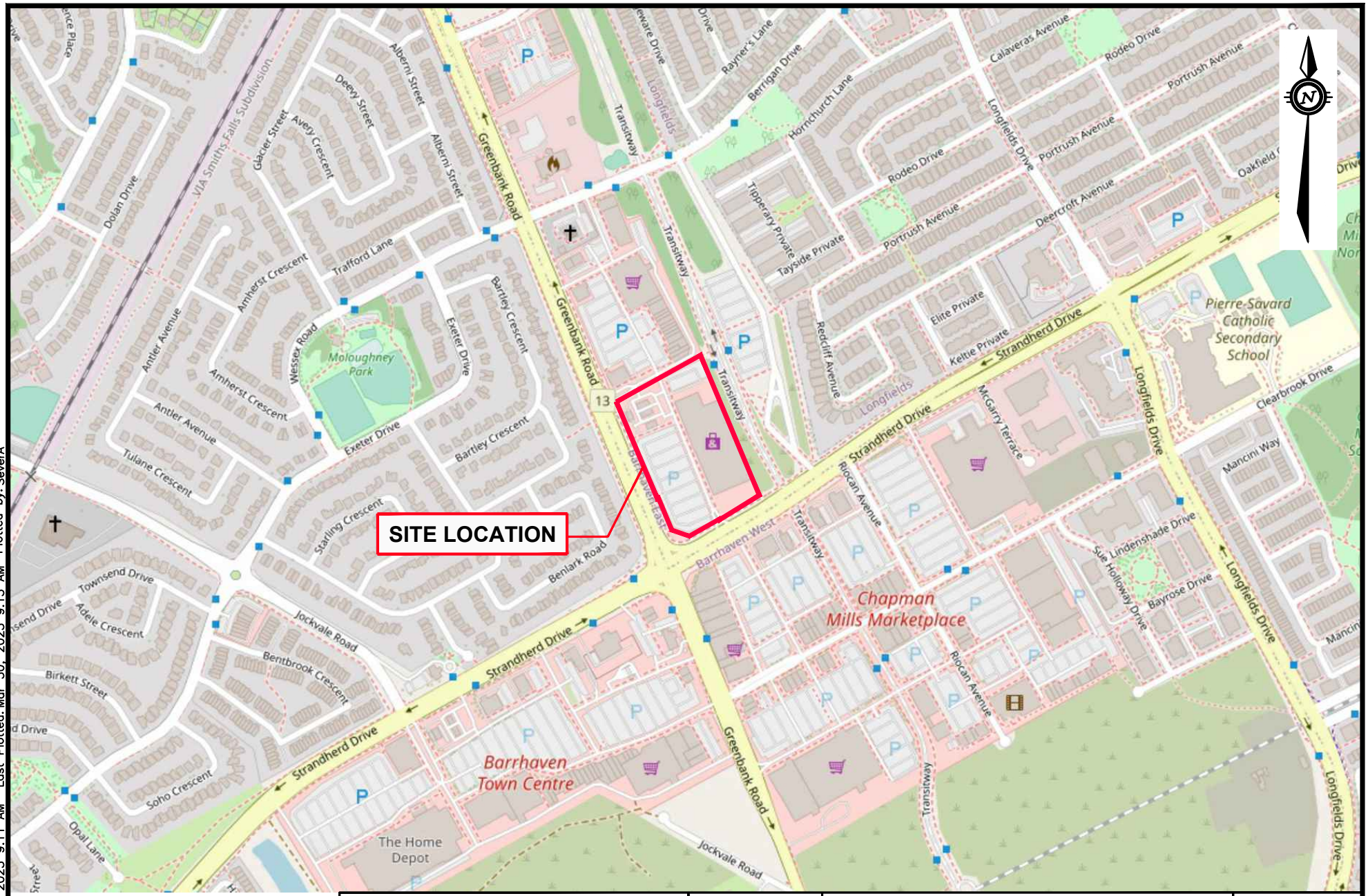
The information contained in this report is not intended to reflect on environmental aspects of the soils. Should specific information be required, including for example, the presence of pollutants, contaminants or other hazards in the soil, additional testing may be required.

We trust that the information contained in this report will be satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Daniel Wall, M. Eng., P.Eng.
Geotechnical Engineer
Earth & Environment

Susan M. Potyondy, P.Eng.
Senior Geotechnical Engineer
Earth & Environment

Figures



ORIGINAL SHEET SIZE = 11" x 8.5"

0 50m 100m 300m

HORIZONTAL 1:7,500

exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
www.exp.com

DESIGN	DW/MZ
DRAWN	AS
DATE	MARCH 2023
FILE NO	OTT-23002900-A0

PROJECT
PROPOSED ADDITION TO
CANADIAN TIRE STORE 442
2501 GREENBANK ROAD, OTTAWA, ON

TITLE
SITE LOCATION PLAN

SCALE 1:7,500

SKETCH NO
FIG 1

Filename: E:\OTT\OTT-23002900-A0\60 Execution\65 Drawings\23002900-A0_Geo.dwg
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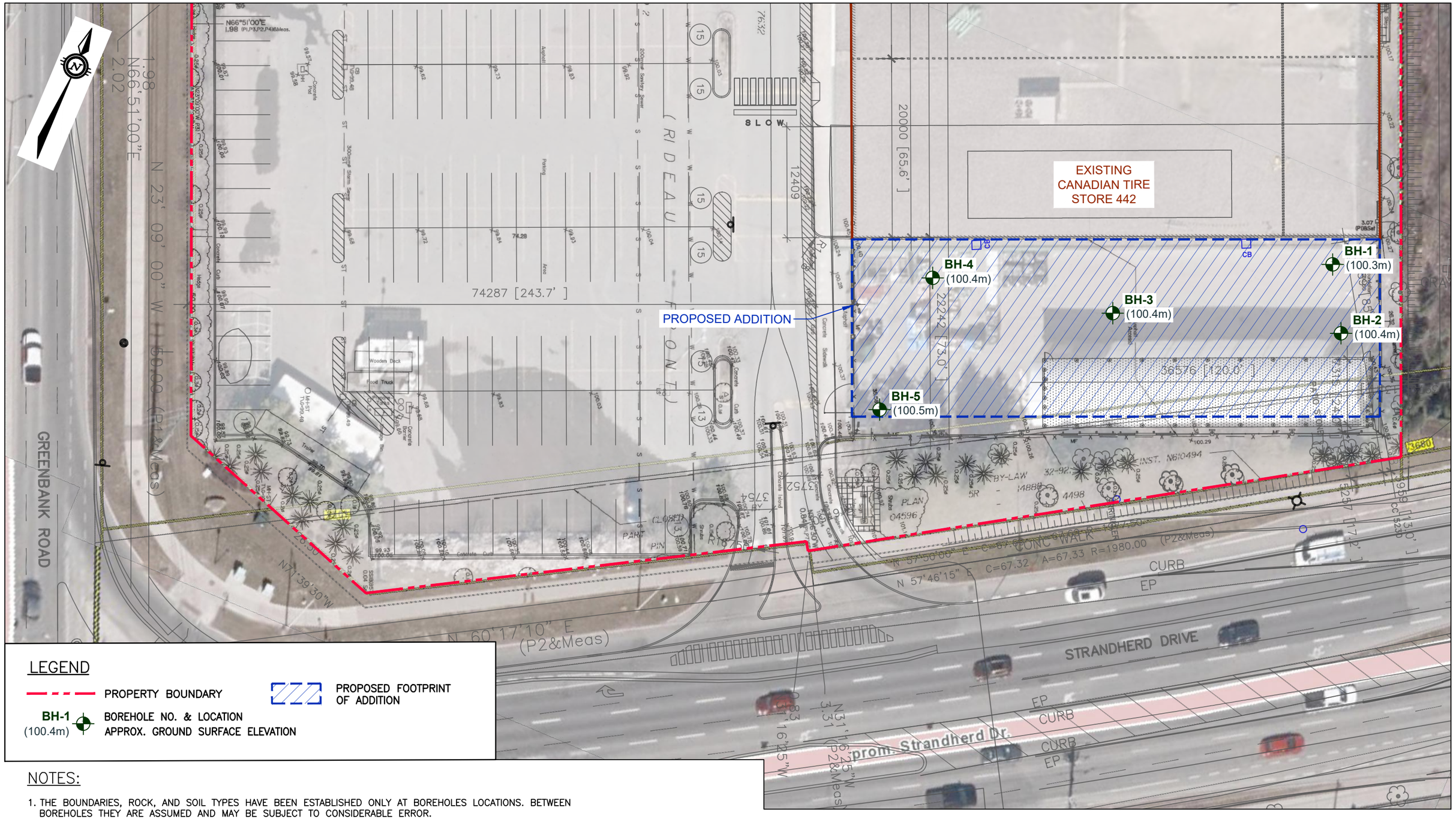

LEGEND

- PROPERTY BOUNDARY
- PROPOSED FOOTPRINT OF ADDITION
- BH-1 (100.4m) BOREHOLE NO. & LOCATION / APPROX. GROUND SURFACE ELEVATION

NOTES:

1. THE BOUNDARIES, ROCK, AND SOIL TYPES HAVE BEEN ESTABLISHED ONLY AT BOREHOLES LOCATIONS. BETWEEN BOREHOLES THEY ARE ASSUMED AND MAY BE SUBJECT TO CONSIDERABLE ERROR.
2. SOIL AND BEDROCK SAMPLES WILL BE RETAINED IN STORAGE FOR THREE MONTHS AND THEN DESTROYED UNLESS THE CLIENT ADVISES THAT AN EXTENDED TIME PERIOD IS REQUIRED.
3. ASPHALT QUANTITIES SHOULD NOT BE ESTABLISHED FROM THE INFORMATION PROVIDED AT THE BOREHOLES LOCATIONS.
4. BOREHOLES ELEVATIONS SHOULD NOT BE USED TO DESIGN BUILDING[S] OR FLOOR SLABS OR PARKING LOT[S] GRADES.
5. THIS DRAWING FORMS PART OF THE REPORT PROJECT NUMBER AS REFERENCED AND SHOULD BE USED ONLY IN CONJUNCTION WITH THIS REPORT.

ORIGINAL SHEET SIZE = 17" x 11"

0 4m 8m 16m

HORIZONTAL 1:400

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DESIGN	DW/SP
DRAWN	AS
DATE	MARCH 2023
FILE NO	OTT-23002900-A0
PROJECT	PROPOSED ADDITION TO CANADIAN TIRE STORE 442 2501 GREENBANK ROAD, OTTAWA, ON
TITLE	BOREHOLE LOCATION PLAN
SCALE	1:400
SKETCH NO	FIG 2

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Notes On Sample Descriptions

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Societv for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by **exp** Services Inc. also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		

0.002 0.006 0.02 0.06 0.2 0.6 2.0 6.0 20 60 200

EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Log of Borehole BH-1

Project No: OTT-23002900-A0

Project: Proposed Addition to Canadian Tire Store 442

Location: 2501 Greenbank Road, Ottawa, ON

Figure No. 3

Page. 1 of 1

Date Drilled: 'March 15, 2023

Drill Type: CME-75 Truck-Mounted Drill Rig

Datum: Approximate Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○—|
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Approximate Geodetic Elevation m	Depth
		ASPHALTIC CONCRETE ~ 100 mm thick	100.3	0
		GRANULAR FILL ~ 200 mm thick Sand and crushed gravel, damp, dark brown	100.2 100.0	
		FILL Sand and gravel, some silt, with possible cobbles, boulders or debris, damp, brown, (dense) Augers grinding 0.1 m to 1.5 m depths		1
			98.9	
		SILT AND CLAY Brown, moist, (very stiff)		2
			97.3	3
		GLACIAL TILL Sandy silt, some gravel to gravelly, with cobbles, and boulders, grey, moist to wet, (compact to dense)		4
			95.4	
		Auger Refusal at 4.9 m Depth		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

33
14
180 kPa
8
130 kPa
10
41
15 then 8 / 25 mm

SAMPLES	Natural Unit Wt. kN/m³
AS-1	
SS-1	
SS-2	18.6
SS-3	18.7
SS-4	
SS-5	
SS-6	

LOG OF BOREHOLE OTT-23002900 LOGS GINT MARCH 20, 2023.GPJ TROW OTTAWA.GDT 4/3/23

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. 32 mm diameter well installed upon completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-23002900-A0

WATER LEVEL RECORDS		
Date	Water Level (m)	Hole Open To (m)
'March 24, 2023	Dry	

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH-2

Project No: OTT-23002900-A0

Project: Proposed Addition to Canadian Tire Store 442

Location: 2501 Greenbank Road, Ottawa, ON

Figure No. 4

Page. 1 of 1

Date Drilled: 'March 15, 2023

Drill Type: CME-75 Truck-Mounted Drill Rlg

Datum: Approximate Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠ | Auger Sample ◧ | SPT (N) Value ○ | Dynamic Cone Test —— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits ⊢○⊣ | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Approximate Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALTIC CONCRETE ~ 110 mm thick	100.4	0				
		GRANULAR FILL ~240 mm thick Sand and crushed gravel, damp, dark brown	100.3 100.1				AS1	
		FILL Sand and gravel, some silt, with possible cobbles, boulders or debris, damp, brown (compact)		1	24		SS-2	
			99.0					
		SILT AND CLAY Medium plasticity, some sand, brown, moist, (very stiff)		2	13, 145 kPa		SS-3	19.0
		With silt seams below 2.3 m			9, 145 kPa		SS-4	18.6
			97.4	3				
		GLACIAL TILL Silty sand, gravelly to some gravel, trace clay, with cobbles and boulders, grey, moist to wet (loose to very dense)			7		SS-5	
		Auger grinding from 3.0 m to 3.8 m depth		4	76		SS-6	
					40		SS-7	
			95.4	5				
		Auger Refusal at 5.0 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled upon completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-23002900-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	Dry	4.1

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE OTT-23002900 LOGS GINT MARCH 20, 2023.GPJ TROW OTTAWA.GDT 4/3/23

Log of Borehole BH-3

Project No: OTT-23002900-A0

Project: Proposed Addition to Canadian Tire Store 442

Location: 2501 Greenbank Road, Ottawa, ON

Figure No. 5

Page. 1 of 1

Date Drilled: 'March 15, 2023

Drill Type: CME-75 Truck-Mounted Drill Rig

Datum: Approximate Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Approximate Geodetic Elevation m	Depth
		ASPHALTIC CONCRETE ~ 110 mm thick	100.4	0
		GRANULAR FILL ~190 mm thick Sand and crushed gravel, damp, dark brown	100.3 100.1	
		FILL Sand and gravel, some silt, with brick fragments and possible cobbles or boulders, damp, brown, (dense)		1
			99.0	
		SILT AND CLAY Brown, moist, (very stiff)		
		Silty sand seams below 2.3 m depth		2
			97.8	
		GLACIAL TILL Silty sand with gravel, cobbles, and boulders, grey, moist to wet, (compact)		3
			96.7	
		Auger Refusal at 3.7 m Depth		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

31
13
135 kPa
13
15

SAMPLES	Natural Unit Wt. kN/m³
AS-1	
SS-2	
SS-3	18.6
SS-4	
SS-5	

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled upon completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-23002900-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	Dry	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE OTT-23002900 LOGS GINT MARCH 20, 2023.GPJ TROW OTTAWA.GDT 4/3/23

Log of Borehole BH-4

Project No: OTT-23002900-A0

Project: Proposed Addition to Canadian Tire Store 442

Location: 2501 Greenbank Road, Ottawa, ON

Figure No. 6

Page. 1 of 1

Date Drilled: 'March 16, 2023

Drill Type: CME-75 Truck-Mounted Drill Rlg

Datum: Approximate Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Approximate Geodetic Elevation m	Depth
		ASPHALTIC CONCRETE ~ 90 mm thick	100.4	0
		GRANULAR FILL ~210 mm thick Sand and crushed gravel, damp, dark brown	100.3 100.1	
		FILL Sand and gravel, some silt, with possible cobbles, boulders or debris, damp, brown, (compact)		1
		CLAYEY SILT With sand, trace organics, brown, moist	99.3 99.0	
		GLACIAL TILL Silty sand with gravel, cobbles, and boulders, light brown to grey, moist to wet, (very dense)		2
				3
		SANDSTONE BEDROCK Grey, slightly weathered, (good quality)	96.1	4
			96.2	5
		Borehole Terminated at 5.8 m Depth	94.6	

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

22
10 then 50 / 100 mm refusal
60
73

SAMPLES	Natural Unit Wt. kN/m³
AS-1	
SS-2	
SS-3	
COBBLE	
SS-4	
BOULDER	
SS5	
RUN 1	

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. 32 mm diameter well installed upon completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-23002900-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
'March 24, 2023	4.2	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	4.3 - 5.8	100	83

LOG OF BOREHOLE OTT-23002900 LOGS GINT MARCH 20, 2023.GPJ TROW OTTAWA.GDT 4/3/23

Log of Borehole BH-5

Project No: OTT-23002900-A0

Project: Proposed Addition to Canadian Tire Store 442

Location: 2501 Greenbank Road, Ottawa, ON

Figure No. 7

Page. 1 of 1

Date Drilled: 'March 16, 2023

Drill Type: CME-75 Truck-Mounted Drill Rlg

Datum: Approximate Geodetic Elevation

Logged by: M.Z. Checked by: D.W.

Split Spoon Sample ⊠
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Approximate Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALTIC CONCRETE ~ 100 mm thick	100.5	0				
		GRANULAR FILL ~120 mm thick Sand and crushed gravel, damp, dark brown	100.4 100.3					
		FILL Sand and gravel, some silt, with possible cobbles, boulders or debris, damp, brown, (compact)		1	12		AS-1 AS-2 SS-2	
			99.1					
		GLACIAL TILL Silty sand, some gravel, trace clay, with cobbles and boulders, brown to grey, moist to wet, (dense to very dense)		2	40 then 13 / 25 mm 35		SS-3 COBBLE SS-4	
				3	52		SS-5	
			97.4					
		Borehole Terminated at 3.1 m Depth						

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. Borehole was backfilled upon completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-23002900-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE OTT-23002900 LOGS GINT MARCH 20, 2023.GPJ TROW OTTAWA.GDT 4/3/23

exp Services Inc.
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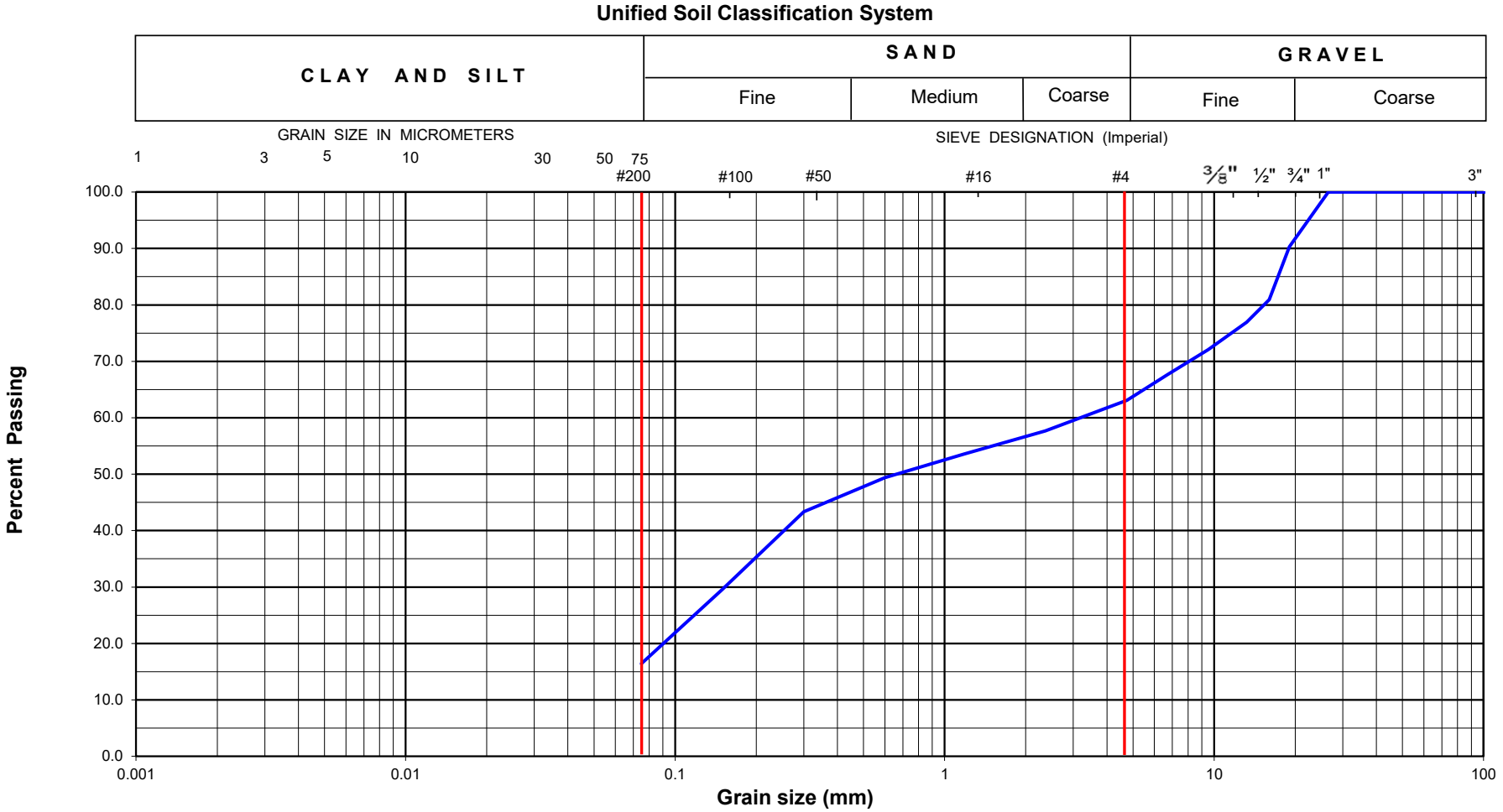
Ottawa, ON K2B 8H6

Grain-Size Distribution Curve

Method of Test for Sieve Analysis of Aggregate

ASTM C-136 (LS-602)



Exp Project No.:	**OTT-23002900-A0**	**Project Name :**	**Proposed Addition to Canadian Tire Store 442**						
Client :	**Canadian Tire Real Estate Limited**	**Project Location :**	**2501 Greenbank Road, Ottawa, ON**						
Date Sampled :	**March 15, 2023**	**Borehole:**	**BH3**	**Sample:**	**AS1**	**Depth (m) :**	**0.3 - 0.6**		
Sample Composition:		**Gravel (%)**	**37**	**Sand (%)**	**47**	**Silt & Clay (%)**	**16**	**Figure :**	**8**
Sample Description :	**FILL: Sand and Gravel, Some Silt; USCS - Silty Sand with Gravel (SM)**								

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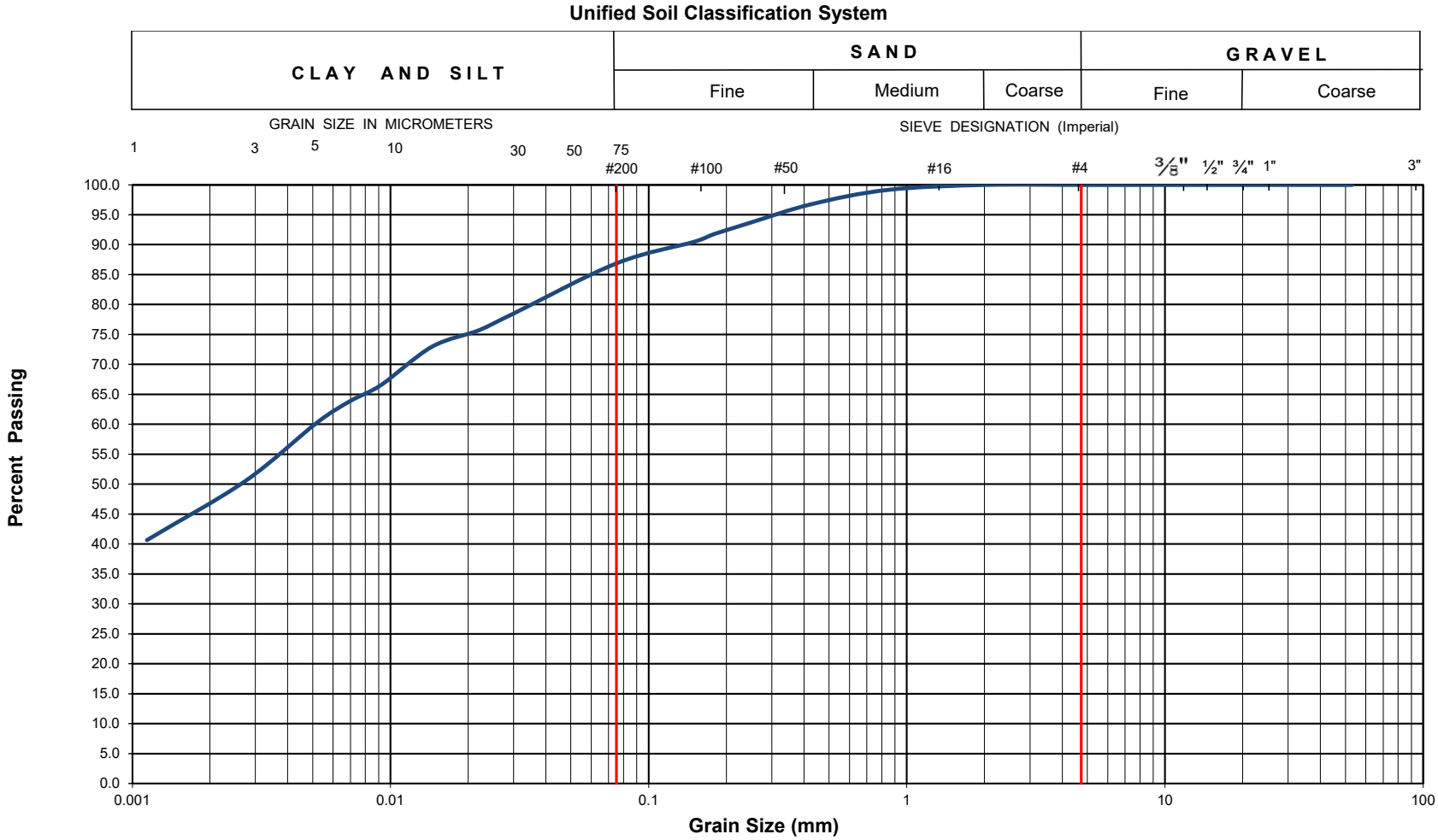
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.:	**OTT-23002900-A0**	**Project Name :**	**Proposed Addition to Canadian Tire Store 442**						
Client :	**Canadian Tire Real Estate Limited**	**Project Location :**	**2501 Greenbank Road, Ottawa, ON**						
Date Sampled :	**March 16, 2023**	**Borehole No:**	**BH2**		**Sample No.:**	**SS3**		**Depth (m) :**	**1.5-2.1**
Sample Description :		**% Silt and Clay**	**87**	**% Sand**	**13**	**% Gravel**	**0**	**Figure :**	**9**
Sample Description :	**Silt and Clay, Some Sand; USCS - Clay of Medium Plasticity (CL)**								

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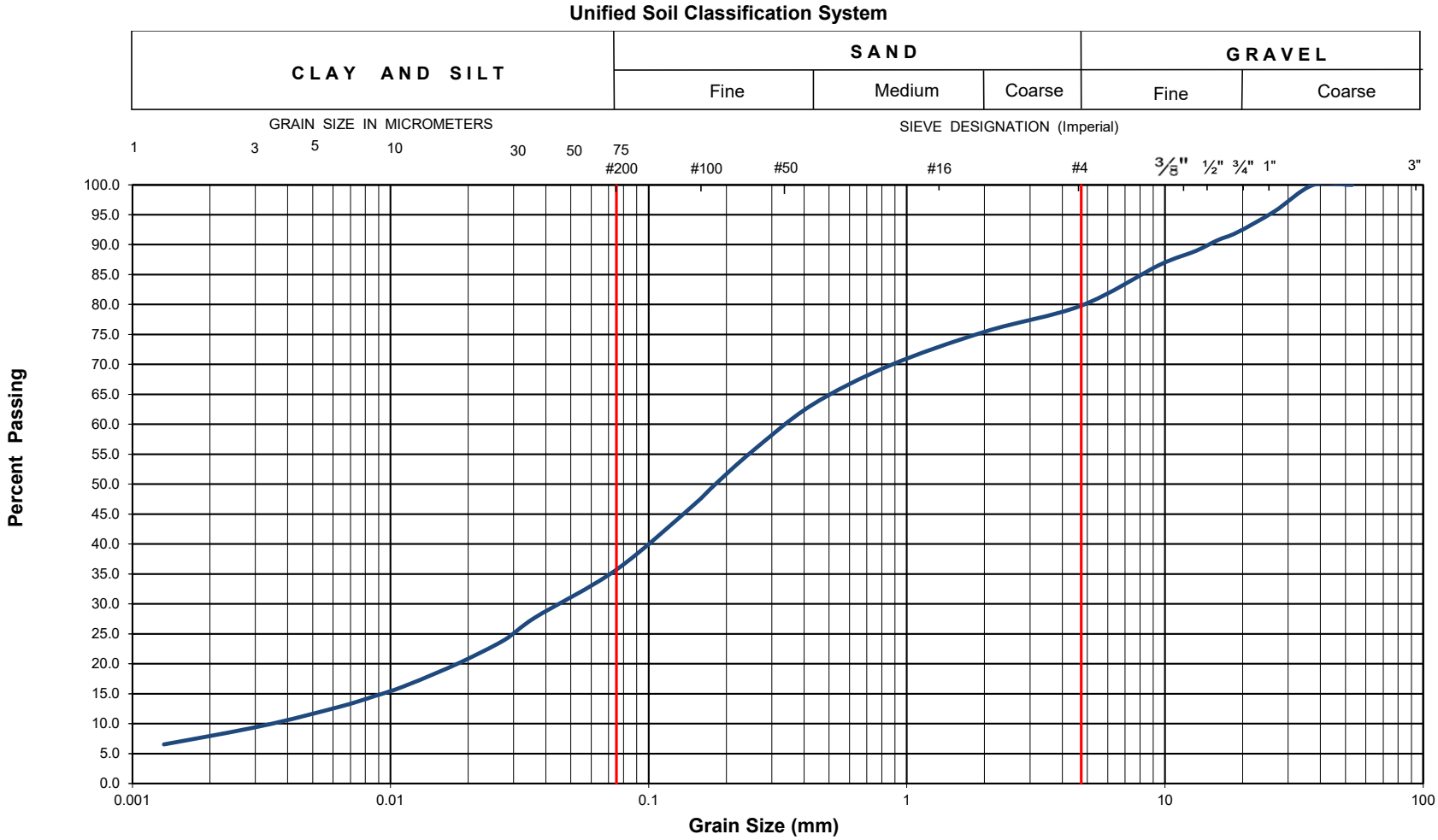
Ottawa, ON K2B 8H6

Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.:	**OTT-23002900-A0**	**Project Name :**	**Proposed Addition to Canadian Tire Store 442**						
Client :	**Canadian Tire Real Estate Limited**	**Project Location :**	**2501 Greenbank Road, Ottawa, ON**						
Date Sampled :	**March 16, 2023**	**Borehole No:**	**BH2**	**Sample No.:**	**SS6**	**Depth (m) :**	**3.8-4.4**		
Sample Description :		**% Silt and Clay**	**36**	**% Sand**	**44**	**% Gravel**	**20**	**Figure :**	**10**
Sample Description :	**Glacial Till: Silty Sand, Gravelly to Some Gravel, Trace Clay; USCS - Silty Sand with Gravel (SM)**								

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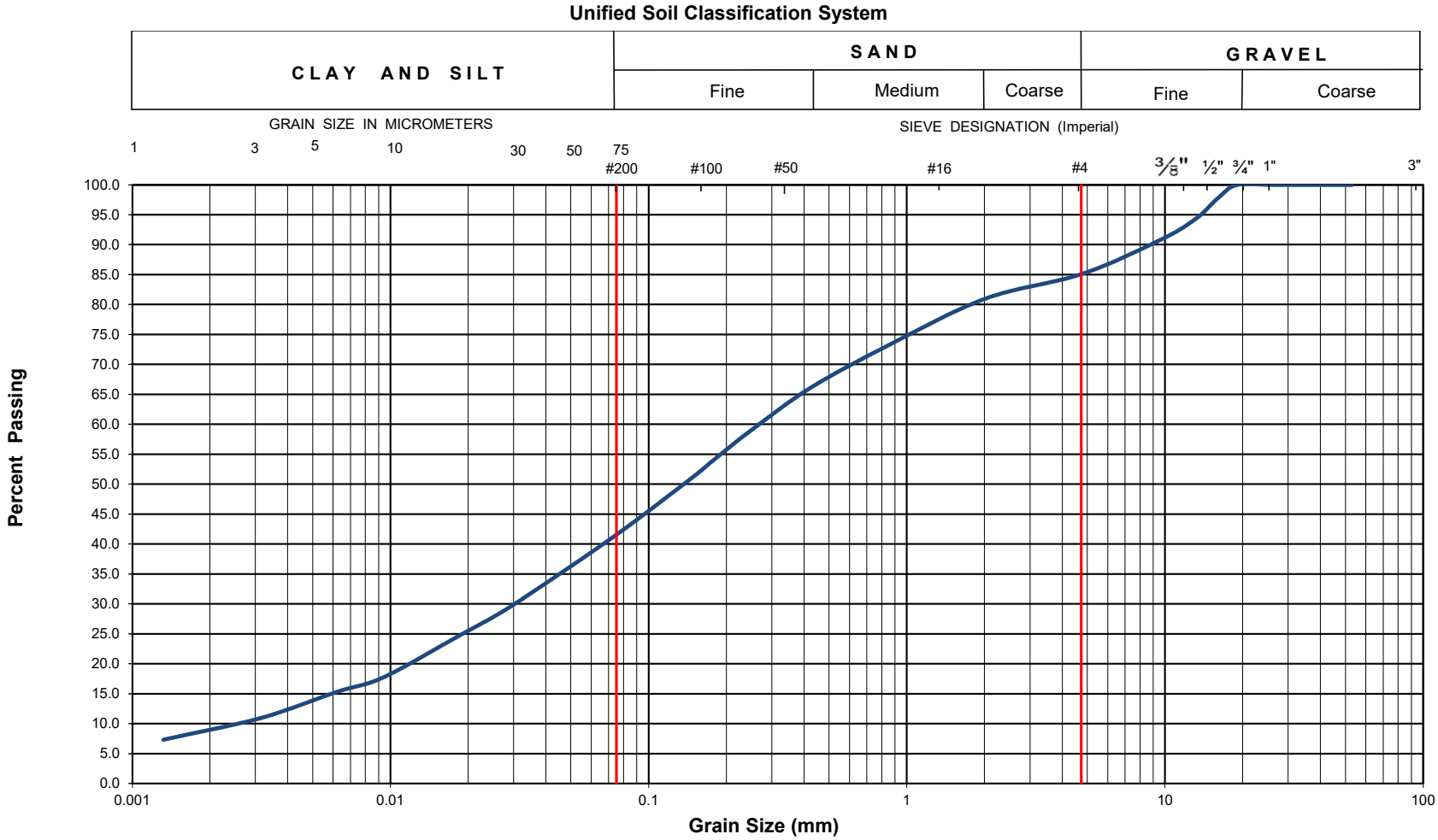
Ottawa, ON K2B 8H6

Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422



EXP Project No.:	**OTT-23002900-A0**	**Project Name :**	**Proposed Addition to Canadian Tire Store 442**						
Client :	**Canadian Tire Real Estate Limited**	**Project Location :**	**2501 Greenbank Road, Ottawa, ON**						
Date Sampled :	**March 16, 2023**	**Borehole No:**	**BH5**		**Sample No.:**	**SS5**		**Depth (m) :**	**2.5 - 3.1**
Sample Description :		**% Silt and Clay**	**42**	**% Sand**	**43**	**% Gravel**	**15**	**Figure :**	**11**
Sample Description :	**Glacial Till: Silty Sand, Some Gravel, Trace Clay; USCS - Silty Sand with Gravel (SM)**								

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borehole no. **BH4**	Run 1: 2.8m - 3.4m Run 2: 4.3m - 5.8m	project Proposed Addition to Canadian Tire Store 442	project no. OTT-23002900-A0
date cored Mar 16, 2023		Rock Core Photographs	FIG 12

Appendix A - Laboratory Certificate of Analysis

Legal Notification

This report was prepared by EXP Services for the account of Canadian Tire Real Estate Limited.

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

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