FOX STREET PENETANGUISHENE
PROPOSED DEVELOPMENT

Geotechnical Investigation

Project Location:
160 - 200 Fox Street
Penetanguishene, ON

Prepared for:
Wilmington Capital Management Inc.
505 3rd Street SW, Suite 700
Calgary, AB

Prepared by:
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September 4, 2018

MTE File No.: 43022-100

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APPENDICES

1.0 INTRODUCTION

MTE Consultants Inc. (MTE) was retained by Wilmington Capital Management Inc. to conduct a geotechnical investigation for a proposed development at Municipal Numbers 160 to 200 along Fox Street in Penetanguishene, Ontario. The site is located west of Fox Street, as shown on **Figure 1 in Appendix A**. The development will involve 60 total units including 28 single detached residential buildings, 6 semi-detached residential buildings, and 26 townhomes, as per the Travis and Associates Incorporated Site Plan SP-3, dated March 2018. It is noted a future recreation centre is planned for the northeast corner of the site and additional investigation is recommended in this area once design details are known.

The site is currently the Bay Moorings Marina with numerous storage buildings and asphalt covered areas for boat storage. The site is bordered to the north by Dutchman's Cove Marina and Boat Rentals; to the east by Fox Street and a residential subdivision; to the south by residential buildings; and to the west by Penetang Harbour. The site generally slopes down from east to west approximately 4.5 m between borehole locations.

The purpose of this geotechnical investigation is to determine the soil and groundwater conditions in the area of the proposed residential development and provide geotechnical engineering recommendations for site grading, site servicing, foundations, concrete slab-on-grade, pavement design, subdrainage requirements, and stormwater infiltration.

2.0 CONCURRENT WORK

MTE conducted a due diligence Phase 2 ESA on October 16, 2017, File No. 43022-100, and is currently conducting a Phase 2 ESA and Record of Site Condition environmental investigation at the site. Environmental technicians were onsite directing the drilling and sampling during the fieldwork.

3.0 FIELD AND LABORATORY PROGRAM

The fieldwork for this investigation was carried out on March 26th, April 9th and April 10th, 2018 and involved the drilling of twenty boreholes (Boreholes BH201-18 to BH220-18) to depths ranging from 1.5 to 8.2 m. The locations 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 Geoprobe 7822DT track mounted drill rig equipped with continuous flight hollow stem augers and direct push equipment, supplied and operated by Direct Environmental Drilling Inc.

Boreholes MW202-18 and BH216-18 to BH220-18 were advanced with hollow stem augers for geotechnical data and sample collection, while Boreholes BH201-18 and MW203-18 to BH215-18 were advanced using direct push equipment for environmental sample collection.

Representative soil samples were recovered throughout the depths explored. Standard Penetration Tests (SPT) were carried out during sampling operations in Boreholes MW202-18 and BH216-18 to BH220-18 using conventional split spoon equipment. The SPT N-values recorded are plotted on the borehole logs in **Appendix B.**

Samples of the cohesive soil samples were tested using a pocket penetrometer, in Boreholes MW202-18 and BH216-18 to BH220-18, respectively, to determine approximate shear strengths. The results of the penetrometer testing are plotted on the appended borehole logs.

A 50 mm diameter monitoring well and a 19 mm diameter monitoring well were installed in Boreholes MW202-18 and MW203-18 to allow measurement of the stabilized groundwater levels and groundwater sampling and testing. The installation comprised of a 3.0 m filtered screen and a bentonite seal above the screen. Details of the installation and groundwater observations and measurements are provided on the appended borehole logs.

The monitoring wells were installed in accordance to Ontario Regulation 903, as amended. 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.

Upon completion of drilling, the 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.

The fieldwork was monitored throughout by members of our geotechnical and environmental engineering staff, who directed the drilling procedures; conducted SPT tests; documented the soil stratigraphies; monitored the groundwater conditions; installed the monitoring wells; and transported the recovered soil samples back to our office for further classification.

The ground surface elevations at the borehole locations were surveyed by MTE by use of a Trimble survey device and tied into geodetic elevations.

Soil samples collected were submitted for moisture content testing. Geotechnical laboratory testing comprised of five soil samples submitted for particle size distribution analyses, one soil sample for grain size distribution analysis, and two samples for Atterberg Limits tests. 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.

4.0 SOIL CONDITIONS

Reference is provided to the appended borehole logs for soil stratigraphy details, SPT N-values, results of pocket penetrometer testing, moisture content profiles, and groundwater observations and measurements. Soil conditions encountered at the site typically include asphaltic concrete and/or fill overlying native sand, silt, and clay deposits.

4.1 Asphaltic Concrete and Fill

Three of the boreholes (Boreholes MW202-18, BH216-18 and BH218-18) were drilled within the existing parking and driveway areas and encountered 50 to 100 mm of asphaltic concrete overlying fill.

Fill was encountered surficially or beneath the asphaltic concrete in all of the boreholes and is 0.1 to 4.0 m thick (average thickness = 1.9 m). The fill ranges in composition from brown silty sand and gravel to grey clayey silt. It is noted organics (topsoil) was contacted within the fill at Boreholes BH205-18, BH206-18, BH209-18, BH210-18, BH211-18, BH212-18, BH217-18, BH219-18 and BH220-18 and organic content (rootlets, peat and wood fragments) were contacted within the fill in all of the boreholes except Boreholes BH201-18, BH204-18, BH207-18 and BH216-18. Brick fragments, Styrofoam pieces and large cobbles were contacted in Boreholes BH219-18, BH207-18 and BH216-18, respectively. SPT N-values in the fill range from 1 to 46 blows per 300 mm penetration of the split spoon sampler indicating a very loose to dense relative density.

Insitu moisture contents in the fill range from 5 to 40% indicating moist to saturated conditions.

4.2 Silt / Silt and Clay

Silt was encountered underlying the fill and/or sand in Boreholes BH201-18, MW202-18, MW203-18, BH204-18, BH210-18, BH212-18, BH213-18, BH215-18, BH218-18, BH219-18 and BH220-18. The silt and clay was 0.6 to 2.3 m thick and continues to the termination depth of Boreholes BH201-18, BH210-18, BH212-18 and BH213-18. The silt ranges in composition from brown sandy silt to grey clay and silt with trace sand. The results of three particle size distribution analyses conducted on samples of the silt and clay are provided in **Appendix C** and summarized in the following table;

TABLE 1 - RESULTS OF SILT AND CLAY PARTICLE SIZE DISTRIBUTION ANALYSES

Borehole Number	Sample Depth (m)	Sand (%)	Silt (%)	Clay (%)
MW202-18	3.05-3.66	1	52	47
BH218-18	2.29-2.90	29	66	5
BH219-18	1.52-2.13	5	44	51

The SPT N-values in the silt range from 0 to 6 blows per 300 mm penetration of the split spoon sampler indicating a very loose to loose relative density. Shear strength measured in the cohesive deposits of the silt and clay ranges from was 25 to 100 kPa using a pocket penetrometer.

Two samples of the silt and clay were submitted for Atterberg Limits tests and the results summarized in the following table;

TABLE 2 - RESULTS OF SILT AND CLAY ATTERBERG LIMITS TESTS

Borehole Number	Sample Depth (m)	Moisture Content (%)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Liquidity Index (LI)
MW202-18	1.52-2.13	21	25	14	11	0.63
BH219-18	1.52-2.13	40	47	22	25	-0.28

Atterberg limits test results indicate the silt and clay has a medium degree of plasticity.

Insitu moisture contents in the silt range from 21 to 40% indicating wet to saturated or drier than the plastic limit (DTPL) to wetter than the plastic limit (WTPL) conditions.

4.3 Sand

Sand was encountered beneath the fill and/or silt and clay in all of the boreholes except for Boreholes BH210-18 and BH212-18. The sand was 0.9 m and 0.6 m thick in Boreholes BH201-18 and BH213-18, respectively. The sand continues to the termination depth in the remaining boreholes. The sand deposit was underlain by a silt and clay layer in Boreholes MW202-18 and BH204-18 at a depth of 1.5 m (Elevation 176.4 m) and 0.6 m (Elevation 178.8 m), and then continues again at a depth of 3.8 m (Elevation 174.1 m) and 0.9 m (Elevation 178.5 m) to the termination depth of each borehole. The sand typically ranges in composition from grey gravelly sand with some silt to brown silty sand with trace clay. The results of three grain/particle size distribution analyses conducted on the sand are provided in **Appendix C** and summarized in the following table;

TABLE 3 - RESULTS OF SAND PARTICLE/GRAIN SIZE DISTRIBUTION ANALYSES

Borehole Number	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH217-18	1.52-2.13	0	74	25	1
BH220-18	3.05-3.66	8	62	24	6
BH216-18	4.57-5.18	0	98	2	

SPT N-values measured in the sand typical increase with depth and range from 0 to 23 blows per 300 mm penetration of the split spoon sampler indicating very loose to compact conditions.

Insitu moisture contents in the sand range from 6 to 30% indicating moist to saturated conditions.

5.0 GROUNDWATER CONDITIONS

Groundwater observations and measurements were carried out in the open boreholes at the time of drilling and are summarized on the borehole logs. Upon completion of drilling activities, free groundwater was encountered in all of the geotechnical boreholes and the depths and elevations are summarized in the following table;

TABLE 4 - GROUNDWATER DEPTHS AND ELEVATIONS UPON COMPLETION OF DRILLING

Borehole Number	Borehole Elevation (m)	Groundwater Depth (m)	Groundwater Elevation (m)
MW202-18	177.87	0.31	177.56
BH216-18	182.24	2.90	179.34
BH217-18	178.11	1.22	176.89
BH218-18	178.11	0.91	177.20
BH219-18	179.97	1.52	178.45
BH220-18	178.82	1.22	177.60

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations and local variations. Additional groundwater levels will be measured in the installed wells prior to finalization of the report.

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 General

The project involves the design of a new residential development which will include 60 units total with 28 single detached residential buildings, 6 semi-detached residential buildings and 26 townhomes. The site is currently the Bay Moorings Marina located along Fox Street in Penetanguishene, Ontario. Three new roadways are proposed within the development.

The subsurface stratigraphy at the site comprises asphaltic concrete and/or fill overlying native sand, silt, and clay deposits. Free groundwater was encountered at Elevation 176.89 to 179.34 m upon completion of drilling activities.

Based on the results of this geotechnical investigation, the site is suitable for the proposed development; however the fill thickness, the low strength of the native soils and the high groundwater table will affect design and construction. The following subsections of this report contain geotechnical recommendations pertaining to development of the property including site grading, site servicing, foundations, floor slabs, pavement design, subdrainage requirements, and stormwater infiltration.

6.2 Site Preparation

The first construction activity that will be required for the proposed development will be grading. Due to the volume of fill at the site (average thickness = 1.9 m) and loose native soil deposits, It is understood leaving the existing fill in place is the preferred option. The residential units will need to be properly supported with deep foundations and roadways properly supported with geogrids and geotextiles.

The surficial organic topsoil would not be suitable to remain below the residential units and roadways and must be removed. The topsoil could be used in landscaping areas such as parks, pending consultation with environmental engineers.

These recommendations are subject to change if additional soil is to be removed as part of site remediation activities. The extent of the site remediation was unknown at the time of this report.

The native soils are not suitable for reuse as engineered fill due to high moisture contents. All engineered fill should be imported and placed in maximum 300 mm thick lifts, compacted to the following percentages;

TABLE 5 - ENGINEERED FILL REQUIREMENTS

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

Structural fill used for raising grades beneath the residential units should be comprised of granular material such as OPSS Granular ‘A’. Subgrade fill material beneath the proposed pavement areas and services should meet the requirements of OPSS Select Subgrade Material. 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.

6.3 Site Servicing

6.3.1 Excavations and Dewatering

The development will be serviced to provide the individual lots with full municipal services. It is anticipated that the invert levels for watermain and sanitary 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 fill would be classified as Type 4 soils and temporary side slopes must be trimmed back at an inclination of 3 horizontal to 1 vertical or less above the base of the trench as per O.Reg 213/91. The native soils encountered in the boreholes would be classified as Type 3 soils (O. Reg. 213/91, s. 226 (4)). Temporary side slopes must be cut at an inclination of 1.0 horizontal to 1.0 vertical or less from the base of the excavation for open cut pipe installation, 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 to high groundwater inflow should be expected where the excavations extend into the groundwater table encountered within the fill and native sand deposits. It is envisioned that groundwater inflow from the excavations extending up to 0.3 m below the groundwater regime can be controlled using a gravity dewatering system with properly constructed sumps and perimeter interceptor ditches and pumps. Well points or an equivalent system may be required for any excavation work extending more than 0.3 m below the groundwater regime.

It should be noted that a Permit to Take Water (PTTW), issued by the Ministry of Environment and Climate Change (MOECC), will be required if the dewatering system/sumps result in water taking of more than 50,000 L/day. 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.

It is recommended that test pits be excavated during the tendering stage of the project to familiarize potential contractors of the soil and groundwater conditions at the site.

6.3.2 Pipe Bedding

It is anticipated invert elevation of the pipes will be at conventional 2 to 3 m depths below ground surface. The existing loose fill and organic soils contacted at the site are not suitable to support pipes without undergoing possible detrimental post-construction settlement. The fill and organic soil should be subexcavated from below the pipes and replaced with well-compacted granular soil, or the pipes should be constructed in structurally supported pipe conduits.

For non-critical flexible piping, the existing fill and organic soils may remain in place below the pipe invert provided that it is understood that some long-term settlement may occur.

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. 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) could be used in the sewer trenches as bedding below the spring line of the pipe to facilitate sump pump dewatering, if necessary. The clear stone should be compacted with a plate tamper

6.3.3 Groundwater Cutoffs

The proposed alignment of the sewers could create a hydraulic connection between groundwater regimes that are not currently connected. To prevent the movement of water along the pipe bedding, it is recommended that concrete or clay cutoff collars be installed. The cutoffs should be 1 m long and in place of regular bedding material.

6.3.4 Trench Backfilling

The trenches above the specified pipe bedding should be backfilled with engineered fill placed in 300 mm thick lifts and compacted to at least 95% SPMDD. Wet or saturated native mineral 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.

6.3.5 Manholes

The geotechnical bearing resistance at manhole locations should be analyzed for potential settlement prior to final design. Precast concrete manholes shall be backfilled with compacted Type 1 Granular 'B' material on all sides for ease of compaction and to minimize post-construction settlement. The backfill should be placed in maximum 500 mm thick lifts and brought up evenly on all sides in order to provide uniform lateral support and earth pressure. All precast manhole bases shall be set on a pad of drainage stone or Granular 'A' with a minimum thickness of 150 mm.

It is recommended that MTE review the final sewer invert and manhole elevations during design to confirm that the recommendations provided are sufficient for the proposed works.

6.4 Pavements

It is understood pavements will be constructed for the new roadways and parking areas at the site. MTE recommends that the roadways be supported with geogrids and geotextiles due to the existing fill.

A 270R Non-Woven Geotextile provided by Terrafix Geosynthetics Inc. in conjunction with a TX140 Geogrid supplied by Tensar International Corporation, or approved equivalent, is recommended to be placed on the subgrade to provide adequate material separation and strength for the pavement design. Final pavement design should be verified once design details are known. Tensar International Corporation product design information is provided in **Appendix D.**

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 Tensar International Corporation SPECTRAPAVE4-PRO software;

TABLE 6 - PAVEMENT DESIGN

Pavement Component	Local Residential Street And Parking Areas
Asphalt Hot Mix	90 mm
OPSS 1010 Granular 'A' Base	150 mm
OPSS 1010 Granular 'B' Subbase	300 mm

The geogrids and geotextiles must be designed and installed by licensed service providers. The installation process must be inspected by a geotechnical engineer.

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 HL4 surface over 50 mm of HL8 binder for local residential streets.

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 and geogrid and geotextile installation inspection by a geotechnical engineer. If the subgrade is wet and unstable, additional granular subbase will be required.

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 recommended to install subdrains beneath the low areas of pavement and connected to catchbasins. The purpose of the subdrains is to remove excess subsurface water in order to improve overall pavement serviceability and increase the pavement life. Consideration should be given to providing continuous subdrains along the perimeter edges of the new street to promote drainage of the granular materials.

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.

6.5 Curbs, Gutter 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 sidewalk
- Air entrainment = 7.0 ± 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 days 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.

6.6 Residential Foundation Design

Considering the presence of fill and soft silt and clay stratum at deeper depths and associated significant consolidation settlements due to structural loads, it is recommended that the foundations for the proposed residential units be placed on helical piles.

A helical pier foundation system comprises medium diameter steel helices on the end of small diameter solid steel shafts. The steel helices are screwed into the ground to the level of competent bearing soil and attached to grade beams to support the residential units. A pull-down grout system should be used in order to encase the shaft and to provide additional support, lifting resistance and longevity of the foundation system

The piles would be drilled through the existing fill and loose native soils and into the compact native soils encountered approximately at a depth of 9.1 m. Chance SS5 Helical Pile with a compression capacity of 200 kN at Serviceability Limit States (SLS) and 270 kN at Ultimate Limit States (ULS) supplied by EBS Geostructural Inc. or approved equivalent would be adequate to support the residential units. Design dimensions and a product information are provided in **Appendix E**.

The individual pier loading should be confirmed by the contractor supplying and installing the helical piers and by load tests (larger diameter helices could support higher loads). The center-to-center spacing of piles should be at least three times the helix diameter. The pile stability, pile head and pile cap details should be determined and checked by an experienced Structural Engineer and reviewed by the Geotechnical Consultant.

The helical pier installation operations should be monitored on a full-time basis by qualified geotechnical personnel to check, foundation elevation, and allowable pier loading through torque testing.

The helical piles must be designed and installed by licensed service providers. The installation process must be inspected by a geotechnical engineer.

The grade beams between the helical piers 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. If construction is undertaken during the winter, the subgrade soil and concrete should be protected from freezing.

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 fill would be classified as Type 4 soils and temporary side slopes must be trimmed back at an inclination of 3 horizontal to 1 vertical or less above the base of the trench as per O.Reg 213/91 s.234(2). The trench side slopes must be cut back at a shallower angle where waterbearing deposits are encountered.

6.7 Concrete Slab-on-Grade Floors

It is recommended the floor slabs be designed as structural slabs due to the low strength of the fill onsite. MTE does not recommend the construction of basements due to the low strength of native soils and high groundwater table at the site.

No significant methane gas headspace readings were recorded in the fill. Please refer to MTE's due diligence Phase 2 ESA conducted on October 16, 2017, File No.43022-100, for the results of the methane gas headspace readings.

Any additional material required to raise grades below the floor slabs should be comprised of sand and gravel and be compacted to 100% 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.

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

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 pre-locate 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.

6.8 Stormwater Infiltration

It is understood that at-source infiltration of stormwater runoff from the development may be considered for this site. Soak-away pits generally require native 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).

Due to the high groundwater table, at approximately Elevation 176.89 to 179.34 m, and the large amount of fill materials at the site, at-source infiltration of stormwater runoff is not geotechnically feasible for the development.

7.0 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.

Respectfully submitted,

MTE CONSULTANTS INC.

Ben Heinbuch, EIT
Senior Geotechnical Technician

Montana Wilson, M.Eng. P.Eng. PMP
Civil and Geotechnical Division Manager

MXW:dld

APPENDIX A

FIGURES

Figure 1- Location Plan
Figure 2 - Site Plan

ARIEL IMAGE FROM GOOGLE EARTH

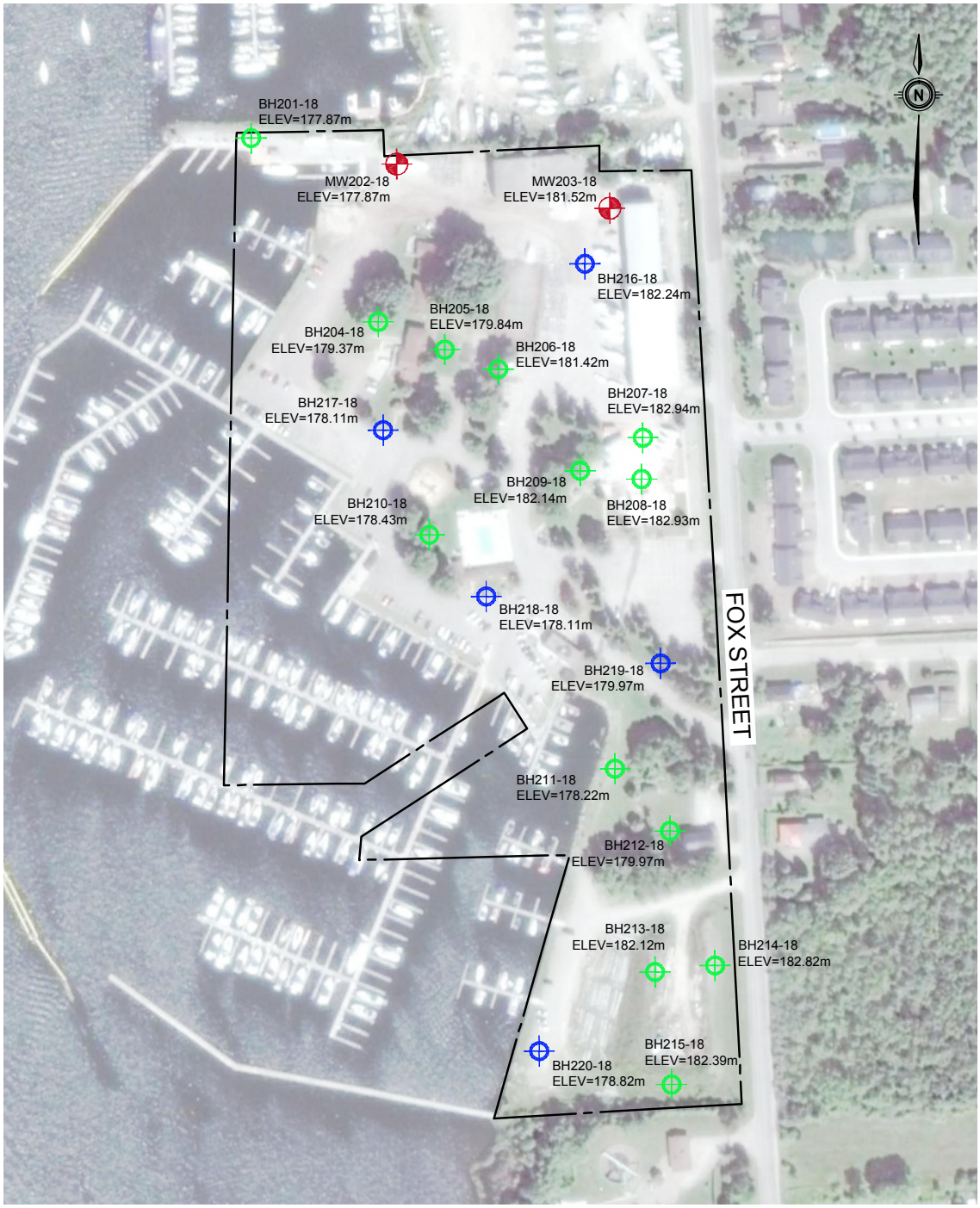
LOCATION PLAN

MTE Engineers | Scientists | Surveyors

Project Name
FOX STREET PENETANGUISHENE SUBDIVISION

Site	Client
160 - 200 FOX STREET, PENETANGUISHENE, ONTARIO	WILMINGTON CAPITAL MANAGEMENT INC.

Scale. (8.5x11)	MTE Project No.	Date	Figure No.
N.T.S	43022-100	MAY.01.2018	1



LEGEND

BH201-18 — DIRECT PUSH METHOD BOREHOLE

BH216-18 — HOLLOW STEM AUGERS BOREHOLE

MW202-18 — MONITORING WELL

REFERENCES:

- ARIEL IMAGE FROM GOOGLE EARTH
- THE GROUND SURFACE ELEVATIONS AT THE BOREHOLE LOCATIONS WERE SURVEYED BY MTE BY THE USE OF A TRIMBLE SURVEY DEVICE AND TIED INTO GEODETIC ELEVATIONS.

MTE Engineers | Scientists | Surveyors

SITE PLAN

Project Name	
FOX STREET PENETANGUISHENE SUBDIVISION	
Site: 160 - 200 FOX STREET, PENETANGUISHENE, ONTARIO	Client: WILMINGTON CAPITAL MANAGEMENT INC.
Scale (11x17): 1:2000	MTE Project No.: 43022-100
Date: MAY.01.2018	Figure No.: 2

APPENDIX B

BOREHOLE LOGS

Boreholes BH201-18
to BH220-18

ID Number: BH201-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

Drill Date: 3/26/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A

SUBSURFACE PROFILE			SAMPLE					HEADSPACE	
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	Soil Sample Lab Analysis	VOC ppm (20 40 60 80) / Hydrocarbon ppm (100 200 300 400)	Well Completion Details
0 ft / 0 m		Ground Surface	177.9						
		FILL brown silty sand and gravel, trace brick fragments, very moist	0.0 / 177.6						
		fine sand, some silt, wet	0.3					10	
2									
4		silty sand, saturated	176.7 / 1.2 / 176.4					20	
		SAND light brown, medium coarse sand, some silt, saturated	1.5						Bentonite
6 / 2								10	
8		**SILT AND CLAY** light grey sandy silt and clay, DTPL	175.4 / 2.4					5	
10			174.8						
		Drilling Terminated	3.0						
12 / 4									
14									
16									

Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

Sheet: 1 of 1

ID Number: MW202-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

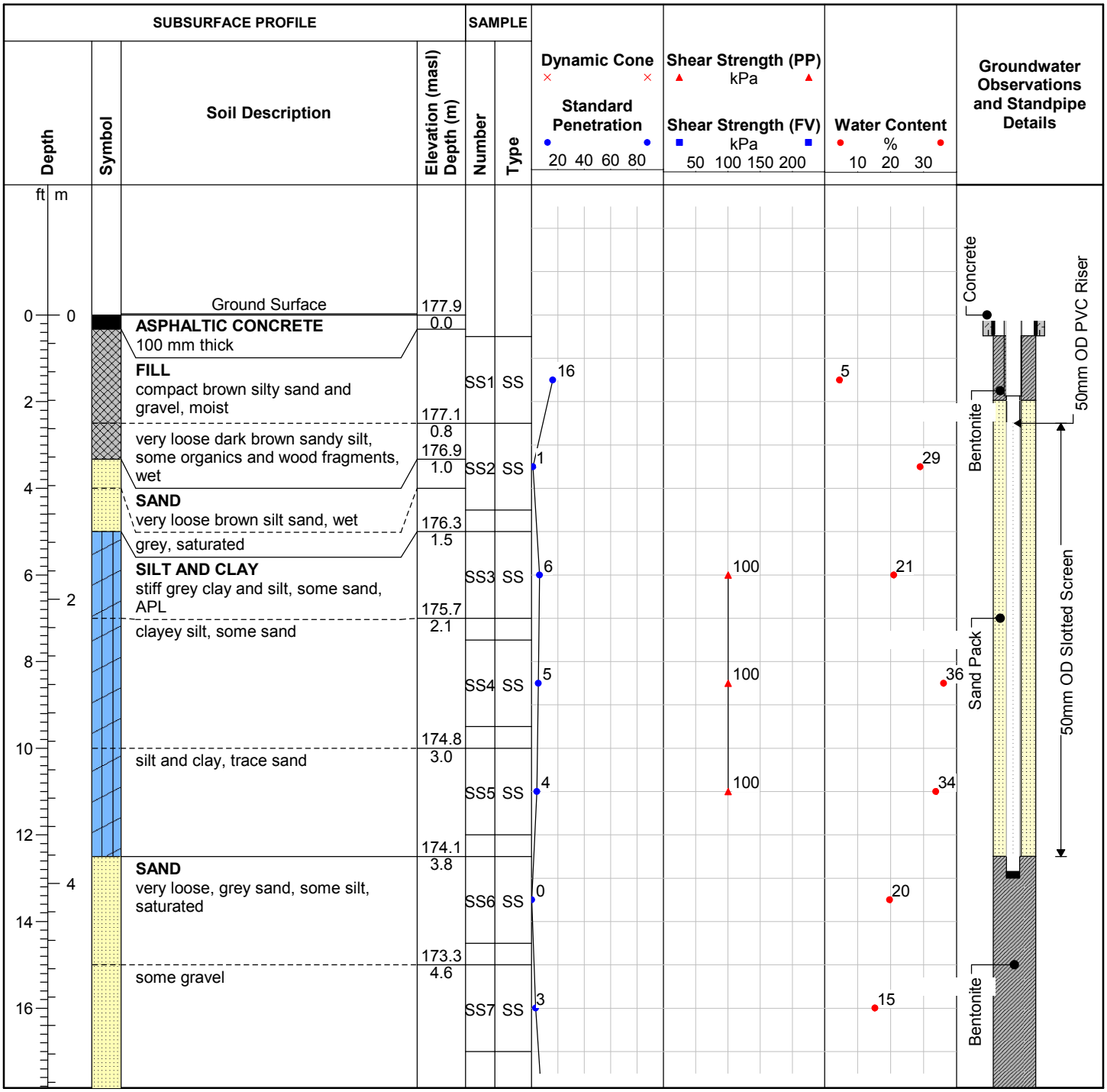
Drill Date: 3/26/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Hollow Stem Augers

Protective Cover: N/A



Field Technician: M. Dalgliesh

Drafted by: B. Heinbuch

Reviewed by: M. Wilson

MTE

ID Number: MW202-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

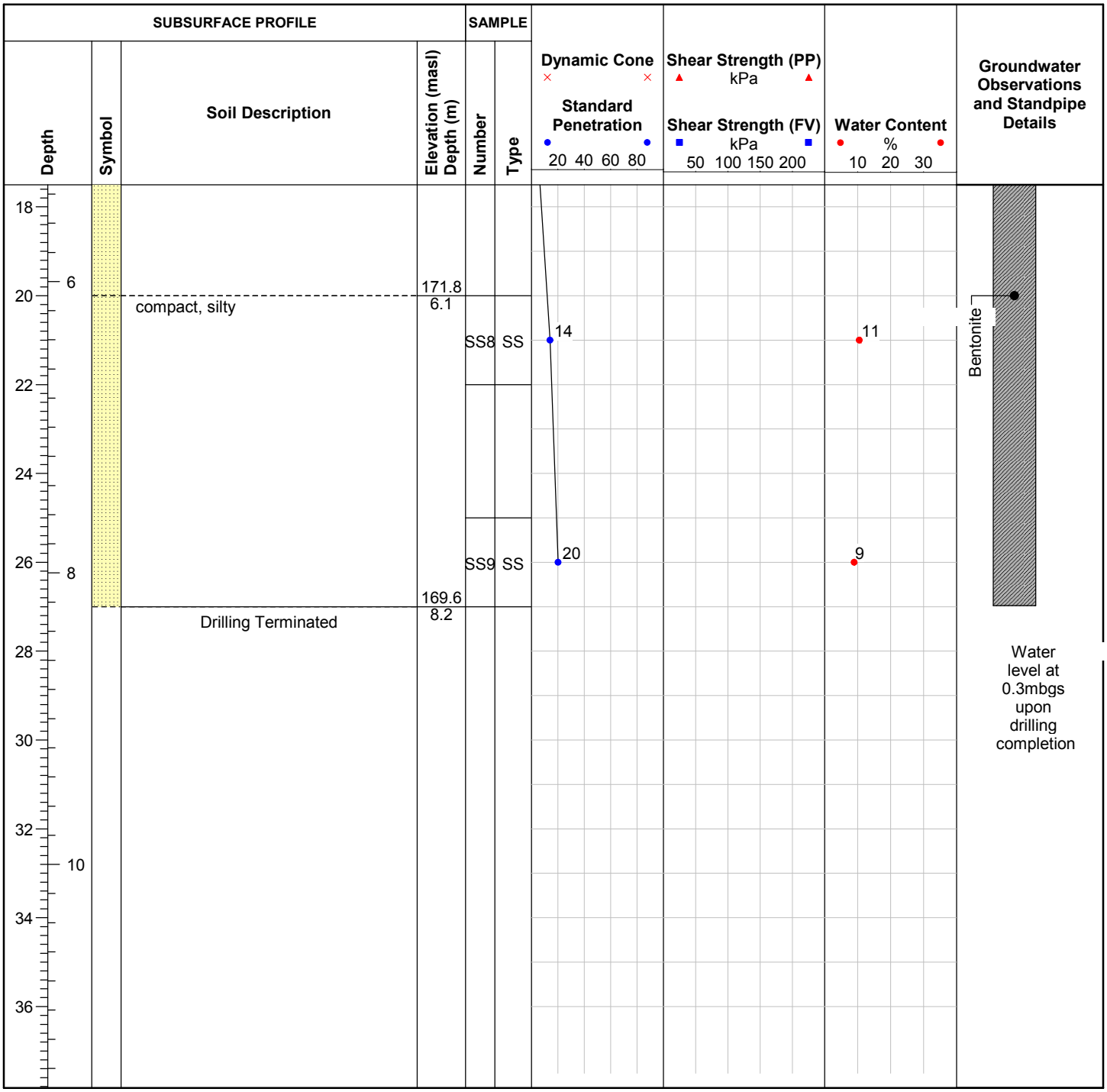
Drill Date: 3/26/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Hollow Stem Augers

Protective Cover: N/A



Field Technician: M. Dalgliesh

Drafted by: B. Heinbuch

Reviewed by: M. Wilson

MTE

Sheet: 2 of 2

ID Number: MW203-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

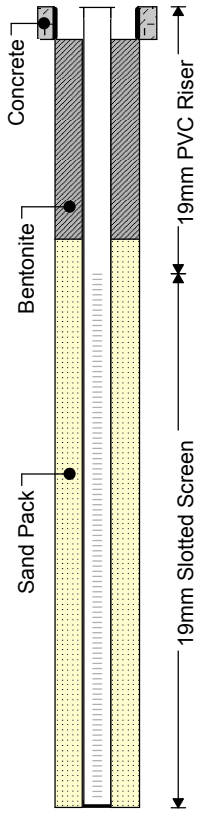
Drill Rig: Bosch Pionjar

Drill Method: Direct Push

Protective Cover: Monument

Depth (ft)	Depth (m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	Soil Sample Lab Analysis	HEADSPACE VOC ppm (20 40 60 80) / Hydrocarbon ppm (100 200 300 400)
0	0		Ground Surface	181.5					
			FILL brown sand, some silt, trace gravel and organics, moist	0.0					0
				180.6					
			SILT AND CLAY brown clayey silt, some sand trace gravel, DTPL, occasional thin sand seams	0.9					0
				179.1					
			SAND brown sand trace silt, wet	2.4					0
			saturated	178.5 / 3.0					
				177.9					
12	4		Drilling Terminated	3.7					

Well Completion Details



Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

Sheet: 1 of 1

ID Number: BH204-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A

SUBSURFACE PROFILE			SAMPLE					HEADSPACE	
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	Soil Sample Lab Analysis	VOC ppm (20 40 60 80) / Hydrocarbon ppm (100 200 300 400)	Well Completion Details
0 ft / 0 m		Ground Surface	179.4 / 0.0						
		FILL brown sand, some silt, trace gravel, very moist						0	
2 ft / 0.6 m		**SAND** light brown silty sand, wet	178.8 / 0.6						
		SILT light brown silt, some sand, wet	178.5 / 0.9					0	
4 ft / 1.2 m		**SAND** brown medium coarse sand and silt, wet, trace silt	178.2 / 1.2						Bentonite
		Drilling Terminated	177.9 / 1.5						
6 ft / 2 m									
8 ft									
10 ft									
12 ft / 4 m									
14 ft									
16 ft									

Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

Sheet: 1 of 1

ID Number: BH205-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

Drill Date: 4/9/2018

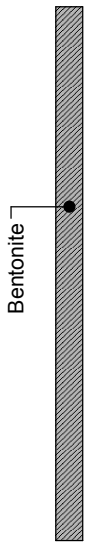
Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A

SUBSURFACE PROFILE			SAMPLE					HEADSPACE	
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	Soil Sample Lab Analysis	VOC ppm (20 40 60 80) / Hydrocarbon ppm (100 200 300 400)	Well Completion Details
0 ft / 0 m		Ground Surface	179.8						
		FILL dark brown fine sand and silt, moist	0.0					0	
2			179.2						
		150 mm thick gravel layer, trace brick fragments	0.6						
		SAND light brown fine sand, some silt, moist						0	
4									
6 / 2		grey, saturated	178.0						
			1.8						
8									
10			176.8						
		Drilling Terminated	3.0						
12 / 4									
14									
16									



Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

Sheet: 1 of 1

ID Number: BH206-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

Drill Date: 4/10/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A

SUBSURFACE PROFILE			SAMPLE					HEADSPACE	
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	Soil Sample Lab Analysis	VOC ppm (20 40 60 80) / Hydrocarbon ppm (100 200 300 400)	Well Completion Details
0 ft / 0 m		Ground Surface	181.4						
		FILL brown silty sand, trace gravel and clay	0.0 / 181.1						
2 ft / 1 m		sand, some silt, some gravel, trace organics	0.3 / 180.2					0	
4 ft / 2 m		**SAND** brown, trace silt, moist	1.2 / 179.9					0	Bentonite
		Drilling Terminated	1.5						
6 ft / 2 m									
8 ft									
10 ft									
12 ft / 4 m									
14 ft									
16 ft									

Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

Sheet: 1 of 1

ID Number: BH207-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene

Drill Date: 4/10/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A

SUBSURFACE PROFILE			SAMPLE					HEADSPACE	
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	Soil Sample Lab Analysis	VOC ppm (20 40 60 80) / Hydrocarbon ppm (100 200 300 400)	Well Completion Details
0 ft / 0 m		Ground Surface	182.9						
		FILL brown sand and gravel, occasional styrofoam pieces, moist	0.0						
		some gravel, trace silt, wet						0	
									Bentonite
			180.2						
		SAND brown sand, occasional silt layers, wet	2.7					0	
			179.9						
		Drilling Terminated	3.0						
2 ft / 4 m									
4 ft / 6 m									
6 ft / 8 m									
8 ft / 10 m									
10 ft / 12 m									
12 ft / 14 m									
14 ft / 16 m									

Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

Sheet: 1 of 1

ID Number: BH208-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

Drill Date: 4/10/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A

SUBSURFACE PROFILE			SAMPLE					HEADSPACE	
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	Soil Sample Lab Analysis	VOC ppm (20 40 60 80) / Hydrocarbon ppm (100 200 300 400)	Well Completion Details
0 ft / 0 m		Ground Surface	182.9						
0 – 8 ft / 0 – 2 m		**FILL** brown sand, trace silt and gravel, moist	0.0 – 180.2	1	MC			0	Bentonite
8 – 12 ft / 2 – 4 m		grey silty clay, some wood fragments, very moist, slight odour	2.7 – 179.3	2	MC			5	
12 – 14 ft / 4 m		**SAND** brown sand, trace silt, wet	3.7 – 178.4	3	MC			0	
14 – 16 ft		Drilling Terminated	4.6						

Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

Sheet: 1 of 1

ID Number: BH209-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

Drill Date: 4/10/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A

Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Recovery (%)	Soil Sample Lab Analysis	HEADSPACE VOC ppm (20 40 60 80) / Hydrocarbon ppm (100 200 300 400)	Well Completion Details
0 ft / 0 m		Ground Surface	182.1						
		FILL dark brown sandy silt, trace clay	0.0 / 181.8						
		grey clayey silt, occasional sand seems, moist	0.3 / 181.2					0	
		brown sand, trace gravel, silt and organcis	0.9 / 180.3	1	MC			0	Bentonite
2 m		**SAND** brown sand, trace silt, moist	1.8 / 179.1					0	
		Drilling Terminated	3.0	2	MC				
4 m				3	MC				

Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

ID Number: BH210-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A

Depth (ft / m)	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	Soil Sample Lab Analysis	HEADSPACE: VOC ppm (20 40 60 80) / Hydrocarbon ppm (100 200 300 400)	Well Completion Details
0 ft / 0 m	Ground Surface	178.4						
	FILL dark brown sand, some silt, wet	0.0 178.0					Note 1	
2	gravelly	0.5 177.7						
	PEAT AND ORGANIC SILT dark brown / black sandy silt, some organics, wet	0.7 176.6					0	
6 / 2	**SILT AND CLAY** grey sandy silt, some clay, trace staining	1.9 176.2					0	
8	grey clayey silt, some sand, DTPL	2.2 175.4					0	
10	Drilling Terminated	3.0						
12 / 4								
14								
16								

Bentonite

Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

Sheet: 1 of 1

Notes:
1) PHC: 0, VOC: 1

ID Number: BH211-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A

SUBSURFACE PROFILE			SAMPLE					HEADSPACE	
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	Soil Sample Lab Analysis	VOC ppm (20 40 60 80) / Hydrocarbon ppm (100 200 300 400)	Well Completion Details
0 ft / 0 m		Ground Surface	178.2						
		FILL brown silt (topsoil), moist	0.0 178.0					0	
		brown silty sand and gravel	0.2						
2 ft		dark brown/black sandy silt, some organics and topsoil, wet	177.5					0	
		SAND brown silty sand, saturated	0.7						Bentonite
4 ft			176.7					0	
		Drilling Terminated	1.5						
6 ft / 2 m									
8 ft									
10 ft									
12 ft / 4 m									
14 ft									
16 ft									

Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

Sheet: 1 of 1

ID Number: BH212-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A

SUBSURFACE PROFILE			SAMPLE					HEADSPACE	
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	Soil Sample Lab Analysis	VOC ppm 20 40 60 80 / Hydrocarbon ppm 100 200 300 400	Well Completion Details
0 ft / 0 m		Ground Surface	180.0						
		FILL brown sandy silt, some gravel and clay, occasional sand seams and topsoil, very moist	0.0 – 179.1					0	
2 ft								0	
		dark brown / black sandy silt, some organics, topsoil, rootlets and wood fragments, wet	0.9 – 178.7						
4 ft		grey, some gravel, trace clay	1.2 – 178.1					0	
6 ft / 2 m		**SILT AND CLAY** light brown silty clay, some sand, trace gravel, WTPL	1.8 – 176.9					0	
8 ft									
10 ft		Drilling Terminated	3.0						
12 ft / 4 m									
14 ft									
16 ft									

Bentonite

Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

Sheet: 1 of 1

ID Number: BH213-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

Drill Date: 4/10/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A

SUBSURFACE PROFILE			SAMPLE					HEADSPACE	
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	Soil Sample Lab Analysis	VOC ppm 20 40 60 80 / Hydrocarbon ppm 100 200 300 400	Well Completion Details
		Ground Surface	182.1						
		FILL brown fine sand and silt, some organics, wet	0.0						
		gravelly, some grey clay pockets	180.6 1.5					5	
		Dark brown / black sandy silt, some organics and topsoil, very moist	178.8 3.4					0	
		SAND brown silty sand, wet	178.5 3.7					0	
		SILT AND CLAY grey silt and clay, some sand, trace gravel, DTPL	177.9 4.3					0	
		Drilling Terminated	177.5 4.6						

Bentonite

Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

Sheet: 1 of 1

ID Number: BH214-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

Drill Date: 4/10/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A

SUBSURFACE PROFILE			SAMPLE					HEADSPACE	
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	Soil Sample Lab Analysis	VOC ppm (20 40 60 80) / Hydrocarbon ppm (100 200 300 400)	Well Completion Details
0 ft / 0 m		Ground Surface	182.8 / 0.0						
		FILL light brown silty sand and gravel, some organics	182.5 / 0.3						
		fine silty sand, very moist						0	
4			181.3 / 1.5						
		dark brown							
6 / 2									
		grey, some gravel, trace clay, wet	180.4 / 2.4					0	
10									
		dark brown / black, gravelly, very moist	179.2 / 3.7						
12 / 4		**SAND** grey sand and silt, trace clay, wet	178.9 / 4.0					0	
14			178.2 / 4.6						
		Drilling Terminated							
16									

Bentonite

Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

Sheet: 1 of 1

ID Number: BH215-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

Drill Date: 4/10/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A

SUBSURFACE PROFILE			SAMPLE					HEADSPACE	
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	Soil Sample Lab Analysis	VOC ppm (20 40 60 80) / Hydrocarbon ppm (100 200 300 400)	Well Completion Details
0 ft / 0 m		Ground Surface	182.4						
		FILL brown sand and silt, some gravel, wet	0.0					0	
6 ft / 2 m		saturated	180.6 1.8						
		grey clayey silt, DTPL	180.3 2.1					0	
		dark brown / black sandy silt, some organics, very moist	179.0 3.4					0	
12 ft / 4 m		**SILT AND CLAY** grey clay and silt, some sand, WTPL	178.7 3.7					0	
		SAND grey fine silty sand, saturated	178.1 4.3					0	
		Drilling Terminated	177.8 4.6						
16 ft									Bentonite

Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

Sheet: 1 of 1

ID Number: BH216-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

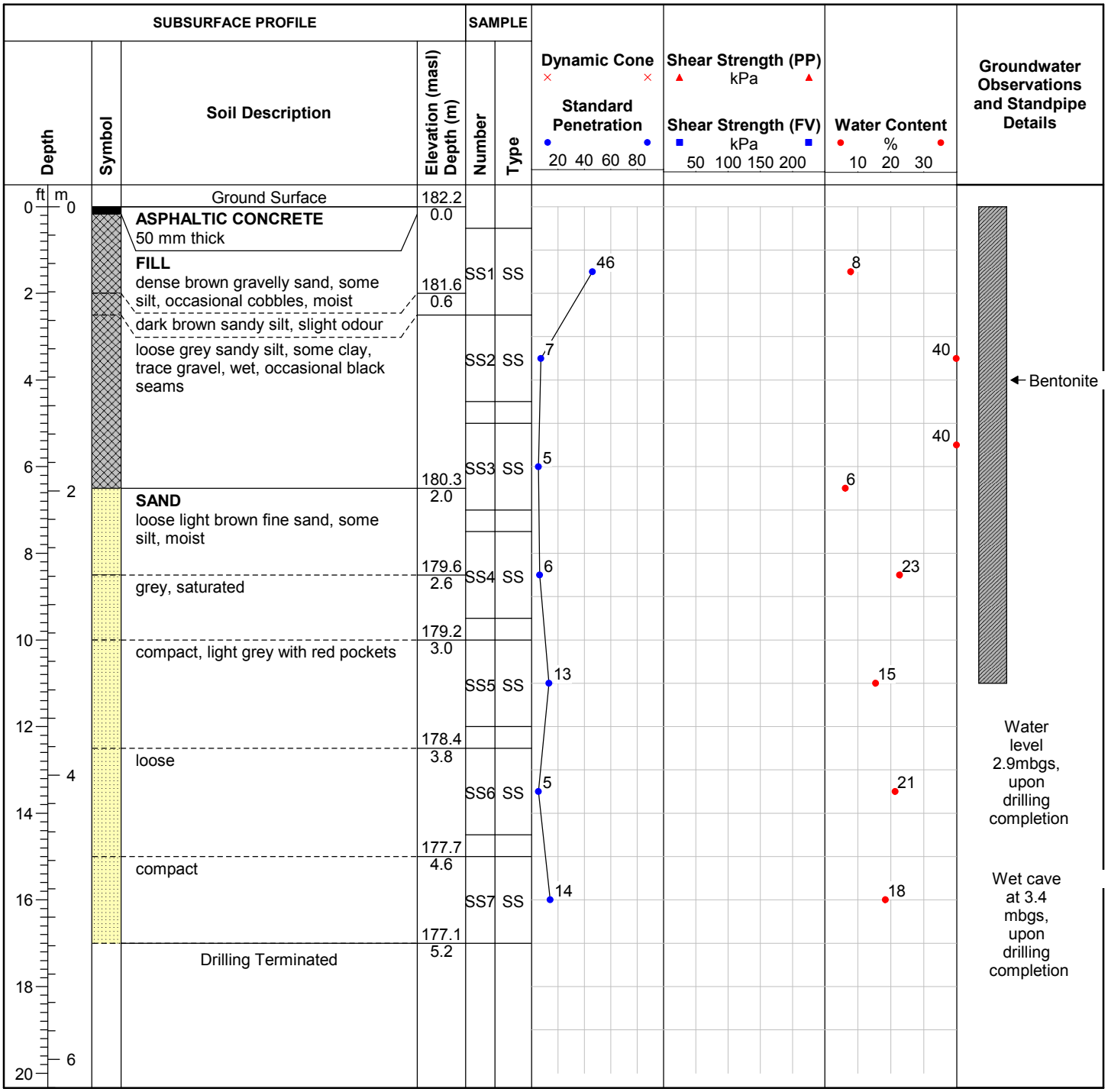
Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Hollow Stem Augers

Protective Cover: N/A



Field Technician: M. Dalgliesh

Drafted by: B. Heinbuch

Reviewed by: M. Wilson

Notes: Auger refusal on suspected cobble at depth 0.6m, borehole moved 1.5 m west

ID Number: BH217-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

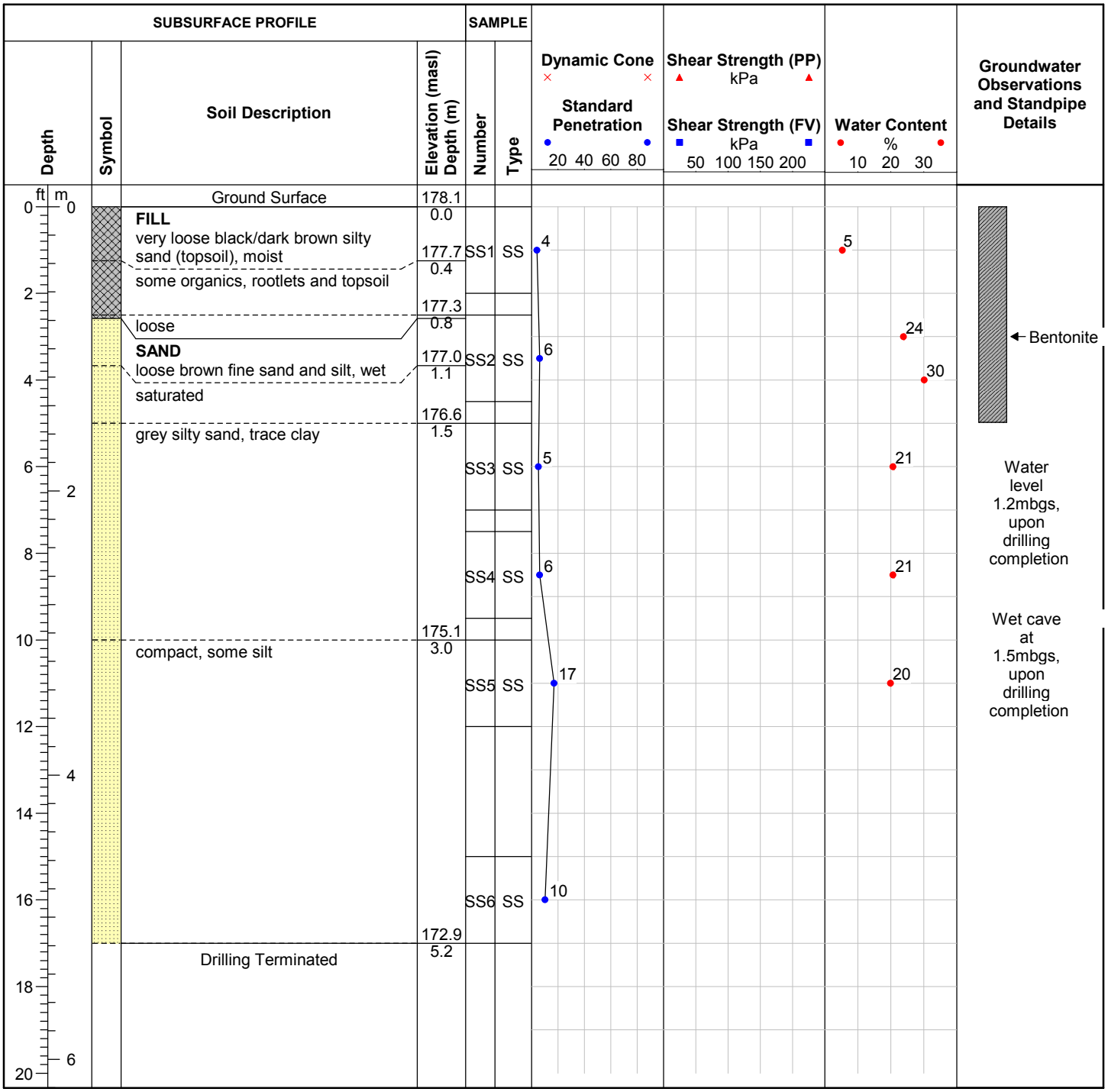
Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Hollow Stem Augers

Protective Cover: N/A



Field Technician: M. Dalgliesh

Drafted by: B. Heinbuch

Reviewed by: M. Wilson

MTE

Sheet: 1 of 1

ID Number: BH218-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

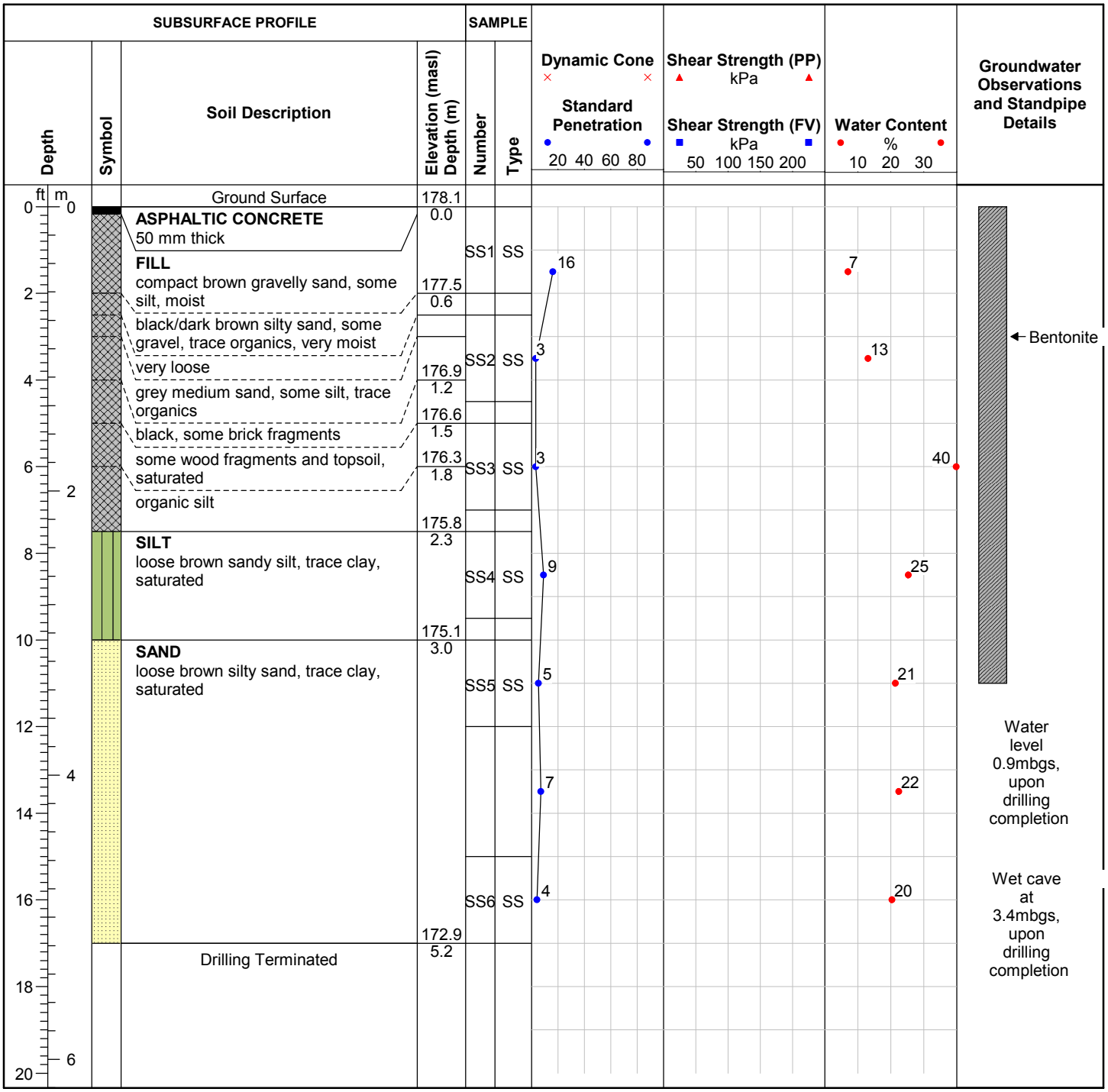
Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Hollow Stem Augers

Protective Cover: N/A



Field Technician: M. Dalgliesh

Drafted by: B. Heinbuch

Reviewed by: M. Wilson

MTE

Sheet: 1 of 1

ID Number: BH219-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

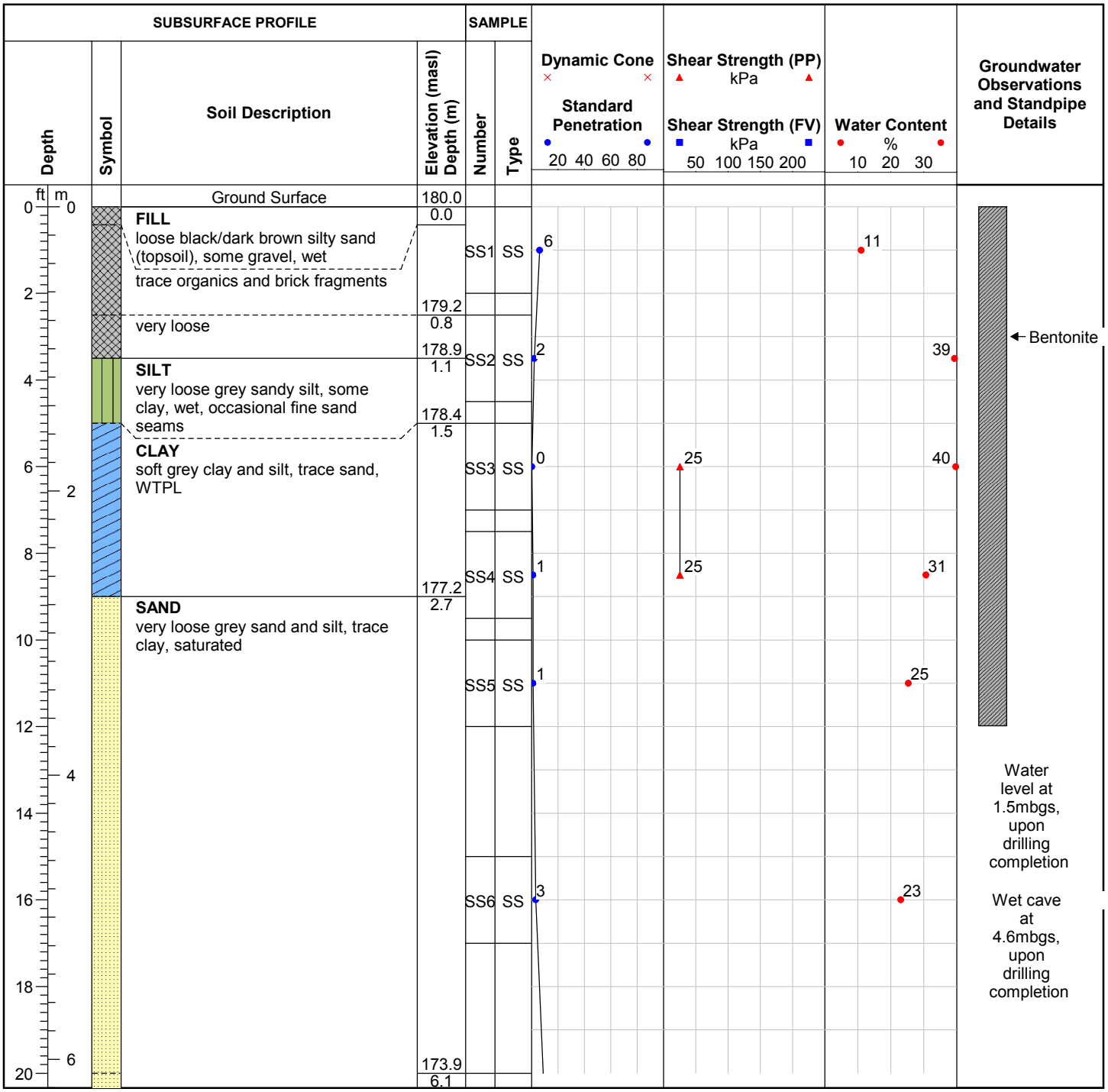
Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Hollow Stem Augers

Protective Cover: N/A



Field Technician: M. Dalgliesh

Drafted by: B. Heinbuch

Reviewed by: M. Wilson

MTE

ID Number: BH219-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Hollow Stem Augers

Protective Cover: N/A

SUBSURFACE PROFILE				SAMPLE		Dynamic Cone / Standard Penetration (20 40 60 80)	Shear Strength (PP) / Shear Strength (FV) kPa (50 100 150 200)	Water Content % (10 20 30)	Groundwater Observations and Standpipe Details
Depth	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type				
22		compact gravelly sand, some silt		SS7	SS	10		12	
24									
26	8			SS8	SS	11		11	
			171.7 8.2						
28		Drilling Terminated							
30									
32									
34	10								
36									
38									
40	12								

Field Technician: M. Dalgliesh

Drafted by: B. Heinbuch

Reviewed by: M. Wilson

MTE

ID Number: BH220-18

Project: Fox Street, Penetanguishene Development

Project No: 43022-100

Client: Wilmington Capital Management Inc.

Site Location: 160 - 200 Fox Street, Penetanguishene, ON

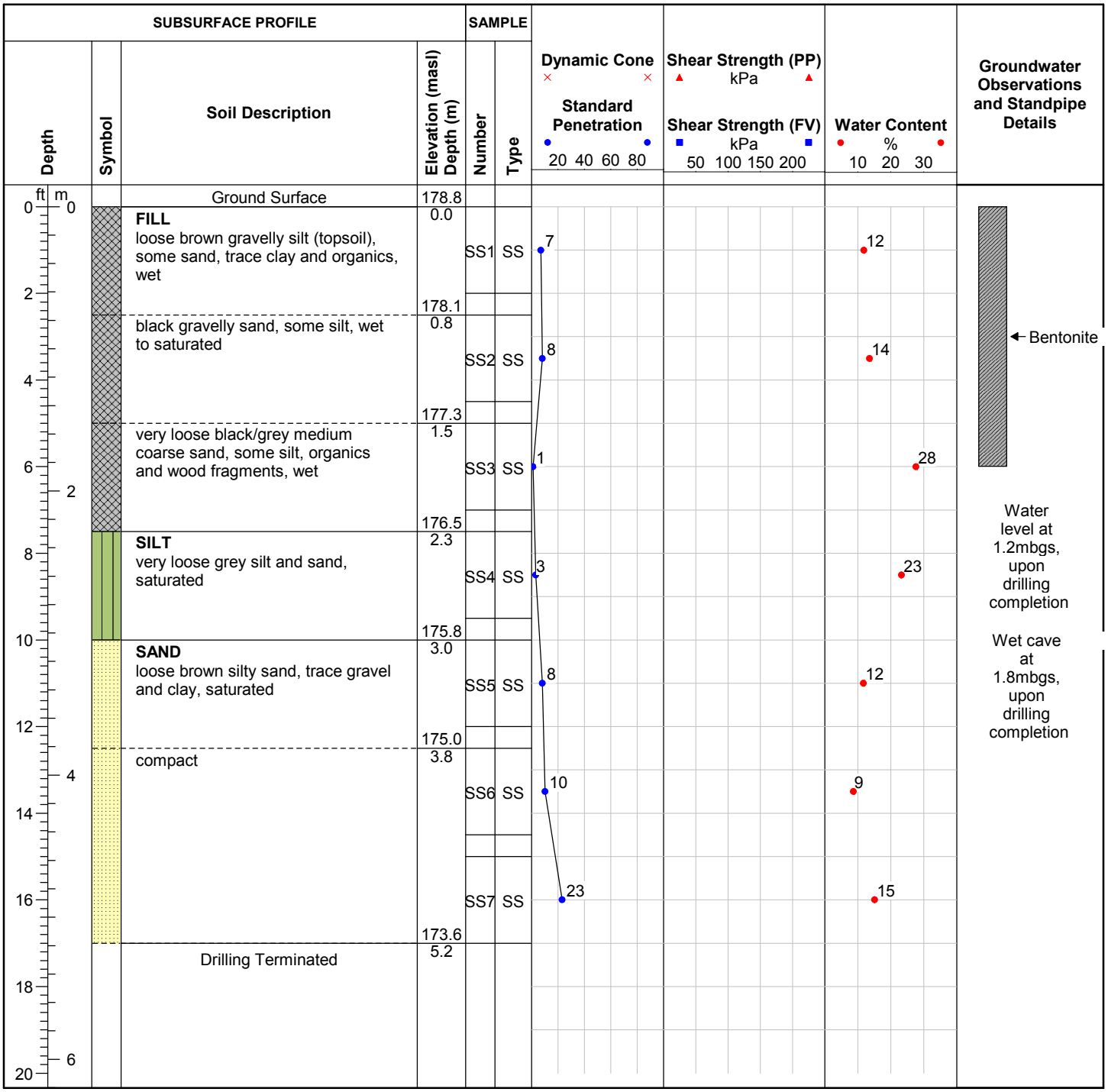
Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Hollow Stem Augers

Protective Cover: N/A



Field Technician: M. Dalgliesh

Drafted by: B. Heinbuch

Reviewed by: M. Wilson

MTE

Sheet: 1 of 1

APPENDIX C

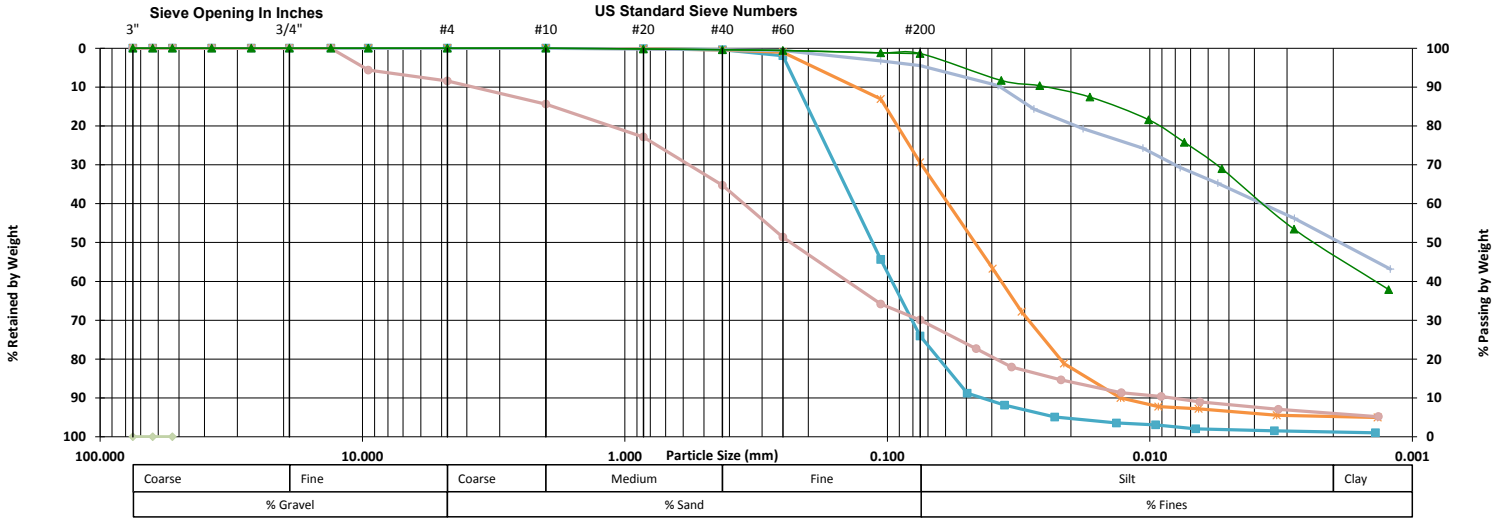
LABORATORY TEST RESULTS

Table 1 – Particle Size Distribution Analyses
Table 2 – Grain Size Distribution Analysis

Particle Size Distribution Analysis Test Results

PROJECT NAME: Fox Street Penetanguishene
CLIENT: Wilmington Capital Inc.
DATE SAMPLED: Apr. 9, 2018
DATE TESTED: Apr. 24-27, 2018
FILE No.: 43022-100
TABLE #: 1

Unified Soil Classification



Symbol	Borehole ID	Sample #	*Sample Depth*	Description
	BH217-18	SS-5	3.05 - 3.66 mbgs	SILT and CLAY, trace Sand
	BH218-18	SS-3	1.52 - 2.13 mbgs	Silty SAND, trace Clay
	BH219-18	SS-4	2.29 - 2.90 mbgs	Sandy SILT, trace Clay
	BH220-18	SS-3	1.52 - 2.13 mbgs	CLAY and SILT, trace Sand
		SS-5	3.05 - 3.66 mbgs	Silty SAND, trace Gravel and Clay

CERTIFIED BY CCIL Canadian Council of Independent Laboratories
For specific tests as listed on www.ccil.com

NOTES:

MTE Consultants Inc.
365 Home Street
Stratford, Ontario N5A 2A5
Phone: 519-271-7952
Fax: 519-271-3545
www.mte85.com

LABORATORY TEST RESULTS

PROJECT NAME:	Fox Street Penetanguishene		
CLIENT:	Wilmington Capital Inc.	**FILE NO.:**	43022-100
		DATE:	April 10, 2018
DATE SAMPLED:	April 9, 2018	**LAB NO.:**	S90G
		BOREHOLE ID:	BH216-18
DATE TESTED:	April 23, 2018	**SAMPLE INFO:**	SS-7 4.57-5.18mbgs
TESTED BY:	M.Dalgliesh	**TABLE NO.:**	2

SIEVE ANALYSIS OF AGGREGATE

SIEVE SIZE (mm)	% PASSING
150	100.0
100	100.0
63.0	100.0
53.0	100.0
37.5	100.0
26.5	100.0
22.0	100.0
19.0	100.0
16.0	100.0
13.2	100.0
9.50	100.0
6.75	100.0
4.75	100.0
2.36	99.7
1.18	98.4
0.600	85.7
0.300	33.4
0.150	5.1
0.075	1.7

CERTIFIED BY CCIL Canadian Council of Independent Laboratories For specific tests as listed on www.ccil.com

NOTES:

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APPENDIX D

TENSAR INTERNATIONAL CORPORATION
PRODUCT INFORMATION

SpectraPave4 PRO™
Subgrade Stabilization Design Analysis

DESIGN PARAMETERS

DESIGN REQUIREMENTS

Property	Value
Axle Load (kN)	80
Tire Pressure (kPa)	552
Axle Passes (Each)	12000
Maximum Rut Depth (mm)	40

PAVEMENT SOIL PROPERTIES

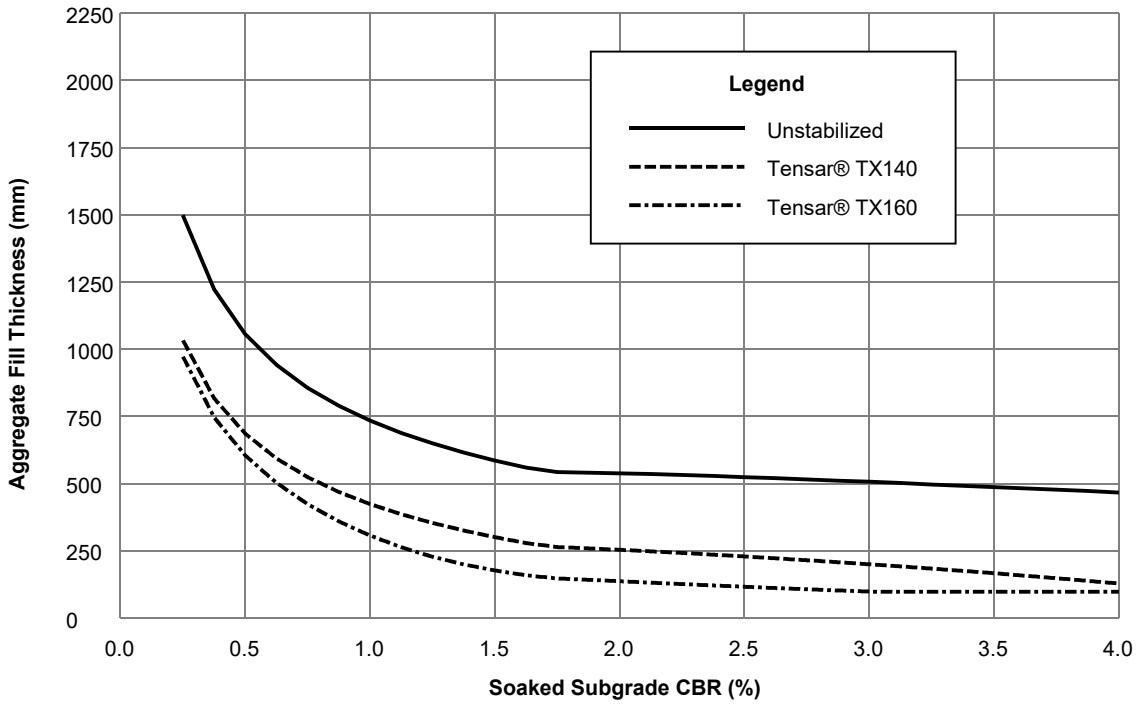
Property	Value
Aggregate Fill CBR (%)	20
Soaked Subgrade CBR (%)	0.8

Aggregate fill shall conform to following requirement:

D50 <= 27mm

RESULTS

Geosynthetic	Aggregate Fill Thickness (mm)		Aggregate Fill Thickness Savings (mm)	
	Calculated	Required	(mm)	(%)
Unstabilized	840.9	850	N/A	N/A
TX140	509.0	510	340	40
TX160	403.1	410	440	52



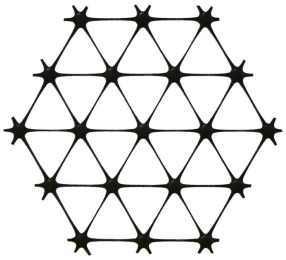
Project Name	Fox Street, Penetanguishene		
Company Name	MTE		
Designer		Date	

Tensar. THE COMPANY YOU CAN BUILD ON®

Product Specification - TriAx® TX140 Geogrid

Tensar International Corporation reserves the right to change its product specifications at any time. It is the responsibility of the person specifying the use of this product and of the purchaser to ensure that product specifications relied upon for design or procurement purposes are current and that the product is suitable for its intended use in each instance.

Tensar TriAx® Geogrid



General

1. The geogrid is manufactured from a punched polypropylene sheet, which is then oriented in three substantially equilateral directions so that the resulting ribs shall have a high degree of molecular orientation, which continues at least in part through the mass of the integral node.
2. The properties contributing to the performance of a mechanically stabilized layer include the following:

Index Properties	Longitudinal	Diagonal	Transverse	General
▪ Rib pitch[2], mm (in)	40 (1.60)	40 (1.60)	-	
▪ Mid-rib depth[2], mm (in)	-	1.2 (0.05)	1.2 (0.05)	
▪ Mid-rib width[2], mm (in)	-	1.1 (0.04)	1.1 (0.04)	
▪ Rib shape				rectangular
▪ Aperture shape				triangular

Structural Integrity

▪ Junction efficiency[3], %	93
▪ Aperture stability[4], kg-cm/deg @ 5.0kg-cm [2]	3.0
▪ Radial stiffness at low strain[5], kN/m @ 0.5% strain	225
(lb/ft @ 0.5% strain)	(15,430)

Durability

▪ Resistance to chemical degradation[6]	100%
▪ Resistance to ultra-violet light and weathering[7]	100%

Dimensions and Delivery

The TX Geogrid shall be delivered to the jobsite in roll form with each roll individually identified and nominally measuring 3.0 meters (9.8 feet) and/or 4.0 meters (13.1feet) in width and 75 meters (246 feet) in length.

Notes

1. Unless indicated otherwise, values shown are minimum average roll values determined in accordance with ASTM D4759-02. Brief descriptions of test procedures are given in the following notes.
2. Nominal dimensions.
3. Load transfer capability determined in accordance with GRI-GG2-87 and GRI-GG1-87 and expressed as a percentage of ultimate tensile strength.
4. In-plane torsional rigidity measured by applying a moment to the central junction of a 225mm x 225mm specimen restrained at its perimeter in accordance with GRI-GG9 modified.
5. Radial stiffness is determined from tensile stiffness measured in any in-plane axis from testing in accordance with ASTM D6637-10.
6. Resistance to loss of load capacity or structural integrity when subjected to chemically aggressive environments in accordance with EPA 9090 immersion testing.
7. Resistance to loss of load capacity or structural integrity when subjected to 500 hours of ultraviolet light and aggressive weathering in accordance with ASTM D4355-05.

Tensar International Corporation
2500 Northwinds Parkway, Suite 500
Alpharetta, Georgia 30009

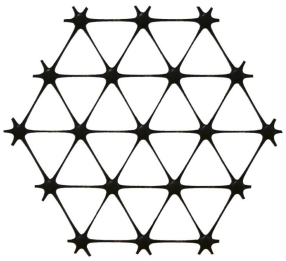
Phone: 800-TENSAR-1
www.tensar-international.com

Tensar. THE COMPANY YOU CAN BUILD ON®

Product Specification - TriAx® TX160 Geogrid

Tensar International Corporation reserves the right to change its product specifications at any time. It is the responsibility of the person specifying the use of this product and of the purchaser to ensure that product specifications relied upon for design or procurement purposes are current and that the product is suitable for its intended use in each instance.

Tensar TriAx® Geogrid



General

1. The geogrid is manufactured from a punched polypropylene sheet, which is then oriented in three substantially equilateral directions so that the resulting ribs shall have a high degree of molecular orientation, which continues at least in part through the mass of the integral node.
2. The properties contributing to the performance of a mechanically stabilized layer include the following:

Index Properties	Longitudinal	Diagonal	Transverse	General
▪ Rib pitch[2], mm (in)	40 (1.60)	40 (1.60)	-	
▪ Mid-rib depth[2], mm (in)	-	1.6 (0.06)	1.4 (0.06)	
▪ Mid-rib width[2], mm (in)	-	1.0 (0.04)	1.2 (0.05)	
▪ Rib shape				rectangular
▪ Aperture shape				triangular

Structural Integrity

▪ Junction efficiency[3], %	93
▪ Aperture stability[4], kg-cm/deg @ 5.0kg-cm [2]	3.6
▪ Radial stiffness at low strain[5], kN/m @ 0.5% strain	300
(lb/ft @ 0.5% strain)	(20,580)

Durability

▪ Resistance to chemical degradation[6]	100%
▪ Resistance to ultra-violet light and weathering[7]	100%

Dimensions and Delivery

The TX Geogrid shall be delivered to the jobsite in roll form with each roll individually identified and nominally measuring 3.0 meters (9.8 feet) and/or 4.0 meters (13.1feet) in width and 75 meters (246 feet) in length.

Notes

1. Unless indicated otherwise, values shown are minimum average roll values determined in accordance with ASTM D4759-02. Brief descriptions of test procedures are given in the following notes.
2. Nominal dimensions.
3. Load transfer capability determined in accordance with GRI-GG2-87 and GRI-GG1-87 and expressed as a percentage of ultimate tensile strength.
4. In-plane torsional rigidity measured by applying a moment to the central junction of a 225mm x 225mm specimen restrained at its perimeter in accordance with GRI-GG9 modified.
5. Radial stiffness is determined from tensile stiffness measured in any in-plane axis from testing in accordance with ASTM D6637-10.
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7. Resistance to loss of load capacity or structural integrity when subjected to 500 hours of ultraviolet light and aggressive weathering in accordance with ASTM D4355-05.

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Alpharetta, Georgia 30009

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Geogrid Specifications

Provisional use of Geogrids for Subgrade Stabilization

Geogrid shall be Tensar TX140 or TX160 as manufactured by Tensar International and supplied by Terrafix Geosynthetics. Material selection and design for the Mechanically Stabilized Layer shall be carried out as follows:

The Mechanical Stabilized Layer shall be designed in accordance with the Giroud-Han Method (Giroud and Han, 2004) of unpaved road design.

Approved Alternatives:

In-air index testing of geogrid properties, or explanation of performance based on in-air index testing of geogrid properties are not sufficient to understand the complex mechanisms involved in soil-geogrid interaction and/or the performance of Mechanically Stabilized Layers. Therefore, no acceptance of alternates based on material index property comparisons or explanations of performance based on in-air testing of geogrid properties will be allowed.

Any submittal for an alternative Mechanically Stabilized Layer design must be submitted at least 2 weeks in advance of the bid date and must be accompanied with the following:

- A design signed and sealed by a professional engineer registered to practice in the Province of Ontario.

- Unpaved design- A written statement from the alternative Mechanically Stabilized Layer design engineer of record that the design is based upon the Giroud-Han Method and that proper calibration and validation testing has been performed for the geogrid reinforcement utilized in the Mechanically Stabilized Layer in accordance with these specifications.

- A submittal package that includes documented evidence of proper calibration and validation testing.

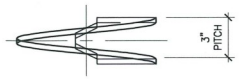
APPENDIX E

EBS GEOSTRUCTURAL INC.
HELICAL PILE INFORMATION

DISCLAIMER

1. The information and sketches contained in these drawings are given as guidelines only.
2. Capacities of Chance Helical Piles/Anchors may vary depending on, but not limited to, water table elevation and changes to that elevation, changing soil conditions, soil layer thicknesses.
3. Achievable capacities could be higher or lower than ratings due to site-specific conditions. On site load testing should be performed to confirm additional pile/anchor capacities.
4. Installed capacities to be verified on site by a registered Professional Engineer.
5. The information contained herein is to be used for preliminary design activities only, and subject to EBS' Website Disclaimer.

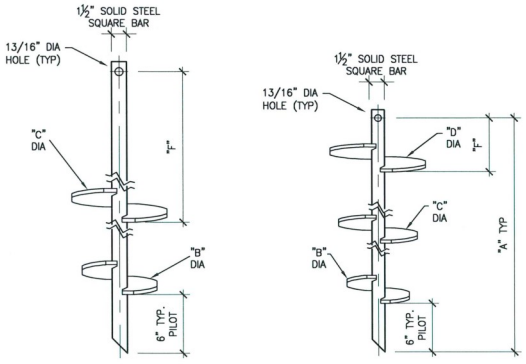
TWIN & TRIPLE SS5 HELICAL PIERS / ANCHORS



HELIX MUST BE FORMED BY MATCHING METAL DIE
(SIDE VIEW OF TRUE HELICAL FORM)

NOTES

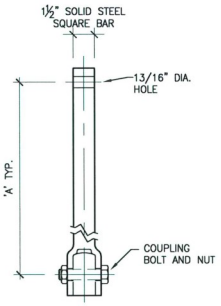
1. HOT DIP GALVANIZED PER ASTM A153-(LATEST REV.)
2. SHAFT MATERIAL-HOT ROLLED ROUND-CORNERED SQUARE (RCS) SOLID STEEL BARS PER ASTM A29; MINIMUM YIELD STRENGTH=70 KSI.
3. HELIX MATERIAL-HOT ROLLED LOW CARBON STEEL SHEET, STRIP, OR PLATE PER ASTM A572, OR A1018, OR A656; MINIMUM YIELD STRENGTH=50 KSI; 3/8" THICK.
4. COUPLING BOLTS: 3/4" DIAMETER X 3" LONG HEX HEAD PER ASTM A320 GRADE L7.
5. NOMINAL SPACING BETWEEN HELICAL PLATES IS THREE TIMES THE DIAMETER OF THE LOWER HELIX.
6. MANUFACTURER TO HAVE IN EFFECT INDUSTRY RECOGNIZED WRITTEN QUALITY CONTROL FOR ALL MATERIALS AND MANUFACTURING PROCESSES.
7. ALL WELDING TO BE COMPLETED BY WELDERS CERTIFIED UNDER SECTION 5 OF THE AWS CODE D1.1.
8. ALL HELICES HAVE A SHARPENED LEADING EDGE.
9. TORQUE STRENGTH RATING-5,500 FT-LB.
10. ULTIMATE CAPACITY (TENSION/COMPRESSION)-55 KIP, BASED ON A TORQUE FACTOR (K_t)=10.
11. ULTIMATE TENSION STRENGTH (COUPLING BOLT)-70 KIP.



LEAD SECTION

SCALE: N.T.S.

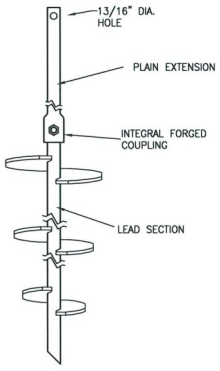
LEAD SECTION				
"A"	"B"	"C"	"D"	"F"
82-1/4"	6"	8"		58-1/4"
82-1/4"	8"	10"		52-1/4"
82-1/4"	10"	12"		46-1/4"
63-1/4"	8"	10"	12"	5-3/4"
82-1/4"	10"	12"	14"	10-1/4"



PLAIN EXTENSION

SCALE: N.T.S.

EXTENSION
"A"
57-1/2"
80-1/2"
120"



TYPICAL PIER / ANCHOR ASSEMBLY

SCALE: N.T.S.

EBS GEOSTRUCTURAL
320 Woolwich Street South, Breslau, Ontario N0B 1M0
Tel: 519-648-3613 Fax: 519-648-2526
Email: info@ebsgeo.com

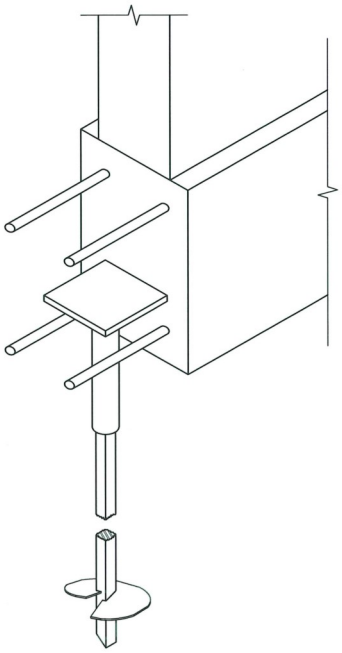
PROJECT: SAMPLE

DRAWING: SS5 HELICAL PIERS / ANCHORS

DRW'N BY:	SCALE: N.T.S.
CHECKED:	DATE: NOVEMBER 2012
PROJECT No.:	DWG. No.:

DISCLAIMER

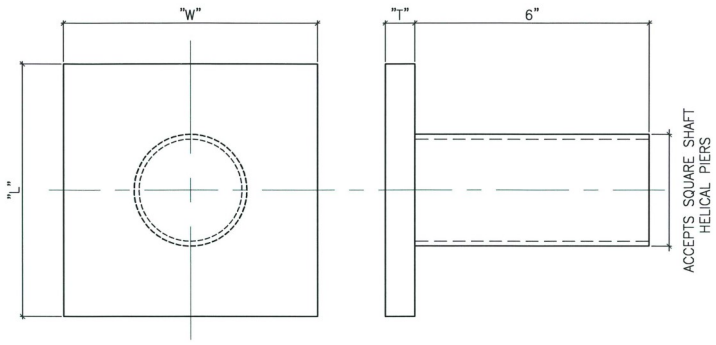
1. The information and sketches contained in these drawings are given as guidelines only.
2. Capacities of Chance Helical Piles/Anchors may vary depending on, but not limited to, water table elevation and changes to that elevation, changing soil conditions, soil layer thicknesses.
3. Achievable capacities could be higher or lower than ratings due to site-specific conditions. On site load testing should be performed to confirm additional pile/anchor capacities.
4. Installed capacities to be verified on site by a registered Professional Engineer.
5. The information contained herein is to be used for preliminary design activities only, and subject to EBS' Website Disclaimer.



INSTALLATION CONCEPT OF PIER CAP DETAIL

SCALE: N.T.S.

NEW CONSTRUCTION BRACKET



NEW CONSTRUCTION BRACKET

SCALE: N.T.S.

NEW CONSTRUCTION BRACKET SIZES				
HELICAL SS TYPE	"L"	"W"	"T"	SERVICE LOAD RATING
SS5	6"	6"	1/2"	25 KIP
SS175	6-1/2"	6-1/2"	3/4"	55 KIP
SS200	8"	8"	1"	80 KIP
SS225	9"	9"	1"	100 KIP

NOTES

1. FINISH: MILL FINISH STEEL.
2. PIPE: STEEL TUBE, ROUND, PER ASTM A500 GRADE B OR EQUIVALENT.
3. PLATE: PER ASTM A36 OR EQUIVALENT.
4. RATING: RATING IS VALID ONLY IF THE PIER CAP DETAIL HAS BEEN DESIGNED TO ENSURE ADEQUATE LOAD TRANSFER FROM REINFORCED CONCRETE FOUNDATION TO HELICAL PIER, AND IN ACCORDANCE WITH EXISTING LOCAL CODE REQUIREMENTS AND /OR ESTABLISHED LOCAL PRACTICES.

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Email: info@ebsgeo.com

PROJECT: SAMPLE

DRAWING: NEW CONSTRUCTION BRACKET

DRW'N BY:	SCALE: N.T.S.
CHECKED:	DATE: NOVEMBER 2012
PROJECT No.:	DWG. No.:

GEOTECHNICAL CAPACITIES OF SQUARE SHAFT HELICAL PILES

SOIL PROPERTIES		PRODUCT TYPE	COMPRESSION CAPACITY		TENSION CAPACITY	
"N" VALUE COHESIVE	"N" VALUE NON–COHESIVE	SQUARE SHAFT SIZE mm (INCHES)	SLS kN (KIPS)	ULS kN (KIPS)	SLS kN (KIPS)	ULS kN (KIPS)
25–35	25–30	* SS5 38 (1.5)	200 (45)	270 (60)	60 (13)	80 (18)
35–45	30–35	SS175 44 (1.75)	370 (83)	500 (113)	135 (30)	150 (33)
50–60	40–50	SS200 51 (2)	500 (112)	670 (150)	165 (37)	215 (48)
65–100	55–100	SS225 57 (2.25)	680 (153)	915 (206)	240 (54)	310 (70)

* Ability to install in tight access (3ft wide) and low headroom (6ft high)

GEOTECHNICAL CAPACITIES OF ROUND SHAFT HELICAL PILES

SOIL PROPERTIES		PRODUCT TYPE	COMPRESSION CAPACITY		TENSION CAPACITY	
"N" VALUE COHESIVE	"N" VALUE NON–COHESIVE	DIAMETER mm (INCHES)	SLS kN (KIPS)	ULS kN (KIPS)	SLS kN (KIPS)	ULS kN (KIPS)
20–25	15–20	* RS2875 73 (2.875)	115 (26)	155 (35)	50 (11)	65 (15)
25–30	20–25	RS3500 89 (3.5)	210 (47)	280 (64)	90 (20)	120 (27)
30–35	25–30	RS4500 114 (4.5)	320 (72)	430 (97)	135 (31)	185 (42)
35–40	30–35	RS6625 168 (6.625)	460 (104)	620 (140)	200 (45)	270 (60)
40–45	35–40	RS8625 219 (8.625)	690 (156)	930 (210)	300 (67)	400 (90)
45–50	40–45	RS958 244 (9.625)	950 (214)	1300 (293)	480 (108)	650 (146)

* Ability to install in tight access (3ft wide) and low headroom (6ft high)

"MTE is a trusted advisor to our clients and enhances their projects by providing the right solution in a personal, cost effective and timely manner."

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