Ian D. Wilson Associates Ltd.
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September 4, 2018
Revised February 13, 2019

Wilson Associates

Consulting Hydrogeologists

Mr. Dave Rozycki
3282 Ogden's Beach Road
Midland, ON
L4R 4K6

Dear Mr. Rozycki:

Re: Hydrogeological Study and Water Balance Analysis
Proposed Development of 166, 176 and 200 Fox Street
Town of Penetanguishene

It is proposed to re-develop the existing 6.40ha property at 166, 176 and 200 Fox Street, in the Town of Penetanguishene, as a residential development with detached, semi-detached and townhome buildings. The site is currently in use as a marina and associated facilities.

As requested by WMI & Associates, this report has been prepared to address the requirements of the June 2013 "Hydrogeological Assessment Submissions: Conservation Authority Guidelines for Development Applications" (the CA Guideline).

Provided for this updated study were the following documentation:

- Geotechnical Investigation (Draft), Fox Street Penetanguishene Proposed Development. MTE Consultants Inc. (MTE), May 8, 2018.
- Proposed Site Plan, March 2018.

Copies of the above documentation are attached for reference.

This revised report has been prepared to update the report to the current site plan, dated January 25, 2019, as well as to clarify site references.

LOCATION AND HYDROGEOLOGICAL SETTING

The subject lands at 166, 176 and 200 Fox Street occupy a 6.40ha parcel located on the west side of Fox Street, approximately 240m north of Beck Boulevard and approximately 340m south of Broad Street, within the northern periphery of the Town of Penetanguishene. The lands are situated on the east shore of Penetang Harbour, between Fox Street and the Harbour, and exhibit a generally westwards slope of approximately 4 to 6m between Fox Street and the shore of Penetang Harbour. The lands are currently developed as a marina and associated facilities. The only other surface water body mapped in the vicinity of the site is St. Andrews Lake, located about 1,400m to the east.

Lands in the vicinity of the site are primarily in use as urban residential development, with some lands to the east of Fox Street currently undeveloped.

The subject lands are located within the Simcoe Uplands physiographic region of southern Ontario, an area of northern Simcoe County characterized by till upland plains and steep-sided, flat floored valleys. The site is situated west of, and below, a steep raised shore bluff which was once the shore of glacial Lake Algonquin, the shore bluff being located east of Fox Street.

According to Ontario Geological Survey Open File Map 194 "Quaternary Geology of the Penetanguishene and Christian Island Areas", the upper soils across the site consist of lacustrine coarse-grained deposits (fine to very fine sand, minor pebbly sand and silt). In twenty on-site exploratory boreholes, the native soil profile identified by the MTE report consisted mainly of sand, usually overlying discontinuous silt and clay deposits at depth.

As the area is municipally serviced, few water well records are available in the close vicinity from which to characterize the sequence of lower overburden formations. The Ministry of the Environment, Conservation and Parks (MECP) water well record for a municipal test well (57-12850, copy attached) located nearby to the south of the site (north of Beck Boulevard), indicates that the entire overburden is primarily granular.

According to MECP water well record 57-12850, and interpretation provided by the 2005 North Simcoe Municipal Groundwater Study (NSMGS), the bedrock surface beneath the site is situated at an approximate elevation of 140m above sea level (masl) (per Figure 4.5.2 of the NSMGS). As such, the overburden will be in the range of 42m deep beneath the site. The NSMGS also reports the majority of the overburden to be granular.

The bedrock beneath the site consists mainly of limestone and dolostone of the Simcoe Group.

Although the area is now municipally serviced, historical water wells will have obtained potable groundwater from granular formations in the lower overburden. The bedrock beneath the site is not locally typically used as a source of potable groundwater due to the likelihood of obtaining lower yields of aesthetically-poorer quality groundwater.

According to the 2015 Severn Sound Source Protection Area Approved Assessment Report (the Severn Sound Report), the site is not located within a Well Head Protection Zone. The Severn Sound Report also indicates that the municipal well site to the south, referenced by MECP water well record 57-12850, is no longer in use as a municipal well site. Furthermore, an MECP water well record prepared by International Water Supply in 2007 (no well record number) indicates that a historical municipal water well located to the south of the site was abandoned (record attached).

WATERTABLE

Watertable levels were observed by MTE in open boreholes and in two boreholes equipped as monitoring wells, and are summarized in Table 4 of the MTE report. To generally summarize the MTE Table 4 data, shallow groundwater conditions are reported across the site, with reported watertable levels ranging from between 1.5m to 2.9m below grade in boreholes within the eastern portion of the site near Fox Street to between 0.31m and 1.22m below grade within the western portion of the site near Penetang Harbour. The watertable surface reported by MTE slopes in a westwards direction from an approximate elevation of 179masl within the eastern portion of the site near Fox Street down to an approximate elevation of 176.9masl along the shore of Penetang Harbour. Based on the MTE water level data, a westwards direction of shallow groundwater flow is inferred.

Locally (i.e. the area between Penetang Harbour and St. Andrews Lake), Figures 4.4.1 and 4.4.2 of the NSMGS indicates a westward direction of groundwater flow. Figure 4.4.5 of the NSGMS classifies the site as a major groundwater discharge area.

SHALLOW GROUNDWATER QUALITY

To establish background shallow groundwater quality, a sample of shallow groundwater was collected from MTE BH/MW202-18 on June 14, 2018. The sample was collected using a Waterra inertial pump after purging the well of 20L of standing water (approximately 3 casing volumes). The water sample was collected in laboratory-supplied bottles, stored in an ice-packed cooler and submitted to Maxxam Analytics Inc. under chain of custody for an analysis of general chemistry and heavy metals parameters.

The analytical results indicate that for the parameters determined, most parameters (including sodium, chloride and nitrate) were at relatively low levels typical of shallow groundwater in a municipally-serviced area. The dissolved organic carbon content of the sample was slightly elevated at 8.4mg/L (above the Ontario Drinking Water Quality Standard (ODWQS) of 5mg/L), which is not unexpected in a low-lying groundwater discharge area. The manganese content of the sample at 1.4mg/L is elevated, above the ODWQS of 0.05mg/L, and is also is not unexpected in a low-lying groundwater discharge area. The total dissolved solids (TDS) content of the sample at 550mg/L is slightly elevated above the ODWQS of 500mg/L, however the elevated TDS is not related to road salting, and appears to be naturally-occurring.

A copy of the analytical results are attached.

WATER BUDGET ANALYSIS

The following assumptions are made for this assessment:

- Overall drainage from the site is generally westwards following site topography, and for water budget analysis, the site is assumed to act as one catchment. The site is considered to exhibit a rolling to hilly topography (per the 1995 MECP definitions referenced by the CA guideline) and sandy soil conditions.

- According to calculations provided by WMI & Associates Limited, the 6.40ha site currently exhibits a pervious area of 43% (2.75ha) and an impervious area of 57% (3.65ha). The proposed re-development of the site will exhibit a pervious area of 51% (3.26ha) and an impervious area of 49% (3.14ha). For the purposes of this assessment, it is assumed that infiltration rates will need to be maintained to pre-development conditions, that being prior to the development of the marina facility (i.e. 100% pervious conditions).

- The water surplus for the site is assumed to be 406mm/year, as identified for the Penetanguishene and Tay Point subwatershed by the 2015 Severn Sound Report (precipitation 992mm/year, actual evapotranspiration 586mm/year). Normal precipitation for the area is 1040.6mm/year (1981-2010 precipitation normal for the closest Environment Canada weather station - Midland WPCP weather station). For this assessment, the 2015 Severn Sound Report precipitation rate of 992mm/year is assumed.

The following tables provide a water budget analysis following the general guidance of the April 2013 Conservation Authority Guidelines for Hydrogeological Assessments.

Table 1 - Water Budget - Undeveloped (pre-marina) Conditions

Catchment Designation	Site	
	Undeveloped	Totals
Area (m^2)	64000	64000
Pervious Area (m^2)	64000	64000
Impervious Area (m^2)	0	0
Impervious Factors (Per MECP Guidelines referenced by CA Guideline)		
Topography Infiltration Factor	Rolling to Hilly 0.15	
Soil Infiltration Factor	Sand 0.4	
Land Cover Infiltration Factor	Cleared 0.1	
MOECC Infiltration Factor	0.65	
Actual Infiltration Factor	0.65	
Run-Off Coefficient	0.35	
Runoff from Impervious Surfaces*	0	
Inputs (per Unit Area)		
Precipitation (mm/year)	992	992
Run-On (mm/year)	0	0
Other Inputs (mm/year)	0	0
Total Inputs (mm/year)	992	992
Outputs (per Unit Area)		
Precipitation Surplus (mm/year)	406	406
Net Surplus (mm/year)	406	406
Evapotranspiration (mm/year)	586	586
Infiltration (mm/year)	264	264
Impervious Area Infiltration (mm/year)	0	0
Total Infiltration (mm/year)	264	264
Runoff Pervious Areas (mm/year)	142	142
Runoff Impervious Areas (mm/year)	0	0
Total Runoff (mm/year)	142	142
Total Outputs (mm/year)	992	992
Difference (Inputs - Outputs) (mm/year)	0	0

Inputs (Volume)		
Precipitation (m^3/year)	63488	63488
Run-On (m^3/year)	0	0
Other Inputs (m^3/year)	0	0
Total Inputs (m^3/year)	63488	63488
Outputs (Volume)		
Precipitation Surplus (m^3/year)	25984	25984
Net Surplus (m^3/year)	25984	25984
Evapotranspiration (m^3/year)	37504	37504
Infiltration (m^3/year)	16896	16896
Impervious Area Infiltration (m^3/year)	0	0
Total Infiltration (m^3/year)	16896	16896
Runoff Pervious Areas (m^3/year)	9088	9088
Runoff Impervious Areas (m^3/year)	0	0
Total Runoff (m^3/year)	9088	9088
Total Outputs (m^3/year)	63488	63488
Difference (Inputs - Outputs) (m^3/year)	0	0

Table 2 - Water Budget - Post-Development Conditions

Under Post-Development conditions, The proposed re-development of the site will exhibit a pervious area of 51% (3.26ha) and an impervious area of 49% (3.14ha).

Catchment Designation	Site		
	Pervious	Impervious	Totals
Area (m^2)	32600	31400	64000
Pervious Area (m^2)	32600	0	32600
Impervious Area (m^2)	0	31400	31400
Impervious Factors (Per MECP Guidelines referenced by CA Guideline)			
Topography Infiltration Factor	Rolling to Hilly 0.15	Rolling to Hilly 0.15	
Soil Infiltration Factor	Sand 0.4	Sand 0.4	
Land Cover Infiltration Factor	Cleared 0.1	Impervious 0	
MOECC Infiltration Factor	0.65	0	
Actual Infiltration Factor	0.65	0	
Run-Off Coefficient	0.35	1	
Runoff from Impervious Surfaces*	0	0.8	
Inputs (per Unit Area)			
Precipitation (mm/year)	992	992	992
Run-On (mm/year)	0	0	0
Other Inputs (mm/year)	0	0	0
Total Inputs (mm/year)	992	992	992
Outputs (per Unit Area)			
Precipitation Surplus (mm/year)	406	794	596
Net Surplus (mm/year)	406	794	596
Evapotranspiration (mm/year)	586	198	396
Infiltration (mm/year)	264	0	135
Impervious Area Infiltration (mm/year)	0	0	0
Total Infiltration (mm/year)	264	0	135
Runoff Pervious Areas (mm/year)	142	0	72
Runoff Impervious Areas (mm/year)	0	794	389
Total Runoff (mm/year)	142	794	461
Total Outputs (mm/year)	992	992	992
Difference (Inputs - Outputs) (mm/year)	0	0	0

Inputs (Volume)			
Precipitation (m^3/year)	32339	31149	63488
Run-On (m^3/year)	0	0	0
Other Inputs (m^3/year)	0	0	0
Total Inputs (m^3/year)	32339	31149	63488
Outputs (Volume)			
Precipitation Surplus (m^3/year)	13236	24932	38168
Net Surplus (m^3/year)	13236	24932	38168
Evapotranspiration (m^3/year)	19104	6217	25321
Infiltration (m^3/year)	8606	0	8606
Impervious Area Infiltration (m^3/year)	0	0	0
Total Infiltration (m^3/year)	8606	0	8606
Runoff Pervious Areas (m^3/year)	4629	0	4629
Runoff Impervious Areas (m^3/year)	0	24932	24932
Total Runoff (m^3/year)	4629	24932	29561
Total Outputs (m^3/year)	32339	31149	63488
Difference (Inputs - Outputs) (m^3/year)	0	0	0

Note: * Per guidelines, evaporation from impervious areas assumed to be 20% of precipitation.

** Minor differences attributable to rounding.

Table 3 - Water Budget - Post-Development Conditions with Mitigation

Based on the above assessment, approximately 8,290m^3/year (33.3%) of the runoff from the impervious areas of the site will need to be infiltrated on the site in order to maintain the overall rate of infiltration relative to pre-development (pre-marina) conditions. The viability of infiltrating this volume of water is discussed below.

Catchment Designation	Site		
	Pervious	Impervious	Totals
Area (m^2)	32600	31400	64000
Pervious Area (m^2)	32600	0	32600
Impervious Area (m^2)	0	31400	31400
Impervious Factors (Per MECP Guidelines referenced by CA Guideline)			
Topography Infiltration Factor	Rolling to Hilly 0.15	Rolling to Hilly 0.15	
Soil Infiltration Factor	Sand 0.4	Sand 0.4	
Land Cover Infiltration Factor	Cleared 0.1	Impervious 0	
MOECC Infiltration Factor	0.65	0	
Actual Infiltration Factor	0.65	0	
Run-Off Coefficient	0.35	1	
Runoff from Impervious Surfaces*	0	0.8	
Inputs (per Unit Area)			
Precipitation (mm/year)	992	992	992
Run-On (mm/year)	0	0	0
Other Inputs (mm/year)	0	0	0
Total Inputs (mm/year)	992	992	992
Outputs (per Unit Area)			
Precipitation Surplus (mm/year)	406	794	596
Net Surplus (mm/year)	406	794	596
Evapotranspiration (mm/year)	586	198	396
Infiltration (mm/year)	264	0	135
Impervious Area Infiltration (mm/year)	0	264	129
Total Infiltration (mm/year)	264	264	264
Runoff Pervious Areas (mm/year)	142	0	72
Runoff Impervious Areas (mm/year)	0	530	259
Total Runoff (mm/year)	142	530	331
Total Outputs (mm/year)	992	992	991

Difference (Inputs - Outputs) (mm/year)	0	0	-1**
Inputs (Volume)			
Precipitation (m^3/year)	32339	31149	63488
Run-On (m^3/year)	0	0	0
Other Inputs (m^3/year)	0	0	0
Total Inputs (m^3/year)	32339	31149	63488
Outputs (Volume)			
Precipitation Surplus (m^3/year)	13236	24932	38168
Net Surplus (m^3/year)	13236	24932	38168
Evapotranspiration (m^3/year)	19104	6217	25321
Infiltration (m^3/year)	8606	0	8606
Impervious Area Infiltration (m^3/year)	0	8290	8290
Total Infiltration (m^3/year)	8606	8290	16896
Runoff Pervious Areas (m^3/year)	4629	0	4629
Runoff Impervious Areas (m^3/year)	0	16642	16642
Total Runoff (m^3/year)	4629	16642	21271
Total Outputs (m^3/year)	32339	31149	63488
Difference (inputs - Outputs) (m^3/year)	0	0	0

Note: * Per guidelines, evaporation from impervious areas assumed to be 20% of precipitation.

** Minor differences attributable to rounding.

Table 4 - Water Budget Summary

Characteristic	Site				
	Current	Post-Development	% Change (Current to Post)	Post Development with Mitigation	% Change (Current to Post with Mitigation)
Inputs (Volumes)					
Precipitation (m^3/year)	63488	63488	0	63488	0
Run-On (m^3/year)	0	0	0	0	0
Other Inputs (m^3/year)	0	0	0	0	0
Total Inputs (m^3/year)	63488	63488	0	63488	0
Outputs (Volumes)					
Precipitation Surplus (m^3/year)	25984	38168	47	38168	47
Net Surplus (m^3/year)	25984	38168	47	38168	47
Evapotranspiration (m^3/year)	37504	25321	-28	25321	-28
Infiltration (m^3/year)	16896	8606	-49	8606	-49
Impervious Area Infiltration (m^3/year)	0	0	0	8290	33.3
Total Infiltration (m^3/year)	16896	8606	-49	16896	0
Runoff Pervious Areas (m^3/year)	9088	4629	-49	4629	-49
Runoff Impervious Areas (m^3/year)	0	24932	+24932 m^3/year	16642	+16642 m^3/year
Total Runoff (m^3/year)	9088	29561	193	21271	115
Total Outputs (m^3/year)	63488	63488	0	63488	0

Mitigation assumes that 33.3% of runoff from the impervious areas of the site can be infiltrated on-site, or about 8,290m^3/year. It is assumed that most of this will be infiltrated into grass swales, infiltration galleries, or other equivalent Low Impact Development (LID) measures. According to the grain-size analyses for the sand deposits provided in the MTE report (attached), the predominant native soils (i.e. a silty fine sand) will exhibit a percolation rate (T-time) in the range of 10 to 12 min/cm (based on the Hazen Formula for a Unified Soil Classification "SM"), or about 1.2m/day. Conservatively assuming that the impervious area drainage of 8,290m^3/year is to be infiltrated over 30 days throughout the year, approximately 276m^3 of water needs to be infiltrated per day. Based on an infiltration rate of 1.2m/day, LID measures with a total site footprint of at least 230m^2 are required.

SUMMARY

1. The overburden in the vicinity of the site is reported to be primarily granular, with discontinuous fine-grained lenses.

2. Based on a review of the MTE borehole data, local water well records and the 2005 NSMGS, the regional watertable surface slopes westward across the site. The watertable surface is situated 0.31 to 2.9m below grade over the site, being shallower in a westwards direction.

3. The site is mapped by the NSMGS as a groundwater discharge area.

4. Shallow groundwater quality is typical of shallow groundwater in a municipally-serviced area with few indicators of urban impact. The dissolved organic carbon and manganese contents of shallow groundwater were elevated, but are not unexpected in a low-lying, groundwater discharge area. The slightly elevated TDS content of shallow groundwater appears to be naturally occurring.

5. Based on known site conditions (i.e. sandy soils, rolling to hilly relief, cleared cover), an MECP infiltration factor of 0.65 is indicated for the undeveloped site.

6. Water budget analysis indicates that the development proposal of the site will reduce overall infiltration by about 49% from pre-development (pre-marina) conditions.

7. Due to the calculated loss in overall infiltration of the development proposal in comparison to pre-development conditions, infiltration enhancement measures must be adopted to infiltrate approximately 33.3% of runoff from impervious surfaces. It is assumed that most of this will be infiltrated into grass swales, infiltration galleries, or other equivalent Low Impact Development (LID) measures. The infiltration measures need to be maintained in a low-silt condition to avoid infiltration loss over time.

Should there be any questions regarding the above information and analysis, please feel free to contact this office.

Yours sincerely.
IAN D. WILSON ASSOCIATES LIMITED

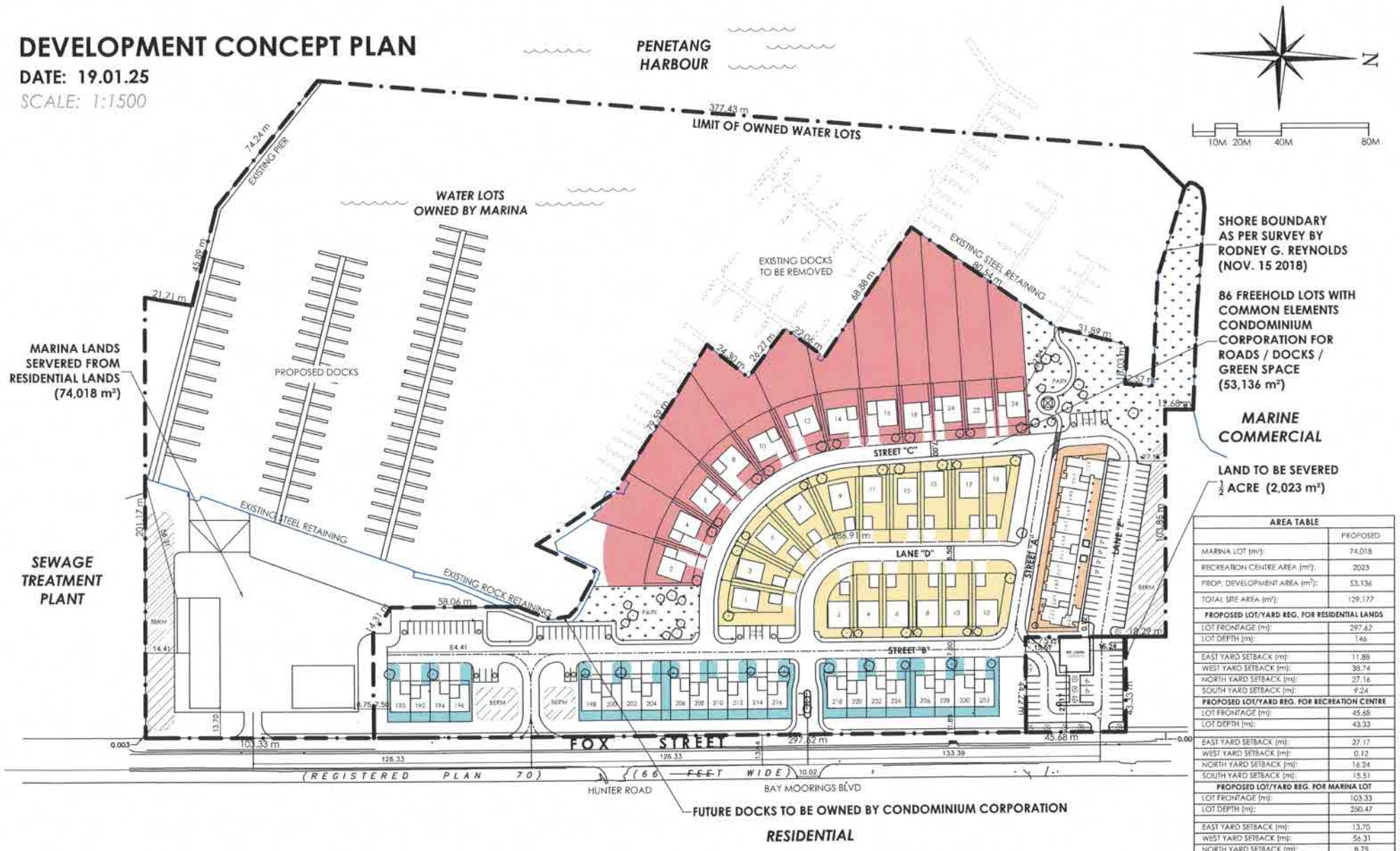
Geoffrey Rether, P.Geo.

PROFESSIONAL GEOSCIENTIST
GEOFFREY B. RETHER
PRACTISING MEMBER
0426
ONTARIO

DEVELOPMENT CONCEPT PLAN

DATE: 19.01.25

SCALE: 1:1500



AREA TABLE	
	PROPOSED
MARINA LOT (m²):	74,018
RECREATION CENTRE AREA (m²):	2023
PROP. DEVELOPMENT AREA (m²):	53,136
TOTAL SITE AREA (m²):	129,177
PROPOSED LOT/YARD REG. FOR RESIDENTIAL LANDS	
LOT FRONTAGE (m):	297.62
LOT DEPTH (m):	146
EAST YARD SETBACK (m):	11.88
WEST YARD SETBACK (m):	38.74
NORTH YARD SETBACK (m):	27.16
SOUTH YARD SETBACK (m):	9.24
PROPOSED LOT/YARD REG. FOR RECREATION CENTRE	
LOT FRONTAGE (m):	45.68
LOT DEPTH (m):	43.33
EAST YARD SETBACK (m):	27.17
WEST YARD SETBACK (m):	0.12
NORTH YARD SETBACK (m):	16.24
SOUTH YARD SETBACK (m):	15.51
PROPOSED LOT/YARD REG. FOR MARINA LOT	
LOT FRONTAGE (m):	103.33
LOT DEPTH (m):	250.47
EAST YARD SETBACK (m):	13.70
WEST YARD SETBACK (m):	56.31
NORTH YARD SETBACK (m):	8.75
SOUTH YARD SETBACK (m):	14.41

MINISTRY OF THE ENVIRONMENT

The Ontario Water Resources Act

WATER WELL RECORD

31D13W

Ontario

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 | 15712850 | MUNICIP 57606 | CON.

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON., BLOCK, TRACT, SURVEY, ETC.	LOT
Simcoe	Penetanguishene	Fox Street	

[redacted] netanguishene, Ont.

DATE COMPLETED DAY 18 MO. Sept YR. 75

NORTHING 959100 | EC ST | ELEVATION 0600 | EC 6 | BASIN CODE 22

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
	clay w/	sand layers		0	53
	sand		medium	53	58
	sand &	gravel	cemented	58	62
	sand		coarse	62	95
	sand &	gravel		95	140
	limestone			140	142

31 | 0053 052874 0058 09 | 0062 281160 0095 10 | 0140 281 11 | 0142 115

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
0053	1 ☒ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
0062	1 ☒ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

OUTSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
06	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	.188	0	0112
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER	LENGTH
030	06.000	026 FEET

MATERIAL AND TYPE: 10' x mild steel; 16' x stainless steel

DEPTH TO TOP OF SCREEN: seal 0106 FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)

71 PUMPING TEST

PUMPING TEST METHOD: 1 ☒ PUMP 2 ☐ BAILER

PUMPING RATE: 0466 GPM | DURATION OF PUMPING: 48 HOURS 00 MINS

WATER LEVELS DURING: 1 ☒ PUMPING 2 ☐ RECOVERY

STATIC LEVEL	WATER LEVEL END OF PUMPING	1 HR	2 HRS	3 HRS	4 HRS
-56 FEET	045 FEET	043 FEET	043 FEET	044 FEET	044 FEET
Flow FEET	44.74 FEET	42.58 FEET	43.00 FEET	43.63 FEET	43.76 FEET

IF FLOWING, GIVE RATE: 0060 GPM

PUMP INTAKE SET AT: FEET

WATER AT END OF TEST: 1 ☒ CLEAR 2 ☐ CLOUDY

RECOMMENDED PUMP TYPE: ☐ SHALLOW ☐ DEEP

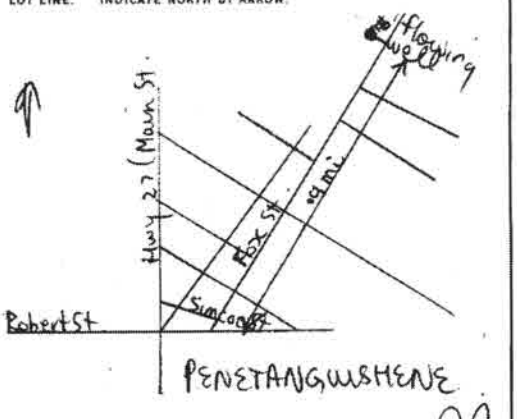
RECOMMENDED PUMP SETTING: FEET

RECOMMENDED PUMPING RATE: GPM

GPM./FT. SPECIFIC CAPACITY

LOCATION OF WELL 8459

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS

FINAL STATUS OF WELL 2
1 ☐ WATER SUPPLY 2 ☒ OBSERVATION WELL 3 ☒ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED

WATER USE 06
1 ☐ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☐ INDUSTRIAL ☐ OTHER 5 ☐ COMMERCIAL 6 ☒ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF DRILLING 2
1 ☐ CABLE TOOL 2 ☒ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☐ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: Snider Drilling Limited. | LICENCE NUMBER: 4816

ADDRESS: Craighurst, Ont.

NAME OF DRILLER OR BORER: Donald Prince. | LICENCE NUMBER:

SIGNATURE OF CONTRACTOR: Ralph Snider. | SUBMISSION DATE DAY MO. YR.

OFFICE USE ONLY

DATA SOURCE 1 | CONTRACTOR 4816 | DATE RECEIVED 240276

DATE OF INSPECTION Aug 11/76 | INSPECTOR

REMARKS: CSS.58 | P BF | WI

MINISTRY OF THE ENVIRONMENT COPY

FORM 7 MOE 07-091

Ontario Ministry of the Environment

Well Tag Number (Place sticker and print number below): N/A

Well Record

Regulation 903 Ontario Water Resources Act

page 1 of 1

Instructions for Completing Form

- For use in the **Province of Ontario** only. This document is a permanent **legal** document. Please retain for future reference.
- All Sections **must** be completed in full to avoid delays in processing. Further instructions and explanations are available on the back of this form.
- Questions regarding completing this application can be directed to the Water Well Management Coordinator at 416-235-6203.
- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only

MUN | CON | LOT

Well Owner's Information and Location of Well Information

[redacted]

Address of Well Location (County/District/Municipality): SIMCOE | Township: TINY | Lot | Concession

RR#/Street Number/Name: FOX ST. | City/Town/Village: PENETANGUISHENE | Site/Compartment/Block/Tract etc.

GPS Reading | NAD: 83 | Zone: 17 | Easting: 584478 | Northing: 4959345 | Unit Make/Model: MAGELLAN | Mode of Operation: [X] Undifferentiated [ ] Averaged [ ] Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To
	-ABANDONMENT OF OLD 8" DIA. WELL KNOWN AS FOX ST. #2				
	- CUT CASING 6.1m (20 FT) BELOW GROUND LEVEL AND REMOVED				

Hole Diameter

Depth From	Depth To	Diameter Centimetres

Water Record

Water found at ___ Metres / Kind of Water

- ___ m [ ] Fresh [ ] Sulphur [ ] Gas [ ] Salty [ ] Minerals [ ] Other:
- ___ m [ ] Fresh [ ] Sulphur [ ] Gas [ ] Salty [ ] Minerals [ ] Other:
- ___ m [ ] Fresh [ ] Sulphur [ ] Gas [ ] Salty [ ] Minerals [ ] Other:

After test of well yield, water was [ ] Clear and sediment free [ ] Other, specify

Chlorinated [ ] Yes [ ] No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Depth To
Casing				
	[ ] Steel [ ] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized			
	[ ] Steel [ ] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized			
	[ ] Steel [ ] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized			
Screen				
Outside diam	[ ] Steel [ ] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized	Slot No.		
No Casing or Screen				
	[ ] Open hole			

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level			
Pumping rate - (litres/min)	1		1	
Duration of pumping ___ hrs + ___ min	2		2	
Final water level end of pumping ___ metres	3		3	
Recommended pump type. [ ] Shallow [ ] Deep	4		4	
Recommended pump depth. ___ metres	5		5	
Recommended pump rate. (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

Plugging and Sealing Record [ ] Annular space [X] Abandonment

Depth set at - Metres From	Depth set at - Metres To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
43.1	0	BENTONITE	1.3

Method of Construction

[ ] Cable Tool [ ] Rotary (air) [ ] Diamond [ ] Digging
[ ] Rotary (conventional) [ ] Air percussion [ ] Jetting [ ] Other
[ ] Rotary (reverse) [ ] Boring [ ] Driving

Water Use

[ ] Domestic [ ] Industrial [ ] Public Supply [ ] Other
[ ] Stock [ ] Commercial [ ] Not used
[ ] Irrigation [ ] Municipal [ ] Cooling & air conditioning

Final Status of Well

[ ] Water Supply [ ] Recharge well [ ] Unfinished [X] Abandoned, (Other)
[ ] Observation well [ ] Abandoned, insufficient supply [ ] Dewatering
[ ] Test Hole [ ] Abandoned, poor quality [ ] Replacement well

Well Contractor/Technician Information

Name of Well Contractor: INTERNATIONAL WATER SUPPLY | Well Contractor's Licence No.: 2801

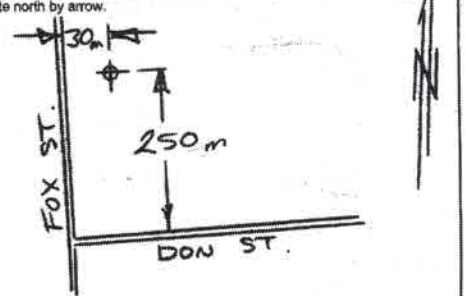
Business Address (street name, number, city etc.): PO BOX 310 BARRIE ON L4M 4T5

Name of Well Technician (last name, first name): WALTER NOBES | Well Technician's Licence No.: 7015

Signature of Technician/Contractor: X [signature] | Date Submitted: 2002 / 12 / 19

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.



Audit No. Z 33272 | Date Well Completed: YYYY 2006 / MM 12 / DD 04

Was the well owner's information package delivered? [ ] Yes [X] No | Date Delivered: YYYY / MM / DD

Ministry Use Only

Data Source | Contractor: 2801

Date Received: JAN 25 2007 MM DD | Date of Inspection: YYYY / MM / DD

Remarks | Well Record Number

0506E (09/03) Contractor's Copy [ ] Ministry's Copy [X] Well Owner's Copy [ ]

Cette formule est disponible en français

Maxxam
A Bureau Veritas Group Company

Your Project #: MOORINGS
Your C.O.C. #: 12478

Attention: Geoff Rether

Ian D Wilson Associates Ltd
PO Box 299
76722 Airport Rd
Clinton, ON
CANADA N0M 1L0

Report Date: 2018/06/21
Report #: R5260835
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8E7265
Received: 2018/06/15, 10:30

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	1	N/A	2018/06/20	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	1	N/A	2018/06/21	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	1	N/A	2018/06/19	CAM SOP-00463	EPA 325.2 m
Conductivity	1	N/A	2018/06/20	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2018/06/19	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	1	N/A	2018/06/21	CAM SOP 00102/00408/00447	SM 2340 B
Lab Filtered Metals by ICPMS	1	2018/06/19	2018/06/20	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	1	N/A	2018/06/21		
Anion and Cation Sum	1	N/A	2018/06/21		
Total Ammonia-N	1	N/A	2018/06/19	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	1	N/A	2018/06/19	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	1	N/A	2018/06/20	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	1	N/A	2018/06/19	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	1	N/A	2018/06/21		
Sat. pH and Langelier Index (@ 4C)	1	N/A	2018/06/21		
Sulphate by Automated Colourimetry	1	N/A	2018/06/19	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	1	N/A	2018/06/21		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam
A Bureau Veritas Group Company

Your Project #: MOORINGS
Your C.O.C. #: 12478

Attention: Geoff Rether

Ian D Wilson Associates Ltd
PO Box 299
76722 Airport Rd
Clinton, ON
CANADA N0M 1L0

Report Date: 2018/06/21
Report #: R5260835
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8E7265
Received: 2018/06/15, 10:30

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Ashton Gibson
Project Manager
22 Jun 2018 15:57:09

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ashton Gibson, Project Manager
Email: AGibson@maxxam.ca
Phone# (905) 817-5700
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam
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Maxxam Job #: B8E7265
Report Date: 2018/06/21

Ian D Wilson Associates Ltd
Client Project #: MOORINGS

RCAP - COMPREHENSIVE (LAB FILTERED)

Maxxam ID		GZA031		
Sampling Date		2018/06/14 14:30		
COC Number		12478		
	UNITS	BH 202-18	RDL	QC Batch
Calculated Parameters				
Anion Sum	me/L	10.8	N/A	5584342
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	500	1.0	5584337
Calculated TDS	mg/L	550	1.0	5584345
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.8	1.0	5584337
Cation Sum	me/L	10.7	N/A	5584342
Hardness (CaCO3)	mg/L	480	1.0	5584340
Ion Balance (% Difference)	%	0.550	N/A	5584341
Langelier Index (@ 20C)	N/A	1.18		5584343
Langelier Index (@ 4C)	N/A	0.935		5584344
Saturation pH (@ 20C)	N/A	6.59		5584343
Saturation pH (@ 4C)	N/A	6.84		5584344
Inorganics				
Total Ammonia-N	mg/L	1.8	0.050	5585860
Conductivity	umho/cm	940	1.0	5586187
Dissolved Organic Carbon	mg/L	8.4	0.50	5586628
Orthophosphate (P)	mg/L	0.024	0.010	5586666
pH	pH	7.77		5586188
Dissolved Sulphate (SO4)	mg/L	10	1.0	5586665
Alkalinity (Total as CaCO3)	mg/L	500	1.0	5586184
Dissolved Chloride (Cl)	mg/L	19	1.0	5586663
Nitrite (N)	mg/L	ND	0.010	5586249
Nitrate (N)	mg/L	ND	0.10	5586249
Metals				
Dissolved Aluminum (Al)	ug/L	6.9	5.0	5588028
Dissolved Antimony (Sb)	ug/L	ND	0.50	5588028
Dissolved Arsenic (As)	ug/L	ND	1.0	5588028
Dissolved Barium (Ba)	ug/L	220	2.0	5588028
Dissolved Beryllium (Be)	ug/L	ND	0.50	5588028
Dissolved Boron (B)	ug/L	66	10	5588028
Dissolved Cadmium (Cd)	ug/L	ND	0.10	5588028
Dissolved Calcium (Ca)	ug/L	150000	200	5588028
Dissolved Chromium (Cr)	ug/L	5.9	5.0	5588028
Dissolved Cobalt (Co)	ug/L	1.1	0.50	5588028

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
ND = Not detected

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RCAP - COMPREHENSIVE (LAB FILTERED)

Maxxam ID		GZA031		
Sampling Date		2018/06/14 14:30		
COC Number		12478		
	UNITS	BH 202-18	RDL	QC Batch
Dissolved Copper (Cu)	ug/L	1.8	1.0	5588028
Dissolved Iron (Fe)	ug/L	ND	100	5588028
Dissolved Lead (Pb)	ug/L	ND	0.50	5588028
Dissolved Magnesium (Mg)	ug/L	23000	50	5588028
Dissolved Manganese (Mn)	ug/L	1400	2.0	5588028
Dissolved Molybdenum (Mo)	ug/L	2.3	0.50	5588028
Dissolved Nickel (Ni)	ug/L	1.7	1.0	5588028
Dissolved Phosphorus (P)	ug/L	ND	100	5588028
Dissolved Potassium (K)	ug/L	2700	200	5588028
Dissolved Selenium (Se)	ug/L	ND	2.0	5588028
Dissolved Silicon (Si)	ug/L	8200	50	5588028
Dissolved Silver (Ag)	ug/L	ND	0.10	5588028
Dissolved Sodium (Na)	ug/L	20000	100	5588028
Dissolved Strontium (Sr)	ug/L	590	1.0	5588028
Dissolved Thallium (Tl)	ug/L	ND	0.050	5588028
Dissolved Titanium (Ti)	ug/L	ND	5.0	5588028
Dissolved Uranium (U)	ug/L	2.0	0.10	5588028
Dissolved Vanadium (V)	ug/L	1.3	0.50	5588028
Dissolved Zinc (Zn)	ug/L	ND	5.0	5588028

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected

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Maxxam Job #: B8E7265
Report Date: 2018/06/21

Ian D Wilson Associates Ltd
Client Project #: MOORINGS

TEST SUMMARY

Maxxam ID: GZA031
Sample ID: BH 202-18
Matrix: Water

Collected: 2018/06/14
Shipped:
Received: 2018/06/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5586184	N/A	2018/06/20	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5584337	N/A	2018/06/21	Automated Statchk
Chloride by Automated Colourimetry	KONE	5586663	N/A	2018/06/19	Deonarine Ramnarine
Conductivity	AT	5586187	N/A	2018/06/20	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5586628	N/A	2018/06/19	Nimarta Singh
Hardness (calculated as CaCO3)		5584340	N/A	2018/06/21	Automated Statchk
Lab Filtered Metals by ICPMS	ICP/MS	5588028	2018/06/19	2018/06/20	Thao Nguyen
Ion Balance (% Difference)	CALC	5584341	N/A	2018/06/21	Automated Statchk
Anion and Cation Sum	CALC	5584342	N/A	2018/06/21	Automated Statchk
Total Ammonia-N	LACH/NH4	5585860	N/A	2018/06/19	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5586249	N/A	2018/06/19	Chandra Nandlal
pH	AT	5586188	N/A	2018/06/20	Surinder Rai
Orthophosphate	KONE	5586666	N/A	2018/06/19	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	5584343	N/A	2018/06/21	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5584344	N/A	2018/06/21	Automated Statchk
Sulphate by Automated Colourimetry	KONE	5586665	N/A	2018/06/19	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5584345	N/A	2018/06/21	Automated Statchk

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GENERAL COMMENTS

The following sediment comments applies to sample BH202-18

All of the 500mL plastic General and Solids bottles contained visible sediment.
All of the 250mL plastic bottles for NH4LOW analysis contained visible sediment.

Sample GZA031 [BH 202-18] : ortho-Phosphate > Total Phosphorus: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
5585860	SAN	Matrix Spike	Total Ammonia-N	2018/06/19		98	%	75 - 125
5585860	SAN	Spiked Blank	Total Ammonia-N	2018/06/19		103	%	80 - 120
5585860	SAN	Method Blank	Total Ammonia-N	2018/06/19	ND, RDL=0.050		mg/L	
5585860	SAN	RPD	Total Ammonia-N	2018/06/19	3.9		%	20
5586184	SAU	Spiked Blank	Alkalinity (Total as CaCO3)	2018/06/20		96	%	85 - 115
5586184	SAU	Method Blank	Alkalinity (Total as CaCO3)	2018/06/20	ND, RDL=1.0		mg/L	
5586184	SAU	RPD	Alkalinity (Total as CaCO3)	2018/06/20	0.81		%	20
5586187	SAU	Spiked Blank	Conductivity	2018/06/20		101	%	85 - 115
5586187	SAU	Method Blank	Conductivity	2018/06/20	ND, RDL=1.0		umho/cm	
5586187	SAU	RPD	Conductivity	2018/06/20	0.33		%	25
5586188	SAU	Spiked Blank	pH	2018/06/20		102	%	98 - 103
5586188	SAU	RPD	pH	2018/06/20	0.26		%	N/A
5586249	C_N	Matrix Spike	Nitrite (N)	2018/06/19		98	%	80 - 120
			Nitrate (N)	2018/06/19		92	%	80 - 120
5586249	C_N	Spiked Blank	Nitrite (N)	2018/06/19		98	%	80 - 120
			Nitrate (N)	2018/06/19		93	%	80 - 120
5586249	C_N	Method Blank	Nitrite (N)	2018/06/19	ND, RDL=0.010		mg/L	
			Nitrate (N)	2018/06/19	ND, RDL=0.10		mg/L	
5586249	C_N	RPD	Nitrate (N)	2018/06/19	NC		%	20
5586628	NS3	Matrix Spike	Dissolved Organic Carbon	2018/06/19		97	%	80 - 120
5586628	NS3	Spiked Blank	Dissolved Organic Carbon	2018/06/19		98	%	80 - 120
5586628	NS3	Method Blank	Dissolved Organic Carbon	2018/06/19	ND, RDL=0.50		mg/L	
5586628	NS3	RPD	Dissolved Organic Carbon	2018/06/19	4.5		%	20
5586663	DRM	Matrix Spike	Dissolved Chloride (Cl)	2018/06/19		86	%	80 - 120
5586663	DRM	Spiked Blank	Dissolved Chloride (Cl)	2018/06/19		104	%	80 - 120
5586663	DRM	Method Blank	Dissolved Chloride (Cl)	2018/06/19	ND, RDL=1.0		mg/L	
5586663	DRM	RPD	Dissolved Chloride (Cl)	2018/06/19	0.023		%	20
5586665	ADB	Matrix Spike	Dissolved Sulphate (SO4)	2018/06/19		107	%	75 - 125
5586665	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2018/06/19		100	%	80 - 120
5586665	ADB	Method Blank	Dissolved Sulphate (SO4)	2018/06/19	ND, RDL=1.0		mg/L	
5586665	ADB	RPD	Dissolved Sulphate (SO4)	2018/06/19	NC		%	20
5586666	ADB	Matrix Spike	Orthophosphate (P)	2018/06/19		101	%	75 - 125
5586666	ADB	Spiked Blank	Orthophosphate (P)	2018/06/19		100	%	80 - 120
5586666	ADB	Method Blank	Orthophosphate (P)	2018/06/19	ND, RDL=0.010		mg/L	
5586666	ADB	RPD	Orthophosphate (P)	2018/06/19	NC		%	25
5588028	TNG	Matrix Spike	Dissolved Aluminum (Al)	2018/06/20		92	%	80 - 120
			Dissolved Antimony (Sb)	2018/06/20		96	%	80 - 120
			Dissolved Arsenic (As)	2018/06/20		91	%	80 - 120
			Dissolved Barium (Ba)	2018/06/20		92	%	80 - 120
			Dissolved Beryllium (Be)	2018/06/20		93	%	80 - 120
			Dissolved Boron (B)	2018/06/20		96	%	80 - 120
			Dissolved Cadmium (Cd)	2018/06/20		93	%	80 - 120
			Dissolved Calcium (Ca)	2018/06/20		NC	%	80 - 120
			Dissolved Chromium (Cr)	2018/06/20		91	%	80 - 120
			Dissolved Cobalt (Co)	2018/06/20		91	%	80 - 120
			Dissolved Copper (Cu)	2018/06/20		92	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Iron (Fe)	2018/06/20		92	%	80 - 120
			Dissolved Lead (Pb)	2018/06/20		89	%	80 - 120
			Dissolved Magnesium (Mg)	2018/06/20		90	%	80 - 120
			Dissolved Manganese (Mn)	2018/06/20		92	%	80 - 120
			Dissolved Molybdenum (Mo)	2018/06/20		95	%	80 - 120
			Dissolved Nickel (Ni)	2018/06/20		90	%	80 - 120
			Dissolved Phosphorus (P)	2018/06/20		99	%	80 - 120
			Dissolved Potassium (K)	2018/06/20		94	%	80 - 120
			Dissolved Selenium (Se)	2018/06/20		95	%	80 - 120
			Dissolved Silicon (Si)	2018/06/20		92	%	80 - 120
			Dissolved Silver (Ag)	2018/06/20		83	%	80 - 120
			Dissolved Sodium (Na)	2018/06/20		NC	%	80 - 120
			Dissolved Strontium (Sr)	2018/06/20		91	%	80 - 120
			Dissolved Thallium (Tl)	2018/06/20		90	%	80 - 120
			Dissolved Titanium (Ti)	2018/06/20		93	%	80 - 120
			Dissolved Uranium (U)	2018/06/20		89	%	80 - 120
			Dissolved Vanadium (V)	2018/06/20		93	%	80 - 120
			Dissolved Zinc (Zn)	2018/06/20		92	%	80 - 120
5588028	TNG	Spiked Blank	Dissolved Aluminum (Al)	2018/06/20		101	%	80 - 120
			Dissolved Antimony (Sb)	2018/06/20		104	%	80 - 120
			Dissolved Arsenic (As)	2018/06/20		97	%	80 - 120
			Dissolved Barium (Ba)	2018/06/20		100	%	80 - 120
			Dissolved Beryllium (Be)	2018/06/20		101	%	80 - 120
			Dissolved Boron (B)	2018/06/20		102	%	80 - 120
			Dissolved Cadmium (Cd)	2018/06/20		101	%	80 - 120
			Dissolved Calcium (Ca)	2018/06/20		101	%	80 - 120
			Dissolved Chromium (Cr)	2018/06/20		98	%	80 - 120
			Dissolved Cobalt (Co)	2018/06/20		98	%	80 - 120
			Dissolved Copper (Cu)	2018/06/20		102	%	80 - 120
			Dissolved Iron (Fe)	2018/06/20		100	%	80 - 120
			Dissolved Lead (Pb)	2018/06/20		98	%	80 - 120
			Dissolved Magnesium (Mg)	2018/06/20		98	%	80 - 120
			Dissolved Manganese (Mn)	2018/06/20		99	%	80 - 120
			Dissolved Molybdenum (Mo)	2018/06/20		102	%	80 - 120
			Dissolved Nickel (Ni)	2018/06/20		98	%	80 - 120
			Dissolved Phosphorus (P)	2018/06/20		118	%	80 - 120
			Dissolved Potassium (K)	2018/06/20		99	%	80 - 120
			Dissolved Selenium (Se)	2018/06/20		102	%	80 - 120
			Dissolved Silicon (Si)	2018/06/20		99	%	80 - 120
			Dissolved Silver (Ag)	2018/06/20		100	%	80 - 120
			Dissolved Sodium (Na)	2018/06/20		99	%	80 - 120
			Dissolved Strontium (Sr)	2018/06/20		98	%	80 - 120
			Dissolved Thallium (Tl)	2018/06/20		97	%	80 - 120
			Dissolved Titanium (Ti)	2018/06/20		101	%	80 - 120
			Dissolved Uranium (U)	2018/06/20		99	%	80 - 120
			Dissolved Vanadium (V)	2018/06/20		100	%	80 - 120
			Dissolved Zinc (Zn)	2018/06/20		99	%	80 - 120
5588028	TNG	Method Blank	Dissolved Aluminum (Al)	2018/06/20	ND, RDL=5.0		ug/L	
			Dissolved Antimony (Sb)	2018/06/20	ND, RDL=0.50		ug/L	
			Dissolved Arsenic (As)	2018/06/20	ND, RDL=1.0		ug/L	
			Dissolved Barium (Ba)	2018/06/20	ND, RDL=2.0		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Beryllium (Be)	2018/06/20	ND, RDL=0.50		ug/L	
			Dissolved Boron (B)	2018/06/20	ND, RDL=10		ug/L	
			Dissolved Cadmium (Cd)	2018/06/20	ND, RDL=0.10		ug/L	
			Dissolved Calcium (Ca)	2018/06/20	ND, RDL=200		ug/L	
			Dissolved Chromium (Cr)	2018/06/20	ND, RDL=5.0		ug/L	
			Dissolved Cobalt (Co)	2018/06/20	ND, RDL=0.50		ug/L	
			Dissolved Copper (Cu)	2018/06/20	ND, RDL=1.0		ug/L	
			Dissolved Iron (Fe)	2018/06/20	ND, RDL=100		ug/L	
			Dissolved Lead (Pb)	2018/06/20	ND, RDL=0.50		ug/L	
			Dissolved Magnesium (Mg)	2018/06/20	ND, RDL=50		ug/L	
			Dissolved Manganese (Mn)	2018/06/20	ND, RDL=2.0		ug/L	
			Dissolved Molybdenum (Mo)	2018/06/20	ND, RDL=0.50		ug/L	
			Dissolved Nickel (Ni)	2018/06/20	ND, RDL=1.0		ug/L	
			Dissolved Phosphorus (P)	2018/06/20	ND, RDL=100		ug/L	
			Dissolved Potassium (K)	2018/06/20	ND, RDL=200		ug/L	
			Dissolved Selenium (Se)	2018/06/20	ND, RDL=2.0		ug/L	
			Dissolved Silicon (Si)	2018/06/20	ND, RDL=50		ug/L	
			Dissolved Silver (Ag)	2018/06/20	ND, RDL=0.10		ug/L	
			Dissolved Sodium (Na)	2018/06/20	ND, RDL=100		ug/L	
			Dissolved Strontium (Sr)	2018/06/20	ND, RDL=1.0		ug/L	
			Dissolved Thallium (Tl)	2018/06/20	ND, RDL=0.050		ug/L	
			Dissolved Titanium (Ti)	2018/06/20	ND, RDL=5.0		ug/L	
			Dissolved Uranium (U)	2018/06/20	ND, RDL=0.10		ug/L	
			Dissolved Vanadium (V)	2018/06/20	ND, RDL=0.50		ug/L	
			Dissolved Zinc (Zn)	2018/06/20	ND, RDL=5.0		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
5588028	TNG	RPD	Dissolved Lead (Pb)	2018/06/20	NC		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B8E7265
Report Date: 2018/06/21

Ian D Wilson Associates Ltd
Client Project #: MOORINGS

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Cristina Carriere

Cristina Carriere, Scientific Service Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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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:
MTE Consultants Inc.
365 Home Street
Stratford, ON N5A 2A5

May 8, 2018

MTE File No.: 43022-100

APPENDICES

APPENDIX A	FIGURES
APPENDIX B	BOREHOLE LOGS
APPENDIX C	LABORATORY TEST RESULTS
APPENDIX D	TENSAR INTERNATIONAL CORPORATION PRODUCT INFORMATION
APPENDIX E	EBS GEOSTRUCTURAL INC. HELICAL PILE INFORMATION

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

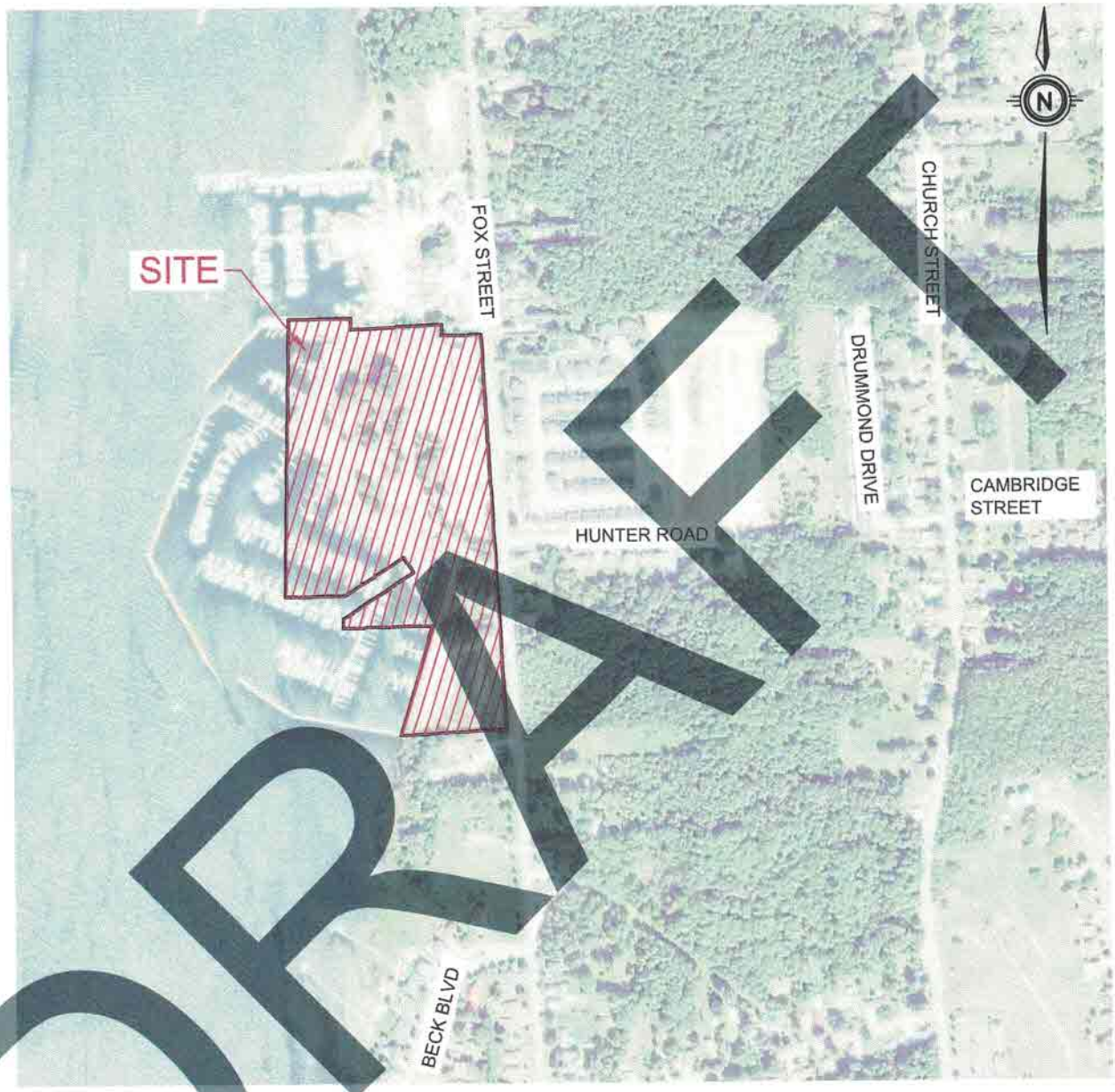
Montana Wilson, M.Eng. P.Eng. PMP
Civil and Geotechnical Division Manager

MXW:dld

APPENDIX A

FIGURES

Figure 1- Location Plan
Figure 2 - Site Plan

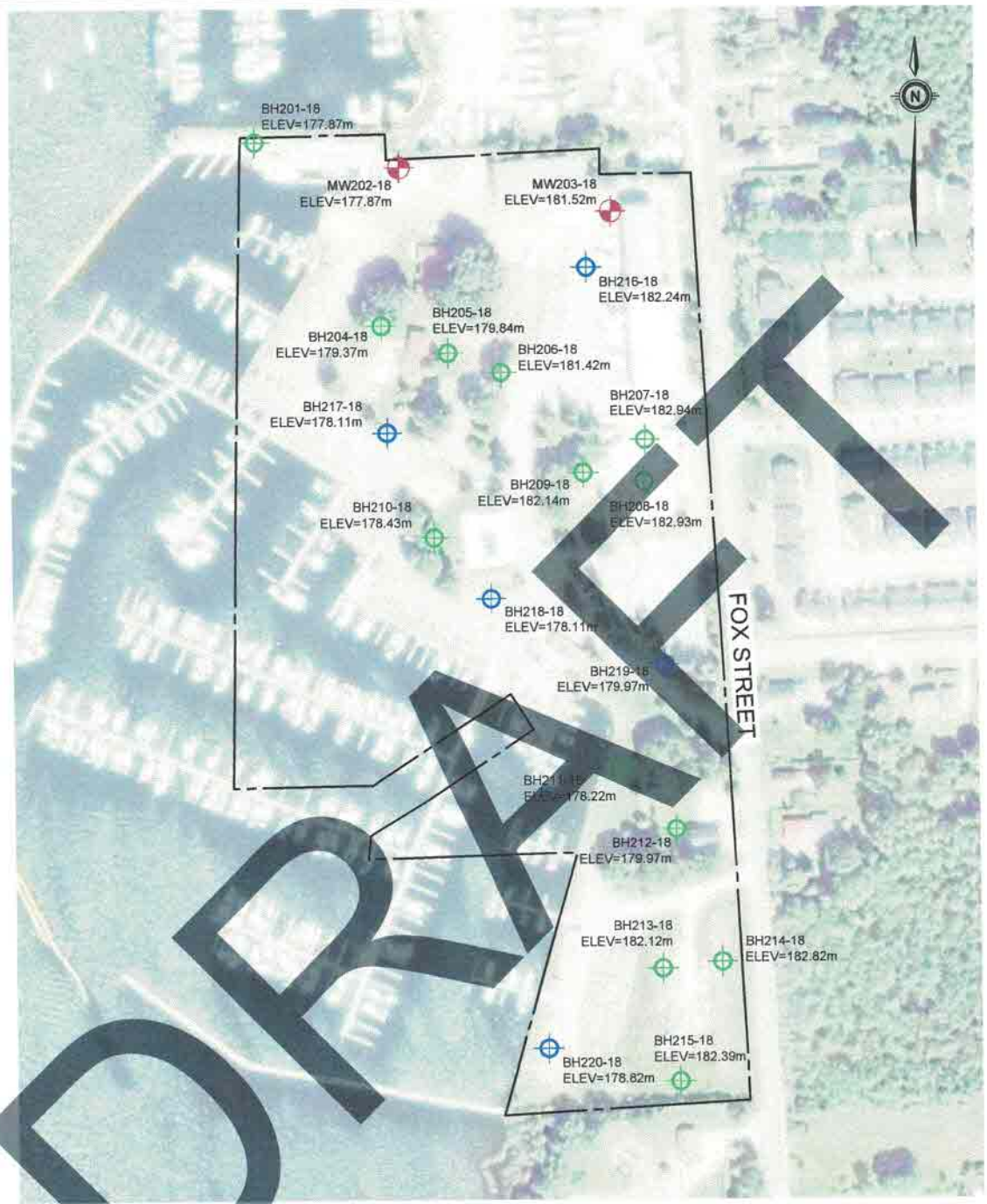


ARIEL IMAGE FROM GOOGLE EARTH

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.

SITE PLAN

MTE Engineers | Scientists | Surveyors

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

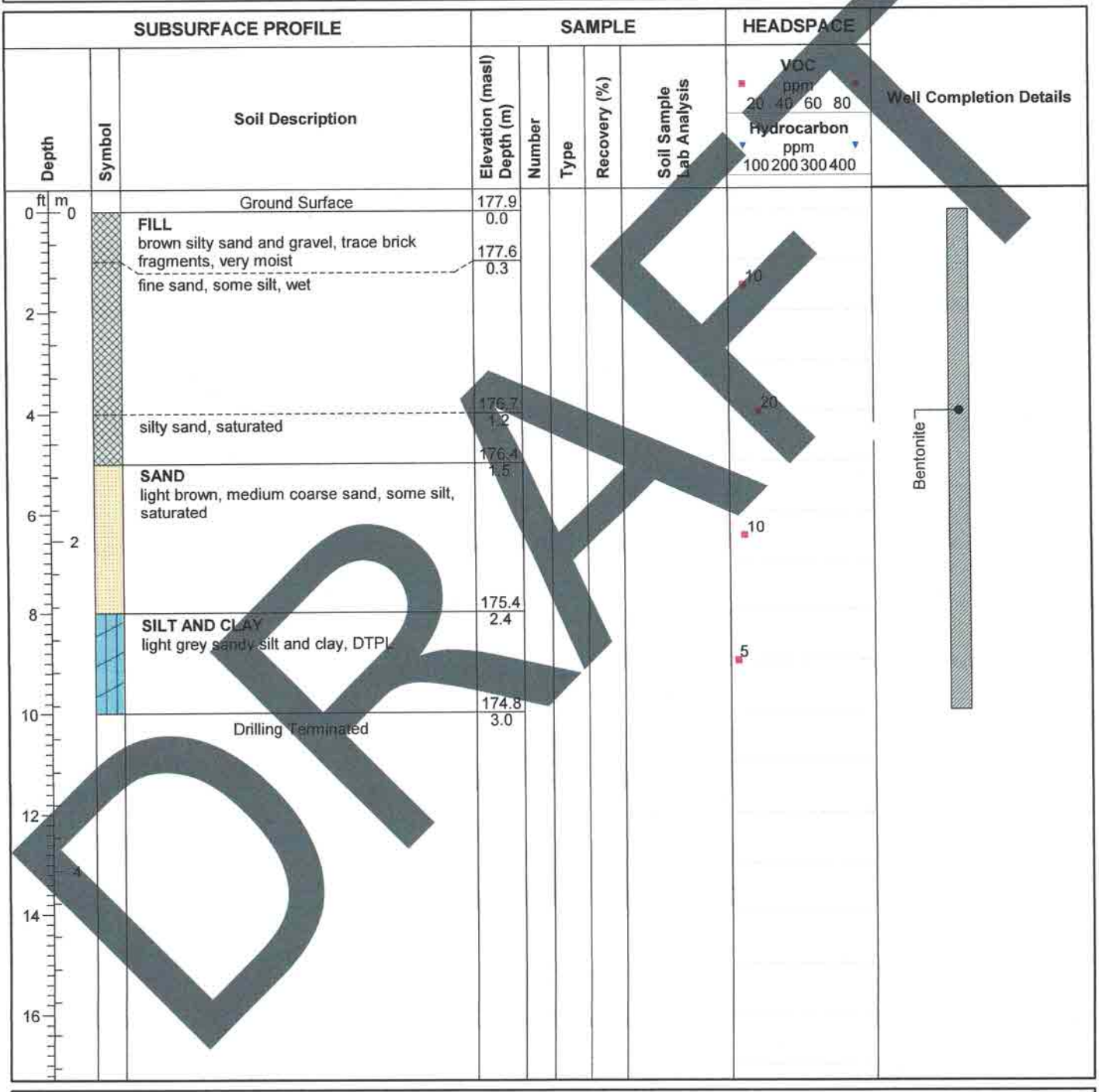
Drill Date: 3/26/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A



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

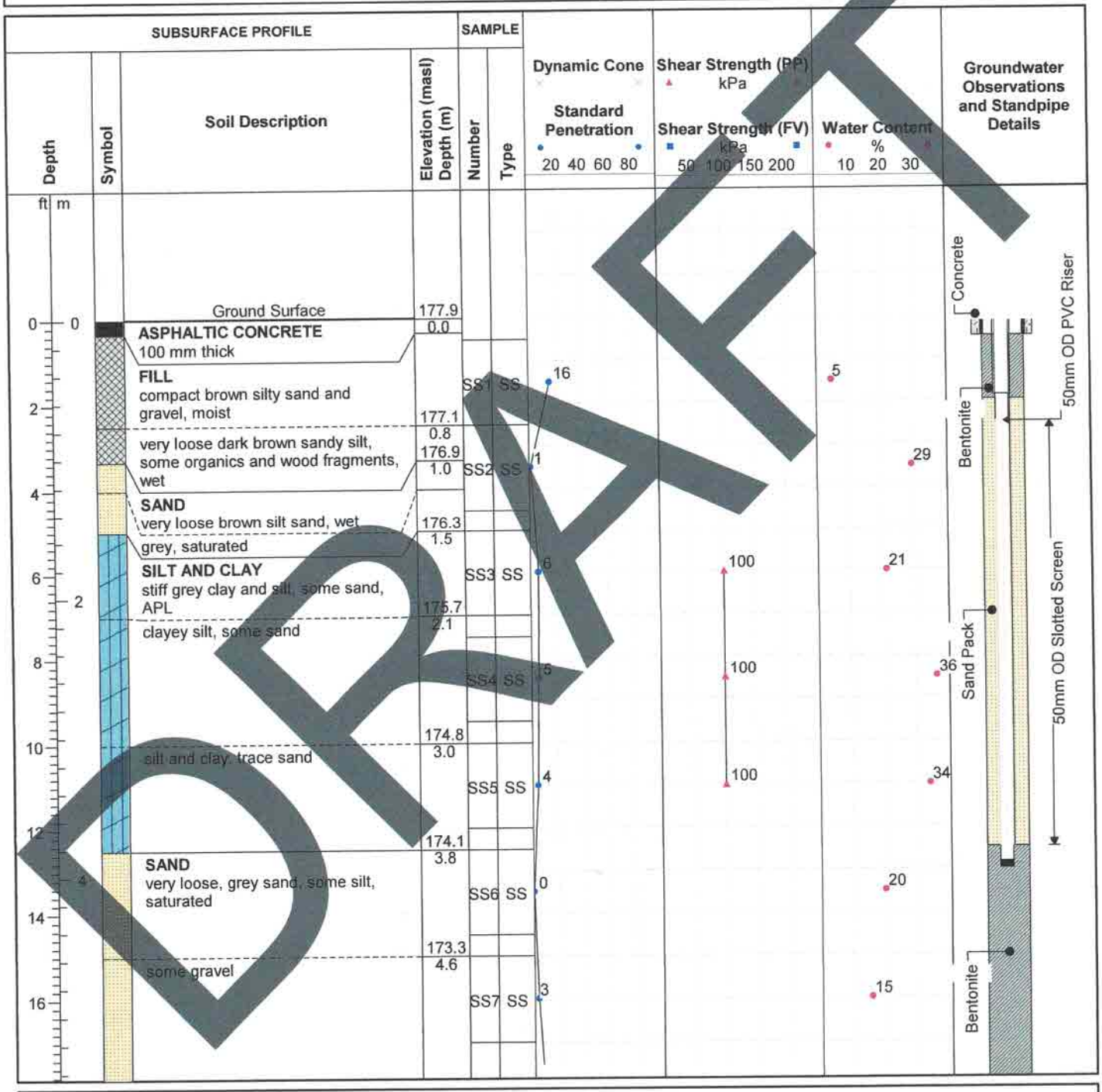
Drill Date: 3/26/2018

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

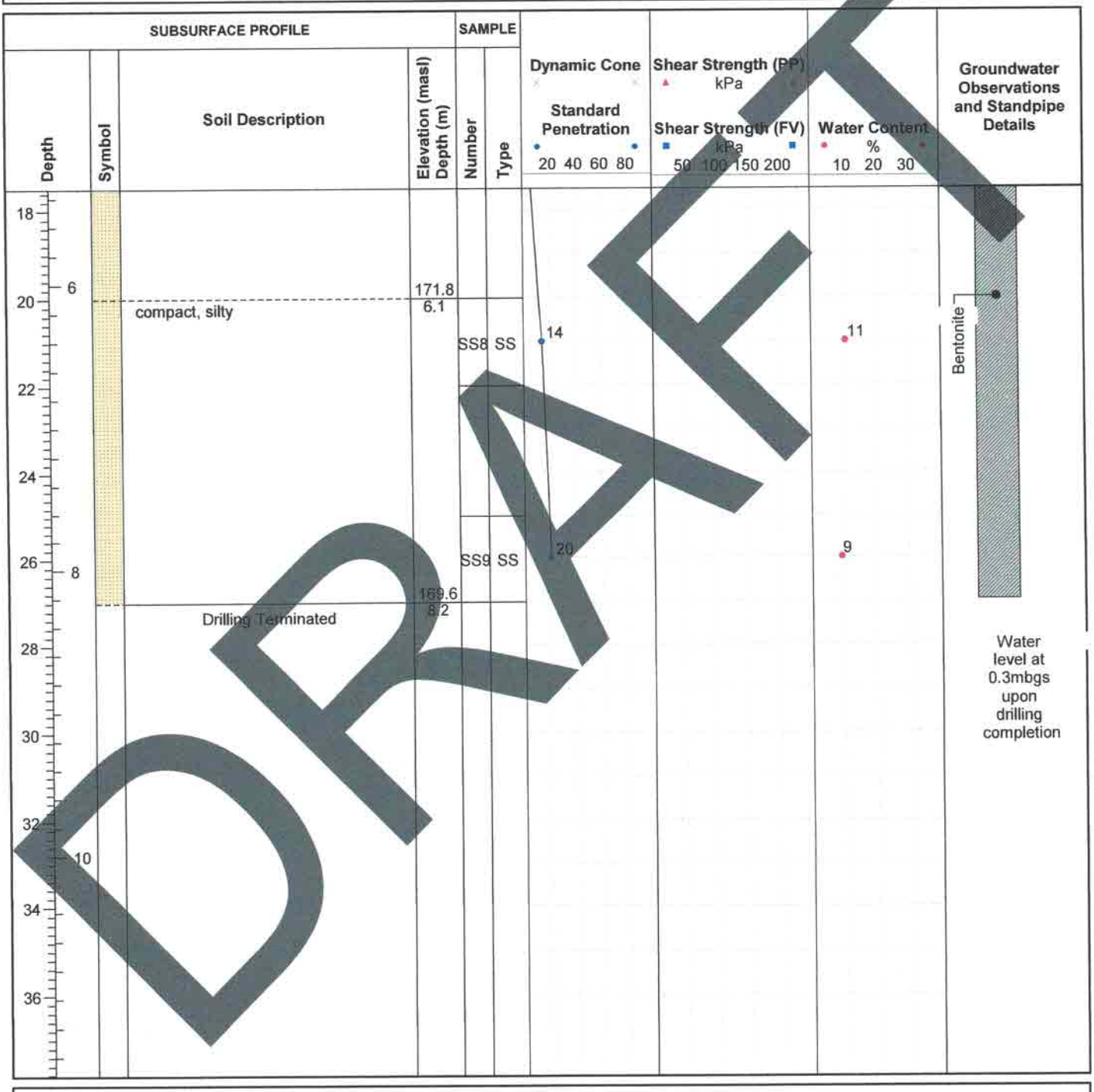
Drill Date: 3/26/2018

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

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 / 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)	Well Completion Details
0 ft / 0 m		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	
2 m									
			179.1						
		SAND brown sand trace silt, wet	2.4					0	
		saturated	178.5						
			3.0						
			177.9						
		Drilling Terminated	3.7						
4 m									

Well Completion Details: Concrete; Bentonite; Sand Pack; 19mm PVC Riser; 19mm Slotted Screen

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

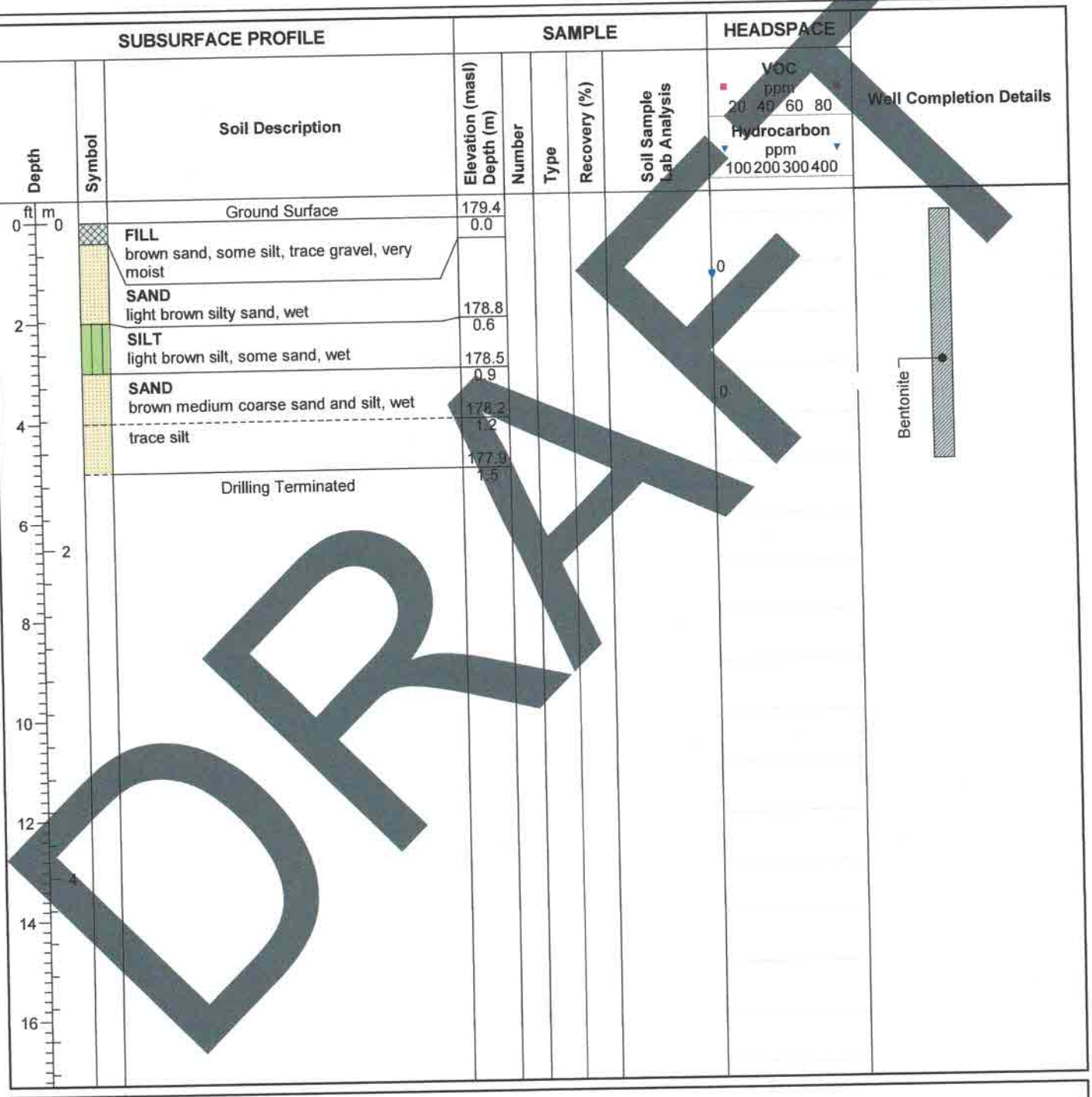
Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A



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

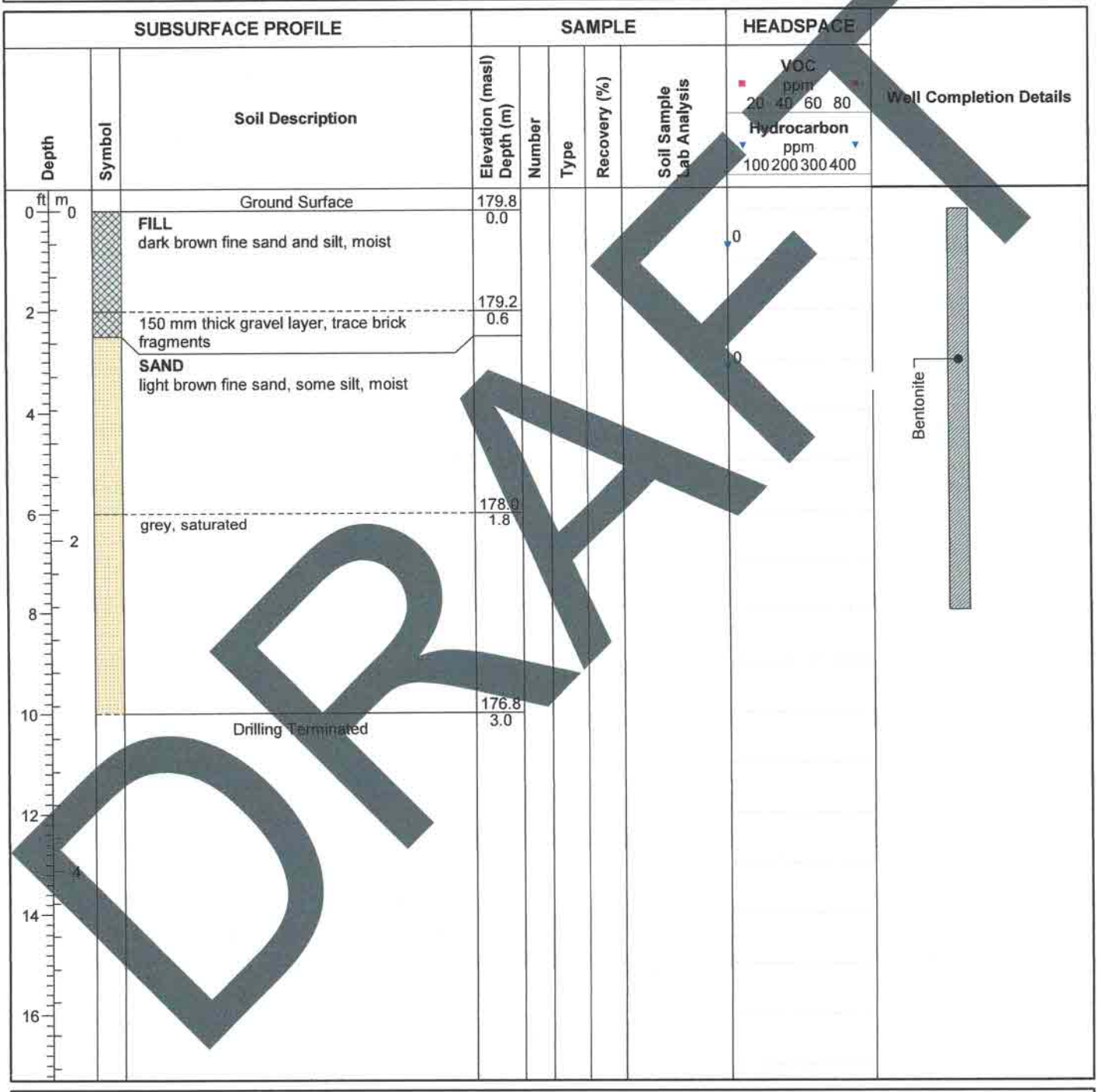
Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A



Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

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

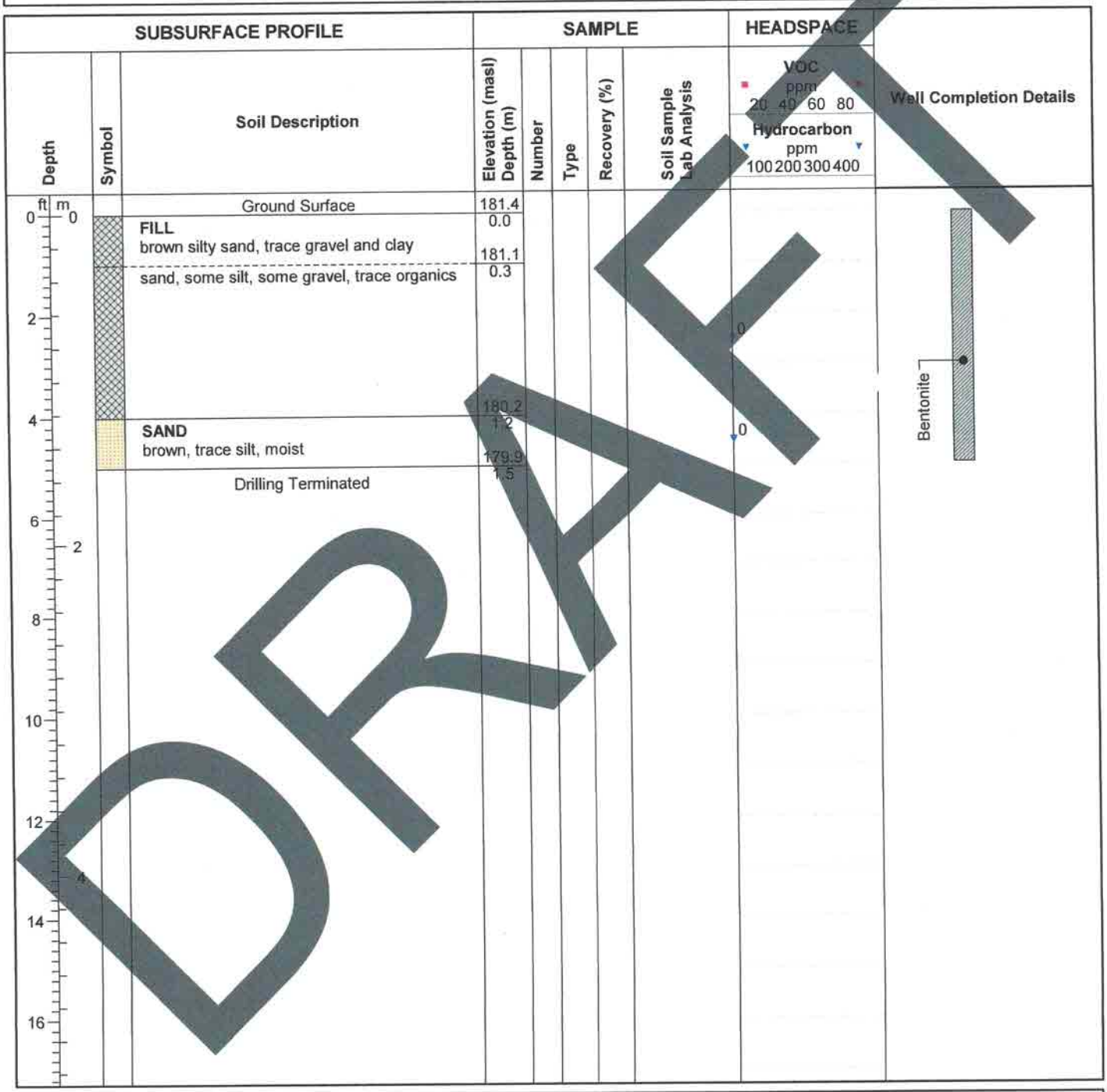
Drill Date: 4/10/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A



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

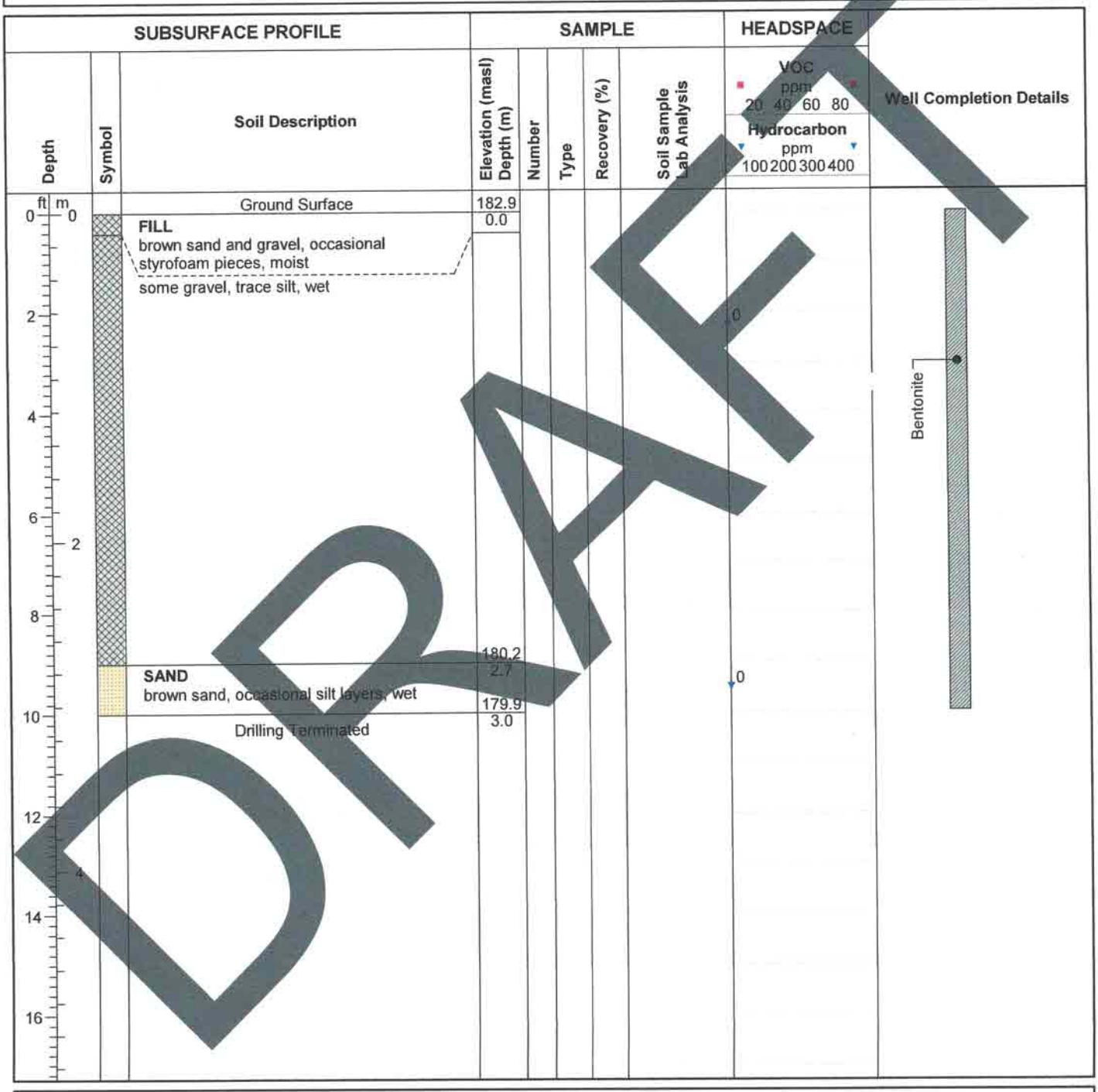
Drill Date: 4/10/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A



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

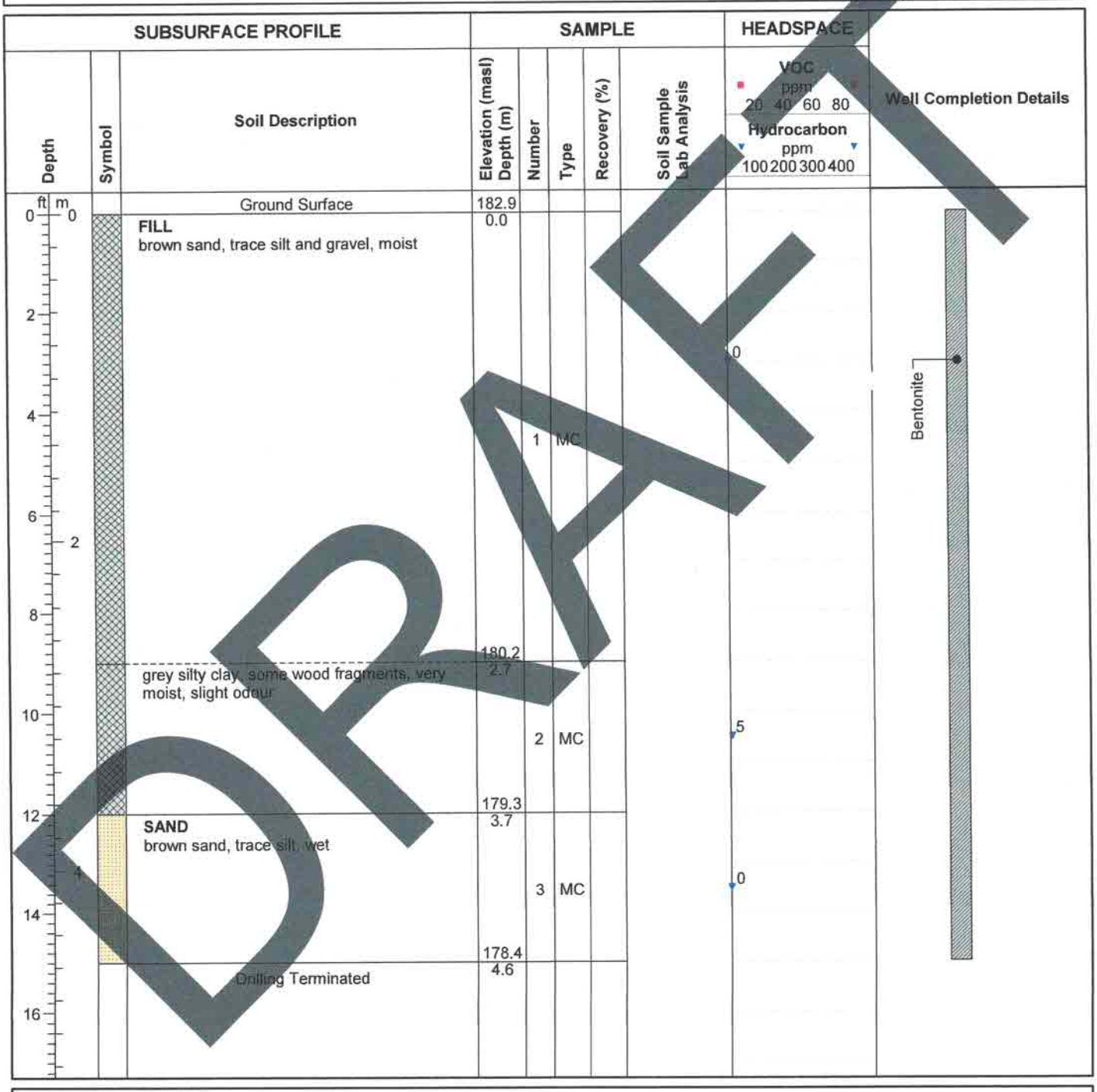
Drill Date: 4/10/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A



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

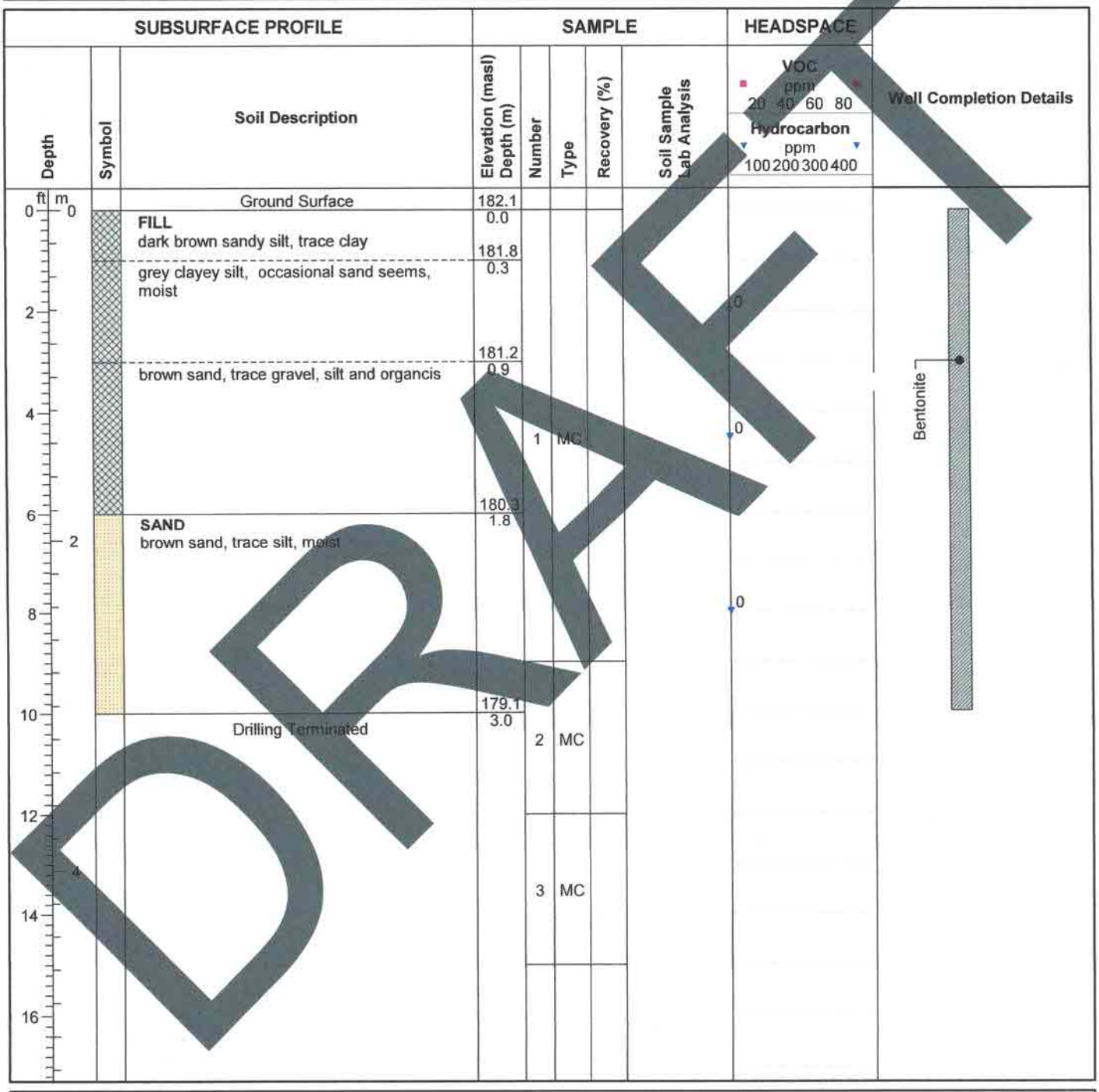
Drill Date: 4/10/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A



Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

Sheet: 1 of 1

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

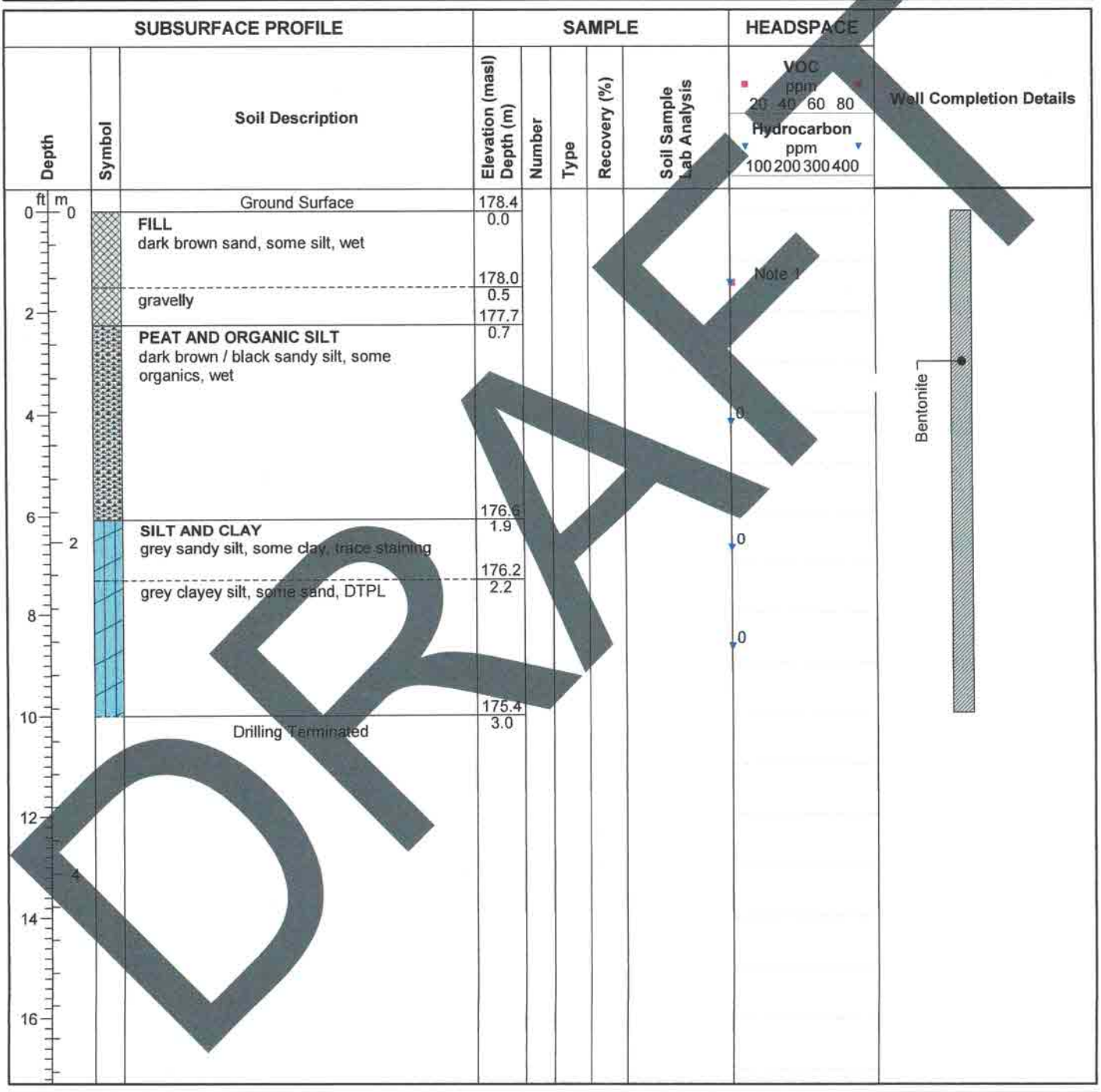
Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A



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

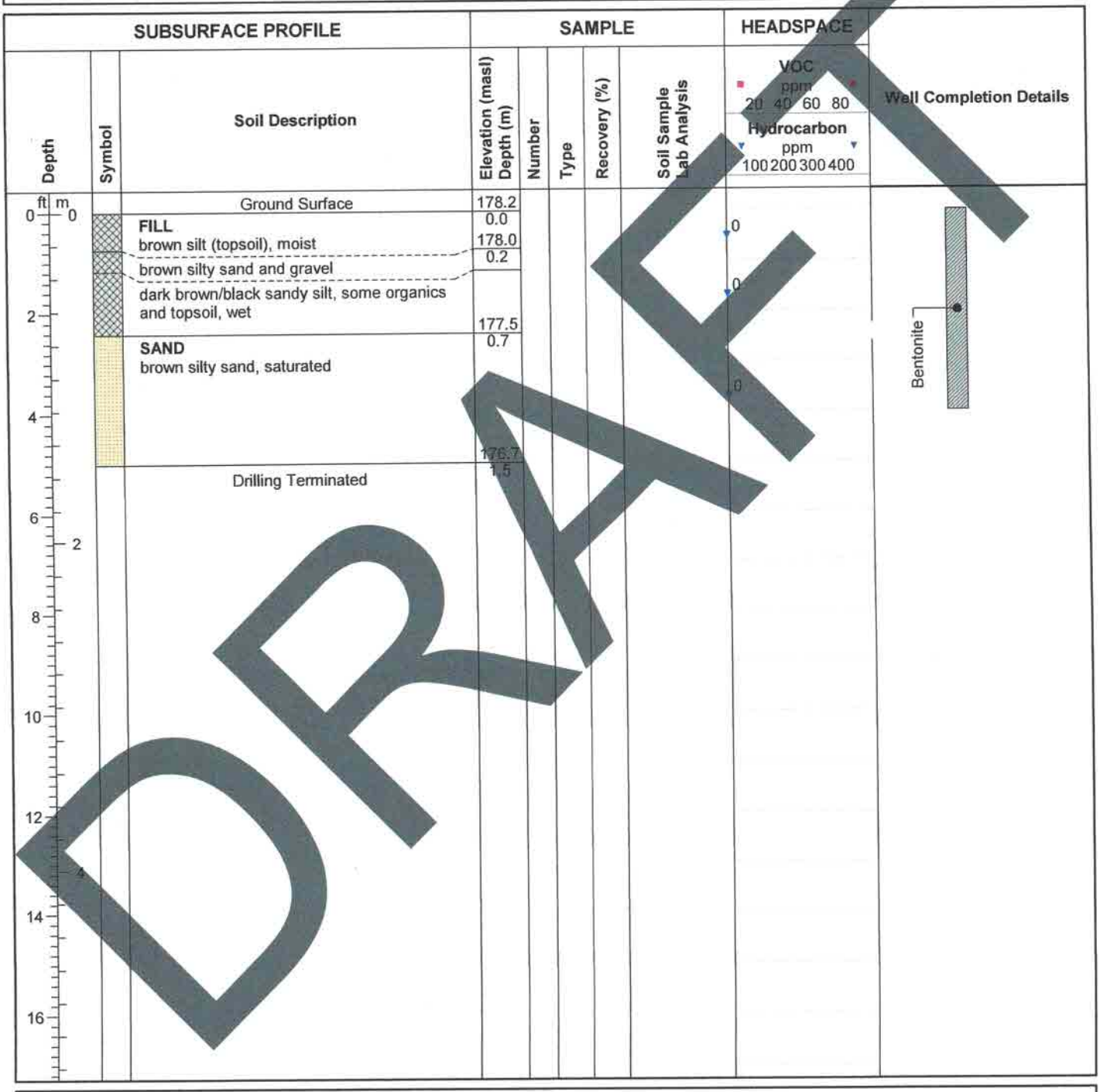
Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A



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

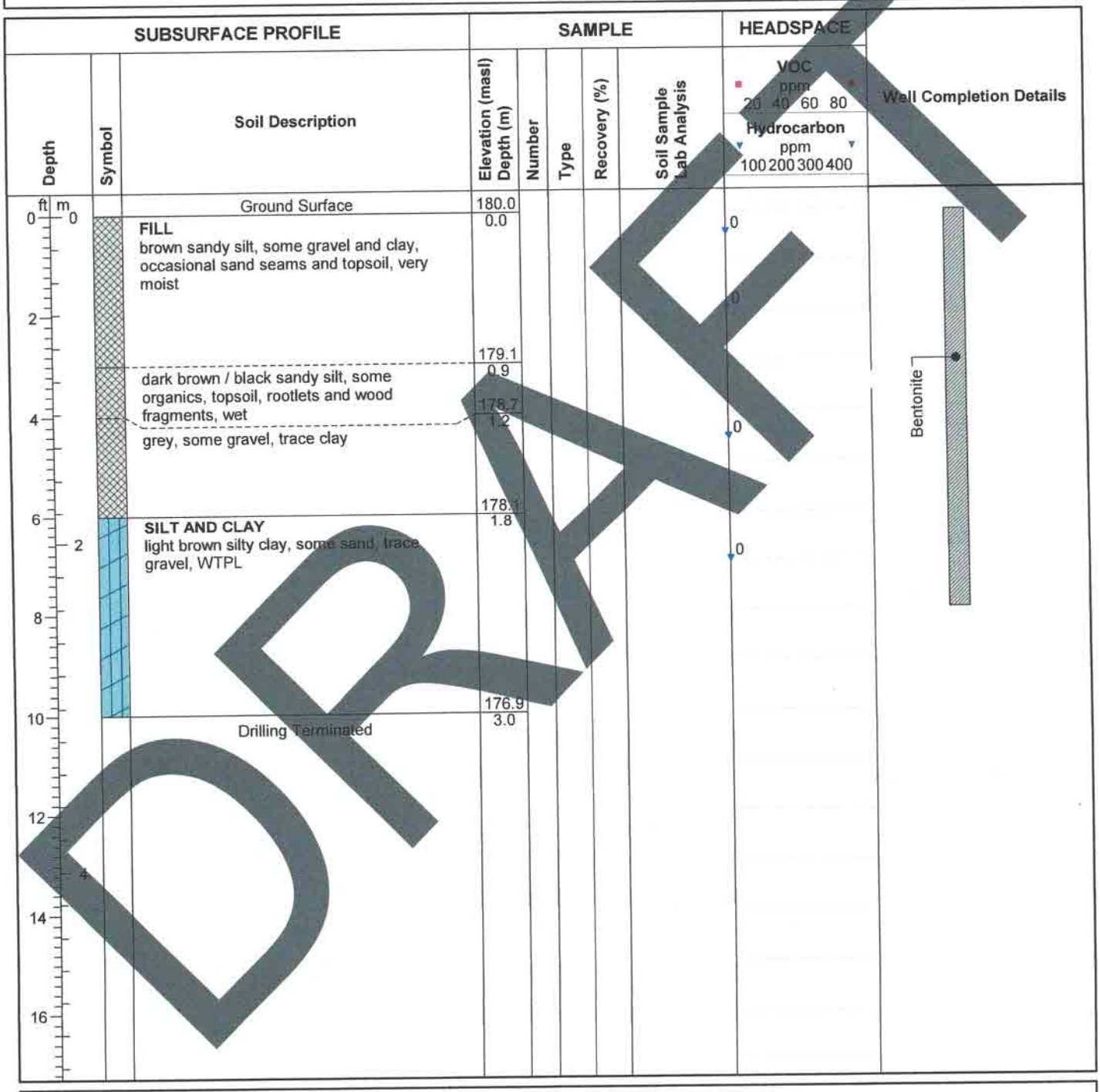
Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A



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
0 ft / 0 m		Ground Surface	182.1 / 0.0						
		FILL brown fine sand and silt, some organics, wet							
		gravelly, some grey clay pockets	180.6 / 1.5					0	
		Dark brown / black sandy silt, some organics and topsoil, very moist	178.8 / 3.4						
		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
2 m									
4 m									

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

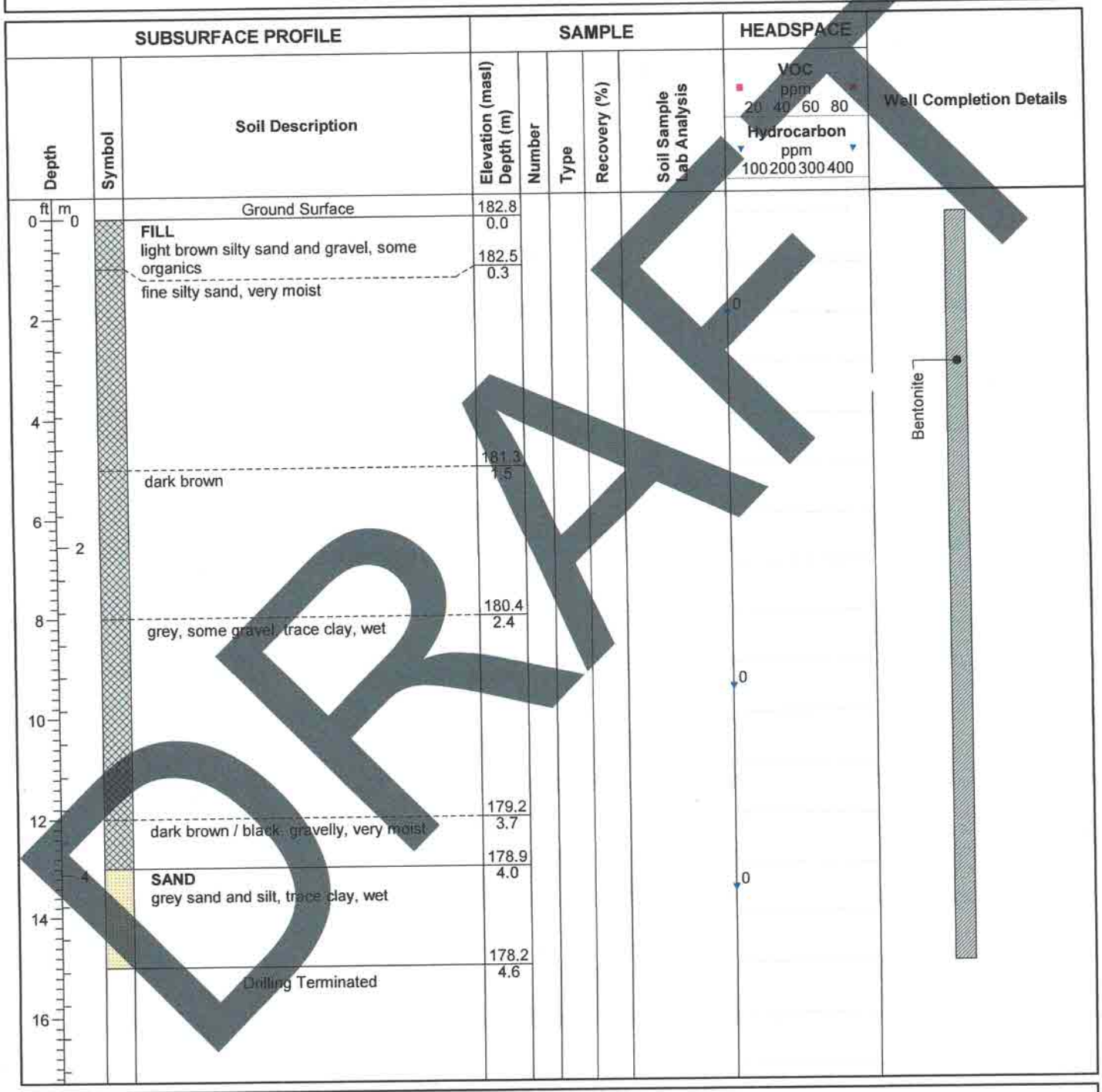
Drill Date: 4/10/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A



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

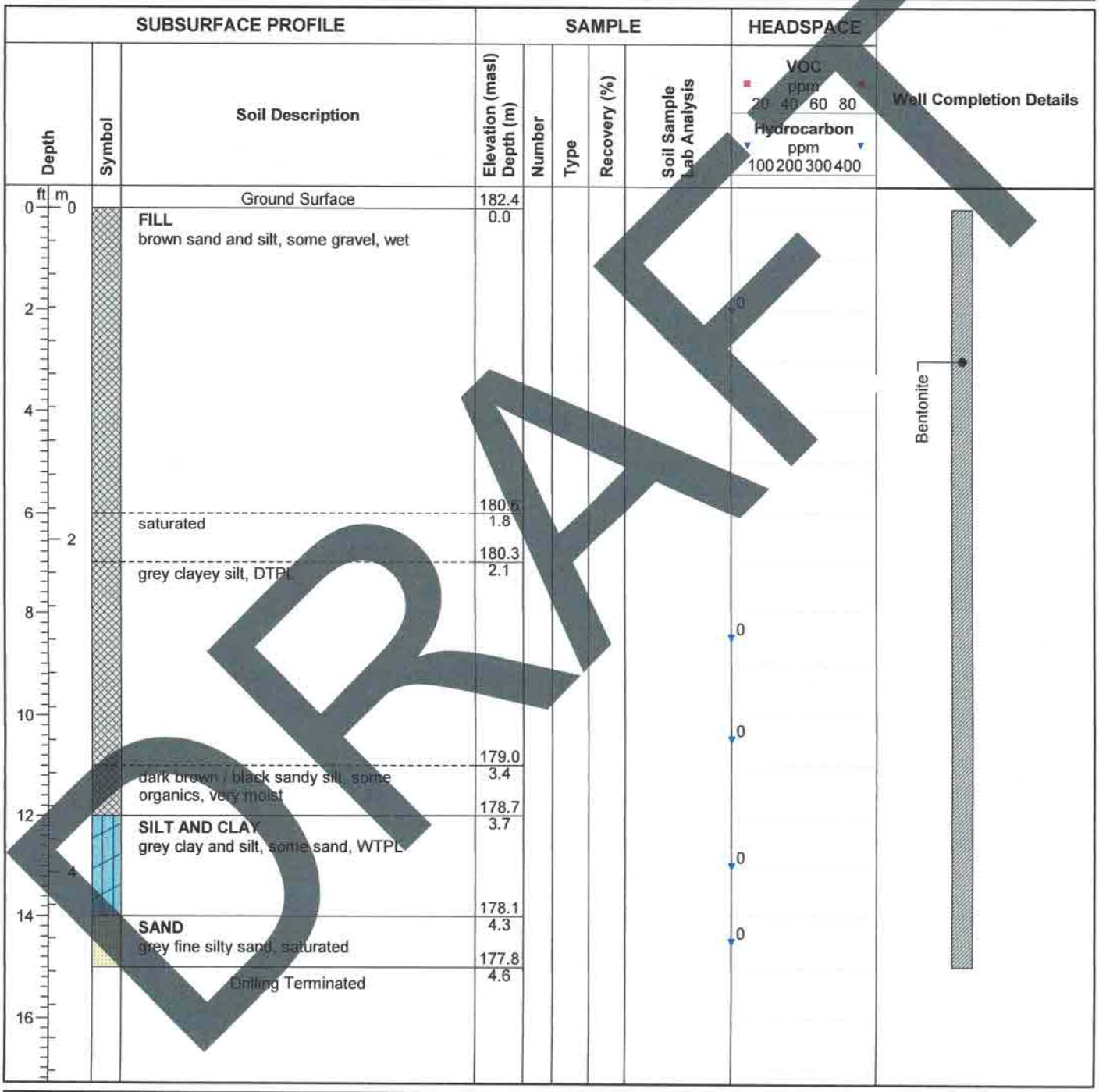
Drill Date: 4/10/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Direct Push

Protective Cover: N/A



Field Technician: K. Maddock

Drafted by: S. Rederer

Reviewed by: R. Fedy

MTE

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

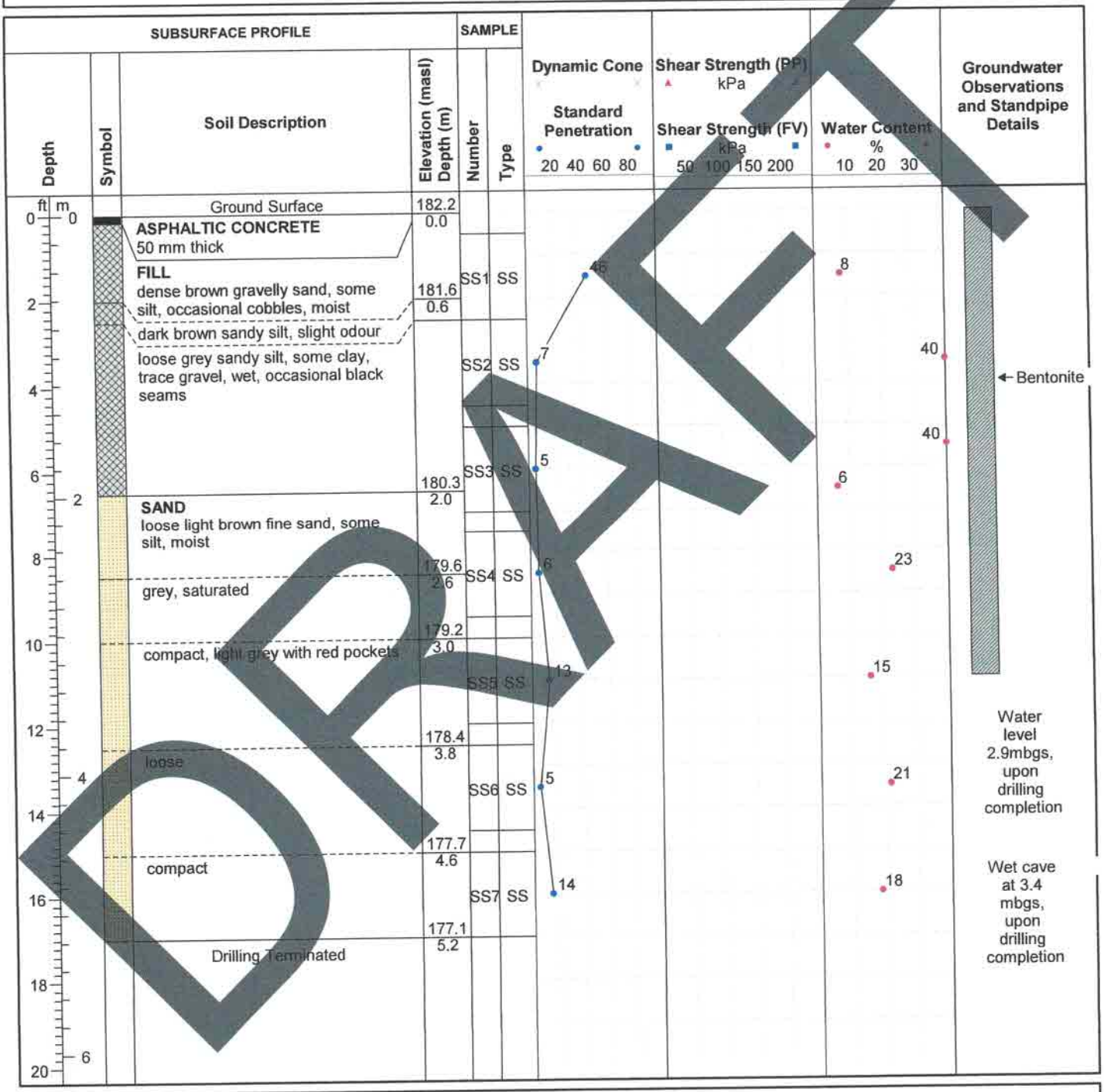
Drill Date: 4/9/2018

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

MTE

Sheet: 1 of 1

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

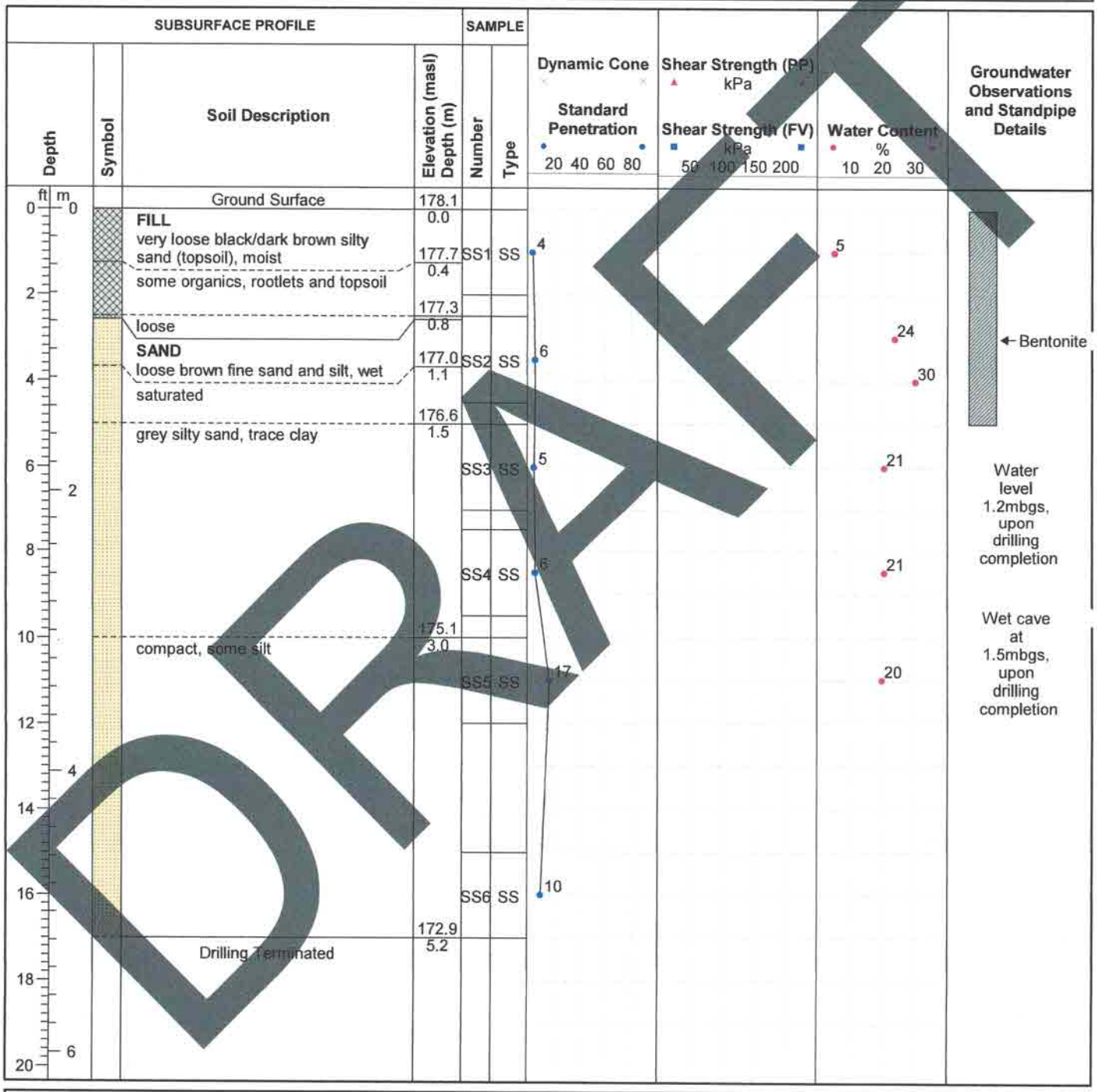
Drill Date: 4/9/2018

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

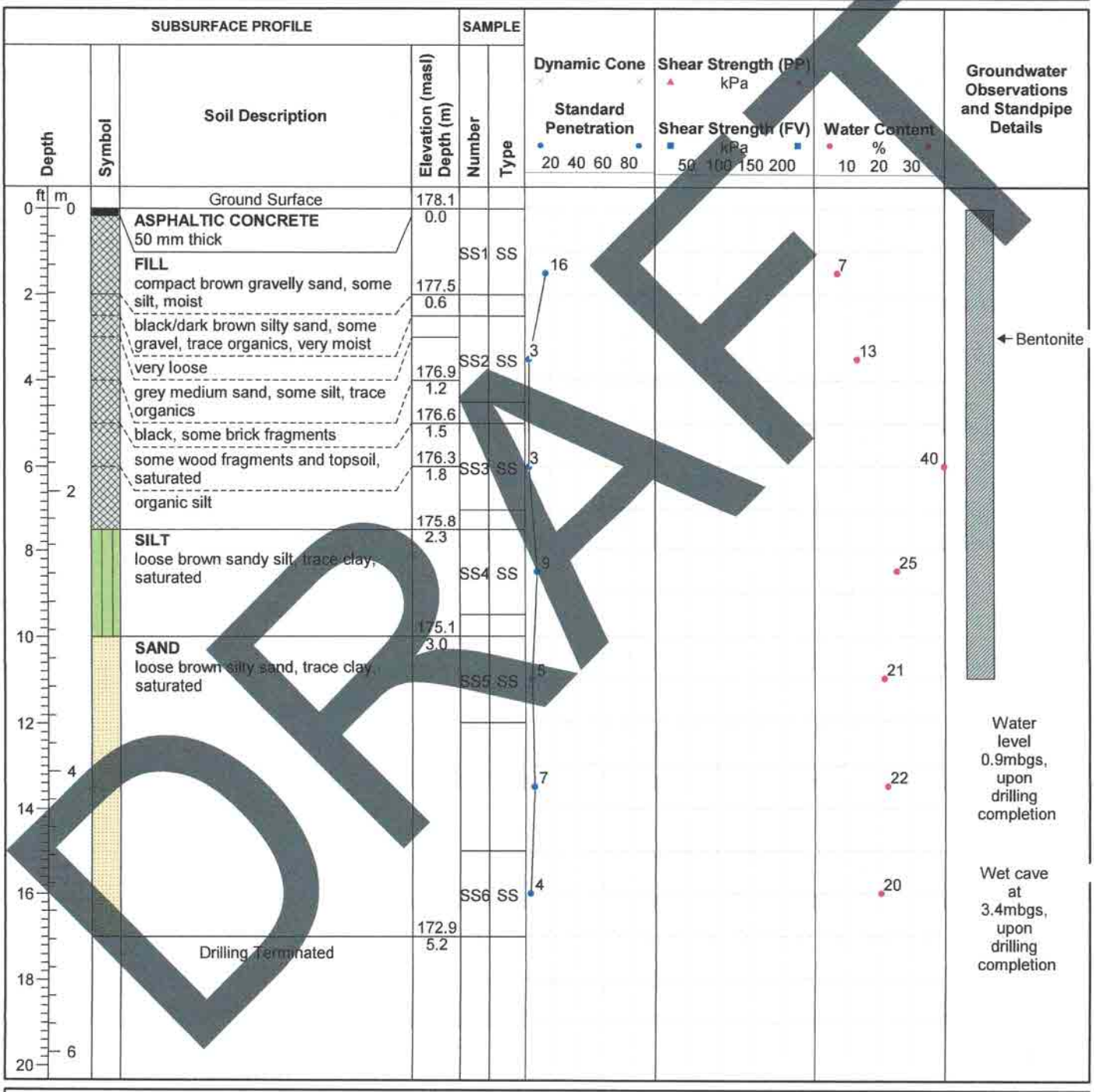
Drill Date: 4/9/2018

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

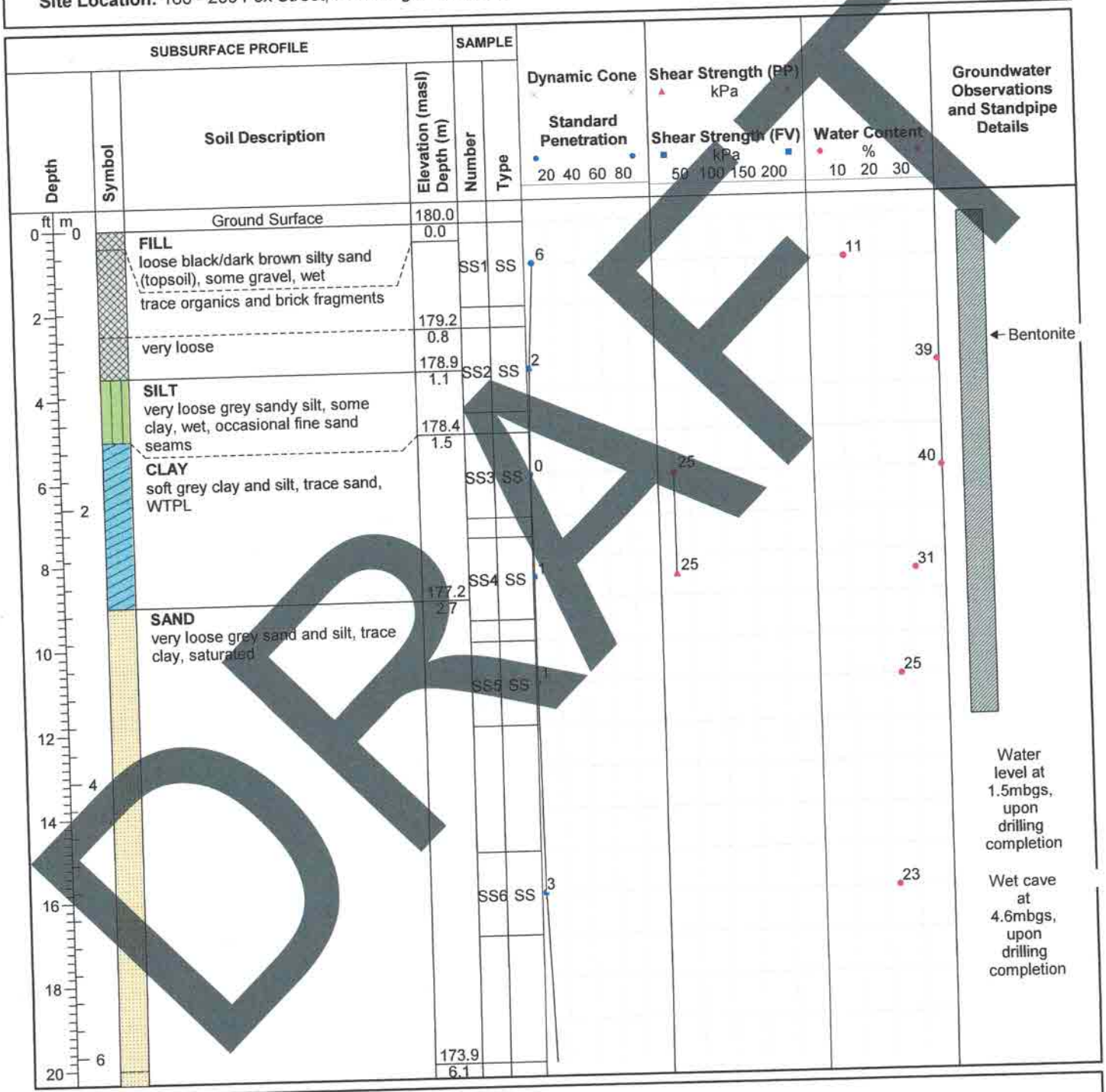
Drill Date: 4/9/2018

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

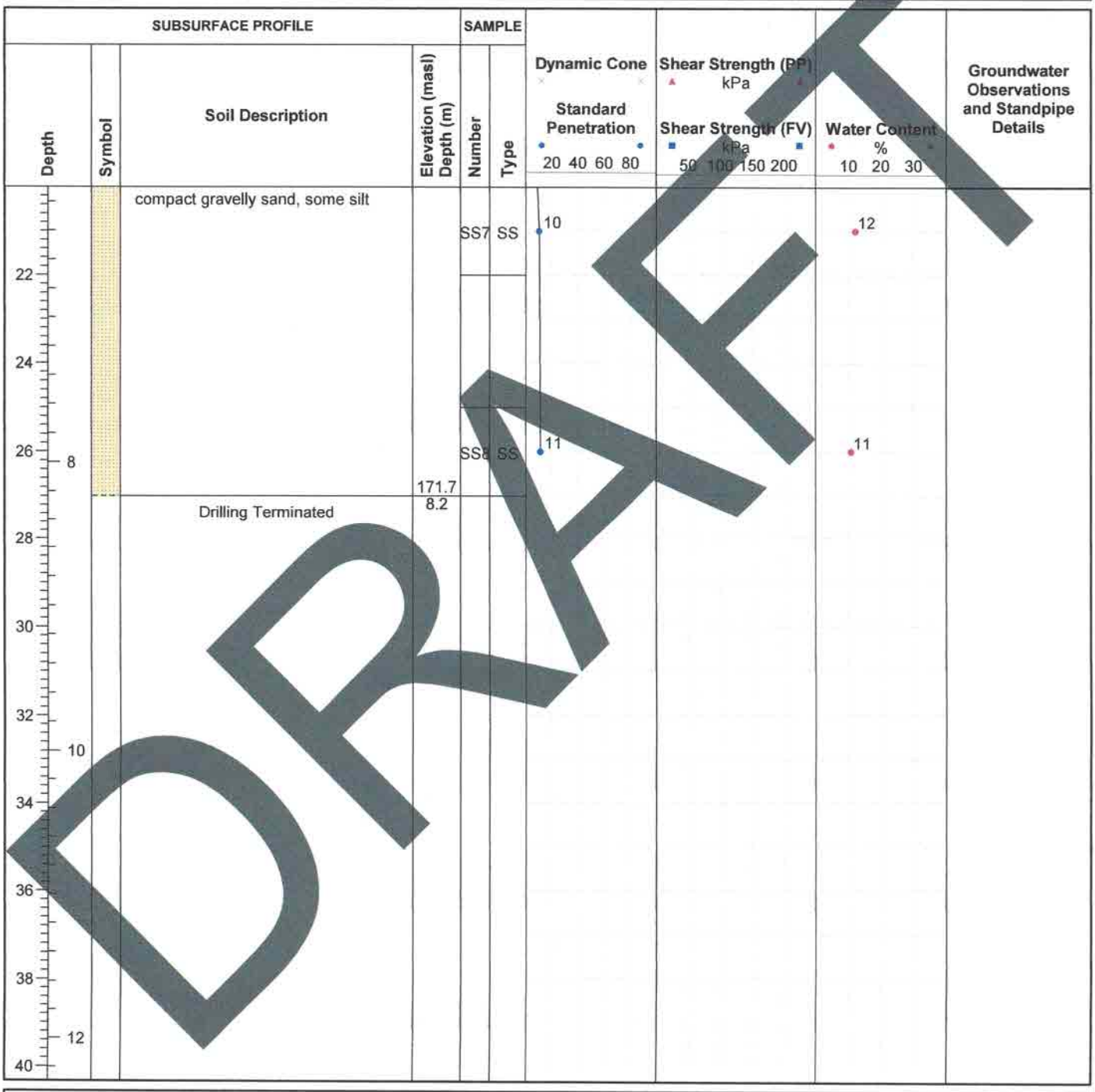
Drill Date: 4/9/2018

Drilling Contractor: Direct Environmental Drilling

Drill Rig: Geoprobe 7822DT

Drill Method: Hollow Stem Augers

Protective Cover: N/A



Field Technician: M. Dalgliesh

Drafted by: B. Heinbuch

Reviewed by: M. Wilson

MTE

Sheet: 2 of 2

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

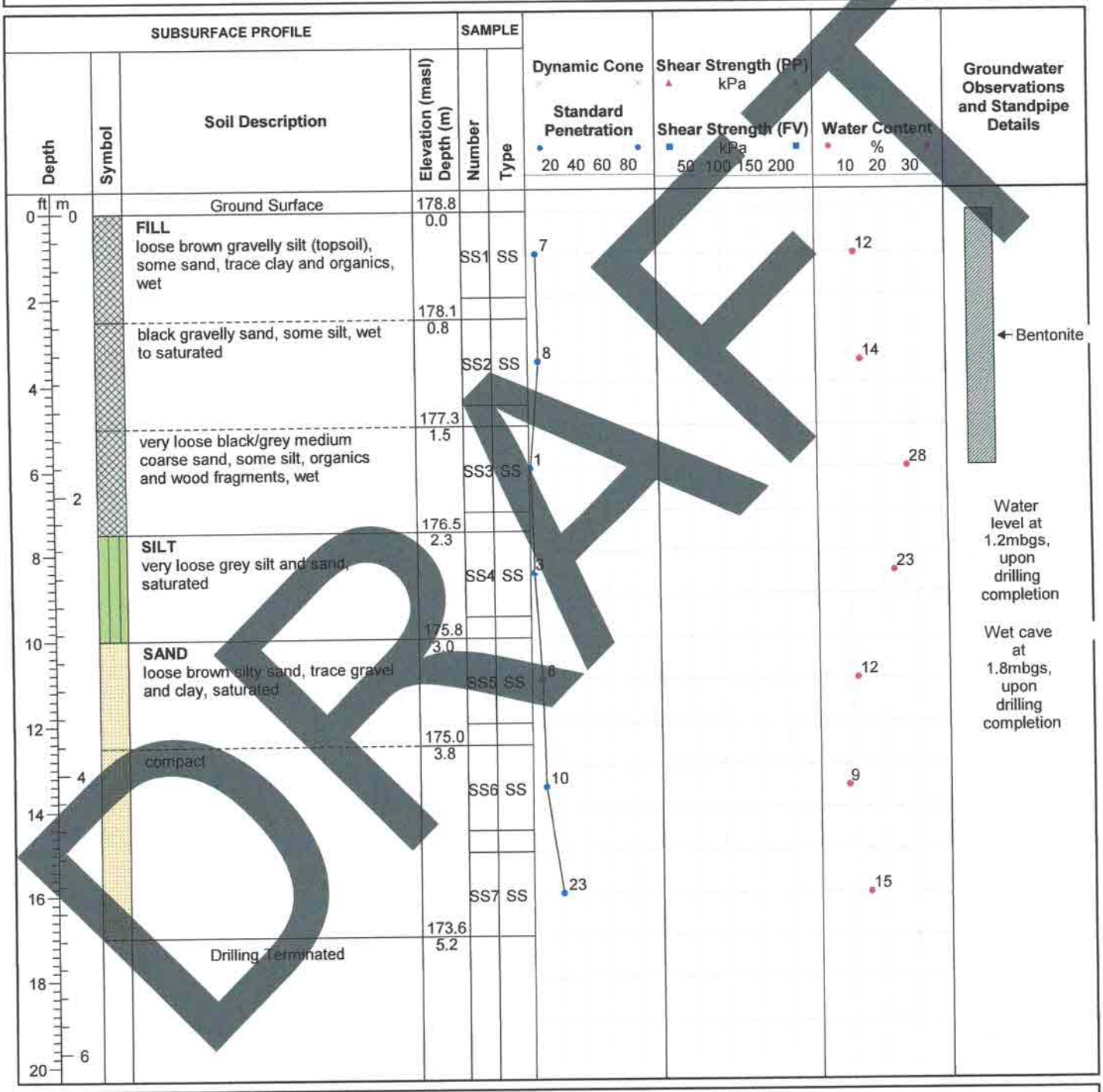
Drill Date: 4/9/2018

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

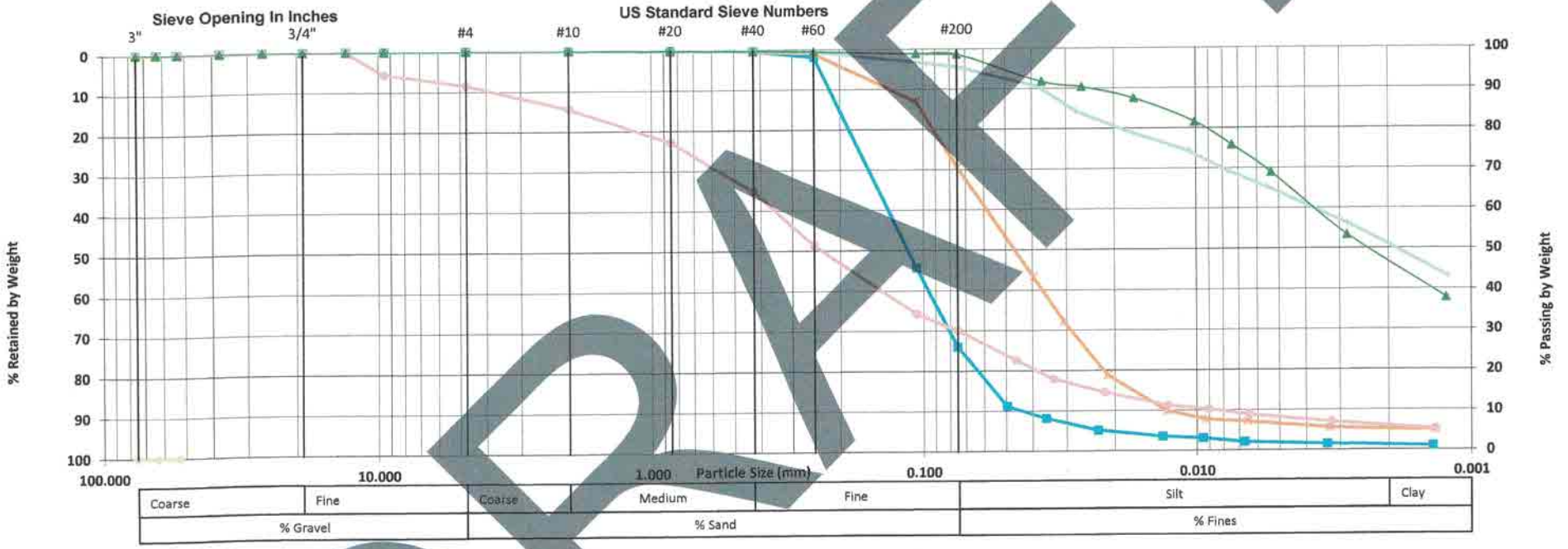
Particle Size Distribution Analysis Test Results

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

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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

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For specific tests as listed on www.ccil.com

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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

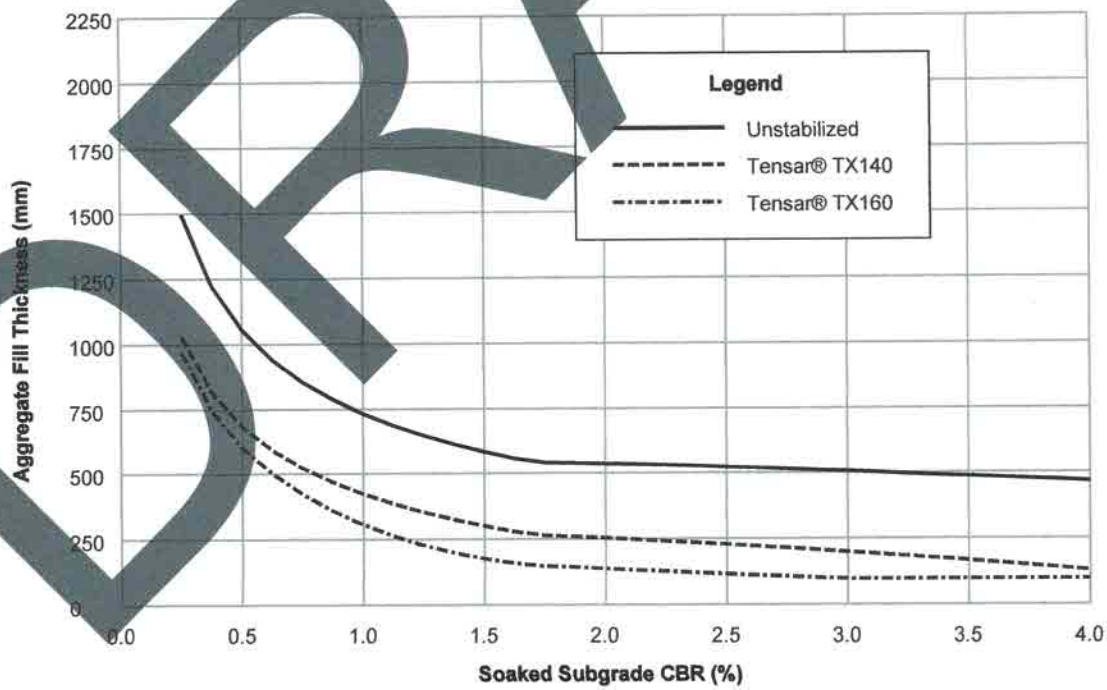
Property	Value
Aggregate Fill CBR (%)	20
Soaked Subgrade CBR (%)	0.8

Aggregate fill shall conform to following requirements:

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



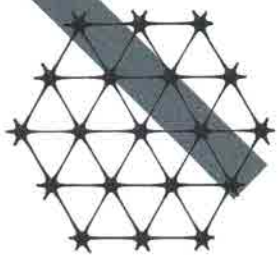
Project Name	Fox Street, Penetanguishene		
Company Name	MTE		
Designer		Date	

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 (lb/ft @ 0.5% strain)				225 (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

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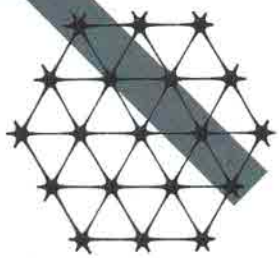
Product Specification - TriAx® TX160 Geogrid

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 (lb/ft @ 0.5% strain)				300 (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

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

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

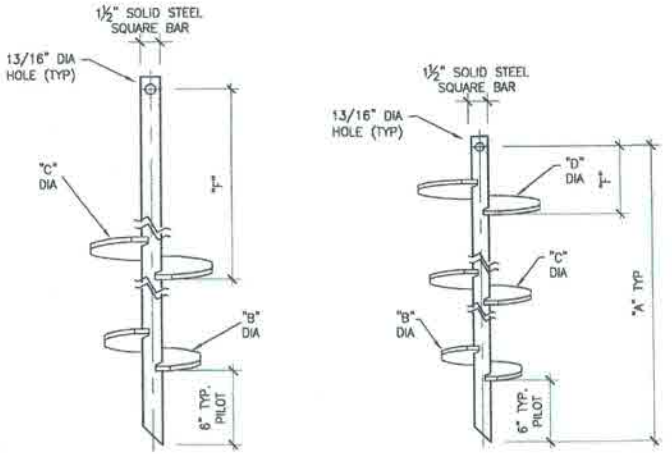
1. The information and sketches contained in these drawings are given as guidelines only.
2. Capacities of Chance Helical Piles/Anchors may vary depending on, but not limited to, water table elevation and changes to that elevation, changing soil conditions, soil layer thicknesses.
3. Achievable capacities 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

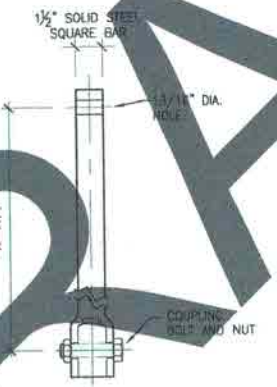
1. HOT DIP GALVANIZED PER ASTM A153-(LATEST REV.)
2. SHAFT MATERIAL-HOT ROLLED ROUND-CORNERED SQUARE (RCS) SOLID STEEL BARS PER ASTM A29; MINIMUM YIELD STRENGTH=70 KSI.
3. HELIX MATERIAL-HOT ROLLED LOW CARBON STEEL SHEET, STRIP, OR PLATE PER ASTM A572, OR A1018, OR A656; MINIMUM YIELD STRENGTH=50 KSI; 3/8" THICK.
4. COUPLING NUTS: 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: 5,900 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.

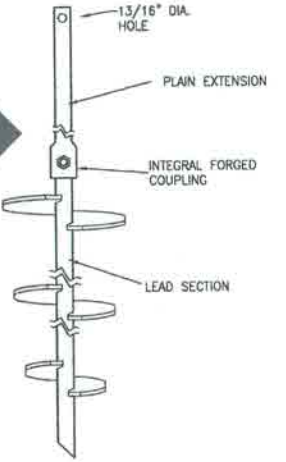
LEAD SECTION				
"A"	"B"	"C"	"D"	"F"
82-1/4"	6"	8"		58-3/4"
82-1/4"	8"	10"		52-1/4"
82-1/4"	10"	12"		46-1/4"
63-1/4"	8"	10"	12"	58-3/4"
82-1/4"	10"	12"	14"	10[illegible]/4"



PLAIN EXTENSION

SCALE: N.T.S.

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



TYPICAL PIER / ANCHOR ASSEMBLY

SCALE: N.T.S.

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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

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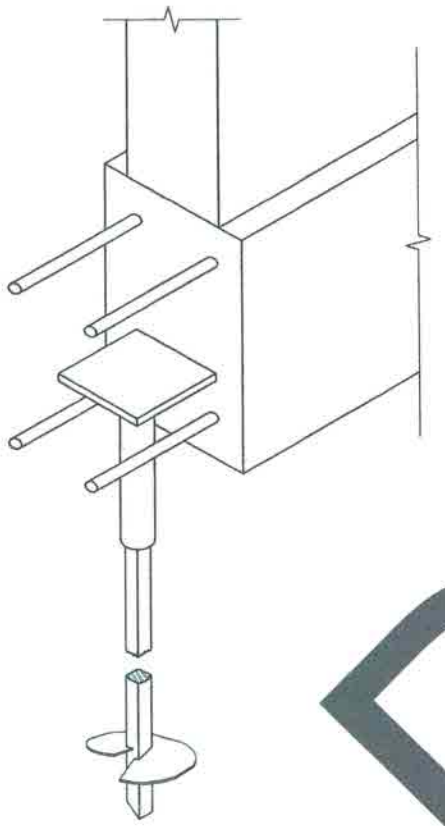
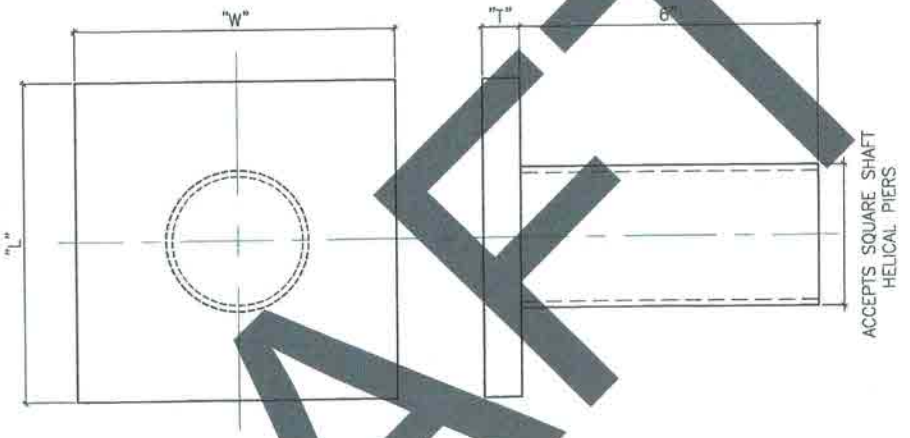
2. Capacities of Chance Helical Piles/Anchors may vary depending on, but not limited to, water table elevation and changes to that elevation, changing soil conditions, soil layer thicknesses.
3. Achievable capacities could be higher or lower than ratings due to site-specific conditions. On site load 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
SS250	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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Tel: 519-648-3513 Fax: 519-648-2526
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)	125 (28)	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)

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