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Hydrogeological Investigation Report

Mayfield West Phase 2 Stage 3 Lands, Caledon, Ontario

Palmer Project #
1701628

Prepared For
Brookvalley Project Management Inc.

April 3, 2024

April 3, 2024

Frank Filippo, P. Eng.
Senior Executive Vice President
Brookvalley Project Management Inc.
137 Bowes Road
Concord, Ontario
L4K 1H3

Re: **Hydrogeological Investigation Report, Mayfield West Phase 2 Stage 3 Lands, Caledon, Ontario**
Project #: **1701628**

Palmer is pleased to submit the attached report describing the results of our Hydrogeological Investigation Report concerning the proposed development of Mayfield West Phase 2 Stage 3 lands (MW2-3) in Caledon, ON. These documents will expand upon Palmer's prior work on the MW2-3 lands, integrating freshly gathered data from 2023 and 2024. Our analysis will align with the 2024 Draft Plan (DP) Concept outlined by MGP.

Beginning in October 2017, Palmer completed a detailed, multi-year hydrogeological and wetland water level monitoring program for the MW2-3 lands to build upon the existing hydrogeological data collected in the area as part of the Secondary Plan study for the overall Mayfield West Phase 2 area.

In October 2023, Soil Engineers Ltd. (SEL) completed a new borehole drilling program for their geotechnical assessment. Palmer utilized the monitoring well and borehole data from SEL to provide an updated Hydrogeological Investigation Report. In addition, the Draft Plan proposed two (2) new bridge crossings of Etobicoke Creek.

This hydrogeological assessment is focused on characterizing groundwater recharge and discharge trends, groundwater flow, vertical and horizontal hydraulic gradients, wetland hydroperiods, Source Water Protection policy implications, and the pre-to-post development water balance. Recommendations are made to protect aquifers and wetland communities through the use of Low Impact Development (LID) design measures that are based on the site-specific conditions encountered.

We trust that this report will be satisfactory for your current needs. If you have any questions or require further information, please contact our office at your convenience. This report is subject to the Statement of Limitations provided at the end of this report.

Yours truly,

Jason Cole, M.Sc., P.Geo.
VP, Principal Hydrogeologist

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1. Introduction

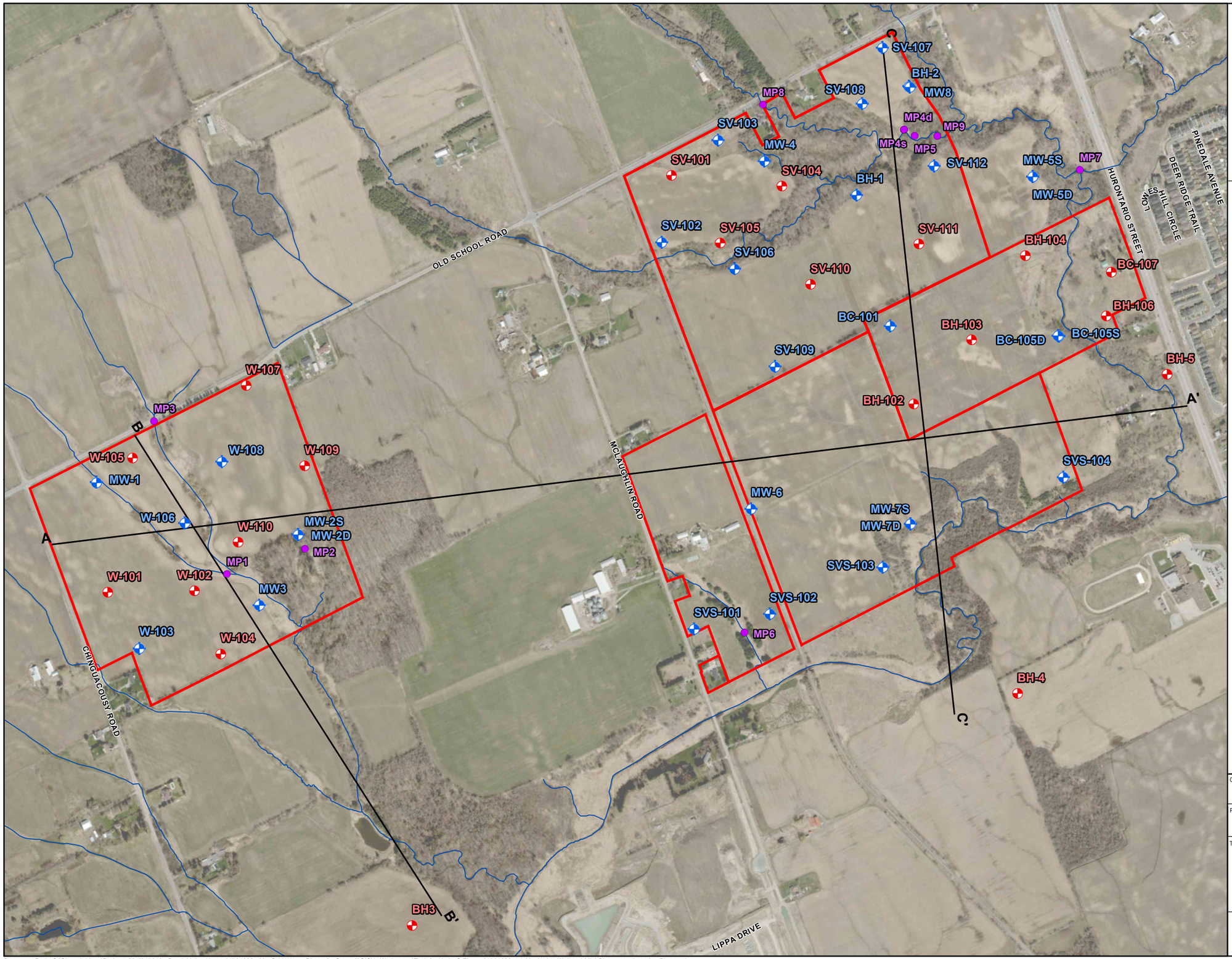
Palmer was retained by Brookvalley Project Management Inc. (Brookvalley) to complete a Hydrogeological Investigation Report as part of a Draft Plan of Subdivision (DPS) for the Mayfield West Phase 2 Stage 3 (MW2-3) project (referred to as the "site" or "study area"). The study area is approximately 430 hectares (ha) in size, with approximately 208 ha of tableland development area, and is bounded to the north by old school Road, to the west by Chinguacousy Road to the east by Highway 10, and to the south by Etobicoke Creek (**Figure 1**). The site is within the jurisdiction of the Toronto and Region Conservation Authority (TRCA) and is situated within the Etobicoke Creek Watershed. The Draft Plan Concept, created by MGP (February 2024), is provided in **Appendix A**.

Palmer Hydrogeologists have been actively working on the site since 2017 collecting groundwater and wetland water level data. This work was focused on characterizing groundwater and surface water interactions within the wetland communities and watercourse present on the site. A series of groundwater monitoring wells were installed across the MW2-3 site, and wetland communities and Etobicoke Creek (including tributaries) were instrumented with wetland mini piezometers (MP) to measure groundwater and surface water levels. The intent of this work was to build on previous work that was completed within the site to better understand the sites hydrogeologic properties. Furthermore, Palmer will utilize the monitoring well and borehole data from Soil Engineers Ltd (SEL) to provide an updated hydrogeological investigation. Finally, Palmer will update the water balance based on updated Draft Plans, and complete infiltration testing at selected locations on site to support future planning of Low Impact Development (LID) measures.

1.1 Scope of Work

The Scope of work for Palmer's 2023/2024 Hydrogeological Assessment includes the following tasks:

- Support SEL with planning the 2023 borehole drilling and groundwater monitoring well installation program;
- Collect two (2) rounds of groundwater level and wetland water level monitoring (December 2023, January 2024) at all groundwater monitoring wells (new SEL wells and old Palmer wells) and the wetland/stream piezometers to supplement the 2017 – 2020 data already obtained;
- Develop the new SEL monitoring wells and complete in-situ hydraulic testing at 50% of the new locations;
- Complete twelve (12) percolation tests using a Guelph Permeameter to measure the in-situ infiltration rate of the soils to assess LID design;
- Update the Pre-Development Water Balance and complete a Post-Development Water Balance for the overall lands based on the 2024 Draft Plan (Appendix A, MGP, 2024);
- Complete a hydrogeological assessment for two (2) bridge crossing locations for Street A and Street C, including dewatering and groundwater management recommendations;
- Assess the potential effects on local groundwater users through the completion of a roadside potable water well screening of all properties within 250 m of the site; and
- Hydrogeological data analysis, updated cross sections, and water level hydrographs; and, preparation of a Hydrogeological Investigation Report.



KEY MAP

LEGEND

- Monitoring Well
- Borehole
- Mini-Piezometer
- Cross Section Location
- Watercourse[1]
- Site Boundary

1. LIO/Field confirmed at site areas

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METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

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Brookvalley Project Management Inc.

PROJECT
Mayfield West - Phase 2 - Stage 3

TITLE
Monitoring Well and Mini-Piezometer Location Plan

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REF. NO. 1701628-1-1

Figure 1

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2. Regional Conditions

2.1 Geological and Hydrogeological Setting

2.1.1 Physiography and Topography

The site is located within the South Slope physiographic region (Chapman and Putnam, 1984), which lies between the Oak Ridges Moraine (ORM) and the Peel Plain. The South Slope was formed along the shorelines of the Iroquois Plain and is characterized by predominately clay till soils derived from former glacial lakes. The South Slope begins on the south side of the Niagara Escarpment, and slopes downwards towards Lake Ontario. Local to the site, topography slopes towards Etobicoke Creek and its tributaries. Surface elevation varies between approximately 255 meters above sea level (masl) and 270 masl.

2.1.2 Surficial Geology

Recent deposits of alluvial silts, sands, and gravels (**Modern Alluvium**) are found in the Etobicoke Creek Valley (**Figure 2**). The Etobicoke Creek follows an ancestral valley system which has subsequently infilled with modern and historical alluvium (TRCA, 2010). These soils have been described as undifferentiated gravels, sands, silts, and muck (Karrow, 2005).

The **Halton Till** overlies the majority of the study area, and consists of clayey silt to silty clay textured till representing the final advance of ice at the end of the Wisconsinan glaciations (**Figure 2**). Typically, this unit is between 3 and 6 m in thickness, however, locally can exceed 15 to 30 m west of Brampton. It has a predominantly silty clay to silt matrix, and contains isolated lenses of laminated sand, silt, and clay. Regionally the unit acts as a surficial aquitard, with hydraulic conductivities ranging from 10^{-10} m/sec to 10^{-6} m/sec (Sharpe et al., 1996), however can often provide sufficient water for residential use where isolated sand lenses occur. Within the till soils, groundwater flow is typically downwards towards the more permeable bedrock aquifer. The water table is commonly high (or perched) within the till due to the poorly drained nature of the soil, that is unless it is drained by underlying ORM deposits which is the preferential pathway for groundwater flow and transport where present.

2.1.3 Bedrock Geology

Bedrock at the site is characterized as Queenston Shale (**Figure 3**), and is described as Upper Ordovician aged, dark red, hematic shale interbedded with grey to green limestone and occasionally sandstone. Shale of the Queenston Formation does not fracture readily and is reportedly compact and dense with relatively poor interconnectivity of pore spaces (Singer et al., 2003). It is expected that the depth to bedrock at the site is approximately 17 to 25 mbgs according to the bedrock found in MECP Well IDs # 4908096 and 4904291, respectively.

LEGEND

Site Boundary

Watercourse[1]

Surficial Geology[2]

Phanerozoic / Cenozoic / Quaternary / Recent

- 20: Organic deposits *(peat, muck, marl)*
- 19: Modern alluvial deposits *(clay, silt, sand, gravel, may contain organic remains)*

Phanerozoic / Cenozoic / Quaternary / Pleistocene

- 12: Older alluvial deposits *(clay, silt, sand, gravel, may contain organic remains)*
- 9c: Coarse-textured glaciolacustrine deposits *(Foreshore and basinal deposits)*
- 8a: Fine-textured glaciolacustrine deposits *(Massive-well laminated)*
- 8b: Fine-textured glaciolacustrine deposits *(Interbedded silt and clay and gritty, pebbly flow till and rainout deposits)*
- 7: Glaciofluvial deposits *(river deposits and delta topset facies)*
- 7a: Glaciofluvial deposits *(Sandy deposits)*
- 7b: Glaciofluvial deposits *(Gravelly deposits)*
- 6: Ice-contact stratified deposits *(sand and gravel, minor silt, clay and till)*
- 5b: Tilll *(Stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain)*
- 5d: Tilll *(Clay to silt-textured till [derived from glaciolacustrine deposits or shale])*

Phanerozoic / Paleozoic

- 4: Bedrock-drift complex in Paleozoic terrain
- 3: Paleozoic bedrock

1. LIO/Field confirmed at site areas
2. Ontario Geological Survey 2010 (Mapped at 1:50,000). Surficial geology of southern Ontario; Ontario Geological Survey. Miscellaneous Release- Data 128 - Revised

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Mayfield West - Phase 2 - Stage 3

TITLE
Surficial Geology

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REF. NO. 1701628-2-1

Figure 2

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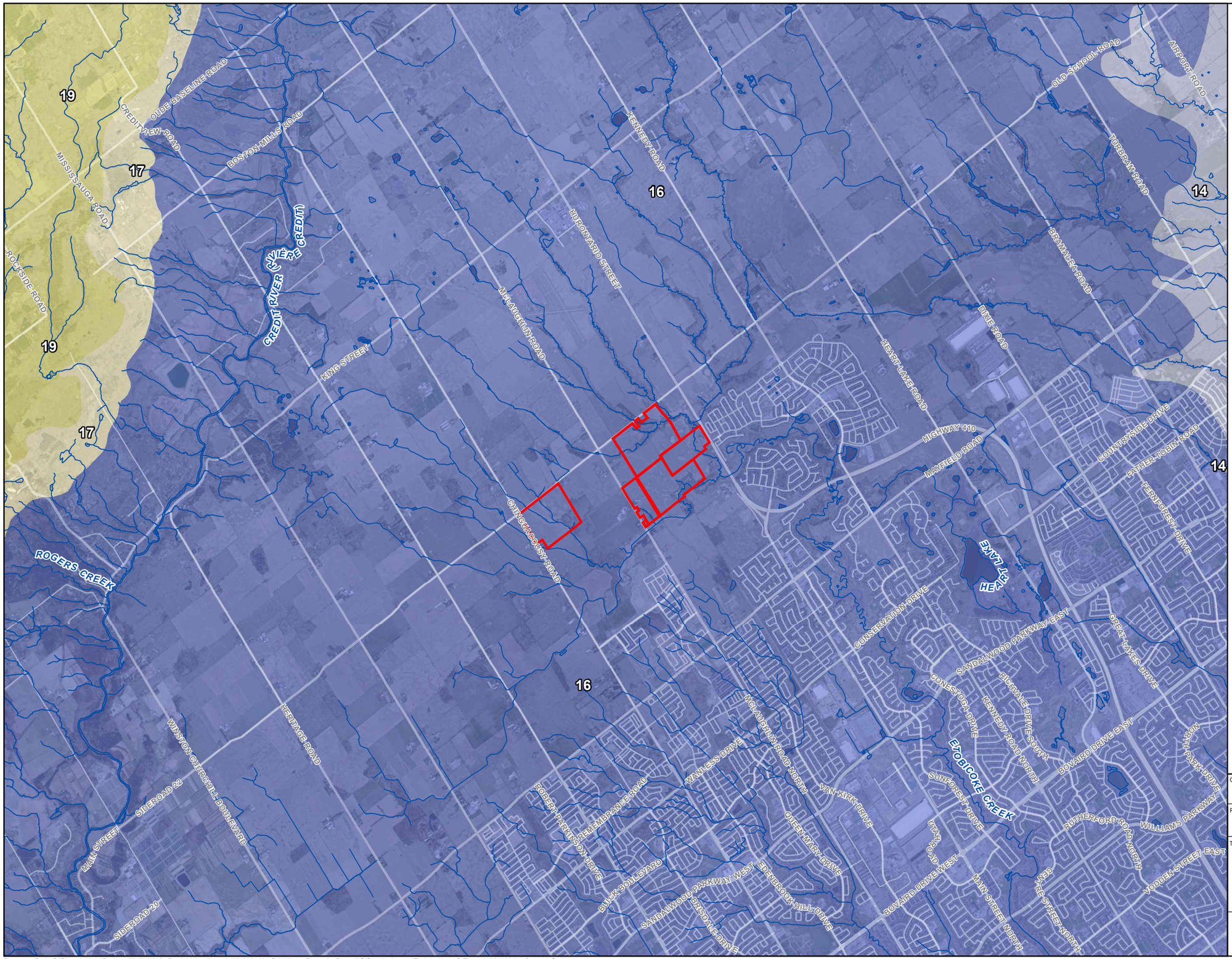

LEGEND

- Site Boundary
- Watercourse[1]

Paleozoic Bedrock Geology[2]

Lower Silurian

- 19: Amabel *(dolostone; thick-bedded, crinoidal, locally biohermal; includes bituminous dolostone)*
- 17: Clinton-Cataract Group *(shale, sandstone, dolostone, limestone units)*

Upper Ordovician

- 16: Queenston *(shale, siltstone, minor limestone and sandstone)*
- 14: Georgian Bay *(shale and limestone)*

1. LIO/Field confirmed at site areas
2. Armstrong, D.K. and Dodge, J.E.P. Paleozoic Geology Map of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 219

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Mayfield West - Phase 2 - Stage 3

TITLE
Bedrock Geology

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REF. NO. 1701628-3-1

Figure 3

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2.1.4 Regional Aquifers and Aquitards

Hydrostratigraphic units can be subdivided into two distinct groups based on their capacity to permit groundwater movement: an aquifer or an aquitard. An aquifer is classically defined as a layer of soil permeable enough to permit a usable supply of water to be extracted. Conversely, an aquitard is a layer of soil that inhibits groundwater movement due to its low permeability. The major regional hydrostratigraphic units at the site are described below.

The Halton Till consists of clayey silt to silt textured till, and forms a regional aquitard at the site. Generally, groundwater flow through these soils is predominantly downwards (vertical), providing recharge (albeit limited) to deeper aquifers. Shallow groundwater flow is expected to mimic site topography and generally flow towards major creek valleys (i.e., Etobicoke Creek). The hydraulic conductivity of the Halton Till ranges between 10^{-10} m/sec to 10^{-6} m/sec (Sharpe et al., 1996). More permeable sand and gravel lenses are known to occur within the Halton Till, which can provide sufficient water for domestic supply and provide localized areas of groundwater discharge to support streams and wetlands.

The Oak Ridges Moraine Aquifer Complex (ORMAC) is a significant regional aquifer in Southern Ontario due to its predominantly sandy surface soils and hummocky topography. It is identified by OGS mapping to occur approximately 12 km north of the site, however ORMAC sediments that have extended south were identified within the project boundary through borehole drilling results (**Figure 2**). These sediments were observed at surface near Etobicoke Creek south of Old School Road where Halton Till was found to be absent at surface, and beneath the Halton Till through the rest of the site. South of Etobicoke Creek the ORMAC sediments tend to thin and pinch out. The hydraulic conductivity of the ORMAC sediments is generally in the range of $3x10^{-6}$ m/sec to $7x10^{-3}$ m/sec (Sharpe et al., 2003), and is tapped by numerous private wells near the study area.

The Newmarket Till acts as a significant regional aquitard at the study area. It is a poorly sorted sandy silt to sand till that forms a thick aquitard unit of fine textured sediments. This limits groundwater recharge and contaminant migration, however thin discontinuous sand layers present in the till cause some heterogeneity. The hydraulic conductivity of the till generally ranges between 10^{-11} to 10^{-9} m/sec (Sharpe et al., 2003), however more permeable regions may have hydraulic conductivity values between 10^{-6} to 10^{-2} m/sec (Fenco-Mclaren, 1994).

The Queenston Shale bedrock is present underlying the site and surrounding region, including much of the Caledon and Brampton area. Generally, the bedrock forms a regional confining unit that limits groundwater movement to deeper bedrock aquifers, however the upper 3 – 6 m can be more highly weathered and can provide significant water for groundwater supplies. The hydraulic conductivity of the shale bedrock is typically in the range of 10^{-8} to 10^{-5} m/sec (Lee and ESG International, 2002). The well yield from the weathered zone is typically low but can be sufficient for residential use.

2.1.5 Source Water Protection

The site is located within the CTC Source Protection Area. The CTC Source Water Protection Plan identifies four main regulatory factors under the Clean Water Act (2006) relating to local hydrogeology to consider for site development: Significant Groundwater Recharge Areas (SGRAs), Highly Vulnerable Aquifers (HVAs), and Wellhead Protection Areas (WHPAs), and Intake Protection Zones (IPZs).

A Wellhead Protection Area (WHPA) is the area around the wellhead where land use activities have the potential to affect the quality or quantity of water that flows into the well. These areas are delineated into zones of vulnerability (A, B, C, and D) based on the time of travel of water into the well, and zones around a surface water body influencing a Groundwater Under Direct Influence (GUDI) (E, F). Other zones (Q1, and Q2) are defined as the areas where new water takings or reduced recharge could impact the quantity of water available to municipal supply wells. IPZs are the area on the water and land surrounding a municipal surface water intake. HVAs are aquifers that are susceptible to contamination as a result of the soil structure/material or due its location near the ground surface. Lastly, SGRAs are areas where recharge is important to maintain the water level in a community drinking water aquifer.

The site is not located within any WHPA-A to D, IPZs, SGRAs, or WHPA Q1 or Q2 areas. There are HVAs scattered across the site with a vulnerability scoring of 6 (**Figure 4**)**.** Based upon this assessment, there are no significant restrictions to development within the MW2-3 lands from Source Water Protection Policies and that changes to the post-development infiltration rates should be focused on the potential impacts to features.

2.1.6 MECP Water Wells

Water well Records (WWRs) were compiled from the Ontario Ministry of the Environment, Conservation and Parks (MECP) database, and reviewed to determine the number of water wells documented within a 500 m radius of the site boundaries. The locations of the MECP WWRs are shown in **Figure 5**.

The MECP WWR database indicates that one-hundred and five (105) wells are located within the 500 m radius of the site, referred to from here as the Study Area. Of these, fifty (50) are for domestic, ten (10) are for domestic and livestock use, twenty-seven (27) are for monitoring, one (1) listed as for livestock, one (1) for listed as for public use, and six (6) with no use. Finally, there were ten (10) records where there is no well use indicated. Upon review of the WWRs within the Study Area, static groundwater level ranged from 0.9 to 14.6 mbgs (meters below ground surface), with depth of bedrock ranging from 6.4 to 53.5 mbgs.

There were 60 records with domestic as part of their classification, and it is understood that groundwater is used as a source of water for the residents within the Study Area as the area is within a rural land use, however it is expected that municipal water will be available in the near future. A door-to-door water well survey is recommended as part of the Environmental Implementation Reporting (EIR) stage to confirm the presence/absence of active potable groundwater wells. A summary of wells is provided in **Table 1.**

Table 1. Summary of MECP Water Well Records

Classification		Record Number
Water Use	Livestock	1
	Domestic	50
	Domestic and Livestock	10
	Monitoring	27
	No Use	6
	Public	1
	Unknown/No Use Stated	10

LEGEND

- Site Boundary
- Watercourse[1]

Source Water Protection[2]

- Highly Vulnerable Aquifer

1. LIO/Field confirmed at site areas
2. *Source Protection Information Atlas*, MECP © King's Printer for Ontario 2024

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TITLE
Source Water Protection Areas

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REF. NO. 1701628-4-1

Figure 4

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LEGEND

- Site Boundary
- 500m Site Buffer
- Watercourse[1]

Water Well within 500m²

by Well Use

- Water Supply
- Test Well/Monitoring Well
- N/A

1. LIO/Field confirmed at site areas
2. MECP

0 100 200 300 400 500

METRE SCALE

North American Datum 1983
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TITLE
MECP Water Well Records within 500m of Site

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Figure 5

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3. Site-Specific Conditions

3.1 Borehole Drilling and Monitoring Well Installation

A borehole drilling investigation was completed by Soil Engineers Ltd. (SEL) at the site for geotechnical and hydrogeological purposes from October 10 – 23, 2023. Monitoring well construction was confirmed by Palmer staff. Thirty four (34) boreholes (BC-101, BC-102, BC-103, BC-104, BC-105s/d, BC-106, BC-107, SV-101, SV-102, SV-103, SV-104, SV-105, SV-106, SV-107, SV-108, SV-109, SV-110, SV-111, SV-112, SVS-101, SVS-102, SVS-103, SVS-104, W-101, W-102, W-103, W-104, W-105, W-106, W-107, W-108, W-109, and W-110) were drilled by SEL. Under the recommendations of Palmer staff, monitoring wells were installed from depths ranging from 6.2 to 15.7 mbgs. **Table 2** presents a summary of the boreholes and monitoring well installations.

Borehole drilling was completed using solid stem auger methods, and soil samples were collected using a 0.61 m long split spoon. Each borehole was completed as a 51 mm diameter monitoring well using schedule 52 PVC pipe and a 1.5 m long screen. The location of each borehole is presented on **Figure 1,** and the details of the installed monitoring wells are provided on **Table 2**. Nested wells, which consisted of one deep and one shallow monitoring well, were installed at MW-2s/d, MW-5s/d, MW-7s/d, and BC-105s/d. The borehole logs completed by SEL are presented in **Appendix B1.**

Borehole drilling investigations at the site for hydrogeological purposes were previously completed from November 13 – 15, 2017 by Palmer staff. Eleven (11) boreholes (MW-1, MW-2s/d, MW-3, MW-4, MW-5s/d, MW-6, MW-7s/d, MW-8) were drilled by DrillTech Ltd. under the supervision of Palmer staff, to depths ranging from 7.85 to 12.80 mbgs.

In addition, monitoring wells that were previously installed by AMEC Earth and Environmental (AMEC) (now called WSP) and Palmer as part of the Mayfield West Phase 2 Secondary Plan Comprehensive Environmental Impact Study and Management Plan (CEISMP) (AMEC, 2010) were utilized as part of this study. The locations of the applicable AMEC wells (BH1 and BH2) are shown on **Figure 1**. The available details for these monitoring wells are provided in **Table 2**, and available borehole logs are provided in **Appendix B2 and Appendix B3.**

Table 2. Monitoring Well Details

BH ID	Surface Elevation (masl)	Stickup (m)	Depth (mbgs)	Screened Interval (mbgs)	Screened Unit
SV-102	264.58	1.01	6.02	4.3 – 5.8	(ORM or Equivalent) Silty Fine Sand to Sandy Silt, trace clay
SV-103	264.10	1.01	6.20	4.6 – 6.1	(ORM or Equivalent) Silty Fine Sand to Sandy Silt, trace clay
SV-106	264.91	0.85	7.36	6.1 – 9.1	(ORM or Equivalent) Silty Fine Sand to Sandy Silt, trace clay
SV-107	265.08	0.93	10.40	9.2 – 10.7	(ORM or Equivalent) Silt to fine sand, trace clay and fine sand
SV-108	264.29	0.98	10.41	9.2 – 10.7	(ORM or Equivalent) Silty fine sand to sandy silt, trace clay
SV-109	263.55	0.84	6.17	4.6 – 6.1	(ORM or Equivalent) Silty fine sand to sandy silt, trace clay
SV-112	262.92	0.85	6.26	4.6 – 6.1	(Newmarket Till) Silty clay till to silty fine sand to sandy silt, trace clay
BC-101	262.42	0.93	6.15	4.6 – 6.5	(Newmarket Till) Silty Clay, trace sand
BC-105S	260.13	0.92	7.69	6.1 – 7.5	(Newmarket Till) Silt, fine sand and trace clay
BC-105D	260.11	0.91	14.94	13.7 – 15.2	(ORM or Equivalent) Sandy silt till, to silty clay till
SVS-101	261.60	1.02	15.27	13.7 – 15.2	(Queenston Formation) Silty clay to shale bedrock
SVS-102	260.56	0.87	6.00	4.6 – 6.1	(ORM or Equivalent) Sandy silt to sandy silt till, trace clay
SVS-103	259.00	0.97	5.89	4.6 – 6.1	(ORM or Equivalent) Sandy silt, trace clay and trace gravel
SVS-104	257.98	0.93	6.19	4.6 – 6.1	(Newmarket Till to ORM or Equivalent) Silty clay till to silt, trace sand and trace clay
W-103	264.85	0.89	5.64	4.6 – 6.1	(Newmarket Till) Silty clay till to silt, some sand to sandy, trace grave and clay
W-106	265.52	0.95	6.11	4.6 – 6.1	(Newmarket Till) Sandy silt till, trace clay and gravel
W-108	267.55	0.68	5.54	4.6 – 6.1	(Newmarket Till) Sandy silt till, trace clay and gravel
BH-1	263.24	0.48	7.77	6.05 – 9.10	(ORM or Equivalent) Sandy silt, trace gravel, trace clay
BH-2	264.14	0.73	6.38	6.05 – 9.10	(ORM or Equivalent) Sandy silt, trace gravel, trace clay
MW-1	268	-	-	4.57 – 6.02	(ORM or Equivalent) Sand and silt
MW-2S	268	0.66	5.14	3.04 – 4.57	(Newmarket Till) Clayey silt to silty clay till
MW-2D	268	0.67	9.06	6.09 – 9.14	(Newmarket Till) Clayey silt to silty clay till
MW-4	266	0.73	7.90	6.09 – 7.62	(ORM or Equivalent) Fine to medium sand and silt
MW-5S	260	0.58	6.33	4.57 – 6.09	(ORM or Equivalent) Silt and fine sand
MW-5D	260	0.52	10.91	9.14 – 10.66	(ORM or Equivalent) Silt and fine sand
MW-6	263	0.58	4.73	3.65 – 5.18	(ORM or Equivalent) fine sand and silt, some clay
MW-7S	259	0.75	5.85	4.57 – 6.09	(ORM or Equivalent) Fine sand, silt, and some clay
MW-7D	259	0.78	10.71	9.14 – 10.66	(Newmarket Till) Clayey silt till, some sand, trace clay
MW8	265	0.76	8.83	9.75 – 11.27	(ORM or Equivalent) Fine to coarse sand, some silt

3.2 Site Specific Geology and Soil Profile

The subsurface stratigraphy of the site encountered during borehole drilling is summarized below based on the 2023 geotechnical drilling program and referencing previous on-site drilling programs. Detailed borehole logs are provided in **Appendix B**, and soil grain sizes are provided in **Appendix C**. Three (3) hydrostratigraphic cross sections through the site were interpreted based on borehole drilling investigations by Palmer, as well as drilling results reported by AMEC (2010), and are provided in **Figures 6, 7, and 8**. Cross sections were completed through three transects labeled A-A', B-B', and C-C' (noted on **Figure 1**) within the MW2-3 lands. In addition to boreholes drilled by Palmer, the cross sections incorporate borehole logs completed by AMEC (2010).

The following soil condition, and their associated hydrostratigraphic units were encountered and interpreted in MW2-3 study area over the depth of drilling:

Topsoil: All boreholes encountered topsoil that ranged in thickness from 0.10 m (SVS-104) to 1.45 m (MW-2, MW-3, MW-5s/d, and MW-6). Topsoil is generally described as loose fine sand, silt, and clay, with some organics. Generally, the soil material was moist to dry, and brown in colour.

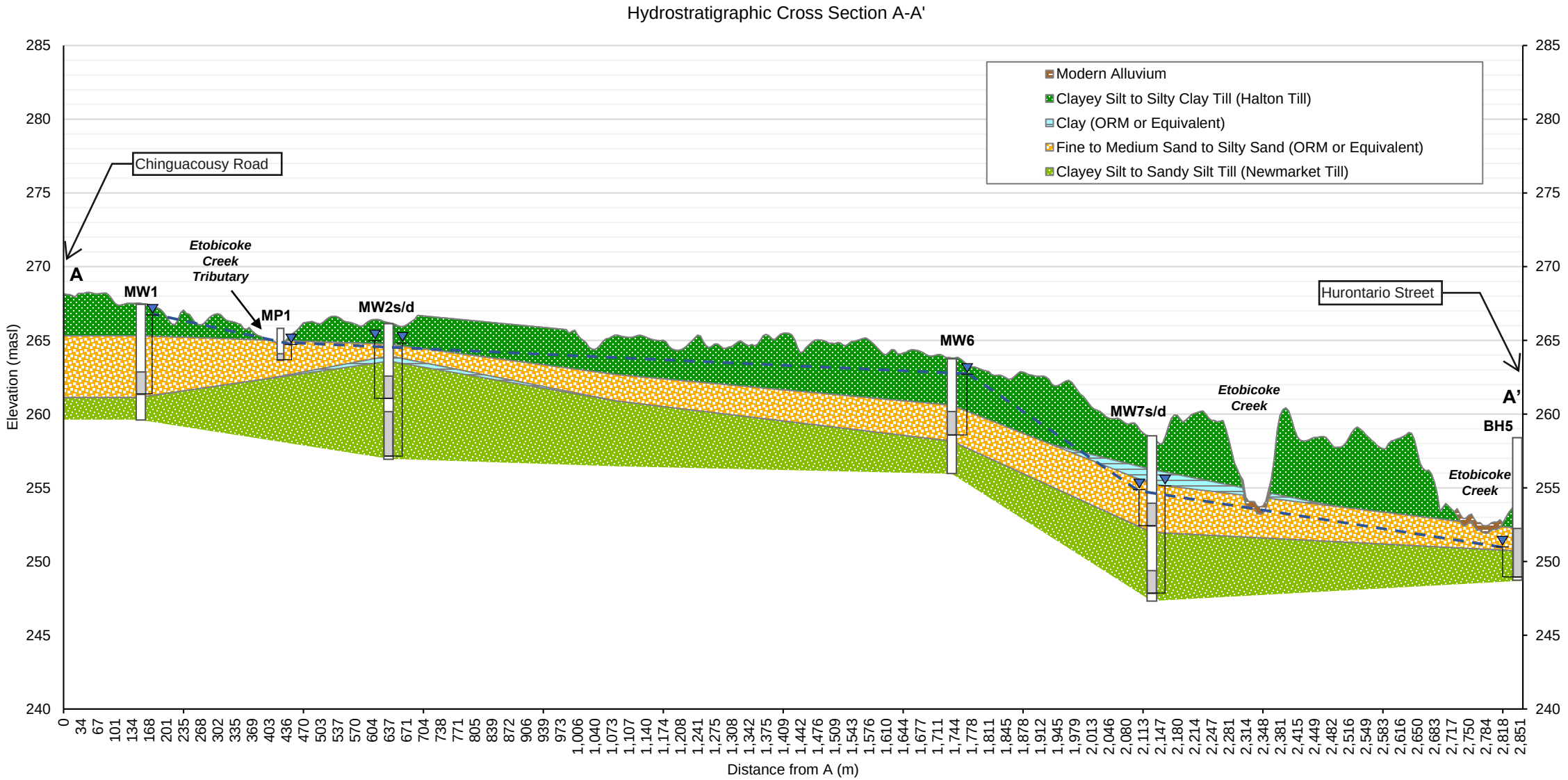
Sandy Silt: An upper layer of sandy silt was seen across BS-101 to 103, SV-102 to SV-106, and SV-111. At these wells, the sandy silt layer would underly the topsoil and typically overly silty clay till (the sandy silt layer at SV-111 overlies a silt layer). This unit is mainly described as brown and loose sandy silt with occasional sand seams and layers. The thickness of this unit ranged from 0.39 m (SV-105) to 1.2 m (BC-103). Note that at BC-104 rather than a sandy silt layer underlying the topsoil there was a sandy silt/silty fine sand layer with a thickness of 0.39 m.

Clayey Silt Till and Silty Clay (Halton Till): A surficial unit of clayey silt till was encountered in MW-1, MW-5s/d, MW-6, MW-7s/d, and all AMEC wells (BH-1 – BH6). Halton Till was encountered across the majority of BC, SV, SVS, and W series wells (not found in W-106 and W-110) and would either underly or overly the sandy silt layer. If the Halton Till was overlying the sandy silt unit it would act as the surficial unit below the topsoil. This unit is described as very stiff brown clayey silt to silty clay till with some sand, gravel, and occasional cobbles. The unit thickness ranged from 0.8 m (BH-2) to 6.7 m (BH-4).

Fine to Medium Sand and Silt (Oak Ridges Moraine Aquifer Complex or Equivalent): A laterally extensive unit of fine and medium sand and silt with some clay was encountered in most boreholes (not found in BC-101 to 103, and W-109). The thickness ranged between 0.7 m (SV-111) to 9.0 m (SV-107 and SC-108). Note that the lower extent of the unit could not be determined at some wells (MW-8, SV-101 to SV-104, SV-107 to SV-110, SV-112, SVS-103, W-101 and W-103 to W-105) as the depth of the borehole did not exceed the depth of the silt and fine sand. The ORMAC sediments were encountered directly under either the topsoil sediments at borehole locations BC-104, SV-110, SV-111, W-106, and W-110.

Clay: Layers of fine-textured glaciolacustrine clay were noted either underlying or overlying the ORM sediments at MW-2s/d, MW-3, MW-4, MW-5s/d, and MW-7s/d. The thickness of the clay layers ranged from 0.26 m (MW-3) to 1.88 m (MW-4).

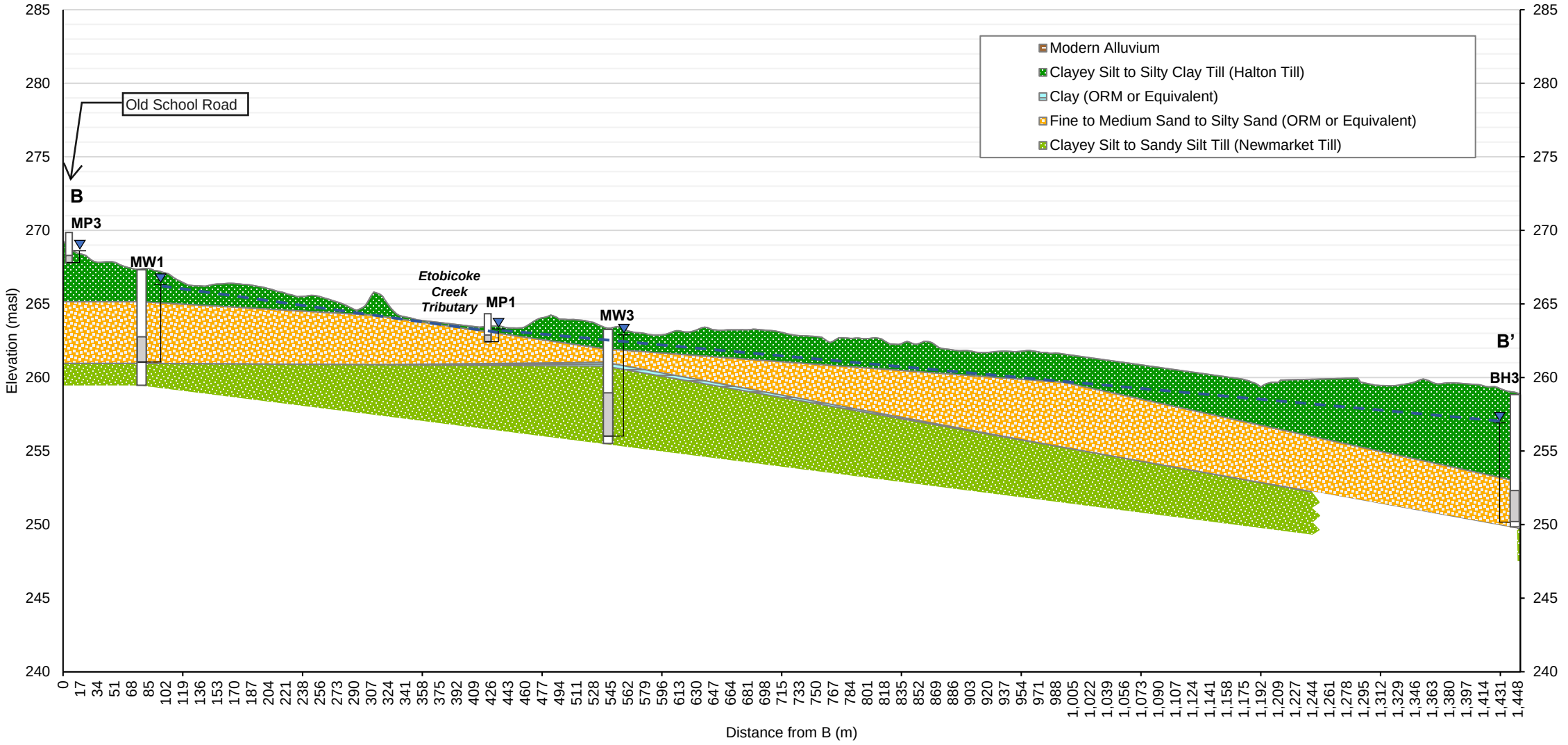
Sandy Silt to Silty Sand Till and Lower Silty Clay (Newmarket Till): A lower till unit, interpreted to be the Newmarket Till Formation was encountered in all boreholes except MW-8, BH-1, BH-2, BH-3, SV-101, SV-102 to SV-104, SV-107, SV-108, SV-110, SV-112, SVS-103, and W-103 to W-105. This unit is generally described as red/brown silty clay to sandy silt till with some sand, gravel, and cobbles. The red/brown colouration of the soils is a result of the erosional material from the underlying Queenston Shale bedrock during glaciation. The depth to the Newmarket Till from the surface ranged from 2.6 mbgs (MW-2s/d) to 11.9 mbgs (BC-105D). The majority of boreholes where the Newmarket Till was encountered were terminated within this unit (SV-109 terminated in Silty Fine Sand/Sandy Silt [ORMAC], SVS-101 terminated in underlying Shale Bedrock).



Hydrostratigraphic Fence Diagram A-A'
Mayfield West Phase 2 Stage 3

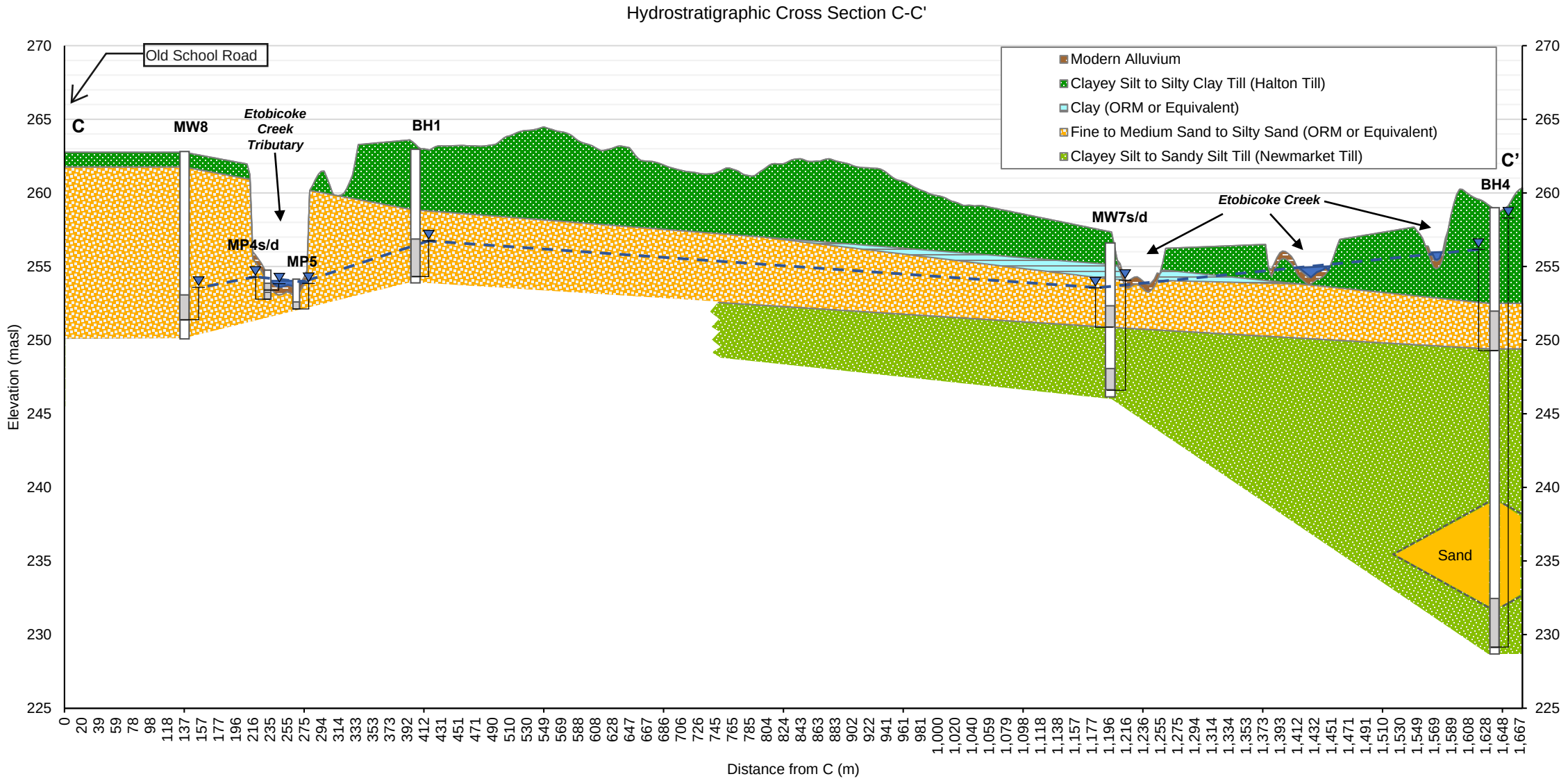
FIGURE 6
Project Number: 1701628

Hydrostratigraphic Cross Section B-B'



Hydrostratigraphic Cross Section B-B'
Mayfield West Phase 2 Stage 3

FIGURE 7
Project Number: 1701628



Hydrostratigraphic Cross Section C-C'
Mayfield West Phase 2 Stage 3

FIGURE 8
Project Number: 1701628

3.3 Groundwater Level and Flow

Groundwater levels were monitored by Palmer staff for a period between October 2017 and May 2022, with additional monitoring events occurring in December 2023 and January 2024 to provide updated winter water level data. A water level tape was used to measure the depth to water level to the nearest centimeter. The monitoring data collected to date is provided in **Table 3** and **Table 4.** A groundwater level hydrograph is provided in **Figure 9**. Generally, these results indicate shallow groundwater depths ranging between 0.02 mbgs (MW-2D) and 9.14 mbgs (MW-8). It is expected that local shallow groundwater flow follows topography and is directed towards the valleylands of Etobicoke Creek and its associated tributaries. Previous water level data collected and reported by AMEC (2010) at monitoring wells BH-1 to BH-6 from April 23, 2009, to October 22, 2009, is also included for reference.

The ranges of groundwater water levels in the Fall of 2023 and Winter of 2024 were found to be within previously reported and manually measured data. The shallowest groundwater level observed over these recent monitoring events was recorded at MW-2S with a groundwater level of 1.46 mbgs on December 6th, 2023, while the deepest groundwater level observed was 8.83 mbgs (MW-8) on December 6th, 2023.

Deeper vertical groundwater movement at the site is hydraulically influenced by the higher permeability sand and silt soils of the ORMAC, and the upper weathered zone of the Queenston Shale bedrock compared with the Halton and Newmarket Till units. The vertical hydraulic gradient was noted at the three nested monitoring wells installed on site (MW-2s/d, MW-5s/d, and MW-7s/d). At MW-7s/d, the shallow and deep wells were installed within the ORMAC and the Newmarket Till units, respectively. The upwards gradient suggests groundwater flowing from the Newmarket Till towards the higher permeability ORMAC. A similar upwards gradient was noted at monitoring completed at BH-4s/d on April 23, 2009, by AMEC (2010) which also has wells screened in the Newmarket Till and ORMAC sediments. At MW-2s/d, both the shallow and deep screened zones were installed within the Newmarket Till, and a downwards gradient was identified. This is potentially reflective of groundwater flowing downwards towards the higher permeability upper weathered zone of Queenston Shale bedrock.

Within the ORMAC Aquifer, it is expected that groundwater will flow laterally towards groundwater discharge areas within Etobicoke Creek. At MW-5s/d, both wells are screened within silt and fine to medium sand of the ORM. The near neutral gradient in these wells is therefore reflective of screening within the same geological unit and the predominance of lateral vs. vertical groundwater flow.

The interpreted groundwater flow for the MW2-3 lands is presented in **Figure 10**. On the land parcels east of McLaughlin Road, the groundwater flow matches the conceptual site model of horizontal groundwater flow focused within the ORMAC and flowing towards groundwater discharge areas in Etobicoke Creek. This pattern is less well defined on the west side of McLaughlin Road, where Halton Till soils were predominantly found over the drilling depths and groundwater is perched within the low permeability till soils. The deepest groundwater levels are found on the central-northern part of the site immediately south of Old School Road at BH-2, MW8, SV-107 and SV-108. Sandy soils from the ORMAC were found at surface in this area and have created a well-drained condition with a deep groundwater table hydraulically influenced by discharge within the wetlands and watercourses of the Etobicoke Creek valley near MP4s/d and MP5.

Table 3. Groundwater Monitoring Data from Previous Investigations (2009 to 2022)

MW ID	Screened Geology	Water Level Measurement (mbgs)																
		23-Apr-2009*	30-Jul-2009*	6-Aug-2009*	10-Sept-2009*	9-Oct-2009*	22-Oct-2009*	5-Dec-2017	10-Jan-2018	26-Feb-2018	26-Mar-2018	17-May-2018	13-Jun-2018	19-Jul-2018	27-Aug-2018	29-Oct-2018	16-Apr-2019	25-May-2022
MW1	ORM or Equivalent	-	-	-	-	-	-	1.38	1.49	0.66	0.82	0.41	0.88	1.22	1.40	1.58	0.19	0.48
MW2s	Newmarket Till	-	-	-	-	-	-	1.66	1.83	0.67	1.21	0.28	0.98	1.18	1.61	1.92	0.15	0.73
MW2d	Newmarket Till	-	-	-	-	-	-	1.74	1.98	0.84	1.32	0.41	1.12	0.94	1.73	1.99	0.02	0.77
MW3	Newmarket Till	-	-	-	-	-	-	0.59	0.7	0.06	0.34	0.12	0.49	0.80	0.89	0.88	-0.15	0.17
MW4	ORM or Equivalent	-	-	-	-	-	-	4.53	4.6	4.32	4.44	4.29	4.35	4.48	4.51	4.59	4.19	4.41
MW5s	ORM or Equivalent	-	-	-	-	-	-	5.74	5.79	5.34	5.56	5.23	5.5	5.76	5.84	5.84	5.21	5.33
MW5d	ORM or Equivalent	-	-	-	-	-	-	5.77	5.8	5.38	5.62	5.29	5.56	5.79	5.86	5.85	5.23	5.38
MW6	ORM or Equivalent	-	-	-	-	-	-	2.24	2.44	0.61	1.07	0.51	1.12	1.44	1.64	2.33	0.25	0.96
MW7s	ORM or Equivalent	-	-	-	-	-	-	3.91	4.02	2.33	3.57	3.01	3.65	4.33	4.33	4.11	2.26	3.26
MW7d	Newmarket Till	-	-	-	-	-	-	3.63	3.84	2.09	3.32	2.66	3.51	4.47	4.05	3.73	0.94	2.91
MW8	ORM or Equivalent	-	-	-	-	-	-	8.97	9.04	8.7	9.01	8.89	-	9.14	9.08	9.06	8.72	8.98
BH1	ORM or Equivalent	6.23	6.31	6.33	6.40	6.41	6.42	6.57	6.66	6.59	6.64	6.44	5.85	6.57	6.60	6.7	6.47	-
BH2	ORM or Equivalent	8.56	dry	-	dry	8.76	8.72	8.66	dry	8.37	8.68	8.56	dry	dry	dry	8.72	8.38	8.84
BH3	ORM or Equivalent	1.98	2.50	2.59	2.55	2.76	-	-	-	-	-	-	-	-	-	-	-	-
BH4s	ORM or Equivalent	3.10	3.53	3.64	3.63	3.68	3.65	-	-	-	-	-	-	-	-	-	-	-
BH4d	Newmarket Till	1.21	1.65	1.73	1.75	1.77	1.80	-	-	-	-	-	-	-	-	-	-	-
BH5	ORM or Equivalent	6.46	7.42	-	7.55	7.47	7.38	7.43	7.44	6.49	7.18	6.82	7.34	7.64	7.49	7.41	6.46	-
BH6	Newmarket Till	2.12	2.68	-	2.92	3.16	3.40	-	-	-	-	-	-	-	-	-	-	-

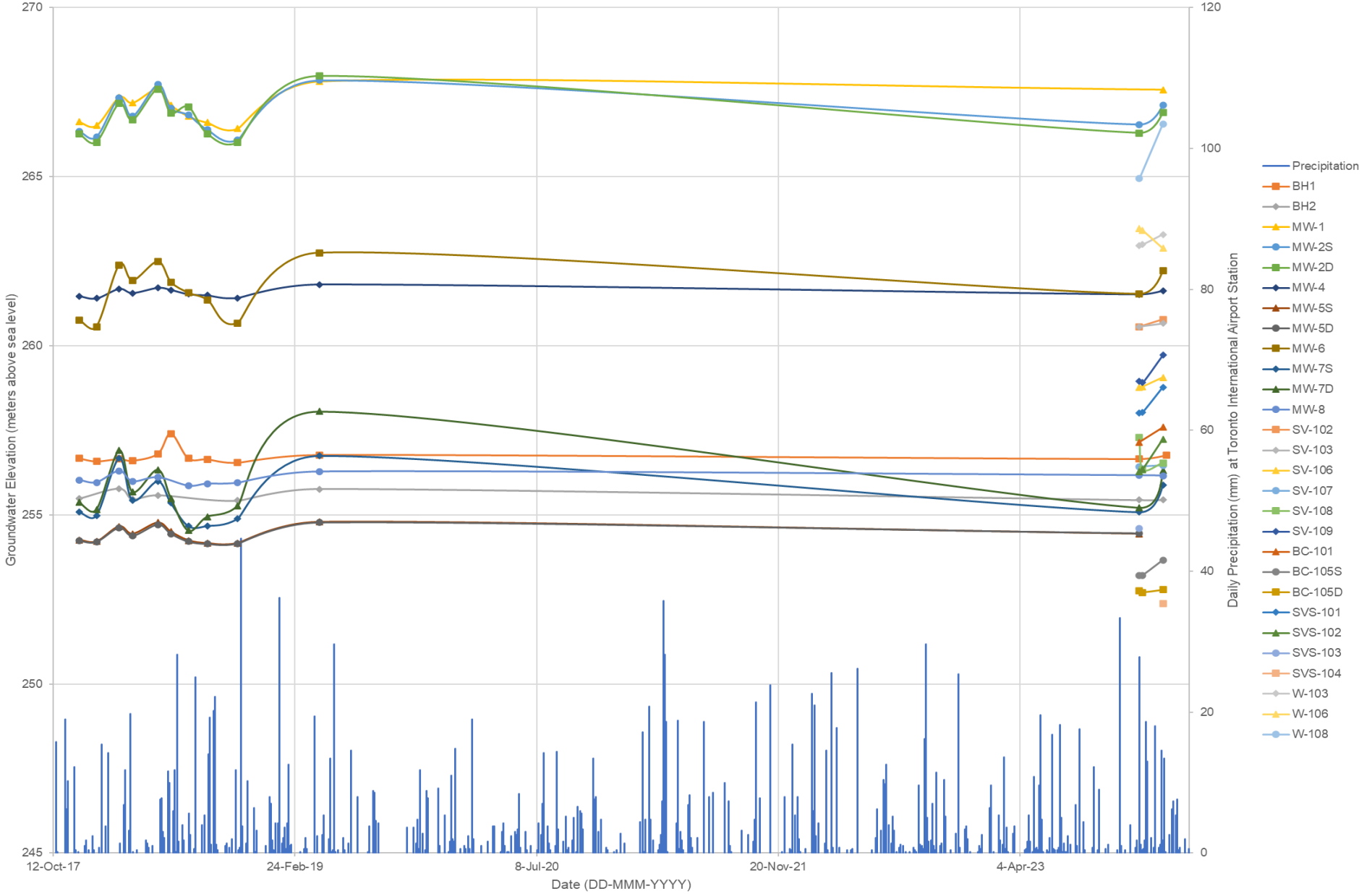
Notes: all groundwater levels in mbgs (meters below ground surface)

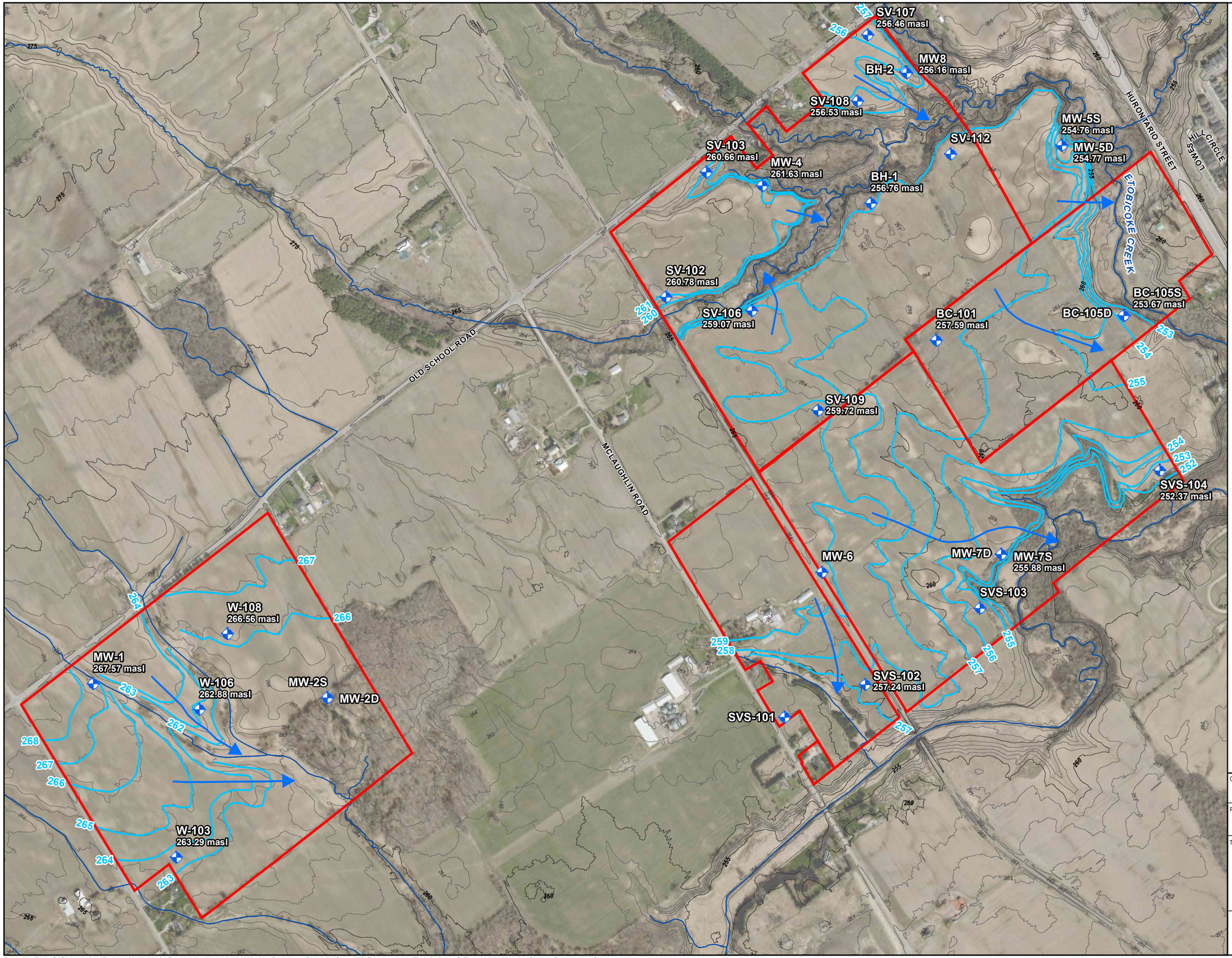
Table 4. Summary of 2023 and 2024 Groundwater Elevations

Well Information			Groundwater Levels											
MW ID	Ground Surface Elevation (masl)	Well Depth (mbgs)	06-Dec-2023			12-Dec-2023			24-Jan-2024			31-Jan-2024		
			mbtoc	mbgs	masl	mbtoc	mbgs	masl	mbtoc	mbgs	masl	mbtoc	mbgs	masl
SV-102	264.58	6.02	5.03	4.02	260.56	-	-	-	4.81	3.80	260.78	-	-	-
SV-103	264.10	6.20	4.55	3.54	260.56	-	-	-	4.45	3.44	260.66	-	-	-
SV-106	264.91	7.36	6.98	6.13	258.78	6.96	6.11	258.80	6.69	5.84	259.07	6.50	5.65	259.26
SV-107	265.08	10.40	9.58	8.65	256.43	-	-	-	9.55	8.62	256.46	-	-	-
SV-108	264.29	10.41	7.98	7.00	257.29	8.94	7.96	256.33	8.74	7.76	256.53	-	-	-
SV-109	263.55	6.17	5.45	4.61	258.94	5.48	4.64	258.91	4.67	3.83	259.72	-	-	-
SV-112	262.92	6.26	Dry			Dry			Dry			Dry		
BC-101	262.42	6.15	6.20	5.27	257.15	-	-	-	5.76	4.83	257.59	-	-	-
BC-105S	260.13	7.69	7.83	6.91	253.22	7.83	6.91	253.22	7.38	6.46	253.67	-	-	-
BC-105D	260.11	14.94	8.26	7.35	252.76	8.31	7.40	252.71	8.23	7.32	252.79	-	-	-
SVS-101	261.60	15.27	4.68	3.59	258.01	4.66	3.57	258.03	3.92	2.83	258.77	-	-	-
SVS-102	260.56	6.00	5.14	4.27	256.29	5.07	4.20	256.36	4.19	3.32	257.24	-	-	-
SVS-103	259.00	5.89	5.37	4.40	254.60	-	-	-	-	-	-	-	-	-
SVS-104	257.98	6.19	Dry			-	-	-	6.54	5.61	252.37	-	-	-
W-103	264.9	5.64	2.83	1.94	262.96	2.79	1.90	263.00	2.50	1.61	263.29	-	-	-
W-106	265.5	6.11	2.99	2.04	263.46	3.04	2.09	263.41	3.57	2.62	262.88	-	-	-
W-108	267.5	5.54	3.24	2.56	264.94	-	-	-	1.62	0.94	266.56	-	-	-
BH-1 (AMEC-1)	263.24	7.77	7.07	6.59	256.65	-	-	-	-	-	-	6.96	6.48	256.76
BH-2 (AMEC-2)	264.14	6.38	9.43	8.70	255.44	-	-	-	9.43	8.70	255.44	-	-	-
MW-1	268.00	6.02	Unable to find			-	-	-	1.08	0.43	267.57	-	-	-
MW-2S	268.00	5.14	2.12	1.46	266.54	-	-	-	1.54	0.88	267.12	-	-	-
MW-2D	268.00	9.06	2.38	1.71	266.29	-	-	-	1.77	1.10	266.90	-	-	-
MW-4	266.00	7.90	5.21	4.48	261.52	-	-	-	5.10	4.37	261.63	-	-	-
MW-5S	260.00	6.33	6.14	5.56	254.44	-	-	-	-	-	-	5.82	5.24	254.76
MW-5D	260.00	10.91	6.07	5.55	254.45	-	-	-	-	-	-	5.75	5.23	254.77
MW-6	263.00	4.73	2.05	1.47	261.53	-	-	-	1.36	0.78	262.22	-	-	-
MW-7S	259.00	5.85	4.67	3.92	255.08	-	-	-	3.87	3.12	255.88	-	-	-
MW-7D	259.00	10.71	4.57	3.79	255.21	-	-	-	3.46	2.68	256.32	-	-	-
MW8	265.00	8.83	9.59	8.83	256.17	-	-	-	9.60	8.84	256.16	-	-	-

Notes: mbtoc (meters below top of casing), mbgs (meters below ground surface), and masl (meters above sea level)

Figure 9: Groundwater Hydrographs





LEGEND

- Monitoring Well
- Watercourse[1]
- Shallow Groundwater Elevation Contour (masl)[2]
- Groundwater Flow Direction
- Surface Elevation Contour (1m)
- Site Boundary

1. LIO/Field confirmed at site areas
2. Water levels measured on Jan 24, 2024

0 100 200 300 400 500
METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

Scale: 1:8,000
Page Size: Tabloid (11 x 17 inches)

Drawn: CV
Checked: ZK
Date: Apr 5, 2024

Source Notes:
Imagery (2022) provided by Esri basemap service.
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NORTH

CLIENT
Brookvalley Project Management Inc.

PROJECT
Mayfield West - Phase 2 - Stage 3

TITLE
Shallow Groundwater Contours

Palmer PART OF SLR

REF. NO. 1701628-10-1

Figure 10

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3.4 Hydraulic Conductivity

3.4.1 In-Situ Single Well Response Testing

Palmer personnel conducted single well response tests at each monitoring well on a series of dates, December 12 and 13, 2023, February 26, 2018, January 10, 2018, and December 5 and 6, 2017, to determine the hydraulic conductivity (K) of the identified hydrostratigraphic units. Response tests included both slug testing and injection testing. Injection testing was completed only in the case where there was insufficient water in the monitoring well to successfully conduct a slug test.

Slug tests were completed by lowering a 1 m long slug into each well (slug test) to create a change in hydraulic head. Hydraulic conductivity values were estimated by measuring the rate of change in recovery of the water level once the slug was inserted into the well (also known as a Falling Head (FH) Test). Once the Falling Head Test was terminated, the slug was removed and the subsequent rate of change in the water level was recorded (also known as a Rising Head (RH) Test). Where slug testing was conducted on DrillTech Ltd. Drilled wells (MW-1, MW-2s/d, MW-3, MW-4, MW-5d, MW-6, and MW-7s/d) both rising head (RH) and falling head (FH) tests were completed. For slug testing on more recent Soil Engineering Ltd. Wells, tests were one of either falling head (SVS-102, SV-106, SV-108, SV-109, and BC-105s/d) or rising head (W-103 and W-106). Injection tests were completed where the water level within the well was too low to accommodate the length of the slug (MW-5s and MW-8). In these cases, approximately 2 L of water was instantaneously added to each well to create a change in hydraulic head

Water levels in each well were recorded using a datalogger set to record water levels at 2-second intervals. Manual water-level measurements were also collected during the tests to gauge recovery. Tests were terminated once either 80% recovery had been attained, or 30-minutes had elapsed, whichever occurred first.

K values were calculated using the displacement-time data and were analysed using the Hvorslev (1951) method for confined aquifers, and Bower and Rice (1976) method for unconfined aquifers, as modelled by Aqtesolv™ software. The analysis results are presented in **Appendix C**, and the range of calculated hydraulic conductivity values are summarized in **Table 5.**

3.4.2 Grain Size

The Puckett Method is typically used for calculating the hydraulic conductivity of low permeability clay and silt soils from grain size data (Puckett et al., 1985). This method utilizes the percentage of the total sample that is finer than 0.002 mm by weight. Puckett's method was utilized on the clayey silt till soil sample from BH-1 and was based on the grain size distribution curves completed by Terraprobe (2010) provided in **Appendix B2**. The resulting K value using this method is approximately $5.3x10^{-8}$ m/sec and are provided in **Table 5**.

The Hazen Method is typically used for calculating the hydraulic conductivity of more permeable sandy soils (Hazen, 1892), by incorporating the 10% "finer than" grain size data. Hazen's method was utilized on the silt and sand soil samples from BH-2, BH-3, BH-4, and BH-5, and was based on the grain size distribution curves completed by Terraprobe (2010) provided in **Appendix B2**. The resulting K values

using this method range from $1.0x10^{-7}$ m/sec (BH-5) to $2.3x10^{-6}$ m/sec (BH-2) and are provided in **Table 5.**

3.4.3 Summary of Hydraulic Conductivity Testing

For the purpose of summarizing values obtained from hydraulic conductivity testing, wells were sorted into groupings based on the hydrostratigraphic unit that each well was screened within. These groupings are Fractured Bedrock of the Queenston Formation, Halton Till, Oak Ridges Moraine (ORMAC) or equivalent, Sand/Gravel layer within Newmarket Till, and Newmarket Till. The geomean was taken for each groupings hydraulic conductivity (K) value to represent an average value (taking outliers into account). Likewise, the 90th percentile for hydraulic conductivity within each hydrostratigraphic unit to show a realistic higher end of the value.

Table 5. Summary of Hydraulic Conductivity Results

Hydrostratigraphic Unit	BH/MW ID	Test Type	Hydraulic Conductivity (K) [m/sec]	Geomean K [m/s]
Fractured Bedrock of The Queenston Formation	SVS-101	FH	1.3×10^{-6}	1.3×10^{-6}
Halton Till	AMEC-1	Grain Size	5.3×10^{-8}	5.3×10^{-8}
ORMAC	BC-105d	FH	5.0×10^{-7}	3.0×10^{-6}
	SV-106	FH	1.8×10^{-5}	
	SV-108	FH	7.1×10^{-7}	
	SV-109	FH	1.2×10^{-6}	
	SVS-102	FH	3.3 x -07	
	MW1	FH	1.3×10^{-6}	
		RH	1.0×10^{-6}	
	MW4	FH	1.4×10^{-5}	
		RH	6.1×10^{-6}	
	MW5s	Injection 1	1.9×10^{-6}	
		Injection 2	6.6×10^{-6}	
	MW5d	FH	9.9×10^{-7}	
		RH	1.9×10^{-6}	
	MW6	FH	6.4×10^{-6}	
		RH	9.9×10^{-6}	
	MW7s	FH	5.2×10^{-6}	
	MW8	Injection 1	3.4×10^{-5}	
		Injection 2	3.2×10^{-5}	
	AMEC-2	Grain Size	2.3×10^{-6}	
	AMEC-3	Grain Size	2.0×10^{-7}	
Sand/Gravel Layer Within Newmarket Till	MW2s	FH	1.3×10^{-6}	1.2×10^{-6}
		RH	6.3×10^{-7}	
	AMEC-4	Grain Size	2.0×10^{-6}	
Newmarket Till	BC-105s	FH	1.9×10^{-5}	7.2×10^{-7}

Hydrostratigraphic Unit	BH/MW ID	Test Type	Hydraulic Conductivity (K) [m/sec]	Geomean K [m/s]
	W-103	RH	6.0×10^{-7}	
	W-106	RH	2.3×10^{-6}	
	MW2d	FH	5.1×10^{-7}	
		RH	5.1×10^{-7}	
	MW3	FH	4.6×10^{-7}	
		RH	3.4×10^{-7}	
	MW7d	FH	4.3×10^{-7}	
	AMEC-5	Grain Size	1.0×10^{-7}	
	AMEC-6	Grain Size	8.4×10^{-7}	

Based on the results of the single well response testing and grain size analyses, the geometric mean hydraulic conductivity of the Queeston Formation is approximately 1.31×10^{-6} m/sec, Halton Till is approximately 5.3×10^{-8} m/sec, the ORM is approximately 3.0×10^{-6} m/sec, Sand/Gravel within Newmarket Till is approximately 1.2×10^{-6} and the Newmarket Till is approximately 7.2×10^{-7} m/sec. It should be noted that sand and gravel layers may exist within the Newmarket Till, such as the ones encountered at MW-2s and BH-4, that could increase the bulk hydraulic conductivity of the unit. Based on the results of slug testing completed at MW2s and the Hazen analysis on BH-4, the geometric mean K value of this layer is approximately 1.2×10^{-6} m/sec.

These values are comparable with previously reported values, which specified a K-values in the range of 10^{-10} to 10^{-6} m/sec for the Halton Till (IWA, 1994), 3×10^{-6} to 7×10^{-3} m/sec for ORMAC sediments (Sharpe et al., 2003), and 10^{-11} to 10^{-9} m/sec for the Newmarket Till (Sharpe et al., 2003) with regions of higher permeability ranging from 10^{-6} to 10^{-2} m/sec (Fenco-Mclaren, 1994). The ORMAC sediments were found to be within the lower range of their expected permeability, potentially as a result of higher than typical silt and clay content and being less well sorted. The upper portion of the Queenston Formation was screened in borehole SVS-101. It's noted that higher hydraulic conductivity values will occur in the weathered portion of the upper bedrock and contact with the overburden. The reported K-value for SVS-101 was found to be 1.31×10^{-6} m/s.

3.4.4 Infiltration Testing

Infiltration Tests (IT) were completed at twelve (12) locations (**Table 6**) on December 7 and 12, 2023 using a constant head permeameter method using a Guelph Permeameter. All tests were completed using the combined reservoir. Field-saturated hydraulic conductivity (K_{fs}) values were calculated using the Guelph Permeameter K-sat Calculator (2012) using the single-head method for all IT locations. Auger holes ranged from 0.59 (BH INF23-2) to 0.77 (BH INF23-9) meters below ground surface. Soils ranged from silty clay to silty sand with some gravel, with head pressures ranging from 0.05 to 0.1 m.

To inform the design of infiltration facilities as part of LID and stormwater management, the infiltration rate for shallow overburden was estimated through the following empirical equation correlating K-values and infiltration rate provided in Ontario Ministry of Municipal Affairs and Housing (OMMAH) Supplementary Guidelines to the Ontario Building Code 1997, and in the Low Impact Development Stormwater

Management Planning and Design Guide (TRCA/CVC, 2010):

$$K = (6 \times 10^{-11})I^{3.7363}$$

Where:

K = hydraulic conductivity (cm/s)

I = infiltration rate (mm/hr)

Rearranging for infiltration rate, we obtain the following relationship:

$$I = \left[\frac{K}{6 \times 10^{-11}}\right]^{\frac{1}{3.7363}}$$

Infiltration Tests (IT) were conducted at various locations across the site to assess the local infiltration characteristics of the soil. The results of the IT, including hydraulic conductivity fully saturated (K_{fs}) values, infiltration rates, testing depths, and summary of the soils at IT testing depths, are summarized in **Table 6**. The infiltration rate for the site was estimated to be 14 mm/hr, with a range of 0 and 27 mm/hr. It is noted that inconclusive results were observed in five locations (BH INF23-2, BH INF23-4, BH INF23-5, BH INF23-11, and BH INF23-12), due to a lack in infiltration during testing. All infiltration testing locations were within fine-grained materials, primarily clayey silt, silty clay, or sandy clay, with occasional components of sands and gravels, and the majority of tests were completed within the Halton Till formation.

Table 6. Infiltration Testing Summary

Testing Location ID	Vertical Hydraulic Conductivity		Infiltration Rate	Testing Depth	Soil Substrate Tested
	(cm/s)	(m/s)	(mm/hr)	(mbgs)	
BH INF23-1	5.9×10^{-4}	5.9×10^{-6}	22	0.75	Clayey Silt
BH INF23-2	0.0×10^{0}	0.0×10^{0}	0	0.75	Clayey Silt
BH INF23-3	6.57×10^{-5}	6.6×10^{-7}	12	0.83	Clayey Silt
BH INF23-4	0.0×10^{0}	0.0×10^{0}	0	0.75	Clayey Silt
BH INF23-5	0.0×10^{0}	0.0×10^{0}	0	0.75	Clayey Silt
BH INF23-6	7.9×10^{-5}	7.9×10^{-7}	13	0.75	Silt, Some Clay, trace Sand
BH INF23-7	2.0×10^{-4}	2.0×10^{-6}	16	0.65	Clayey Silt, trace Sand and Gravel
BH INF23-8	3.9×10^{-6}	3.9×10^{-8}	6	0.76	Silty Clay to Clayey Silt, trace Gravel
BH INF23-9	1.3×10^{-3}	1.3×10^{-5}	27	0.77	Silty Sand
BH INF23-10	1.5×10^{-6}	1.5×10^{-8}	4	0.78	Sandy Clay, some Silt
BH INF23-11	0.0×10^{0}	0.0×10^{0}	0	0.65	Silty Clay
BH INF23-12	0.0×10^{0}	0.0×10^{0}	0	0.6	Clayey Silt, trace Sand, trace Gravel

LEGEND

- Infiltration Location
- Watercourse[1]
- Site Boundary

1. LIO/Field confirmed at site areas

0 100 200 300 400 500

METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

Scale: 1:8,000
Page Size: Tabloid (11 x 17 inches)

Drawn: CV
Checked: ZK
Date: Apr 3, 2024

NORTH

Source Notes:
Imagery (2022) provided by Esri basemap service.
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CLIENT
Brookvalley Project Management Inc.

PROJECT
Mayfield West - Phase 2 - Stage 3

TITLE
Infiltration Location Plan

Palmer PART OF SLR

REF. NO. 1701628-11-1

Figure 11

Document Path: G:\Shared drives\Projects 2017\17016 - Brook Valley Homes\1701628 - Mayfield West - Phase 2 - Stage 3\GIS\1_Workspace\Task 3 - HydroG Figures\1701628-11-1-Infiltration Location Plan.mxd

3.4.5 Groundwater Chemistry

3.4.5.1 Ontario Drinking Water Standards

Groundwater quality sampling was completed at MW6 on December 6, 2017, and January 10, 2018. The sample was analyzed for a suite of water quality parameters such as turbidity, TSS, pH, metals, and cations and anions. A summary table of the groundwater analysis results is presented on **Table 7**, and the Certificate of Analysis is provided in **Appendix D**.

Results were compared against Microbiological and Chemical criteria, and Aesthetic and Operational Guidelines under the Ontario Drinking Water Standards (ODWS). No exceedances to ODWS criteria were measured, with the exception of Turbidity. Total Suspended Solids (TSS) and turbidity were found to be very high in the sample at 64,900 mg/L and >4,000 NTU, respectively, and is likely due to the fine-grained nature of the aquifer material and the sampling methods used.

Table 7. Summary of Groundwater Quality Results

Parameter	Units	Detection Limit	ODWS		Sample Concentration
			Microbiological and Chemical Standards	Aesthetic and Operational Guidelines	MW6
Physical Tests					
Color, Apparent	C.U.	2.0	-	5	232[1]
pH	pH units	0.10	-	6.5-8.5	7.98
Redox Potential	mV	-1000.00	-	-	350[1]
Total Suspended Solids	mg/L	4	-	-	64,900
Total Dissolved Solids	Mg/L	20	-	500	369
Turbidity	NTU	0.10	-	5	>4000[1]
Anions and Nutrients					
Acidity (as $CaCO_3$)	mg/L	5.0	-	-	30.0[1]
Alkalinity, Total (as $CaCO_3$)	mg/L	10	-	30-500	234[1]
Ammonia, Total (as N)	mg/L	0.020	-	-	0.159
Bromide (Br)	mg/L	0.10	-	-	<0.10[1]
Chloride (Cl)	mg/L	0.5	-	250	5.21[1]
Fluoride (F)	mg/L	0.020	1.5	-	0.126[1]
Nitrate (as N)	mg/L	0.020	10.0	-	<0.020[1]
Nitrite (as N)	mg/L	0.010	1.0	-	<0.010[1]
Total Kjeldahl Nitrogen	mg/L	1.5	-	-	8.0
Phosphate-P (ortho)	mg/L	0.0030	-	-	<0.0030[1]
Phosphorous, Total	mg/L	0.030	-	-	38.3
Sulfate (SO_4)	mg/L	0.30	-	500	54.0[1]
Organic / Inorganic Carbon					
Dissolved Organic Carbon	mg/L	1.0	-	5	1.8
Dissolved Metals					
Aluminum (Al)	mg/L	0.050	-	0.1	<0.0050
Antimony (Sb)	mg/L	0.0010	0.006	-	0.00053
Arsenic (As)	mg/L	0.0010	0.01	-	0.00161
Barium (Ba)	mg/L	0.0020	1.0	-	0.162
Beryllium (Be)	mg/L	0.0010	-	-	<0.00010
Bismuth (Bi)	mg/L	0.00050	-	-	<0.000050
Boron (B)	mg/L	0.10	5.0	-	0.016

Parameter	Units	Detection Limit	ODWS		Sample Concentration
			Microbiological and Chemical Standards	Aesthetic and Operational Guidelines	MW6
Cadmium (Cd)	mg/L	0.000050	0.005	-	<0.0000050
Calcium (Ca)	mg/L	5.0	-	-	73.9
Cesium (Cs)	mg/L	0.00010	-	-	<0.000010
Chromium (Cr)	mg/L	0.0050	0.05	-	<0.00050
Cobalt (Co)	mg/L	0.0010	-	-	0.00056
Copper (Cu)	mg/L	0.010	-	1	0.00026
Iron (Fe)	mg/L	0.50	-	0.3	<0.010
Lead (Pb)	mg/L	0.00050	0.01	-	<0.000050
Lithium (Li)	mg/L	0.010	-	-	0.0119
Magnesium (Mg)	mg/L	0.50	-	-	21.9
Manganese (Mn)	mg/L	0.0050	-	0.05	0.0418
Molybdenum (Mo)	mg/L	0.00050	-	-	0.00365
Nickel (Ni)	mg/L	0.0050	-	-	0.00156
Phosphorus (P)	mg/L	0.50	-	-	<0.050
Potassium (K)	mg/L	0.50	-	-	3.44
Rubidium (Rb)	mg/L	0.0020	-	-	0.00154
Selenium (Se)	mg/L	0.00050	0.05	-	0.000142
Silicon (Si)	mg/L	1.0	-	-	7.02
Silver (Ag)	mg/L	0.00050	-	-	<0.000050
Sodium (Na)	mg/L	5.0	20	200	5.59
Strontium (Sr)	mg/L	0.010	-	-	0.312
Sulfur (S)	mg/L	5.0	-	-	19.0
Tellurium (Te)	mg/L	0.0020	-	-	<0.00020
Thallium (Tl)	mg/L	0.00010	-	-	0.000013
Thorium (Th)	mg/L	0.0010	-	-	<0.00010
Tin (Sn)	mg/L	0.0010	-	-	0.00010
Titanium (Ti)	mg/L	0.0030	-	-	<0.00030
Tungsten (W)	mg/L	0.0010	-	-	<0.00010
Uranium (U)	mg/L	0.00010	0.02	-	0.00168
Vanadium (V)	mg/L	0.0050	-	-	0.00155
Zinc (Zn)	mg/L	0.030	-	5	<0.0010
Zirconium (Zr)	mg/L	0.0030	-	-	<0.00030

[1]*Sample collected on January 10, 2018 (others collected on December 6, 2017)*

ONTARIO DRINKING WATER STANDARDS (ODWS)

Analytical result for this parameter exceeds Guideline Limit for Schedule 1 (Microbiological) and 2 (Chemical) ODWS

The analytical result for this parameter exceeds the Guideline Limit for Aesthetic and Operational ODWS

3.4.6 Natural Features Groundwater and Surface Water Level Monitoring

3.4.6.1 Surface Water

The study area lies within the Etobicoke Creek Headwaters Subwatershed, where Etobicoke Creek first appears as many small tributaries as possible, groundwater springs, and wetland pockets. The drainage area of the subwatershed is roughly 6,300 ha and occupies portions of the Town of Caledon and the City of Brampton. The land use where Etobicoke Creek is primarily agricultural. The overall groundwater and surface water flow within the watershed is directed southeast towards Lake Ontario.

There are two main branches of Etobicoke Creek within the MW2-3 lands. The first is present flowing from east to west immediately south of the study area, and the second flowing north to south along the eastern boundary of the site (**Figure 1**). These branches ultimately converge at a culvert flowing beneath Hurontario Street just east of the site boundary. The main branches are characterized by permanently flowing channels situated within a relatively defined valley setting.

3.4.6.2 Groundwater / Surface Water Interactions

Identified wetlands, and portions of Etobicoke Creek and its tributaries were instrumented with shallow mini-piezometers (MPs) on October 23-24, and October 31, 2017, to measure groundwater and surface water interactions and hydraulic gradients at these features. In addition, eleven (11) surface water flow observation stations were established at creek culvert locations bordering the study area to monitor seasonality in surface water flow conditions.

A total of 8 mini-piezometers (MP-1 to MP-8) were installed at the locations shown in **Figure 1**. Five of the MPs were installed within headwater tributaries/ riparian marsh communities leading to Etobicoke Creek (MP-1, MP-2, MP-3, MP-6, and MP-8), and the remaining four were installed within the main branches of Etobicoke Creek (MP-4, MP-5, and MP-7). MP4s/d was installed in an online shallow aquatic marsh wetland created by beaver dam activity. Reach delineation of Etobicoke Creek within the Mayfield West study area was completed by AMEC (2010).

Groundwater and surface water levels were monitored from early December 2017 to mid-April 2019. Additional visits were conducted in May 2022 and December 2023 to ensure that current water levels continue to be within the expected ranges. Water levels were collected using manual monthly measurements by Palmer, as well as leveloggers set to record water levels continuously in hourly intervals. Continuous water level hydrographs from each MP are presented in **Appendix E**. The details of the water level measurements collected to date and calculated vertical hydraulic gradients from the mini-piezometers are summarized in **Table 8**.

In addition to monitoring the groundwater and surface water levels at the MPs, surface water flow to Etobicoke Creek was observed at the tributaries crossing the site boundary along Chinguacousy Road and Old School Road. Locations of the flow monitoring stations are identified on **Figure 1**, and coordinates are listed in **Table 9**. If flow was present at the time of observation, a visual quantitative estimation was made and recorded. The results of the flow observations are provided in **Table 9**.

Groundwater and surface water results from the smaller tributaries of Etobicoke Creek suggest that these features are ephemeral to intermittent and are primarily surface water supported. At the tributaries near Chinguacousy Road (MP-1, MP-2, and MP-3), the calculated hydraulic gradients were mainly neutral to negative, and the surface water levels were observed dry at each monitoring event except February, March, and May 2018, April 2019, and December 2023. This indicates the tributaries in this part of the creek are likely ephemeral and are surface water supported throughout the year. In comparison, the central tributary which crosses McLaughlin Road (MP-6) was slightly more inundated through the year, and surface water levels were observed above ground at all monitoring events except in January, June, and July 2018, and December 2023. Additionally, the hydraulic gradients generally ranged from neutral to slightly positive indicating that this portion of the tributary is likely intermittent and may receive some seasonal groundwater discharge. However, in some more recent monitoring events (October 2018 and

April 2019) the hydraulic gradient was slightly negative indicating possible seasonal groundwater recharge.

MP4s/d is installed within a shallow aquatic marsh wetland formed through recent beaver activity. It is likely this feature is fed through groundwater discharge as surface water levels were typically present ranging from dry (December 2023) to 0.815 mags (April 2019), and hydraulic gradients in the deep mini piezometer were positive ranging from -0.02 (August 2018) to +0.19 (June 2018). MP-5 is installed in a small tributary connecting the wetland to the larger tributary containing MP-9. In contrast to the shallow aquatic marsh wetland, this feature is not likely connected to the water table as water levels ranged from dry (June and July 2018) to 0.35 mags (October 2018), and the hydraulic gradients were generally negative or neutral.

In 2022, manual monitoring showed the groundwater levels in the MPs to fall within the previous ranges reported except levels recorded for MP4s and MP5. Between 2017-2019 beaver activity in the area had created an open water wetland at the MP4s/d location, which is no longer present in May 2022 suggesting that the beaver dam had been washed out. MP5 still had a water level close to the ground surface consistent with the expected upward hydraulic gradient at this location. In addition, during the May 2022 monitoring, MP1 and MP4d were unable to be located. As 18 months of continuous data had already been collected from these locations, this loss of monitoring locations does not impact the overall trends and conclusions of the report.

In the December 2023 and January 2024 site visits, all manual groundwater measurements fell within the previous ranges except for MW4s which were measured dry for the first time. MW4s/d surface water measurements were measured dry for the first time in the measuring points history. Additionally, MP1, MP5, and MP9 were unable to be found, and are assumed to have been destroyed.

Surface water flow was generally absent in the winter months as the tributaries were either dry or frozen over (**Table 8**). During the warmer period in February 2018, and early spring (March and May 2018) flow was present at most stations and ranged from <1 L/sec at Flow Stations 5 and 6 where ponded water was present, to approximately 62.5 L/sec at Flow Station 11. Very low to no flow was common in the summer months (June to August 2018), where only Flow Stations 9, 10, and 11 had observable flow. The April 16, 2019 monitoring event captured flows following a significant precipitation event and are therefore more representative of storm flow than the other monitoring events that capture primarily baseflow conditions. Flow estimates were made in May 2022 and were generally consistent with previous spring flow trends.

Table 8. Mini-Piezometer Monitoring Data

MP ID	Location within Etobicoke Creek	Measurement	Water Level (*meters below ground surface*)												
			05-Dec-17	10-Jan-18	26-Feb-18	26-Mar-18	17-May-18	13-Jun-18	19-Jul-18	27-Aug-18	18-Oct-18	19-Apr-19	25-May-22	06-Dec-23	24-Jan-24
MP-1	Tributary/ Riparian Wetland	GW	0.075	0.705	-0.245	0.075	-0.095	0.425	0.665	0.75	0.545	-0.125	-	-0.105	-
		SW	dry	dry	-0.225	-0.045	-0.105	dry	dry	dry	dry	-0.205	-	-0.105	-
		Gradient	**-**	**-**	***0.02***	***-0.12***	***-0.01***	**-**	**-**	**-**	**-**	***-0.08***	**-**	***0***	**-**
MP-2	Marsh Wetland	GW	dry	0.49	0	0.76	0	dry	dry	dry	dry	0.08	0.25	dry	dry
		SW	dry	dry	-0.07	dry	-0.02	dry	dry	dry	dry	0.02	dry	dry	dry
		Gradient	**-**	**-**	***-0.07***	**-**	***-0.02***	**-**	**-**	**-**	**-**	***-0.06***	**-**	**-**	**-**
MP-3	Tributary	GW	0.94	0.89	-0.36	-0.04	-0.29	0.32	0.53	0.42	dry	-0.28	-0.25	-0.32	-0.4
		SW	dry	dry	-0.36	-0.16	-0.29	dry	dry	dry	dry	-0.35	-0.25	-0.33	-0.5
		Gradient	**-**	**-**	***0***	***-0.12***	***0***	**-**	**-**	**-**	**-**	***-0.07***	***0***	***-0.01***	***-0.1***
MP-4s	Shallow Aquatic Wetland	GW	-0.12	-0.07	-0.26	-0.2	-0.3	-0.04	-0.15	-0.335	-0.13	-0.47	dry	dry	-0.62
		SW	-0.12	-0.06	-0.26	-0.19	-0.32	-0.05	-0.15	-0.33	-0.15	-0.48	dry	dry	dry
		Gradient	***0***	***0.01***	***0***	***0.01***	***-0.02***	***-0.01***	***0***	***0.005***	***-0.02***	***-0.01***	**-**	**-**	**-**
MP-4d	Shallow Aquatic Wetland	GW	-0.365	-0.425	-0.695	-0.675	-0.725	-0.545	-0.59	-0.715	-0.525	-0.835	-	-0.365	-0.52
		SW	-0.405	-0.425	-0.575	-0.525	-0.605	-0.355	-0.455	-0.63	-0.455	-0.815	-	dry	dry
		Gradient	***-0.04***	***0***	***0.12***	***0.15***	***0.12***	***0.19***	***0.135***	***0.085***	***0.07***	***0.02***	**-**	**-**	**-**
MP-5	Etobicoke Creek	GW	-0.205	-0.115	-0.115	0.175	0.085	0.565	0.13	-0.095	-0.275	-0.055	-0.215	-	-
		SW	-0.205	-0.165	-0.035	-0.005	0.025	dry	moist	-0.1	-0.345	-0.025	dry	-	-
		Gradient	***0***	***-0.05***	***0.08***	***-0.18***	***-0.06***	**-**	**-**	***-0.005***	***-0.07***	***0.03***	**-**	**-**	**-**
MP-6	Tributary/ Mineral Meadow Marsh	GW	-0.07	-0.07	-0.19	0.04	-0.11	0.22	0.41	-0.07	-0.03	-0.07	-0.03	-0.06	-0.88
		SW	-0.06	dry	-0.16	0.04	-0.09	dry	dry	-0.05	-0.05	-0.16	0	dry	dry
		Gradient	***0.01***	**-**	***0.03***	***0***	***0.02***	**-**	**-**	***0.02***	***-0.02***	***-0.09***	***0.03***	**-**	**-**
MP-9	Etobicoke Creek	GW	-0.12	-0.19	-0.28	0.06	-0.18	-0.1	-0.055	-0.15	-0.18	-0.48	0.5	-	-
		SW	-0.06	-0.23	-0.35	-0.04	-0.11	-0.1	0	-0.035	-0.08	-0.36	dry	-	-
		Gradient	***0.06***	***-0.04***	***-0.07***	***-0.1***	***0.07***	***0***	***0.055***	***0.115***	***0.1***	***0.12***	**-**	**-**	**-**

Notes: - negative gradient indicates groundwater recharge, and a positive gradient indicates groundwater discharge.

- "tributary" or "main branch" designation based on the Mayfield West Phase 2 Secondary Plan Comprehensive Environmental Impact Study and Management Plan completed by AMEC, 2010

Table 9. Surface Water Flow Observations at Tributaries to Etobicoke Creek

Flow Station ID	Location within Etobicoke Creek	UTM Coordinates		Approximate Flow Measurement (L/sec)										
		Easting (m)	Northing (m)	5-Dec-2017	10-Jan-2018	26-Feb-2018	26-Mar-2018	17-May-2018	13-Jun-2018	19-Jul-2018	27-Aug-2018	29-Oct-2018	16-Apr-2019	25-May-2022
Flow Point 1	Tributary	591944	4841766	5	-	10	7.5	3	-	-	-	-	16	<1
Flow Point 2	Tributary	591550	4842151	-	-	2	-	10	0	-	-	-	11.4	<1
Flow Point 3	Tributary	591322	4842378	-	-	0.5	-	3	-	-	-	-	35.1	<1
Flow Point 4	Tributary	591098	4842601	-	-	3	-	3	-	-	-	-	10.9	0
Flow Point 5	Tributary	590852	4843042	-	-	0	-	-	-	-	-	-	<1	0
Flow Point 6	Tributary	590983	4843206	-	-	0	-	-	-	-	-	-	<1	0
Flow Point 7	Tributary	591558	4843979	-	-	20	4	21	0	-	-	-	14.7	0
Flow Point 8	Tributary	591813	4844290	-	-	4	-	-	-	-	-	-	8.8	-
Flow Point 9	Etobicoke Creek	592003	4844544	4	-	20	20	19	0	0	<1	21	37.5	20
Flow Point 10	Tributary	592229	4844855	4	-	20	20	15	12	7.3	12.9	24	64.9	0
Flow Point 11	Etobicoke Creek	592852	4844727	12	5	50	35	62.5	1	1	18.9	35	19.4	40

Notes:

"tributary" or "main branch" designation based on the Mayfield West Phase 2 Secondary Plan Comprehensive Environmental Impact Study and Management Plan completed by AMEC, 2010.

" - " indicates no flow or dry conditions were observed.

4. Water Budget Assessment

4.1 Water Balance Methodology

The study area is just outside of the TRSPA Online Water Balance Tool coverage and therefore this method was not used for pre-development conditions. A Thornthwaite and Mather water balance method was therefore utilized.

4.1.1 Water Surplus

The water surplus describes the difference between precipitation and evapotranspiration (ET) to estimate the amount of water or surplus that is available to contribute to infiltration and runoff. The surplus was calculated using the monthly soil-moisture balance approach as described in Thornthwaite and Mather (1957). A soil moisture storage value of 200 mm was chosen, appropriate for shallow-rooted crops in silty clay loam. Data for average monthly precipitation and temperature was derived from the 1981 – 2010 climate normals from the Georgetown WWTP (43°38' N/79°52' W) meteorological station. This is the closest climate station to the site, at approximately 11 km from the site. Actual evapotranspiration is calculated based on a potential ET (or PET) and soil-moisture storage withdrawal. Monthly PET is estimated using monthly temperature data and is defined as a water loss from a homogeneous vegetation-covered area that never lacks water (Thornthwaite, 1948; Mather, 1978).

4.1.2 Infiltration Factors

The partitioning of the water surplus between runoff and infiltration depends on soil type, topography, and vegetation cover. Water will infiltrate more easily through sands compared to clays, on flat slopes compared to steep slopes, and through natural vegetated soils compared to agricultural crops or urban areas. The method developed by Bernard (1932) and described by the MOEE (1995) was used to estimate infiltration for the site.

The infiltration factors are described in the MOEE manual and are reproduced here for reference (**Table 10**). The infiltration factor is calculated by adding the individual sub-factors at the site. The water surplus is then multiplied by the total infiltration factor to determine the partitioning between the amount of runoff and the amount of infiltration that occurs annually. The runoff is the total amount of surplus remaining after taking into account infiltration or (1) – (infiltration factor) = (runoff factor).

This approach takes into consideration three factors: topography/slope, soil type, and land cover. The topography factor for each Ecological Land Classification (ELC) area was estimated based on different elevation lines drawn across the site, after ELC areas were combined the lowest topographic factor was chosen. The soil type factor was determined from surficial geology mapping published by the Geological Survey of Canada (Sharpe et al., 1999) (**Figure 2**). The final factor in the MOEE (1995) methodology is based on land cover and utilized the ELC mapping completed by Palmer staff (see CEISMP Report, 2022). The total average annual infiltration estimates for each section were then calculated by multiplying the appropriate water surplus value by the sum of the three individual factors.

Table 10. Summary of Infiltration Factors

Area Description	Infiltration Factor Value
SOIL TYPE	
Modern alluvial deposits; *silt, sand*	0.40
Halton Till; *clay to silt-textured till*	0.10
ORMAC deposits: *fine to medium sand and silt*	0.30
Fine-grained Glaciolacustrine; *massive to well-laminated clay and silt*	0.10
TOPOGRAPHY/SLOPE	
10% slope	0.05
5% slope	0.10
1% slope	0.15
0.5% slope	0.20
0.1% slope	0.25
VEGETATION FACTOR	
Agricultural (Halton Till)	0.10
Agricultural (Modern Alluvial Deposits)	0.10
Natural Heritage (Halton Till)	0.15
Natural Heritage (Modern Alluvial Deposits)	0.25
Wetland (Halton Till)	0.25
Anthropogenic (Rural Residential)	0.10
PRE-DEVELOPMENT LAND COVER	
Agricultural (Halton Till)	0.55
Agricultural (Modern Alluvial Deposits)	0.80
Natural Heritage (Halton Till)	0.45
Natural Heritage (Modern Alluvial Deposits)	0.80
Wetland (Halton Till)	0.55
Anthropogenic (Rural Residential)	0.55
Arterial Road Widening	0.55

4.2 Site-Wide Water Balance

4.2.1 Pre-development Conditions

The total yearly precipitation as published in the Georgetown WWTP 1981 – 2010 Climate Normals was 877 mm/yr. The calculated actual ET (or AET) based on the Thornthwaite and Mather monthly water balance model is approximately 559.7 mm within the study area (**Table 11**). The calculated PET for the study area is 593 mm/yr, or about 68% of the total precipitation. There is a total soil moisture deficit of about 98 mm/yr, equivalent to 11% of the total precipitation in the study area. The estimated water surplus for the site area is approximately 318 mm/yr (36% of the total precipitation).

Table 11. Summary of Annual Water Surplus

Water Balance (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation	67.8	60	57.2	76.5	79.3	74.8	73.5	79.3	86.2	68.3	88.5	65.9	877
Temperature (C)	-6.3	-5.2	-0.9	6	12.3	17.4	20	19	14.8	8.4	2.8	-2.9	7.12
Potential Evapotranspiration (PET)	0	0	0	32	77	112	132	116	77	38	10	0	594
P-PET	68	60	57	45	2	-37	-59	-36	10	30	78	66	283
Change in Soil Moisture Storage	0	0	0	0	0	-34	-43	-21	5	18	75	0	0
Soil Moisture Storage	200	200	200	200	200	166	123	102	107	125	200	200	0
Actual Evapotranspiration (AET)	0	0	0	32	77	109	117	100	77	38	10	0	560
Soil Moisture Deficit	0	0	0	0	0	-34	-43	-21	0	0	0	0	-98
Surplus (P-AET)	68	60	57	45	2	-34	-43	-21	10	30	78	66	318

Based on OGS surficial geology mapping and drilling results, the site is mostly underlain by till with some fine textured glaciolacustrine deposits (infiltration factors of 0.1), near the creeks there are modern alluvial deposits (infiltration factor of 0.4). The site is hilly within forested areas and near the creeks with slopes ranging from 1% to 11% resulting in a range of infiltration factors. **Table 12** presents the interpreted vegetation, soil, and slope factors used for each pre-development land use area. The selection of these values is generally based on the MOEE (1995) values and are presented in **Table 11**.

Table 12. Infiltration Factors for the Site Pre-Development

Land Use (ELC)	Area (ha)	Vegetation Factor	Soil Factor	Slope Factor	Infiltration Factor	Run off Factor
Agricultural (Halton Till)	119.62	0.10	0.15	0.30	0.55	0.45
Agricultural (Modern Alluvial Deposits)	7.07	0.10	0.4	0.30	0.80	0.20
Natural Heritage (Halton Till)	0.98	0.15	0.15	0.15	0.55	0.45
Natural Heritage (Modern Alluvial Deposits)	17.61	0.25	0.4	0.15	0.80	0.20
Wetland (Halton Till)	10.24	0.15	0.15	0.15	0.55	0.45
Anthropogenic (Rural Residential)	0.30	0.1	0.15	0.3	0.55	0.45

Using the method in the MOE SWM manual and MOEE (1995) for guidance, it is estimated that approximately 40% of the surplus runs off, and the remaining 60% infiltrates. Based on a site area of 155.82 ha, it is estimated that 286,494 m^3/yr of precipitation infiltrates and 192,921 m^3/yr runs off. Results are summarized in **Table 13**. Eventually, this runoff may either enter the local creeks or recharge the local groundwater system.

Table 13. Pre-Development Water Balance Results

Land Use	Total (ha)	Impervious Factor	Impervious area (ha)	Water Surplus on Impermeable Surfaces (m/yr)	Run off from Impervious Area (m^3/yr)	Estimated Pervious Area (ha)	Water Surplus on Vegetated Pervious Areas (m/yr)	Runoff Coefficient	Runoff Volume From Pervious Area (m^3/yr)	Infiltration Coefficient	Infiltration Volume from Pervious Area (m^3/yr)	Total Runoff Volume (m^3/yr)	Total Infiltration Volume (m^3/yr)
Agricultural - Halton Till	119.62	0.00	0.00	0.790	0.00	119.62	0.318	0.45	171,003	0.55	209,004	171,003	209,004
Natural Heritage - Halton Till	7.07	0.00	0.00	0.790	0.00	7.07	0.318	0.45	10,107	0.55	12,353	10,107	12,353
Agricultural - Modern Alluvial Deposits	0.98	0.00	0.00	0.790	0.00	0.98	0.318	0.20	623	0.80	2,491	623	2,491
Natural Heritage - Modern Alluvial Deposits	17.61	0.00	0.00	0.790	0.00	17.61	0.318	0.20	11,189	0.80	44,755	11,189	44,755
Wetland - Halton Till	10.24	0.00	0.00	0.790	0.00	10.24	0.318	0.45	14,639	0.55	17,892	14,639	17,892
Anthropogenic (rural residential)	0.30	1.00	0.30	0.790	2,368.71	0.00	0.318	0.45	0	0.55	0	2,369	0
Total	**155.82**		**0.30**		**0**	**155.52**		**39%**	**192,921**	**61%**	**286,494**	**192,921**	**286,494**

4.2.2 Post-Development Conditions

The proposed development on site will include low and medium density residential units, parklands, roads, stormwater management facilities, schools, commercial lots, natural heritage system (NHS), vista and walkways, and arterial road widening. The post-development water balance is presented in **Table 14**.

In the absence of mitigation measures, it is estimated that in the post-development scenario, 201,306 m^3/yr of precipitation will infiltrate and 563,635 m^3/yr of precipitation will run off within the MW2-3 area. This represents a decrease in infiltration of 30% or 85,188 m^3/yr.

Table 14. Post-Development Water Balance Results

Land Use	Total (ha)	Impervious Factor	Impervious Area (ha)	Water Surplus on Impermeable Surfaces (m/yr)	Run off from Impervious Area (m^3/yr)	Estimated Pervious Area (ha)	Water Surplus on Vegetated Pervious Areas (m/yr)	Runoff Coefficient	Runoff Volume from Pervious Area (m^3/yr)	Infiltration Coefficient	Infiltration Volume from Pervious Area (m^3/yr)	Total Runoff Volume (m^3/yr)	Total Infiltration Volume (m^3/yr)
Roads	25.96	1.00	25.96	0.79	204,972	0.00	0.318	0.45	0	0.55	0	204,972	0
Stormwater Management Facility	7.14	0.50	3.57	0.79	28,188	3.57	0.318	0.45	5,104	0.55	6,238	33,291	6,238
Parkland	10.80	0.07	0.76	0.79	5,969	10.04	0.318	0.45	14,358	0.55	17,549	20,328	17,549
School Block	2.89	0.85	2.46	0.79	19,396	0.43	0.318	0.45	620	0.55	757	20,015	757
Commercial	4.92	0.55	2.71	0.79	21,366	2.21	0.318	0.45	3,165	0.55	3,868	24,531	3,868
Residential - Low Density - Single Detached	33.59	0.41	13.77	0.79	108,739	19.82	0.318	0.45	28,331	0.55	34,627	137,070	34,627
Residential - Low Density - Townhouse	15.09	0.41	6.19	0.79	48,850	8.90	0.318	0.45	12,727	0.55	15,556	61,577	15,556
Residential - Medium Density	7.87	0.43	3.38	0.79	26,720	4.49	0.318	0.45	6,413	0.55	7,838	33,133	7,838
Natural Heritage System	45.20	0.00	0.00	0.79	0	45.20	0.318	0.20	28,718	0.80	114,873	28,718	114,873
Vista - Walkways	0.09	1.00	0.09	0.79	711	0.00	0.318	0.45	0	0.55	0	711	0
Future Development / Part Lot	1.27	0.00	0.00	0.79	0	1.27	0.318	0.45	1,816	0.55	2,219	1,816	2,219
Arterial Road Widening	0.91	1.00	0.91	0.79	7,185	0.00	0.318	0.45	0	0.55	0	7,185	0
Pumping Station	0.09	0.5	0.5	0.79	355	0.05	0.318	0.45	64	0.55	79	420	79
Total	**155.82**		**58.79**		**464,199**	**94.67**		**37%**	**100,258**	**61%**	**200,880**	**563,635**	**201,306**

5. Hydrogeological Impact Assessment

5.1 Low-Impact Development Recommendations

The use of Low Impact Development (LID) measures is recommended as part of the overall stormwater management plan to help achieve at least 5 mm of stormwater retention and minimize changes to the existing water budget. As stated in *Low Impact Development Stormwater Management Planning and Design Guide Version 1.0* (2010) by CVC and TRCA,

> "Developing stormwater management plans requires an understanding of the depth to water table, depth to bedrock, native soil infiltration rates, estimated annual groundwater recharge rates, locations of significant groundwater recharge and discharge, groundwater flow patterns and the characteristics of the aquifers and aquitards that underlay the area" (TRCA and CVC, 2010).

For sites with deep water table conditions and high permeability soils, LID practices can significantly improve infiltration and groundwater recharge to maintain the groundwater characteristics of the underlying aquifer. Conversely, for sites with low permeability soils and high-water table conditions, the amount of infiltration is limited by the saturated hydraulic conductivity of the soil (i.e., the rate at which water can infiltrate).

LID measures need to take the permeability of the soils, and depth to the seasonally high-water table into consideration. Based on OGS surficial geology mapping, infiltration testing, and borehole drilling results, the surficial material across the site consists primarily of low permeability clayey silt to silty clay till of the Halton Till formation (K value of 10-8 m/sec), higher permeability alluvial deposits, and silt and fine sand of the ORM formation (K value of 10-6 m/sec) near the Etobicoke Creek valley. Based on initial water level monitoring results, the shallow water table ranges between approximately 0.41 mbgs (MW-1) and 9.14 mbgs (MW-8) within the ORMAC sand and silt deposits, and between approximately 0.02 mbgs (MW2D) and 6.13 mbgs (SV-106) within the Newmarket Till. Infiltration trenches, vegetated swales, and bioretention areas can all be effective in low-permeability soils to increase infiltration. It is recommended that the implemented LIDs target areas associated with the deeper water table to ensure that the minimum separation requirement of 1 m from the seasonally high-water table is met.

The northeast corner of the site near the Etobicoke Creek valley and Old School Road has a high infiltration capacity due to the presence of higher permeability ORMAC and alluvial soil deposits at surface, as well as a very deep-water table (approximately 3.54 (SV-103) – 9.14 (MW-8) m below ground). A wide variety of infiltration-based LIDs, such as infiltration chambers (i.e., clean water collection systems), and infiltration galleries, are expected to be effective in this area.

For the overall site, it is recommended that site and rear yard grading should be directed to the main branches and tributaries of Etobicoke Creek to contribute infiltration and overland flow to these features and maintain the water balance pre- to post-development, where applicable.

5.2 Impacts to Groundwater Supported Natural Features

As presented in Cross Section in **Figures 6, 7** and **8**, Etobicoke Creek, its tributaries and valley wetlands are interpreted to be supported by groundwater discharge from the ORM aquifer where the valley lands have incised through the Halton Till. These areas are contained within the protected NHS and Greenbelt Lands and will not be directly impacted. Targeted infiltration-based LID measures are recommended to be employed in tableland areas where groundwater flow is towards these on-site features. Shallow drainage features and wetlands on the tableland areas are interpreted to be perched on the Halton Till and not connected to the groundwater table.

5.3 Aquifers and Local Groundwater Users

The ORMAC is present at shallow depths over the majority of the study area, and is expected to be utilized by older, shallow dug water wells. A search of the MECP database identified potable water wells in the vicinity of the MW2-3 area, however it is expected that municipal water will be available in the near future. Newer well records generally target deeper overburden or bedrock aquifers below the Newmarket Till. These deeper wells would not be impacted by the proposed development.

The primary groundwater recharge area for the ORMAC is from lands north of the MW2-3 area and with LID measures implemented, no impacts to this aquifer are expected. A door-to-door water well survey should be completed at a future design phase to confirm the number of active wells and assess the risks to individual groundwater users.

5.4 Source Water Protection

As presented in section 2.1.5. and in **Figure 4**, certain areas of the site are located within an HVA with a score of 6. There are no WHPAs, SGRAs, or IPZs located on site. Given that the site is situated within an HVA, it is recommended to adopt best management practices during construction and to devise an construction phase emergency spill response plan during to minimize potential contamination of groundwater. No other Source Water Protection policy requirements would apply to this site.

6. Summary and Conclusions

The following summarizes the key results of the Hydrogeological Investigation for the Mayfield West Phase 2 Stage 3 Lands:

- The MW2-3 study area lies within the South Slope physiographic region, characterized by predominately the clayey silt to silty clay Halton Till soils, derived from former glacial lakes. Modern alluvial deposits of clay, silt, sand, gravel, and organics are present within the Etobicoke Creek valley. Based on the results of borehole drilling, fine to medium sand and silt deposits associated with the Oak Ridges Moraine Formation were identified and mapped in the northwestern portion of the study area near Etobicoke Creek and Old School Road.

- The site is located within the Etobicoke Creek Headwaters Subwatershed. Etobicoke Creek is present along the eastern and southern boundaries of the site, and ultimately flows east and then south towards Lake Ontario.

- The Halton Till is the dominant surficial unit across the site and behaves as an unconfined aquitard. Based on single well response testing and grain size analyses results, the geometric mean hydraulic conductivity of the Halton Till is approximately 5.3 x 10^{-8} m/sec, the underlying ORM aquifer is approximately 3.0 x 10^{-6} m/sec, and the Newmarket Till is approximately 7.2 x 10^{-7} m/sec. Note that more permeable gravel layers may occur within the Newmarket Till. Based on the results of slug testing, these deposits have a geometric mean K value of approximately 1.2 x 10^{-6} m/sec.

- Groundwater quality was tested for a suite of parameters included turbidity, TSS, pH, metals, and cations and anions, and compared with Ontario Drinking Water Standards. No exceedances were with the exception of turbidity, which is related to aquifer materials and sampling methods.

- Within the study area, groundwater levels were monitored by Palmer staff for a period between October 2017 to November 2022, with additional monitoring events completed in December 2023, and January 2024 to provide recent confirmatory water level data. Generally, these results indicate that groundwater levels on the table lands are moderately deep and are well drained by the ORMAC present below the site. The groundwater table in April 2019 was found ranging between approximately 2.26 mbgs (MW-7s) and 9.14 mbgs (MW-8) for wells screen on the ORMAC. Shallower, perched groundwater can be found in wells completed in the Halton Till. It is expected that local shallow groundwater flow follows topography and is directed towards the valleylands of Etobicoke Creek and its associated tributaries. The water table is generally deeper near the north corner of the site near the Etobicoke Creek valley and Old School Road (approximately 4.29 – 9.14 m below ground). It is expected that local shallow groundwater flow follows topography and is directed towards the Etobicoke Creek valley and topographic depressions.

- Groundwater and surface water monitoring was completed at MPs installed within the main branch and tributaries to Etobicoke Creek, as well as surface water flow measurements at tributaries surrounding the site. Groundwater and surface water results of the tributaries indicate

an ephemeral to intermittent flow regime, as these reaches of the creek were often observed as dry and had hydraulic gradients indicative of surface water supported features. Monitoring of the main branch and the larger tributaries indicates a permanent flow regime, and seasonal to continual groundwater discharge. Results indicate the that the tableland drainage features are perched on the Halton Till and would be considered ephemeral.

- A water budget was completed for the site under the pre-development scenario. Results of this analysis showed that over the MW2-3 area, it is estimated that approximately 40% (192,921 m^3/yr) of the surplus runs off, and the remaining 60% (286,494 m^3/year) infiltrates. The development will change the infiltration factors of the site. Planned changes to the landscape will increase the impervious area from 0.30 ha to 58.79 ha and with no mitigation measures, it is estimated that post-development, 201,306 m^3/yr of precipitation will infiltrate and 563,635 m^3/yr of precipitation will run off just within the areas set for development within the site area. This represents a decrease of 30% in pre-to post-development infiltration.

- Given the low permeability soils over most of the study area, LID measures should focus on infiltration trenches, vegetated swales and bioretention areas, which can all be effective in low permeability soils to increase infiltration. The average infiltration rate for the site was determined to be 14 mm/hr, with rates ranging from 0 mm/hr to 27 mm/hr. Site grading and rear yard grading should be directed to the main branches and tributaries of Etobicoke Creek to contribute overland flow to these features and maintain the water balance, where applicable. Opportunities for higher volume infiltration type LIDs should be explored south of Old School Road where a deeper water table is expected, and the higher permeability ORM materials were encountered at the surface (BH-2, MW-4, and MW-8). In addition, areas adjacent to the Etobicoke Creek valleylands where the shallow groundwater table is deeper during the hydraulic influence of the ORMAC, are good locations for infiltration-based LID.

- Certain areas of the site are located within an HVA with a score of 6. There are no WHPAs, SGRAs, or IPZs located on site. Given that the site is situated within an HVA, it is recommended to adopt best management practices during construction and to devise an construction phase emergency spill response plan during to minimize potential contamination of groundwater. No other Source Water Protection policy requirements would apply to this site.

- With the implementation of the mitigation measures recommended in this report, no impacts to groundwater quality or quality are expected.

7. Statement of Limitations

The extent of this study was limited to the specific scope of work for which we were retained and that is described in this report. Palmer has assumed that the information provided by the client or any secondary sources of information are factual and accurate. Palmer accepts no responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of omissions, misinterpretations or negligent acts from relied upon data. Judgment has been used by Palmer in the interpretation of the information provided but subsurface physical and chemical characteristics may differ from regional scale geology mapping and vary between or beyond well/borehole locations given the inherent variability in geological conditions.

Palmer is not a guarantor of the geological or groundwater conditions at the subject site, but warrants only that its work was undertaken and its report prepared in a manner consistent with the level of skill and diligence normally exercised by competent geoscience professionals practicing in the Province of Ontario. Our findings, conclusions and recommendations should be evaluated in light of the limited scope of our work.

The information and opinions expressed in the Report are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT PALMER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS PALMER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belongs to Palmer. Any use which a third party makes of the Report is the sole responsibility of such third party. Palmer accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Palmer's express written permission. Should the project design change following issuance of the Report, Palmer must be provided the opportunity to review and revise the Report in light of such alteration or variation.

8. Certification

This report was prepared, reviewed and approved by the undersigned:

Prepared By:

Zach Kuszczak, P.Geo.
Hydrogeologist

Reviewed and Approved By:

Jason Cole, M.Sc., P.Geo.
VP, Principal Hydrogeologist

9. References

AMEC Earth and Environmental (AMEC). 2010.
Mayfield West, Phase 2 Secondary Plan Comprehensive Environmental Impact Study and Management Plan. Part A: Existing Conditions and Characterization. No. 108041.

Chapman, L.J. and D.F. Putnam. 1984.
Physiography of Southern Ontario. Ontario Geological Survey, Special Volume 2: 270 p.

Credit Valley Conservation (CVC) and Toronto and Region Conservation Authority (TRCA). 2010.
Low Impact Development Stormwater Management Planning and Design Guide. Version 1.0.

Hazen, A. 1892.
Some physical properties of sands and gravels: Mass. State Board of Health, Ann. Rept. Pp: 539-556.

Karrow, P.F. 1987.
Quaternary geology of the Hamilton-Cambridge area, Southern Ontario: Ontario Geological Survey Report 255, 94p. Accompanied by Maps 2508 and 2509, scale 1:50,000 and 4 Charts.

Karrow, P.F. 2005.
Quaternary geology of the Brampton area, Ontario Geological Survey, Report 257, 59p.

Lee, P.K. & ESG International. 2002.
Shale Resources Review Final Report Technical Report Appendix. City of Brampton.

Mather, J.R. 1978.
The climactic water balance in environmental analysis: Lexington, Mass., D.C. Heath and Company, 239 p.

MGP, 2024.
Land Use Plan: Mayfield West Phase 2 – Stage 3, Caledon.

Ministry of Environment and Energy (MOEE). 1995.
Hydrogeological Technical Information Requirements for Land Development Applications.

Ostry, R.C. 1979.
The Hydrogeology of IFYGL Forty Mile and Oakville Creeks Study Areas. Ontario Ministry of the Environment (MOE), Water Resources Report 5b.

Palmer, 2022.
Hydrogeological Assessment – Mayfield West Phase 2, Stage 3 Lands, Caledon, Ontario

Sharpe, D.R., Barnett, P.J., Brennand, T.A., Gorrell, G., Russell, H.A.J. 1999.

Digital Surficial Geology Data of the Greater Toronto and Oak Ridges Moraine Area, Southern Ontario; Geological Survey of Canada, 1999.

Singer, S.N., Cheng, C.K., Scafe, M.G. 2003.
The hydrogeology of southern Ontario. Hydrogeology of Ontario series, Report 1, Ontario Ministry of Environment, Toronto.

Thornthwaite, C.W. 1948.
An approach toward a rational classification of climate. Geographical Review, Vol. 38, No. 1, pp. 55-94.

Thornthwaite, C.W., and Mather, J.R. 1957.
Instructions and tables for computing potential evapotranspiration and the water balance. Publications in Climatology, Vol. 10, No. 3, pp. 185-311. Laboratory of Climatology, Drexel Institute of Technology, Centerton, New Jersey.

Toronto Region Conservation Authority (TRCA). 2008.
Etobicoke Creek Headwaters Subwatershed Study Synthesis Report.

Toronto Region Conservation Authority (TRCA). 2010.
Etobicoke and Mimico Creeks Watersheds Technical Update Report, 21p.

Appendix A

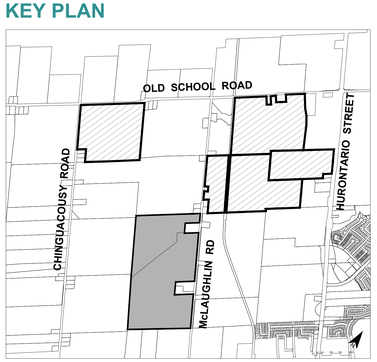
Draft Plan: Mayfield West Phase 2 – Stage 3, Caledon (MGP, 2024)

DRAFT PLAN OF SUBDIVISION

19T - _____

Part of Lot 21 and 22,
Concession 1 and Part of Lot 22,
Concession 2
West of Hurontario Street,
(Geographic Township of Chinguacousy)
Town of Caledon,
Regional Municipality of Peel

KEY PLAN



SCHEDULE OF LAND USE

LOT/BLOCK	LAND USE		UNITS	AREA (ha)
1-1031	11.6m x 20.0m Single Detached	+	575	20.87
	9.20m x 28.0m Single Detached	o	456	12.72
1032-1152	6.1m x 28.0m Townhouse Street	x	726	14.43
1153-1157	6.1m x 27.0m Townhouse Lane	=	32	0.66
1158-1160	Medium Density Blocks		630	7.87
1161-1162	Commercial			4.92
1163	Elementary School			2.89
1164-1167	Park			10.80
1168-1175	Storm Water Management Facilty			7.14
1176-1177	Vista / Walkways			0.09
1178-1187	Natural Heritage System			45.17
1188	Future Natural Heritage System			0.03
1189-1226	Future Development / Part Lots		(49)	1.27
1227-1234	Future Roadway/Lane	145 m		0.30
1235-1237	Arterial Road Widening			0.60
1238-1247	0.3m Reserves			0.01
1248	Pumping Station			0.09
Streets A-B	22.0m Road length	1,545 m		3.42
Streets C-D	20.0m Road length	1,360 m		2.75
Streets 1-40	18.0m Road length	10,096 m		18.48
Sts. 2,7 & 31	16.0m Road length	687 m		1.09
Lane 1-2	8.0m Lane length	276 m		0.22
TOTAL		13,964 m	2,419	155.82
		(14,109 m)	(2,468)	

SURVEYOR'S CERTIFICATE

I hereby certify that the boundaries of the lands to be subdivided as shown on this Plan and their relationship to the adjacent lands are accurately and correctly shown.

Budziak — March 4, 2024

MONIKA BUDZIAK, OLS
J.D. Barnes Ltd.

Date

OWNER'S AUTHORIZATION

I hereby authorize Malone Given Parsons Ltd. to prepare and submit this Draft Plan of Subdivision to the City of Vaughan.

Date

ADDITIONAL INFORMATION

AS REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT, CHAPTER P.13(R.S.O. 1990).

(a),(e),(f),(g),(j),(l) - As shown of the Draft Plan.
(b),(c) - As shown on the Draft and Key Plan.
(d) - Land to be used in accordance with the Schedule of Land Use.
(i) - Soil is clay loam.
(h),(k) - Full municipal services to be provided.

Date: March 28, 2024

Date	Revision	By

MGP Malone Given Parsons.
140 Renfrew Drive, Suite 201 | Markham, ON | L3R 6B3
905 513 0170 | mgp.ca

Appendix B

Borehole Logs and Grain Size Distributions

B1. Borehole Logs and Grain Size (Soil Engineers Ltd., 2023)
B2. Borehole Logs (Palmer, 2018)
B3. Borehole Logs and Grain Size (AMEC, 2010)

Appendix B1

Borehole Logs and Grain Size (Soil Engineers Ltd., 2023)

JOB NO.: 2310-S040

LOG OF BOREHOLE: 101

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Pumping Station and Stormwater Management Ponds

METHOD OF BORING: Hollow Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Road, Town of Caledon

DRILLING DATE: October 18, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
261.6	Ground Surface							
0.0	**30 cm TOPSOIL**				0			
	Brown, firm to hard	1	DO	7			16	
	SILTY CLAY TILL — weathered	2	DO	26	1		17	
	some sand to sandy a trace of gravel occ. sand and silt seams and layers, cobbles and boulders	3	DO	35			11	
		4	DO	55	2		12	
258.3		5	DO	78	3		18	
3.3	Compact, moist to wet — moist							
	SANDY SILT — brown grey				4			
	a trace of clay occ. silt layers	6	DO	25	5		19	
255.3		7A	DO	20	6		20	
6.3	Grey, very stiff	7B					22	
	SILTY CLAY				7			
254.4	a trace of sand							
7.2	Reddish-brown, very dense							
	SANDY SILT TILL	8	DO	50/13	8		9	
	some clay, a trace of gravel occ. sand and silt seams and layers, cobbles and boulders	9	DO	55/15	9		10	
251.6					10			

Soil Engineers Ltd.

JOB NO.: 2310-S040

LOG OF BOREHOLE: 101

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Pumping Station and Stormwater Management Ponds

METHOD OF BORING: Hollow Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Road, Town of Caledon

DRILLING DATE: October 18, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
10.0	Reddish-brown, very dense				10			
	SANDY SILT TILL	10	DO	50/10			8	
	some clay, a trace of gravel occ. sand and silt seams and layers, cobbles and boulders				11			
		11	DO	50/13	12		9	
247.9					13			
13.7	Reddish-brown, hard, very moist	12	DO	50/8			15	
	SILTY CLAY clay shale reversion; with shale fragments				14			
247.0								
14.6	Grey, weathered **SHALE BEDROCK** with reddish-brown clay				15			
246.3		13	DO	50/3			14	
15.3	**END OF BOREHOLE**				16			
	Installed 50-mm Ø PVC monitoring well to 15.2 m, complete with 1.5 m screen Sand backfill from 13.1 to 15.2 m Bentonite seal from 0.0 to 13.1 m Provided with a steel monument casing				17			
					18			
					19			
					20			

W.L. @ El. 246.7 m on completion

JOB NO.: 2310-S040

LOG OF BOREHOLE: 102

FIGURE NO.: 2

PROJECT DESCRIPTION: Proposed Pumping Station and Stormwater Management Ponds

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Road, Town of Caledon

DRILLING DATE: October 19, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
260.6	Ground Surface							
0.0	**36 cm TOPSOIL**	1	DO	7	0		14	
	Brown, firm to very stiff							
	SILTY CLAY TILL — weathered	2	DO	24	1		13	
	sandy a trace of gravel occ. sand and silt seams and layers, cobbles and boulders	3	DO	26	2		11	
258.1								
2.5	Grey, hard	4	DO	41			19	
	SILTY CLAY				3			
	a trace to some sand occ. gravel	5	DO	35			18	
256.6					4			
4.0	Grey, compact, wet							
	SANDY SILT							
	a trace of clay	6	DO	30	5		20	
255.0								
5.6	Grey, compact, very moist				6			
	SANDY SILT TILL							
	traces of clay and gravel	7	DO	20			12	
254.0								
6.6	**END OF BOREHOLE**				7			
	Installed 50-mm Ø PVC monitoring well to 6.1 m, complete with 1.5 m screen Sand backfill from 4.0 to 6.1 m Bentonite seal from 0.0 to 4.0 m Provided with a steel monument casing				8			Dry on completion
					9			
					10			

Soil Engineers Ltd.

JOB NO.: 2310-S040

LOG OF BOREHOLE: 103

FIGURE NO.: 3

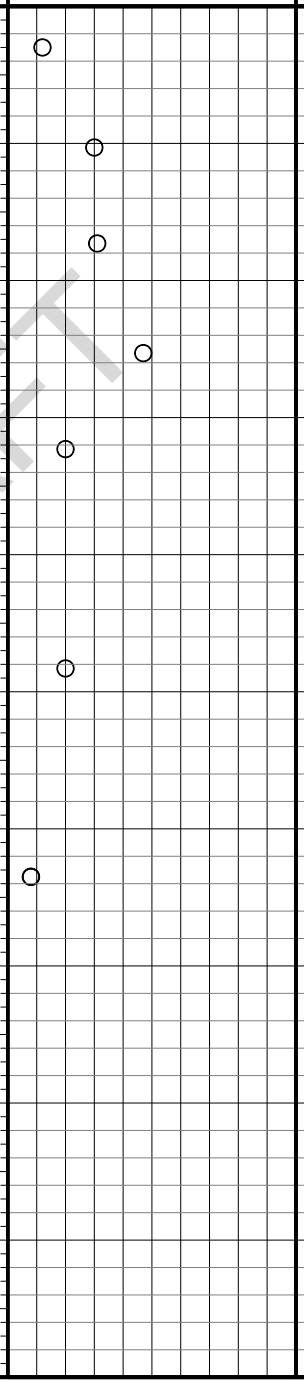
PROJECT DESCRIPTION: Proposed Pumping Station and Stormwater Management Ponds

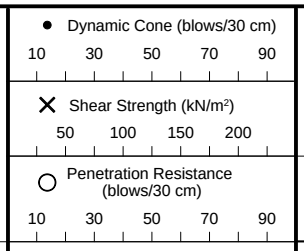
METHOD OF BORING: Solid Stem Augers

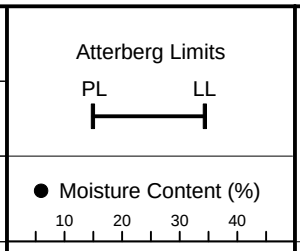
PROJECT LOCATION: Southwest of Old School Road and Hurontario Road, Town of Caledon

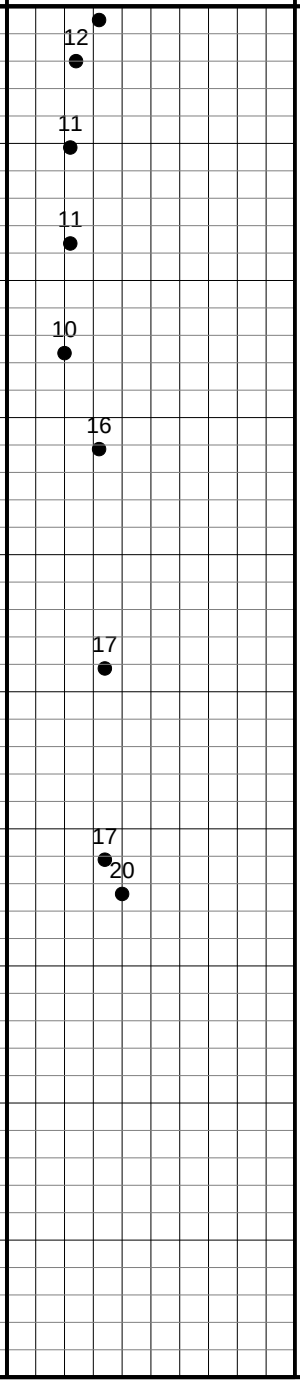
DRILLING DATE: October 18, 2023

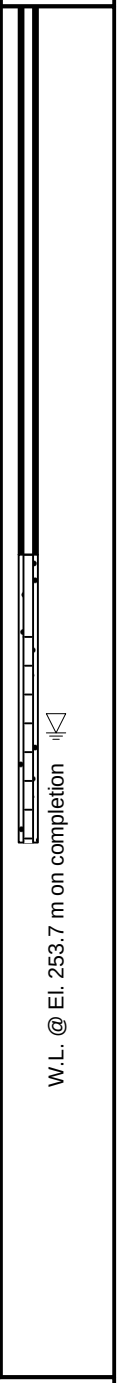
El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
259.0	Ground Surface			
0.0	**20 cm TOPSOIL**	1A		
	Brown, stiff to hard	1B	DO	12
	SILTY CLAY TILL — weathered	2	DO	30
	sandy, a trace of gravel occ. sand and silt seams and layers, cobbles and boulders	3	DO	31
		4	DO	47
256.1				
2.9	Very stiff — brown / grey	5	DO	20
	SILTY CLAY some sand, occ. gravel			
255.0				
4.0	Grey, loose to compact, wet			
	SANDY SILT	6	DO	20
	a trace of clay			
		7A	DO	8
252.4	— clay layer	7B		
6.6	**END OF BOREHOLE**			
	Installed 50-mm Ø PVC monitoring well to 6.1 m, complete with 1.5 m screen Sand backfill from 4.0 to 6.1 m Bentonite seal from 0.0 to 4.0 m Provided with a steel monument casing			











Soil Engineers Ltd.

JOB NO.: 2310-S040

LOG OF BOREHOLE: 104

FIGURE NO.: 4

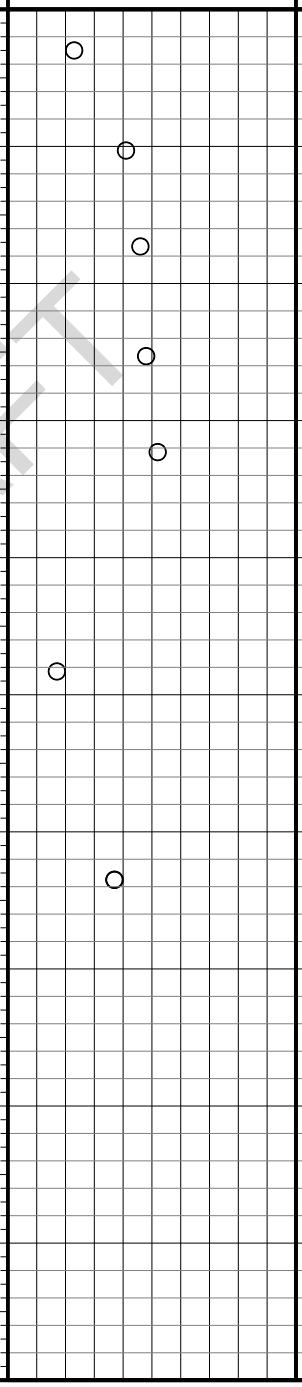
PROJECT DESCRIPTION: Proposed Pumping Station and Stormwater Management Ponds

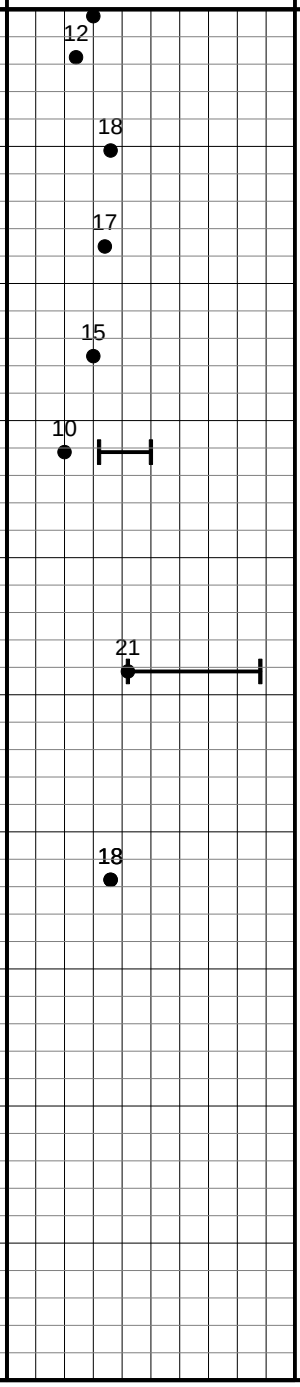
METHOD OF BORING: Solid Stem Augers

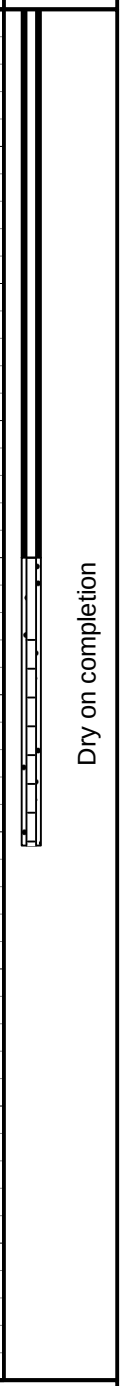
PROJECT LOCATION: Southwest of Old School Road and Hurontario Road, Town of Caledon

DRILLING DATE: October 16, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
258.0 / 0.0	Ground Surface				
	10 cm TOPSOIL	1A			0
	Brown, very stiff **SILTY CLAY TILL** sandy, a trace of gravel	1B	DO	23	
257.1 / 0.9	Brown, hard	2	DO	41	1
	SILTY CLAY a trace to some sand, occ. gravel	3	DO	46	2
255.6 / 2.4	Brown, hard	4	DO	48	
	SILTY CLAY TILL sandy, a trace of gravel occ. sand and silt seams and layers	5	DO	52	3
254.0 / 4.0	Grey, very stiff **SILTY CLAY** a trace of sand occ. silt layers	6	DO	17	4 5
252.4 / 5.6	Grey, dense, very moist **SILT** a trace of sand, with clay layers	7	DO	37	6
251.4 / 6.6	**END OF BOREHOLE** Installed 50-mm Ø PVC monitoring well to 6.1 m, complete with 1.5 m screen Sand backfill from 4.0 to 6.1 m Bentonite seal from 0.0 to 4.0 m Provided with a steel monument casing				7 8 9 10







JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-101

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Road
Town of Caledon

DRILLING DATE: October 10, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
266.1	Ground Surface							
0.0	**28 cm TOPSOIL**	1A	DO	6	0		18	
	Firm to very stiff	1B						
	weathered							
	SILTY CLAY TILL	2	DO	25	1		13	
	some sand to sandy a trace of gravel occ. sand and silt seams and layers, cobbles	3	DO	26	2		11	
		4	DO	30			16	
	brown grey	5	DO	28	3		15	
262.1 4.0	Brown, compact to dense, wet				4			
	SILTY FINE SAND/SANDY SILT a trace of clay occ. silt and sand layers	6	DO	31	5		21	
		7	DO	12	6		23	
258.9 7.2	Grey, compact, wet **SILT**				7			
258.0 8.1	occ. sand and clay layers **END OF BOREHOLE**	8	DO	17	8		26	
					9			
					10			
					11			
					12			
					13			
					14			

W.L. @ El. 262.4 m on completion

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-102

FIGURE NO.: 2

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Hollow Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Road
Town of Caledon

DRILLING DATE: October 11, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
264.6	Ground Surface							
0.0	**15 cm TOPSOIL**	1A			0		13	
	Brown, compact, weathered **SANDY SILT** with roots inclusions	1B	DO	11				
263.8	weathered							
0.8	Brown, very stiff	2	DO	23	1		14	
	SILTY CLAY TILL some sand, a trace of gravel occ. sand and silt seams and layers	3	DO	28			20	
262.5					2			
2.1	Brown, compact, moist	4	DO	22			21	
	SILTY FINE SAND/SANDY SILT	5	DO	26	3		20	
	a trace of clay grey below 5.0 m possibly transitioning to till below 6.1 m				4			
	wet, occ. gravel grey clay layer	6A 6B	DO	21	5		23 24	
	wet silt and clay layers	7	DO	19	6		25	
258.0								
6.6	**END OF BOREHOLE**				7			
	Installed 50-mm Ø PVC monitoring well to 5.8 m, completed with 1.5 m screen Sand backfill from 3.7 to 5.8 m Bentonite seal from 0.0 to 3.7 m Provided with a steel monument casing				8			
					9			
					10			
					11			
					12			
					13			
					14			

Water was used during drilling

Soil Engineers Ltd.

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-103

FIGURE NO.: 3

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Hollow Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Road
Town of Caledon

DRILLING DATE: October 11, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
264.1	Ground Surface							
0.0	**25 cm TOPSOIL**	1A			0			
	Brown, loose, weathered	1B	DO	8			13	
263.3	**SANDY SILT**							
0.8	Brown, stiff to very stiff — weathered	2	DO	18	1		17	
	SILTY CLAY TILL							
	some sand, a trace of gravel	3	DO	12			24	
262.0	occ. sand seams and clay layers				2			
2.1	Loose to compact, wet	4	DO	8			22	
	SILTY FINE SAND/SANDY SILT	5	DO	20	3		21	
	a trace of clay							
	occ. fine sand layers				4			
	fine sand, some silt	6	DO	22	5		21	
	brown grey							
257.5		7	DO	19	6		21	
6.6	**END OF BOREHOLE**				7			
	Installed 50-mm Ø PVC monitoring well to 6.1 m, completed with 1.5 m screen Sand backfill from 4.0 to 6.1 m Bentonite seal from 0.0 to 4.0 m Provided with a steel monument casing				8			
					9			
					10			
					11			
					12			
					13			
					14			

Water was used during drilling

Soil Engineers Ltd.

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-104

FIGURE NO.: 4

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Road
Town of Caledon

DRILLING DATE: October 10, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
264.1	Ground Surface							
0.0	**30 cm TOPSOIL**	1A	DO	8	0		18	
	Brown, loose, weathered	1B						
263.3	**SANDY SILT**							
0.8	Brown, stiff to very stiff weathered	2	DO	12	1		14	
	SILTY CLAY TILL							
	some sand, a trace of gravel	3	DO	26	2		16	
	occ. sand seams and clay layers							
262.0								
2.1	Brown, compact to very dense, moist	4	DO	50			14	
	SILTY FINE SAND/SANDY SILT				3			
		5	DO	61			14	
	a trace of clay				4			
	occ. silt and fine sand layers							
	wet below 6.1 m	6	DO	38	5		17	
					6			
		7	DO	27			23	
257.5								
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			

W.L. @ El. 258.6 m on completion

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-105

FIGURE NO.: 5

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Road
Town of Caledon

DRILLING DATE: October 10, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
264.7	Ground Surface							
0.0	**41 cm TOPSOIL**	1A	DO	10	0		12	
	Brown, loose, weathered	1B						
263.9	**SANDY SILT** — weathered							
0.8	with clay and roots inclusions	2	DO	18	1		12	
	Brown, very stiff to hard							
	SILTY CLAY TILL	3	DO	23	2		12	
	some sand, a trace of gravel							
	occ. sand and silt seams and layers	4	DO	37			12	
261.8								
2.9	Grey, very stiff	5	DO	17	3		20	
	SILTY CLAY							
	a trace of sand				4			
260.7								
4.0	Compact to dense, wet							
	SILTY FINE SAND/SANDY SILT	6	DO	43	5		20	
	a trace of clay							
		7	DO	20	6		23	
	— — brown / grey				7			
		8	DO	13	8		20	
255.5								
9.2	Brown, very dense	9A/9B	DO	80/23	9		13 / 8	
	SANDY SILT TILL				10			
	traces of clay and gravel	10	DO	50/13			8	
	occ. sand seams and cobbles				11			
252.4		11	DO	50/10	12		7	
12.3	**END OF BOREHOLE**				13			
					14			

Dry on completion

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-106

FIGURE NO.: 6

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Hollow Stem Augers and Tricone

PROJECT LOCATION: Southwest of Old School Road and Hurontario Road Town of Caledon

DRILLING DATE: October 12, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
264.9	Ground Surface							
0.0	**23 cm TOPSOIL**	1A			0			
	Brown, loose, weathered	1B	DO	6			18	
264.1	**SANDY SILT**							
0.8	occ. gravel — weathered						12	
	Brown, very stiff to hard	2	DO	22	1			
	SILTY CLAY TILL						13	
		3	DO	25	2			
	some sand to sandy, a trace of gravel						10	
	occ. sand and silt seams and layers	4	DO	32				
261.9								
3.0	Brown, hard	5	DO	38	3		18	
	SILTY CLAY							
260.9	a trace of sand, occ. sand seams							
4.0	Compact to dense, moist to wet				4			
	— — brown / grey							
	SILTY FINE SAND/SANDY SILT	6	DO	42	5		14	
	a trace of clay							
	occ. fine sand layers				6			
	occ. clay and silt lenses	7	DO	28			19	
					7			
		8	DO	45	8		19	
256.2								
8.7	Grey, very stiff				9			
	SILTY CLAY	9	DO	21			22	
	a trace of sand, with silt layers				10			
254.7								
10.2	Brown, very dense							
	SANDY SILT TILL	10	DO	50/13	11		9	
	a trace to some clay							
	a trace of gravel							
	occ. sand and silt seams and layers, cobbles				12		8	
252.6		11	DO	50/13				
12.3	**END OF BOREHOLE**				13			
	Installed 50-mm Ø PVC monitoring well to 9.1 m, completed with 3.0 m screen. Backfill from 9.1 to 12.3 m. Sand backfill from 5.5 to 9.1 m. Bentonite seal from 0.0 to 5.5 m. Provided with a monument casing.				14			

Water was used during drilling

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-107

FIGURE NO.: 7

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Hollow Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Road
Town of Caledon

DRILLING DATE: October 16, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
265.1	Ground Surface				
0.0	**25 cm TOPSOIL**	1	DO	10	0
	Brown, stiff to very stiff				
	SILTY CLAY TILL — weathered	2	DO	19	1
	some sand to sandy, a trace of gravel				
263.7	occ. sand and silt seams and layers				
1.4	Brown, very stiff	3	DO	24	2
	SILTY CLAY				
263.0	occ. gravel				
2.1	Brown, loose to compact, moist	4	DO	9	
	FINE SAND				3
	some silt, a trace of clay	5	DO	28	
261.1					
4.0	Brown, dense to very dense, moist to very moist				4
	SILTY FINE SAND/SANDY SILT	6	DO	37	5
	a occ. silt layers				
					6
		7	DO	52	
257.9					7
7.2	Grey, compact, very moist to wet				
	SILT	8	DO	14	8
	traces of clay and fine sand				
	occ. sand and clay layers				9
		9A 9B	DO	29	
254.9					10
10.2	Grey, dense, wet				
	FINE SAND				
	a trace of silt	10	DO	33	11
254.0					
11.1	**END OF BOREHOLE**				
	Installed 50-mm Ø PVC monitoring well to 10.7 m, completed with 1.5 m screen Sand backfill from 8.5 to 10.7 m Bentonite seal from 0.0 to 8.5 m Provided with a steel monument casing				12
					13
					14

Dynamic Cone (blows/30 cm) 10 30 50 70 90

Shear Strength (kN/m²) 50 100 150 200

Penetration Resistance (blows/30 cm) 10 30 50 70 90

Atterberg Limits PL LL

Moisture Content (%) 10 20 30 40

WATER LEVEL

W.L. @ El. 255.0 m on completion

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-108

FIGURE NO.: 8

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Hollow Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Road
Town of Caledon

DRILLING DATE: October 16, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
264.3	Ground Surface				
0.0	**30 cm TOPSOIL**	1	DO	12	0
	Brown, stiff to very stiff				
	SILTY CLAY TILL — weathered				
	sandy, a trace of gravel	2	DO	27	1
	occ. sand and silt seams and layers				
262.9					
1.4	Brown, very stiff	3	DO	17	2
	SILTY CLAY				
262.2	occ. gravel				
2.1	Brown, compact to dense, moist	4	DO	25	
	FINE SAND				3
	a trace to some silt	5	DO	34	
260.3					
4.0	Brown, loose to very dense, very moist to wet				4
	SILTY FINE SAND/SANDY SILT	6	DO	35	5
	a trace of clay				
	occ. silt layers				6
		7	DO	42	
					7
		8A	DO	28	
	grey clay	8B			8
255.0		9A	DO	9	9
9.3	Grey, compact, wet	9B			
	SILT				10
	some sand and clay				
	occ. clay lenses	10	DO	18	
253.2					11
11.1	**END OF BOREHOLE**				
	Installed 50-mm Ø PVC monitoring well to 10.7 m, completed with 1.5 m screen				12
	Sand backfill from 8.5 to 10.7 m				
	Bentonite seal from 0.0 to 8.5 m				13
	Provided with a steel monument casing				
					14

Dynamic Cone (blows/30 cm) 10 30 50 70 90

Shear Strength (kN/m²) 50 100 150 200

Penetration Resistance (blows/30 cm) 10 30 50 70 90

Atterberg Limits PL LL

Moisture Content (%) 10 20 30 40

WATER LEVEL

W.L. @ El. 255.2 m on completion

Soil Engineers Ltd.

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-109

FIGURE NO.: 9

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Hollow Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Road
Town of Caledon

DRILLING DATE: October 13, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
263.6	Ground Surface							
0.0	**38 cm TOPSOIL**	1	DO	3	0		17	
	Brown, soft to very stiff							
	weathered							
	SILTY CLAY TILL	2	DO	19	1		14	
	some sand to sandy, a trace of gravel occ. sand and silt seams and layers	3	DO	30	2		11	
261.5								
2.1	Brown, dense to very dense							
	silt							
	SANDY SILT TILL	4	DO	47	3		14	
	a trace of clay occ. sand and silt seams and layers	5	DO	50/13			12	
259.6								
4.0	Dense to very dense, very moist to wet				4			
	SILTY FINE SAND/SANDY SILT	6	DO	70	5		16	
	a trace of clay							
	brown / grey				6			
		7	DO	42			22	
257.0								
6.6	**END OF BOREHOLE**				7			
	Installed 50-mm Ø PVC monitoring well to 6.1 m, completed with 1.5 m screen Sand backfill from 4.0 to 6.1 m Bentonite seal from 0.0 to 4.0 m Provided with a steel monument casing				8			
					9			
					10			
					11			
					12			
					13			
					14			

W.L. @ El. 257.7 m on completion

Soil Engineers Ltd.

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-110

FIGURE NO.: 10

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Road
Town of Caledon

DRILLING DATE: October 12, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
263.6	Ground Surface							
0.0	**28 cm TOPSOIL**	1A	DO	5	0		21	
	Brown, loose to compact	1B						
	SILT	2	DO	13	1		20	
	weathered							
	some sand to sandy						23	
261.8	occ. clay lenses	3	DO	14	2			
1.8	Grey, very stiff						11	
	SILTY CLAY TILL	4	DO	17				
260.7	sandy, a trace of gravel							
2.9	Grey, stiff	5	DO	15	3		19	
	SILTY CLAY							
259.6	occ. gravel				4			
4.0	Grey, loose to compact, wet							
	SILTY FINE SAND/SANDY SILT	6	DO	26	5		18	
	occ. silt layers							
					6			
		7	DO	9			22	
257.0								
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			

Dry on completion

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-111

FIGURE NO.: 11

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Road
Town of Caledon

DRILLING DATE: October 13, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
263.7	Ground Surface							
0.0	**33 cm TOPSOIL**	1	DO	8	0		19	
	Brown, loose to compact							
	SANDY SILT — weathered	2	DO	16	1		19	
262.3	a trace of clay							
1.4	Compact							
	SILT — brown grey	3	DO	15	2		24	
261.6	a trace of clay, occ. sand seams							
2.1	Grey, stiff to very stiff							
		4	DO	12			15	
	SILTY CLAY TILL							
	sandy, a trace of gravel							
	occ. sand seams and layers	5	DO	18	3		12	
259.7								
4.0	Grey, stiff to very stiff				4			Dry on completion
	SILTY CLAY	6	DO	16	5		20	
	a trace of sand, occ. gravel							
	occ. sand and silt seams				6		26	
		7	DO	15				
257.1								
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-112

FIGURE NO.: 12

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Road
Town of Caledon

DRILLING DATE: October 13, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
262.9	Ground Surface							
0.0	**25 cm TOPSOIL**	1	DO	7	0		20	
	Firm to hard — weathered	2	DO	23	1		15	
	SILTY CLAY TILL	3	DO	22	2		16	
	some sand to sandy, a trace of gravel occ. sand and silt seams and layers	4	DO	37	3		18	
		5	DO	28	4		16	
	varved silt and clay structure	6A 6B	DO	33	5		20 16	
257.3								
5.6	Brown, dense, moist							
	SILTY FINE SAND/SANDY SILT a trace of clay	7	DO	42	6		16	
256.3								
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			

Dry on completion

JOB NO.: 2310-S042

LOG OF BOREHOLE: BC-101

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 12760 Hurontario Road, Town of Caledon

DRILLING DATE: October 13, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
262.4	Ground Surface							
0.0	**41 cm TOPSOIL**	1	DO	5	0		13	
	Brown, loose							
	SANDY SILT	2	DO	6	1		24	
	occ. sand seams and layers — weathered						19	
260.8		3A	DO	21			12	
1.6	Brown, very stiff	3B			2			
	SILTY CLAY TILL	4	DO	30			11	
	some sand to sandy a trace of gravel occ. sand and silt seams and layers	5	DO	24	3		17	
258.4								
4.0	Grey, stiff to very stiff				4			
	SILTY CLAY	6	DO	12	5		24	
	a trace of sand occ. silt seams and layers							
	— — — silt	7A	DO	23	6		29	
255.8		7B					20	
6.6	**END OF BOREHOLE** Installed 50-mm Ø PVC monitoring well to 6.1 m, completed with 1.5 m screen Sand backfill from 4.0 to 6.1 m Bentonite seal from 0.0 to 4.0 m Provided with a steel monument casing				7 8 9 10			Dry on completion

Soil Engineers Ltd.

JOB NO.: 2310-S042

LOG OF BOREHOLE: BC-102

FIGURE NO.: 2

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 12760 Hurontario Road, Town of Caledon

DRILLING DATE: October 16, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
261.3	Ground Surface							
0.0	**18 cm TOPSOIL**	1A			0			
	Brown, loose, weathered **SANDY SILT** occ. sand seams and layers	1B	DO	9			13	
260.5 / 0.8	Very stiff to hard	2	DO	26	1		12	
	SILTY CLAY TILL	3	DO	29			12	
	some sand to sandy a trace of gravel occ. sand and silt seams and layers, cobbles	4	DO	55	2		12	
		5	DO	58	3		10	
	brown / grey				4			
		6	DO	29	5		18	
255.7								
5.6	Grey, very stiff				6			
	SILTY CLAY							
254.7	a trace of sand	7	DO	24			26	
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			

Dry on completion

Soil Engineers Ltd.

JOB NO.: 2310-S042

LOG OF BOREHOLE: BC-103

FIGURE NO.: 3

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 12760 Hurontario Road, Town of Caledon

DRILLING DATE: October 16, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
261.3	Ground Surface							
0.0	**20 cm TOPSOIL**	1A			0			
	Brown, compact, weathered	1B	DO	11			14	
	SANDY SILT							
	with organics, occ. silt seams and layers	2	DO	11	1		22	
259.9								
1.4	Very stiff to hard	3	DO	25			21	
	SILTY CLAY TILL				2			
	some sand to sandy	4	DO	36			11	
	a trace of gravel — brown / grey							
	occ. sand and silt seams and layers, cobbles	5	DO	33	3		10	
256.7					4			
4.6	Grey, very stiff	6	DO	17			22	
	SILTY CLAY				5			
	a trace of sand, occ. gravel with dilating silt layers				6			
		7	DO	22			25	
254.7								
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			

Dry on completion

JOB NO.: 2310-S042

LOG OF BOREHOLE: BC-104

FIGURE NO.: 4

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 12760 Hurontario Road, Town of Caledon

DRILLING DATE: October 16, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
259.5	Ground Surface							
0.0	**41 cm TOPSOIL**	1A	DO	8	0		25	
	Brown, loose, weathered **SANDY SILT/SILTY FINE SAND**	1B					22	
258.7								
0.8	Brown, stiff to very stiff **SILTY CLAY TILL** some sand, a trace of gravel occ. sand and clay layers	2	DO	14	1		12	
		3	DO	27	2		23	
257.2								
2.3	Brown, very stiff **SILTY CLAY** a trace of sand, occ. gravel	4	DO	17			25	
		5	DO	16	3		28	
255.5								
4.0	Grey, loose, wet **SILT** some fine sand a trace of clay	6	DO	9	4 5		23	
		7	DO	9	6		19	▽ W.L. @ El. 253.6 m on completion
252.3					7			
7.2	Grey, stiff **SILTY CLAY** a trace of sand, with varved (silt) layering	8	DO	13	8		28	
251.4								
8.1	**END OF BOREHOLE**				9 10			

JOB NO.: 2310-S042

LOG OF BOREHOLE: BC-105D

FIGURE NO.: 5

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Hollow Stem Augers and Tricone

PROJECT LOCATION: 12760 Hurontario Road, Town of Caledon

DRILLING DATE: October 17, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
260.1	Ground Surface							
0.0	**25 cm TOPSOIL**	1A	DO	10	0		19	
	Brown, stiff to hard	1B						
	SILTY CLAY TILL — weathered	2	DO	26	1		13	
	some sand to sandy a trace of gravel occ. sand and silt seams and layers, cobbles	3	DO	26			19	
		4	DO	37	2		12	
		5	DO	38	3		10	
256.1								
4.0	Stiff				4			
	SILTY CLAY							
	a trace of sand, occ. gravel — brown grey	6	DO	13	5		23	
254.5								
5.6	Grey, compact to dense, wet				6			
	SILT	7	DO	32			18	
	some fine sand a trace of clay				7			
		8	DO	11	8		18	
251.4								
8.7	Grey, very stiff to hard				9			
	SILTY CLAY TILL	9	DO	18			14	
	sandy, a trace of gravel occ. sand and silt seams and layers				10			
250.1								

Water was used during drilling

JOB NO.: 2310-S042

LOG OF BOREHOLE: BC-105D

FIGURE NO.: 5

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Hollow Stem Augers and Tricone

PROJECT LOCATION: 12760 Hurontario Road, Town of Caledon

DRILLING DATE: October 17, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
10.0	Grey, very stiff to hard **SILTY CLAY TILL** sandy, a trace of gravel occ. sand and silt seams and layers	10A	DO	50	10	○		
		10B	DO	52	11	○	12	
248.2								
11.9	Grey, dense to very dense **SANDY SILT TILL** traces of clay and gravel occ. cobbles	11	DO	44	12	○	11	
		12	DO	50	13	○	21	
245.5					14			
14.6	Grey, hard **SILTY CLAY TILL**				15			
244.6	some sand, with silt layers	13	DO	50/13		○	13	
15.5	**END OF BOREHOLE** Installed 50-mm Ø PVC monitoring well to 15.2 m, completed with 1.5 m screen Sand backfill from 13.1 to 15.2 m Bentonite seal from 0.0 to 13.1 m Provided with a steel monument casing				16 17 18 19 20			

JOB NO.: 2310-S042

LOG OF BOREHOLE: BC-105S

FIGURE NO.: 6

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 12760 Hurontario Road, Town of Caledon

DRILLING DATE: October 17, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES: Number	SAMPLES: Type	SAMPLES: N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
260.1 0.0	Ground Surface				0			
	NO SAMPLING **DIRECT AUGER AND INSTALLED NESTED SHALLOW WELL TO 7.6 m**				1 2 3 4 5 6 7			Dry on completion
252.5 7.6	**END OF BOREHOLE** Installed 50-mm Ø PVC monitoring well to 7.6 m, completed with 1.5 m screen Sand backfill from 5.5 to 7.6 m Bentonite seal from 0.0 to 5.5 m Provided with a steel monument casing				8 9 10			

JOB NO.: 2310-S042

LOG OF BOREHOLE: BC-106

FIGURE NO.: 7

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 12760 Hurontario Road, Town of Caledon

DRILLING DATE: October 17, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
256.6	Ground Surface							
0.0	**61 cm TOPSOIL**	1	DO	4	0		26	
	Brown, hard **SILTY CLAY TILL** — weathered some sand, a trace of gravel	2	DO	34	1		20	
255.2								
1.4	Brown, hard **SILTY CLAY** a trace of sand, occ. gravel	3	DO	32	2		19	
254.5								
2.1	Loose to compact **SILT** some sand, a trace of clay occ. sand seams and clay layers moist, becoming wet below 3.0 m	4	DO	8			17	
		5	DO	28	3		21	
	— — brown / grey	6	DO	9	4		21	
					5			
		7	DO	14	6		23	
249.4					7			▽ W.L. @ El. 249.9 m on completion
7.2	Grey, very dense **SANDY SILT TILL/SILTY SAND TILL** a trace of clay a trace to some gravel occ. silt seams and layers, cobbles and boulders	8	DO	82	8		10	
		9	DO	50/13	9		11	
246.6					10			

JOB NO.: 2310-S042

LOG OF BOREHOLE: BC-106

FIGURE NO.: 7

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 12760 Hurontario Road, Town of Caledon

DRILLING DATE: October 17, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
10.0	Grey, very dense **SANDY SILT TILL/SILTY SAND TILL** — — —silt a trace of clay a trace to some gravel occ. silt seams and layers, cobbles and boulders	10	DO	50/10	10		15	
		11	DO	50/10	11			
					12		12	
243.3					13			
13.3	Grey, very dense, moist **SILT** some sand and clay occ. clay layers	12	DO	50/13	14		18	
		13	DO	53	15		19	
240.9								
15.7	**END OF BOREHOLE**				16			
					17			
					18			
					19			
					20			

JOB NO.: 2310-S042

LOG OF BOREHOLE: BC-107

FIGURE NO.: 8

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 12760 Hurontario Road, Town of Caledon

DRILLING DATE: October 17, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
260.6	Ground Surface							
0.0	**25 cm TOPSOIL**				0			
	Brown, firm to hard	1	DO	6			13	
	weathered							
	SILTY CLAY TILL	2	DO	42	1		11	
	some sand to sandy a trace of gravel occ. sand and silt seams and layers	3	DO	40			12	
		4	DO	45	2		12	
		5	DO	42	3		15	
256.6								
4.0	Brown, very dense, moist				4			
	SANDY SILT	6	DO	56			11	
	a trace of clay occ. silt lenses				5			
255.0								
5.6	Brown, very dense				6			
	SANDY SILT TILL	7	DO	89			16	
	traces of clay and gravel occ. sand and silt seams and layers				7			
254.0								
6.6	**END OF BOREHOLE**				8			
					9			
					10			

Dry on completion

JOB NO.: 2310-S043

LOG OF BOREHOLE: W-101

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

DRILLING DATE: October 23, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
266.0	Ground Surface							
0.0	**25 cm TOPSOIL**				0			
	Stiff to hard	1	DO	12			15	
	SILTY CLAY TILL — weathered	2	DO	25	1		13	
	sandy, a trace of gravel occ. sand and silt seams and layers	3	DO	37			9	
		4	DO	32	2		13	
	— — brown / grey	5	DO	20	3		12	
262.0								
4.0	Grey, stiff				4			
	SILTY CLAY a trace of sand occ. silt seams and layers	6	DO	11	5		21	
260.4								
5.6	Grey, compact, very moist to wet				6			
	SILT traces of fine sand and clay	7	DO	30			19	
259.4								
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			Dry on completion

JOB NO.: 2310-S043

LOG OF BOREHOLE: W-102

FIGURE NO.: 2

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

DRILLING DATE: October 23, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
264.7	Ground Surface							
0.0	**33 cm TOPSOIL**	1	DO	9	0		15	
	Brown, stiff to hard weathered							
	SILTY CLAY TILL	2	DO	34	1		10	
	sandy, a trace of gravel occ. sand and silt seams and layers	3	DO	39	2		12	
262.6								
2.1	Grey, compact to dense, very moist to wet							
	SILT	4	DO	21	3		17	
	a trace to some sand occ. sand seams and clay layers	5	DO	36			21	
		6	DO	31	4		23	
258.4		7A			5			
6.3	Reddish-brown, very dense, moist	7B	DO	71	6		22	
258.1	**SANDY SILT TILL**						10	
6.6	traces of clay and gravel				7			
	END OF BOREHOLE				8			
					9			
					10			

W.L. @ El. 262.0 m on completion

JOB NO.: 2310-S043

LOG OF BOREHOLE: W-103

FIGURE NO.: 3

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

DRILLING DATE: October 19, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
264.9	Ground Surface							
0.0	**20 cm TOPSOIL**				0			
	Stiff to hard	1	DO	10			13	
	SILTY CLAY TILL — weathered	2	DO	24	1		13	
	some sand to sandy a trace of gravel occ. sand and silt seams and layers, cobbles	3	DO	36	2		12	
		4	DO	37			13	
	— — brown grey	5	DO	35	3		12	
		6	DO	15	4		13	
259.3					5			
5.6	Grey, compact, wet **SILT**				6			
	traces of fine sand and clay	7	DO	28			20	
258.3					7			
6.6	**END OF BOREHOLE**				8			
	Installed 50-mm Ø PVC monitoring well to 6.1 m, completed with 1.5 m screen Sand backfill from 4.0 to 6.1 m Bentonite seal from 0.0 to 4.0 m Provided with a steel monument casing				9			Dry on completion
					10			

JOB NO.: 2310-S043

LOG OF BOREHOLE: W-104

FIGURE NO.: 4

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

DRILLING DATE: October 23, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
263.4	Ground Surface							
0.0	**33 cm TOPSOIL**	1	DO	9	0		15	
	Brown, stiff to very stiff							
	weathered							
	SILTY CLAY TILL	2	DO	25	1		12	
	sandy, a trace of gravel occ. sand and silt seams and layers	3	DO	23			19	
261.3					2			
2.1	Grey, compact to dense, very moist to wet							
	SILT	4	DO	32			18	
	some sand to sandy a trace of clay occ. clay layers	5	DO	40	3		17	
					4			
		6	DO	41	5		22	
					6			
	moist,	7A	DO	25			18	
256.8	varved clay	7B					21	
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			

W.L. @ El. 261.8 m on completion

JOB NO.: 2310-S043

LOG OF BOREHOLE: W-105

FIGURE NO.: 5

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

DRILLING DATE: October 20, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
267.6	Ground Surface							
0.0	**28 cm TOPSOIL**				0			
	Brown, firm to hard	1	DO	6				
	weathered							
	SILTY CLAY TILL	2	DO	32	1			
	sandy, a trace of gravel occ. sand and silt seams and layers, cobbles	3	DO	36				
					2			
		4	DO	28				
264.7								
2.9	Compact to very dense, wet				3			
		5	DO	70				
	SILT							
	some sand, a trace of clay occ. silty fine sand layers brown grey				4			
		6	DO	59	5			
					6			
		7	DO	25				
261.0								
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			

W.L. @ El. 265.2 m on completion

JOB NO.: 2310-S043

LOG OF BOREHOLE: W-106

FIGURE NO.: 6

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

DRILLING DATE: October 19, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
265.5	Ground Surface							
0.0	**20 cm TOPSOIL**				0			
	Brown, stiff, weathered **SILTY CLAY TILL** sandy, a trace of gravel	1	DO	9			14	
264.7								
0.8	Brown, loose to compact, very moist to wet — weathered	2	DO	19	1		21	
	SILT some sand, a trace of clay	3	DO	10			20	
263.4					2			
2.1	Brown, dense, wet — seepage							
	SILTY FINE SAND a trace of clay	4	DO	31			21	
262.6					3			
2.9	Reddish-brown/grey, very dense — grey, silt and clay layers	5	DO	31			17	
	SANDY SILT TILL traces of clay and gravel occ. silt and clay layers, cobbles and boulders	6	DO	50/13	4 5 6		7	
259.1		7	DO	50			8	
6.4	**END OF BOREHOLE**				7 8 9 10			

Installed 50-mm Ø PVC monitoring well to 6.1 m, completed with 1.5 m screen
Sand backfill from 4.0 to 6.1 m
Bentonite seal from 0.0 to 4.0 m
Provided with a steel monument casing

Seepage and cave-in detected at 2.4 m

JOB NO.: 2310-S043

LOG OF BOREHOLE: W-107

FIGURE NO.: 7

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

DRILLING DATE: October 20, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
268.7	Ground Surface							
0.0	**18 cm TOPSOIL**				0			
	Stiff to hard	1	DO	10			13	
	weathered							
	SILTY CLAY TILL	2	DO	19	1		11	
	sandy, a trace of gravel occ. sand and silt seams and layers, cobbles	3	DO	38			13	
	silt				2			
		4	DO	60			16	
	brown grey							
		5	DO	62	3		11	
264.7								
4.0	Grey, very dense, dry				4			
	SILT							
	some clay occ. clay layers	6	DO	57	5		13	
263.1								
5.6	Reddish-brown, very dense				6			
	SANDY SILT TILL							
	traces of clay and gravel, occ. cobbles	7	DO	75			7	
262.1								
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			

Dry on completion

JOB NO.: 2310-S043

LOG OF BOREHOLE: W-108

FIGURE NO.: 8

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

DRILLING DATE: October 19, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
267.5 / 0.0	Ground Surface				
	18 cm TOPSOIL				0
	Brown, firm, weathered	1	DO	7	
	SILTY CLAY TILL				
	sandy, a trace of gravel occ. topsoil inclusions	2	DO	8	1
266.1 / 1.4	Brown, compact to dense, wet				
	SILT	3	DO	23	2
	some sand, a trace of clay occ. sand layers	4	DO	32	
264.6 / 2.9	Brown, dense, wet — seepage				3
	SILTY FINE SAND	5	DO	38	
	a trace of clay occ. silt lenses and layers				
263.5 / 4.0	Reddish-brown, dense to very dense				4
	SANDY SILT TILL	6	DO	39	5
	traces of clay and gravel occ. silt layers				6
261.1 / 6.4		7	DO	50/10	
	END OF BOREHOLE				7
	Installed 50-mm Ø PVC monitoring well to 6.1 m, completed with 1.5 m screen Sand backfill from 4.0 to 6.1 m Bentonite seal from 0.0 to 4.0 m Provided with a steel monument casing				8
	Seepage and cave-in detected at 3.0 m				9
					10

Dynamic Cone (blows/30 cm) 10 30 50 70 90

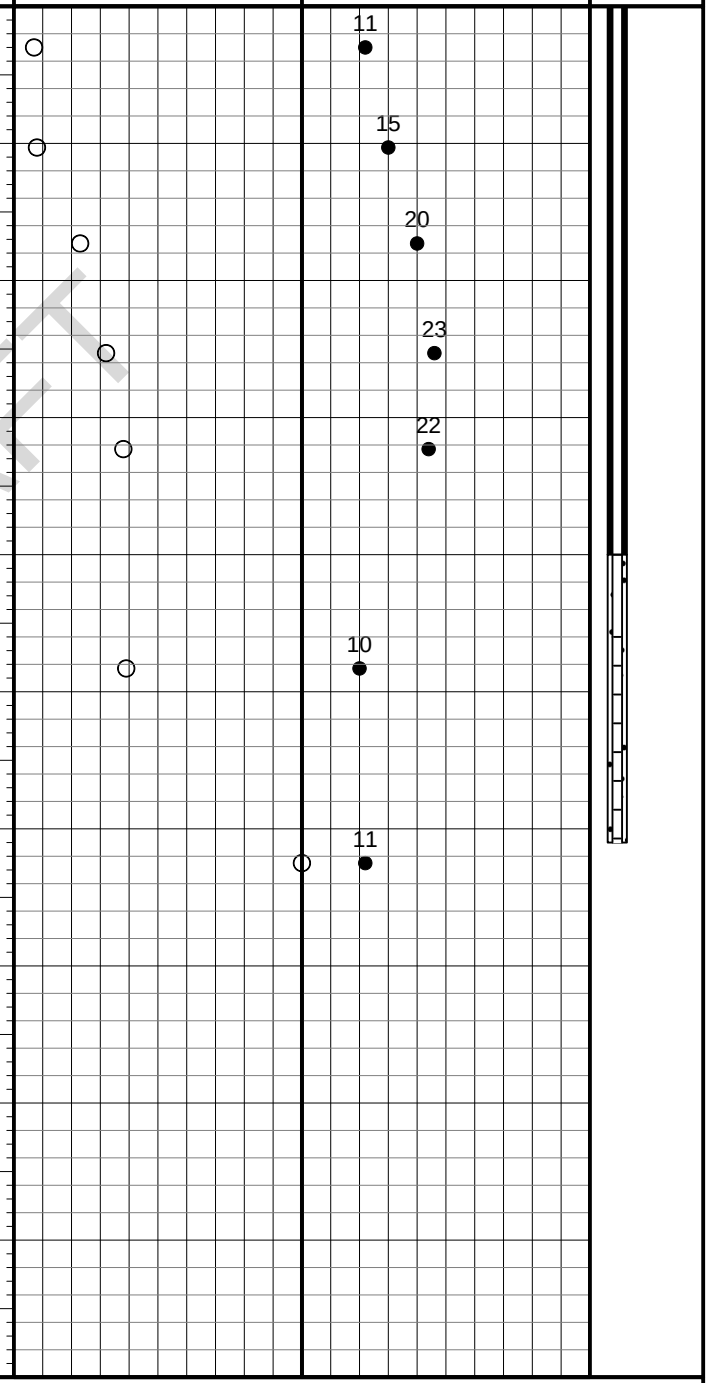
Shear Strength (kN/m²) 50 100 150 200

Penetration Resistance (blows/30 cm) 10 30 50 70 90

Atterberg Limits PL LL

Moisture Content (%) 10 20 30 40

WATER LEVEL



JOB NO.: 2310-S043

LOG OF BOREHOLE: W-109

FIGURE NO.: 9

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

DRILLING DATE: October 20, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
267.7	Ground Surface							
0.0	**23 cm TOPSOIL**				0			
	Brown, loose to very dense	1	DO	6			14	
	SANDY SILT TILL/SILTY SAND TILL	2	DO	35	1		13	
	weathered							
	traces of clay and gravel occ. cobbles and boulders	3	DO	54			9	
					2			
		4	DO	78			10	
264.8								
2.9	Hard				3			
	brown / grey	5	DO	89			12	
	SILTY CLAY							
	a trace to some sand frequent silt layers occ. gravel and sand seams				4			
		6	DO	50			15	
					5			
261.5		7A			6		16	
6.2	Reddish-brown, very dense	7B	DO	50			13	
261.3	**SANDY SILT TILL**							
6.4	**END OF BOREHOLE**				7			
					8			
					9			
					10			Dry on completion

Soil Engineers Ltd.

JOB NO.: 2310-S043

LOG OF BOREHOLE: W-110

FIGURE NO.: 10

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

DRILLING DATE: October 20, 2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
265.4	Ground Surface							
0.0	**30 cm TOPSOIL**				0			
	Brown, loose to dense, moist	1	DO	5			15	
	SILT	2	DO	7	1		20	
	weathered							
	some sand to sandy a trace of clay occ. sand layers becoming wet below 3.0 m	3	DO	27	2		17	
		4	DO	45			20	
		5	DO	41	3		23	
261.4								
4.0	Reddish-brown/grey, very dense				4			
	SANDY SILT TILL	6	DO	90/13	5		10	
	traces of clay and gravel occ. sand and silt seams and layers, cobbles and boulders							
259.2		7	DO	50/10	6		12	
6.2	**END OF BOREHOLE**				7			
					8			
					9			
					10			

W.L. @ El. 262.7 m on completion

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

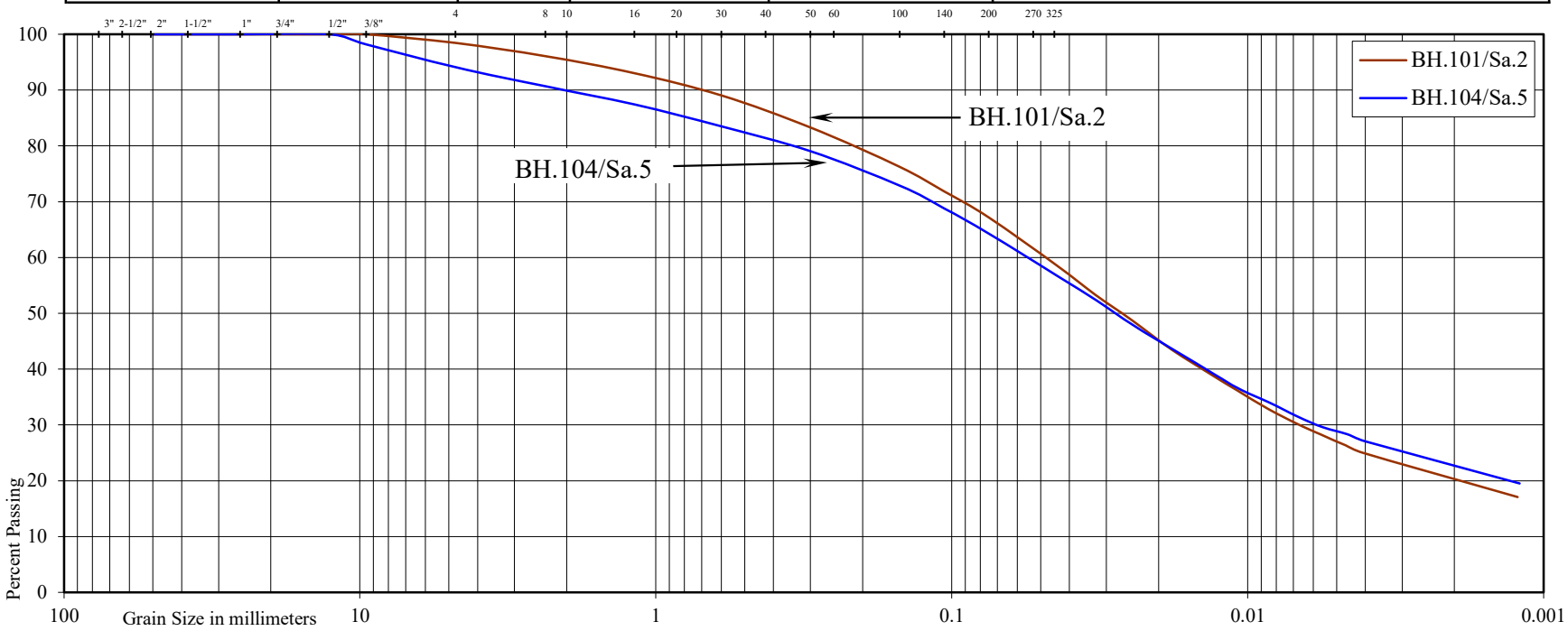
Reference No: 2310-S040

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Pumping Station and Stormwater Management Facilities

Location: Southeast of Old School Road and McLaughlin Road, Town of Caledon

Borehole No:	101	104
Sample No:	2	5
Depth (m):	1.0	3.2
Elevation (m):	260.6	254.8

BH./Sa.	101/2	104/5
Liquid Limit (%) =	23	25
Plastic Limit (%) =	15	16
Plasticity Index (%) =	8	9
Moisture Content (%) =	17	10
Estimated Permeability (cm./sec.) =	10^{-7}	10^{-7}

Classification of Sample [& Group Symbol]: SILTY CLAY TILL

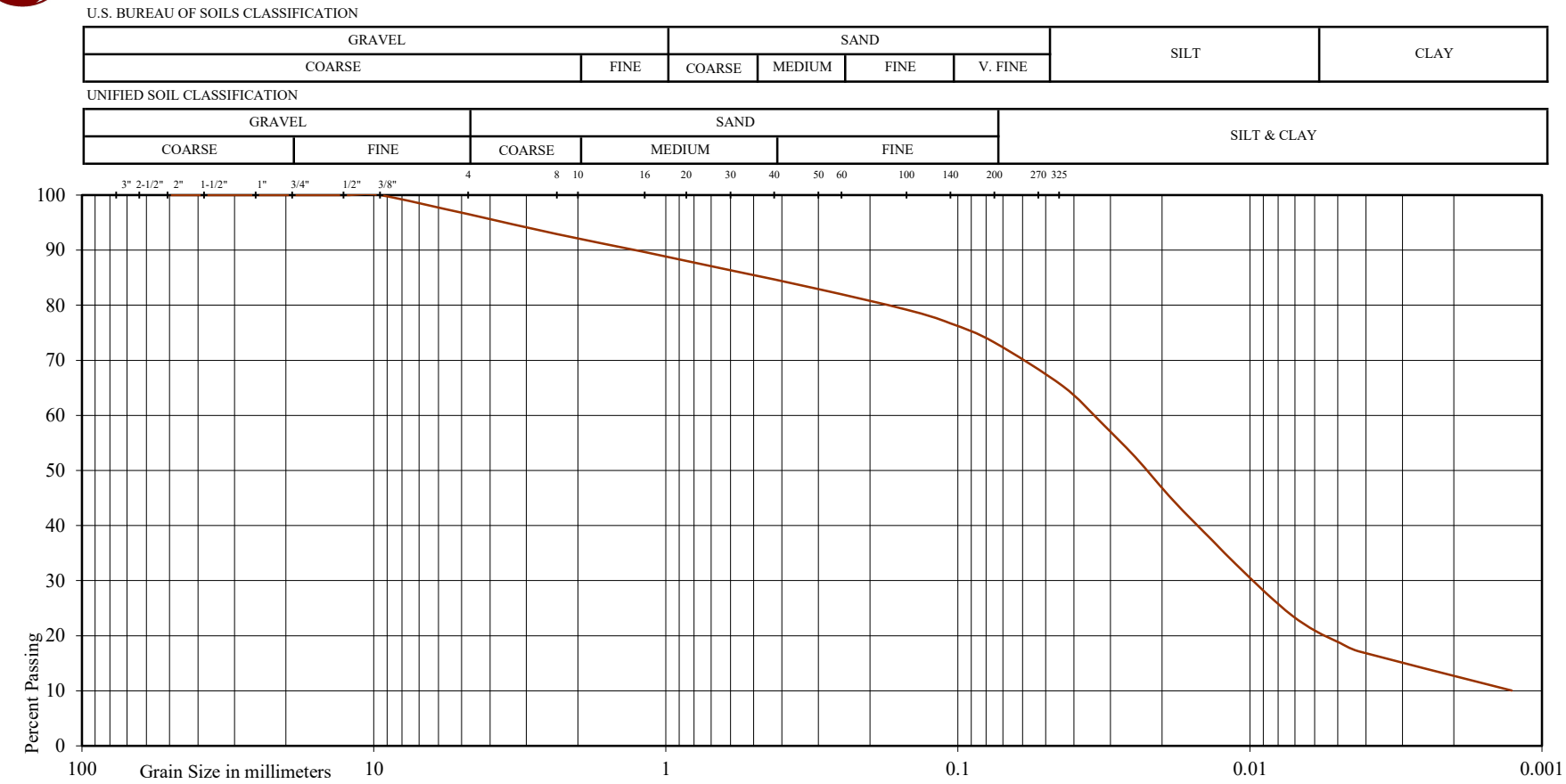
sandy, a trace of gravel

Figure: 5

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2310-S040



Project: Proposed Pumping Station and Stormwater Management Facilities

Location: Southeast of Old School Road and McLaughlin Road, Town of Caledon

BH./Sa. 101/11

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = 9

Estimated Permeability (cm./sec.) = 10^{-6}

Borehole No: 101

Sample No: 11

Depth (m): 12.3

Elevation (m): 249.3

Classification of Sample [& Group Symbol]: SANDY SILT, TILL
some clay, a trace of gravel

Figure: 6

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

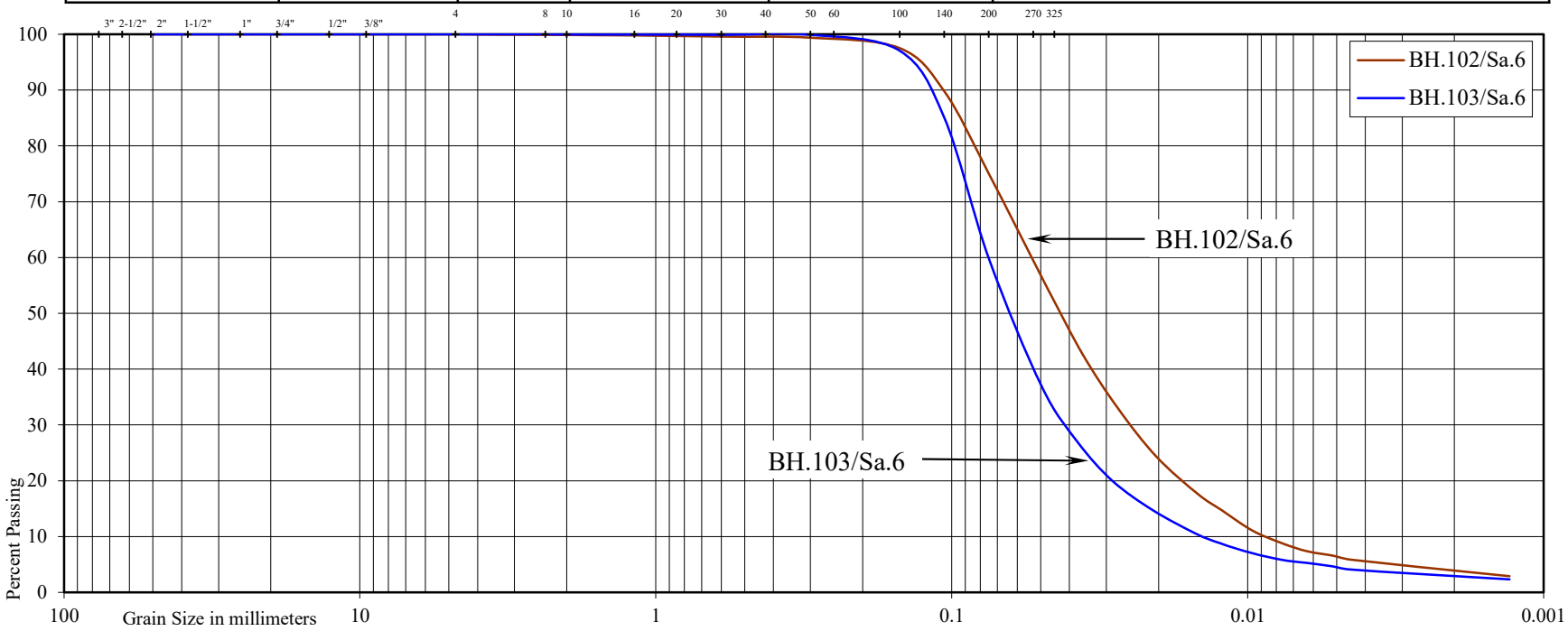
Reference No: 2310-S040

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Pumping Station and Stormwater Management Facilities

Location: Southeast of Old School Road and McLaughlin Road, Town of Caledon

Borehole No:	102	103
Sample No:	6	6
Depth (m):	4.8	4.8
Elevation (m):	255.8	254.2

BH./Sa.	102/6	103/6
Liquid Limit (%) =	-	-
Plastic Limit (%) =	-	-
Plasticity Index (%) =	-	-
Moisture Content (%) =	20	17
Estimated Permeability (cm./sec.) =	10^{-4}	10^{-4}

Classification of Sample [& Group Symbol]: SANDY SILT
a trace of clay

Figure: 7

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

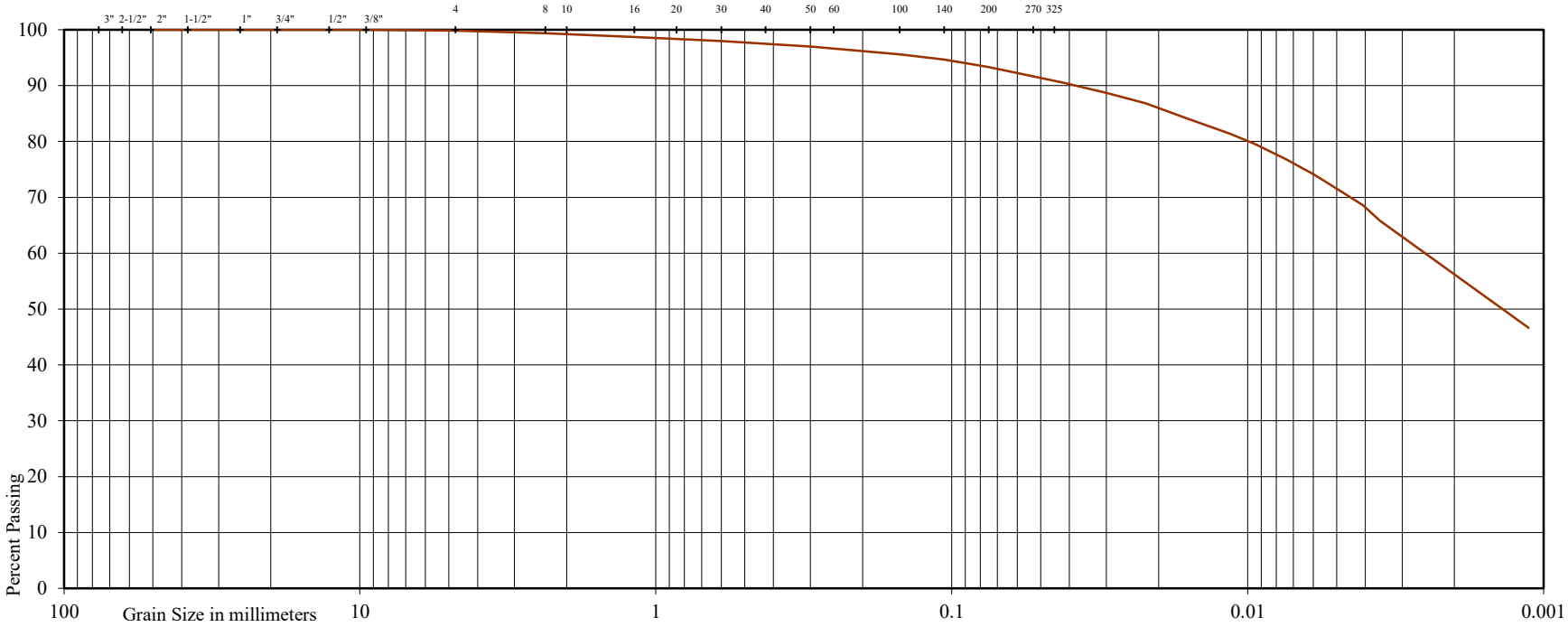
Reference No: 2310-S040

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Pumping Station and Stormwater Management Facilities

Location: Southeast of Old School Road and McLaughlin Road, Town of Caledon

BH./Sa. 104/6

Liquid Limit (%) = 44

Plastic Limit (%) = 21

Plasticity Index (%) = 23

Moisture Content (%) = 21

Estimated Permeability (cm./sec.) = 10^{-7}

Borehole No: 104

Sample No: 6

Depth (m): 4.8

Elevation (m): 253.2

Classification of Sample [& Group Symbol]: SILTY CLAY

a trace of sand

Figure: 8

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

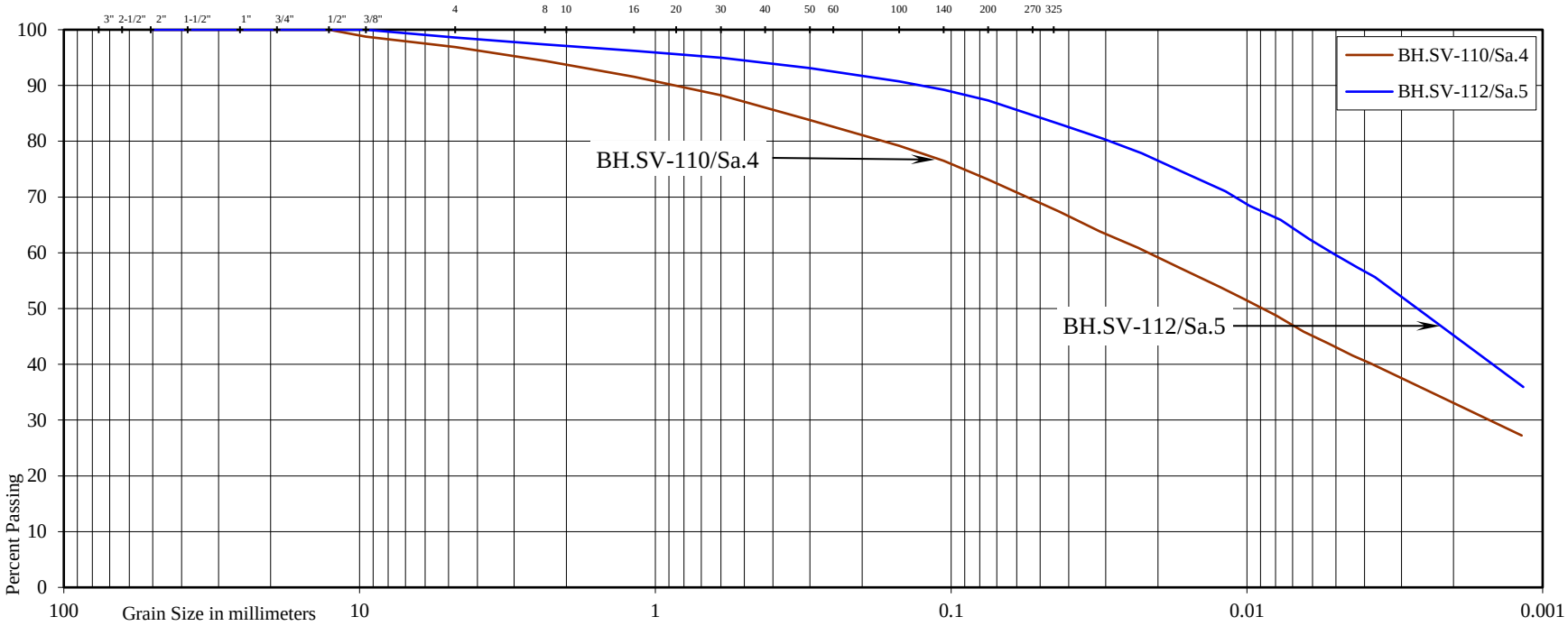
Reference No: 2310-S041

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: Southwest of Old School Road and Hurontario Road, Town of Caledon

Borehole No:	SV-110	SV-112
Sample No:	4	5
Depth (m):	2.5	3.2
Elevation (m):	261.1	259.7

BH./Sa.	110/4	112/5
Liquid Limit (%) =	30	37
Plastic Limit (%) =	17	20
Plasticity Index (%) =	13	17
Moisture Content (%) =	11	16
Estimated Permeability (cm./sec.) =	10^{-7}	10^{-7}

Classification of Sample [& Group Symbol]: SILTY CLAY TILL

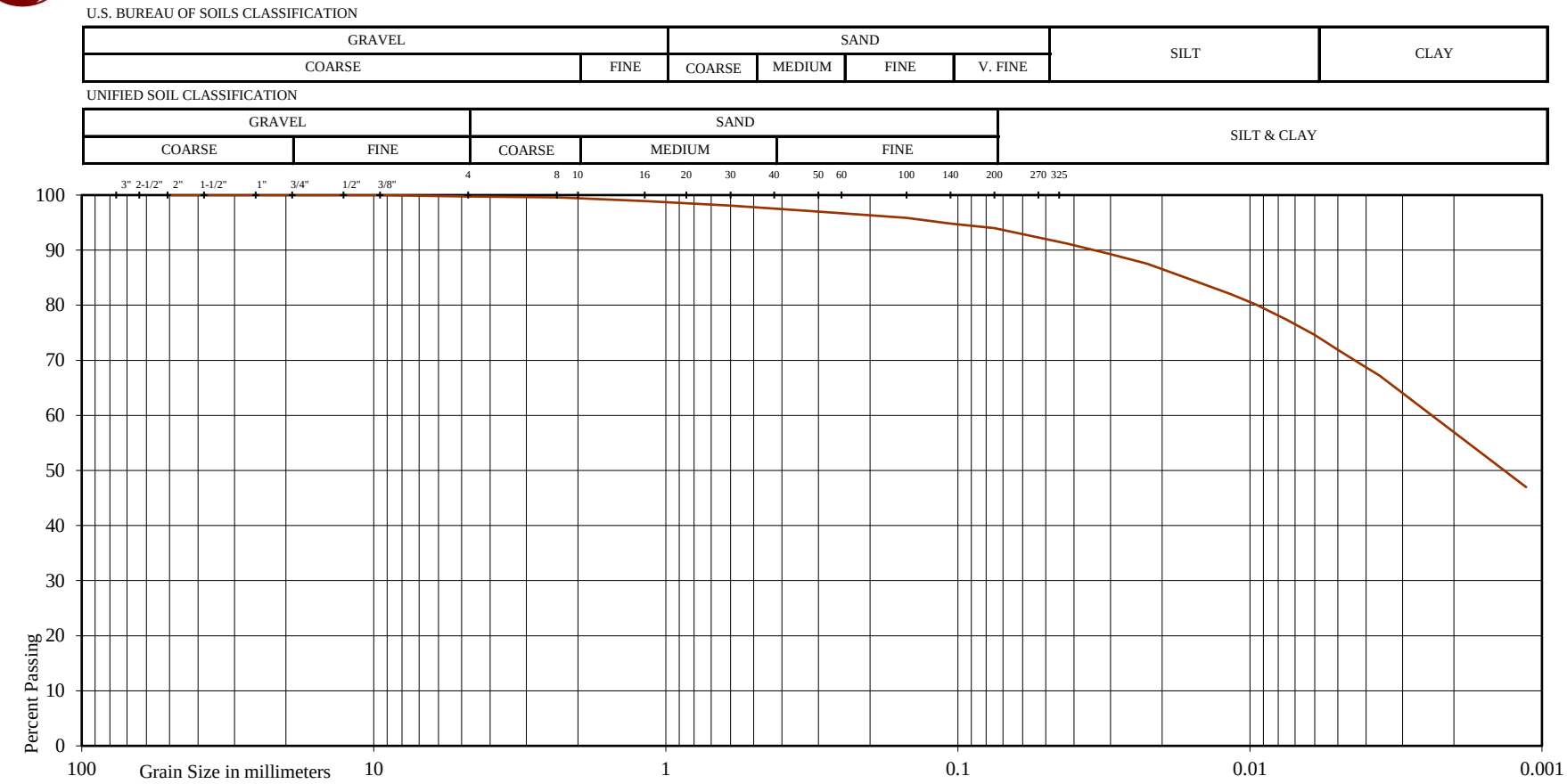
some sand to sandy, a trace of gravel

Figure: 13

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2310-S041



Project: Proposed Residential Development

Location: Southwest of Old School Road and Hurontario Road, Town of Caledon

BH./Sa. 111/6

Liquid Limit (%) = 42

Plastic Limit (%) = 21

Plasticity Index (%) = 21

Moisture Content (%) = 20

Estimated Permeability (cm./sec.) = 10^{-7}

Borehole No: SV-111

Sample No: 6

Depth (m): 4.8

Elevation (m): 258.9

Classification of Sample [& Group Symbol]: SILTY CLAY

a trace of sand

Figure: 14

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

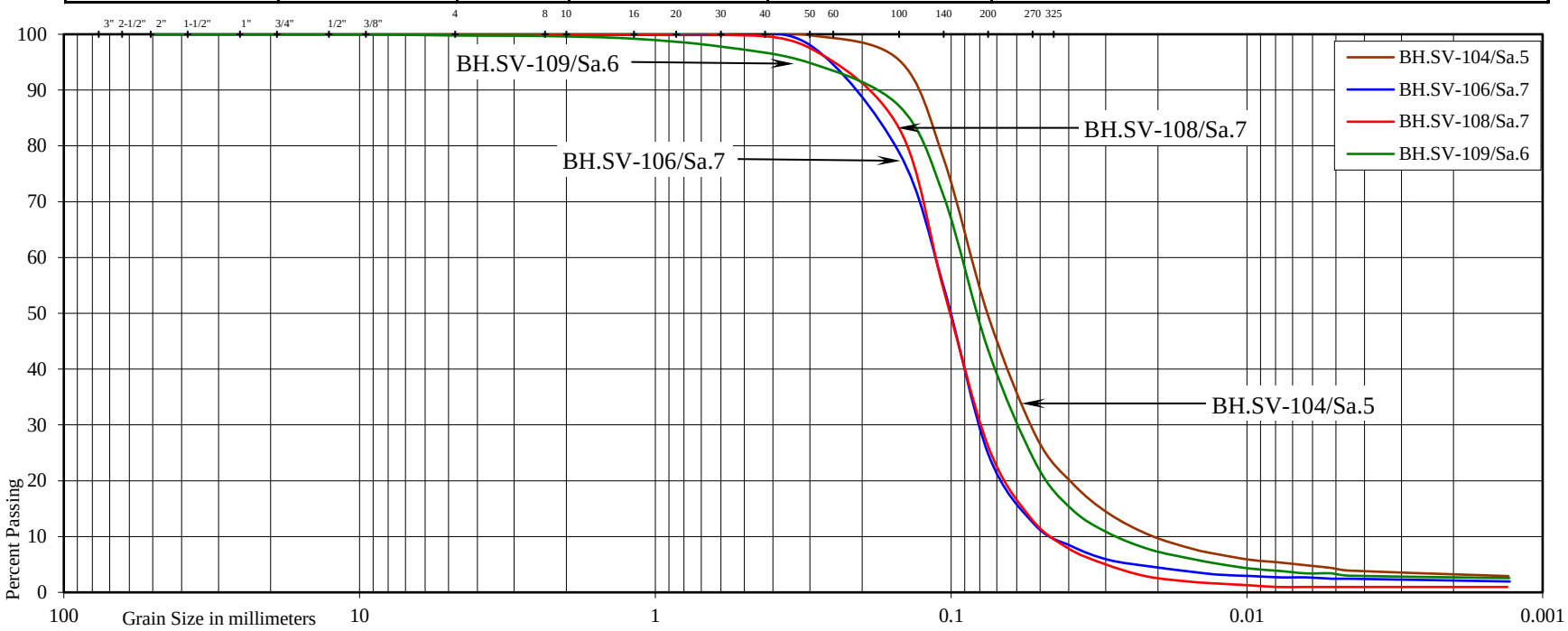
Reference No: 2310-S041

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: Southwest of Old School Road and Hurontario Road, Town of Caledon

Borehole No:	SV-104	SV-106	SV-108	SV-109
Sample No:	5	7	7	6
Depth (m):	3.2	6.3	6.3	4.8
Elevation (m):	260.9	258.6	258.0	258.8

BH./Sa.	104/5	106/7	108/7	109/6
Liquid Limit (%) =	-	-	-	-
Plastic Limit (%) =	-	-	-	-
Plasticity Index (%) =	-	-	-	-
Moisture Content (%) =	14	19	25	16
Estimated Permeability (cm./sec.) =	10^{-3}	10^{-3}	10^{-3}	10^{-3}

Classification of Sample [& Group Symbol]: SILTY FINE SAND

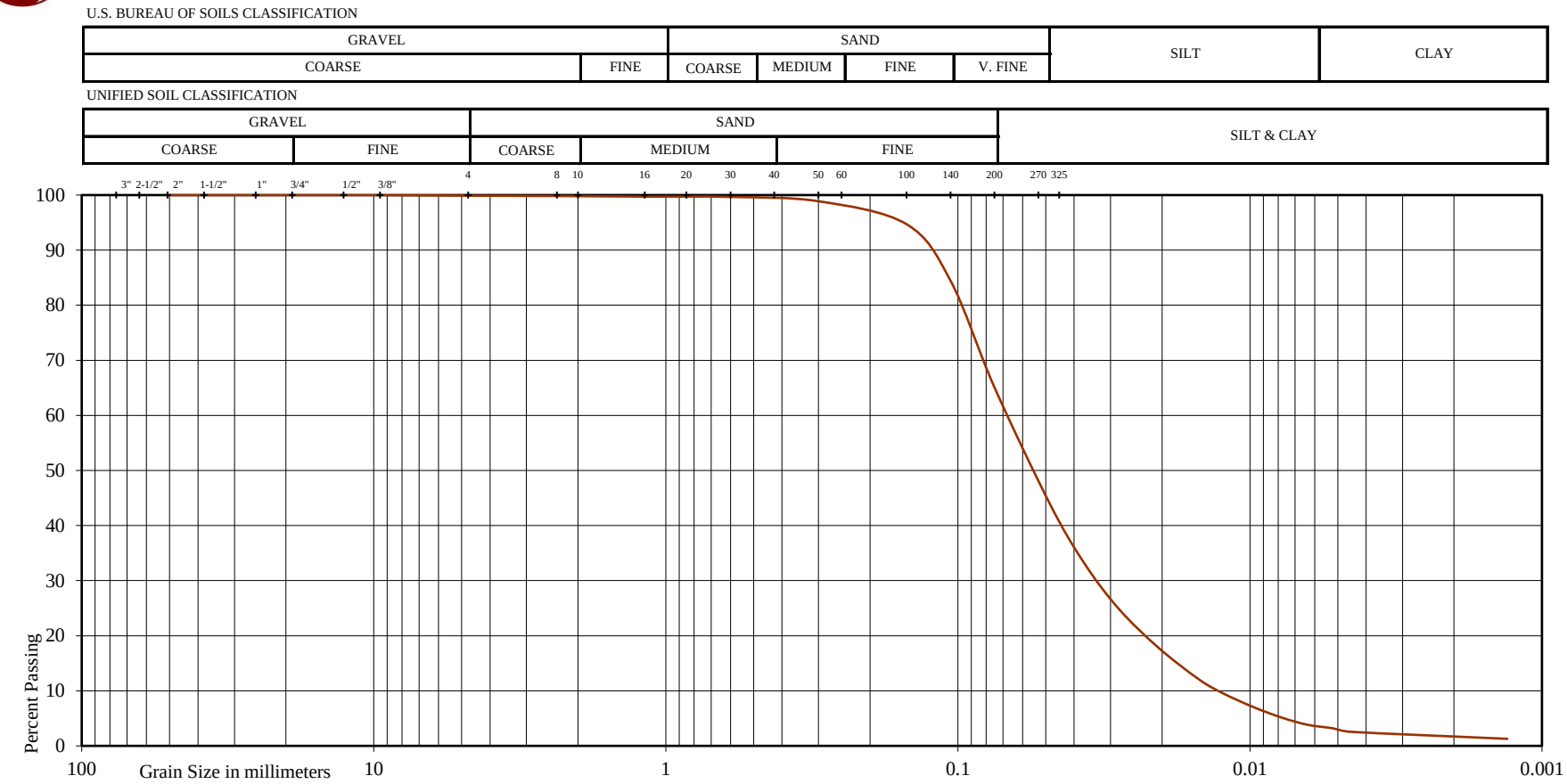
a trace of clay

Figure: 15

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2310-S041



Project: Proposed Residential Development

Location: Southwest of Old School Road and Hurontario Road, Town of Caledon

BH./Sa. 102/5

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = 20

Estimated Permeability (cm./sec.) = 10^{-4}

Borehole No: SV-102

Sample No: 5

Depth (m): 3.2

Elevation (m): 261.4

Classification of Sample [& Group Symbol]: SANDY SILT
a trace of clay

Figure: 16

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

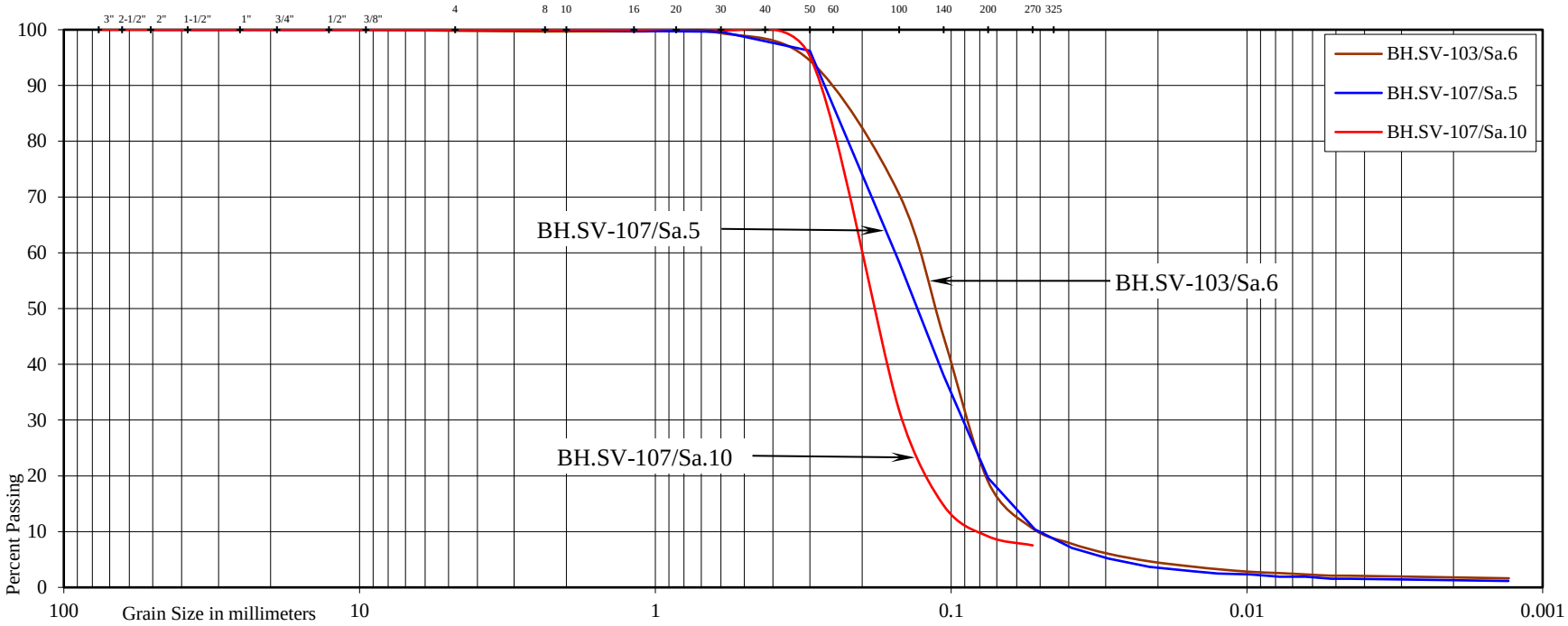
Reference No: 2310-S041

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: Southwest of Old School Road and Hurontario Road, Town of Caledon

Borehole No:	SV-103	SV-107	SV-107
Sample No:	6	5	10
Depth (m):	4.8	3.2	10.9
Elevation (m):	259.3	261.9	254.2

BH./Sa.	103/6	107/5	107/10
Liquid Limit (%) =	-	-	-
Plastic Limit (%) =	-	-	-
Plasticity Index (%) =	-	-	-
Moisture Content (%) =	21	6	22
Estimated Permeability (cm./sec.) =	10^{-3}	10^{-3}	10^{-2}

Classification of Sample [& Group Symbol]: FINE SAND

a trace to some silt, a trace of clay

Figure: 17

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

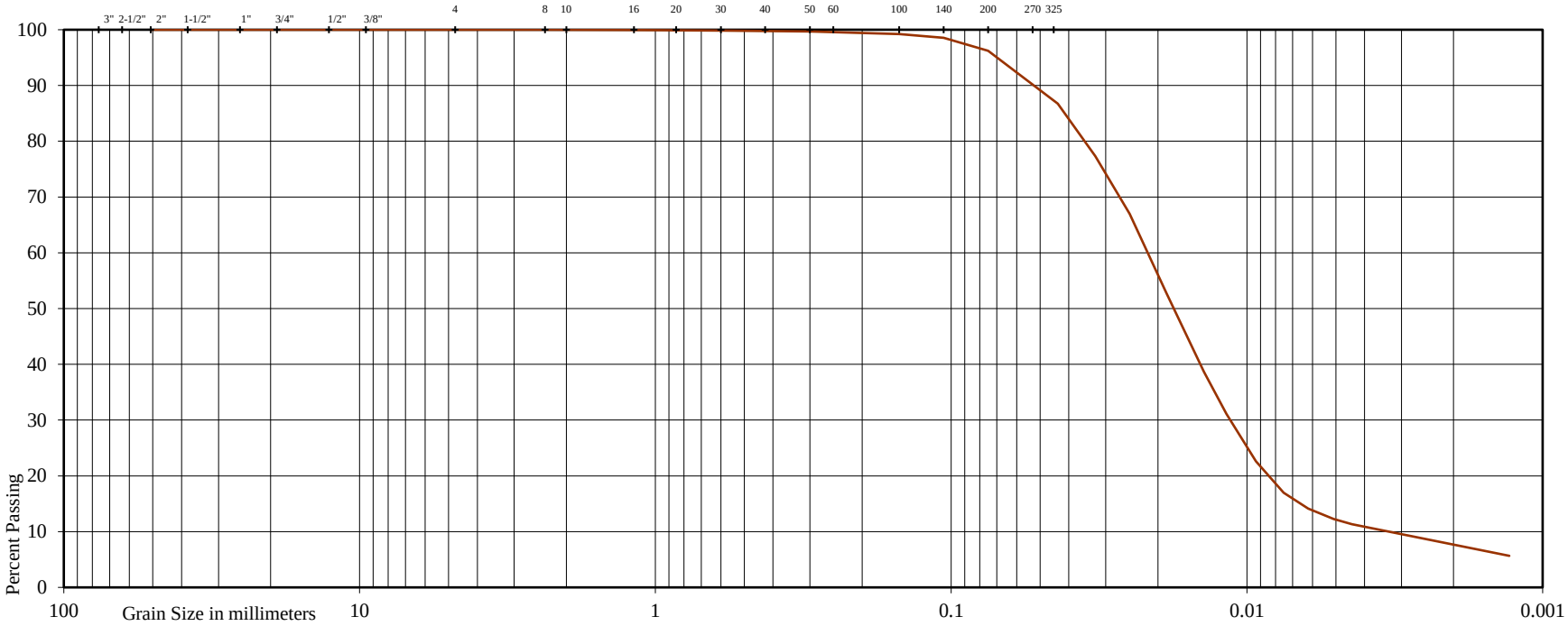
Reference No: 2310-S041

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: Southwest of Old School Road and Hurontario Road, Town of Caledon

BH./Sa. 107/9A

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = 21

Estimated Permeability (cm./sec.) = 10^{-5}

Borehole No: SV-107

Sample No: 9A

Depth (m): 9.2

Elevation (m): 255.9

Classification of Sample [& Group Symbol]: SILT

traces of fine sand and clay

Figure: 18

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

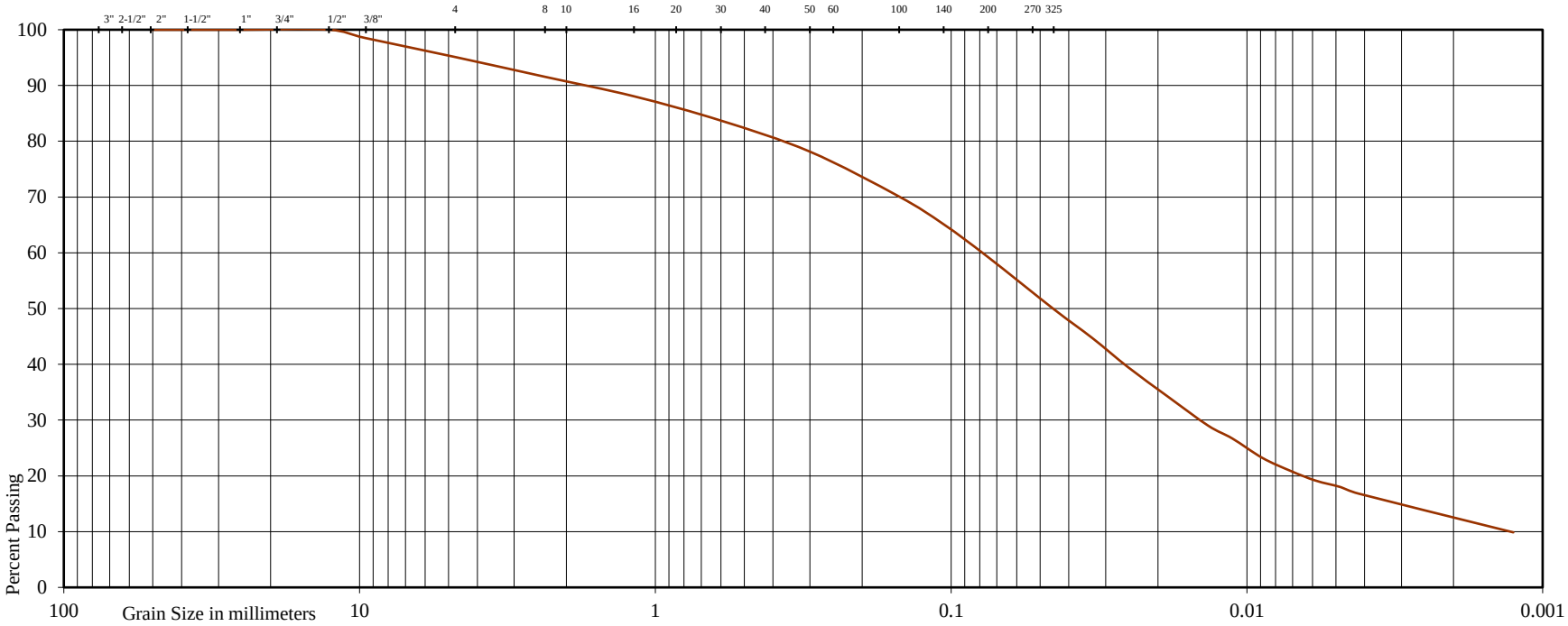
Reference No: 2310-S041

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: Southwest of Old School Road and Hurontario Road, Town of Caledon

BH./Sa. 106/10

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = 9

Estimated Permeability (cm./sec.) = 10^{-6}

Borehole No: SV-106

Sample No: 10

Depth (m): 10.8

Elevation (m): 254.1

Classification of Sample [& Group Symbol]: SANDY SILT TILL

some clay, a trace of gravel

Figure: 19

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

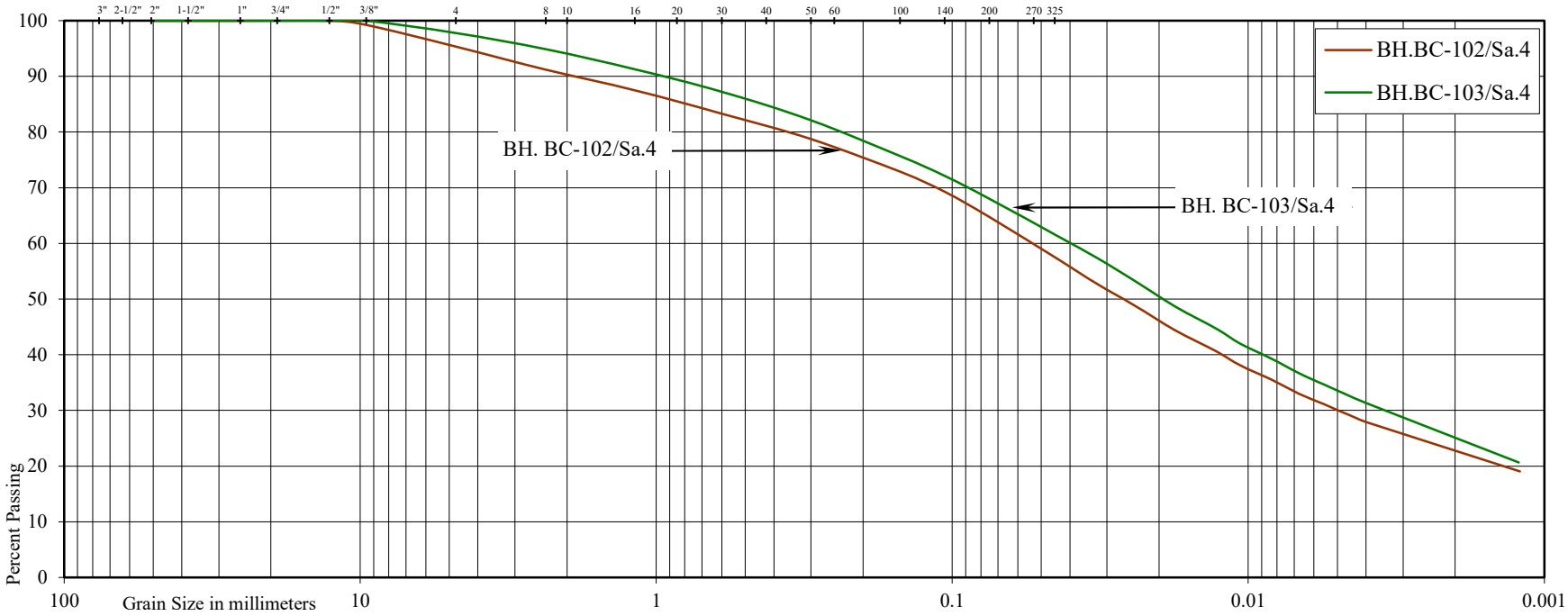
Reference No: 2310-S042

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: 12760 Hurontario Road, Town of Caledon

	BH./Sa.	102/4	103/4
	Liquid Limit (%) =	24	25
Borehole No:	Plastic Limit (%) =	15	16
Sample No:	Plasticity Index (%) =	9	9
Depth (m):	Moisture Content (%) =	12	11
Elevation (m):	Estimated Permeability (cm./sec.) =	10^{-7}	10^{-7}

Classification of Sample [& Group Symbol]: SILTY CLAY TILL

sandy, a trace of gravel

Figure: 9

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

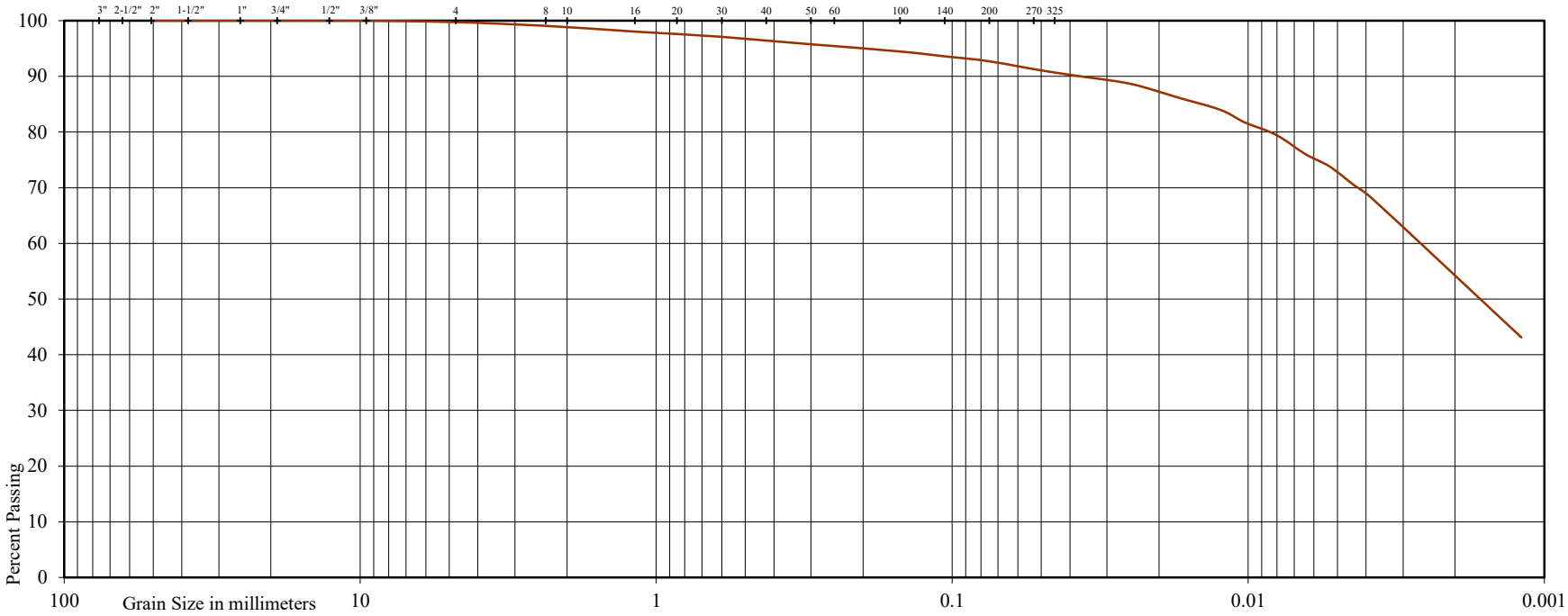
Reference No: 2310-S042

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: 12760 Hurontario Road, Town of Caledon

BH./Sa. 101/6

Liquid Limit (%) = 45

Borehole No: BC-101

Plastic Limit (%) = 22

Sample No: 6

Plasticity Index (%) = 23

Depth (m): 4.8

Moisture Content (%) = 24

Elevation (m): 257.6

Estimated Permeability (cm./sec.) = 10^{-7}

Classification of Sample [& Group Symbol]: SILTY CLAY

a trace of sand

Figure: 10

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

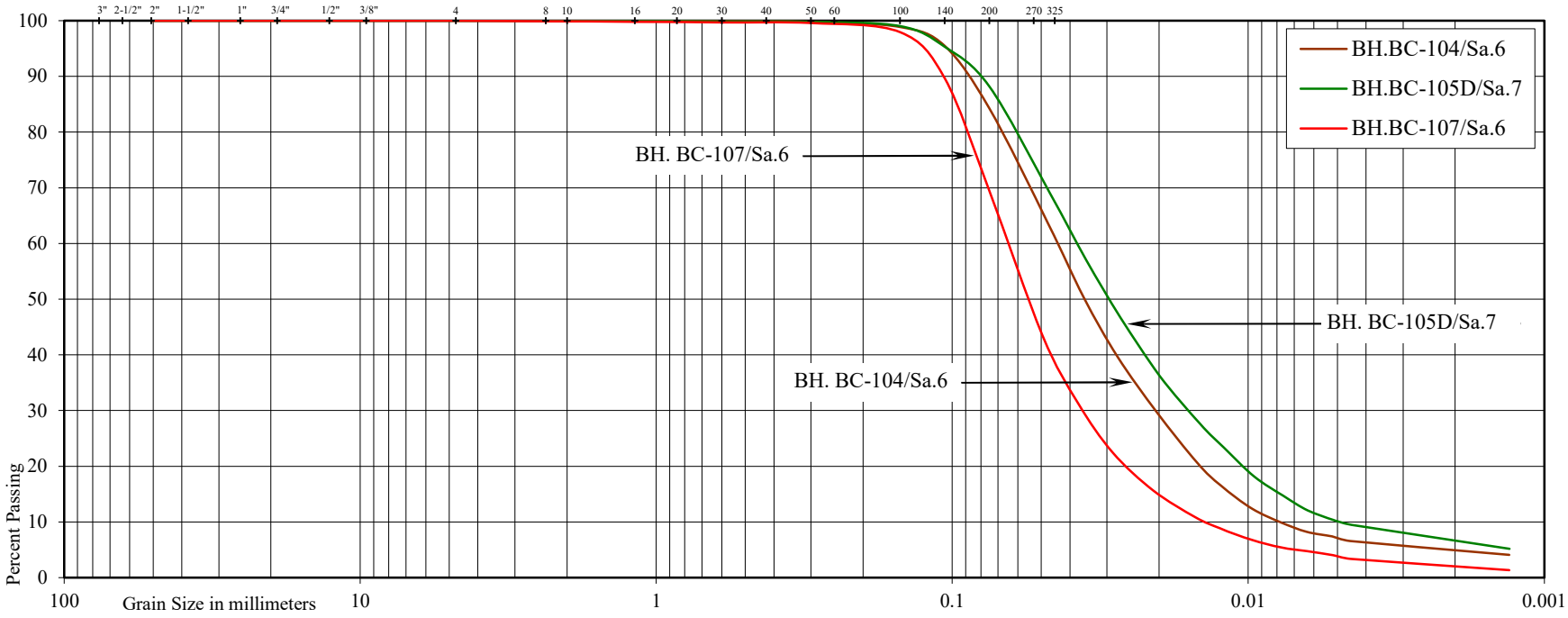
Reference No: 2310-S042

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: 12760 Hurontario Road, Town of Caledon

Borehole No:	BC-104	BC-105D	BC-107
Sample No:	6	7	6
Depth (m):	4.8	6.3	4.8
Elevation (m):	254.7	253.8	255.8

BH./Sa.	104/6	105/7	107/6
Liquid Limit (%) =	-	-	-
Plastic Limit (%) =	-	-	-
Plasticity Index (%) =	-	-	-
Moisture Content (%) =	23	18	11
Estimated Permeability (cm./sec.) =	10^{-4}	10^{-5}	10^{-4}

Classification of Sample [& Group Symbol]: SILT, some sand to sandy a trace of clay

Figure: 11

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

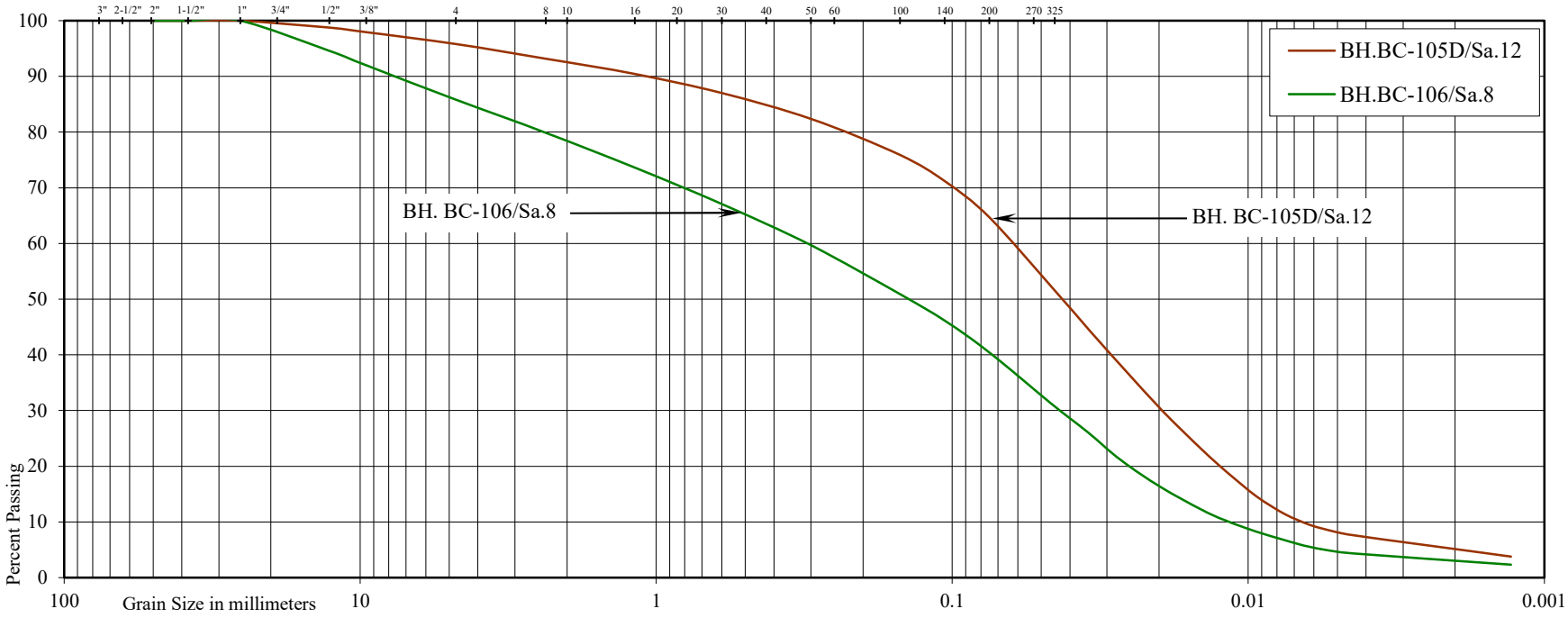
Reference No: 2310-S042

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: 12760 Hurontario Road, Town of Caledon

Borehole No:	BC-105D	BC-106
Sample No:	12	8
Depth (m):	13.8	7.8
Elevation (m):	246.3	248.8

BH./Sa.	105/12	106/8
Liquid Limit (%) =	-	-
Plastic Limit (%) =	-	-
Plasticity Index (%) =	-	-
Moisture Content (%) =	21	10
Estimated Permeability (cm./sec.) =	10^{-4}	10^{-4}

Classification of Sample [& Group Symbol]: BC-105D/Sa 12 : SANDY SILT TILL traces of clay and gravel

BC-106/Sa 8: SILTY SAND TILL

Figure: 12

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

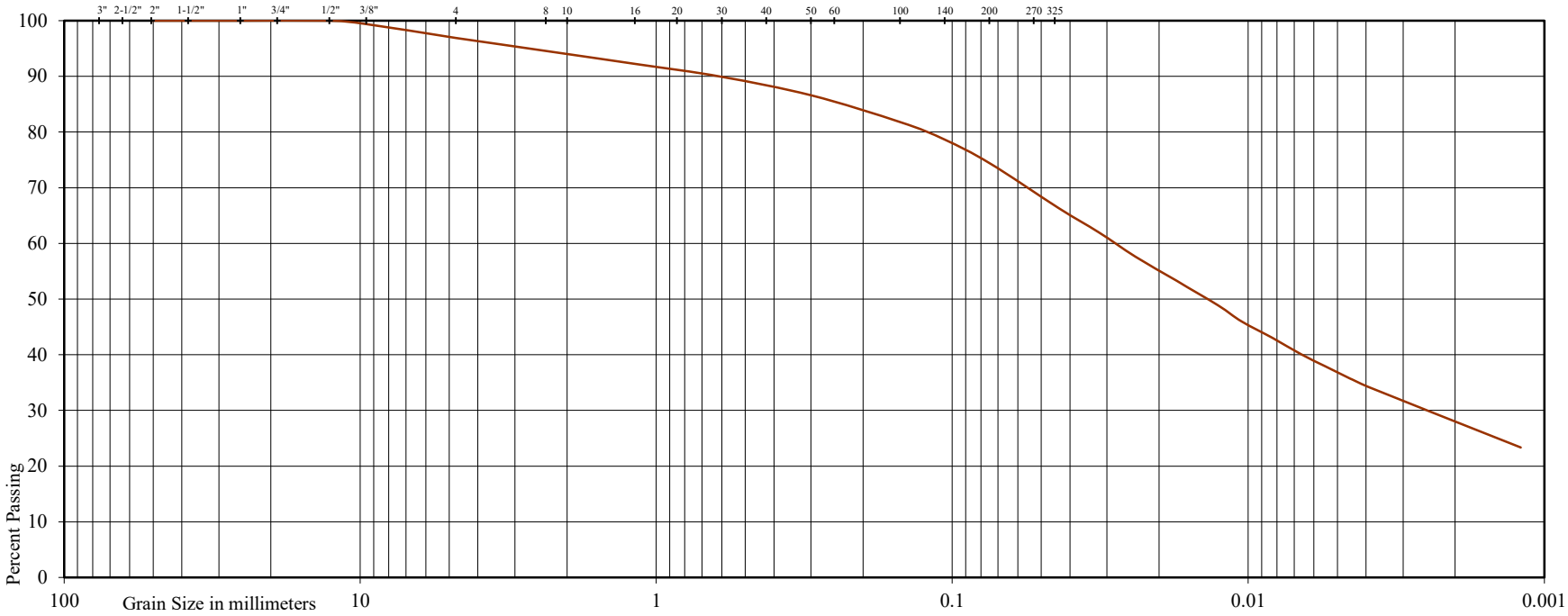
Reference No: 2310-S043

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

BH./Sa. 103/4

Liquid Limit (%) = 27

Plastic Limit (%) = 17

Plasticity Index (%) = 10

Moisture Content (%) = 13

Estimated Permeability (cm./sec.) = 10^{-7}

Borehole No: W-103

Sample No: 4

Depth (m): 2.5

Elevation (m): 262.4

Classification of Sample [& Group Symbol]: SILTY CLAY TILL

sandy, a trace of gravel

Figure: 11

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

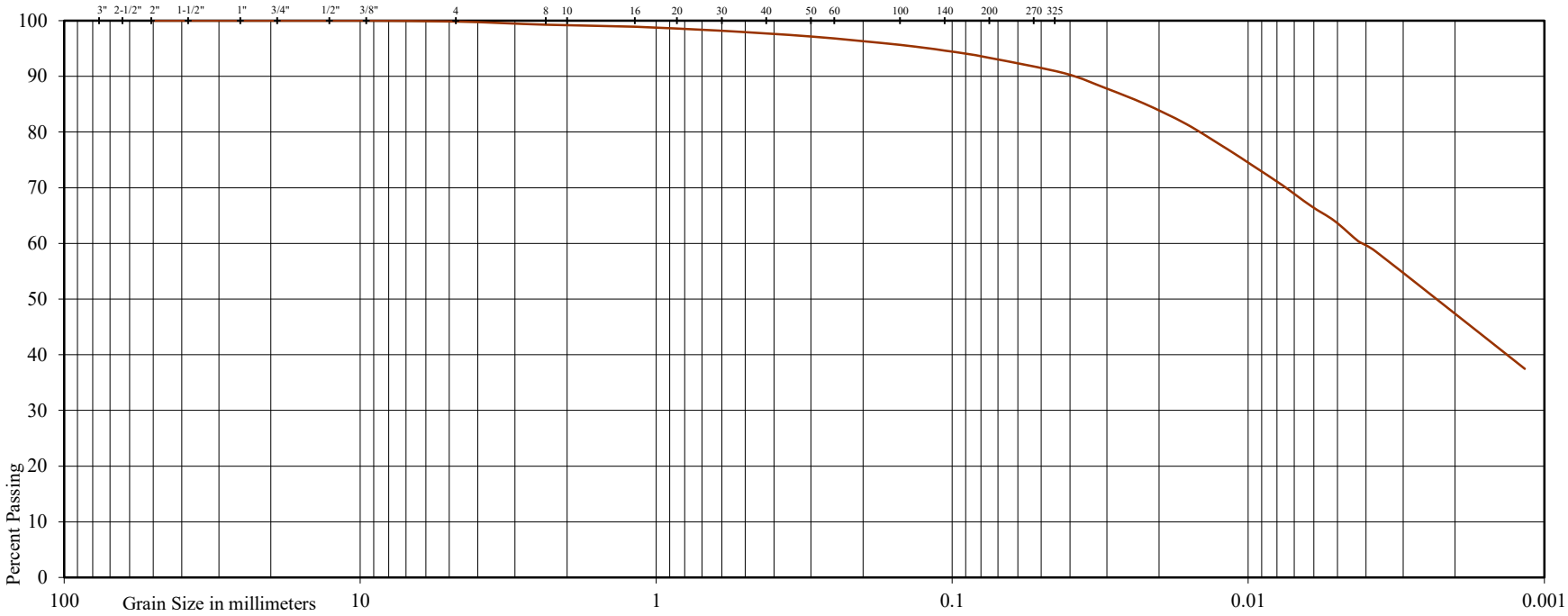
Reference No: 2310-S043

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

BH./Sa. 101/6

Liquid Limit (%) = 40

Plastic Limit (%) = 20

Plasticity Index (%) = 20

Moisture Content (%) = 21

Estimated Permeability (cm./sec.) = 10^{-7}

Borehole No: W-101

Sample No: 6

Depth (m): 4.8

Elevation (m): 261.2

Classification of Sample [& Group Symbol]: SILTY CLAY

a trace of sand

Figure: 12

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

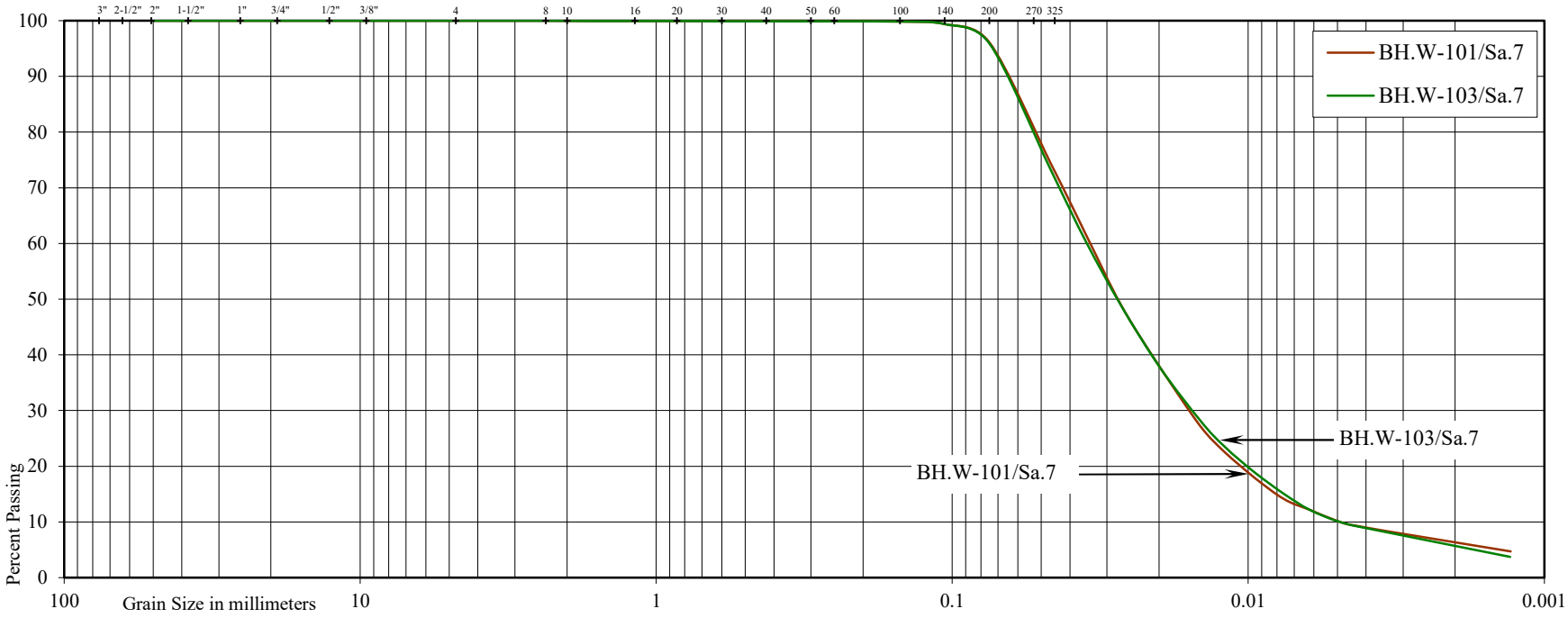
Reference No: 2310-S043

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

Borehole No:	W-101	W-103
Sample No:	7	7
Depth (m):	6.3	6.3
Elevation (m):	259.7	258.6

BH./Sa.	101/7	103/7
Liquid Limit (%) =	-	-
Plastic Limit (%) =	-	-
Plasticity Index (%) =	-	-
Moisture Content (%) =	19	20
Estimated Permeability (cm./sec.) =	10^{-5}	10^{-5}

Classification of Sample [& Group Symbol]: SILT

traces of fine sand and clay

Figure: 13

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

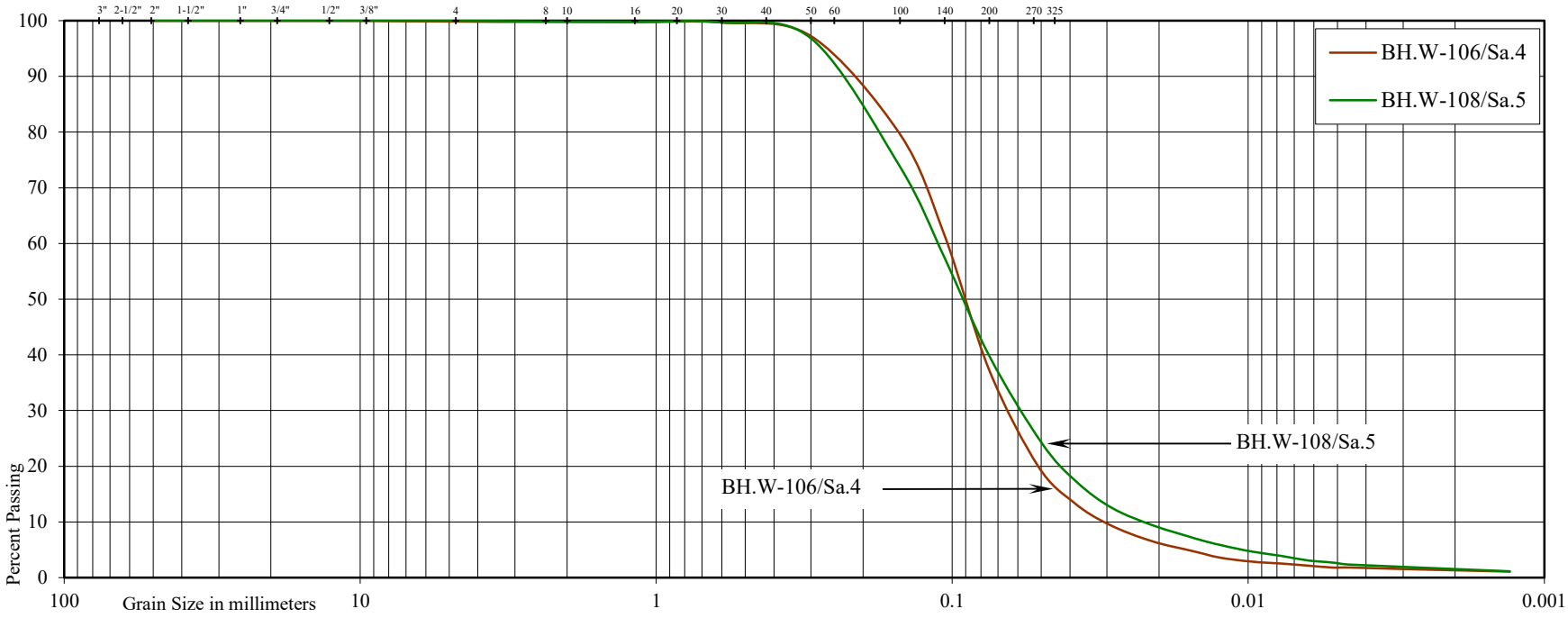
Reference No: 2310-S043

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

Borehole No:	W-106	W-108
Sample No:	4	5
Depth (m):	2.5	3.2
Elevation (m):	263.0	264.3

BH./Sa.	106/4	108/5
Liquid Limit (%) =	-	-
Plastic Limit (%) =	-	-
Plasticity Index (%) =	-	-
Moisture Content (%) =	21	22
Estimated Permeability (cm./sec.) =	10^{-3}	10^{-3}

Classification of Sample [& Group Symbol]: SILTY FINE SAND

a trace of clay

Figure: 14

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

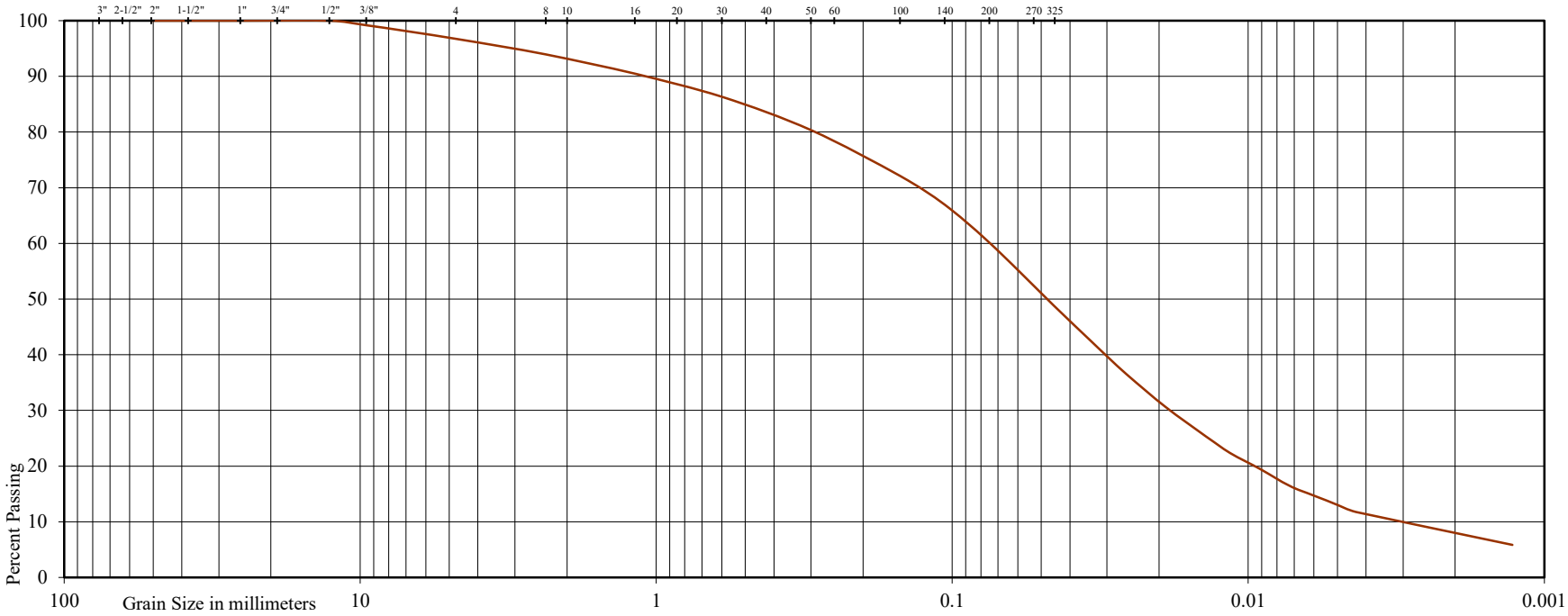
Reference No: 2310-S043

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

BH./Sa. 108/6

Liquid Limit (%) = -

Borehole No: W-108

Plastic Limit (%) = -

Sample No: 6

Plasticity Index (%) = -

Depth (m): 4.8

Moisture Content (%) = 10

Elevation (m): 262.7

Estimated Permeability (cm./sec.) = 10^{-5}

Classification of Sample [& Group Symbol]: SANDY SILT TILL

traces of clay and gravel

Figure: 15

Appendix B2

Borehole Logs (Palmer, 2018)

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

BOREHOLE RECORD OF MW-1

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 590926.7 E, 4843008.5 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** N/A
Date: November 13, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 4.57 m - 6.09 m

Depth (mbgs)	Soil Profile: Description	Strata	Elevation / Depth	Samples: Number	Samples: Type	Sample Description: Recovery (m)	Sample Description: N-Value	Piezometer Installation
0	Topsoil: clay and silt, some sand, organics, loose, moist, brown		267.16	1	SS	0.254 / 0.609	8	
0.6								
0.75	Clayey silt till, some sand, some gravel, very stiff to hard, moist, brown		0.84 / 265.79	2	SS	0.432 / 0.609	30	
1.36								
1.52				3	SS	0.432 / 0.609	44	
2.13								
2.28	Medium sand and silt, medium dense to very dense, wet, grey		2.21	4	SS	0.533 / 0.609	55	
2.89								
3.04				5	SS	0.609 / 0.609	26	
3.65								
4.57				6	SS	0.609 / 0.609	47	
5.18								
6.09			261.6	N/A	N/A	N/A	N/A	
6.7	Silty clay till, some sand, very dense, moist, red/brown		6.4					
7.62				7	SS	0.279 / 0.279	83 / 0.28m	
7.9	END OF BOREHOLE AT 7.9 m		260.1 / 7.9					

Well Installation Details

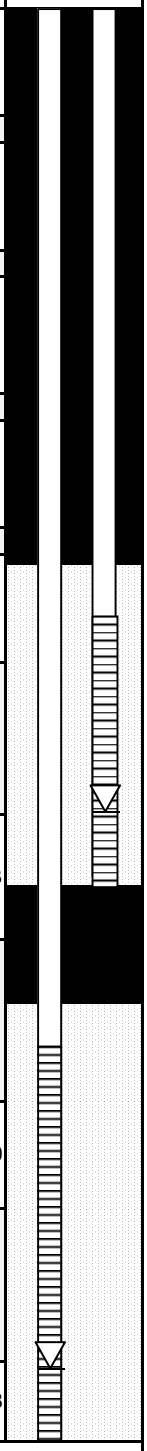
Stick Up Height: 0.65 m	**W.L. upon Well Completion (D.):** 2.93 mbtoc, 2.28 mbgs
Ground Elevation: 268 masl	**W.L. upon Well Completion (S.):** N/A

BOREHOLE RECORD OF MW-2 s/d

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 591429.4 E, 4843101.6 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** 3.35 m - 4.88 m
Date: November 13, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 5.79 m - 8.84 m

Depth (mbgs)	Soil Profile: Description	Strata	Elevation / Depth	Samples: Number	Samples: Type	Sample Description: Recovery (m)	Sample Description: N-Value
0	Topsoil: Fine and medium sand and silt, some clay, organics, loose, moist to dry, dark brown			1	SS	0.330 / 0.609	7
0.6							
0.75				2	SS	0.305 / 0.609	10
1.36			266.55				
1.52	Fine to medium sand and silt, medium dense, moist to wet, brown/grey		1.45	3	SS	0.609 / 0.609	22
2.13			265.76				
2.28	Clay, very stiff, cohesive, moist, grey		2.24	4	SS	0.609 / 0.609	28
2.89			265.4				
3.04			2.6	5	SS	0.508 / 0.609	49
3.65							
4.11	*4.11 m - 4.65 m: Gravel with silt matrix, very wet, grey*						
4.57				6	SS	0.356 / 0.381	71 / 0.23
5.18	Clayey silt to silty clay till, some sand, gravel and cobbles very dense, moist, red/brown						
6.09				7	SS	0.102 / 0.102	50 / 0.10
6.7							
7.62				8	SS	0.076 / 0.076	50 / 0.08

Piezometer Installation



Well Installation Details

S. Stick Up Height: 0.66 m; **D. Stick Up Height**: 0.75 m	**W.L. upon Well Completion (D.):** 8.35 mbtoc, 7.60 mbgs
Ground Elevation: 268 masl	**W.L. upon Well Completion (S.):** 5.14 mbtoc, 4.48 mbgs

BOREHOLE RECORD OF MW-2 s/d

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 591429.4 E, 4843101.6 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** 3.35 m - 4.88 m
Date: November 13, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 5.79 m - 8.84 m

Depth (mbgs)	Soil Profile: Description	Strata	Elevation / Depth	Samples: Number	Samples: Type	Sample Description: Recovery (m)	Sample Description: N-Value	Piezometer Installation
8.22	*Continued* Clayey silt to silty clay till, some sand, gravel and cobbles very dense, moist, red/brown		258.78					
9								
9.14	END OF BOREHOLE AT 9.22 m		9.22	9	SS	0.076 / 0.076	50 / 0.08	
9.75								
10								
10.66								
11								
11.27								
12								
12.19								
12.8								
13								
13.71								
14								
14.32								
15								
15.24								
15.84								
16								

Well Installation Details

S. Stick Up Height: 0.66 m; **D. Stick Up Height**: 0.75 m	**W.L. upon Well Completion (D.):** 8.35 mbtoc, 7.60 mbgs
Ground Elevation: 268 masl	**W.L. upon Well Completion (S.):** 5.14 mbtoc, 4.48 mbgs

BOREHOLE RECORD OF MW-3

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 591415.3 E, 4842905.2 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** N/A
Date: November 13, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 4.57 m - 7.62 m

Depth (mbgs)	Soil Profile: Description	Strata	Elevation / Depth	Samples: Number	Type	Sample Description: Recovery (m)	N-Value	Piezometer Installation
0	Topsoil: silt and fine sand, some clay, some organics, loose, moist to wet, brown			1	SS	0.254 / 0.609	5	
0.6								
0.75	*1.12 m: soils turn grey*			2	SS	0.483 / 0.609	7	
1.36			261.55					
1.52	Fine sand and silt, some clay, laminae, medium dense, wet, grey		1.45	3	SS	0.584 / 0.609	22	
2.13			260.64					
2.28	Clay, some silt, cohesive, hard, wet, grey		2.36	4	SS	0.533 / 0.609	27	
2.89			260.38					
3.04	Silty sand to silty clay till, gravel and cobbles, dense to very dense, moist, red/brown		2.62	5	SS	0.609 / 0.609	47	
3.65								
4.57				6	SS	0.381 / 0.609	37	
5.18								
6.09				7	SS	0.279 / 0.279	73 / 0.28	
6.7								
7.62				8	SS	0.305 / 0.305	59	
7.92	END OF BOREHOLE AT 7.92 m		255.08 7.92					

Well Installation Details

Stick Up Height: 0.75 m	**W.L. upon Well Completion (D.):** 5.80 mbtoc, 5.05 mbgs
Ground Elevation: 263 masl	**W.L. upon Well Completion (S.):** N/A

BOREHOLE RECORD OF MW-4

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 592076.8 E, 4844412.8 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** N/A
Date: November 15, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 6.40 m - 7.92 m

Depth (mbgs)	Soil Profile: Description	Strata	Elevation / Depth	Samples: Number	Type	Sample Description: Recovery (m)	N-Value	Piezometer Installation
0								
0.6	Topsoil: clay and silt, organics, loose, moist, brown			1	SS	0.330 / 0.609	8	
0.75			264.93					
1			1.07					
1.36								
1.52				2	SS	0.330 / 0.609	9	
2								
2.13								
2.28								
2.89								
3								
3.04				3	SS	0.508 / 0.609	13	
3.65	Fine and medium sand and silt, laminae, loose to medium density, moist to wet, light brown							
4								
4.57				4	SS	0.609 / 0.609	23	
5								
5.18								
6								
6.09	*6.25 m: Grey*			5	SS	0.609 / 0.609	15	
6.7								
7								
7.62			258.18	6	SS	0.533 / 0.609	21	
8	Clay, cohesive, very stiff, wet, grey		7.82					

Well Installation Details

Stick Up Height: 0.68 m	**W.L. upon Well Completion (D.):** 5.27 mbtoc, 4.59 mbgs
Ground Elevation: 266 masl	**W.L. upon Well Completion (S.):** N/A

BOREHOLE RECORD OF MW-4

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 592076.8 E, 4844412.8 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** N/A
Date: November 15, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 6.40 m - 7.92 m

Depth (mbgs)	Soil Profile: Description	Strata	Elevation / Depth	Samples: Number	Samples: Type	Sample Description: Recovery (m)	Sample Description: N-Value	Piezometer Installation
8.22	*Continued*							
9	Clay, cohesive, very stiff, wet, grey							
9.14				7	SS	0.533 / 0.609	20	
9.75			256.3					
10	Silty clay till, some gravel and cobbles, very dense, moist, red/brown		9.7					
10.66			255.09					
11	END OF BOREHOLE AT 10.91 m		10.91	8	SS	0.254 / 0.254	70 / 0.25	
11.27								
12								
12.19								
12.8								
13								
13.71								
14								
14.32								
15								
15.24								
15.84								
16								

Well Installation Details

Stick Up Height: 0.68 m	**W.L. upon Well Completion (D.):** 5.27 mbtoc, 4.59 mbgs
Ground Elevation: 266 masl	**W.L. upon Well Completion (S.):** N/A

BOREHOLE RECORD OF MW-5 s/d

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 592688.1 E, 4844655.6 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** 4.57 m - 6.10 m
Date: November 14, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 9.14 m - 10.67 m

Depth (mbgs)	Soil Profile: Description	Strata	Elevation / Depth	Samples: Number	Type	Sample Description: Recovery (m)	N-Value	Piezometer Installation
0	Topsoil: silt and sand, some clay, organics, loose, moist, dark brown			1	SS	0.483 / 0.609	5	
0.6								
0.75				2	SS	0.051 / 0.609	5	
1.36			258.55					
1.52	Clayey silt to silty clay till, some gravel, moist, brown		1.45	3	SS	0.508 / 0.609	18	
2.13								
2.28	*2.57 m: Grey*			4	SS	0.533 / 0.609	28	
2.89			257.03					
3.04	Clay, cohesive, hard, wet, grey		2.97	5	SS	0.508 / 0.609	33	
3.65			256.47					
	Silt and fine to medium sand, some clay, medium dense to dense, moist to wet, brown		3.53					
4.57				6	SS	0.609 / 0.609	33	
5.18								
6.09				7	SS	0.609 / 0.609	33	
6.7								
7.62				8	SS	0 / 0.609	7	

Well Installation Details

S. Stick Up Height: 0.62 m; **D. Stick Up Height**: 0.71 m	**W.L. upon Well Completion (D.):** 8.85 mbtoc, 8.23 mbgs
Ground Elevation: 260 masl	**W.L. upon Well Completion (S.):** 6.77 mbtoc, 6.06 mbgs

BOREHOLE RECORD OF MW-5 s/d

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 592688.1 E, 4844655.6 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** 4.57 m - 6.10 m
Date: November 14, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 9.14 m - 10.67 m

Depth (mbgs)	Soil Profile: Description	Strata	Elevation / Depth	Samples: Number	Type	Sample Description: Recovery (m)	N-Value	Piezometer Installation
8.22	*Continued*							
9	Silt and fine to medium sand, some clay, medium dense to dense, moist to wet, brown							
9.14	*9.14 m: Grey*			9	SS	0.609 / 0.609	38	
9.75	*9.45 m - 9.50 m: Coarse sand lense, wet, grey*							
10								
10.66				10	SS	0.305 / 0.609	16	
11								
11.27								
			248.27					
12	Clay and silt till, gravel and cobbles, very dense, moist, red/brown		11.73					
12.19			247.68					
	END OF BOREHOLE AT 12.32 m		12.32	11	SS	0.128 / 0.128	50 / 0.13	
12.8								
13								
13.71								
14								
14.32								
15								
15.24								
15.84								
16								

Well Installation Details

S. Stick Up Height: 0.62 m; **D. Stick Up Height**: 0.71 m	**W.L. upon Well Completion (D.):** 8.85 mbtoc, 8.23 mbgs
Ground Elevation: 260 masl	**W.L. upon Well Completion (S.):** 6.77 mbtoc, 6.06 mbgs

BOREHOLE RECORD OF MW-6

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 592407.1 E, 4843628.3 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** N/A
Date: November 14, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 3.66 m - 5.18 m

Depth (mbgs)	Soil Profile: Description	Strata	Elevation / Depth	Samples: Number	Type	Sample Description: Recovery (m)	N-Value	Piezometer Installation
0	Topsoil: Sand and silt, some clay, loose to dense, dry, dark brown			1	SS	0.305 / 0.609	12	
0.6								
0.75				2	SS	0.305 / 0.609	47	
1.36			261.55					
1.52	Clayey silt to silty clay till, gravel and cobbles, hard, moist brown		1.45	3	SS	0.457 / 0.609	32	
2.13								
2.28	*2.67 m: Grey*			4	SS	0.508 / 0.609	44	
2.89								
3.04			259.8	5	SS	0.533 / 0.609	45	
3.65	Fine sand and silt, some clay, very dense, wet, grey		3.2					
4.57				6	SS	0.609 / 0.609	49	
5.18	*4.97 m - 5.18: Medium to coarse sand lense*							
6.09			257.36	7	SS	0.152 / 0.152	50 / 0.15	
6.7	Silty clay to clayey silt till, gravel and cobbles, very dense moist, red/brown		5.64					
7.62			255.15	8	SS	0.203 / 0.229	95 / 0.23	
	END OF BOREHOLE AT 7.85 m		7.85					

Well Installation Details

Stick Up Height: 0.68 m	**W.L. upon Well Completion (D.):** 3.68 mbtoc, 3.00 mbgs
Ground Elevation: 263 masl	**W.L. upon Well Completion (S.):** N/A

BOREHOLE RECORD OF MW-7 s/d

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 592776.2 N, 4843760.4 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** 4.57 m - 6.10 m
Date: November 15, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 9.14 m - 10.67 m

Depth (mbgs)	Soil Profile: Description	Strata	Elevation / Depth	Samples: Number	Samples: Type	Sample Description: Recovery (m)	Sample Description: N-Value	Piezometer Installation
0	Topsoil: sand, silt, clay, loose, moist, dark brown		258.31	1	SS		8	
0.6			0.69					
0.75	Clayey silt till, gravel and cobbles, some sand, medium dense, dry to moist, brown			2	SS		18	
1.36								
1.52				3	SS		22	
2.13			256.79					
2.21	Clay, cohesive, wet, hard, moist to wet, brown			4	SS		34	
2.28	*2.67 m: Grey*							
2.89			255.8					
3.04	*3.20 m - 4.72 m: Cohesive clay, sand, and silt layer*		3.2	5	SS		41	
3.65	Fine and medium sand, silt, and clay, dense, wet, grey							
4.57				6	SS		37	
5.18								
6.09			252.52	7	SS		39	
6.7	Clayey silt till, some sand, some gravel, very dense, wet, red/brown		6.48					
7.62				8	SS	0.254 / 0.254	71 / 0.25	

Well Installation Details

S. Stick Up Height: 0.81 m; **D. Stick Up Height**: 0.84 m	**W.L. upon Well Completion (D.):** 11.34 mbtoc, 10.50 mbgs
Ground Elevation: 259 masl	**W.L. upon Well Completion (S.):** 5.75 mbtoc, 4.94 mbgs

BOREHOLE RECORD OF MW-7 s/d

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 592776.2 N, 4843760.4 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** 4.57 m - 6.10 m
Date: November 15, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 9.14 m - 10.67 m

Depth (mbgs)	Soil Profile: Description	Strata	Elevation / Depth	Samples: Number	Samples: Type	Sample Description: Recovery (m)	Sample Description: N-Value	Piezometer Installation
8.22	*Continued*							
9								
9.14	Clayey silt till, some sand, some gravel, very dense, wet, red/brown			9	SS	0.127 / 0.127	50 / 0.13	
9.75								
10								
	10.21 m: Grey							
10.66								
11				10	SS	0.457 / 0.457	90	
			247.87					
11.27	END OF BOREHOLE AT 11.13 m		11.13					
12								
12.19								
12.8								
13								
13.71								
14								
14.32								
15								
15.24								
15.84								
16								

Well Installation Details

S. Stick Up Height: 0.81 m; **D. Stick Up Height**: 0.84 m	**W.L. upon Well Completion (D.):** 11.34 mbtoc, 10.50 mbgs
Ground Elevation: 259 masl	**W.L. upon Well Completion (S.):** 5.75 mbtoc, 4.94 mbgs

Appendix B3

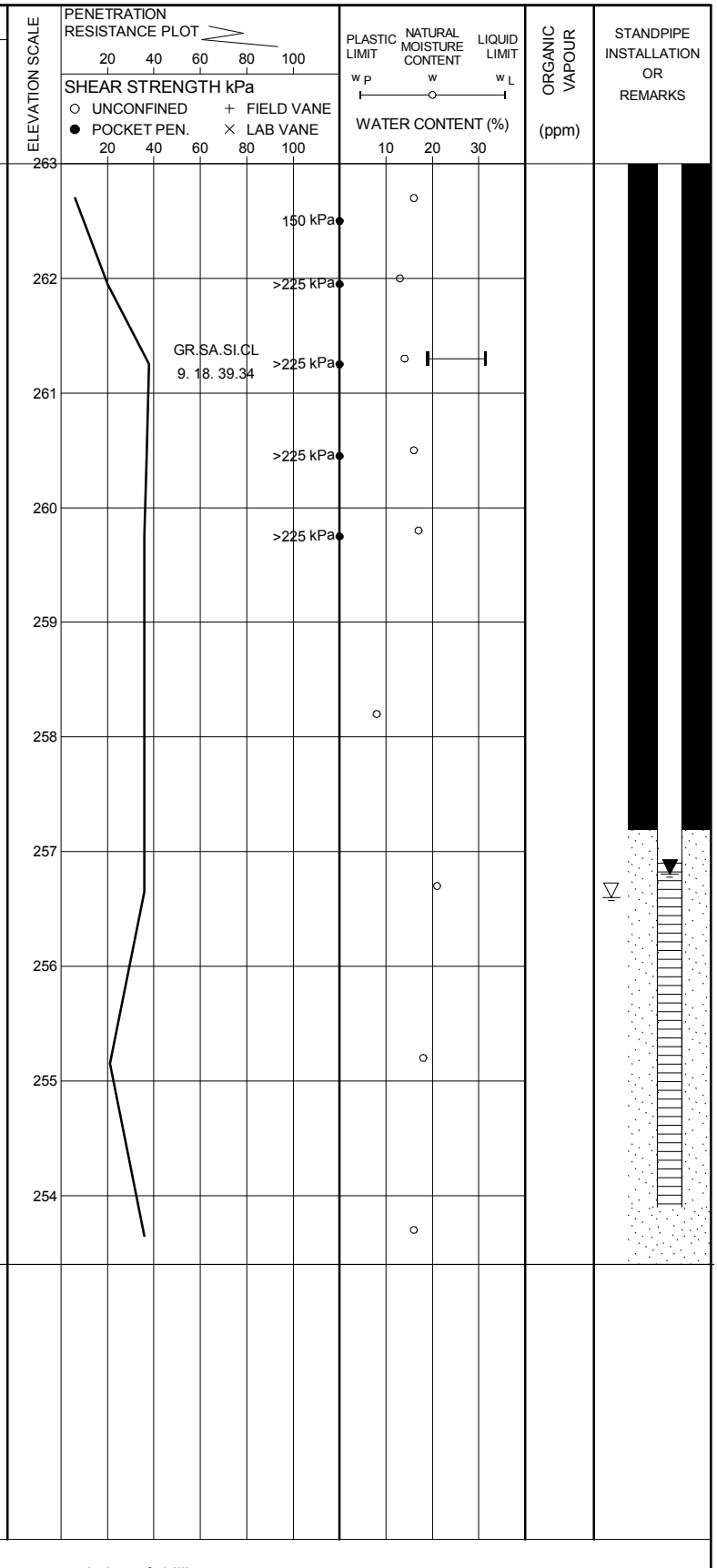
Borehole Logs and Grain Size (AMEC, 2010)

Terraprobe

LOG OF BOREHOLE 1

PROJECT: Mayfield West
DATE: February 12, 2009
LOCATION: Caledon, Ontario
EQUIPMENT: Bombardier/Hollow Stem Augers
CLIENT: Philips Engineering Ltd.
ELEVATION DATUM: Geodetic
FILE: 1-08-3053

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
263.0 0.0					
262.8	250mm TOPSOIL		1	SS	6
0.3	Weathered, firm ---- CLAYEY SILT embedded sand and gravel, very stiff to hard, brown, moist (GLACIAL TILL)		2	SS	20
			3	SS	38
			4	SS	37
	---- sandy		5	SS	36
258.4					
4.6	SANDY SILT trace gravel, trace clay, compact to dense, brown, moist		6	SS	36
	---- wet		7	SS	36
	---- grey		8	SS	21
253.4			9	SS	36
9.6	End of Borehole				



NOTES:
Borehole was caving at 6.7m and unstabilized water level at 6.4m upon completion of drilling.
Water level in monitoring well at 6.2m (Elev. 256.8m) on April 23, 2009.

Terraprobe

LOG OF BOREHOLE 2

PROJECT: Mayfield West
DATE: February 12, 2009
LOCATION: Caledon, Ontario
EQUIPMENT: Bombardier/Hollow Stem Augers
CLIENT: Philips Engineering Ltd.
ELEVATION DATUM: Geodetic
FILE: 1-08-3053

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES
264.3				
0.0 / 264.0	280mm TOPSOIL			
0.3	CLAYEY SILT embedded sand and gravel, stiff to very stiff, brown, moist	1	SS	7
263.2	(GLACIAL TILL)	2	SS	15
1.1	SANDY SILT trace gravel, trace clay, compact to dense, brown, moist	3	SS	24
		4	SS	24
		5	SS	26
		6	SS	31
		7	SS	35
	---- wet	8	SS	26
254.7		9	SS	25
9.6	End of Borehole			

PENETRATION RESISTANCE PLOT
SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● POCKET PEN. × LAB VANE
100 kPa
150 kPa
GR.SA.SI.CL
1. 34. 63. 2

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)

ORGANIC VAPOUR (ppm)

STANDPIPE INSTALLATION OR REMARKS

NOTES:
Borehole was caving at 8.8m and unstabilized water level at 8.8m upon completion of drilling.
Water level in monitoring well at 8.6m (Elev. 255.7m) on April 23, 2009.

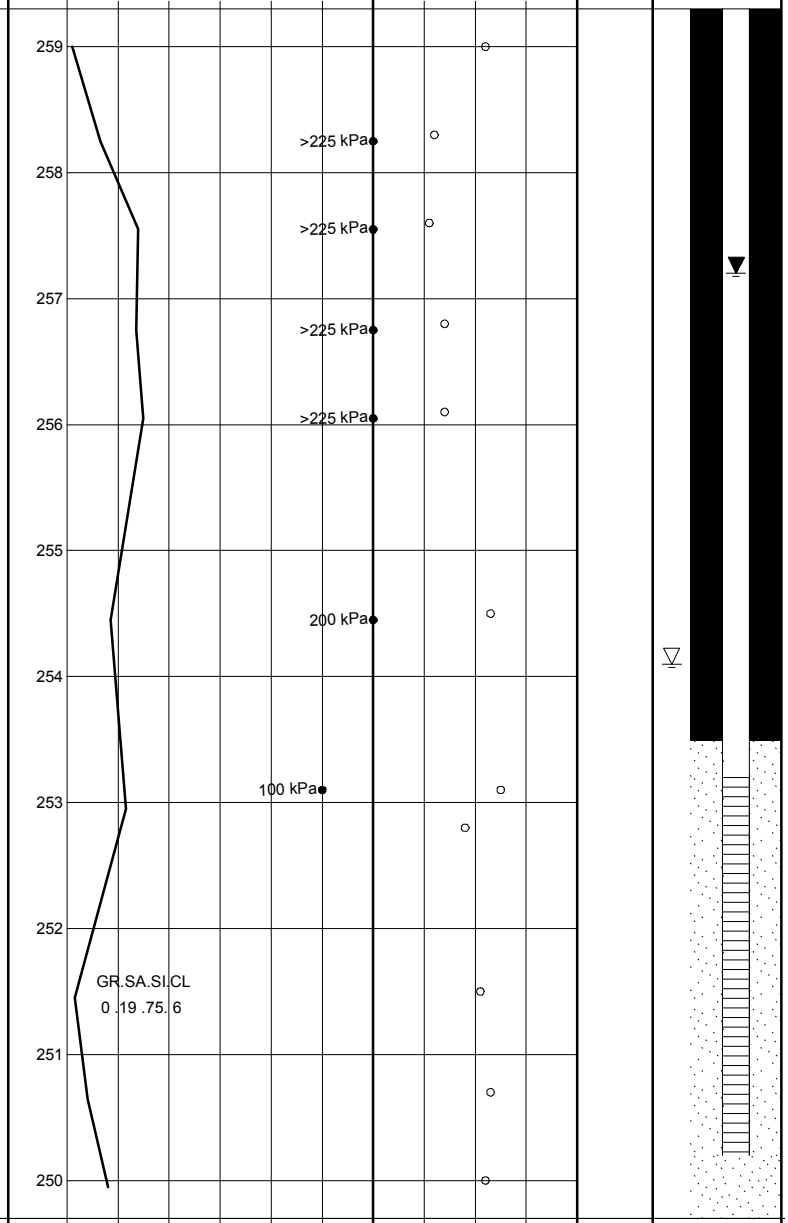
Terraprobe

LOG OF BOREHOLE 3

PROJECT: Mayfield West
DATE: February 09, 2009
LOCATION: Caledon, Ontario
EQUIPMENT: Bombardier/Hollow Stem Augers
CLIENT: Philips Engineering Ltd.
ELEVATION DATUM: Geodetic
FILE: 1-08-3053

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES
259.3				
0.0 / 259.0	280mm TOPSOIL			
0.3	Weathered, soft, dark brown ---- CLAYEY SILT embedded sand and gravel, very stiff to hard, brown, moist (GLACIAL TILL)	1	SS	2
		2	SS	13
		3	SS	28
		4	SS	27
	---- grey	5	SS	30
		6	SS	17
252.9		7	SS	23
6.4	moist, compact ---- SILT some sand, trace clay, very loose to loose, grey, wet	8	SS	3
		9	SS	8
	---- compact	10	SS	16
249.7				
9.6	End of Borehole			

PENETRATION RESISTANCE PLOT
SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● POCKET PEN. × LAB VANE



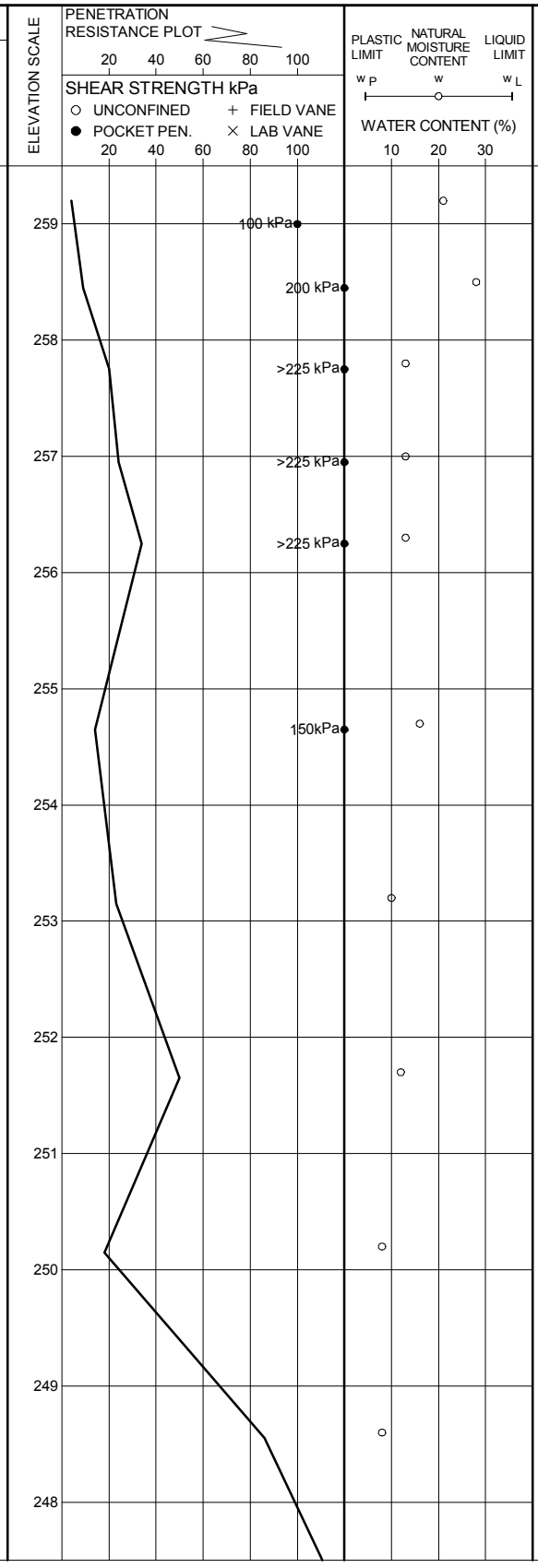
NOTES:
Borehole was caving at 5.5m and unstabilized water level at 5.2m upon completion of drilling.
Water level in monitoring well at 2.1m (Elev. 257.2m) on April 23, 2009.

Terraprobe

LOG OF BOREHOLE 4

PROJECT: Mayfield West
DATE: February 10 & 11, 2009
LOCATION: Caledon, Ontario
EQUIPMENT: Bombardier/Hollow Stem Augers
CLIENT: Philips Engineering Ltd.
ELEVATION DATUM: Geodetic
FILE: 1-08-3053

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES
259.5				
0.0 / 259.2	280mm TOPSOIL	1	SS	4
0.3	Weathered, firm ---- CLAYEY SILT embedded sand and gravel, very stiff to hard, brown, moist (GLACIAL TILL)	2	SS	9
		3	SS	20
		4	SS	24
		5	SS	34
	---- grey	6	SS	14
		7	SS	23
252.5				
7.0	SILT some sand, trace clay, dense to very dense, grey, moist	8	SS	50
	---------- compact ----------	9	SS	18
	---- damp	10	SS	86



ORGANIC VAPOUR (ppm)

STANDPIPE INSTALLATION OR REMARKS

NOTES:
Borehole was open and unstabilized water level at 9.8m upon completion of drilling.
Water level in deep well at 1.3m (Elev. 258.2m) on April 23, 2009.
Water level in shallow well at 3.1m (Elev. 256.4m) on April 23, 2009.

Terraprobe

LOG OF BOREHOLE 4

PROJECT: Mayfield West
DATE: February 10 & 11, 2009
LOCATION: Caledon, Ontario
EQUIPMENT: Bombardier/Hollow Stem Augers
CLIENT: Philips Engineering Ltd.
ELEVATION DATUM: Geodetic
FILE: 1-08-3053

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
	---- finelly bedded		11	SS	96/25cm
	---- wet		12	SS	80/28cm
			13	SS	47
	---- compact		14	SS	28
			15	SS	
	---- dense, reddish brown		16	SS	34
238.2					
21.3	SAND some silt, trace gravel, compact, reddish brown, wet		17	SS	26
	---- dense to very dense		18	SS	30

ELEVATION SCALE: 247, 246, 245, 244, 243, 242, 241, 240, 239, 238, 237, 236

PENETRATION RESISTANCE PLOT
20 40 60 80 100
SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● POCKET PEN. × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

ORGANIC VAPOUR (ppm)

STANDPIPE INSTALLATION OR REMARKS

NOTES:
Borehole was open and unstabilized water level at 9.8m upon completion of drilling.
Water level in deep well at 1.3m (Elev. 258.2m) on April 23, 2009.
Water level in shallow well at 3.1m (Elev. 256.4m) on April 23, 2009.

Terraprobe

LOG OF BOREHOLE 4

PROJECT: Mayfield West
DATE: February 10 & 11, 2009
LOCATION: Caledon, Ontario
EQUIPMENT: Bombardier/Hollow Stem Augers
CLIENT: Philips Engineering Ltd.
ELEVATION DATUM: Geodetic
FILE: 1-08-3053

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
232.1			19	SS	37
	---- some gravel		20	SS	60
27.4			21	SS	50/5cm
	SILT AND SAND gravelly, trace clay very dense, reddish brown, wet		22	SS	76/28cm
229.0	---- moist		23	SS	50/3cm
30.5	End of Borehole				

ELEVATION SCALE: 235, 234, 233, 232, 231, 230, 229

PENETRATION RESISTANCE PLOT
20 40 60 80 100
SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● POCKET PEN. × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

GR.SA.SI.CL
22.35.40. 3

ORGANIC VAPOUR (ppm)

STANDPIPE INSTALLATION OR REMARKS

NOTES:
Borehole was open and unstabilized water level at 9.8m upon completion of drilling.
Water level in deep well at 1.3m (Elev. 258.2m) on April 23, 2009.
Water level in shallow well at 3.1m (Elev. 256.4m) on April 23, 2009.

Terraprobe

LOG OF BOREHOLE 5

PROJECT: Mayfield West
DATE: February 12, 2009
LOCATION: Caledon, Ontario
EQUIPMENT: Bombardier/Hollow Stem Augers
CLIENT: Philips Engineering Ltd.
ELEVATION DATUM: Geodetic
FILE: 1-08-3053

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES
258.3				
0.0 / 258.1	250mm TOPSOIL			
0.3	Weathered, firm ---- CLAYEY SILT embedded sand and gravel, very stiff to hard, brown, moist (GLACIAL TILL)	1	SS	7
		2	SS	16
		3	SS	23
		4	SS	33
		5	SS	22
	---- stiff, grey	6	SS	12
252.2				
6.1	SANDY SILT trace clay, compact, grey, wet	7	SS	15
250.7				
7.6	SANDY SILT embedded gravel, trace clay, compact to dense, grey, moist (GLACIAL TILL)	8	SS	22
		9	SS	47
248.7				
9.6	End of Borehole			

PENETRATION RESISTANCE PLOT
20 40 60 80 100
SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● POCKET PEN. × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

ELEVATION SCALE: 258, 257, 256, 255, 254, 253, 252, 251, 250, 249

>225 kPa
>225 kPa
>225 kPa
>225 kPa
150 kPa

GR.SA.SI.CL
7. 30. 56. 7

ORGANIC VAPOUR (ppm)

STANDPIPE INSTALLATION OR REMARKS

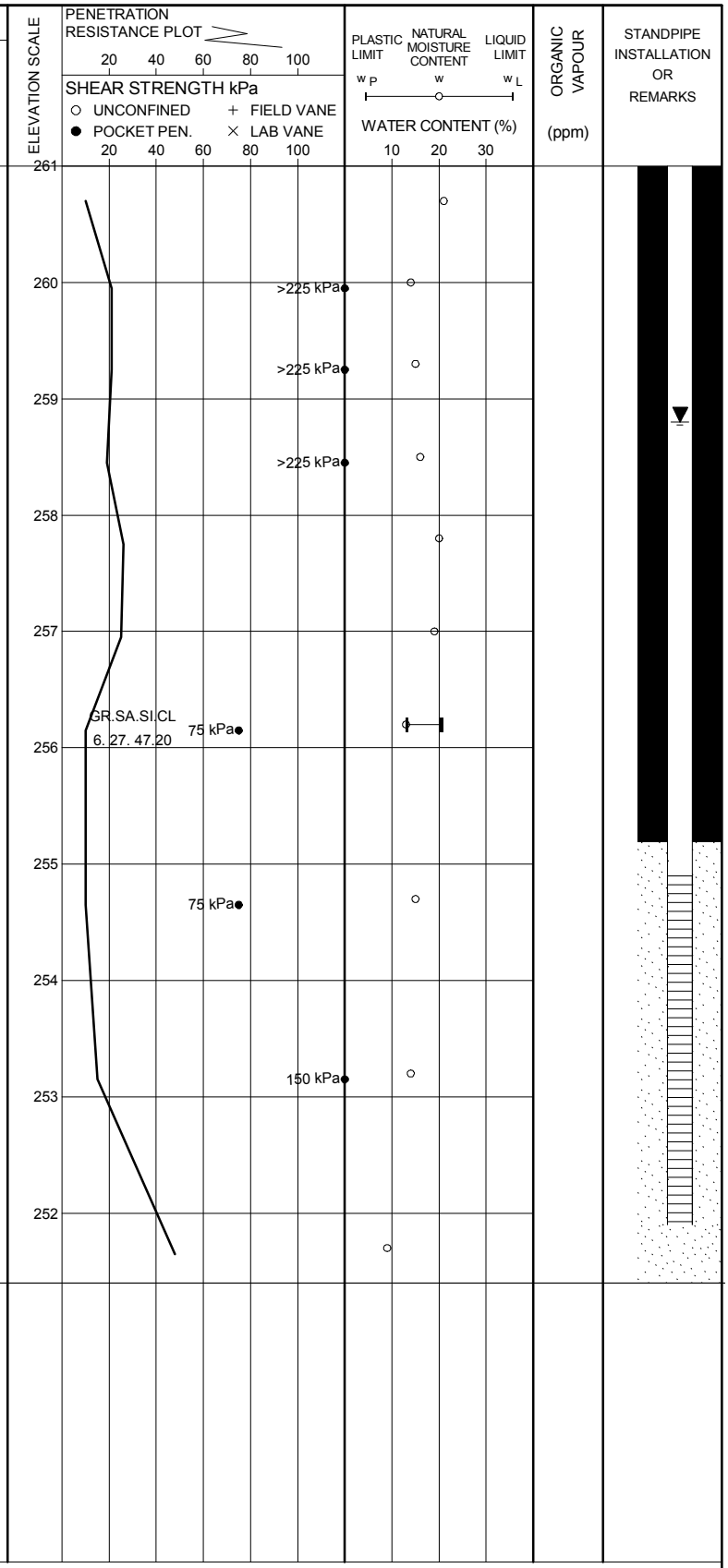
NOTES:
Borehole was caving at 8.4m and unstabilized water level at 7.6m upon completion of drilling.
Water level in monitoring well at 6.2m (Elev. 252.1m) on April 23, 2009.

Terraprobe

LOG OF BOREHOLE 6

PROJECT: Mayfield West
DATE: February 09, 2009
LOCATION: Caledon, Ontario
EQUIPMENT: Bombardier/Hollow Stem Augers
CLIENT: Philips Engineering Ltd.
ELEVATION DATUM: Geodetic
FILE: 1-08-3053

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
261.0					
0.0 260.7	280mm TOPSOIL		1	SS	10
0.3	Weathered, stiff ---- CLAYEY SILT embedded sand and gravel, very stiff, brown, moist (GLACIAL TILL)		2	SS	21
			3	SS	21
			4	SS	19
258.0					
3.0	SANDY SILT trace gravel, compact, brown, moist ---- wet		5	SS	26
			6	SS	25
256.4					
4.6	CLAYEY SILT embedded sand and gravel, stiff, grey, moist (GLACIAL TILL)		7	SS	10
			8	SS	10
			9	SS	15
251.9					
9.1 251.4	SANDY SILT - embedded gravel, some limestone fragments, dense, reddish grey, moist (GLACIAL TILL)		10	SS	48
9.6	End of Borehole				



NOTES:
Borehole was open and dry upon completion of drilling.
Water level in monitoring well at 2.2m (Elev. 258.8m) on April 23, 2009.

Terraprobe

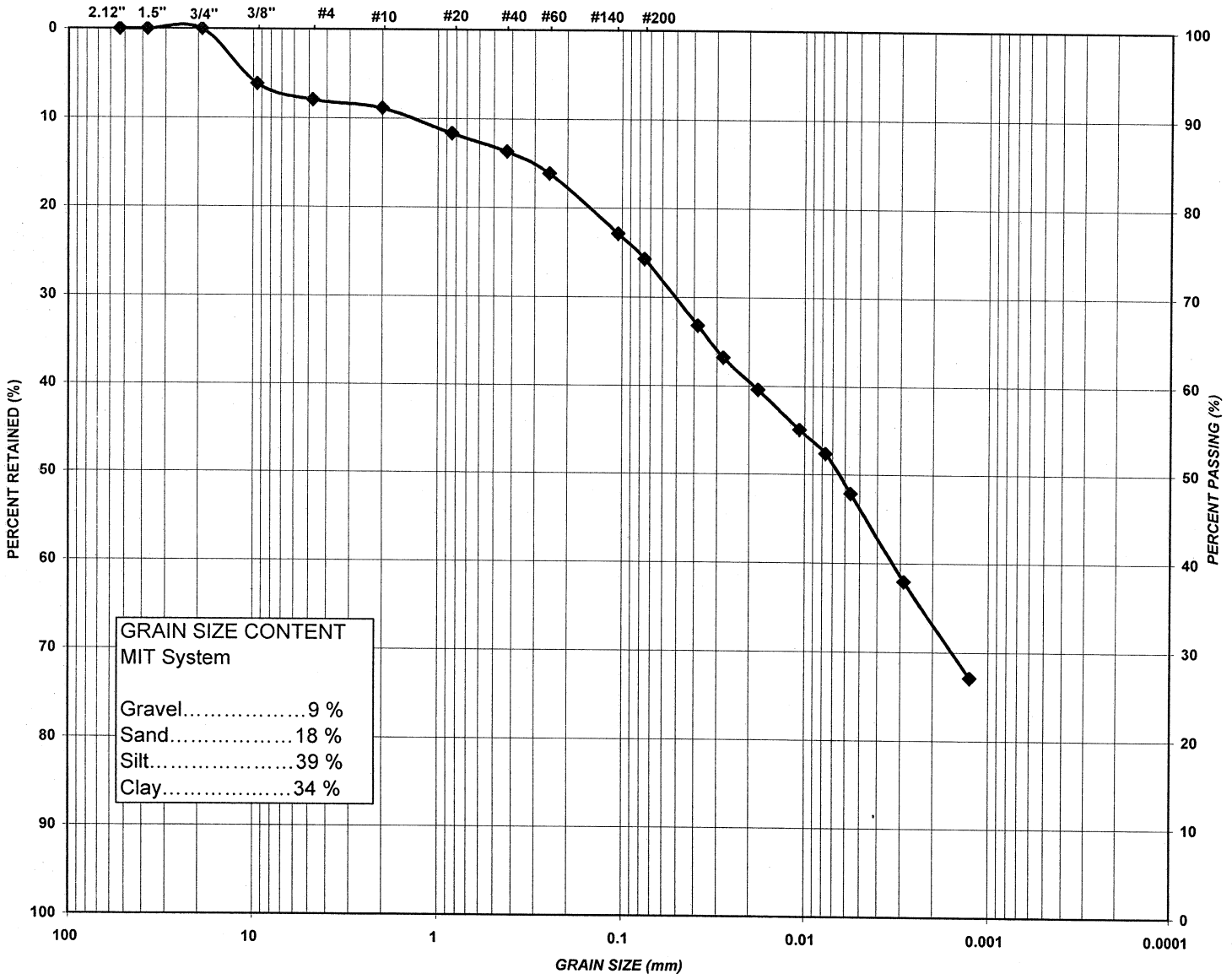
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **Mayfield West**
LOCATION: **Caledon, Ontario**
CLIENT: **Philips Engineering**
BOREHOLE NUMBER: **1**
SAMPLE NUMBER: **3**
SAMPLE DEPTH: **1.5 - 2.0 m**
SAMPLE DESCRIPTION: **CLAYEY SILT, some sand, trace gravel Glacial Till)**

FILE NO.: **1-08-3053**
LAB NO.: **1039A**
SAMPLE DATE: **February 12, 2009**
SAMPLED BY: **P.K.**

GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL		SAND			SILT	CLAY
			COARSE	MEDIUM	FINE		

UNIFIED SYSTEM	GRAVEL		SAND			SILT AND CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Terraprobe

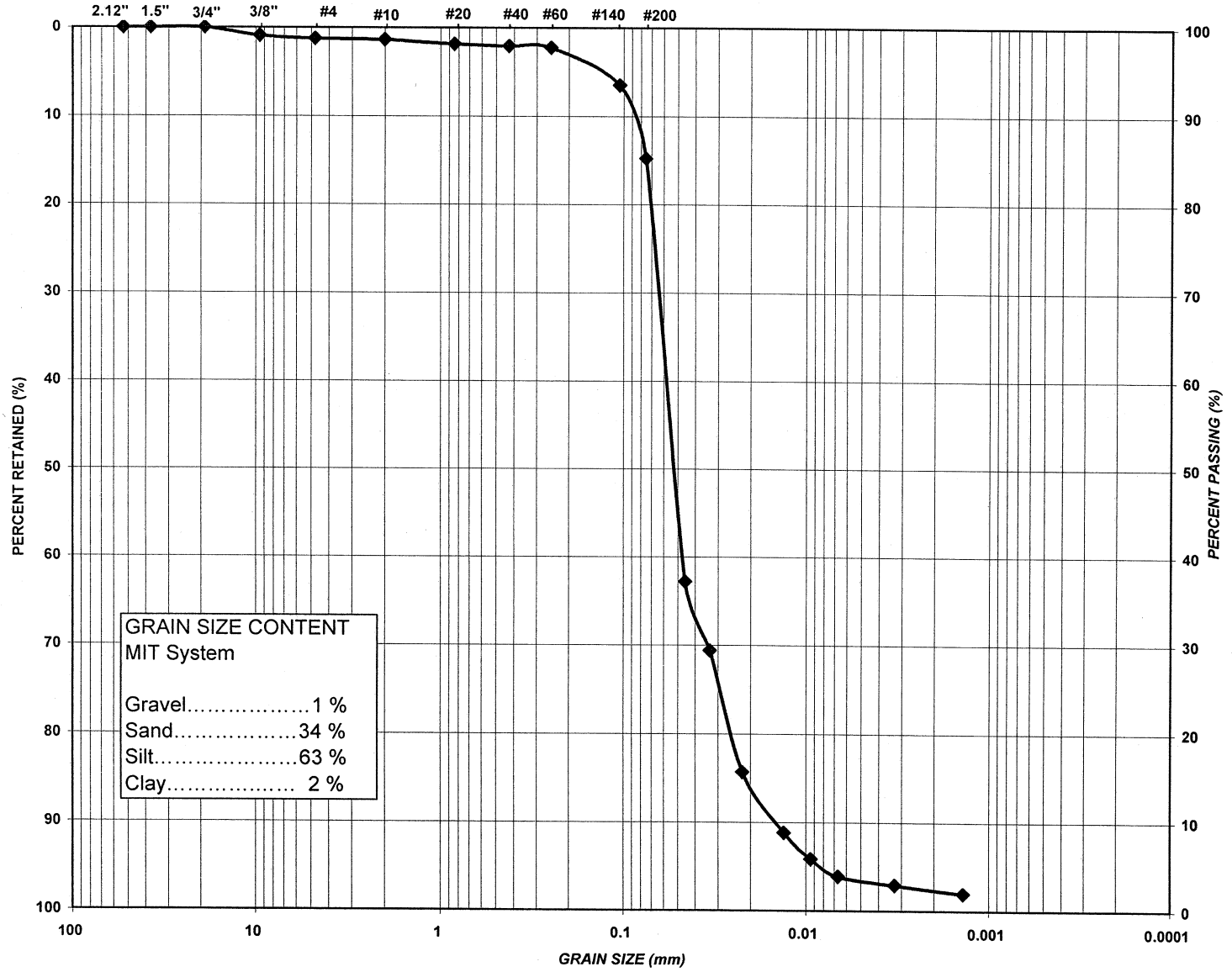
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **Mayfield West**
LOCATION: **Caledon, Ontario**
CLIENT: **Philips Engineering**
BOREHOLE NUMBER: **2**
SAMPLE NUMBER: **7**
SAMPLE DEPTH: **6.1 - 6.6 m**
SAMPLE DESCRIPTION: **SANDY SILT, trace clay, trace gravel**

FILE NO.: **1-08-3053**
LAB NO.: **1039B**
SAMPLE DATE: **February 12, 2009**
SAMPLED BY: **P.K.**

GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				
UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY	
	GRAVEL		SAND				

Terraprobe

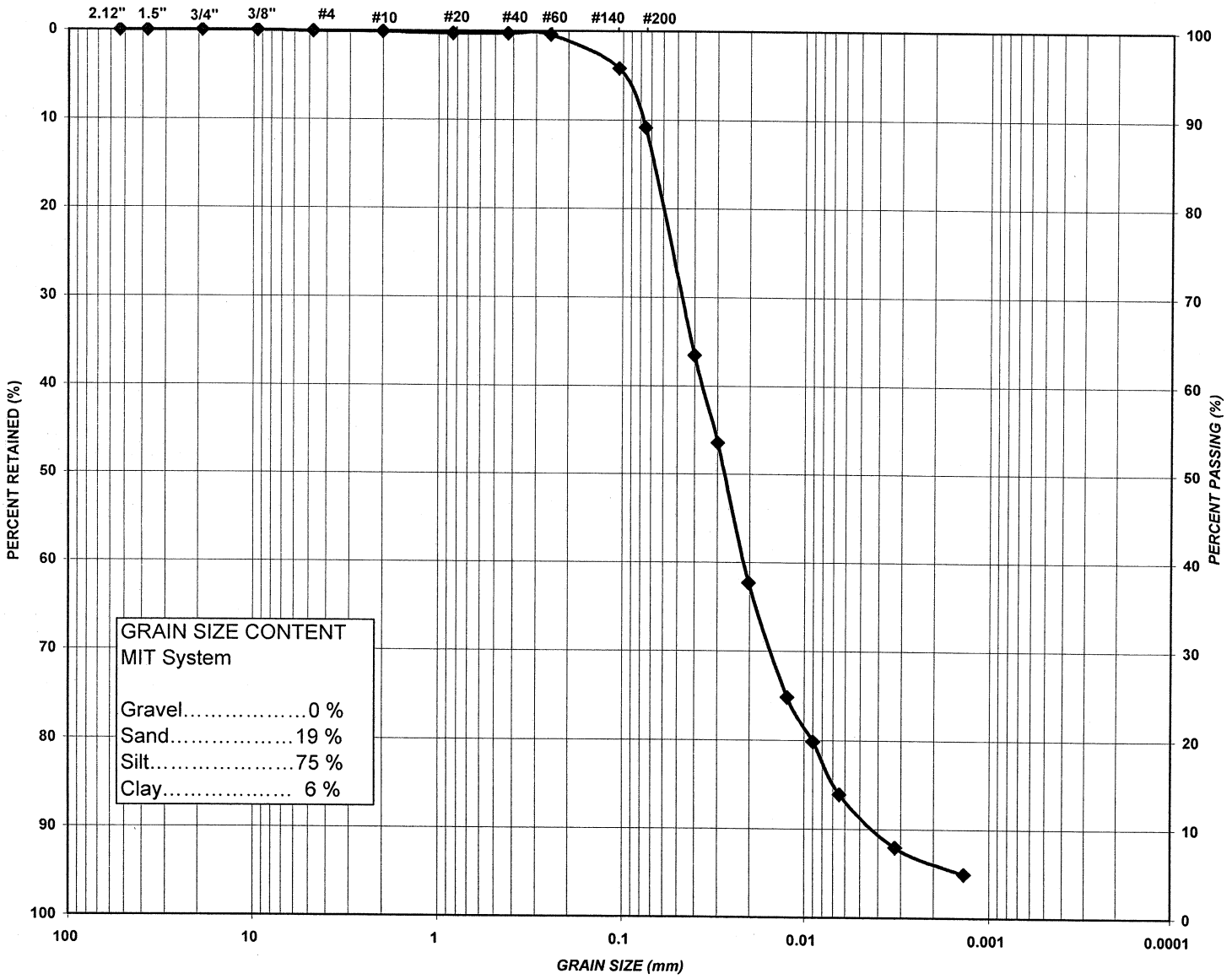
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **Mayfield West**
LOCATION: **Caledon, Ontario**
CLIENT: **Philips Engineering**
BOREHOLE NUMBER: **3**
SAMPLE NUMBER: **8**
SAMPLE DEPTH: **7.6 - 8.1 m**
SAMPLE DESCRIPTION: **SILT, some sand, trace clay**

FILE NO.: **1-08-3053**
LAB NO.: **1039C**
SAMPLE DATE: **February 9, 2009**
SAMPLED BY: **P.K.**

GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				
UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY	
	GRAVEL		SAND				

Terraprobe

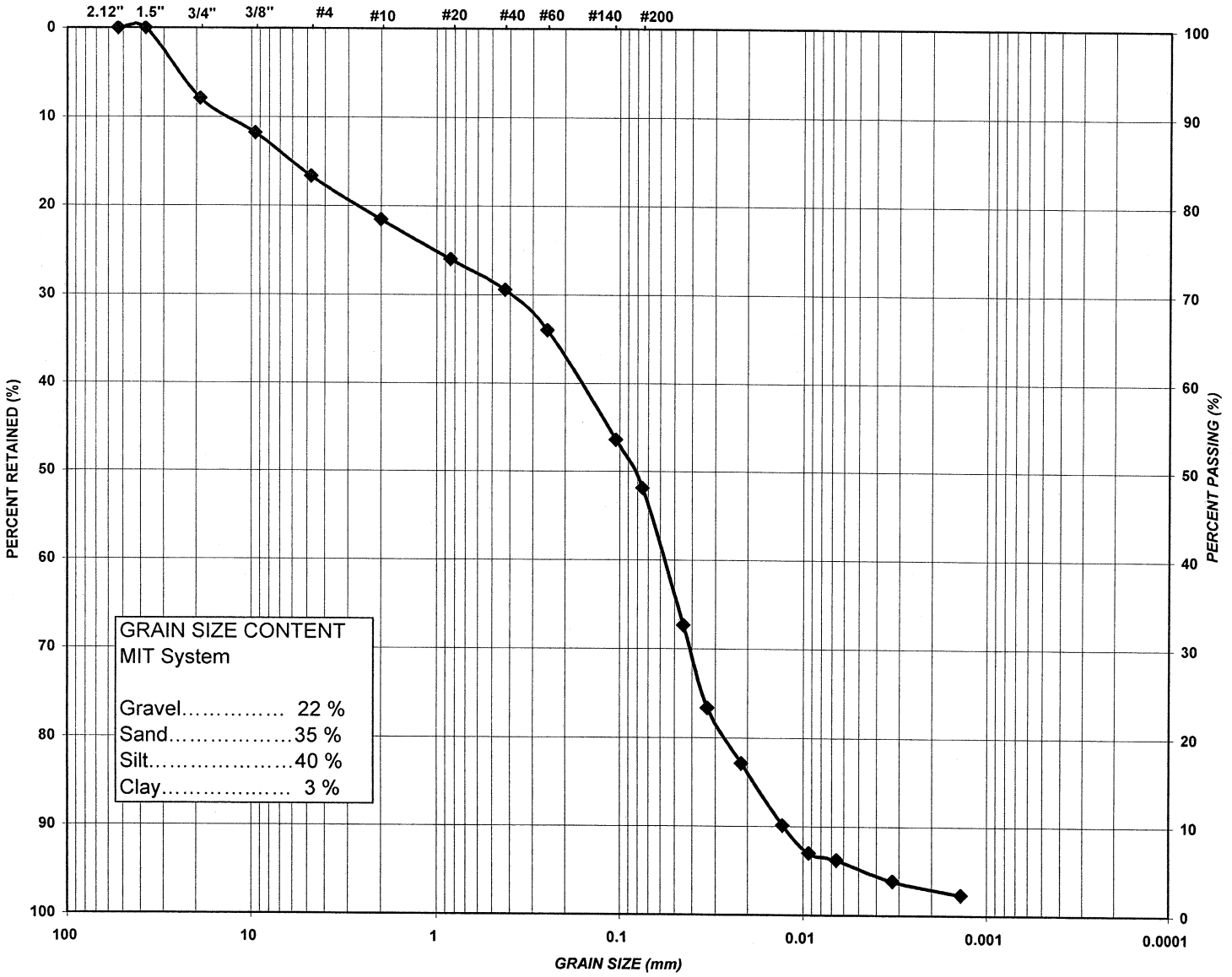
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **Mayfield West**
LOCATION: **Caledon, Ontario**
CLIENT: **Philips Engineering**
BOREHOLE NUMBER: **4**
SAMPLE NUMBER: **22**
SAMPLE DEPTH: **29.0 - 29.8 m**
SAMPLE DESCRIPTION: **SILT AND SAND, gravelly, trace clay**

FILE NO.: **1-08-3053**
LAB NO.: **1039D**
SAMPLE DATE: **February 11, 2009**
SAMPLED BY: **P.K.**

GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				
UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY	
	GRAVEL		SAND				

Terraprobe

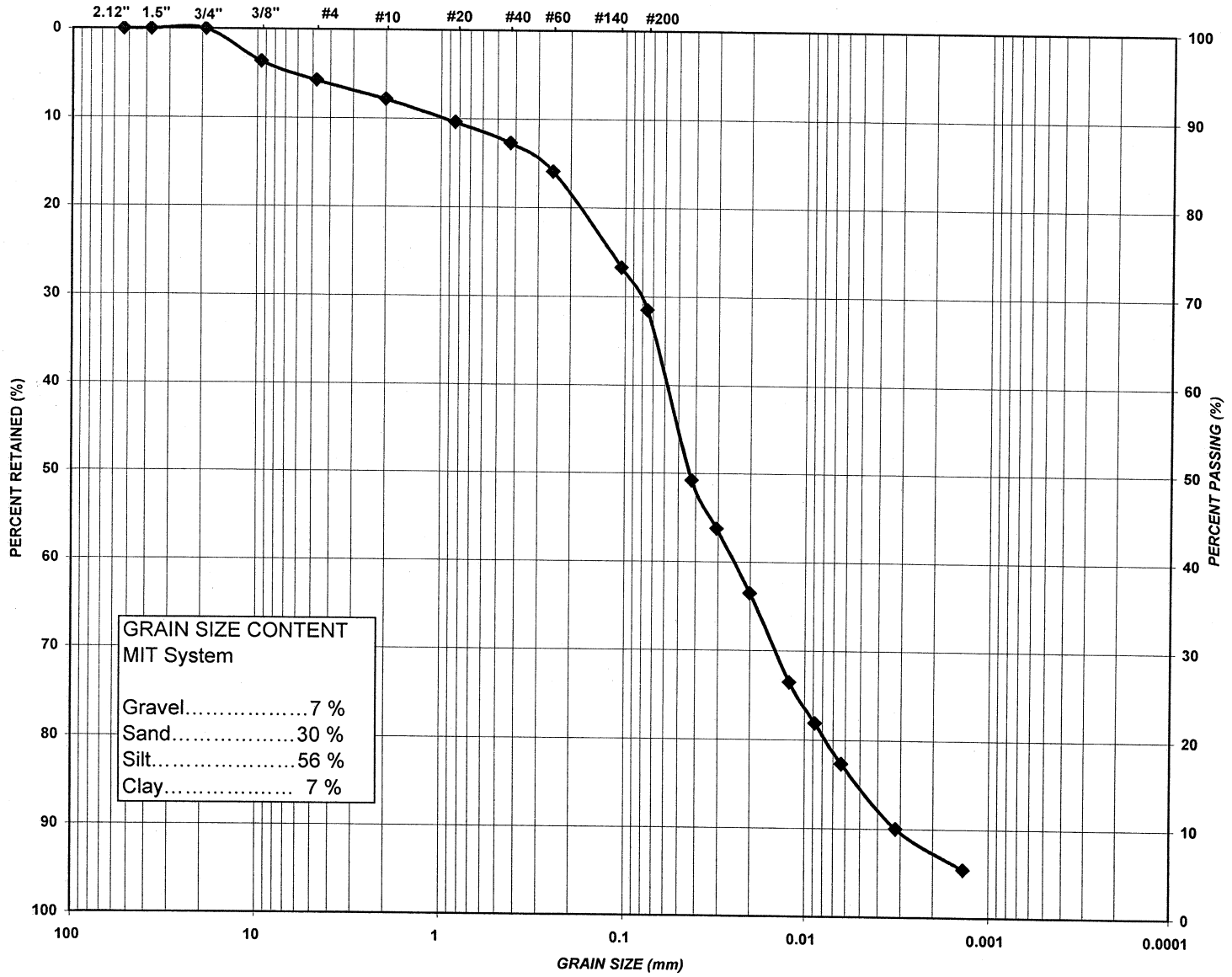
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **Mayfield West**
LOCATION: **Caledon, Ontario**
CLIENT: **Philips Engineering**
BOREHOLE NUMBER: **5**
SAMPLE NUMBER: **9**
SAMPLE DEPTH: **9.1 - 9.6 m**
SAMPLE DESCRIPTION: **SANDY SILT, trace clay, trace gravel (Glacial Till)**

FILE NO.: **1-08-3053**
LAB NO.: **1039E**
SAMPLE DATE: **February 12, 2009**
SAMPLED BY: **P.K.**

GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				
UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY	
	GRAVEL		SAND				

Terraprobe

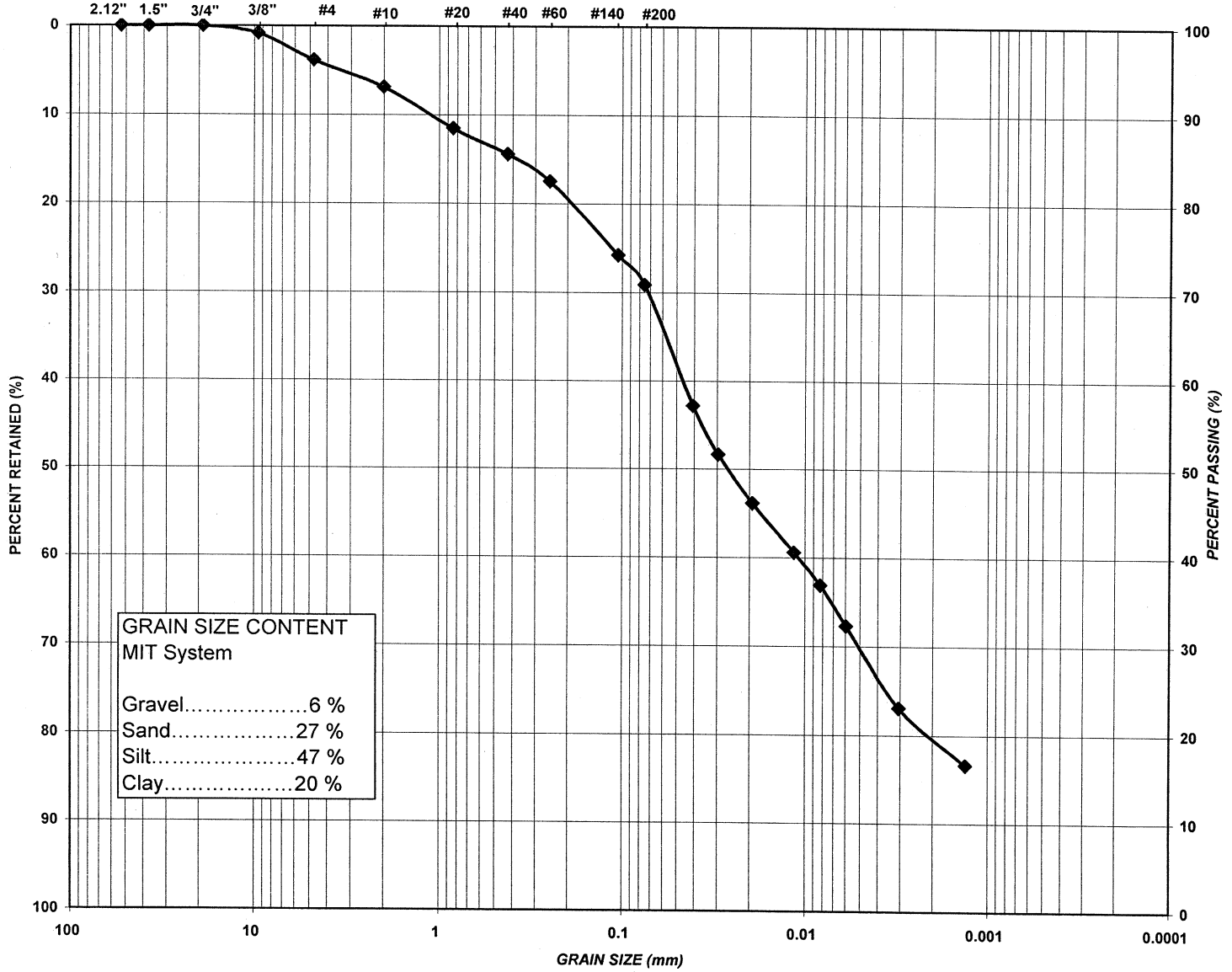
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **Mayfield West**
LOCATION: **Caledon, Ontario**
CLIENT: **Philips Engineering**
BOREHOLE NUMBER: **6**
SAMPLE NUMBER: **7**
SAMPLE DEPTH: **4.0 - 5.0 m**
SAMPLE DESCRIPTION: **CLAYEY SILT, sandy, trace gravel (Glacial Till)**

FILE NO.: **1-08-3053**
LAB NO.: **1039F**
SAMPLE DATE: **February 9, 2009**
SAMPLED BY: **P.K.**

GRAIN SIZE DISTRIBUTION

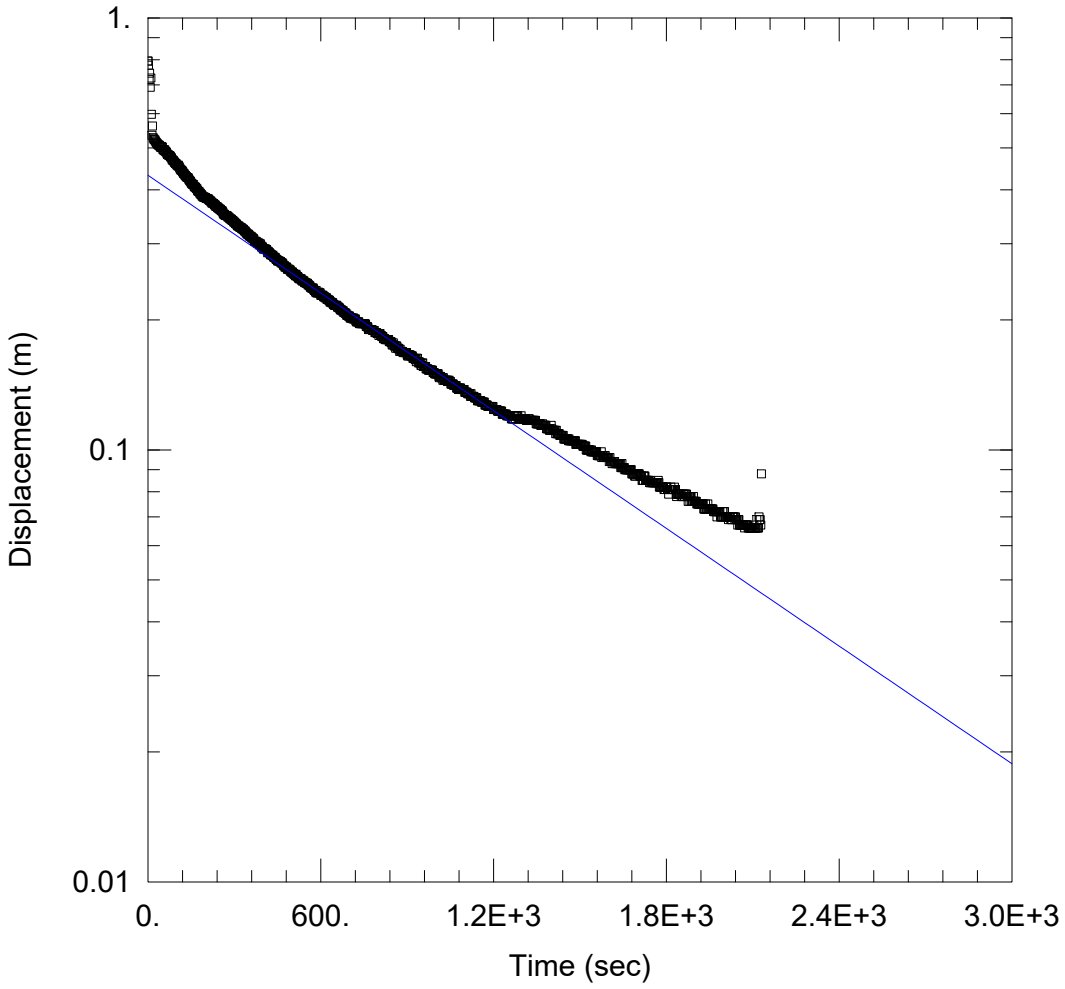
U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				
UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			

Appendix C

Single Well Response Test Analyses (Palmer, 2024)



WELL TEST ANALYSIS

Data Set: Z:\...\MW-1 FH.aqt
Date: 01/31/18 Time: 15:45:09

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Mayfield
Test Well: Test Well
Test Date: Dec 6, 2017

AQUIFER DATA

Saturated Thickness: 4.77 m Anisotropy Ratio (Kz/Kr): 0.1

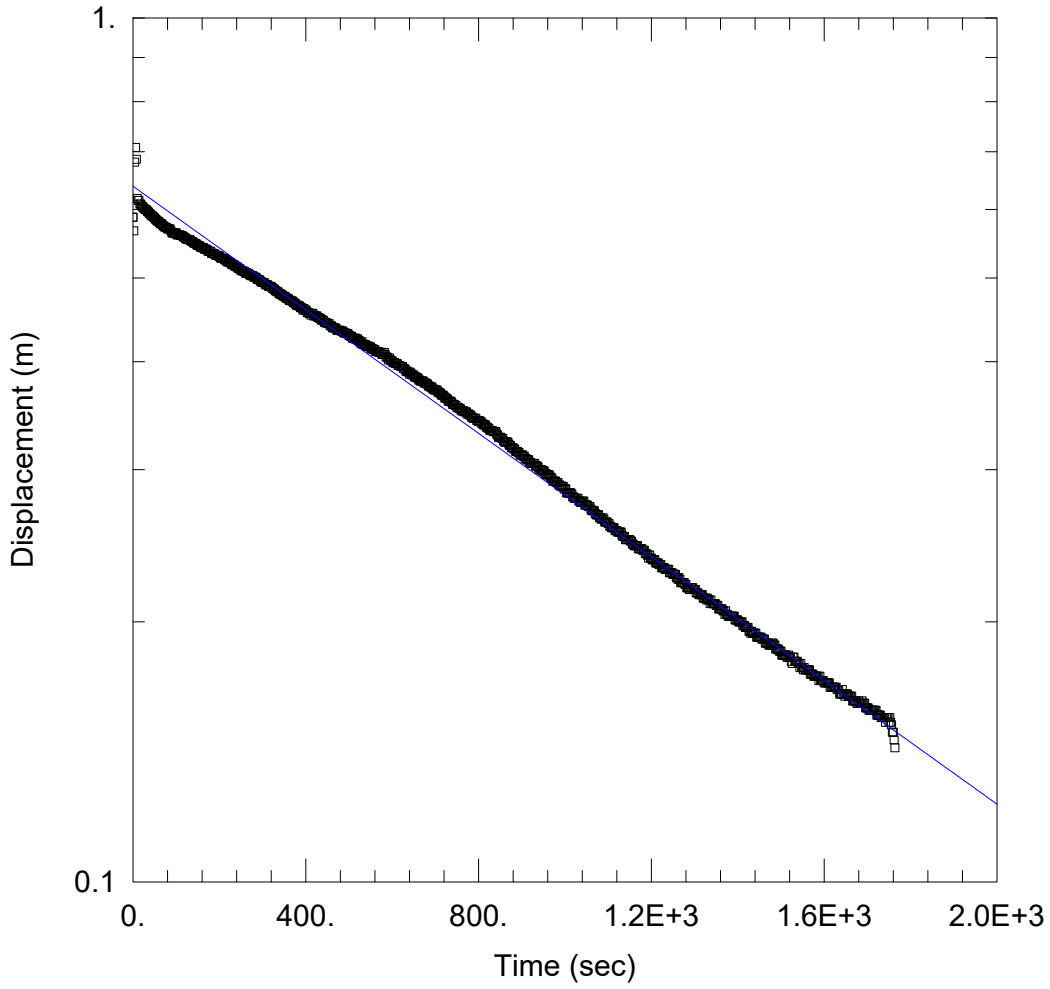
WELL DATA (MW-1)

Initial Displacement: 0.795 m
Total Well Penetration Depth: 4.77 m
Casing Radius: 0.025 m
Static Water Column Height: 4.77 m
Screen Length: 1.52 m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 1.279E-6 m/sec y0 = 0.4321 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-1 RH.aqt
Date: 01/31/18 Time: 15:46:32

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Mayfield
Test Well: Test Well
Test Date: Dec 6, 2017

AQUIFER DATA

Saturated Thickness: 4.77 m Anisotropy Ratio (Kz/Kr): 0.1

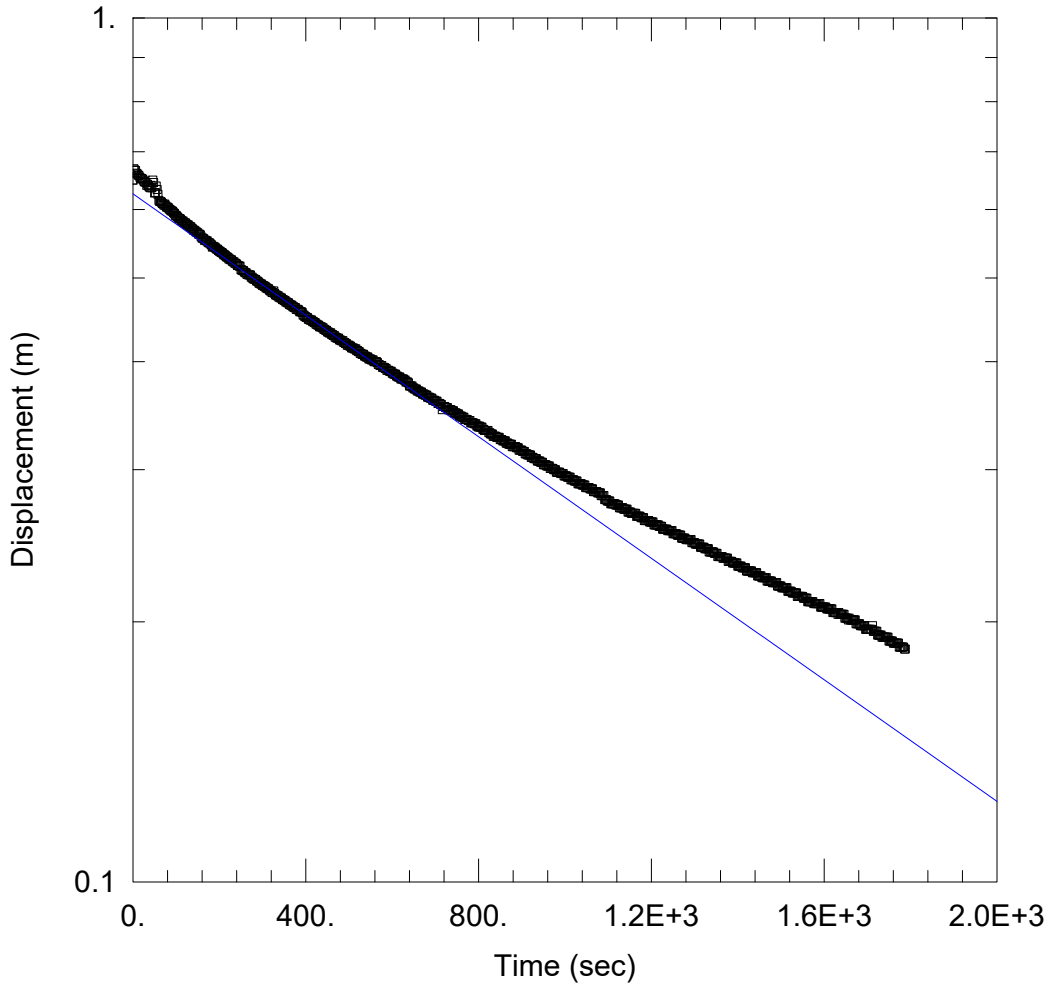
WELL DATA (MW-1)

Initial Displacement: 0.588 m
Total Well Penetration Depth: 4.77 m
Casing Radius: 0.025 m
Static Water Column Height: 4.77 m
Screen Length: 1.52 m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 1.008E-6 m/sec y0 = 0.6386 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-2d FH.aqt
Date: 01/31/18 Time: 15:47:17

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Sheldon Cr
Test Well: MW3
Test Date: 08Jan18

AQUIFER DATA

Saturated Thickness: 6.86 m Anisotropy Ratio (Kz/Kr): 0.1

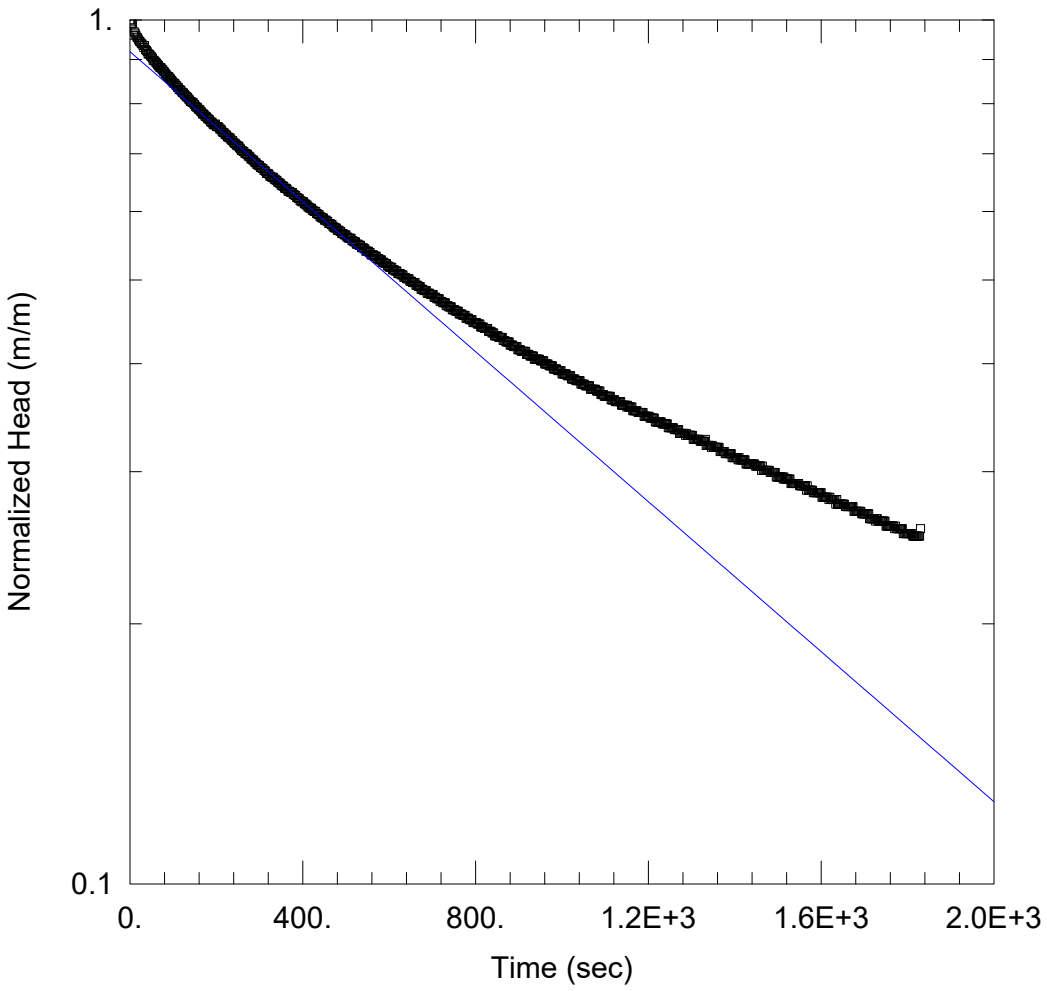
WELL DATA (MW-2)

Initial Displacement: 0.649 m
Total Well Penetration Depth: 6.86 m
Casing Radius: 0.0254 m
Static Water Column Height: 6.86 m
Screen Length: 3.05 m
Well Radius: 0.0254 m
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 5.085E-7 m/sec y0 = 0.6258 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-2d RH.aqt
Date: 01/31/18 Time: 15:48:13

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Sheldon Cr
Test Well: MW3
Test Date: 08Jan18

AQUIFER DATA

Saturated Thickness: 8. m Anisotropy Ratio (Kz/Kr): 1.

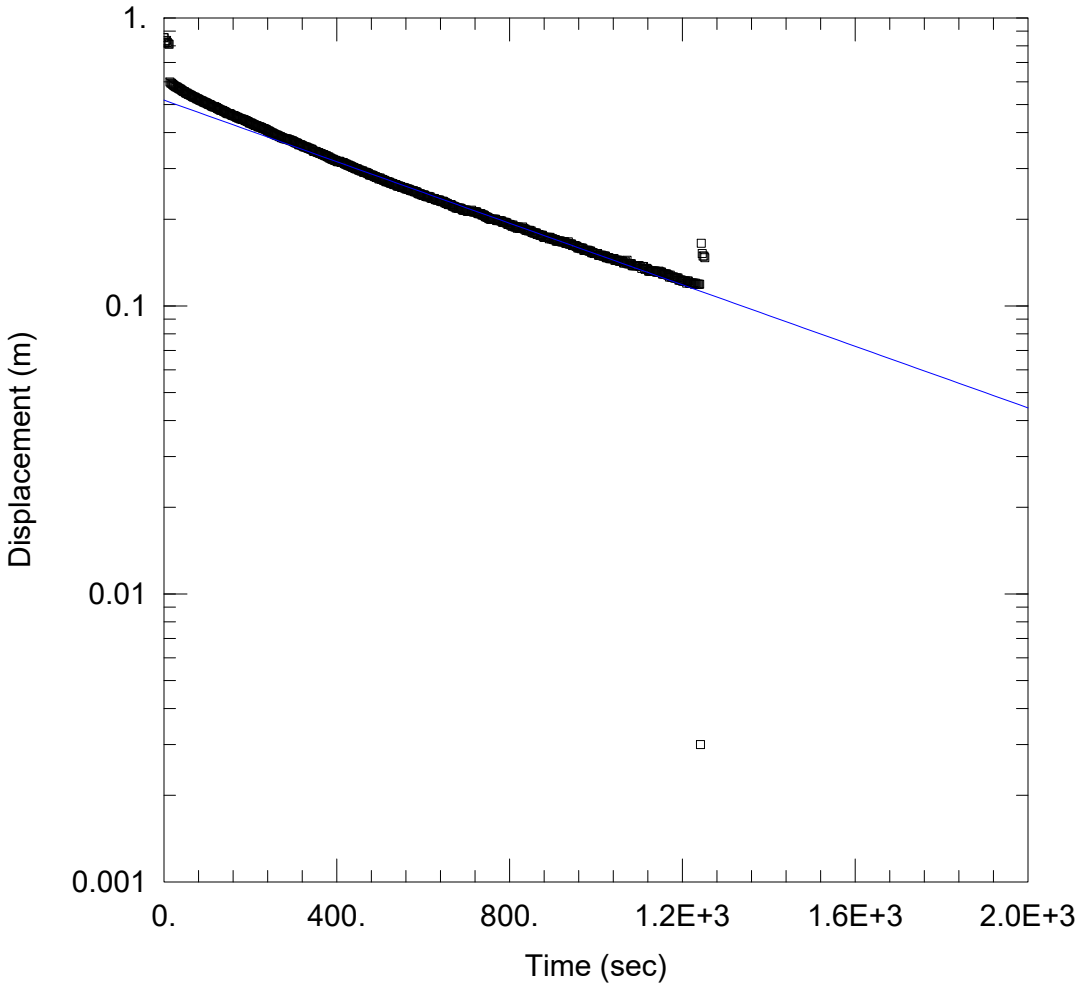
WELL DATA (MW-2 RH)

Initial Displacement: 0.578 m
Total Well Penetration Depth: 6.86 m
Casing Radius: 0.0254 m
Static Water Column Height: 6.86 m
Screen Length: 3.05 m
Well Radius: 0.0254 m
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 5.062E-7 m/sec y0 = 0.5312 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-2s FH.aqt
Date: 01/31/18 Time: 15:51:18

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Mayfield
Test Well: Test Well
Test Date: Dec 6, 2017

AQUIFER DATA

Saturated Thickness: 3.18 m Anisotropy Ratio (Kz/Kr): 0.1

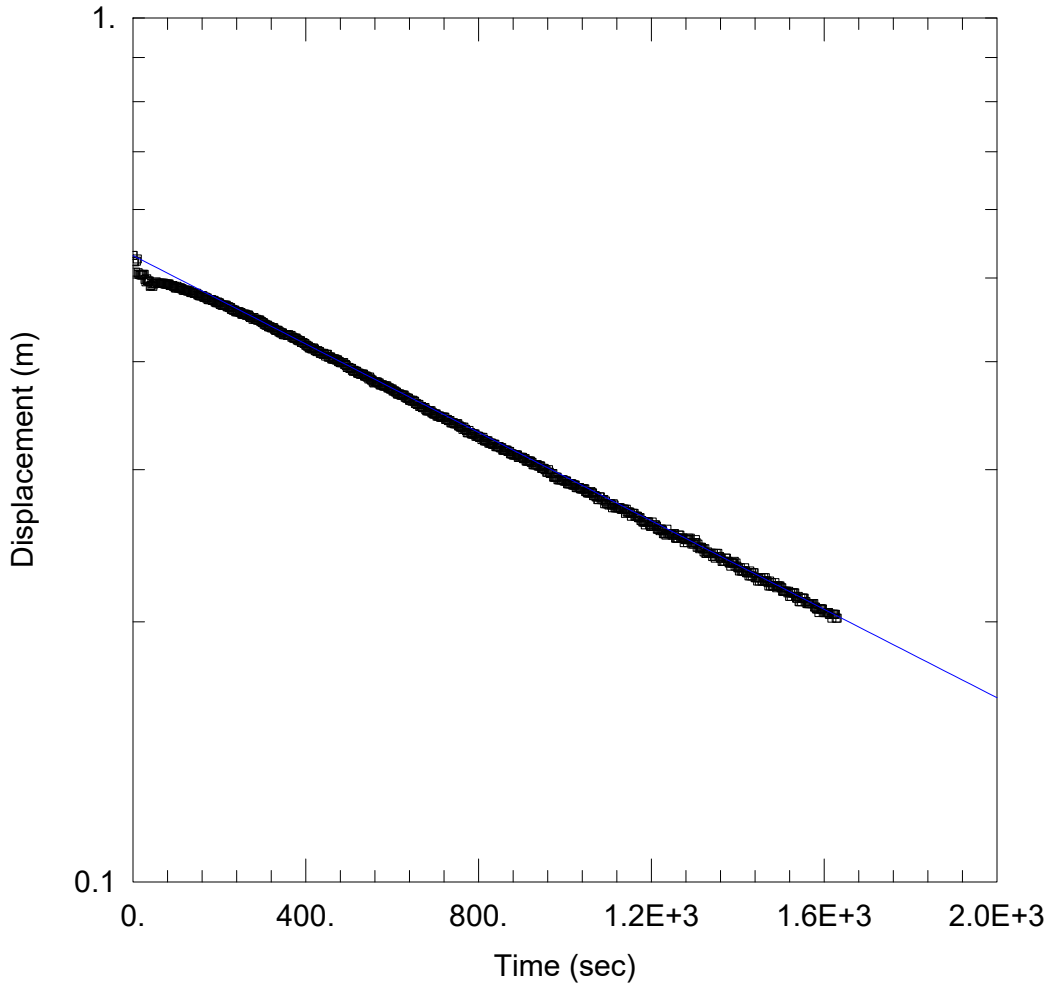
WELL DATA (MW-2s)

Initial Displacement: 0.854 m
Total Well Penetration Depth: 3.18 m
Casing Radius: 0.025 m
Static Water Column Height: 3.18 m
Screen Length: 1.53 m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 1.323E-6 m/sec y0 = 0.5182 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-2s RH.aqt
Date: 01/31/18 Time: 15:50:01

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Mayfield
Test Well: Test Well
Test Date: Dec 6, 2017

AQUIFER DATA

Saturated Thickness: 3.18 m Anisotropy Ratio (Kz/Kr): 0.1

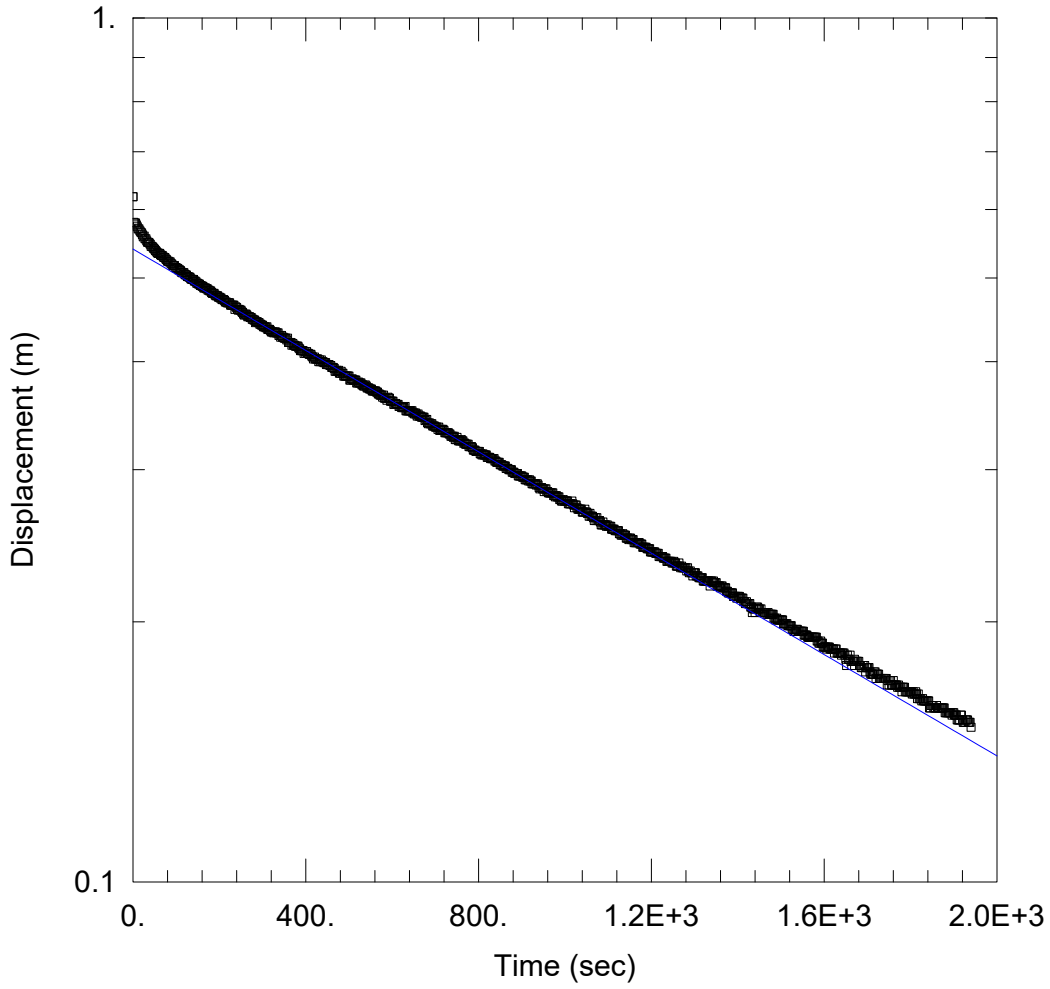
WELL DATA (MW-2s)

Initial Displacement: 0.531 m
Total Well Penetration Depth: 3.18 m
Casing Radius: 0.025 m
Static Water Column Height: 3.18 m
Screen Length: 1.53 m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 6.337E-7 m/sec y0 = 0.5309 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-3 FH.aqt
Date: 01/31/18 Time: 15:52:23

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Sheldon Cr
Test Well: MW3
Test Date: 08Jan18

AQUIFER DATA

Saturated Thickness: 7.06 m Anisotropy Ratio (Kz/Kr): 0.1

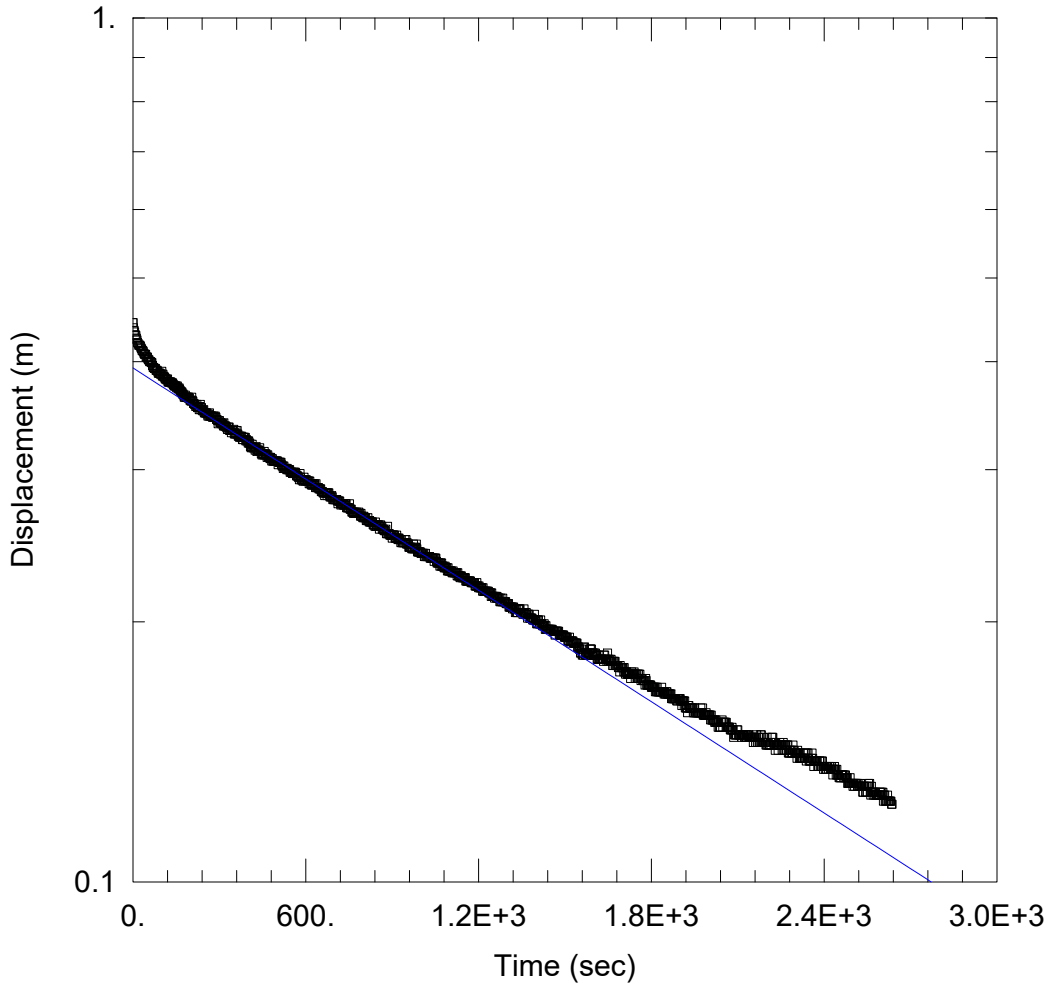
WELL DATA (MW-3 FH)

Initial Displacement: 0.621 m
Total Well Penetration Depth: 7.06 m
Casing Radius: 0.025 m
Static Water Column Height: 7.06 m
Screen Length: 3.05 m
Well Radius: 0.025 m
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 4.601E-7 m/sec y0 = 0.5401 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-3 RH.aqt
Date: 01/31/18 Time: 15:52:54

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Sheldon Cr
Test Well: MW3
Test Date: 08Jan18

AQUIFER DATA

Saturated Thickness: 7.06 m Anisotropy Ratio (Kz/Kr): 0.1

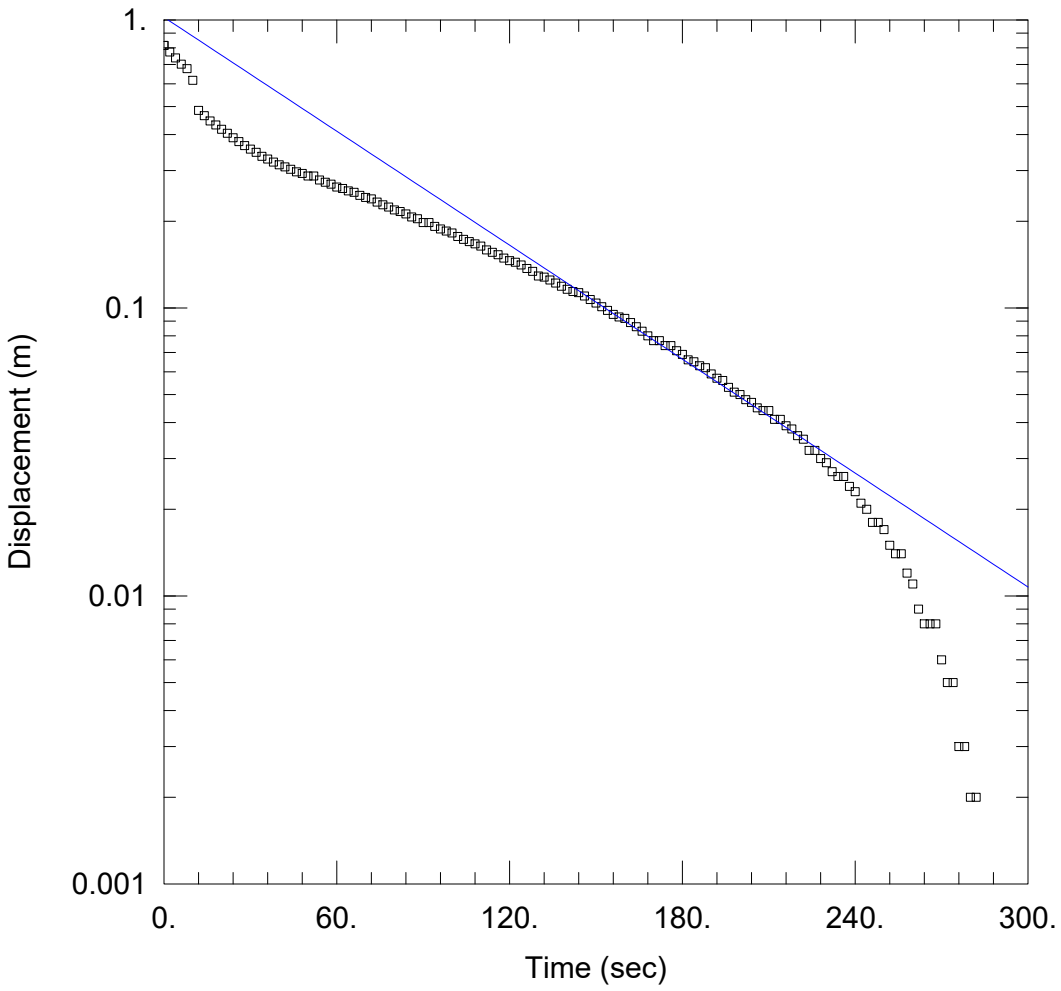
WELL DATA (MW-3 RH)

Initial Displacement: 0.444 m
Total Well Penetration Depth: 7.06 m
Casing Radius: 0.025 m
Static Water Column Height: 7.06 m
Screen Length: 3.05 m
Well Radius: 0.025 m
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 3.366E-7 m/sec y0 = 0.3934 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-4 FH.aqt
Date: 01/31/18 Time: 15:53:49

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Mayfield
Test Well: Test Well
Test Date: Dec 6, 2017

AQUIFER DATA

Saturated Thickness: 3.39 m Anisotropy Ratio (Kz/Kr): 0.1

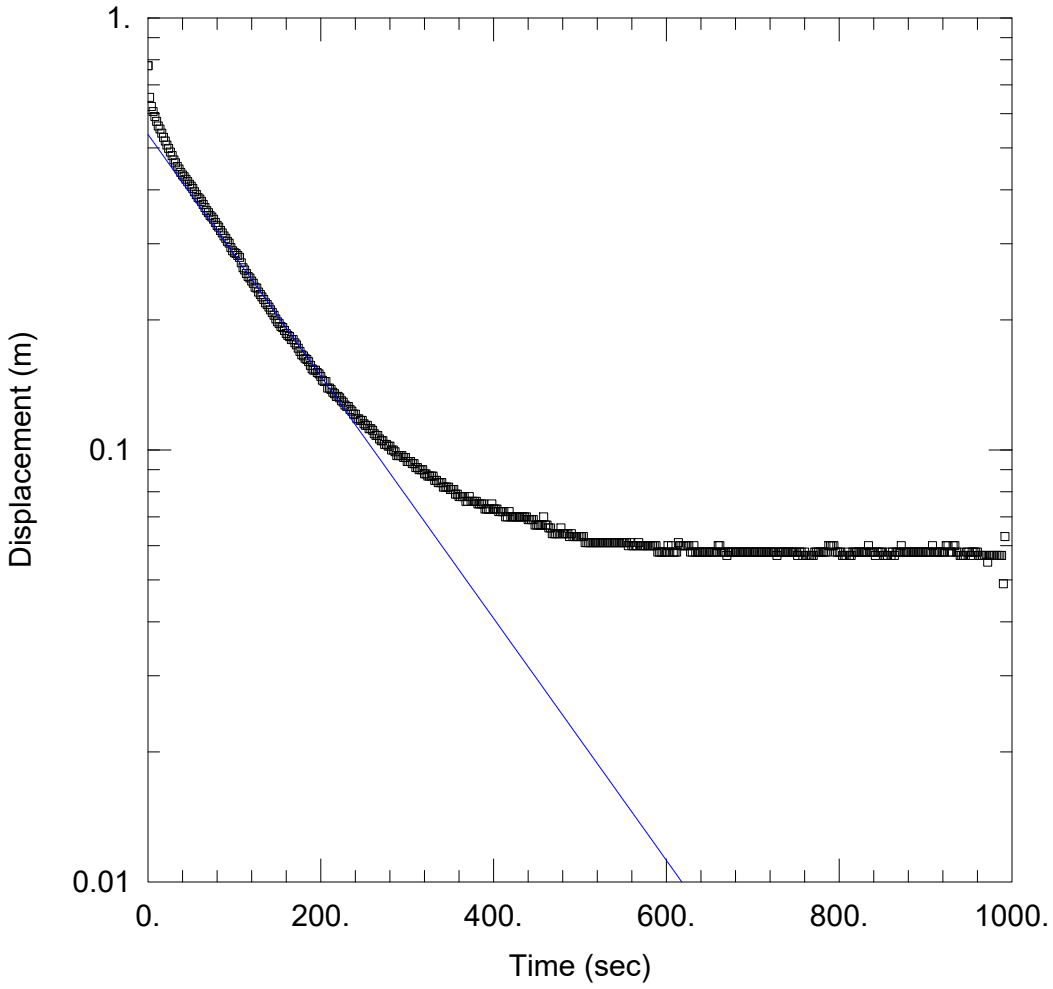
WELL DATA (MW-4)

Initial Displacement: 0.815 m
Total Well Penetration Depth: 3.39 m
Casing Radius: 0.025 m
Static Water Column Height: 3.39 m
Screen Length: 1.53 m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.433E-5 m/sec y0 = 1.021 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-4 RH.aqt
Date: 01/31/18 Time: 15:55:05

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Mayfield
Test Well: Test Well
Test Date: Dec 6, 2017

AQUIFER DATA

Saturated Thickness: 3.39 m Anisotropy Ratio (Kz/Kr): 0.1

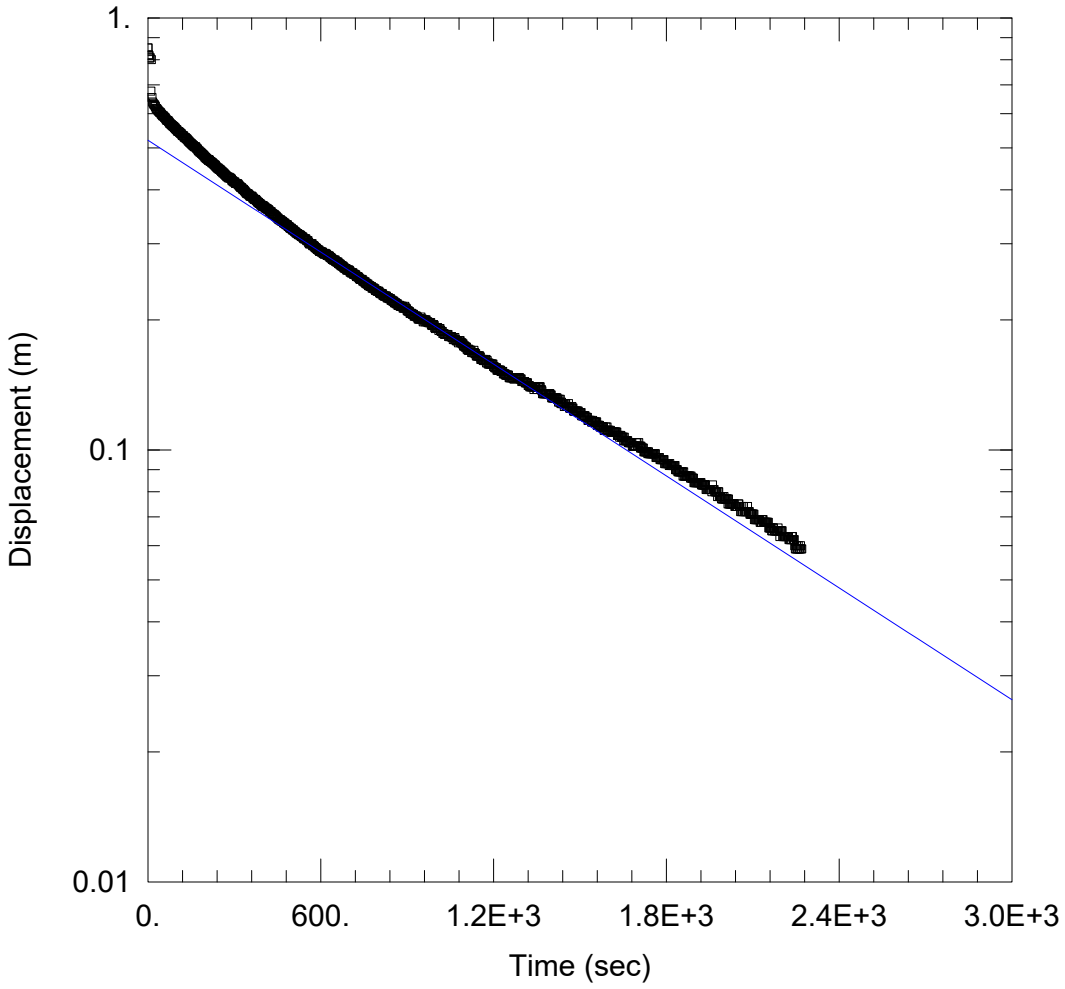
WELL DATA (MW-4)

Initial Displacement: 0.775 m
Total Well Penetration Depth: 3.39 m
Casing Radius: 0.025 m
Static Water Column Height: 3.39 m
Screen Length: 1.53 m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 6.084E-6 m/sec y0 = 0.5373 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-5d FH.aqt
Date: 01/31/18 Time: 15:56:13

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Mayfield
Test Well: Test Well
Test Date: Dec 6, 2017

AQUIFER DATA

Saturated Thickness: 4.96 m Anisotropy Ratio (Kz/Kr): 0.1

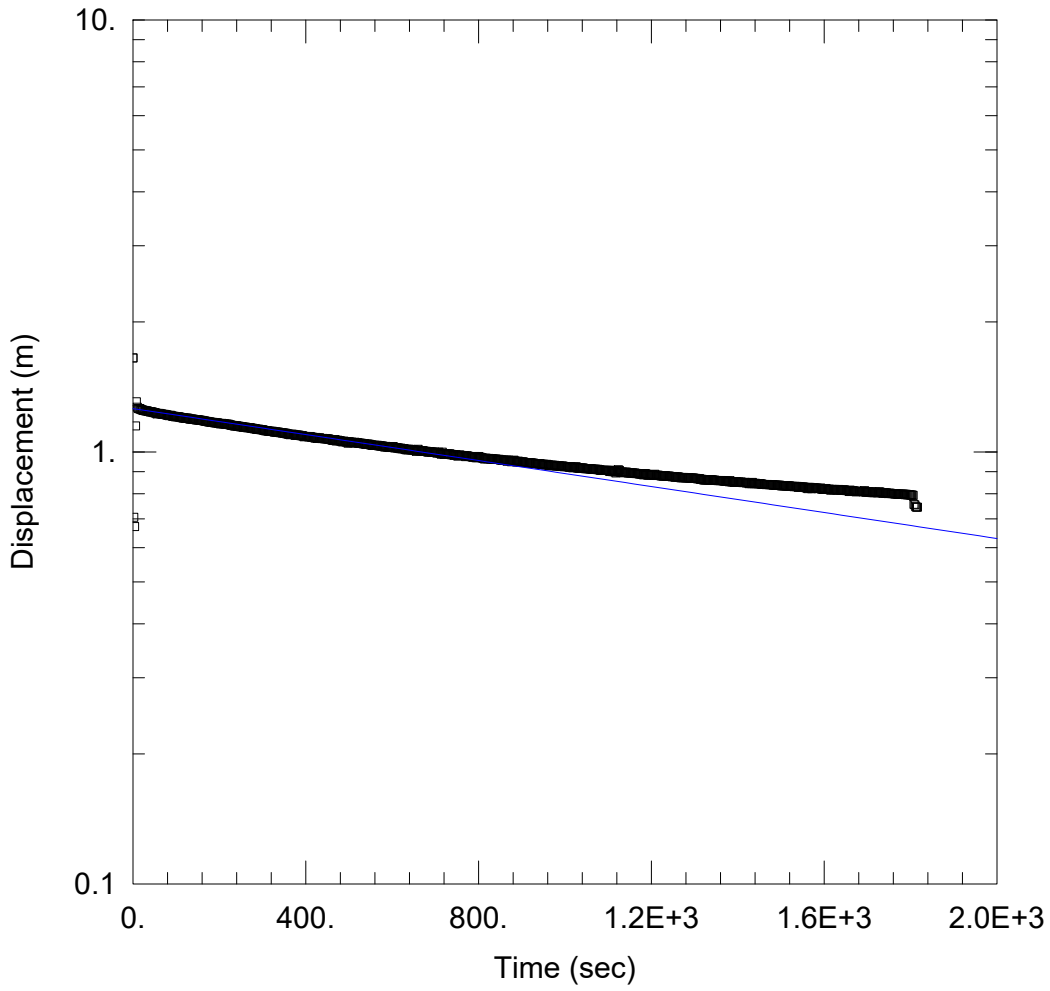
WELL DATA (New Well)

Initial Displacement: 0.852 m
Total Well Penetration Depth: 4.96 m
Casing Radius: 0.025 m
Static Water Column Height: 4.96 m
Screen Length: 1.53 m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 9.87E-7 m/sec y0 = 0.5211 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-5d RH.aqt
Date: 01/31/18 Time: 16:03:18

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Mayfield
Test Well: Test Well
Test Date: Dec 6, 2017

AQUIFER DATA

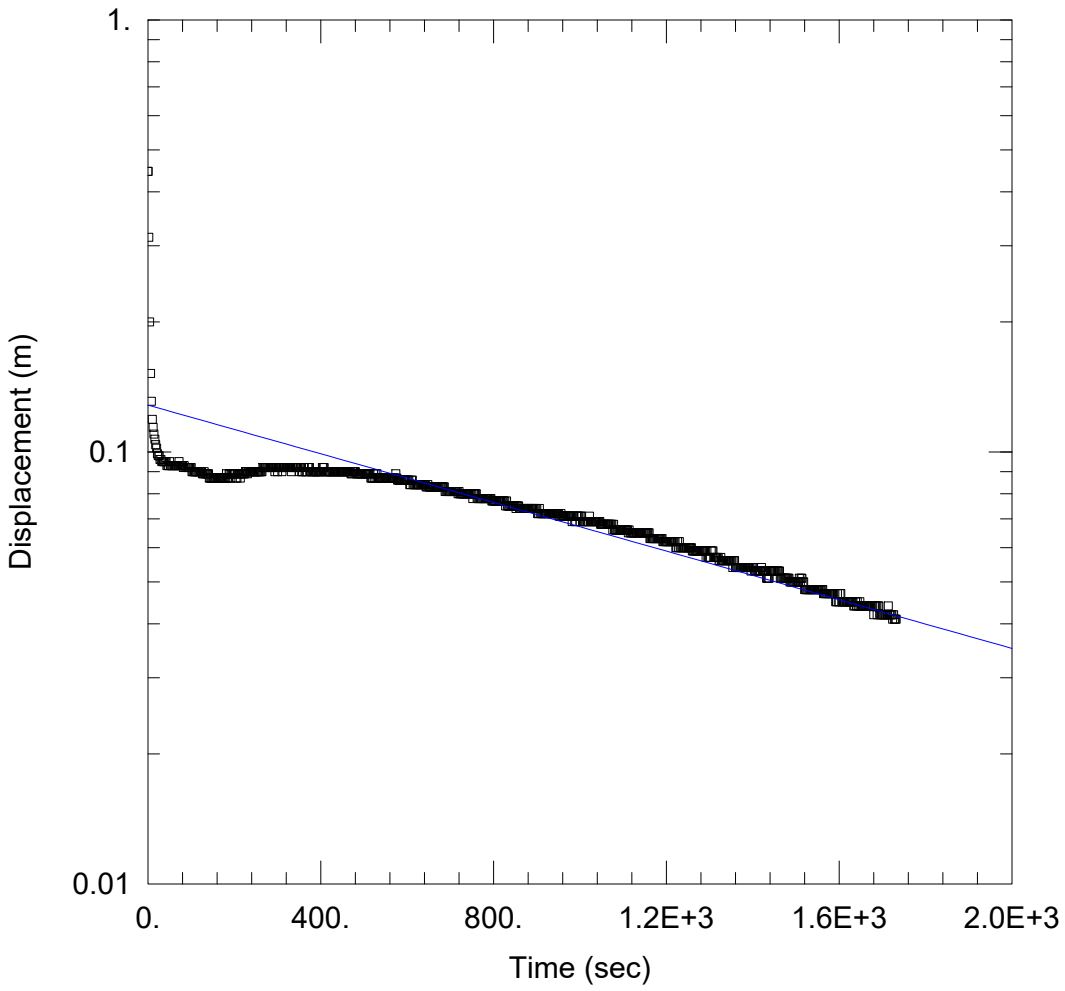
Saturated Thickness: 4.96 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (New Well)

Initial Displacement: 1.651 m
Total Well Penetration Depth: 4.96 m
Casing Radius: 0.025 m
Static Water Column Height: 4.96 m
Screen Length: 1.53 m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 3.437E-7 m/sec
y0 = 1.26 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-5s Injection 1.aqt
Date: 01/31/18 Time: 15:57:38

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Mayfield
Test Well: MW-5s
Test Date: Dec 6, 2017

AQUIFER DATA

Saturated Thickness: 0.27 m Anisotropy Ratio (Kz/Kr): 0.1

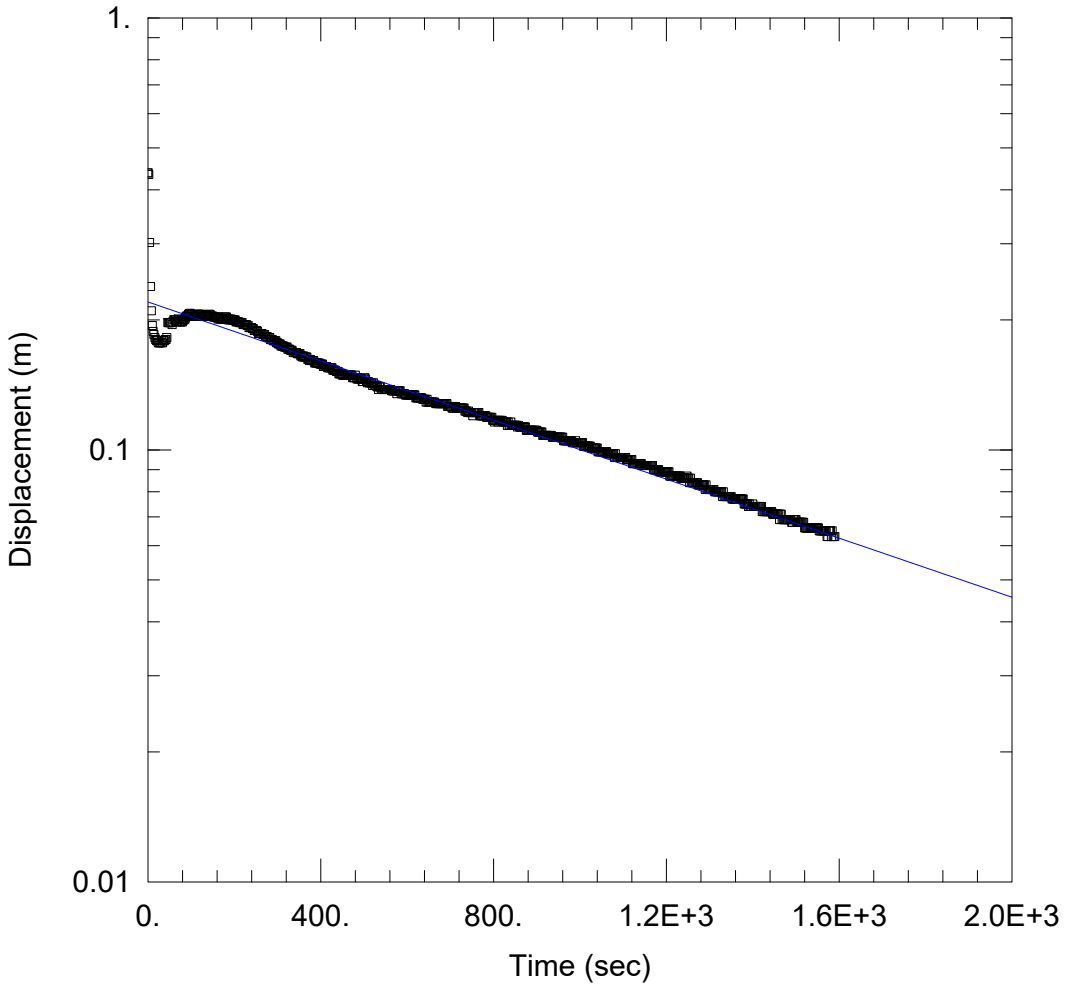
WELL DATA (New Well)

Initial Displacement: 0.446 m
Total Well Penetration Depth: 1.53 m
Casing Radius: 0.025 m
Static Water Column Height: 0.27 m
Screen Length: 1.53 m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.924E-6 m/sec y0 = 0.1283 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-5s Injection 2.aqt
Date: 01/31/18 Time: 15:57:59

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Mayfield
Test Well: MW-5s
Test Date: Dec 6, 2017

AQUIFER DATA

Saturated Thickness: 0.27 m Anisotropy Ratio (Kz/Kr): 0.1

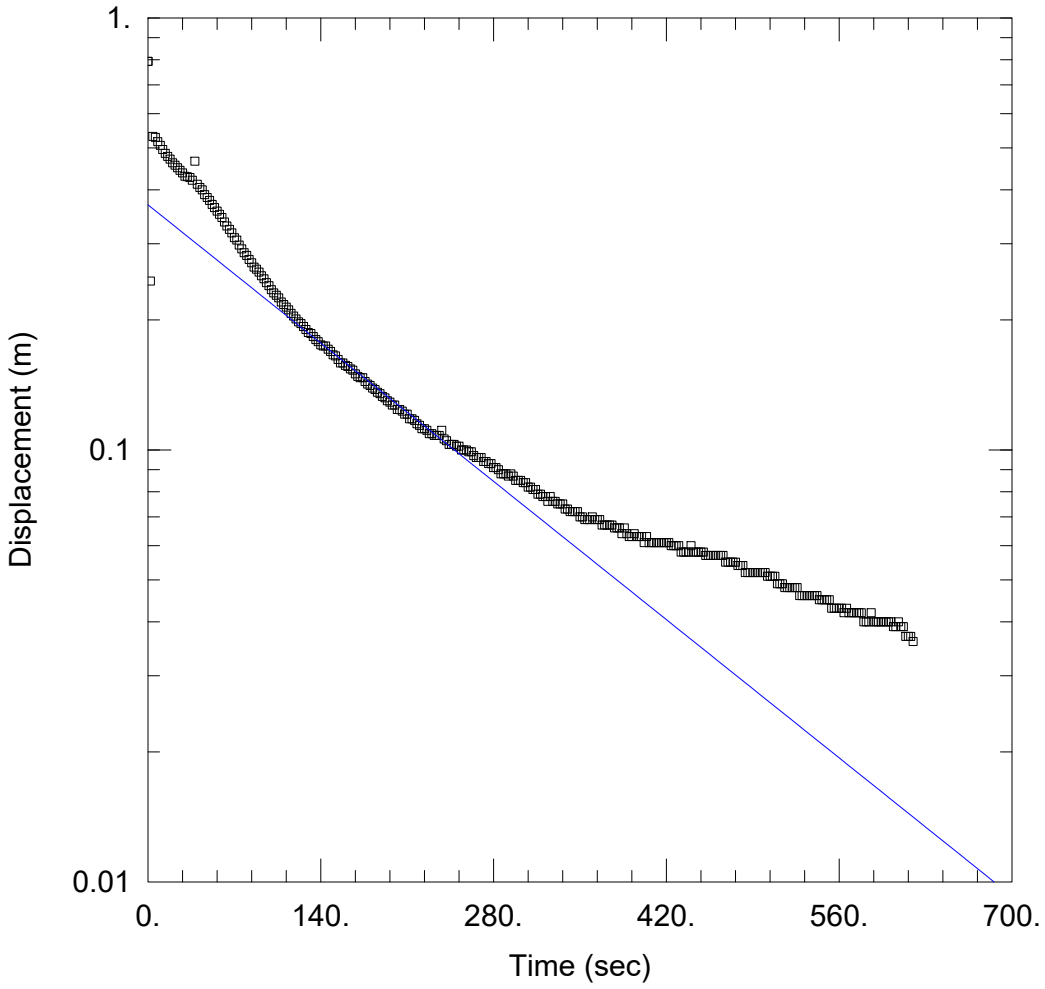
WELL DATA (New Well)

Initial Displacement: 0.438 m
Total Well Penetration Depth: 1.53 m
Casing Radius: 0.025 m
Static Water Column Height: 0.27 m
Screen Length: 1.53 m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 2.335E-6 m/sec y0 = 0.22 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-6 FH.aqt
Date: 01/31/18 Time: 15:58:42

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Mayfield
Test Well: Test Well
Test Date: Dec 6, 2017

AQUIFER DATA

Saturated Thickness: 2.92 m Anisotropy Ratio (Kz/Kr): 0.1

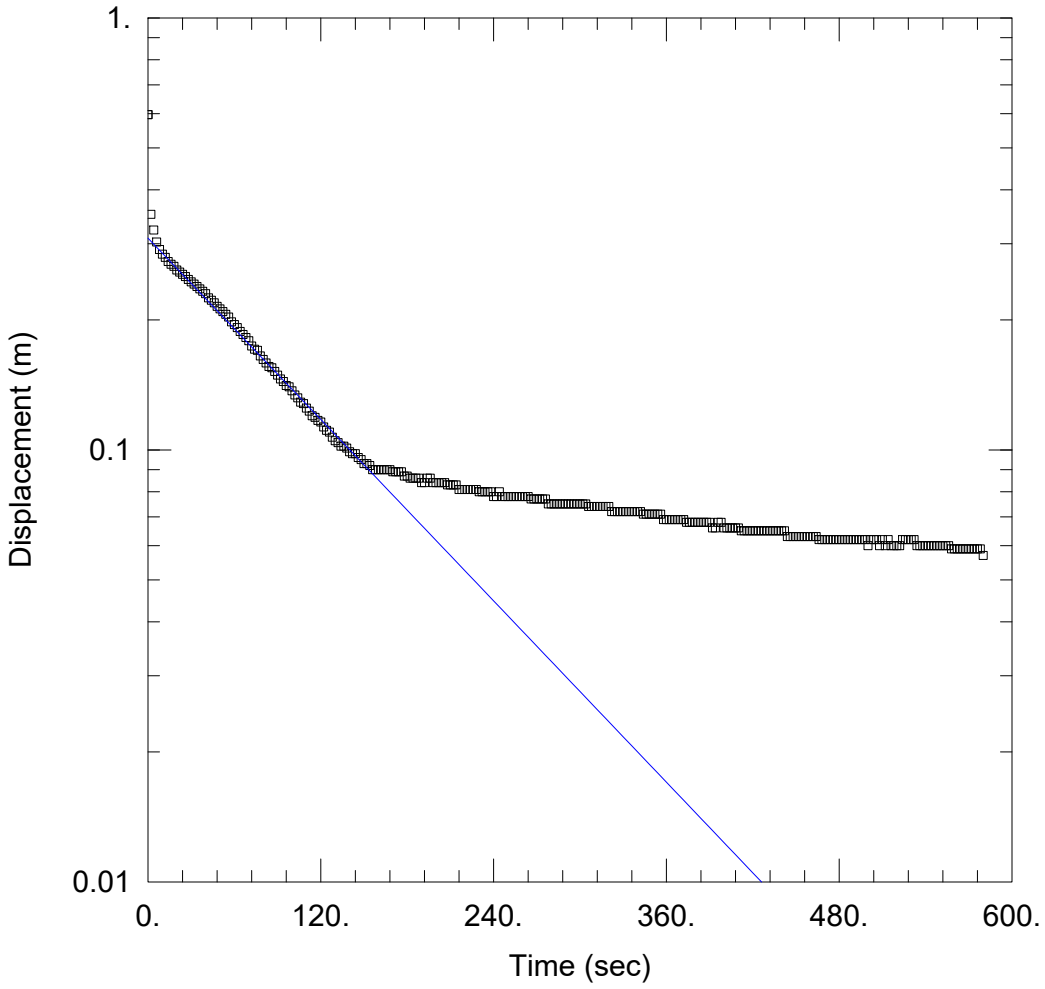
WELL DATA (MW-6)

Initial Displacement: 0.793 m
Total Well Penetration Depth: 1.52 m
Casing Radius: 0.025 m
Static Water Column Height: 2.92 m
Screen Length: 1.52 m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 6.442E-6 m/sec y0 = 0.3692 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-6 RH.aqt
Date: 01/31/18 Time: 16:02:14

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Mayfield
Test Well: Test Well
Test Date: Dec 6, 2017

AQUIFER DATA

Saturated Thickness: 2.92 m Anisotropy Ratio (Kz/Kr): 0.1

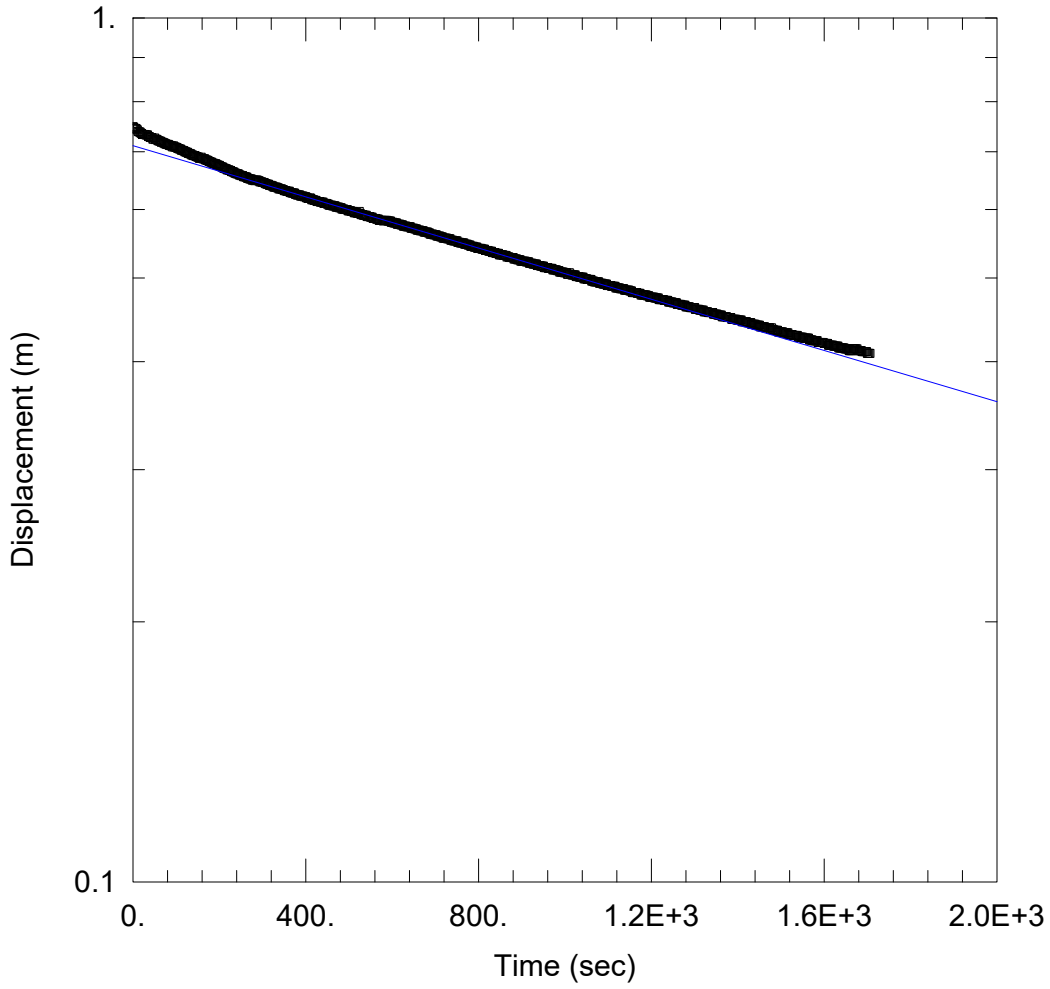
WELL DATA (MW-6)

Initial Displacement: 0.597 m
Total Well Penetration Depth: 1.52 m
Casing Radius: 0.025 m
Static Water Column Height: 2.92 m
Screen Length: 1.52 m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 9.856E-6 m/sec y0 = 0.3091 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-7d FH.aqt
Date: 01/31/18 Time: 16:00:19

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Sheldon Cr
Test Well: MW3
Test Date: 08Jan18

AQUIFER DATA

Saturated Thickness: 2. m Anisotropy Ratio (Kz/Kr): 0.1

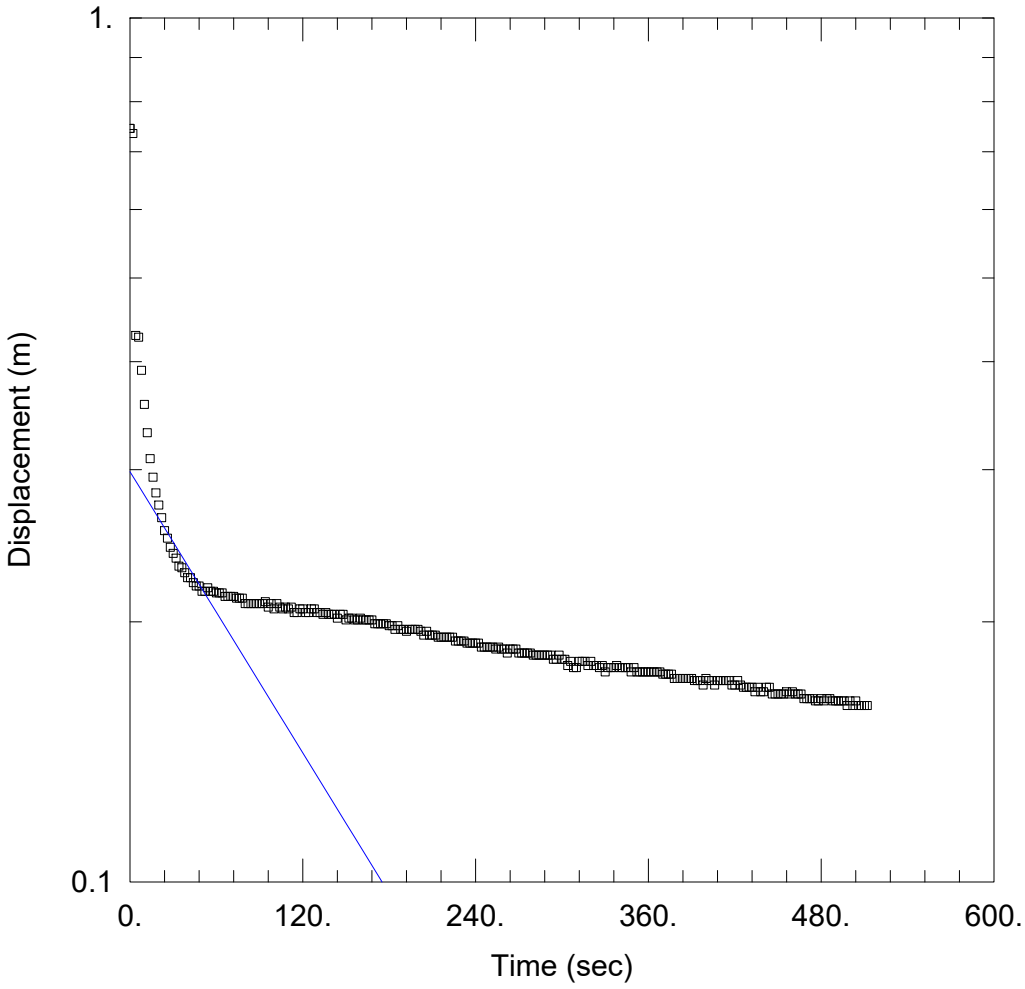
WELL DATA (MW-7d FH)

Initial Displacement: 0.748 m
Total Well Penetration Depth: 1.53 m
Casing Radius: 0.0254 m
Static Water Column Height: 1.34 m
Screen Length: 1.53 m
Well Radius: 0.0254 m
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 4.272E-7 m/sec y0 = 0.7113 m



WELL TEST ANALYSIS

Data Set: C:\Users\CORINN~1\AppData\Local\Temp\MW-7s FH_JC.aqt
Date: 10/12/18 Time: 09:42:40

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Sheldon Cr
Test Well: MW3
Test Date: 08Jan18

AQUIFER DATA

Saturated Thickness: 2.15 m Anisotropy Ratio (Kz/Kr): 0.1

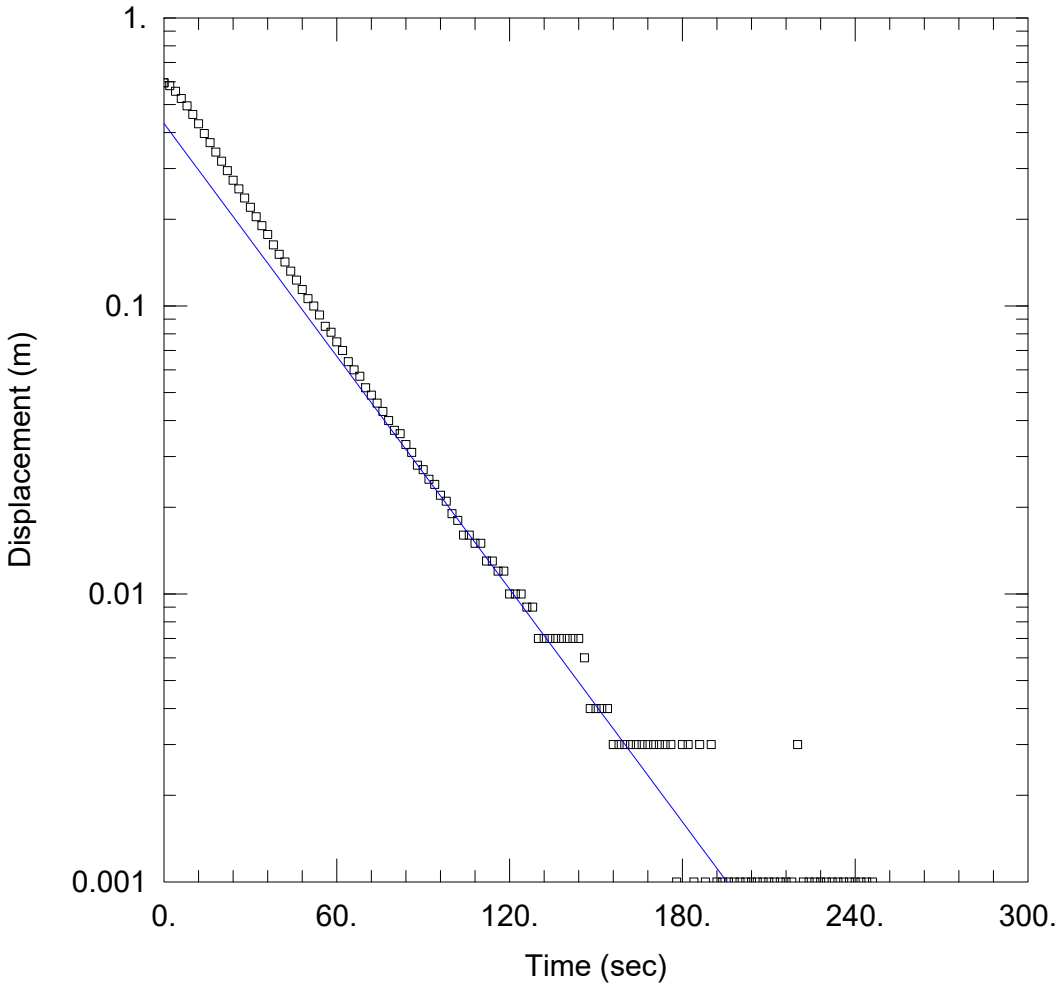
WELL DATA (MW7s FH)

Initial Displacement: 0.745 m
Total Well Penetration Depth: 2.15 m
Casing Radius: 0.025 m
Static Water Column Height: 2.15 m
Screen Length: 1.53 m
Well Radius: 0.025 m
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 5.517E-6 m/sec y0 = 0.2984 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-8 Injection 1.aqt
Date: 01/31/18 Time: 16:00:43

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Mayfield
Test Well: MW-8
Test Date: Dec 6, 2017

AQUIFER DATA

Saturated Thickness: 2.31 m Anisotropy Ratio (Kz/Kr): 0.1

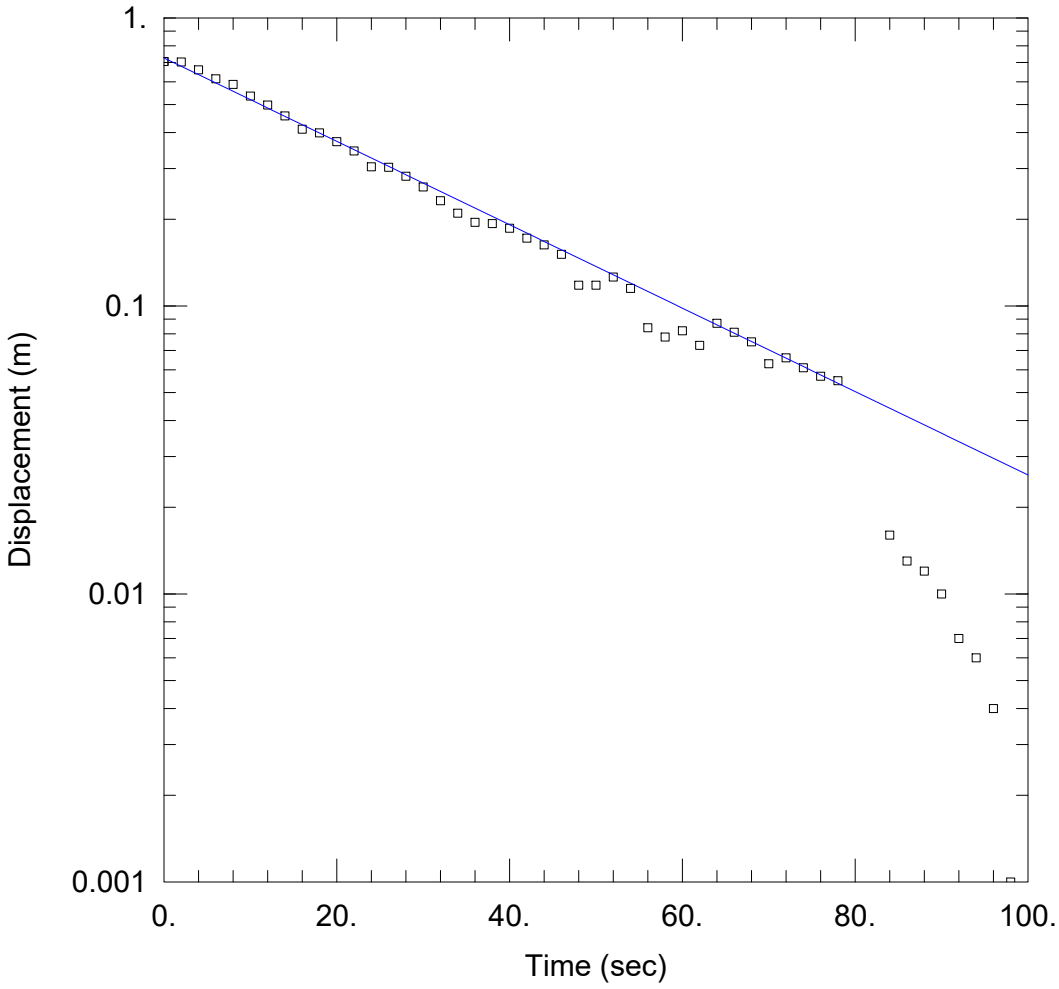
WELL DATA (MW-8)

Initial Displacement: 0.595 m
Total Well Penetration Depth: 2.31 m
Casing Radius: 0.025 m
Static Water Column Height: 2.31 m
Screen Length: 1.53 m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 2.77E-5 m/sec y0 = 0.4299 m



WELL TEST ANALYSIS

Data Set: Z:\...\MW-8 Injection 2.aqt
Date: 01/31/18 Time: 16:01:31

PROJECT INFORMATION

Company: Palmer
Project: 170352
Location: Mayfield
Test Well: MW-8
Test Date: Dec 6, 2017

AQUIFER DATA

Saturated Thickness: 2.31 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW-8)

Initial Displacement: 0.706 m
Total Well Penetration Depth: 2.31 m
Casing Radius: 0.025 m
Static Water Column Height: 2.31 m
Screen Length: 1.53 m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 2.977E-5 m/sec
y0 = 0.726 m

Appendix D

Laboratory Certificate of Analysis (ALS, 2017)

PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
ATTN: JASON COLE
374 Wellington Street West, Suite 3
Toronto ON M5E 1B5

Date Received: 06-DEC-17
Report Date: 18-DEC-17 10:23 (MT)
Version: FINAL

Client Phone: 647-795-8153

Certificate of Analysis

Lab Work Order #: L2032761

Project P.O. #: NOT SUBMITTED
Job Reference: MAYFIELD PHASE 3
C of C Numbers: 15-611901
Legal Site Desc:

Amanda Fazekas
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2032761-1 MW6 Sampled By: JMQ on 06-DEC-17 @ 10:00 Matrix: WATER							
Field Tests							
Temperature, Client	7.0		-50	Deg. C		15-DEC-17	R3914261
Physical Tests							
pH	7.98		0.10	pH units		09-DEC-17	R3907997
Total Suspended Solids	64900	DLHC	100	mg/L	12-DEC-17	13-DEC-17	R3912174
Total Dissolved Solids	369	DLDS	20	mg/L		11-DEC-17	R3912544
Anions and Nutrients							
Ammonia, Total (as N)	0.159		0.020	mg/L		11-DEC-17	R3909902
Total Kjeldahl Nitrogen	8.0	DLM	1.5	mg/L	13-DEC-17	14-DEC-17	R3913273
Phosphorus, Total	38.3	DLM	0.30	mg/L	13-DEC-17	14-DEC-17	R3913002
Organic / Inorganic Carbon							
Dissolved Organic Carbon	1.8		1.0	mg/L		11-DEC-17	R3911861
Total Metals							
Aluminum (Al)-Total	90.5	DLHC	0.050	mg/L	08-DEC-17	12-DEC-17	R3908668
Antimony (Sb)-Total	<0.0010	DLHC	0.0010	mg/L	08-DEC-17	12-DEC-17	R3908668
Arsenic (As)-Total	0.0536	DLHC	0.0010	mg/L	08-DEC-17	12-DEC-17	R3908668
Barium (Ba)-Total	0.811	DLHC	0.0020	mg/L	08-DEC-17	12-DEC-17	R3908668
Beryllium (Be)-Total	0.0048	DLHC	0.0010	mg/L	08-DEC-17	12-DEC-17	R3908668
Bismuth (Bi)-Total	0.00158	DLHC	0.00050	mg/L	08-DEC-17	12-DEC-17	R3908668
Boron (B)-Total	<0.10	DLHC	0.10	mg/L	08-DEC-17	12-DEC-17	R3908668
Cadmium (Cd)-Total	0.000841	DLHC	0.000050	mg/L	08-DEC-17	12-DEC-17	R3908668
Calcium (Ca)-Total	1560	DLHC	5.0	mg/L	08-DEC-17	12-DEC-17	R3908668
Cesium (Cs)-Total	0.00728	DLHC	0.00010	mg/L	08-DEC-17	12-DEC-17	R3908668
Chromium (Cr)-Total	0.149	DLHC	0.0050	mg/L	08-DEC-17	12-DEC-17	R3908668
Cobalt (Co)-Total	0.0997	DLHC	0.0010	mg/L	08-DEC-17	12-DEC-17	R3908668
Copper (Cu)-Total	0.311	DLHC	0.010	mg/L	08-DEC-17	12-DEC-17	R3908668
Iron (Fe)-Total	212	DLHC	0.50	mg/L	08-DEC-17	12-DEC-17	R3908668
Lead (Pb)-Total	0.0986	DLHC	0.00050	mg/L	08-DEC-17	12-DEC-17	R3908668
Lithium (Li)-Total	0.235	DLHC	0.010	mg/L	08-DEC-17	12-DEC-17	R3908668
Magnesium (Mg)-Total	181	DLHC	0.50	mg/L	08-DEC-17	12-DEC-17	R3908668
Manganese (Mn)-Total	8.41	DLHC	0.0050	mg/L	08-DEC-17	12-DEC-17	R3908668
Molybdenum (Mo)-Total	0.00270	DLHC	0.00050	mg/L	08-DEC-17	12-DEC-17	R3908668
Nickel (Ni)-Total	0.200	DLHC	0.0050	mg/L	08-DEC-17	12-DEC-17	R3908668
Phosphorus (P)-Total	8.59	DLHC	0.50	mg/L	08-DEC-17	12-DEC-17	R3908668
Potassium (K)-Total	14.8	DLHC	0.50	mg/L	08-DEC-17	12-DEC-17	R3908668
Rubidium (Rb)-Total	0.0937	DLHC	0.0020	mg/L	08-DEC-17	12-DEC-17	R3908668
Selenium (Se)-Total	0.00082	DLHC	0.00050	mg/L	08-DEC-17	12-DEC-17	R3908668
Silicon (Si)-Total	98.5	DLHC	1.0	mg/L	08-DEC-17	12-DEC-17	R3908668
Silver (Ag)-Total	0.00071	DLHC	0.00050	mg/L	08-DEC-17	12-DEC-17	R3908668
Sodium (Na)-Total	9.6	DLHC	5.0	mg/L	08-DEC-17	12-DEC-17	R3908668
Strontium (Sr)-Total	2.51	DLHC	0.010	mg/L	08-DEC-17	12-DEC-17	R3908668
Sulfur (S)-Total	50.4	DLHC	5.0	mg/L	08-DEC-17	12-DEC-17	R3908668
Tellurium (Te)-Total	<0.0020	DLHC	0.0020	mg/L	08-DEC-17	12-DEC-17	R3908668

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2032761-1 MW6 Sampled By: JMQ on 06-DEC-17 @ 10:00 Matrix: WATER							
Total Metals							
Thallium (Tl)-Total	0.00120	DLHC	0.00010	mg/L	08-DEC-17	12-DEC-17	R3908668
Thorium (Th)-Total	0.0455	DLHC	0.0010	mg/L	08-DEC-17	12-DEC-17	R3908668
Tin (Sn)-Total	0.0012	DLHC	0.0010	mg/L	08-DEC-17	12-DEC-17	R3908668
Titanium (Ti)-Total	0.949	DLHC	0.0030	mg/L	08-DEC-17	12-DEC-17	R3908668
Tungsten (W)-Total	<0.0010	DLHC	0.0010	mg/L	08-DEC-17	12-DEC-17	R3908668
Uranium (U)-Total	0.00726	DLHC	0.00010	mg/L	08-DEC-17	12-DEC-17	R3908668
Vanadium (V)-Total	0.173	DLHC	0.0050	mg/L	08-DEC-17	12-DEC-17	R3908668
Zinc (Zn)-Total	0.473	DLHC	0.030	mg/L	08-DEC-17	12-DEC-17	R3908668
Zirconium (Zr)-Total	<0.0030	DLHC	0.0030	mg/L	08-DEC-17	12-DEC-17	R3908668
Dissolved Metals							
Dissolved Metals Filtration Location	LAB					11-DEC-17	R3908267
Aluminum (Al)-Dissolved	<0.0050		0.0050	mg/L	11-DEC-17	11-DEC-17	R3909632
Antimony (Sb)-Dissolved	0.00053		0.00010	mg/L	11-DEC-17	11-DEC-17	R3909632
Arsenic (As)-Dissolved	0.00161		0.00010	mg/L	11-DEC-17	11-DEC-17	R3909632
Barium (Ba)-Dissolved	0.162		0.00010	mg/L	11-DEC-17	11-DEC-17	R3909632
Beryllium (Be)-Dissolved	<0.00010		0.00010	mg/L	11-DEC-17	11-DEC-17	R3909632
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L	11-DEC-17	11-DEC-17	R3909632
Boron (B)-Dissolved	0.016		0.010	mg/L	11-DEC-17	11-DEC-17	R3909632
Cadmium (Cd)-Dissolved	<0.0000050		0.0000050	mg/L	11-DEC-17	11-DEC-17	R3909632
Calcium (Ca)-Dissolved	73.9		0.050	mg/L	11-DEC-17	11-DEC-17	R3909632
Cesium (Cs)-Dissolved	<0.000010		0.000010	mg/L	11-DEC-17	11-DEC-17	R3909632
Chromium (Cr)-Dissolved	<0.00050		0.00050	mg/L	11-DEC-17	11-DEC-17	R3909632
Cobalt (Co)-Dissolved	0.00056		0.00010	mg/L	11-DEC-17	11-DEC-17	R3909632
Copper (Cu)-Dissolved	0.00026		0.00020	mg/L	11-DEC-17	11-DEC-17	R3909632
Iron (Fe)-Dissolved	<0.010		0.010	mg/L	11-DEC-17	11-DEC-17	R3909632
Lead (Pb)-Dissolved	<0.000050		0.000050	mg/L	11-DEC-17	11-DEC-17	R3909632
Lithium (Li)-Dissolved	0.0119		0.0010	mg/L	11-DEC-17	11-DEC-17	R3909632
Magnesium (Mg)-Dissolved	21.9		0.050	mg/L	11-DEC-17	11-DEC-17	R3909632
Manganese (Mn)-Dissolved	0.0418		0.00050	mg/L	11-DEC-17	11-DEC-17	R3909632
Molybdenum (Mo)-Dissolved	0.00365		0.000050	mg/L	11-DEC-17	11-DEC-17	R3909632
Nickel (Ni)-Dissolved	0.00156		0.00050	mg/L	11-DEC-17	11-DEC-17	R3909632
Phosphorus (P)-Dissolved	<0.050		0.050	mg/L	11-DEC-17	11-DEC-17	R3909632
Potassium (K)-Dissolved	3.44		0.050	mg/L	11-DEC-17	11-DEC-17	R3909632
Rubidium (Rb)-Dissolved	0.00154		0.00020	mg/L	11-DEC-17	11-DEC-17	R3909632
Selenium (Se)-Dissolved	0.000142		0.000050	mg/L	11-DEC-17	11-DEC-17	R3909632
Silicon (Si)-Dissolved	7.02		0.050	mg/L	11-DEC-17	11-DEC-17	R3909632
Silver (Ag)-Dissolved	<0.000050		0.000050	mg/L	11-DEC-17	11-DEC-17	R3909632
Sodium (Na)-Dissolved	5.59		0.50	mg/L	11-DEC-17	11-DEC-17	R3909632
Strontium (Sr)-Dissolved	0.312		0.0010	mg/L	11-DEC-17	11-DEC-17	R3909632
Sulfur (S)-Dissolved	19.0		0.50	mg/L	11-DEC-17	11-DEC-17	R3909632
Tellurium (Te)-Dissolved	<0.00020		0.00020	mg/L	11-DEC-17	11-DEC-17	R3909632

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2032761-1 MW6 Sampled By: JMQ on 06-DEC-17 @ 10:00 Matrix: WATER							
Dissolved Metals							
Thallium (Tl)-Dissolved	0.000013		0.000010	mg/L	11-DEC-17	11-DEC-17	R3909632
Thorium (Th)-Dissolved	<0.00010		0.00010	mg/L	11-DEC-17	11-DEC-17	R3909632
Tin (Sn)-Dissolved	0.00010		0.00010	mg/L	11-DEC-17	11-DEC-17	R3909632
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L	11-DEC-17	11-DEC-17	R3909632
Tungsten (W)-Dissolved	<0.00010		0.00010	mg/L	11-DEC-17	11-DEC-17	R3909632
Uranium (U)-Dissolved	0.00168		0.000010	mg/L	11-DEC-17	11-DEC-17	R3909632
Vanadium (V)-Dissolved	0.00155		0.00050	mg/L	11-DEC-17	11-DEC-17	R3909632
Zinc (Zn)-Dissolved	<0.0010		0.0010	mg/L	11-DEC-17	11-DEC-17	R3909632
Zirconium (Zr)-Dissolved	<0.00030		0.00030	mg/L	11-DEC-17	11-DEC-17	R3909632
Aggregate Organics							
COD	1600	DLM	1000	mg/L		12-DEC-17	R3911759

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	COD	MS-B	L2032761-1
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2032761-1
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2032761-1
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2032761-1
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2032761-1
Matrix Spike	Potassium (K)-Dissolved	MS-B	L2032761-1
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L2032761-1
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2032761-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2032761-1
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L2032761-1
Matrix Spike	Uranium (U)-Dissolved	MS-B	L2032761-1
Matrix Spike	Barium (Ba)-Total	MS-B	L2032761-1
Matrix Spike	Calcium (Ca)-Total	MS-B	L2032761-1
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2032761-1
Matrix Spike	Silicon (Si)-Total	MS-B	L2032761-1
Matrix Spike	Sodium (Na)-Total	MS-B	L2032761-1
Matrix Spike	Strontium (Sr)-Total	MS-B	L2032761-1
Matrix Spike	Sulfur (S)-Total	MS-B	L2032761-1
Matrix Spike	Uranium (U)-Total	MS-B	L2032761-1
Matrix Spike	Ammonia, Total (as N)	MS-B	L2032761-1

Sample Parameter Qualifier key listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
C-DIS-ORG-WT	Water	Dissolved Organic Carbon	APHA 5310 B-INSTRUMENTAL

Sample is filtered through a 0.45um filter, then injected into a heated reaction chamber which is packed with an oxidative catalyst. The water is vaporized and the organic carbon is oxidized to carbon dioxide. The carbon dioxide is transported in a carrier gas and is measured by a non-dispersive infrared detector.

COD-T-WT	Water	Chemical Oxygen Demand	APHA 5220 D

This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colourimetric method.

MET-D-CCMS-WT	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

MET-T-CCMS-WT	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

NH3-WT	Water	Ammonia, Total as N	EPA 350.1

Sample is measured colorimetrically. When sample is turbid a distillation step is required, sample is distilled into a solution of boric acid and measured colorimetrically.

P-T-COL-WT	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is deteremined colourimetrically after persulphate digestion of the sample.

Reference Information

PH-WT	Water	pH	APHA 4500 H-Electrode

Water samples are analyzed directly by a calibrated pH meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days

SOLIDS-TDS-WT	Water	Total Dissolved Solids	APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

SOLIDS-TSS-WT	Water	Suspended solids	APHA 2540 D-Gravimetric

A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 104–1°C for a minimum of four hours or until a constant weight is achieved.

TEMP-CLIENT-WT	Water	Temperature	Result supplied by Client

TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-N

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 Celsius with analysis using an automated colorimetric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

15-611901

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
374 Wellington Street West, Suite 3
Toronto ON M5E 1B5
Contact: JASON COLE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-DIS-ORG-WT	**Water**							
Batch R3911861								
WG2681835-2 LCS								
Dissolved Organic Carbon			100.4		%		80-120	11-DEC-17
WG2681835-1 MB								
Dissolved Organic Carbon			<1.0		mg/L		1	11-DEC-17
COD-T-WT	**Water**							
Batch R3911759								
WG2682634-2 LCS								
COD			102.3		%		85-115	12-DEC-17
WG2682634-1 MB								
COD			<10		mg/L		10	12-DEC-17
MET-D-CCMS-WT	**Water**							
Batch R3909632								
WG2681426-2 LCS								
Aluminum (Al)-Dissolved			103.6		%		80-120	11-DEC-17
Antimony (Sb)-Dissolved			94.7		%		80-120	11-DEC-17
Arsenic (As)-Dissolved			100.1		%		80-120	11-DEC-17
Barium (Ba)-Dissolved			98.9		%		80-120	11-DEC-17
Beryllium (Be)-Dissolved			94.9		%		80-120	11-DEC-17
Bismuth (Bi)-Dissolved			97.9		%		80-120	11-DEC-17
Boron (B)-Dissolved			94.4		%		80-120	11-DEC-17
Cadmium (Cd)-Dissolved			99.2		%		80-120	11-DEC-17
Calcium (Ca)-Dissolved			98.3		%		80-120	11-DEC-17
Cesium (Cs)-Dissolved			95.3		%		80-120	11-DEC-17
Chromium (Cr)-Dissolved			101.4		%		80-120	11-DEC-17
Cobalt (Co)-Dissolved			99.7		%		80-120	11-DEC-17
Copper (Cu)-Dissolved			99.2		%		80-120	11-DEC-17
Iron (Fe)-Dissolved			97.0		%		80-120	11-DEC-17
Lead (Pb)-Dissolved			98.5		%		80-120	11-DEC-17
Lithium (Li)-Dissolved			98.0		%		80-120	11-DEC-17
Magnesium (Mg)-Dissolved			104.2		%		80-120	11-DEC-17
Manganese (Mn)-Dissolved			103.0		%		80-120	11-DEC-17
Molybdenum (Mo)-Dissolved			95.1		%		80-120	11-DEC-17
Nickel (Ni)-Dissolved			100.6		%		80-120	11-DEC-17
Phosphorus (P)-Dissolved			105.7		%		80-120	11-DEC-17
Potassium (K)-Dissolved			102.7		%		80-120	11-DEC-17
Rubidium (Rb)-Dissolved			101.4		%		80-120	11-DEC-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3909632								
WG2681426-2 LCS								
Selenium (Se)-Dissolved			100.2		%		80-120	11-DEC-17
Silicon (Si)-Dissolved			103.5		%		60-140	11-DEC-17
Silver (Ag)-Dissolved			96.7		%		80-120	11-DEC-17
Sodium (Na)-Dissolved			107.7		%		80-120	11-DEC-17
Strontium (Sr)-Dissolved			96.3		%		80-120	11-DEC-17
Sulfur (S)-Dissolved			94.4		%		80-120	11-DEC-17
Tellurium (Te)-Dissolved			92.8		%		80-120	11-DEC-17
Thallium (Tl)-Dissolved			94.6		%		80-120	11-DEC-17
Thorium (Th)-Dissolved			97.5		%		80-120	11-DEC-17
Tin (Sn)-Dissolved			97.8		%		80-120	11-DEC-17
Titanium (Ti)-Dissolved			94.4		%		80-120	11-DEC-17
Tungsten (W)-Dissolved			97.4		%		80-120	11-DEC-17
Uranium (U)-Dissolved			101.2		%		80-120	11-DEC-17
Vanadium (V)-Dissolved			101.1		%		80-120	11-DEC-17
Zinc (Zn)-Dissolved			96.5		%		80-120	11-DEC-17
Zirconium (Zr)-Dissolved			98.5		%		80-120	11-DEC-17
WG2681426-1 MB								
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	11-DEC-17
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	11-DEC-17
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	11-DEC-17
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	11-DEC-17
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	11-DEC-17
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	11-DEC-17
Boron (B)-Dissolved			<0.010		mg/L		0.01	11-DEC-17
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	11-DEC-17
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	11-DEC-17
Cesium (Cs)-Dissolved			<0.000010		mg/L		0.00001	11-DEC-17
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	11-DEC-17
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	11-DEC-17
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	11-DEC-17
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	11-DEC-17
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	11-DEC-17
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	11-DEC-17
Magnesium (Mg)-Dissolved			<0.050		mg/L		0.05	11-DEC-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R3909632								
WG2681426-1 MB								
Manganese (Mn)-Dissolved			<0.00050		mg/L		0.0005	11-DEC-17
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	11-DEC-17
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	11-DEC-17
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	11-DEC-17
Potassium (K)-Dissolved			<0.050		mg/L		0.05	11-DEC-17
Rubidium (Rb)-Dissolved			<0.00020		mg/L		0.0002	11-DEC-17
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	11-DEC-17
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	11-DEC-17
Silver (Ag)-Dissolved			<0.000050		mg/L		0.00005	11-DEC-17
Sodium (Na)-Dissolved			<0.50		mg/L		0.5	11-DEC-17
Strontium (Sr)-Dissolved			<0.0010		mg/L		0.001	11-DEC-17
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	11-DEC-17
Tellurium (Te)-Dissolved			<0.00020		mg/L		0.0002	11-DEC-17
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	11-DEC-17
Thorium (Th)-Dissolved			<0.00010		mg/L		0.0001	11-DEC-17
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	11-DEC-17
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	11-DEC-17
Tungsten (W)-Dissolved			<0.00010		mg/L		0.0001	11-DEC-17
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	11-DEC-17
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	11-DEC-17
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	11-DEC-17
Zirconium (Zr)-Dissolved			<0.00030		mg/L		0.0003	11-DEC-17
MET-T-CCMS-WT	**Water**							
Batch R3908668								
WG2680772-2 LCS								
Aluminum (Al)-Total			100.5		%		80-120	12-DEC-17
Antimony (Sb)-Total			100.2		%		80-120	12-DEC-17
Arsenic (As)-Total			100.4		%		80-120	12-DEC-17
Barium (Ba)-Total			101.5		%		80-120	12-DEC-17
Beryllium (Be)-Total			97.0		%		80-120	12-DEC-17
Bismuth (Bi)-Total			101.2		%		80-120	12-DEC-17
Boron (B)-Total			96.2		%		80-120	12-DEC-17
Cadmium (Cd)-Total			99.0		%		80-120	12-DEC-17
Calcium (Ca)-Total			99.4		%		80-120	12-DEC-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R3908668								
WG2680772-2 LCS								
Chromium (Cr)-Total			100.6		%		80-120	12-DEC-17
Cesium (Cs)-Total			97.5		%		80-120	12-DEC-17
Cobalt (Co)-Total			101.1		%		80-120	12-DEC-17
Copper (Cu)-Total			99.1		%		80-120	12-DEC-17
Iron (Fe)-Total			99.3		%		80-120	12-DEC-17
Lead (Pb)-Total			101.2		%		80-120	12-DEC-17
Lithium (Li)-Total			98.8		%		80-120	12-DEC-17
Magnesium (Mg)-Total			103.3		%		80-120	12-DEC-17
Manganese (Mn)-Total			101.6		%		80-120	12-DEC-17
Molybdenum (Mo)-Total			100.4		%		80-120	12-DEC-17
Nickel (Ni)-Total			99.99		%		80-120	12-DEC-17
Phosphorus (P)-Total			101.4		%		70-130	12-DEC-17
Potassium (K)-Total			103.6		%		80-120	12-DEC-17
Rubidium (Rb)-Total			96.8		%		80-120	12-DEC-17
Selenium (Se)-Total			100.1		%		80-120	12-DEC-17
Silicon (Si)-Total			101.8		%		60-140	12-DEC-17
Silver (Ag)-Total			98.4		%		80-120	12-DEC-17
Sodium (Na)-Total			101.1		%		80-120	12-DEC-17
Strontium (Sr)-Total			97.9		%		80-120	12-DEC-17
Sulfur (S)-Total			94.8		%		70-130	12-DEC-17
Thallium (Tl)-Total			102.7		%		80-120	12-DEC-17
Tellurium (Te)-Total			93.6		%		80-120	12-DEC-17
Thorium (Th)-Total			100.7		%		70-130	12-DEC-17
Tin (Sn)-Total			97.2		%		80-120	12-DEC-17
Titanium (Ti)-Total			90.0		%		80-120	12-DEC-17
Tungsten (W)-Total			102.7		%		80-120	12-DEC-17
Uranium (U)-Total			101.5		%		80-120	12-DEC-17
Vanadium (V)-Total			100.7		%		80-120	12-DEC-17
Zinc (Zn)-Total			93.6		%		80-120	12-DEC-17
Zirconium (Zr)-Total			99.1		%		80-120	12-DEC-17
WG2680772-1 MB								
Aluminum (Al)-Total			<0.0050		mg/L		0.005	12-DEC-17
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	12-DEC-17
Arsenic (As)-Total			<0.00010		mg/L		0.0001	12-DEC-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R3908668								
WG2680772-1 MB								
Barium (Ba)-Total			<0.00020		mg/L		0.0002	12-DEC-17
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	12-DEC-17
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	12-DEC-17
Boron (B)-Total			<0.010		mg/L		0.01	12-DEC-17
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	12-DEC-17
Calcium (Ca)-Total			<0.50		mg/L		0.5	12-DEC-17
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	12-DEC-17
Cesium (Cs)-Total			<0.000010		mg/L		0.00001	12-DEC-17
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	12-DEC-17
Copper (Cu)-Total			<0.0010		mg/L		0.001	12-DEC-17
Iron (Fe)-Total			<0.050		mg/L		0.05	12-DEC-17
Lead (Pb)-Total			<0.000050		mg/L		0.00005	12-DEC-17
Lithium (Li)-Total			<0.0010		mg/L		0.001	12-DEC-17
Magnesium (Mg)-Total			<0.050		mg/L		0.05	12-DEC-17
Manganese (Mn)-Total			<0.00050		mg/L		0.0005	12-DEC-17
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	12-DEC-17
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	12-DEC-17
Phosphorus (P)-Total			<0.050		mg/L		0.05	12-DEC-17
Potassium (K)-Total			<0.050		mg/L		0.05	12-DEC-17
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	12-DEC-17
Selenium (Se)-Total			<0.000050		mg/L		0.00005	12-DEC-17
Silicon (Si)-Total			<0.10		mg/L		0.1	12-DEC-17
Silver (Ag)-Total			<0.000050		mg/L		0.00005	12-DEC-17
Sodium (Na)-Total			<0.50		mg/L		0.5	12-DEC-17
Strontium (Sr)-Total			<0.0010		mg/L		0.001	12-DEC-17
Sulfur (S)-Total			<0.50		mg/L		0.5	12-DEC-17
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	12-DEC-17
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	12-DEC-17
Thorium (Th)-Total			<0.00010		mg/L		0.0001	12-DEC-17
Tin (Sn)-Total			<0.00010		mg/L		0.0001	12-DEC-17
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	12-DEC-17
Tungsten (W)-Total			<0.00010		mg/L		0.0001	12-DEC-17
Uranium (U)-Total			<0.000010		mg/L		0.00001	12-DEC-17
Vanadium (V)-Total			<0.00050		mg/L		0.0005	12-DEC-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R3908668								
WG2680772-1 MB								
Zinc (Zn)-Total			<0.0030		mg/L		0.003	12-DEC-17
Zirconium (Zr)-Total			<0.00030		mg/L		0.0003	12-DEC-17
NH3-WT	**Water**							
Batch R3909902								
WG2681901-14 LCS								
Ammonia, Total (as N)			108.2		%		85-115	11-DEC-17
WG2681901-13 MB								
Ammonia, Total (as N)			<0.020		mg/L		0.02	11-DEC-17
P-T-COL-WT	**Water**							
Batch R3913002								
WG2683842-2 LCS								
Phosphorus, Total			94.2		%		80-120	14-DEC-17
WG2683842-1 MB								
Phosphorus, Total			<0.0030		mg/L		0.003	14-DEC-17
PH-WT	**Water**							
Batch R3907997								
WG2680965-2 LCS								
pH			6.99		pH units		6.9-7.1	09-DEC-17
SOLIDS-TDS-WT	**Water**							
Batch R3912544								
WG2681641-2 LCS								
Total Dissolved Solids			96.3		%		85-115	11-DEC-17
WG2681641-1 MB								
Total Dissolved Solids			<10		mg/L		10	11-DEC-17
SOLIDS-TSS-WT	**Water**							
Batch R3912174								
WG2682153-2 LCS								
Total Suspended Solids			101.6		%		85-115	13-DEC-17
WG2682153-1 MB								
Total Suspended Solids			<2.0		mg/L		2	13-DEC-17
TKN-WT	**Water**							
Batch R3913273								
WG2683103-2 LCS								
Total Kjeldahl Nitrogen			104.2		%		75-125	14-DEC-17
WG2683103-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-WT	**Water**							
Batch R3913273								
WG2683103-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	14-DEC-17

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L2032761-COFC

COC Number: 15 - 611901

Page of

Report To	Contact and company name below will appear on the final report
Company:	Palmer Environmental
Contact:	Justin Cole
Phone:	see account
	Company address below will appear on the final report
Street:	See account.
City/Province:	
Postal Code:	
Invoice To	Same as Report To ☐ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☐ PDF ☐ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☐ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	
Email 2	
Email 3	
Invoice Distribution	
Select Invoice Distribution:	☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	
Email 2	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply			
Regular [R]	☒	Standard TAT if received by 3 pm - business days - no surcharges apply	
PRIORITY (Business Days) 4 day [P4]	☐	EMERGENCY 1 Business day [E1]	☐
3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
2 day [P2]	☐		
Date and Time Required for all E&P TATs:		dd-mmm-yy hh:mm	
For tests that can not be performed according to the service level selected, you will be contacted.			

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	Mayfield Phase 3	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L2032761	ALS Contact:	Sampler: J-MQ

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	DOC	Diss Metals	Nutrients	pH, turb, TDI, TSS	Total metals								Number of Containers
	MW6	06/DEC/17	10:00 AM	Water	X	X	X	X	X								5

Drinking Water (DW) Samples' (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	No samples have been filtered.
Are samples for human drinking water use? ☐ YES ☐ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐	
Ice Packs	☒	Ice Cubes ☐	Custody seal intact	Yes ☐	No ☐
Cooling Initiated	☒				

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
7.0			5.2		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
	06/Dec/17	3:55 PM		Dec 6/17	3550		Dec-07-17	16:05

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
ATTN: MATT GILLMAN
374 Wellington Street West, Suite 3
Toronto ON M5E 1B5

Date Received: 10-JAN-18
Report Date: 19-JAN-18 08:57 (MT)
Version: FINAL

Client Phone: 647-795-8153

Certificate of Analysis

Lab Work Order #: L2044112

Project P.O. #: NOT SUBMITTED
Job Reference: MAYFIELD 3
C of C Numbers: 17-637702
Legal Site Desc:

Amanda Fazekas
Account Manager

Sample Details/Parameters	Result	Qualifier	D.L.	Units	Criteria Specific Limits		Analyzed	Batch
L2044112-1 MW6								
Sampled By: CLIENT on 10-JAN-18 @ 08:50								
Matrix: WATER					STANDARDS	GUIDELINES		
Anions in Water by IC								
Bromide (Br)	<0.10		0.10	mg/L			12-JAN-18	R3935479
Chloride (Cl)	5.21		0.50	mg/L		250	12-JAN-18	R3935479
Orthophosphate-Dissolved (as P)	<0.0030		0.0030	mg/L			11-JAN-18	R3933344
Fluoride (F)	0.126		0.020	mg/L	1.5		12-JAN-18	R3935479
Nitrate (as N)	<0.020		0.020	mg/L	10		12-JAN-18	R3935479
Nitrite (as N)	<0.010		0.010	mg/L	1		12-JAN-18	R3935479
Sulfate (SO4)	54.0		0.30	mg/L		500	12-JAN-18	R3935479
Individual Analytes								
Acidity (as CaCO3)	30.0		5.0	mg/L			18-JAN-18	R3939148
Alkalinity, Total (as CaCO3)	234		10	mg/L		30-500	12-JAN-18	R3935472
Colour, Apparent	232		2.0	CU			11-JAN-18	R3933347
Redox Potential	350	PEHR	-1000	mV			12-JAN-18	R3933928
Turbidity	>4000		0.10	NTU		5	12-JAN-18	R3933749

* Detection Limit for result exceeds Criteria Specific Limit. Assessment against Criteria Limit cannot be made.

** Analytical result for this parameter exceeds Criteria Specific Limit listed on this report.

Ontario DW Std O.Reg 169/03 JUNE 2007

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
PEHR	Parameter Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested.

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
ACIDITY-ED	Water	Acidity (as CaCO3)		APHA 2310 B - Potentiometric Titration

Acidity is the capacity of a water sample to react with strong base. It can be measured by titration with a strong base to a designated pH endpoint, usually 8.3. If the sample is colorless and clear, titration with base to the phenolphthalein endpoint is used. For dark or turbid samples, potentiometric titration to pH 8.3 is performed.

ALK-WT	Water	Alkalinity, Total (as CaCO3)		EPA 310.2

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

BR-IC-N-WT	Water	Bromide in Water by IC		EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CL-IC-N-WT	Water	Chloride by IC		EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

COLOUR-APPARENT-WT	Water	Colour		APHA 2120

Apparent Colour is measured spectrophotometrically by comparison to platinum-cobalt standards using the single wavelength method after sample decanting. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.

F-IC-N-WT	Water	Fluoride in Water by IC		EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO2-IC-WT	Water	Nitrite in Water by IC		EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-IC-WT	Water	Nitrate in Water by IC		EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

PO4-DO-COL-WT	Water	Diss. Orthophosphate in Water by Colour		APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

REDOX-POTENTIAL-WT	Water	Redox Potential		APHA 2580

This analysis is carried out in accordance with the procedure described in the "APHA" method 2580 "Oxidation-Reduction Potential" 2012. Results are reported as observed oxidation-reduction potential of the platinum metal-reference electrode employed, in mV.

It is recommended that this analysis be conducted in the field.

SO4-IC-N-WT	Water	Sulfate in Water by IC		EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TURBIDITY-WT	Water	Turbidity		APHA 2130 B

Sample result is based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. Sample readings are obtained from a Nephelometer.

Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

17-637702

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA	ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Reference Information

MAYFIELD 3

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of criteria limits is provided as is without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.

Quality Control Report

Workorder: L2044112 Report Date: 19-JAN-18

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
374 Wellington Street West, Suite 3
Toronto ON M5E 1B5
Contact: MATT GILLMAN

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ACIDITY-ED	**Water**							
Batch R3939148								
WG2700808-3 DUP		**L2041817-1**						
Acidity (as CaCO3)		11.0	10.0		mg/L	9.5	20	18-JAN-18
WG2700808-2 LCS								
Acidity (as CaCO3)			88.0		%		85-115	18-JAN-18
WG2700808-1 MB								
Acidity (as CaCO3)			<5.0		mg/L		5	18-JAN-18
ALK-WT	**Water**							
Batch R3935472								
WG2697663-3 CRM		**WT-ALK-CRM**						
Alkalinity, Total (as CaCO3)			99.2		%		80-120	12-JAN-18
WG2697663-4 DUP		**L2044112-1**						
Alkalinity, Total (as CaCO3)		234	227		mg/L	2.8	20	12-JAN-18
WG2697663-2 LCS								
Alkalinity, Total (as CaCO3)			93.6		%		85-115	12-JAN-18
WG2697663-1 MB								
Alkalinity, Total (as CaCO3)			<10		mg/L		10	12-JAN-18
BR-IC-N-WT	**Water**							
Batch R3935479								
WG2697537-14 DUP		**WG2697537-15**						
Bromide (Br)		<0.10	<0.10	RPD-NA	mg/L	N/A	20	12-JAN-18
WG2697537-12 LCS								
Bromide (Br)			97.5		%		85-115	12-JAN-18
WG2697537-11 MB								
Bromide (Br)			<0.10		mg/L		0.1	12-JAN-18
WG2697537-13 MS		**WG2697537-15**						
Bromide (Br)			98.2		%		75-125	12-JAN-18
CL-IC-N-WT	**Water**							
Batch R3935479								
WG2697537-14 DUP		**WG2697537-15**						
Chloride (Cl)		5.21	5.25		mg/L	0.7	20	12-JAN-18
WG2697537-12 LCS								
Chloride (Cl)			99.0		%		90-110	12-JAN-18
WG2697537-11 MB								
Chloride (Cl)			<0.50		mg/L		0.5	12-JAN-18
WG2697537-13 MS		**WG2697537-15**						
Chloride (Cl)			100.4		%		75-125	12-JAN-18
COLOUR-APPARENT-WT	**Water**							

Quality Control Report

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
COLOUR-APPARENT-WT	**Water**							
Batch R3933347								
WG2697349-3 DUP		**L2044112-1**						
Colour, Apparent		232	260		CU	11	20	11-JAN-18
WG2697349-2 LCS								
Colour, Apparent			98.6		%		85-115	11-JAN-18
WG2697349-1 MB								
Colour, Apparent			<2.0		CU		2	11-JAN-18
F-IC-N-WT	**Water**							
Batch R3935479								
WG2697537-14 DUP		**WG2697537-15**						
Fluoride (F)		0.125	0.129		mg/L	3.1	20	12-JAN-18
WG2697537-12 LCS								
Fluoride (F)			99.3		%		90-110	12-JAN-18
WG2697537-11 MB								
Fluoride (F)			<0.020		mg/L		0.02	12-JAN-18
WG2697537-13 MS		**WG2697537-15**						
Fluoride (F)			99.8		%		75-125	12-JAN-18
NO2-IC-WT	**Water**							
Batch R3935479								
WG2697537-14 DUP		**WG2697537-15**						
Nitrite (as N)		<0.010	<0.010	RPD-NA	mg/L	N/A	25	12-JAN-18
WG2697537-12 LCS								
Nitrite (as N)			96.6		%		70-130	12-JAN-18
WG2697537-11 MB								
Nitrite (as N)			<0.010		mg/L		0.01	12-JAN-18
WG2697537-13 MS		**WG2697537-15**						
Nitrite (as N)			96.8		%		70-130	12-JAN-18
NO3-IC-WT	**Water**							
Batch R3935479								
WG2697537-14 DUP		**WG2697537-15**						
Nitrate (as N)		<0.020	<0.020	RPD-NA	mg/L	N/A	25	12-JAN-18
WG2697537-12 LCS								
Nitrate (as N)			99.0		%		70-130	12-JAN-18
WG2697537-11 MB								
Nitrate (as N)			<0.020		mg/L		0.02	12-JAN-18
WG2697537-13 MS		**WG2697537-15**						
Nitrate (as N)			98.8		%		70-130	12-JAN-18
PO4-DO-COL-WT	**Water**							

Quality Control Report

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
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Contact: MATT GILLMAN

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PO4-DO-COL-WT	**Water**							
Batch R3933344								
WG2697344-3 DUP		**L2043701-1**						
Orthophosphate-Dissolved (as P)		<0.0030	<0.0030	RPD-NA	mg/L	N/A	30	11-JAN-18
WG2697344-2 LCS								
Orthophosphate-Dissolved (as P)			106.0		%		70-130	11-JAN-18
WG2697344-1 MB								
Orthophosphate-Dissolved (as P)			<0.0030		mg/L		0.003	11-JAN-18
WG2697344-4 MS		**L2043701-1**						
Orthophosphate-Dissolved (as P)			105.5		%		70-130	11-JAN-18
REDOX-POTENTIAL-WT	**Water**							
Batch R3933928								
WG2697623-1 DUP		**L2044112-1**						
Redox Potential		350	348		mV	0.6	25	12-JAN-18
SO4-IC-N-WT	**Water**							
Batch R3935479								
WG2697537-14 DUP		**WG2697537-15**						
Sulfate (SO4)		54.1	54.5		mg/L	0.8	20	12-JAN-18
WG2697537-12 LCS								
Sulfate (SO4)			98.7		%		90-110	12-JAN-18
WG2697537-11 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	12-JAN-18
WG2697537-13 MS		**WG2697537-15**						
Sulfate (SO4)			100.9		%		75-125	12-JAN-18
TURBIDITY-WT	**Water**							
Batch R3933749								
WG2697503-3 DUP		**L2044146-3**						
Turbidity		251	244		NTU	2.8	15	12-JAN-18
WG2697503-2 LCS								
Turbidity			103.0		%		85-115	12-JAN-18
WG2697503-1 MB								
Turbidity			<0.10		NTU		0.1	12-JAN-18

Quality Control Report

Workorder: L2044112 Report Date: 19-JAN-18

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
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Toronto ON M5E 1B5
Contact: MATT GILLMAN

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L2044112 Report Date: 19-JAN-18

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
374 Wellington Street West, Suite 3
Toronto ON M5E 1B5
Contact: MATT GILLMAN

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential							
	1	10-JAN-18 08:50	12-JAN-18 19:00	0.25	58	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2044112 were received on 10-JAN-18 16:55.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2044112-COFC

COC Number: 17 - 637702

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	Palmer	Select Report Format: ☒ PDF ☒ EXCEL | | EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Matt Gillman	Quality Control (QC) Report with Report ☒ YES ☐ NO	PRIORITY (Business Days): 4 day [P4-20%] ☐ / 3 day [P3-25%] ☐ / 2 day [P2-50%] ☐
Phone:	519 373-6249	☒ Compare Results to Criteria on Report - provide details below if box checked	EMERGENCY: 1 Business day [E-100%] ☐ / Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐
	Company address below will appear on the final report	Select Distribution: ☒ EMAIL | | MAIL ☐ FAX	
Street:	374 Wellington St.	Email 1 or Fax matt@pecg.ca	Date and Time Required for all E&P TATs:
City/Province:	Toronto, ON	Email 2	For tests that can not be performed according to the service level selected, you will be contacted.
Postal Code:		Email 3	

Invoice To		Invoice Distribution	
	Same as Report To ☒ YES ☐ NO	Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	
	Copy of Invoice with Report ☒ YES ☐ NO		
Company:		Email 1 or Fax	
Contact:		Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	Mayfield 3	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):	L2044112 JAN 11 18	ALS Contact:	Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Colour, apparent	Redox pot.	Turbidity	Acidity (as CaCO3)	Alkalinity tot. (as CaCO3)	Bromide (Br)	Chloride (Cl)	Fluoride (F)	Nitrate (as N)	Nitrite (as N)	Orthophosphate-dis (as P)	Sulfate (SO4)	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
1	MW6	10-Jan-18	8:50	GW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			3

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	
Are samples for human consumption/ use? | | YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C					FINAL COOLER TEMPERATURES °C				
7.5					6.2				

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date: 10 Jan 2018	Time: 16:50	Received by:	Date: 10/1/18	Time: 16:55	Received by:	Date: JAN. 11/18	Time: 15:40

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

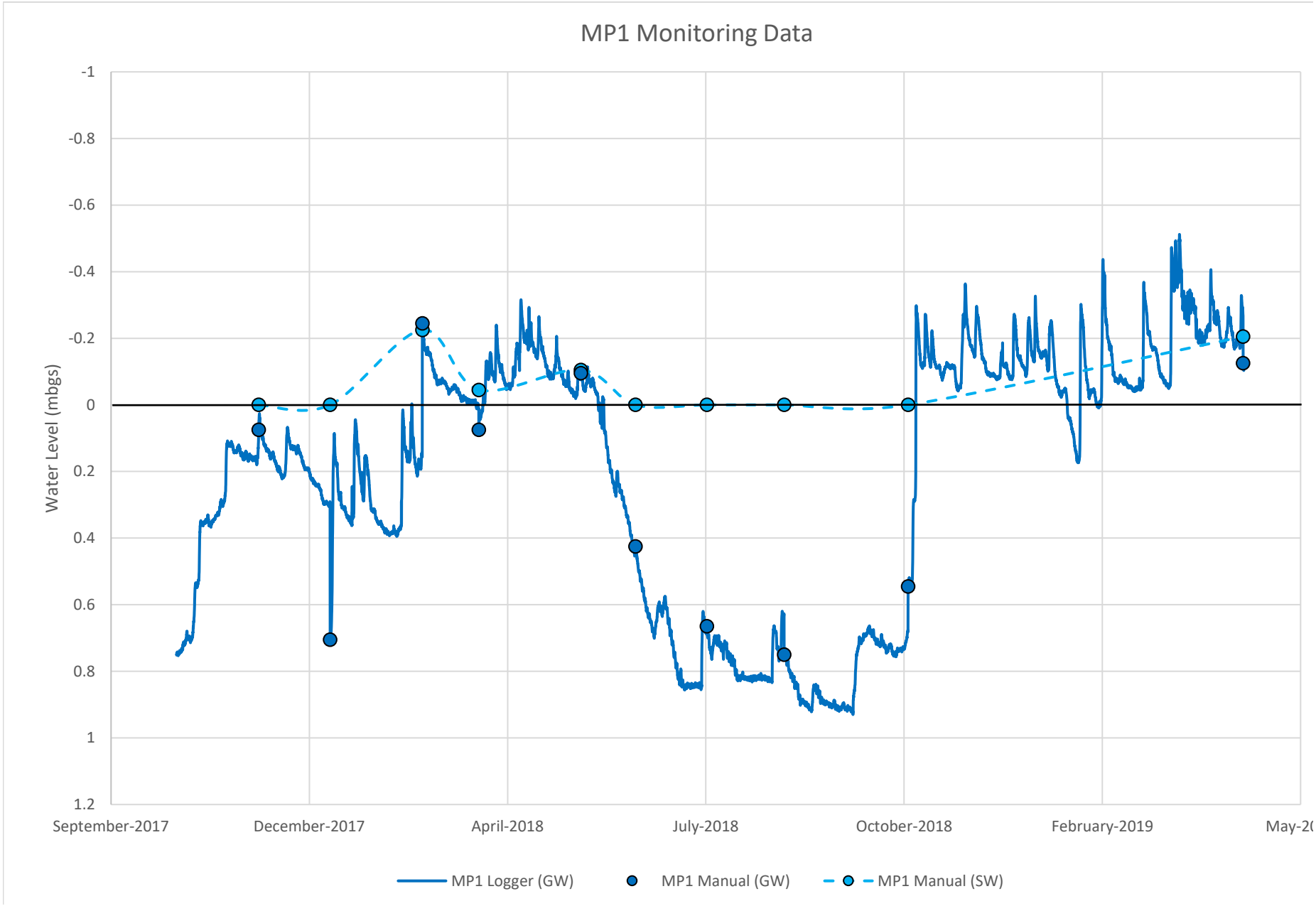
JULY 2017 FRONT

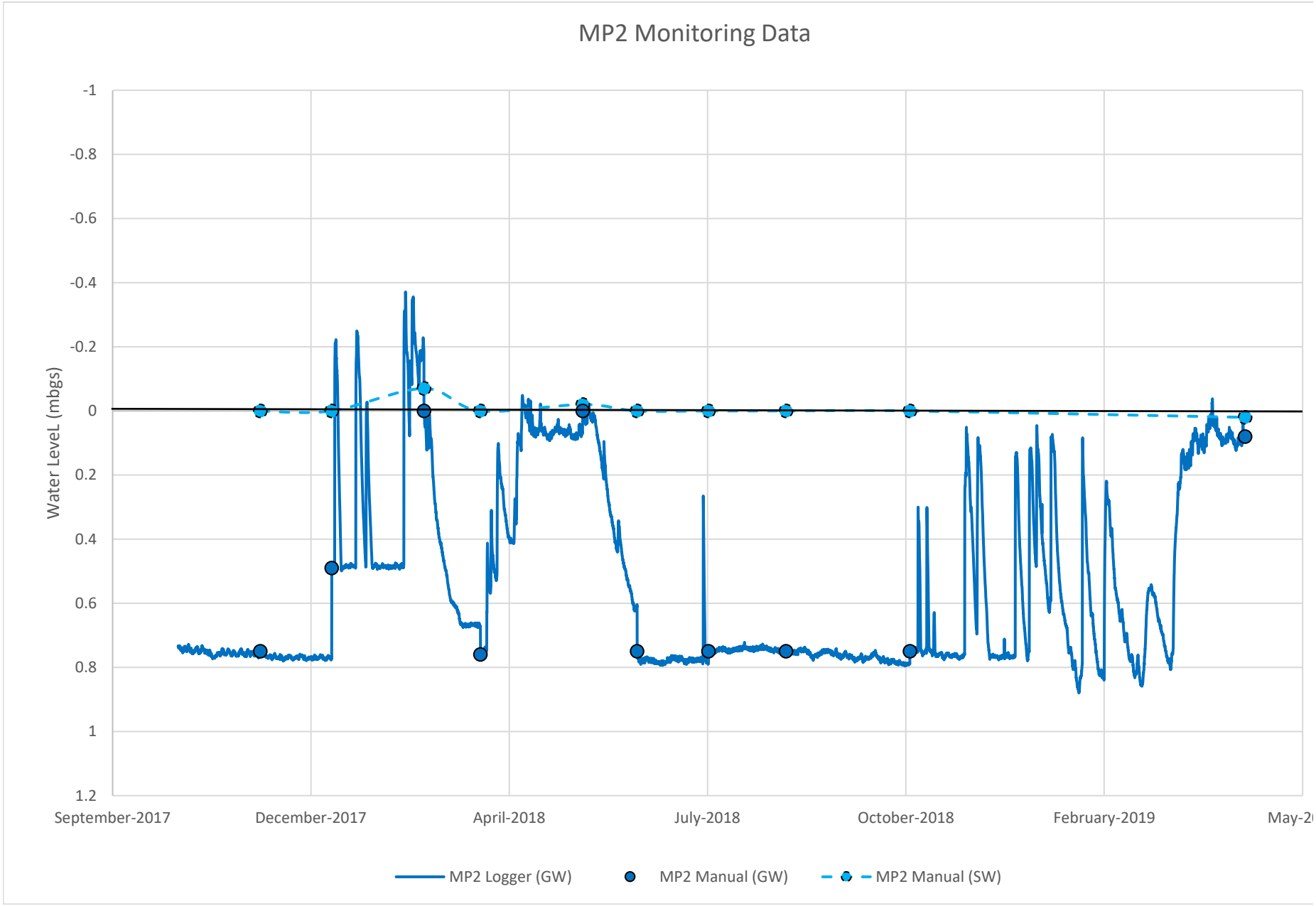
Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

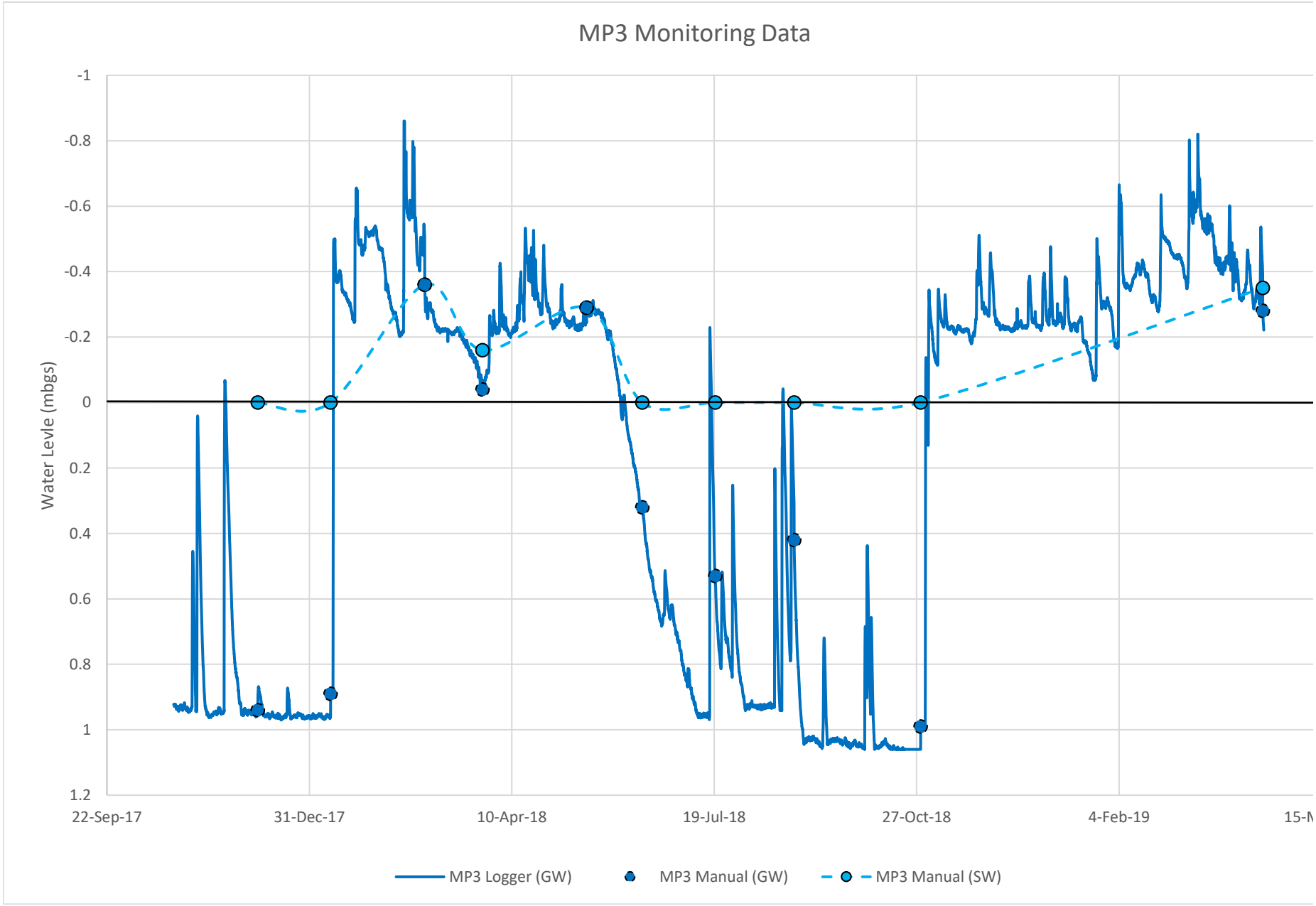
1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

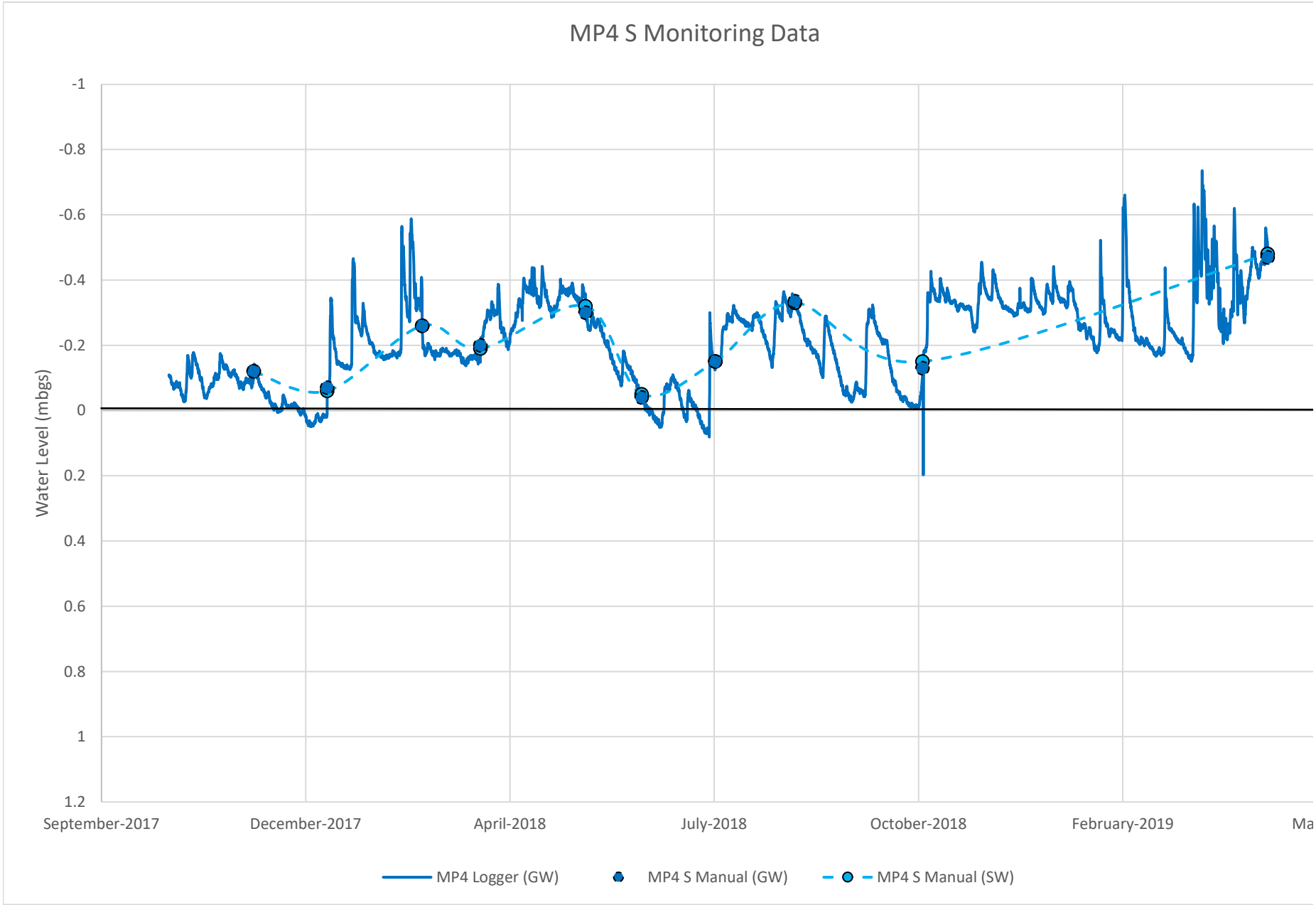
Appendix E

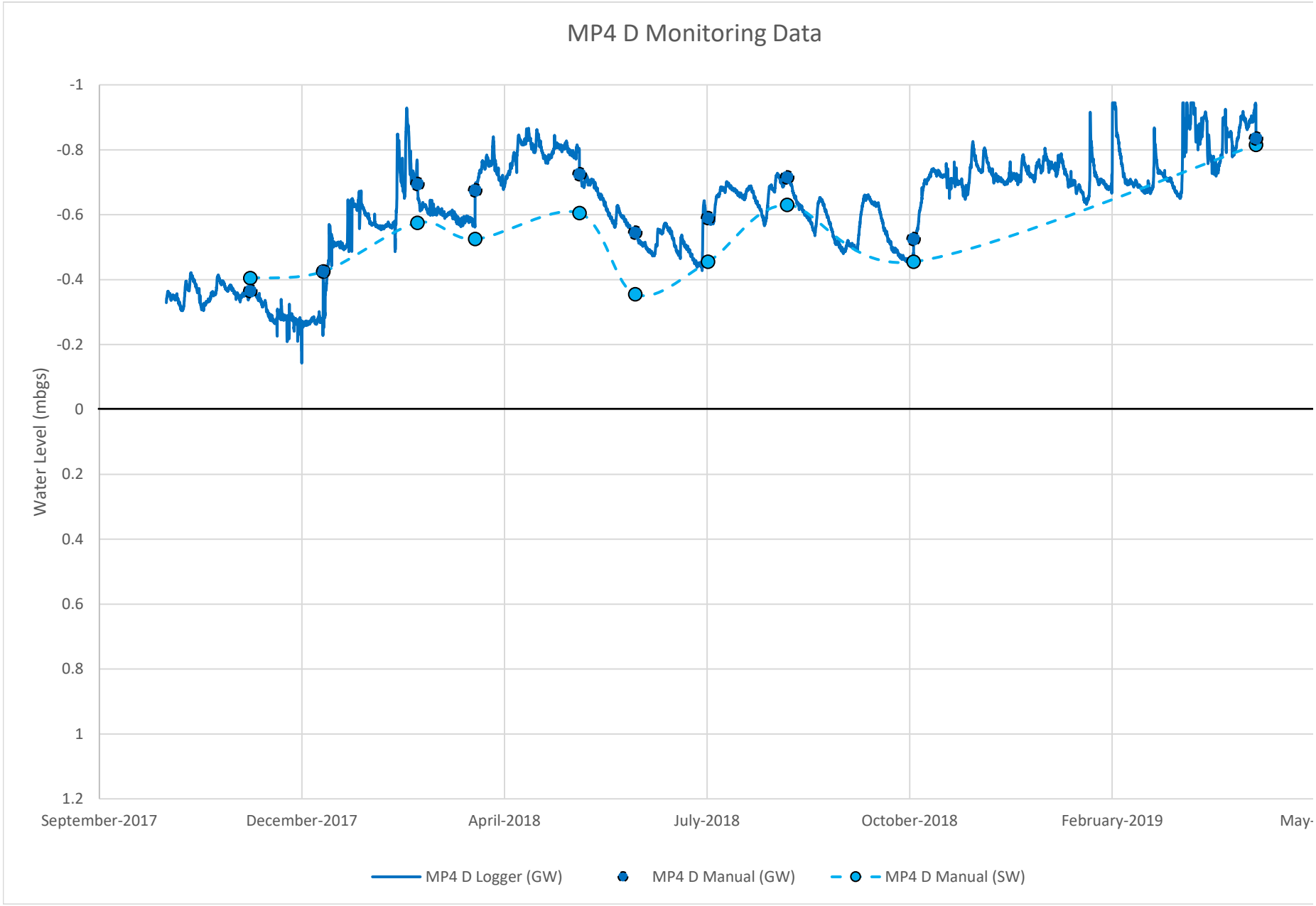
Calibrated Datalogger Monitoring Data Palmer (2017-2019)

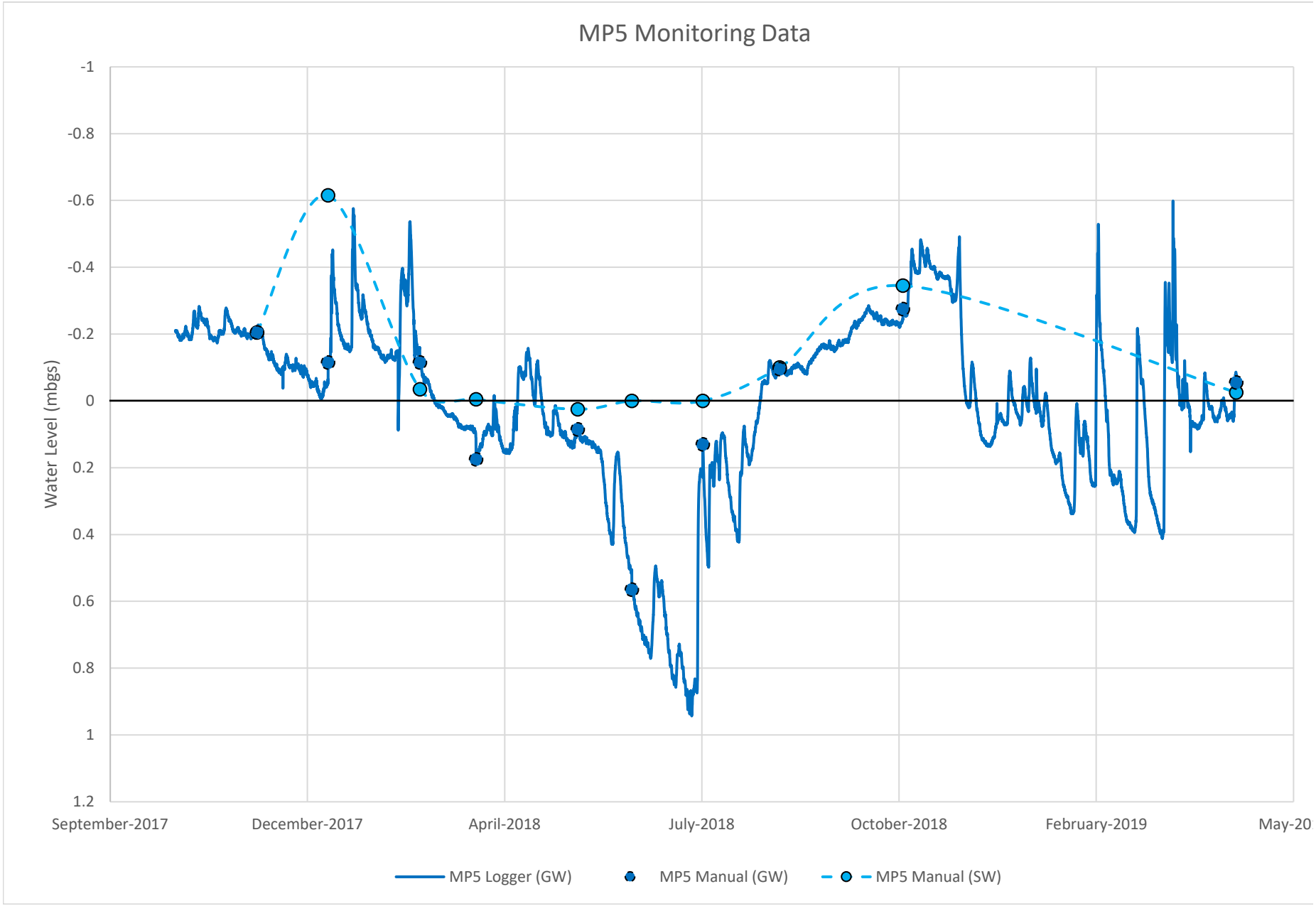

MP1 Monitoring Data
Water Level (mbgs)
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
September-2017
December-2017
April-2018
July-2018
October-2018
February-2019
May-2(
MP1 Logger (GW)
MP1 Manual (GW)
MP1 Manual (SW)

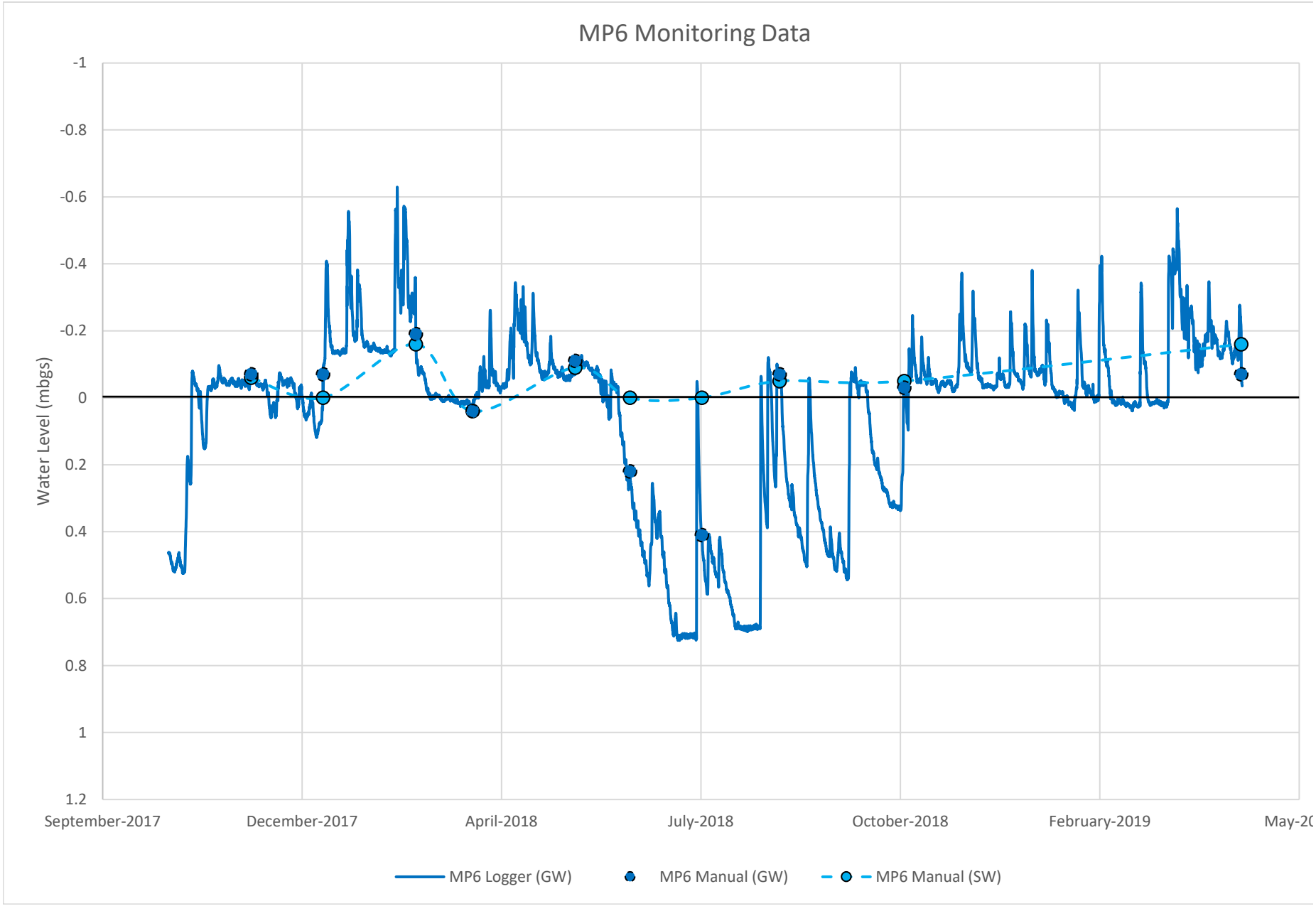

MP2 Monitoring Data
Water LeveL (mbgs)
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
September-2017
December-2017
April-2018
July-2018
October-2018
February-2019
MP2 Logger (GW)
MP2 Manual (GW)
MP2 Manual (SW)

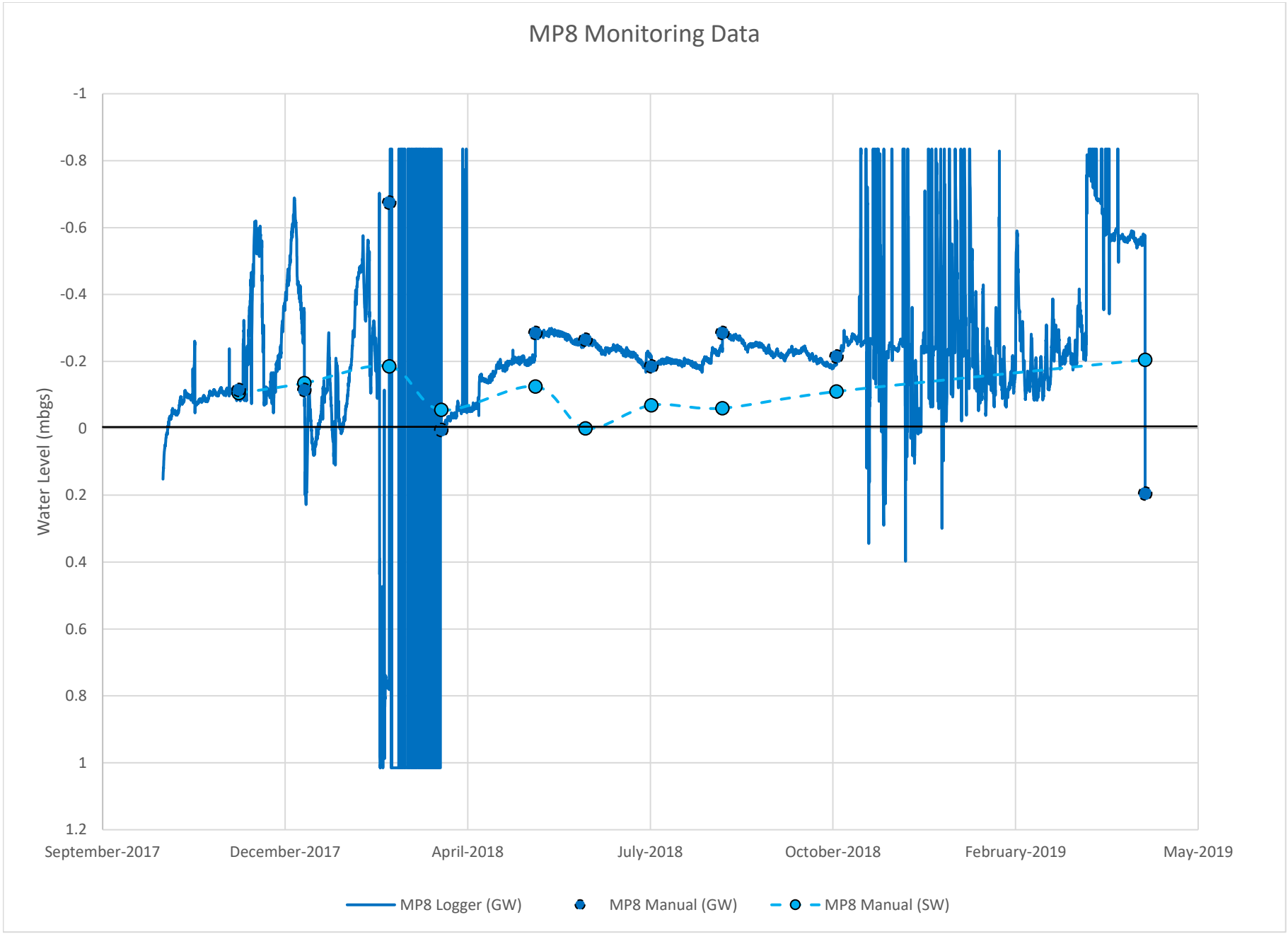

MP3 Monitoring Data
Water Levle (mbgs)
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
22-Sep-17
31-Dec-17
10-Apr-18
19-Jul-18
27-Oct-18
4-Feb-19
MP3 Logger (GW)
MP3 Manual (GW)
MP3 Manual (SW)


MP4 S Monitoring Data
Water Level (mbgs)
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
September-2017
December-2017
April-2018
July-2018
October-2018
February-2019
Ma
MP4 Logger (GW)
MP4 S Manual (GW)
MP4 S Manual (SW)


MP4 D Monitoring Data
Water Level (mbgs)
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
September-2017
December-2017
April-2018
July-2018
October-2018
February-2019
May-
MP4 D Logger (GW)
MP4 D Manual (GW)
MP4 D Manual (SW)


MP5 Monitoring Data
Water Level (mbgs)
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
September-2017
December-2017
April-2018
July-2018
October-2018
February-2019
May-20
MP5 Logger (GW)
MP5 Manual (GW)
MP5 Manual (SW)


MP6 Monitoring Data
Water Level (mbgs)
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
September-2017
December-2017
April-2018
July-2018
October-2018
February-2019
May-2(
MP6 Logger (GW)
MP6 Manual (GW)
MP6 Manual (SW)


MP8 Monitoring Data
Water Level (mbgs)
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
September-2017
December-2017
April-2018
July-2018
October-2018
February-2019
May-2019
MP8 Logger (GW)
MP8 Manual (GW)
MP8 Manual (SW)