



June 19, 2018
File No.: G17440

Mr. Daniel Hrycyna
200-1081 Bloor Street West
Toronto, Ontario
M6H 1M5

Dear Mr. Hrycyna:

**Re: Water Resource Management Report
Proposed Condominium Development
20 Scott Street, Town of Grand Valley, Ontario**

This report has been prepared in support of a proposed condominium development located at 20 Scott Street in the Town of Grand Valley (Figures 1 and 2).

The objectives of this report are as follows:

- To provide an overview of the hydrogeological setting and water resources around the property.
- To assess the feasibility of the proposed storm water management strategy, particularly the infiltration component.
- To assess the potential water quality and quantity impacts of the proposed strategy on the water resources in the area.

1.0 Storm Water Management (SWM) Strategy

The proposed storm water management strategy is described in the Servicing Strategy report by Meritech Engineering (June 2018).

The SWM strategy accounts for all storm water generated at the property: including that directed to the existing storm sewer system on Crozier Street, the 'clean' water directed to backyard or frontyard infiltration galleries, and that directed to an internal storm sewer system designed to capture runoff up to and including the 100-year storm event and conveyed to a storm water tank to provide quality and quantity control. Runoff to the internal storm sewer would be pre-treated through an oil-grit separator prior to entering the tank. The tank would be sized to hold the 100-year storm and configured to allow the controlled release of the stored water to an adjacent infiltration gallery. The strategy also includes provisions to control water from storm events larger than the 100-year event.

2.0 Site Hydrogeological Setting

The subject property is located within a meander bend to the west of the Grand River (Figure 1).

Topography at the property slopes downward to the southeast, from an elevation of 475 mASL +/- in the northwest corner to 459 mASL +/- in the southeast corner. The Grand River is found at an elevation of about 453 mASL to the southeast of the property.

2.1 Geology

Geological mapping for the area (Figure 1 - Quaternary Geology of the Orangeville Area, by Cowan and Sharpe, 1975) indicates the northwestern half the property is underlain by Tavistock silt till (Deposit 5a, Figure 1) and the southeastern half of the property is underlain by glaciofluvial outwash sand and gravel (Deposit 10, Figure 1). The outwash deposit extends another 300-400 m (+/-) to the south and east toward the Grand River. MOECC well records and MNR Aggregate Resource Inventory Reports confirm the extensive nature of this granular deposit in a southerly and easterly direction to the River, and on the order of 12 to 17 m in thickness and extending vertically to bedrock.

CVD completed a field drilling program on May 30 to June 1, 2017 and prepared a Geotechnical Investigation Report (January 2018) summarizing the results. The investigation included thirteen (13) boreholes (BH1 to BH13) across the property (see attached Drawing 1 and boreholes logs), three of which (BH2, BH4 and BH12) were converted into monitoring wells and monitored for water levels on June 14, 2017. The borehole data generally confirm the Quaternary Geology mapping and the following generalized sequence was encountered:

- A thin 1.4 to 2.9-m veneer of sand & silt at surface across much of the property, except in the southeastern corner.
- A thicker 'cleaner' gravelly sand deposit at surface in the southeast corner (at BH10, BH12 and BH13) and underlying the surficial layer of sand & silt at three additional southeast locations, BH6, BH8, BH11. This deposit is 5.5 m thick at BH12 and was not fully penetrated at the other southeastern locations.
- A low-permeability silt till deposit underlying the sand & silt at the northwesterly locations (BH1 to BH5, BH7 and BH9) and beneath the cleaner gravelly sand toward the southeast at BH8 and BH12; at the 5.5-m depth at the latter location.

The geotechnical investigation report indicates an infiltration rate of the gravelly sand in the southeast corner of the property to be about 50 mm/hr. This is viewed to be a conservatively low estimate and it is noted that the rate could easily be as high as 75 to 100 mm/hr.

2.2 Hydrogeology

In the northwestern portion of the property underlain by the sand & silt and the silt till deposits, the June 14, 2017 water level data at BH2 and BH4 indicate the water table is within the upper part of the silt till deposit (3 to 4.5 m), during the late spring season. The water table in these areas likely rises to the top of the till or within the sand & silt layer during early spring (i.e. to about 2 to 3.5 m below ground).

The water table in the gravelly sand deposit at BH12 was measured at about 4.9 m below ground surface in late spring 2017. It is estimated that this water level is at an elevation of about 454 mASL (+/-). This



elevation is only modestly higher than the Grand River, therein confirming the very high permeability of the outwash sand and gravel deposit that leads from the property to the Grand River.

Groundwater flow in the water table aquifer that extends from the property to the River is expected to be in a southeastern direction, dictated by the boundary of the till/outwash deposits (Figure 1) and the southerly flow direction of the Grand River, which is the 'regional' groundwater discharge feature.

2.3 Groundwater Use and Source Water Protection

Although the MOECC database indicates there are several older well records in the area to the south and east of the property toward the Grand River, this area is now serviced by the Grand Valley municipal water supply system. As a result, there is not expected to be any current private groundwater use in the area downgradient from the property.

The 'Approved Assessment Report' (August 2012) of the Grand River Source Protection Plan presents maps of the Wellhead Protection Areas (WHPA) around each municipal well in the Grand River watershed. Figure 2 shows the WHPAs for the bedrock municipal wells servicing Grand Valley, with the outermost WHPA being the 25-year time of travel in the bedrock aquifer leading to the municipal wells.

The shape of the WHPAs leading to Grand Valley Wells PW1 and PW2 indicates that groundwater flow in the bedrock aquifer is directed to the southeast in the area west of the River. Based on this information, the groundwater flow direction in the bedrock aquifer leading away from the subject property is also expected to be to the southeast, as shown by the flow arrows added to the wellhead protection map (Figure 2). Since the outwash sand and gravel water table aquifer appears to be hydraulically connected to the bedrock aquifer between the property and the River, it is also expected that the groundwater flow direction in the outwash deposit is also to the southeast toward the River.

3.0 SWM Infiltration, Water Balance & Impact Assessment

The hydrogeological setting at and around the property is ideally suited to the proposed SWM strategy, whereby runoff will be captured, stored and infiltrated to the shallow groundwater flow system in the southeastern part of the property where the soils are highly permeable and where the water table is sufficiently deep to allow temporary water table mounding to occur. At present, large amounts of runoff already move to the southeast corner of the property and readily infiltrate with no known problems.

The proposed central SWM tank would be appropriately sized to capture the calculated 100-year event runoff from much of the property. Runoff portions not planned for inclusion in this central SWM facility include: 1) the front portions of the townhouse blocks along Crozier Street, which would flow to the Crozier storm sewer, 2) the backyard and rooftop 'clean' water portions from Lots 13 to 18, which would be directed to backyard swales and infiltration galleries at the rear lot lines, and 3) the yard and rooftop 'clean' water portions from Lots 1A to 4A, which would be directed to front yard infiltration galleries (or possibly directed to the central tank and infiltration facility depending on final graded and SWM analyses).



The central SWM tank would be located beneath the proposed cul-de-sac in the central part of the property and the primary infiltration gallery would be located beneath the adjacent proposed visitor parking area. The design and sizing of the tank and gallery would be optimized to slowly release the stored water (e.g. through various orifices) to the infiltration gallery, thereby allow 'non-problematic' water table mounding (i.e. that not impacting neighbouring basements). The water table in the southeast corner is sufficiently deep (i.e. 5 m +/-) to allow the infiltrated water to temporarily mound at the water table, thereby providing the necessary hydraulic gradient to transmit the infiltrated water into the permeable outwash sand and gravel aquifer. Optimization of the infiltration rates, mounding and facility sizing can be accomplished through detailed modelling.

A pre-post development water balance calculation can be completed as part of the detailed engineering site design to illustrate that the 'enhanced infiltration' design strategy would result in a large increase in the annual volume of water that will be recharged. This will ultimately increase aquifer flow and baseflow to the Grand River.

4.0 Conclusions & Recommendations

Based on the hydrogeological assessment for this water resource management plan, we conclude:

1. The hydrogeological setting at the property is ideal for a stormwater management strategy which features enhanced infiltration of virtually all runoff at the property. The infiltration approach relies on the deep water table in the infiltration areas and a highly transmissive gravelly sand aquifer which extends from southeast part of the property in a southeasterly direction to the Grand River.
2. The groundwater flow path for the infiltrated water is expected to move in a southeasterly direction toward the Grand River, an area where there is no current groundwater use and which is outside the Source Water Protection / Wellhead Protection Areas for the local Grand Valley municipal wells.

The following recommendations should be incorporated into the final engineering design that is submitted for approval:

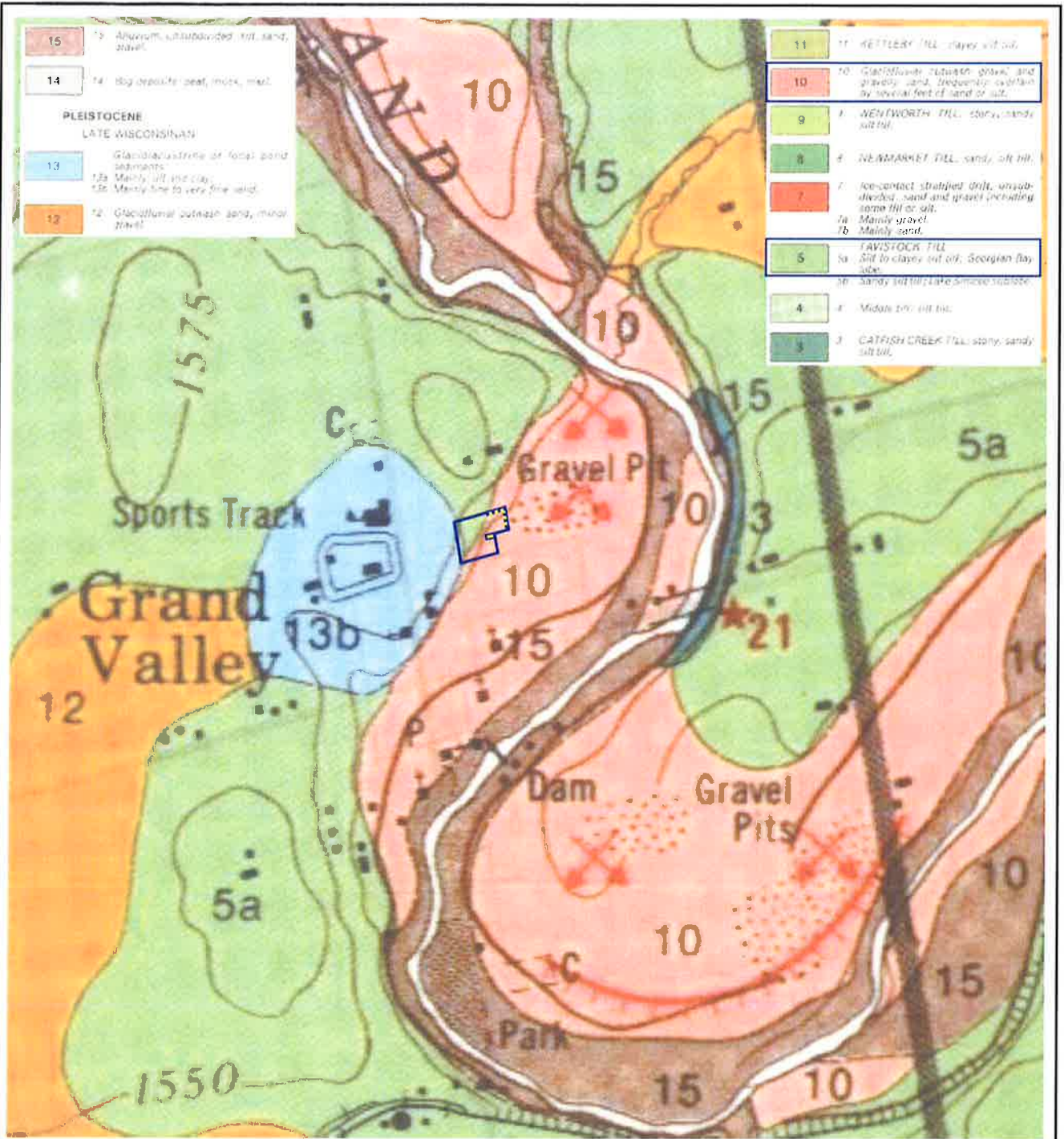
1. A salt management plan should be developed to reduce and manage the use of salt and limit the amount of salt in the infiltrated stormwater.
2. Detailed in-situ testing should be conducted to confirm the soil infiltration rates at the proposed infiltration facilities.
3. Detailed modelling of the infiltration should be completed to optimize the rates of infiltration and size of the infiltration facilities with the permissible mounding.
4. A post-construction program to monitor the infiltration facilities should be developed to ensure the facilities operate as intended.

Respectfully submitted,
CHUNG & VANDER DOELEN ENGINEERING LTD.





William (Sandy) Anderson, M.Sc., P.Eng.
Senior Hydrogeologist and Engineer





Map Source: W.R. Cowan and D.R. Sharpe, 1975. Quaternary Geology of the Orangeville Area; Ontario Division of Mines, Map 2326.

LEGEND

 20 Scott St. Development Property
 Infiltration Areas



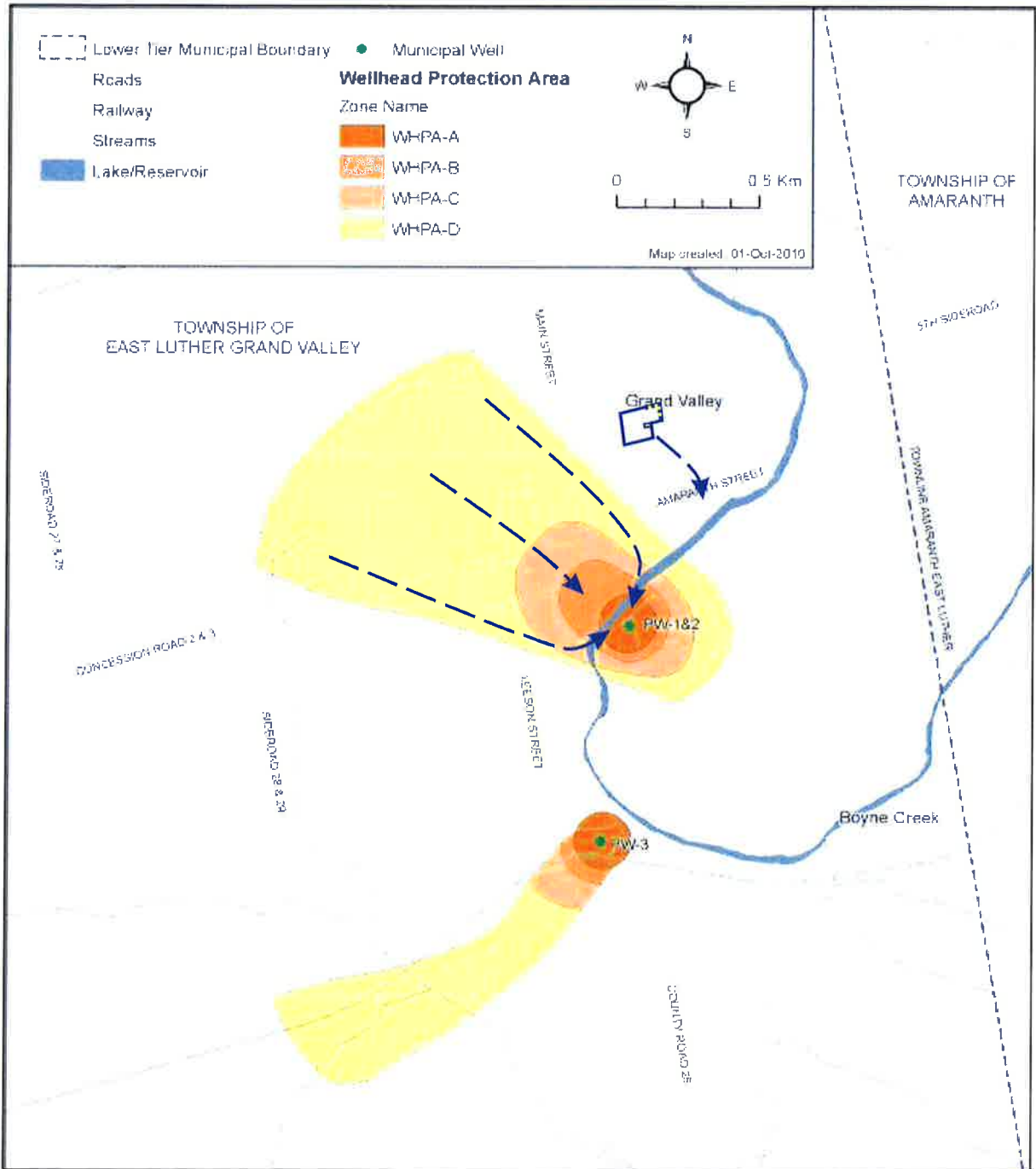
0 200 400 m
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Figure 1 Site Location & Quaternary Geology
Hydrogeological Assessment
20 Scott St., Grand Valley




Drawn By: SA | Date: June 13, 2018 | File No. G17440

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Map 6-12: Grand Valley Well Supply Wellhead Protection Areas



LEGEND

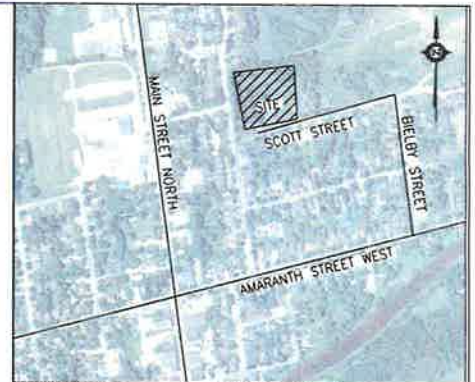
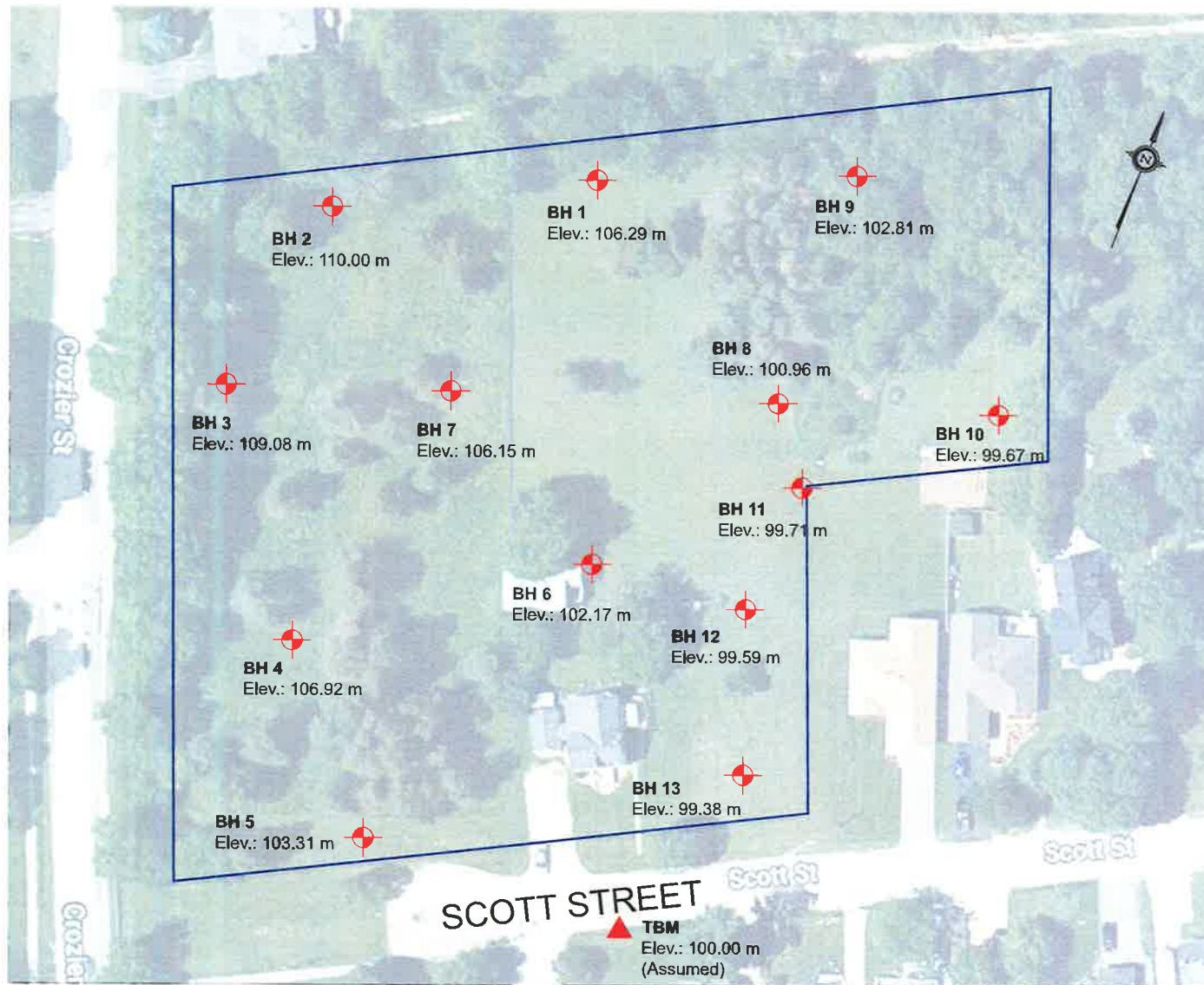
-  20 Scott St. Development Property
-  Infiltration Areas
-  Inferred Groundwater Flow Direction (CVD Added Arrows to Basemap)

Source: Grand River Source Protection, Approved Assessment Report, August 16 2012.

Figure 2 Source Water Protection & Groundwater Flow Interpretation
Hydrogeological Assessment
20 Scott St., Grand Valley



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KEY PLAN SOURCE: Google Earth

LEGEND

-  TBM: Top of existing manhole in Scott Street in front of lot number 20
Elevation: 100.00 m (Assumed)
-  Borehole Location

BOREHOLE LOCATION PLAN

Proposed Townhouse Development

20 Scott Street
Grand Valley, Ontario

311 VICTORIA STREET NORTH
KITCHENER V ONTARIO V N2H 5E1 V 519-742-8

Drawn By: AB	Date: December, 2017	File No.: G17440
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Checked By: EYC	Scale: 1:600	Drawing No.: 1
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Client: **Daniel Hrycyna**
Project: **Proposed Townhouse Development**
Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA
Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **May 31 - 17 to May 31 - 17**

SOIL LITHOLOGY			SAMPLE		SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS	
ELEV./DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200	PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80			W _p				W
106.04 0.25	250 mm TOPSOIL														
	very loose to compact brown	0.5		1	SS	4									
	SAND and SILT trace to some clay, trace gravel moist	1.0		2	SS	7									
		1.5		3	SS	10									
104.16 2.13	compact to very dense brown	2.0													
	SILT TILL some sand, trace to some clay, trace gravel contains cobbles occ. clayey seams/layers moist	2.5		4	SS	41									
		3.0													
		3.5		5	SS	28									
		4.0													
		4.5													
101.26 5.03	End of Borehole	5.0		6	SS	74									
		5.5													
		6.0													
		6.5													
		7.0													
		7.5													
		8.0													
		8.5													

borehole open and dry to 5.03 m bgs upon completion of drilling

CVD BOREHOLE (2017) G17440 20 SCOTT ST GRAND VALLEY GPJ_CVD_ENG_GDT 6-19-18

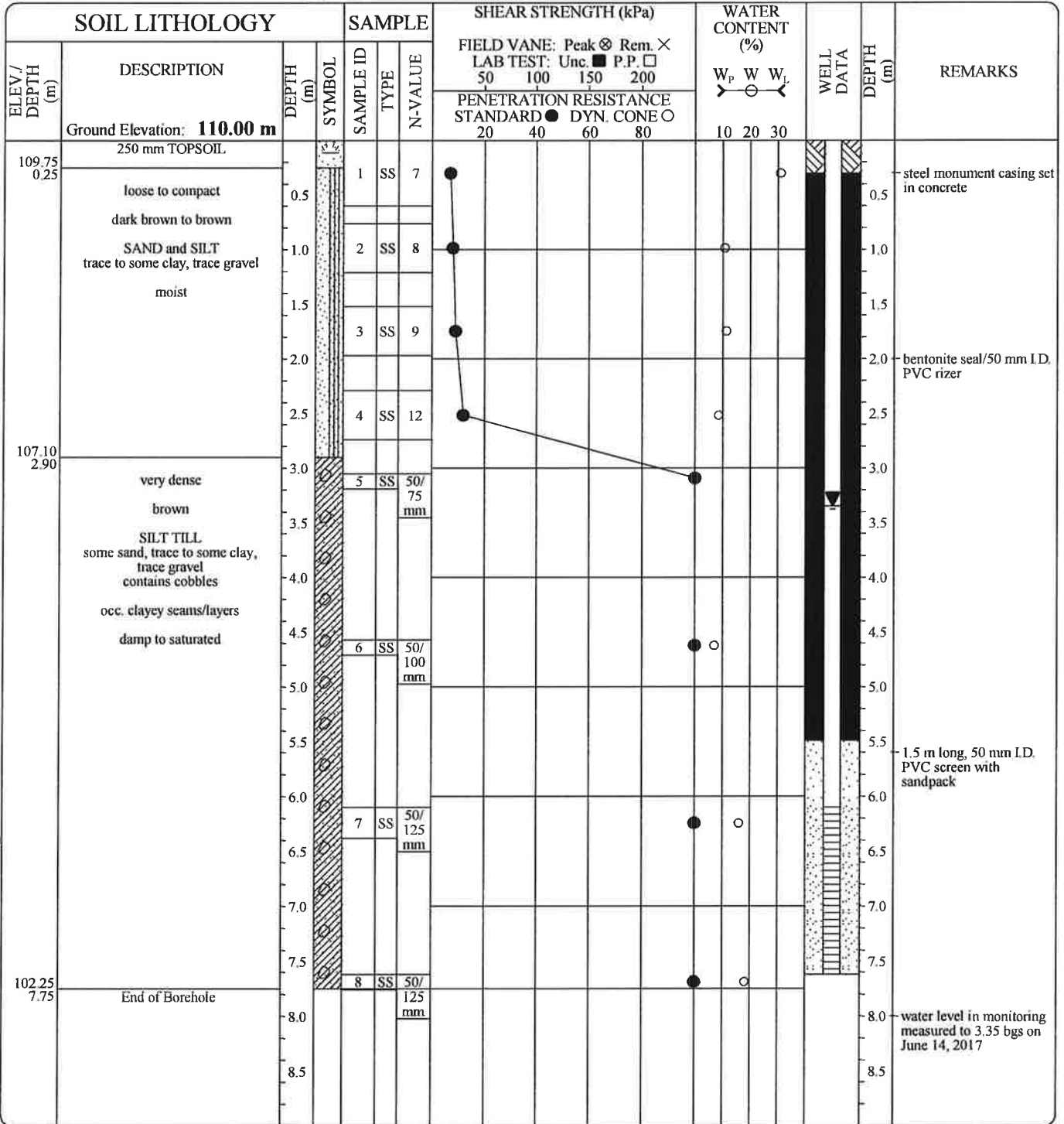
PROJECT MANAGER: **EYC**
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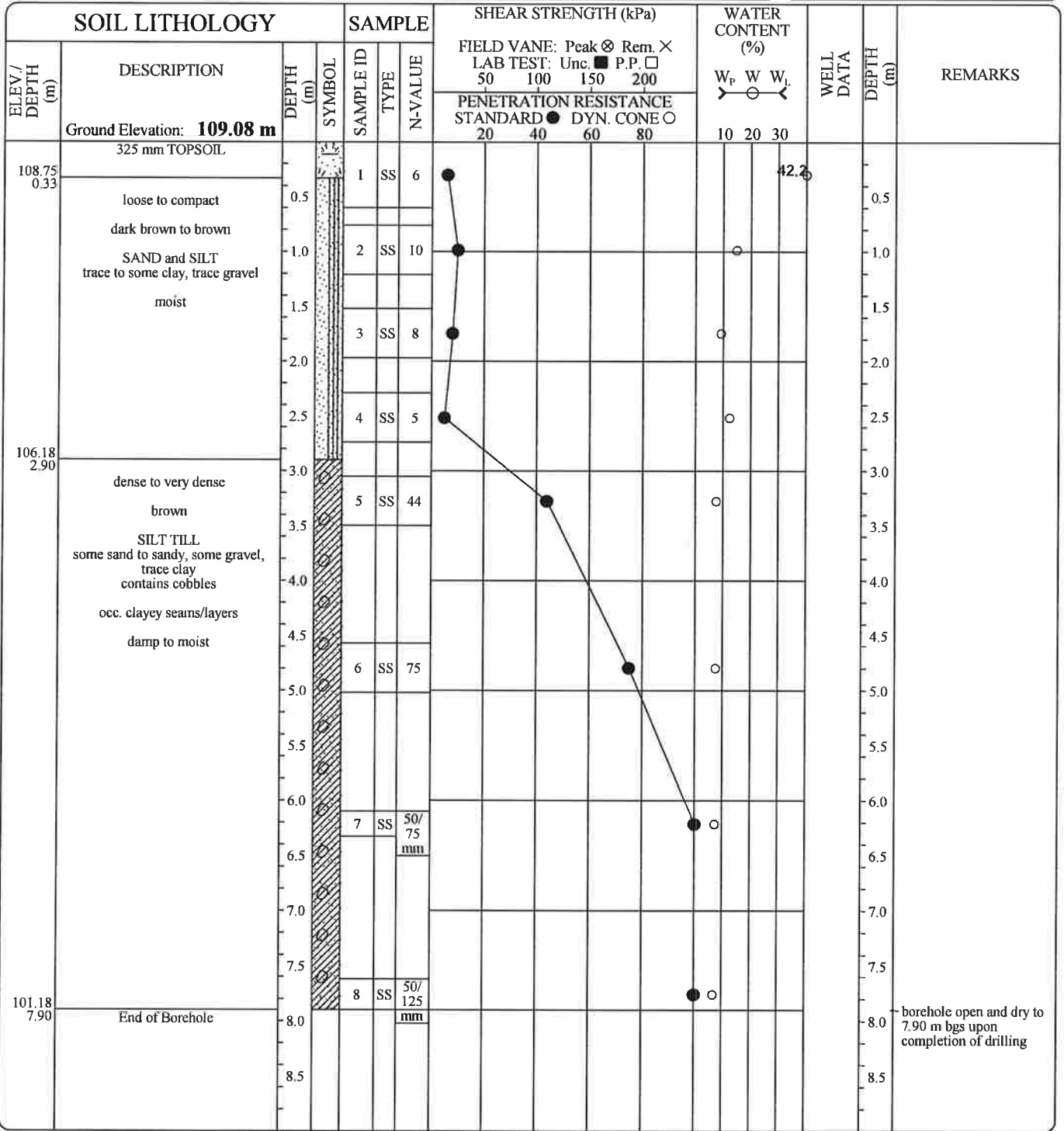
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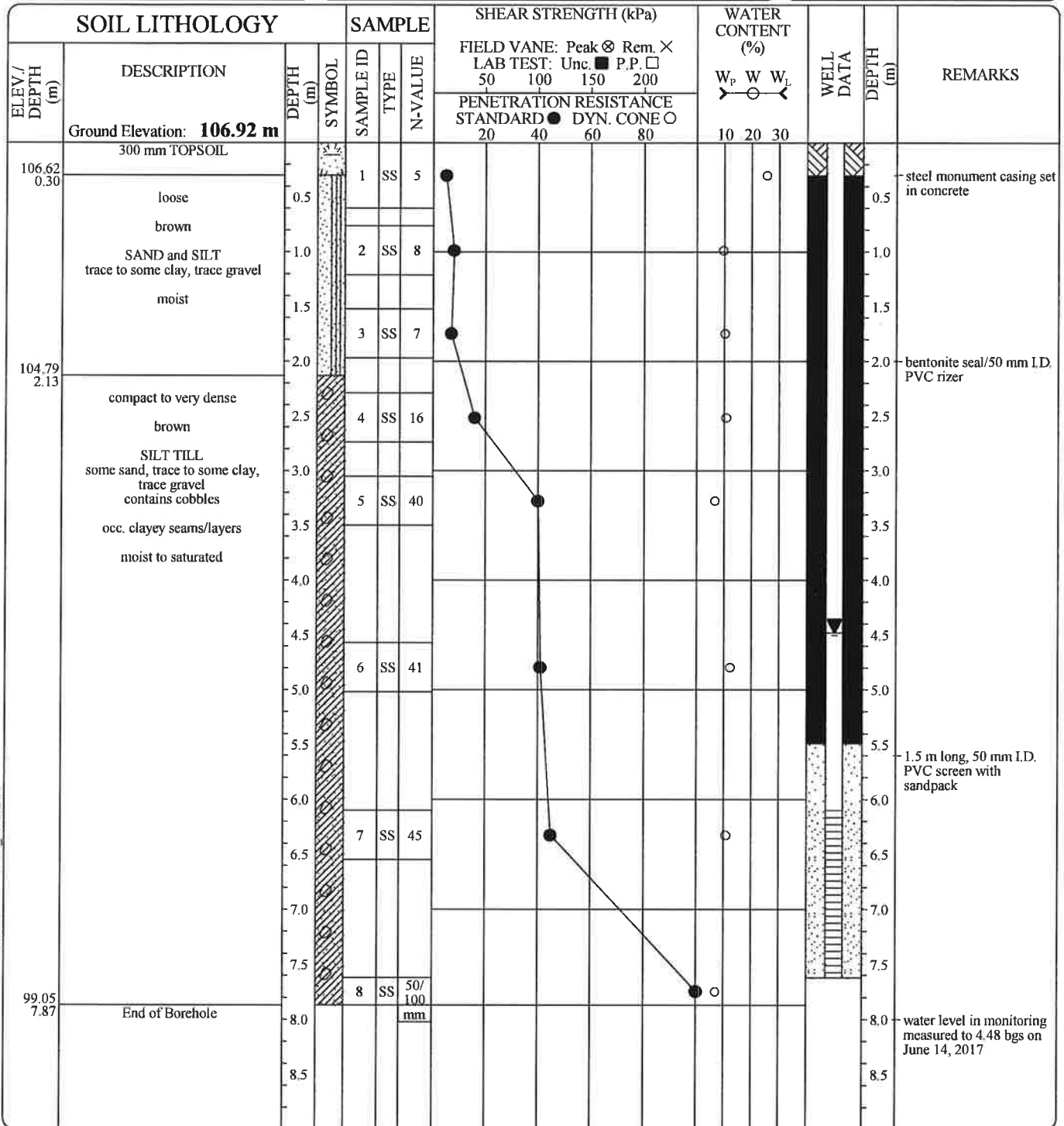
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EQUIPMENT DATA
Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **May 31 - 17 TO May 31 - 17**



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EQUIPMENT DATA
Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **Jun 01 - 17 TO Jun 01 - 17**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS
ELEV./DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200	PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80		W _p	W	W _L			
103.06 0.25	Ground Elevation: 103.31 m 250 mm TOPSOIL														
	loose brown SAND and SILT trace to some clay, trace gravel moist	0.5		1	SS	7									
		1.0		2	SS	6									
		1.5		3	SS	7									
101.18 2.13	loose to very dense brown SILT TILL some sand, trace to some clay, trace gravel contains cobbles occ. clayey seams/layers occ. saturated seams moist to wet	2.0		4	SS	16									
		2.5		5	SS	29									
		3.0													
		3.5													
		4.0													
		4.5													
		5.0		6	SS	7									
		5.5													
96.94 6.37	End of Borehole	6.0		7	SS	50/125 mm									borehole cave-in and dry to 5.79 m bgs upon completion of drilling
		6.5													
		7.0													
		7.5													
		8.0													
		8.5													

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Client: **Daniel Hrycyna**
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Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA
Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **82 mm I.D.**
Date: **May 30 - 17 TO May 30 - 17**

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101.82 0.35	350 mm TOPSOIL	0.0		1	SS	3									
	very loose to loose brown SAND and SILT trace to some clay, trace gravel moist	0.5		2	SS	9									
		1.0		3	SS	9									
100.04 2.13	compact to very dense brown SAND trace to some silt, trace gravel damp to moist	2.0		4	SS	30									
		2.5		5	SS	16									
97.47 4.70	End of Borehole	4.5		6	SS	50/ 125 mm									
		5.0													borehole open and dry to 4.70 m bgs upon completion of drilling
		5.5													
		6.0													
		6.5													
		7.0													
		7.5													
		8.0													
		8.5													

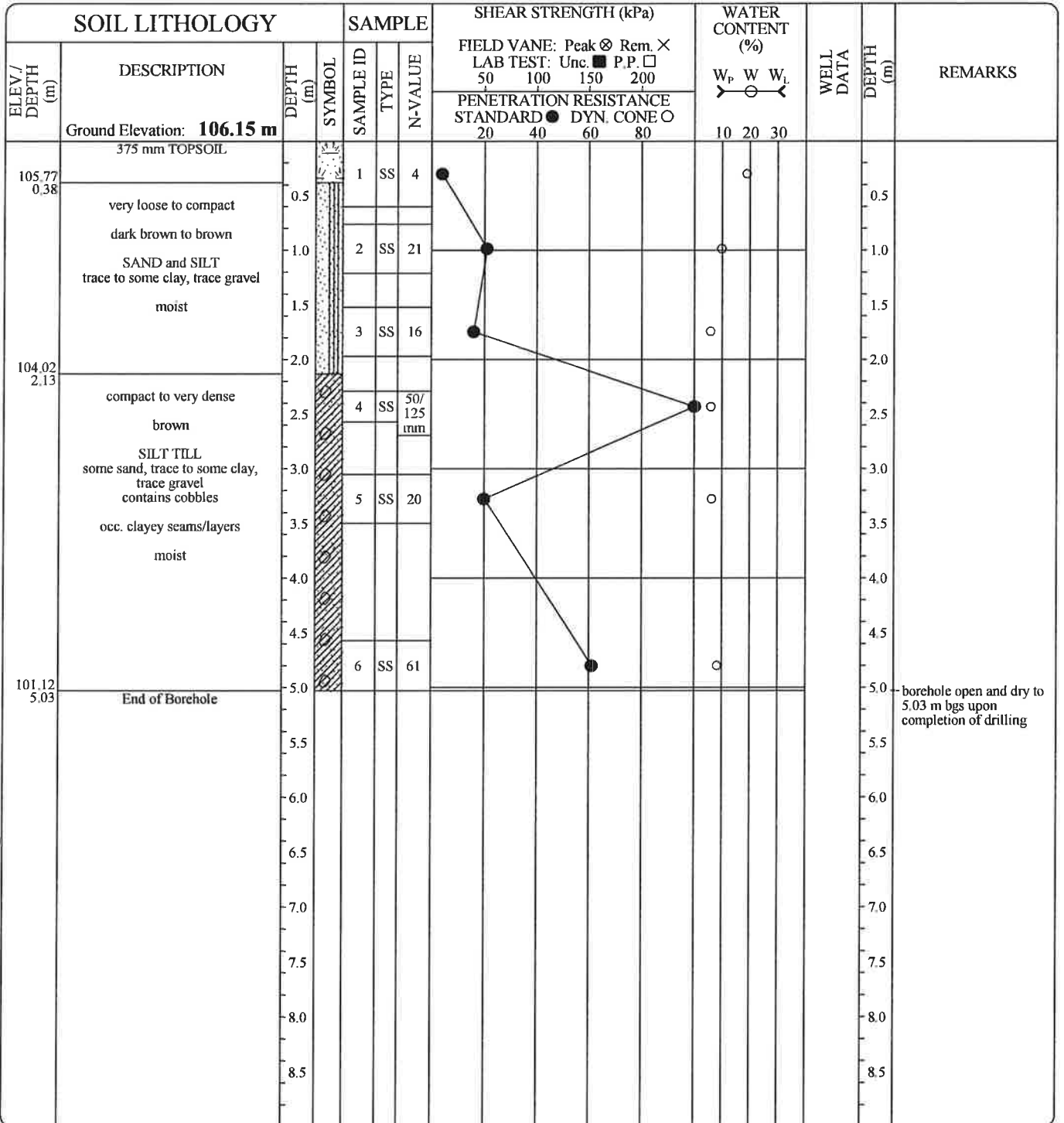
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borehole open and dry to 5.03 m bgs upon completion of drilling

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100.76 0.20	200 mm TOPSOIL	0.20														
	very loose to loose brown SAND and SILT trace to some clay, trace gravel moist	0.5		1	SS	4										
		1.0		2	SS	8										
99.59 1.37	compact brown SAND trace to some silt occ. silt pockets moist	1.5		3	SS	21										
		2.5		4	SS	15										
		3.5		5	SS	11										
97.45 3.51	very dense, brown SILT TILL some sand, trace to some clay, trace gravel contains cobbles occ. clayey seams/layers moist	4.0		6	SS	56										
		4.5		7	SS	50/125 mm										
96.26 4.70	End of Borehole	4.70														borehole open and dry to 4.7 m bgs upon completion of drilling
		5.0														
		5.5														
		6.0														
		6.5														
		7.0														
		7.5														
		8.0														
		8.5														

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102.56 0.25	250 mm TOPSOIL													
	loose brown SAND and SILT trace to some clay, trace gravel moist	0.5		1	SS	6	●							
		1.0		2	SS	6	●							
		1.5												
		2.0		3	SS	8	●							
100.68 2.13	compact to dense brown SILT TILL some sand, trace to some clay, trace gravel contains cobbles occ. clayey seams/layers damp to moist	2.5		4	SS	25	●							
		3.0												
		3.5		5	SS	23	●							
		4.0												
		4.5												
97.78 5.03	End of Borehole	5.0		6	SS	40	●							
		5.5												
		6.0												
		6.5												
		7.0												
		7.5												
		8.0												
		8.5												

borehole open and dry to 5.03 m bgs upon completion of drilling

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99.37 0.30	300 mm TOPSOIL	0.30		1	SS	3										
	very loose to very dense brown SAND trace to some gravel, trace silt damp to moist	0.5														
		1.0		2	SS	40										
		1.5														
		2.0		3	SS	26										
		2.5														
		3.0		4	SS	32										
		3.5														
		4.0														
		4.5														
94.67 5.00	End of Borehole	5.00		6	SS	50/ 125 mm										

borehole cave-in and dry to 3.66 m bgs upon completion of drilling

CVD BOREHOLE (2017) G17440 20 SCOTT ST GRAND VALLEY GPJ CVD ENG GDT 6-19-18

PROJECT MANAGER: **EYC**

CHUNG & VANDER DOELEN ENGINEERING LTD.
311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739



Client: **Daniel Hrycyna**
Project: **Proposed Townhouse Development**
Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA
Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **82 mm I.D.**
Date: **May 30 - 17 TO May 30 - 17**

SOIL LITHOLOGY		SAMPLE		SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS
ELEV./DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200	PENETRATION RESISTANCE STANDARD ● DYN, CONE ○					
99.51 0.20	200 mm TOPSOIL												
	very loose to compact brown SAND and SILT trace to some clay, trace gravel moist	0.5		1	SS	4							
		1.0		2	SS	10							
98.34 1.37		loose to very dense brown SAND trace gravel to gravelly, trace silt damp to moist	1.5		3	SS	8						
			2.5		4	SS	23						
			3.5		5	SS	21						
94.71 5.00	End of Borehole	5.0		6	SS	50/ 125 mm							borehole cave-in and dry to 3.66 m bgs upon completion of drilling

CVD BOREHOLE (2017) G17440 20 SCOTT ST GRAND VALLEY.GPJ CVD_ENG.GDT 6-19-18

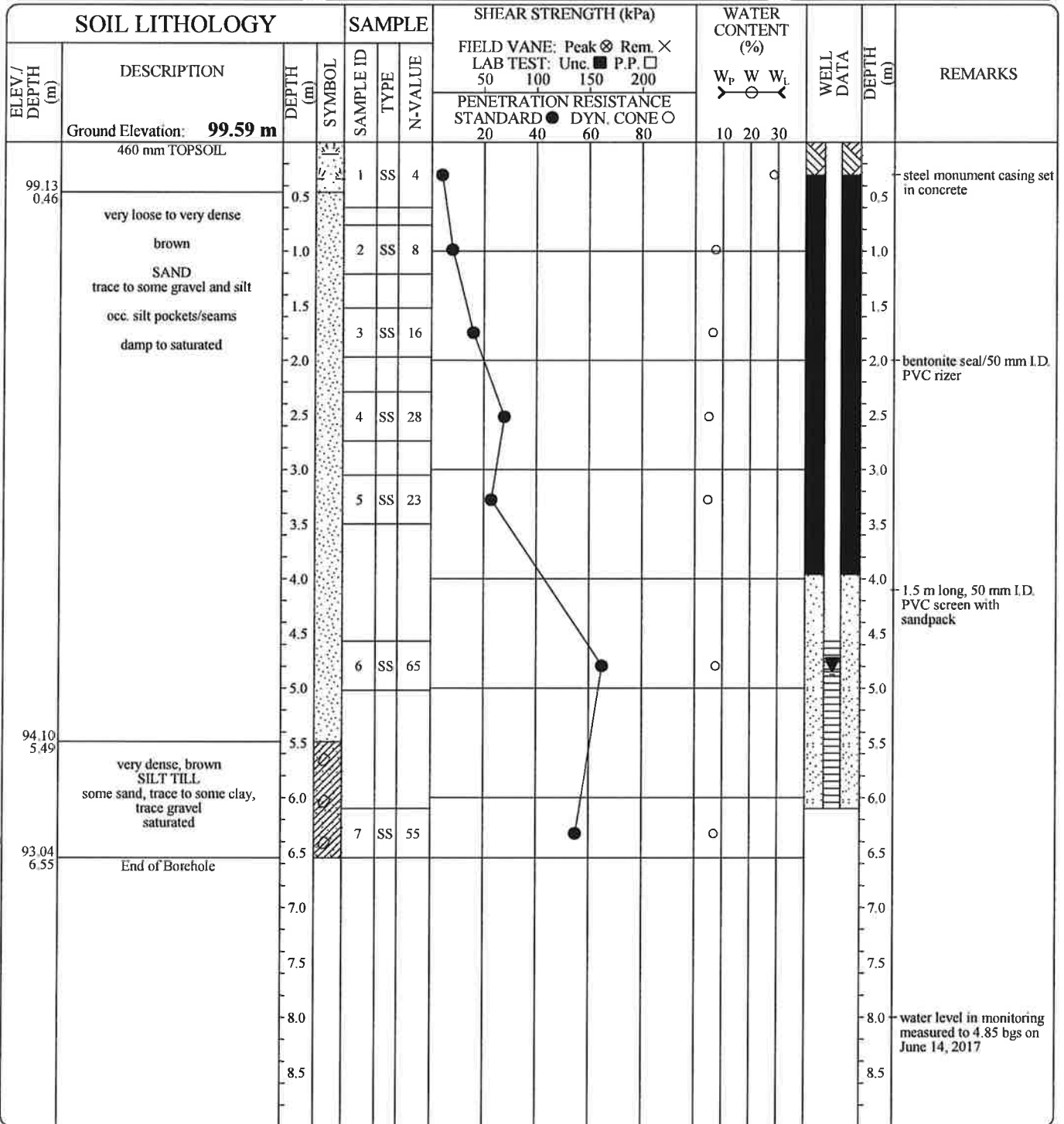
PROJECT MANAGER: **EYC**

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Client: **Daniel Hrycyna**
Project: **Proposed Townhouse Development**
Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA
Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **Jun 01 - 17 TO Jun 01 - 17**



CYD BOREHOLE (2017) G17440 20 SCOTT ST GRAND VALLEY GPJ CYD ENG GDT 6-19-18

PROJECT MANAGER: **EYC**

CHUNG & VANDER DOELEN ENGINEERING LTD.

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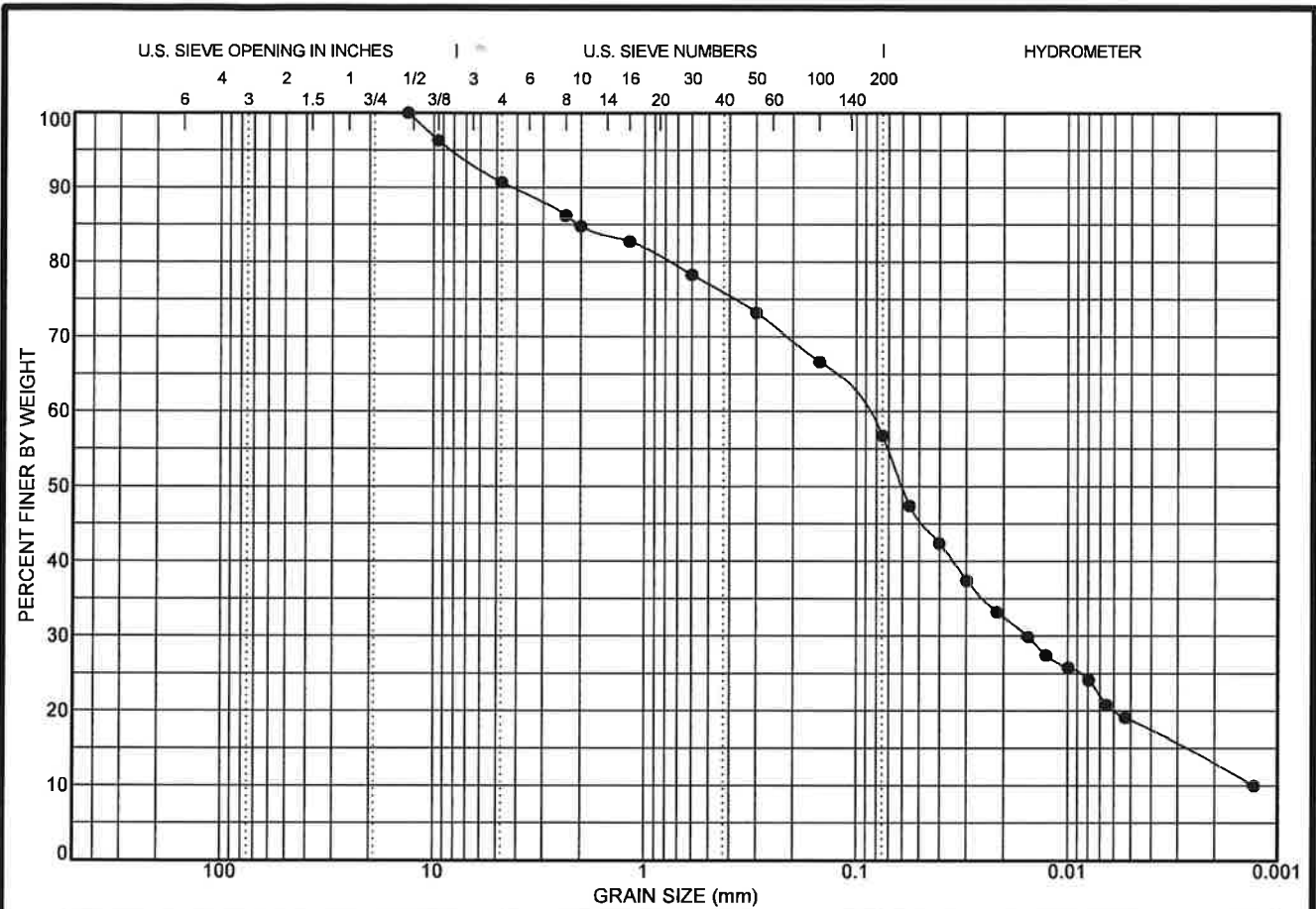
Client: **Daniel Hrycyna**
Project: **Proposed Townhouse Development**
Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA
Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **82 mm I.D.**
Date: **May 30 - 17 TO May 30 - 17**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS
ELEV./DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. ×	LAB TEST: Unc. ■ P.P. □	STANDARD ● DYN. CONE ○	W _p	W	W _L			
99.08 0.30	300 mm TOPSOIL	0.30	[Symbol]	1	SS	5									
	loose to dense brown SAND trace to some silt, trace gravel to gravelly occ. silt pockets/seams damp to saturated	0.5	[Symbol]	2	SS	15									
		1.0	[Symbol]	3	SS	36									
		1.5	[Symbol]	4	SS	36									
		2.0	[Symbol]	5	SS	48									
		2.5	[Symbol]	6	SS	15									
94.35 5.03	End of Borehole	5.03	[Symbol]												hydrostatic pressure

CVD BOREHOLE (2017) G17440 20 SCOTT ST GRAND VALLEY.GPJ CVD_ENG.GDT 6-19-18

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			1.98	72.35	13.2	0.094	0.016	0.001	9.3	33.9	56.8	

Date: Jun. 08 - 2017
Client: Daniel Hrycyna
Contractor:
Source:
Sampled From: BH 7, SA 3, 1.52 to 1.98 m depth
Sample No.: 7-3
Date Sampled: Jun. 06 - 2017
Sampled By: AB
Lab No.: 1736
Date Tested: Jul. 06 - 2017
Type of Material: Sand and Silt, some clay, trace gravel

Sieve Size (mm)	Percent Passing	No Specifications

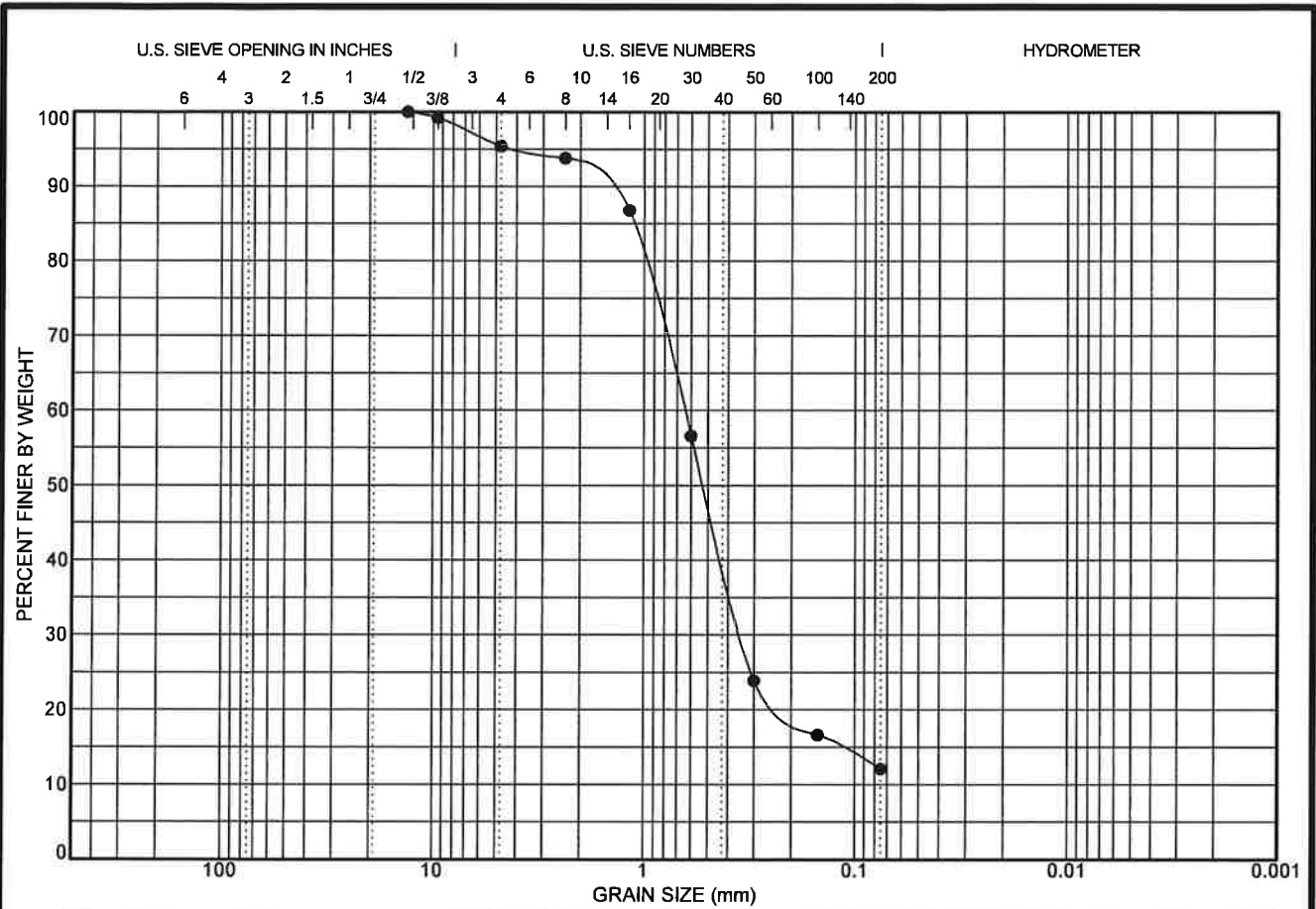
DM - NO SPECIFICATIONS. G17440 20 SCOTT ST GRAND VALLEY G.P.I. LAW LNDN GDT 6-19-18



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 e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

Project: Proposed Townhouse Development
Location: 20 Scott Street, Grand Valley, Ontario
File No.: G17440
Enclosure No.: 14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			3.32	11.93	13.2	0.647	0.341		4.6	83.3	12.1	

Date: Jun. 08 - 2017
Client: Daniel Hrycyna
Contractor:
Source:
Sampled From: BH 12, SA 5, 3.05 to 3.51 m depth
Sample No.: 12-5
Date Sampled: Jun. 06 - 2017
Sampled By: AB
Lab No.: 1734
Date Tested: Jun. 06 - 2017
Type of Material: Sand, some silt, trace gravel

Sieve Size (mm)	Percent Passing	No Specifications

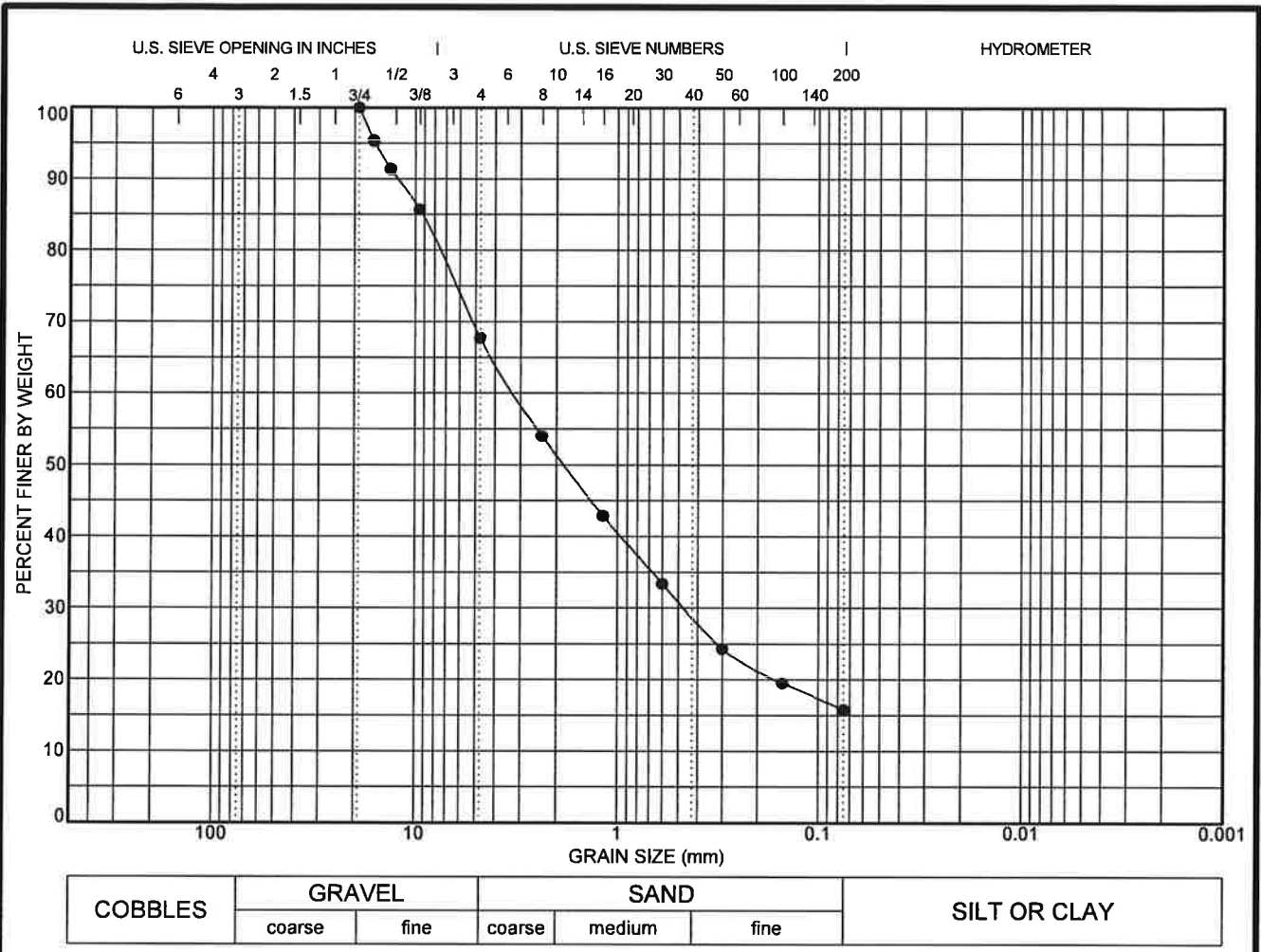
DM - NO SPECIFICATIONS G17440 20 SCOTT ST. GRAND VALLEY G.P.I. LAW LNDN, GDT 6-19-18



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GRAIN SIZE DISTRIBUTION

Project: Proposed Townhouse Development
Location: 20 Scott Street, Grand Valley, Ontario
File No.: G17440
Enclosure No.: 15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
					19	3.206	0.463		32.3	51.9	15.8	

Date: Jun. 08 - 2017
Client: Daniel Hrycyna
Contractor:
Source:
Sampled From: BH 13, SA 5, 3.05 to 3.51 m depth
Sample No.: 13-5
Date Sampled: Jun. 06 - 2017
Sampled By: AB
Lab No.: 1735
Date Tested: Jun. 06 - 2017
Type of Material: Gravelly Sand, some silt

Sieve Size (mm)	Percent Passing	No Specifications

DM - NO SPECIFICATIONS G17440 20 SCOTT ST GRAND VALLEY G.P.I. LAW LNDN GDT 6-19-18



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 e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

Project: Proposed Townhouse Development
Location: 20 Scott Street, Grand Valley, Ontario
File No.: G17440
Enclosure No.: 16