6097 Colonel Talbot Road Development

Geotechnical Investigation

Project Location:
6097 Colonel Talbot Road
London, ON

Prepared for:
MHBC Planning Ltd.
540 Bingemans Centre Dr
Kitchener, ON N2B 3X9

Prepared by:
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April 5, 2022

MTE File No.: 49653-200

Engineers, Scientists, Surveyors.

Contents

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1.0 Introduction

MTE Consultants Inc. (MTE) was retained by MHBC Planning Ltd. for the proposed development at 6097 Colonel Talbot Road in London, Ontario, as shown on Figure 1 in Appendix A. The site is currently agricultural field with residential dwelling on the east side. The site has commercial and industrial building to the east and south of the site with agricultural fields north and west. The site is approximately 42 acres in area.

The ground surface of the site ranges in elevation with a grade difference of about 4.3 m (Elevation 257.3 to 261.6 m) between borehole locations. A hydrogeological report is being prepared under separate cover.

The purpose of this geotechnical investigation is to determine the soil and groundwater conditions at the site and provide geotechnical engineering recommendations pertaining to the property; including site grading, site servicing, foundation design, slab on-grade construction, pavement design and sub-drainage, and storm water infiltration.

2.0 Field and Laboratory Program

The fieldwork for this investigation was carried out on December 15 and 16, 2021 and involved the drilling of nine boreholes (Borehole MW101-21 to BH109-21) to depths of 3.7 to 8.2 m. The location of the boreholes are shown on the Site Plan, Figure 2 in Appendix A.

Private and public utility companies were contacted prior to the start of drilling activities in order to isolate underground utilities near the boring locations.

The boreholes were advanced with a D50T track mounted drill rig equipped with continuous flight hollow stem augers, supplied and operated by London Soil Test Ltd.

Representative soil samples were recovered throughout the depths explored. Standard Penetration Tests (SPT) were carried out during sampling operations in the boreholes using conventional split spoon equipment. The SPT N-values recorded are plotted on the borehole logs in Appendix B.

Upon completion of drilling, four 51 mm diameter monitoring wells were installed in MW101-21 to MW104-21 to allow measurement of stabilized groundwater levels and groundwater sampling and testing, if required. The installations comprised 1.5 to 2.0 m filtered screen and bentonite seals above the screen. The monitoring wells were installed in accordance with Ontario Regulation 468/10. A licensed well technician must properly decommission all wells before construction. The construction, maintenance and abandonment of the wells are regulated under the province's Water Resources Act. The remaining boreholes were backfilled with soil cuttings and bentonite in accordance with Ontario Regulation 468/10 (formerly O. Reg. 903) under the provinces Water Resources Act.

Stabilized water level measurements were taken by MTE on January 12, 2022. Details of the installation and groundwater observations and measurements are provided on the appended borehole logs. The fieldwork was monitored throughout by a member of our geotechnical engineering staff, who directed the drilling procedures; conducted SPT tests; documented the soil stratigraphy; monitored the groundwater conditions; and transported the recovered soil samples back to our office for further classification.

The ground surface elevations at the borehole locations was surveyed by MTE and referenced to geodetic datum.

All of the soil samples collected were submitted for moisture content testing and five soil samples were submitted for particle size distribution analyses. The results of the laboratory tests are provided in Appendix C. The remaining soil samples will be stored for a period of 1 month and will be discarded of at that time without prior request from the client to extend storage time.

3.0 Soil Conditions

Reference is provided to the appended borehole logs for soil stratigraphy details, SPT N-values, moisture content profiles, and groundwater observations and measurements. Soil conditions encountered at the site include topsoil overlying native cohesive deposits interlayered with sand and silt deposits.

3.1 Topsoil

Topsoil was encountered at the ground surface in all boreholes and was 25 to 460 mm thick (average thickness = 230 mm). The topsoil is brown to grey in colour and ranges in composition from clayey silt to sandy silt topsoil. The insitu moisture content of the topsoil was noted as moist to very moist or conditions drier than the plastic limit. The topsoil was determined through visual observation and no nutrient testing for applicable plant growth was performed as part of the scope of work for this project.

3.2 Sand and Silt Deposits

Sand and silt deposits were encountered within most boreholes interlayered within the cohesive deposits between the depths of 0.1 to 0.8 m and ranged from 0.1 to 1.8 m thick. The sand and silt deposits were brown to grey in colour and typically ranges in composition from sandy silt to silty sand to sand and gravel.

SPT N-values measured in the sand and silt deposits ranged from 3 to 10 blows per 300 mm penetration of the split spoon sample indicating loose to compact conditions. It is noted the loose conditions were encountered within the upper 1.5 m of sand and silt soils. Insitu moisture contents in the sand and silt deposits ranged from about 19 to 27% indicating very moist to saturated conditions.

3.3 Granular Deposits

Granular deposits were encountered within the cohesive deposits in Boreholes MW103-21 and BH105-21. The granular deposits were discovered at depths of 0.3 and 2.3 m respectively and were 0.5 to 0.7 m thick. The granular deposits were light brown to brown in colour and typically ranges in composition from sand to sand and gravel.

SPT N-values measured in the granular deposits ranged from 6 and 17 blows per 300 mm penetration of the split spoon sample indicating loose to compact conditions. It is noted the loose conditions were encountered within the upper portion of soil in Borehole MW103-21. Insitu moisture content in the granular deposits ranged from about 17 and 27% indicating wet to saturated conditions.

3.4 Cohesive Deposits

Cohesive deposits were encountered underlying the topsoil or sands and silts in all the boreholes and extended to the termination depth of each borehole. The cohesive deposits were grey to brown in colour and typically ranges in composition from silty clay to clayey silt. The results of five particle size distribution analyses conducted in the cohesive deposits are provided in **Appendix C** and summarized in the following table;

Table 1 - Results of Cohesive Deposits Particle Size Distribution Analyses

Borehole Number	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
MW101-21	4.6-5.2	0	13	46	41
MW102-21	6.1-6.7	2	14	47	37
MW103-21	6.1-6.7	0	8	48	44
MW104-21	6.9-7.5	0	7	44	49
BH106-21	1.5-2.1	0	18	37	45

SPT N-values measured in the cohesive deposits ranged from 4 to 31 blows per 300 mm penetration of the split spoon sampler indicating soft to very stiff conditions. It is noted the soft to firm conditions were noted in the upper 1.5 m of soil in Boreholes MW104-21 and BH105-21. Insitu moisture contents in the cohesive soils ranged from 16 to 26% indicating conditions drier than to wetter than the plastic limit.

4.0 Groundwater Conditions

Groundwater observations were carried out in the open boreholes at the time of drilling and are summarized on the borehole logs. Groundwater was noted within sandy clayey silt soil in Borehole BH105-21 at a depth of 0.8 m, while the remaining boreholes were dry upon drilling completion on December 15 and 16, 2021.

Groundwater levels were measured in the monitoring wells installed in Boreholes MW101-21 to MW104-21 on January 12, 2022 at depths of 2.8 to 7.6 m (Elevation: 251.7 to 255.8 m). The results of the measured groundwater levels are summarized in the table below:

Table 2 - Groundwater Measurements

Borehole	Ground Surface Elevation (m)	Measured Groundwater Level January 12, 2022	
		Depth (m)	Elevation (m)
MW101-21	261.6	5.8	255.8
MW102-21	259.8	5.7	254.0
MW103-21	257.3	2.8	254.5
MW104-21	259.3	7.6	251.7

Additional information on the measured groundwater readings is presented in the hydrogeological assessment under separate cover.

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations and local variations.

5.0 Discussion and Recommendations

5.1 General

The site is currently an agricultural field located at 6097 Colonel Talbot Road in London, Ontario. The proposed development plans were preliminary during the preparation of this report, and preliminary design recommendations are provided and should be revisited and modified upon further design of the proposed development.

The subsurface stratigraphy at the site comprises topsoil overlying native cohesive deposits interlayered with sand and silt deposits. Groundwater observations were carried out in the open boreholes at the time of drilling and were noted dry in most boreholes with the exception of Borehole BH105-21 at a depth of 0.8 m. Groundwater levels were measured in the monitoring wells on January 12, 2022 between the depths of 2.8 to 7.6 m (Elevation: 251.7 to 255.8 m). It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations and local variations.

Based on the results of this geotechnical investigation, the site is suitable for future development. The following subsections of this report contain geotechnical recommendations pertaining to development of the property; including site grading, site servicing, foundation design, slab on-grade construction, pavement design and sub-drainage and storm water infiltration.

5.2 Site Preparation

The first construction activity that will be required for the proposed development will be grading. Prior to carrying out any cutting and engineering fill operations, the topsoil and any fill materials must be removed and stockpiled. The average topsoil thickness measured in the boreholes was about 230 mm thick. It is recommended that the average thickness across the site be increased by 50 mm for removal/stripping calculations to account for variations at the site.

The subgrade should be inspected, and proof rolled in the presence of qualified geotechnical personnel to verify if the subgrade will provide support as intended in the original design. The primary purpose of the inspection is to identify poorly performing areas which should be sub-excavated.

The majority of the native soils above the groundwater table are suitable for reuse as engineered fill provided they are close to optimum water content for compaction purposes, if engineered fill is required. All fill should be placed in maximum 300 mm thick lifts and compacted to the following percentages;

Table 3 - Engineered Fill Requirements

Fill Use	Minimum Compaction Required
Structural fill to support buildings	100% SPMDD
Subgrade fill beneath pavements or services	95% SPMDD
Bulk fill in landscape area	90% SPMDD

The subgrade soils are susceptible to disturbance and it is recommended that construction traffic on the subgrade be minimized.

Structural fill used for raising grades beneath the buildings should comprise granular material such as OPSS Granular ‘A’ or ‘B’. Subgrade fill material beneath the proposed pavement areas

and services should meet the requirements of OPSS Select Subgrade Material (SSM). Any imported fill should be tested and verified by a geotechnical engineer prior to placement.

Structural fill pads should extend a minimum 0.3 m beyond the edge of the footing envelope of any building and down to subgrade at an angle of 45 degrees to the horizontal. Full time testing by geotechnical personnel is recommended during fill placement and compaction to monitor material quality, lift thickness, and verify the compaction by insitu density testing.

In order to minimize the effects of weather and groundwater, fill operations onsite should be carried out in the dry summer months.

5.3 Site Servicing

5.3.1 Excavations and Dewatering

The development will be serviced with full municipal services. It is anticipated that the invert levels for the watermain and sewers will be at conventional depths.

Temporary excavations to conventional depths for installation of underground pipes at this site must comply with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The silt and sand and granular soils would be classified as Type 3 soils and temporary side slopes must be cut at an inclination of 1 horizontal to 1 vertical or less above the base of the excavation, exclusive of groundwater effects. The cohesive soils would be classified as Type 2 soils and temporary side slopes must be cut at an inclination of 1 horizontal to 1 vertical or less at a level 1.2 m above the base of the excavation, exclusive of groundwater effects.

Trench side slopes must be continuously inspected especially after periods of heavy rainfall or snow melt to identify areas of instability. Surface water should be directed away from entering the trench.

Moderate groundwater inflow should be expected if excavations encounter saturated silt and sand deposits. Conventional sump pump techniques should be able to control the inflow. Moderate to significant groundwater inflow should be expected if excavations encountered saturated granular deposits.

It will be necessary to flatten the excavation side slopes where groundwater seepage is occurring to ensure stability. Every excavation that a worker may be required to enter shall be kept reasonably free of water (O. Reg. 213/91, s. 230).

It should be noted that an Environmental Activity and Sector Registry (EASR) or Permit to Take Water (PTTW), issued by the Ministry of Environment, Conservation and Parks, will be required if the dewatering system/sumps result in a water taking of more than 50,000 L/day to 400,000 L/day, respectively. The design of the dewatering system should be left to the contractor's discretion to control groundwater at least 0.5 m below the invert level in order to provide stable excavation base. The contractor should notify the prime consultant in the event that he feels that an EASR/PTTW will be needed. Additional information on the proposed dewatering is presented in the hydrogeological assessment under separate cover.

5.3.2 Pipe Bedding

It is anticipated invert elevation of the pipes will be at conventional 2 to 3 m depths below the ground surface. No bearing problems are anticipated for pipes set on native inorganic subsoil or imported structural fill. The bedding material may need to be thickened in regions where sub-excavation encounters soft or spongy soil from the base on the service trench.

Pipe bedding for water and sewer services should be conventional Class 'B' pipe bedding comprising a minimum 150 mm thick layer of OPSS Granular 'A' aggregate below the pipe invert. Where poorly performing soils are encountered, additional pipe bedding will be required. Granular 'A' type aggregate should be provided around the pipe to at least 300 mm above the pipe and the bedding aggregate should be compacted to a minimum 95% Standard Proctor Maximum Dry Density (SPMDD).

A well-graded clear stone such as Coarse Aggregate for HL4 Asphaltic Concrete (OPSS 1003) should be used in the sewer trenches as bedding below the spring line of the pipe to facilitate sump pump dewatering, where groundwater seepage is encountered. The clear stone should be compacted with a plate tamper and fully wrapped with a non-woven filter cloth.

5.3.3 Trench Backfilling

The trenches above the specified pipe bedding should be backfilled with inorganic onsite soils placed in 300 mm thick lifts and compacted to at least 95% SPMDD. Wet or saturated native soils are not considered suitable for reuse as trench backfill. Any additional material required at the site should comprise imported granular soils such as OPSS Select Subgrade Material.

To minimize potential problems, backfilling operations should follow closely after excavation so that only a minimal length of trench is exposed. Care should be taken to protect side slopes of excavations by diverting surface run-off away from the excavations. If construction extends into the winter, then additional steps should be taken to minimize frost and ensure that frozen material is not used as backfill.

All materials and construction services required for the work should be in accordance with the relevant sections of the Ontario Provincial Standard Specifications.

5.4 Pavements

It is understood pavements will be constructed for the proposed roadways and parking areas at the site. The pavement subgrade soils will comprise native inorganic soils or imported structural fill.

The pavement component thicknesses in the following table are recommended based on the proposed pavement usage, the frost-susceptibility and strength of the subgrade soils, and the Benkelman beam spring rebound coefficient for cohesive soils;

Table 4 - Pavement Design

Pavement Component	Light Duty	Heavy Duty
Asphalt Hot Mix	90 mm	120 mm
OPSS 1010 Granular ‘A’ Base	150 mm	200 mm
OPSS 1010 Granular ‘B’ Subbase	400 mm	500 mm

Heavy duty pavements should be used for main access ways to the development and where large vehicles will frequently travel, such as garbage and fire trucks.

Samples of aggregates should be checked for conformance to OPSS 1010 prior to utilization on site and during construction. The Granular 'B' subbase and Granular 'A' base courses must be compacted to 100% SPMDD, as verified by insitu density testing.

The asphaltic concrete paving materials should conform to the requirements of OPSS 1150. The asphalt should be placed and compacted in accordance with OPSS 310. The Performance Graded Asphalt Cement designation for the asphaltic concrete is 58-28.

The asphaltic concrete should comprise 40 mm of HL3 surface over 50 mm of HL8 binder for the light duty pavement option and 50 mm of HL3 surface over 70 mm of HL8 binder for the heavy duty pavement option.

The pavement design is based on the assumption that construction will be carried out during the drier time of the year and that the subgrade soil is stable as determined by proof-rolling inspected by a geotechnical engineer. If the subgrade is wet and unstable, additional granular subbase will be required and filter cloth may be recommended to ensure integrity of granular soils.

All materials and construction services required for the work should be in accordance with the relevant sections of the Ontario Provincial Standard Specifications.

It is strongly recommended to install subdrains beneath the low areas of pavement and connected to catch basins. The purpose of the subdrains is to remove excess subsurface water in order to improve overall pavement serviceability and increase the pavement life.

The work of subdrain installation shall be in accordance with OPSS 405 and OPSD 216.021. The subdrain shall be 100 or 150 mm diameter perforated pipe conforming to OPSS 1801 or 1840, and wrapped with geotextile conforming to OPSS 1860.

5.5 Curbs, Gutters and Sidewalks

The concrete for curbs, gutters and sidewalks should be proportioned, mixed, placed and cured in accordance with the requirements of OPSS 353, and OPSS 1350 and shall meet the following specific requirements (OPSS 353.05.01):

- Minimum compressive strength = 30 MPa at 28 days
- Coarse aggregate = 19.0 mm nominal max. size
- Maximum slump = 60 mm for curb and gutter, 70 mm for sidewalks
- Air entrainment = 6.5 ± 1.5%

During cold weather any freshly placed concrete must be covered with insulating blankets to protect against freezing as per OPSS 904. Three cylinders from each day's pour should be taken for compressive strength testing. Air entrainment, temperature and slump tests should be conducted on the same batch of concrete from the test cylinders made.

5.6 Foundation Design

The proposed development plans have not been provided at the time of preparing this report, and preliminary design recommendations are provided and should be revisited and modified upon further design of the proposed development.

In general, the undisturbed compact or stiff to very stiff native soils or engineered structural fill are considered suitable to support building foundations. Building footings constructed on the compact or stiff to very stiff native soils or engineered structural fill may be designed for a factored geotechnical bearing resistance at Ultimate Limit States (ULS) of 180 to 225 kPa, and soil bearing resistance for 25 mm of settlement at Serviceability Limit States (SLS) of 100 to 150 kPa depending on encountered soil conditions. The following table provides the minimum recommended depth and elevation for footing placement on suitable native soil.

Table 5 - Recommended Founding Elevation for Building Footings

Borehole Number	Borehole Ground Surface Elevation (masl)	Depth Below Existing Ground Surface to Suitable Native Soil (mbgs)	Elevation of Suitable Native Soil (masl)	Soil Type
MW101-21	261.6	*0.8	260.8	Clayey Silt
MW102-21	259.8	2.3	257.5	Clayey Silt
MW103-21	257.3	2.3	**255.0	Clayey Silt
MW104-21	259.3	*0.8	258.5	Clayey Silt
BH105-21	260.6	1.5	**259.1	Clayey Silt
BH106-21	261.2	1.5	259.7	Clay and Silt
BH107-21	260.5	*0.8	259.7	Clayey Silt
BH108-21	261.1	*0.8	260.3	Clayey Silt
BH109-21	260.1	*0.8	259.3	Clayey Silt

*It is noted 1.2 m of soil cover is required for frost protection

**It is noted groundwater is within 1.0 m of footing depth

The founding materials are susceptible to disturbance by construction activity, especially during wet weather and care should be taken to preserve the integrity of the material as bearing strata.

The soil in trenches beneath footings for sewer and watermain services, if applicable, shall be compacted by tamping up to the level of the footing base, or shall be filled with concrete having a strength not less than 10 MPa, to support the footing.

The footing areas must be inspected by a geotechnical engineer to ensure that the soil conditions encountered at the time of construction are suitable to support the design resistances prior to pouring concrete. Any loose, disturbed, organic and deleterious material identified during the inspection should be removed from the footing areas and replaced with structural fill or concrete.

All exterior floor slabs and footings in unheated areas must be provided with a minimum 1.2 m of earth cover after final grading in order to minimize the potential of damage due to frost action, as per Ontario Provincial Standard Drawing, OPSD 3090.101, dated November 2010. If construction is undertaken during the winter, the subgrade soil and concrete should be protected from freezing.

Where spread footings are constructed at different elevations, the difference in elevation in the individual footing should not be greater than one half of the clear distance between the footings. The lower footing should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevation of the upper footings can be adjusted accordingly. Stepped strip footings should be constructed in accordance with OBC Section 9.15.3.8.

A Site Classification ‘D’ should be used for earthquake load and effects in accordance with Table 4.1.8.4.A. of the 2012 Ontario Building Code. All excavations at the site should be carried out in conformance with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The silt and sand and granular soils would be classified as Type 3 soils

and temporary side slopes must be cut at an inclination of 1 horizontal to 1 vertical or less above the base of the excavation, exclusive of groundwater effects. The cohesive soils would be classified as Type 2 soils and temporary side slopes must be cut at an inclination of 1 horizontal to 1 vertical or less at a level 1.2 m above the base of the excavation, exclusive of groundwater effects. Due to shallow groundwater in selected regions, temporary side slopes may be required to be cut at a further inclination of 3 horizontal to 1 vertical from the base of the excavation.

5.7 Concrete Slab-on-Grade

It is understood that conventional concrete slab-on-grade techniques may be used in the proposed development, following removal of any topsoil, and inspecting the subgrade soils.

Any additional material required to raise grades below the floor slab should be comprised of granular soil and be compacted to 98% SPMDD. A minimum 150 mm thick layer of Granular 'A' material uniformly compacted to 100% SPMDD should be provided directly beneath the slab for leveling and support purposes.

A modulus of subgrade reaction of 15 to 20 MPa/m should be used in the design of the floor slab.

No special underfloor drains are required, provided the exterior grades are lower than the floor slab and positively sloped away from the building.

If a moisture-sensitive floor finish is to be applied to the slab, then we recommend that a 15 mil polyethylene moisture vapour barrier be installed directly beneath the slab as per Article 9.13.2.7 of the Ontario Building Code. The purpose of the vapour barrier is to reduce moisture transfer by diffusion as per Article 5.5.1.2 of the Ontario Building Code. Joints in the vapour barrier should be lapped not less than 100 mm.

The water to cement ratio and slump of the concrete utilized in the floor slab should be strictly controlled to minimize shrinkage of the slab. Control joints should be sawed into the slabs at regular intervals within 12 hours of initial concrete placement in order to prelocate shrinkage cracks.

Concrete testing should be performed onsite to determine the slump, temperature, and air entrainment; and concrete cylinders should be cast for compressive strength testing.

5.8 Stormwater Infiltration

It is understood that at-source infiltration of stormwater runoff from the development may also be considered for this site. Soak-away pits generally require soils with a minimum percolation rate of 15 mm/hr and a minimum separation between the bottom of the pit and the seasonally high water table of 1 m (MOE, 2003). Five particle size distribution analyses were carried out on the native soils encountered at the site and are plotted on Table 101 in Appendix C.

Due to the high content of clay and silt in the native soils, low impact development is not considered feasible for the site. Insitu infiltration testing could be performed in the exact areas of proposed LID measures to accurately measure the infiltration of the soils in those areas. Additional information on stormwater infiltration is presented in the hydrogeological assessment under separate cover.

5.9 Construction Inspection and Testing

MTE recommends that geotechnical inspection and testing procedures be conducted throughout the various phases of the project.

Engineer site visits should be conducted to confirm geotechnical bearing resistances for footings. Soil compaction testing should be carried out on structural fill beneath the residential building, foundation wall backfill, trench backfill and slope stability. Laboratory and field testing of the pavement structure components (granulars and asphaltic concrete) should be conducted, as well as concrete testing for foundations.

MTE offers soil compaction, concrete, and asphalt testing as well as soil inspection services through our Stratford and London offices.

6.0 Limitations of Report

Services performed by MTE Consultants Inc. (MTE) were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the Geotechnical Engineering & Consulting profession practicing under similar conditions in the same geographic area were the services are provided. No other warranty or representation expressed or implied as to the accuracy of the information, conclusions or recommendations is included or intended in this report.

This report was completed for the sole use of the Client. This report is not intended to be exhaustive in scope or to imply a risk-free site. As such, this report may not deal with all issues potentially applicable to the site and may omit aspects which are or may be of interest to the reader.

In addition, it should be recognized that a soil sample result represents one distinct portion of a site at the time it is collected, and that the findings of this report are based on conditions as they existed during the time period of the investigation. The material in the report reflects our best judgment using the information available at the time the report was written. The soil and groundwater conditions between and beyond the test holes may differ from those encountered in the test holes. Should subsurface conditions arise that are different from those in the test holes MTE should be notified to determine whether or not changes should be made as a result of these conditions.

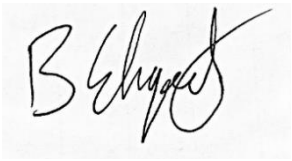
It should be recognized that the passage of time may affect the views, conclusions and recommendations (if any) provided in this report because groundwater conditions of a property can change, along with regulatory requirements. All design details were not known at the time of submission of this report and it is recommended MTE should be retained to review the final design documents prior to construction to confirm they are consistent with our report recommendations. Should additional or new information become available, MTE recommends that it be brought to our attention in order that we may determine whether it affects the contents of this report.

Any use which another party makes of this report, or any reliance on, or decisions to be made based upon it, are the responsibility of such parties. MTE accepts no responsibility for liabilities incurred by or damages, if any, suffered by another party as a result of decisions made or actions taken, based upon this report. Others with interest in the site should undertake their own investigations and studies to determine how or if the condition affects them or their plans. The contractors bidding on this project or undertaking the construction should make their own interpretation of the factual information and draw their own conclusions as to how subsurface conditions may affect their work.

The benchmark and elevations provided in this report are primarily established to identify differences between the test hole locations and should not be used for other purposes such as, planning, development, grading, and excavation.

All of which is respectfully submitted,

MTE Consultants Inc.



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Appendix A

Figures

Figure 1 - Location Plan

Figure 2 - Site Plan

REFERENCES:

- AERIAL IMAGE FROM GOOGLE EARTH PRO

MTE
Engineers, Scientists, Surveyors
Ph. (519) 271-7952 www.mte85.com

SCALE: N.T.S

CLIENT: 2803767 ONTARIO INC.

PROJECT: 6097 COLONEL TALBOT ROAD HYDROGEOLOGICAL CONSULTING SERVICES

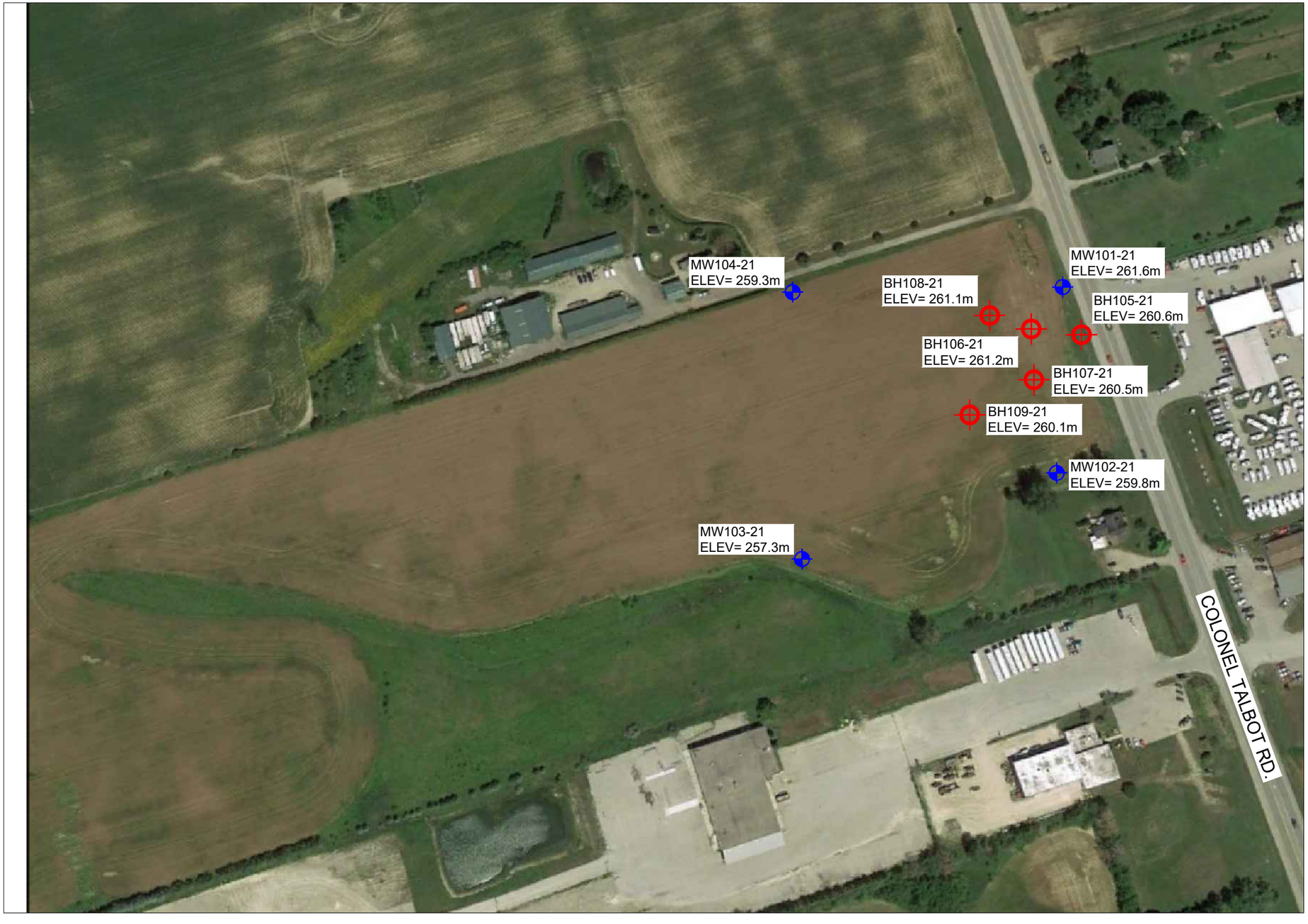
SITE: 6097 COLONEL TALBOT ROAD, LONDON, ONT

TITLE: LOCATION PLAN

Reviewed By	DMG
Prepared By	DXG
Drawn By	DXG
Date	J-N. 2022
Project No.	49653-200
Figure No.	1

N

NORTH



REFERENCES:

- AERIAL IMAGE FROM GOOGLE EARTH PRO
- GROUND SURFACE ELEVATIONS SURVEYED BY MTE.

N

NORTH

LEGEND

BH101-21
MTE BOREHOLE

MW101-21
MTE MONITORING WELL

0 15 30 45 60 75m
Scale(11x17): 1:1500

MTE
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CLIENT
2803767 ONTARIO INC.

PROJECT
6097 COLONEL TALBOT ROAD
HYDROGEOLOGICAL
CONSULTING SERVICES

SITE
6097 COLONEL TALBOT
ROAD, LONDON,
ONT

TITLE
SITE PLAN

Reviewed By	DMG		
Prepared By	DXG	Project No.	49653-200
Drawn By	DXG	Figure No.	2
Date	JAN. 2022		

Appendix B

Borehole Logs

Abbreviations and Symbols

Borehole MW101-21 to BH109-21

The following are abbreviations and symbols commonly used on borehole logs, figures and reports.

Sample Types

AS	Auger Sample
CS	Chunk Sample
BS	Bulk Sample
GS	Grab Sample
WS	Wash Sample
SS	Split Spoon
RC	Rock Core
SC	Soil Core
TW	Thinwall, Open
TP	Thinwall, Piston

Soil Tests

PP	Pocket Penetrometer
FV	Field Vane
SPT	Standard Penetration Test
CPT	Cone Penetration Test
WC	Water Content
WL	Water Level

Penetration Resistance

Standard Penetration Test, N (ASTM D1586)	The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) open spilt spoon sampler for a distance of 300 mm (12 in.).
Dynamic Cone Penetration Resistance	The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive an uncased 50 mm (2 in.) diameter, 60o cone attached to “A” size drill rods for a distance of 300 mm (12 in.).

Soil Description

Cohesive Soils	Undrained Shear Strength (Cu)	
Consistency	kPa	psf
Very Soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very Stiff	100 to 200	2,000 to 4,000
Hard	Above 200	Above 4,000

Cohesionless Soils	
Relative Density	SPT N Value
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Above 50

WH	Sampler advanced by static weight of hammer
WR	Sampler advanced by static weight of drilling rods
PH	Sampler advanced by hydraulic force
PM	Sampler advanced by manual force

DTPL	Drier than Plastic Limit
APL	About Plastic Limit
WTPL	Wetter than Plastic Limit
mbgs	Metres below Ground Surface

ID No.: MW101-21

Project Name: 6097 Colonel Talbot Rd: Hydrogeological Services

MTE File No.: 49653-200

Client: 2803767 Ontario Inc.

Site Location: 6097 Colonel Talbot Rd, London, ON

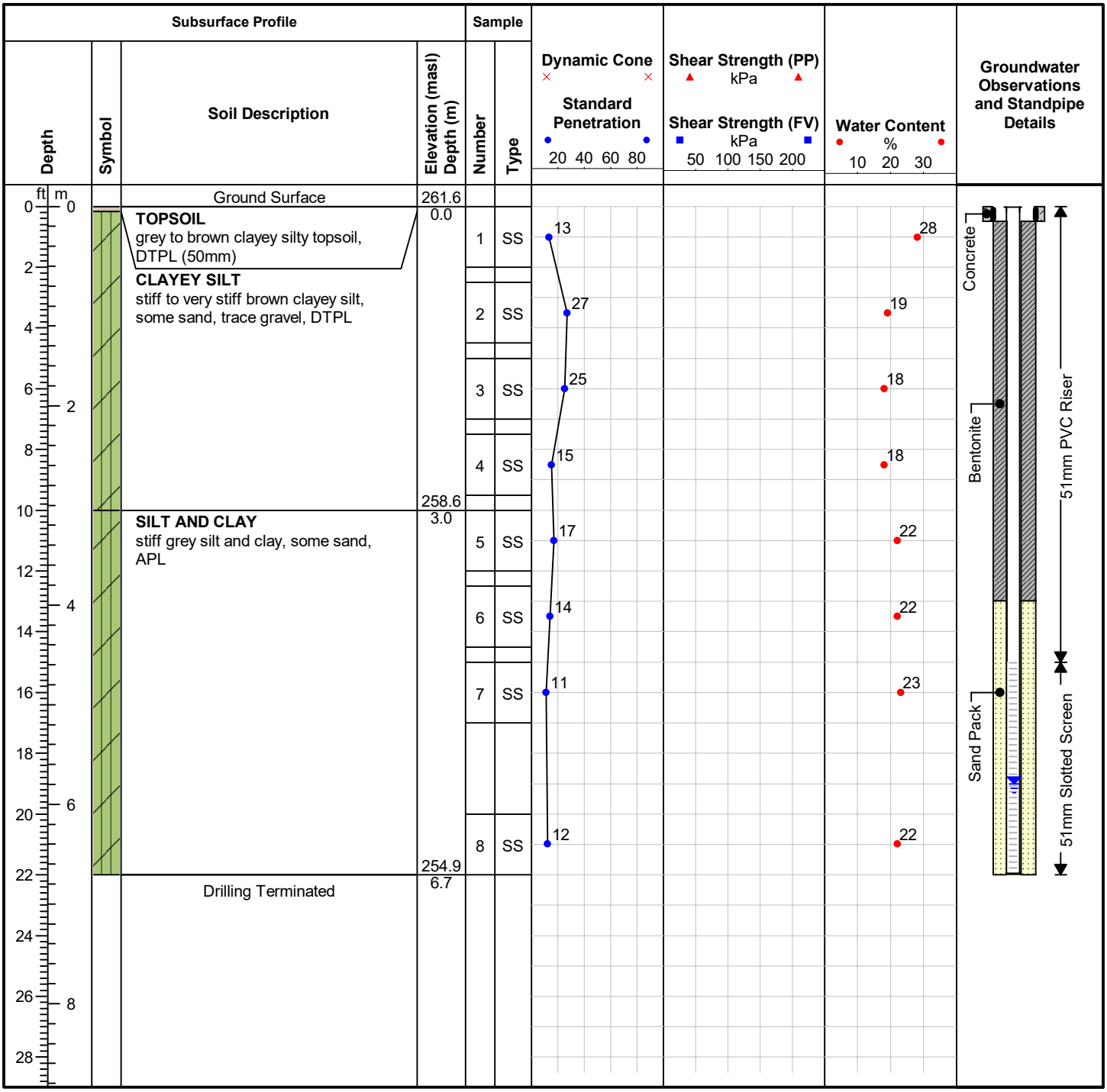
Date Completed: 12/15/2021

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D-50

Drill Method: Conventional

Protective Cover: Monument Casing



Field Technician: AAS

Drafted by: B. Graul

Reviewed by: B. Thorner

Water measured at 5.8 mbgs (Elevation: 255.8 m) on January 12, 2022

ID No.: MW102-21

Project Name: 6097 Colonel Talbot Rd: Hydrogeological Services

MTE File No.: 49653-200

Client: 2803767 Ontario Inc.

Site Location: 6097 Colonel Talbot Rd, London, ON

Date Completed: 12/15/2021

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D-50

Drill Method: Conventional

Protective Cover: Monument Casing

Depth (ft / m)	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Dynamic Cone / Standard Penetration	Shear Strength (PP) kPa / Shear Strength (FV) kPa	Water Content %
0 / 0	Ground Surface	259.8					
0 / 0	**TOPSOIL** loose dark brown sandy silty topsoil, trace clay and gravel, very moist (460mm)	0.0 / 259.3	1	SS	4		29
0.5		0.5					
2 / 0	**SILTY SAND** loose light brown silty sand, some clay, trace gravel, very moist to wet		2	SS	6		24
4	loose, reddish brown, wet						
6 / 2		258.0	3	SS	7		19, 20
6 / 2	**CLAYEY SILT** firm to stiff brown clayey silt, trace gravel, DTPL	1.8 / 257.5					
8	some sand	2.3	4	SS	13		18
10 / 3	grey, APL	256.8 / 3.0	5	SS	10		20
12 / 4	**SILT AND CLAY** stiff grey silt and clay, some sand, trace gravel, APL	256.0 / 3.8	6	SS	11		20
14							
16			7	SS	9		20
18			8	SS	9		21
20 / 6	WTPL	253.7 / 6.1	9	SS	14		20
22							
24			10	SS	12		21
26 / 8			11	SS	10		22
28	Drilling Terminated	251.6 / 8.2					

Groundwater Observations and Standpipe Details: Concrete; Bentonite; 51mm PVC Riser; Sand Pack; 51mm Slotted Screen; Bentonite; Water encountered at 4.6mbgs during drilling

Field Technician: AAS

Drafted by: B. Graul

Reviewed by: B. Thorner

Water measured at 5.7 mbgs (Elevation: 254.0 m) on January 12, 2022

ID No.: MW103-21

Project Name: 6097 Colonel Talbot Rd: Hydrogeological Services

MTE File No.: 49653-200

Client: 2803767 Ontario Inc.

Site Location: 6097 Colonel Talbot Rd, London, ON

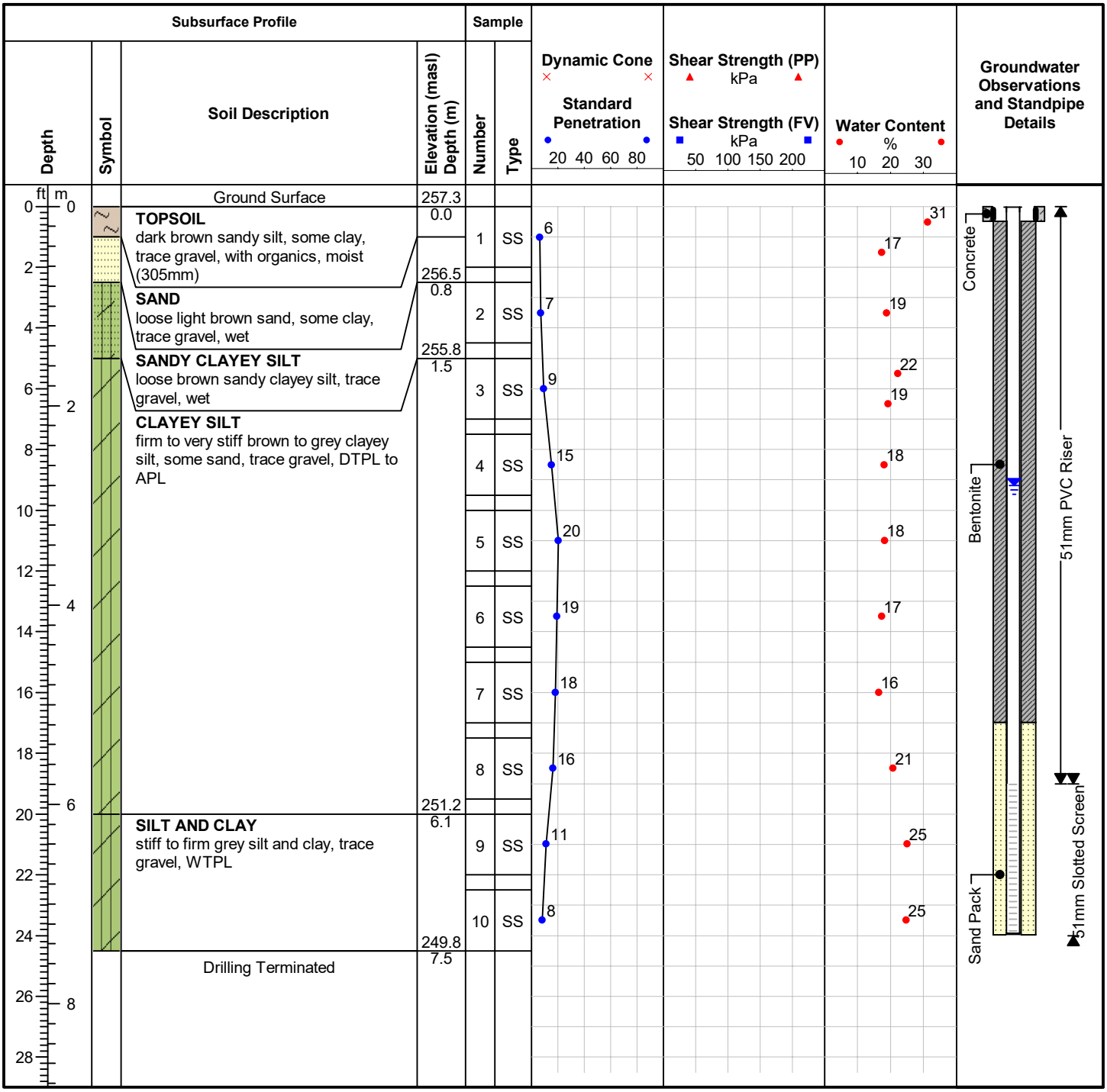
Date Completed: 12/16/2021

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D-50

Drill Method: Conventional

Protective Cover: Monument Casing



Field Technician: AAS

Drafted by: B. Graul

Reviewed by: B. Thorner

Water measured at 2.8 mbgs (Elevation: 254.6 m) on January 12, 2022

ID No.: MW104-21

Project Name: 6097 Colonel Talbot Rd: Hydrogeological Services

MTE File No.: 49653-200

Client: 2803767 Ontario Inc.

Site Location: 6097 Colonel Talbot Rd, London, ON

Date Completed: 12/16/2021

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D-50

Drill Method: Conventional

Protective Cover: Monument Casing

Depth (ft / m)	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type
0 / 0	Ground Surface	259.3		
0 / 0	**TOPSOIL** clayey silty topsoil, some sand trace gravel, with organics, WTPL (305mm)	0.0	1	SS
2 / 0.6	**CLAYEY SILT** firm to stiff brown clayey silt, some sand and gravel, DTPL		2	SS
4 / 1.2		257.8 / 1.5		
6 / 1.8	very stiff, trace gravel, with grey sand seam		3	SS
8 / 2.4			4	SS
10 / 3.0			5	SS
12 / 3.7		255.5		
12 / 3.7	**SILTY CLAY** stiff brown to grey silty clay, trace sand and gravel, WTPL	3.8	6	SS
14 / 4.3		254.7		
14 / 4.3	some sand	4.6	7	SS
16 / 4.9			8	SS
18 / 5.5			9	SS
20 / 6.1		252.4		
20 / 6.1	**CLAY AND SILT** stiff grey clay and silt, trace sand, WTPL	6.9	10	SS
22 / 6.7			11	SS
26 / 7.9		251.1		
26 / 7.9	Drilling Terminated	8.2		

Sample Number	Dynamic Cone / Standard Penetration	Shear Strength (PP) kPa	Shear Strength (FV) kPa	Water Content %
1	4			27
2	12			20
3	21			17
4	29			17
5	22			19
6	16			20
7	16			20
8	12			22
9	12			21
10	9			22
11	12			22

Groundwater Observations and Standpipe Details: Concrete; Bentonite; Sand Pack; 51mm PVC Riser; 51mm Slotted Screen

Field Technician: AAS

Drafted by: B. Graul

Reviewed by: B. Thorner

Water measured at 7.6 mbgs (Elevation: 251.7 m) on January 12, 2022

ID No.: BH105-21

Project Name: 6097 Colonel Talbot Rd: Hydrogeological Services

MTE File No.: 49653-200

Client: 2803767 Ontario Inc.

Site Location: 6097 Colonel Talbot Rd, London, ON

Date Completed: 12/16/2021

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D-50

Drill Method: Conventional

Protective Cover:

Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type
0 / 0		Ground Surface	260.6		
0 / 0		**TOPSOIL** dark brown sandy silt topsoil, trace clay, with organics, very moist (355mm)	0.0 / 260.2 / 0.4	1	SS
2 /		**SANDY CLAYEY SILT** very loose grey/brown sandy clayey silt, with organics, saturated	259.8 / 0.8	2	SS
6 / 2		**CLAYEY SILT** soft to firm dark grey to brown clayey silt, some sand, trace gravel, WTPL		3	SS
8 /		**SAND AND GRAVEL** compact sand and gravel, some clay, saturated	258.3 / 2.3	4	SS
10 /		**CLAYEY SILT** very stiff brown clayey silt, some sand, trace gravel, DTPL	257.6 / 3.0	5	SS
12 / 4		Drilling Terminated	256.9 / 3.7		

Dynamic Cone — Standard Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200

Water Content %: 10 20 30

Standard Penetration values: 3, 4, 12, 17, 21

Water Content values: 29, 26, 26, 23, 20, 27, 20

Groundwater Observations and Standpipe Details: Cuttings; Bentonite

Water encountered at 0.8 mbgs during drilling

Field Technician: AAS

Drafted by: B. Graul

Reviewed by: B. Thorner

MTE

Sheet: 1 of 1

ID No.: BH106-21

Project Name: 6097 Colonel Talbot Rd: Hydrogeological Services

MTE File No.: 49653-200

Client: 2803767 Ontario Inc.

Site Location: 6097 Colonel Talbot Rd, London, ON

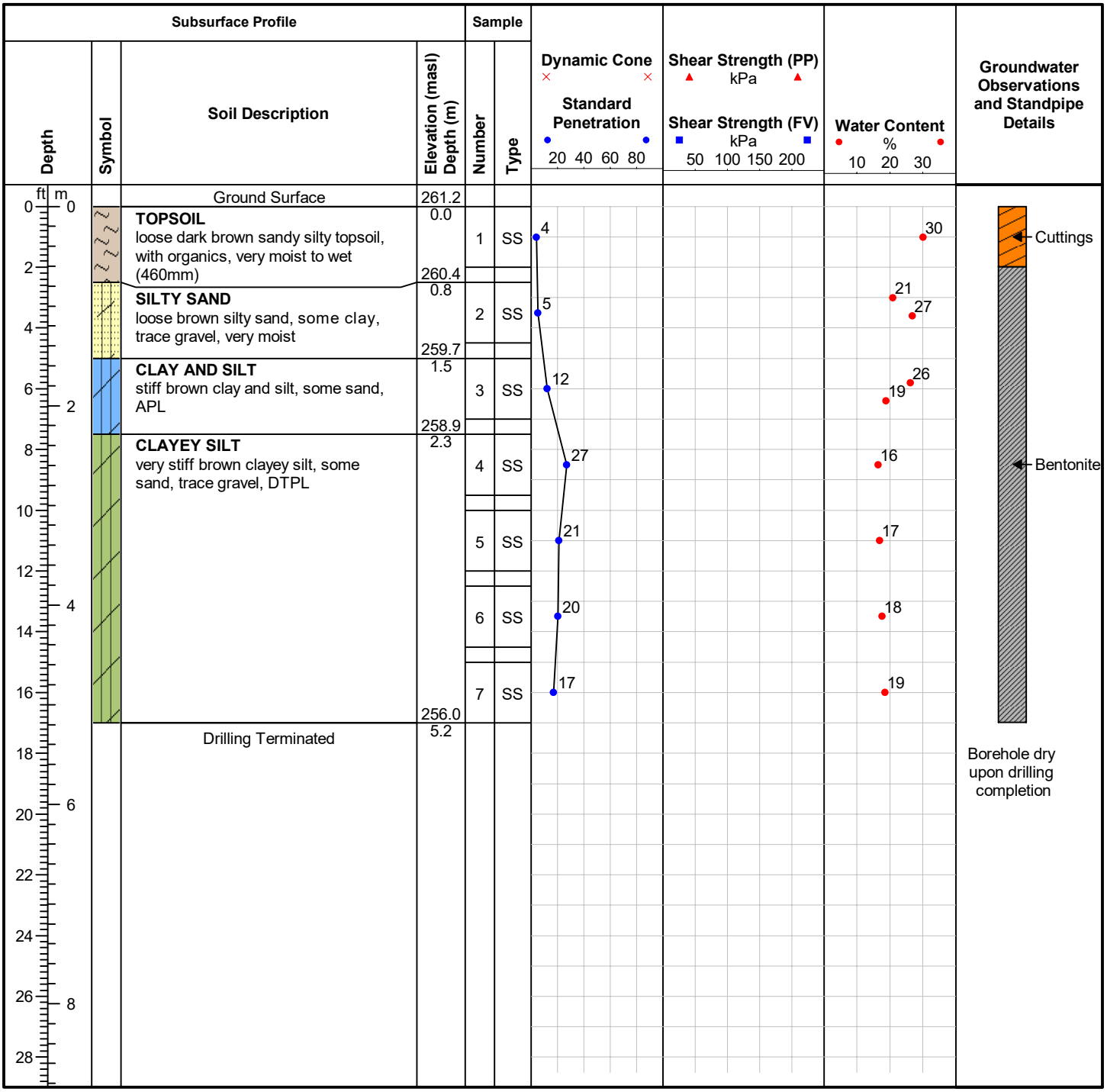
Date Completed: 12/15/2021

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D-50

Drill Method: Conventional

Protective Cover:



Field Technician: AAS

Drafted by: B. Graul

Reviewed by: B. Thorner

Sheet: 1 of 1

ID No.: BH107-21

Project Name: 6097 Colonel Talbot Rd: Hydrogeological Services

MTE File No.: 49653-200

Client: 2803767 Ontario Inc.

Site Location: 6097 Colonel Talbot Rd, London, ON

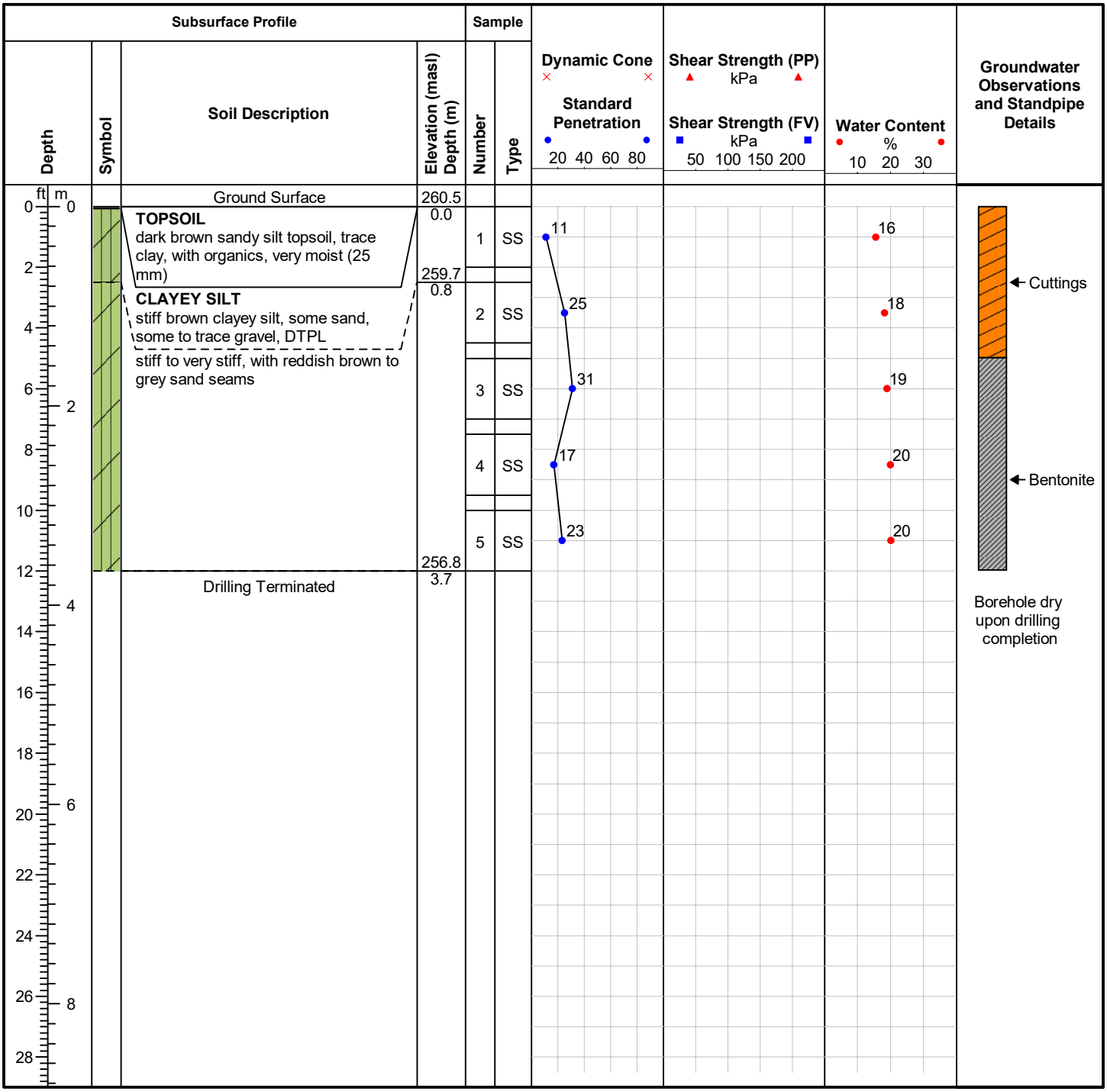
Date Completed: 12/15/2021

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D-50

Drill Method: Conventional

Protective Cover:



Field Technician: AAS

Drafted by: B. Ehgoetz

Reviewed by: B. Thorner

Sheet: 1 of 1

ID No.: BH108-21

Project Name: 6097 Colonel Talbot Rd: Hydrogeological Services

MTE File No.: 49653-200

Client: 2803767 Ontario Inc.

Site Location: 6097 Colonel Talbot Rd, London, ON

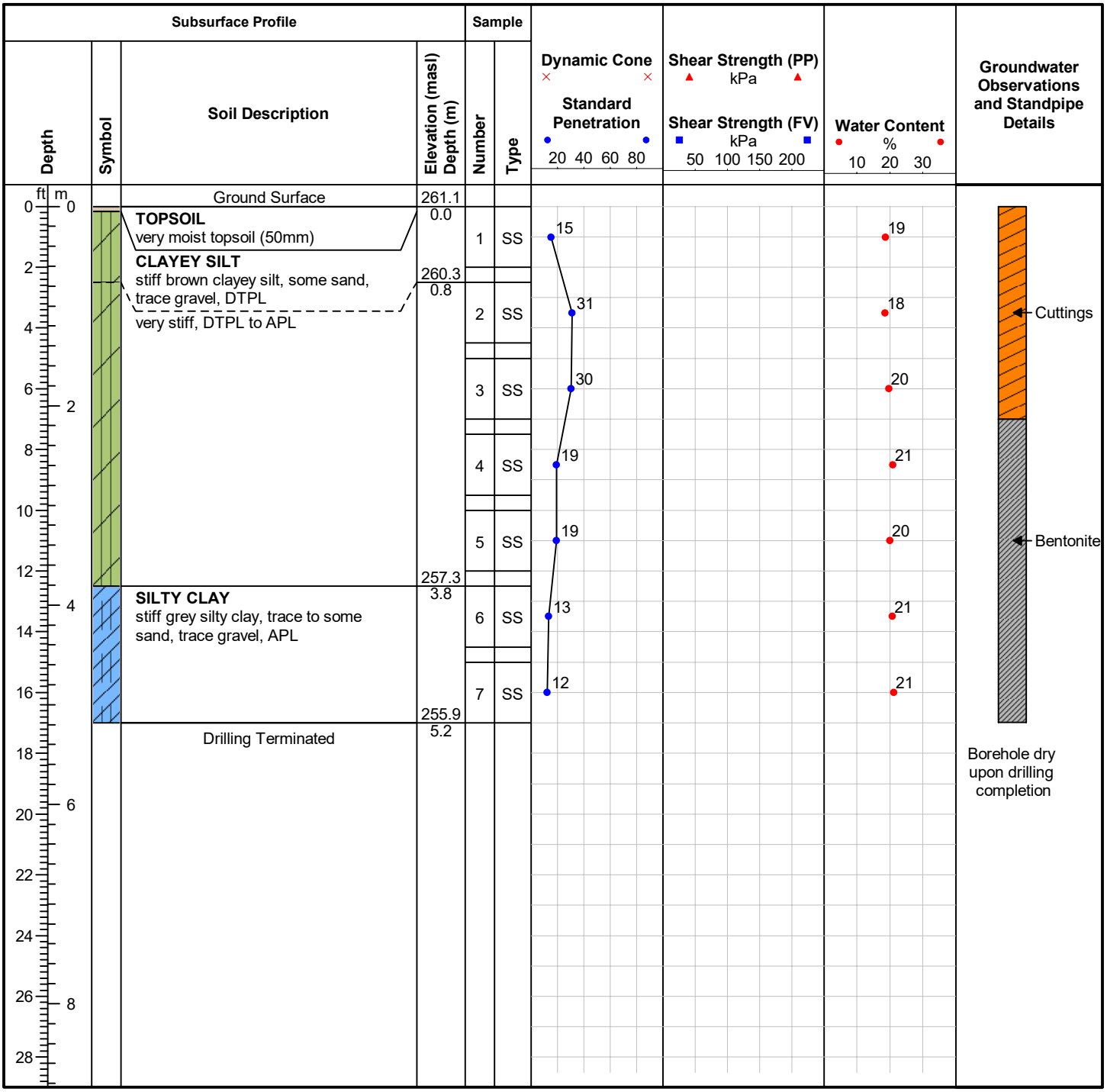
Date Completed: 12/15/2021

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D-50

Drill Method: Conventional

Protective Cover:



Field Technician: AAS

Drafted by: B. Graul

Reviewed by: B. Thorner

Sheet: 1 of 1

ID No.: BH109-21

Project Name: 6097 Colonel Talbot Rd: Hydrogeological Services

MTE File No.: 49653-200

Client: 2803767 Ontario Inc.

Site Location: 6097 Colonel Talbot Rd, London, ON

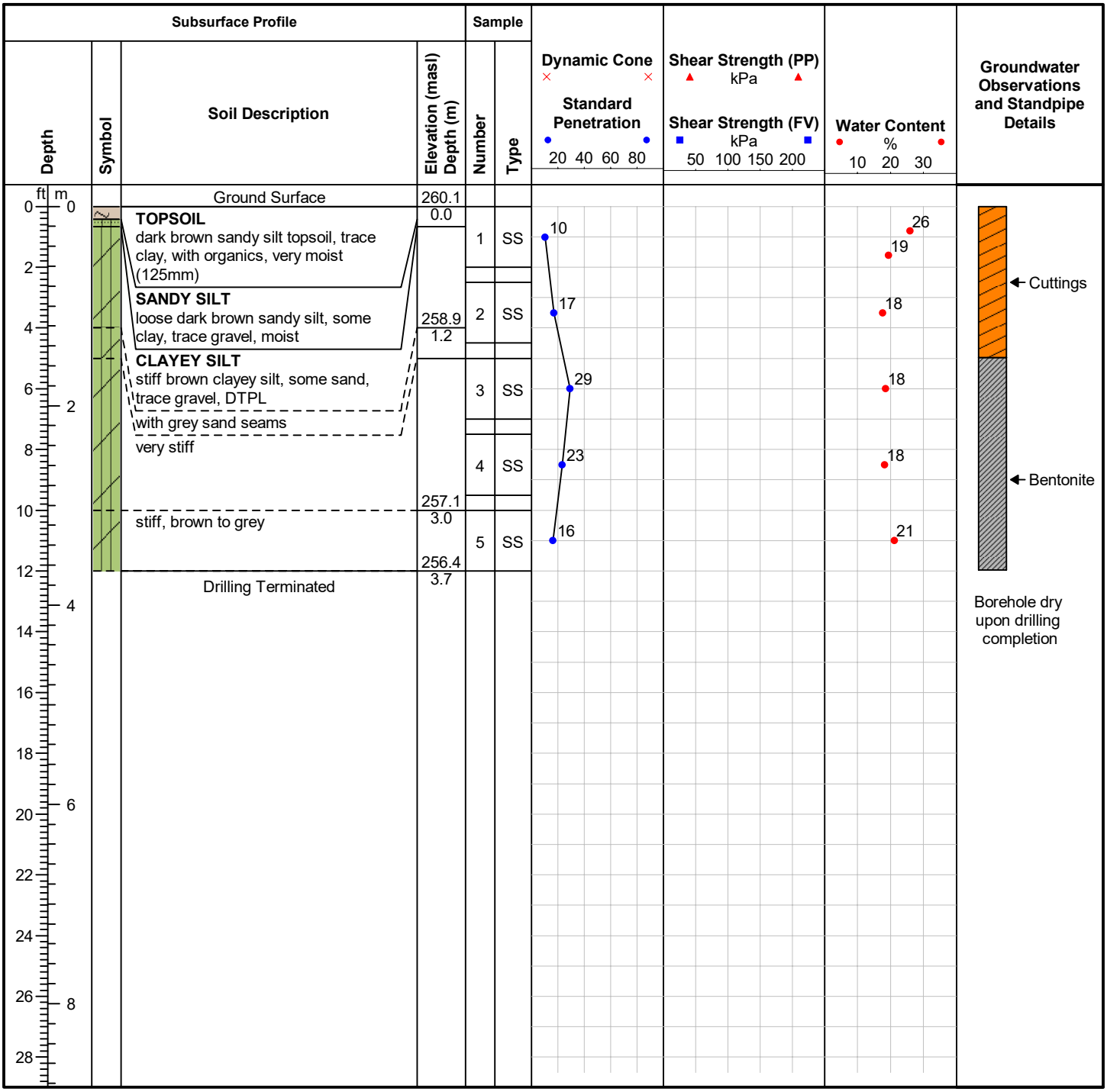
Date Completed: 12/15/2021

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D-50

Drill Method: Conventional

Protective Cover:



Field Technician: AAS

Drafted by: B. Graul

Reviewed by: B. Thorner

Sheet: 1 of 1

Appendix C

Laboratory Test Results

Table 101

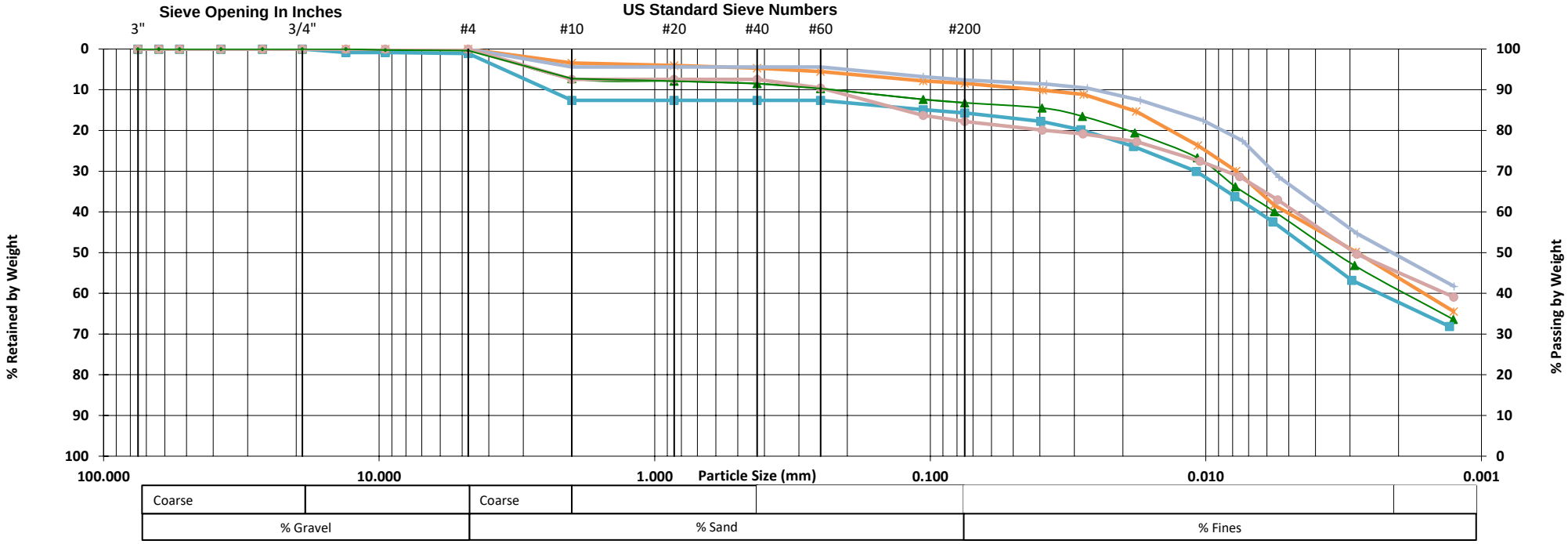
Particle Size Distribution Analysis Test Results

Project Name: 6097 Colonel Talbot Road Geotechnical Investigation
Client: 2803767 Ontario Inc.
Project Location: 6097 Colonel Talbot Road, London, ON

Date Sampled: Dec. 15-16, 2021
Date Tested: Jan. 5-13, 2022

MTE File No.: 49653-200
Table No: 101

Unified Soil Classification



Symbol	Borehole ID	Sample #	Sample Depth	Description
▲	MW101-21	SS-7	4.6-5.2 mbgs	SILT and CLAY, some Sand
■	MW102-21	SS-9	6.1-6.7 mbgs	SILT and CLAY, some Sand, trace Gravel
✳	MW103-21	SS-9	6.1-6.7 mbgs	SILT and CLAY, trace Sand
+	MW104-21	SS-10	6.9-7.5 mbgs	CLAY and SILT, trace Sand
●	BH106-21	SS-3	1.5-2.1 mbgs	CLAY and SILT, some Sand

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For specific tests as listed on www.ccil.com

NOTES: