74 Berkeley Street, Toronto, ON M5A 2W7
Tel: 647-795-8153 | www.pecg.ca

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

Official Plan Amendment (OPA) Application

Palmer Project #
1701616

Prepared For
Brookvalley Project Management Inc.

July 4, 2022

74 Berkeley Street, Toronto, ON M5A 2W7
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July 4, 2022

Frank Filippo
Director, Land & Construction
Brookvalley Project Management Inc.
137 Bowes Road
Concord, Ontario
L4K 1H3

Dear Mr. Filippo:

Re: Hydrogeological Assessment – Mayfield West Phase 2 Stage 3 Lands, Caledon, Ontario
Project #: 1701616

Palmer is pleased to submit the attached report describing the results of our Hydrogeological Investigation for the Mayfield West Phase 2 Stage 3 Lands (MW2-3) as part of an Official Plan Amendment (OPA) application. This report was also prepared to support the preparation of a Comprehensive Environmental Impact Study and Management Plan (CEISMP) for the study area.

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. 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

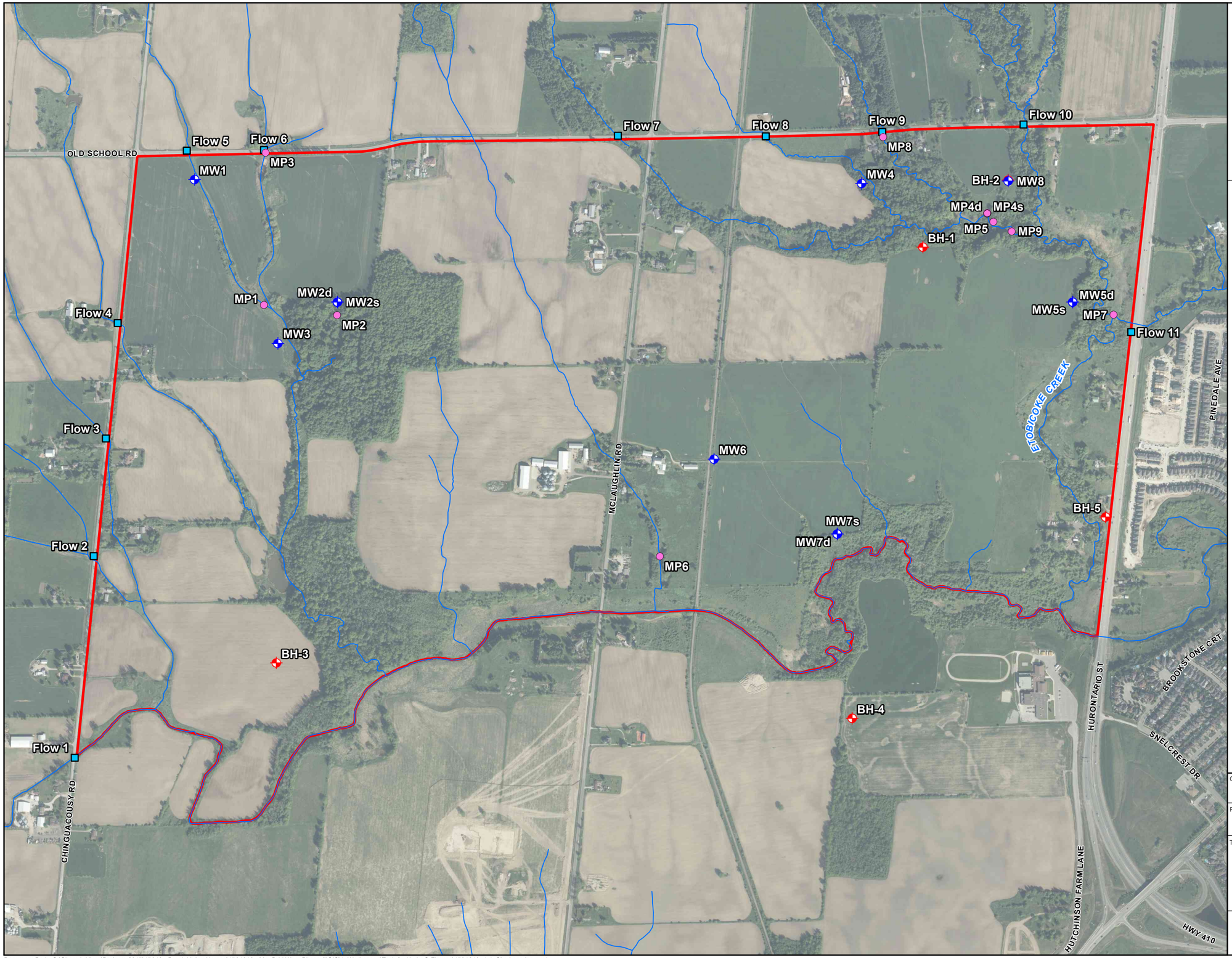
Palmer was retained by Brookvalley Project Management Inc. (Brookvalley) to complete a Hydrogeological Assessment for the Mayfield West Phase 2 Stage 3 (MW2-3) project. The study area is approximately 430 hectare (ha) in size, with 208 ha of tableland development area, and is bounded to the north by 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 Land Use Plan, created by MGP (2022) is given 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 watercourses 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 assess each wetland from a hydrological and hydrogeological perspective to characterize each as groundwater supported, surface water supported, or a combination of both to allow for a representative impact assessment and future feature-based water budget to be completed, where necessary.

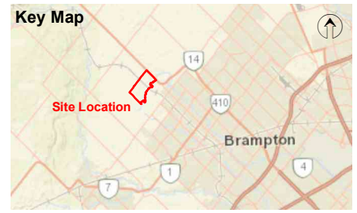
1.1 Scope of Work

The scope of work for Palmer Hydrogeological Assessment includes the following main tasks:

- Review of available background information and data for the study area, including the AMEC Secondary Plan and the associated Hydrogeological Assessment Report;
- Characterize the surface and sub-surface geological and hydrogeological conditions through a borehole drilling and monitoring well installation program completed in 2017. This drilling program included a series of shallow and deep nested groundwater monitoring wells;
- Develop and test monitoring wells to estimate hydraulic conductivity, assess groundwater flow, and the distribution of aquifers and aquitards;
- Characterize the groundwater / surface water interaction within wetland communities, Etobicoke Creek and its tributaries through the installation and monitoring of mini-piezometers;
- Complete monthly groundwater and surface water level monitoring for 1-year, and continuous groundwater level and wetland water level monitoring for 18 months to establish seasonal trends in groundwater and surface water/ wetland water levels;
- Complete a site scale water balance to establish infiltration and runoff volumes under pre-development conditions;
- Complete a preliminary post-development water balance to assess pre-to-post changes
- Provide recommendations for Low Impact Development (LID) measures to maintain infiltration volumes post-development;
- Prepare a Hydrogeological Assessment Report to document the study findings for the OPA submission; and,
- Provide hydrogeological and water balance information to support the Comprehensive Environmental Impact Study and Management Plan (CEISMP) Report for the site.



KEY MAP



LEGEND

- Monitoring Well (Palmer, 2017)
- Monitoring Well (AMEC, 2010)
- Mini-Piezometer
- Surface Water Flow Station
- Watercourse[1]
- Study Area

1. LIO/MNRF

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PROJECT
Mayfield West Phase 2

TITLE
Site Location

Palmer

REF. NO. 1701616-MR-201-A

Figure 1

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2. Regional Conditions

2.1 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.

2.2 Surficial and Bedrock Geology

The surficial and bedrock geology at the site as described by OGS mapping is described in detail below.

2.2.1 Modern Alluvium Deposits

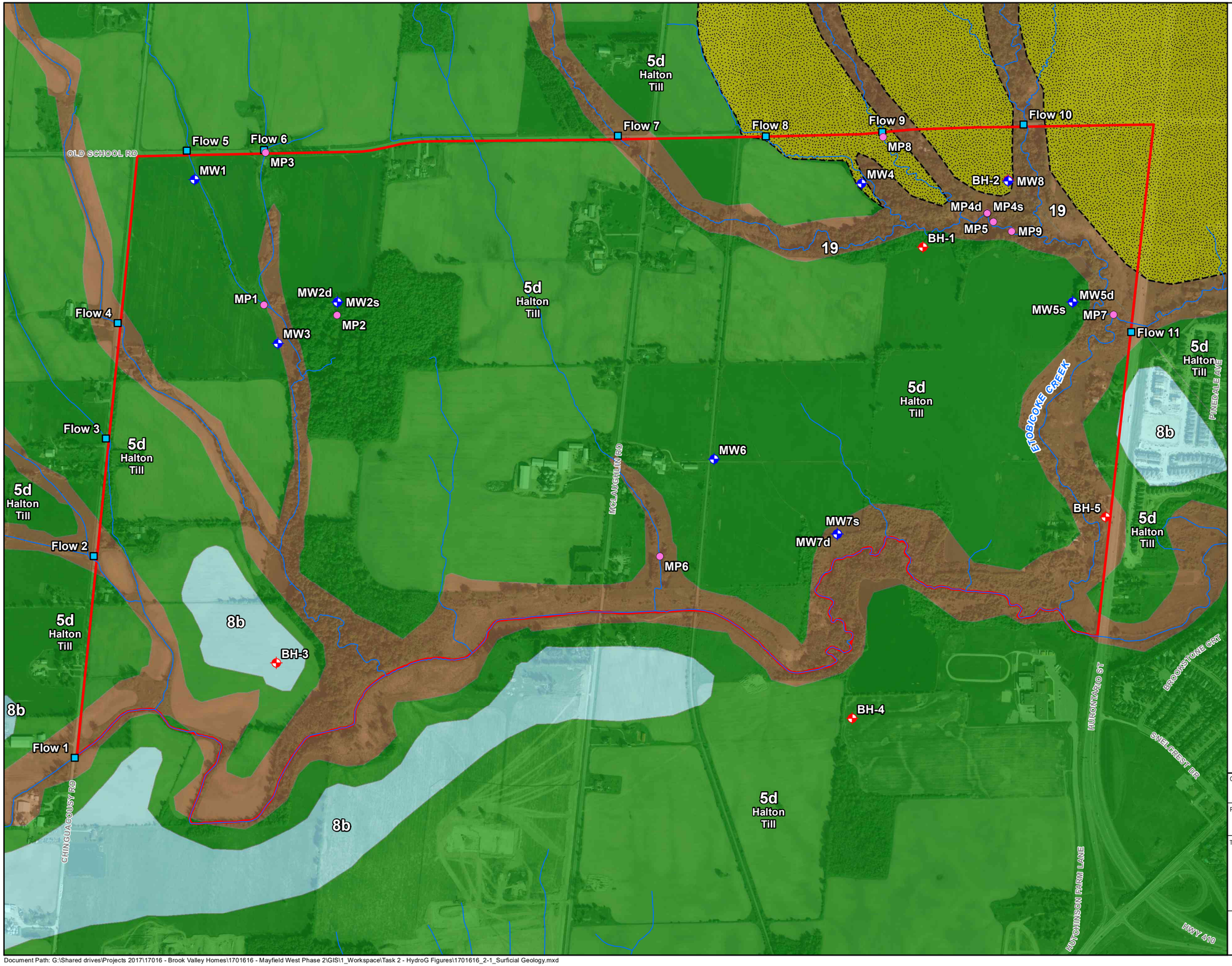
Recent deposits of alluvial silts, sands, and gravels are found in the Etobicoke Creek Valley (**Figure 2**). The Etobicoke Creek follows an ancestral valley system which has subsequently infilled with modern and historical alluvium (TRCA, 2010). These soils have been described as undifferentiated gravels,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

2.2.2 Fine Grained Glaciolacustrine Deposits

Fine grained glaciolacustrine sediments (silt and clay) are located within small regions of the site along Etobicoke Creek (**Figure 2**). These soils were deposited in former glacial lakes in calm, offshore environments, and are generally less than 1 m in thickness. The soil textures range from near shore sand and beach deposits from the shoreline of Lake Iroquois, to fine sand, silts, and clay deposits of glaciolacustrine ponding.

2.2.3 Halton Till

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 glaciation (**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 (Interim Waste Authority, 1994), 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 within the till due to the poorly drained nature of the soil.



LEGEND

- Monitoring Well (Palmer, 2017)
- Monitoring Well (AMEC, 2010)
- Mini-Piezometer
- Surface Water Flow Station
- Watercourse[1]
- Study Area

Surficial Geology[2]

Phanerozoic / Cenozoic / Quaternary / Recent

19: Modern alluvial deposits *(clay, silt, sand, gravel, may contain organic remains)*

Phanerozoic / Cenozoic / Quaternary / Pleistocene

8b: Fine-textured glaciolacustrine deposits *(Interbedded silt and clay and gritty, pebbly flow till and rainout deposits)*

5d: Tilll *(Clay to silt-textured till [derived from glaciolacustrine deposits or shale])*

Interpreted (from borehole drilling data)

Oak Ridges Moraine Formation (or equivalent) *(Fine to medium sand and silt*

1. LIO/MNRF
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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TITLE
Surficial Geology

Palmer

REF. NO. 1701616-MR-202-A

Figure 2

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2.2.4 Oak Ridges Moraine Formation

The Oak Ridges Moraine sand and gravel deposits formed approximately 13,000 ybp and is a significant regional aquifer unit in Southern Ontario. Although the Oak Ridges Moraine (ORM) landform lies approximately 12 km north of the study area, “finger-like” protrusions of highly permeable ORM sediments are known to extend southward below the South Slope physiographic region in the vicinity of the study area, and pinch out beneath the Halton Till south of Mayfield Road. Some ORM sediments are also present at surface within the headwaters of Etobicoke Creek north of Mayfield Road (**Figure 2**). These deposits are generally less than 30 m thick, and especially thin out south of Mayfield Road.

Where low-lying watercourse or wetland features encounter permeable ORM sand and gravel deposits below the Halton Till, groundwater discharge is expected, which can support wetland function and stream baseflow.

2.2.5 Newmarket Till

The Newmarket Till is a regionally extensive subglacial till which underlies the Oak Ridges Moraine and most of south central Ontario (Sharpe et al., 1997). Typically, this unit is characterized by a dense, over-consolidated till deposit, which ranges in thickness from 1 to 50 m. Sediments in the till are comprised of sandy silt to silt with trace gravel. Generally, it is massive however coarser textured features, such as interbeds and sand dykes, are common.

2.2.6 Bedrock Geology

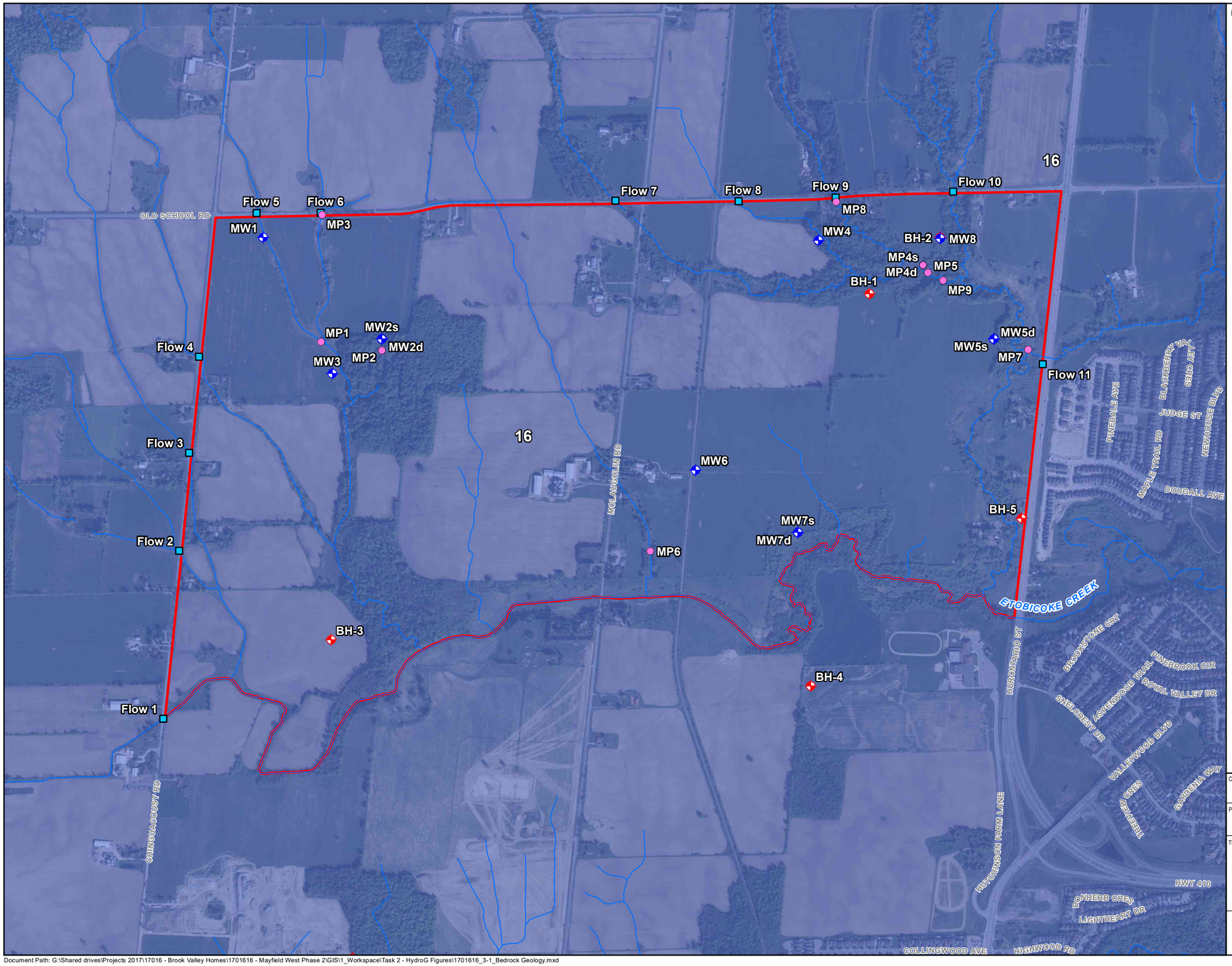
Bedrock at the site is characterized as Queenston Shale (**Figure 3**), and is described as Upper Ordovician aged, dark red, hematic shale interbedded with grey to green limestone and occasionally sandstone. Shale of the Queenston Formation does not fracture readily and is reportedly compact and dense with relatively poor interconnectivity of pore spaces (Singer et al., 2x003). It is expected that the depth to bedrock at the site is approximately 17 mbgs - 25 mbgs according to the bedrock found in MECP Well IDs # 4908096 and 4904291 respectively.

2.2.7 Physiographic Region

The South Slope physiographic region (**Figure 4**) (Chapman and Putnam, 1984), deposited by successive glaciers between 135,000 and 13,000 years ago. This area is a sloping glaciolacustrine till plain that extends across the City of Toronto, as well as York, Peel, Halton and Durham Regions, and Northumberland County. The dominant soil texture of the region is clay and silt, but some deposits of sand and gravel may be found. In the Halton Region the South Slope begins on the south side of the Niagara escarpment and slopes downward to the south. The topography in this region is gently rolling with numerous drumlins oriented up slope.

2.3 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



LEGEND

- Monitoring Well (Palmer, 2017)
- Monitoring Well (AMEC, 2010)
- Mini-Piezometer
- Surface Water Flow Station
- Watercourse[1]
- Study Area

Paleozoic Bedrock Geology[2]

Upper Ordovician

16: Queenston *(shale, siltstone, minor limestone and sandstone)*

1. LIO/MNRF
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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PROJECT
Mayfield West Phase 2

TITLE
Bedrock Geology

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Figure 3

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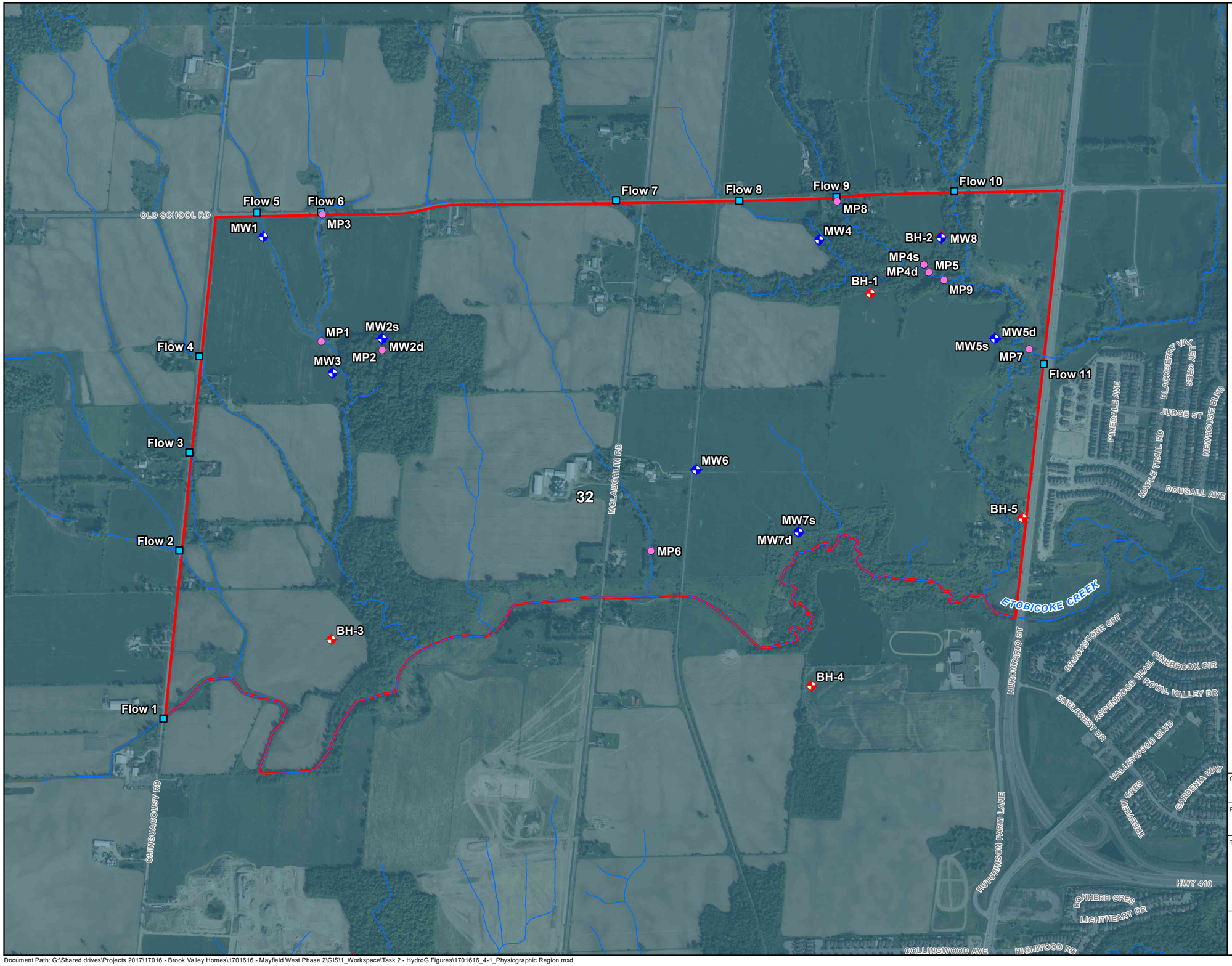

LEGEND

- Monitoring Well (Palmer, 2017)
- Monitoring Well (AMEC, 2010)
- Mini-Piezometer
- Surface Water Flow Station
- Watercourse[1]
- Study Area

Physiographic Region[2]

- 32: South Slope

1. LIO/MNRF
2. Chapman, L.J. and Putnam, D.F. 2007. Physiography of southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 228.

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Physiographic Region

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Figure 4

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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 (Interim Waste Authority, 1994). 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 (ORM)*** 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 ORM sediments that have extended south were identified within the project boundary (**Figure 2**). These sediments were observed at surface near Etobicoke Creek where Halton Till was absent, and beneath the Halton Till through the rest of the site. South of Mayfield Road these sediments tend to thin and pinch out. The hydraulic conductivity of the ORM 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 and several municipal supply wells.

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^{-5} to 10^{-8} m/sec (Lee and ESG International, 2002). The well yield from the weathered zone is typically low.

2.3.1 Surface Water Protection

The site is located within the Toronto Region Conservation Authority. The 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 5**). 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.

2.3.2 MECP Water Wells

Based on a review of the MECP water well records, a total of 130 water wells are present within a 500 m radius of the MW2-3 lands, including within the site (**Figure 6).** Of these, 61 wells are used for domestic purposes, 26 are used for monitoring, 12 are used for domestic and livestock purposes, 4 are just used for livestock, one is used for monitoring and testing and the last use stated is for public use. Of the remaining wells 8 are marked as no longer in use, and the remaining 17 have no use stated.

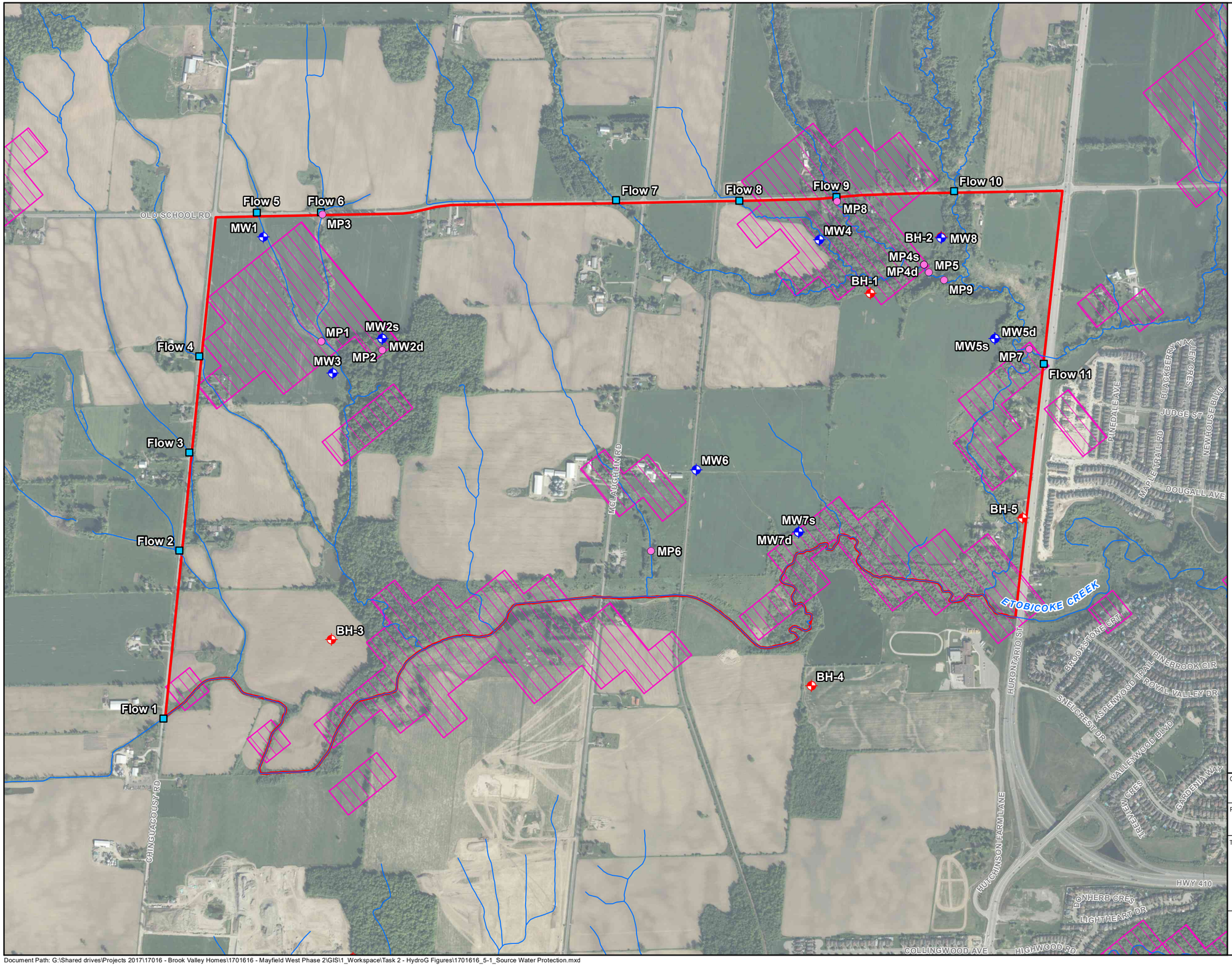
A door-to-door water well survey is recommended as part of the Environmental Implementation Reporting (EIR) stage to confirm the presence/ absence of active potable groundwater wells.

3. Local Conditions

3.1 Site Geology

Borehole drilling investigations at the site for hydrogeological purposes was conducted from November 13 – 15, 2017. Eleven 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 mbgs to 12.80 mbgs. 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 1**. Nested wells, which consisted of one deep and one shallow monitoring well, were installed at MW-2s/d, MW-5s/d, and MW-7s/d. Borehole logs are presented in **Appendix B1**.

In addition, monitoring wells that were previously installed by AMEC Earth and Environmental (AMEC) (now called Wood.) as part of the Mayfield West Phase 2 Secondary Plan Environmental Impact Study (AMEC, 2010) where utilized as part of this study. The locations of all AMEC wells (BH1 to BH6) are shown on **Figure 1**. The available details for these monitoring wells are provided in **Table 1**, and available borehole logs are provided in **Appendix B2**.



LEGEND

- Monitoring Well (Palmer, 2017)
- Monitoring Well (AMEC, 2010)
- Mini-Piezometer
- Surface Water Flow Station
- Watercourse[1]
- Study Area

Source Water Protection[2]

- Highly Vulnerable Aquifer

1. LIO/MNRF
2. *Source Water Policy*, TRCA 2022

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METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

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Source Water Protection

Palmer

REF. NO. 1701616-MR-205-A

Figure 5

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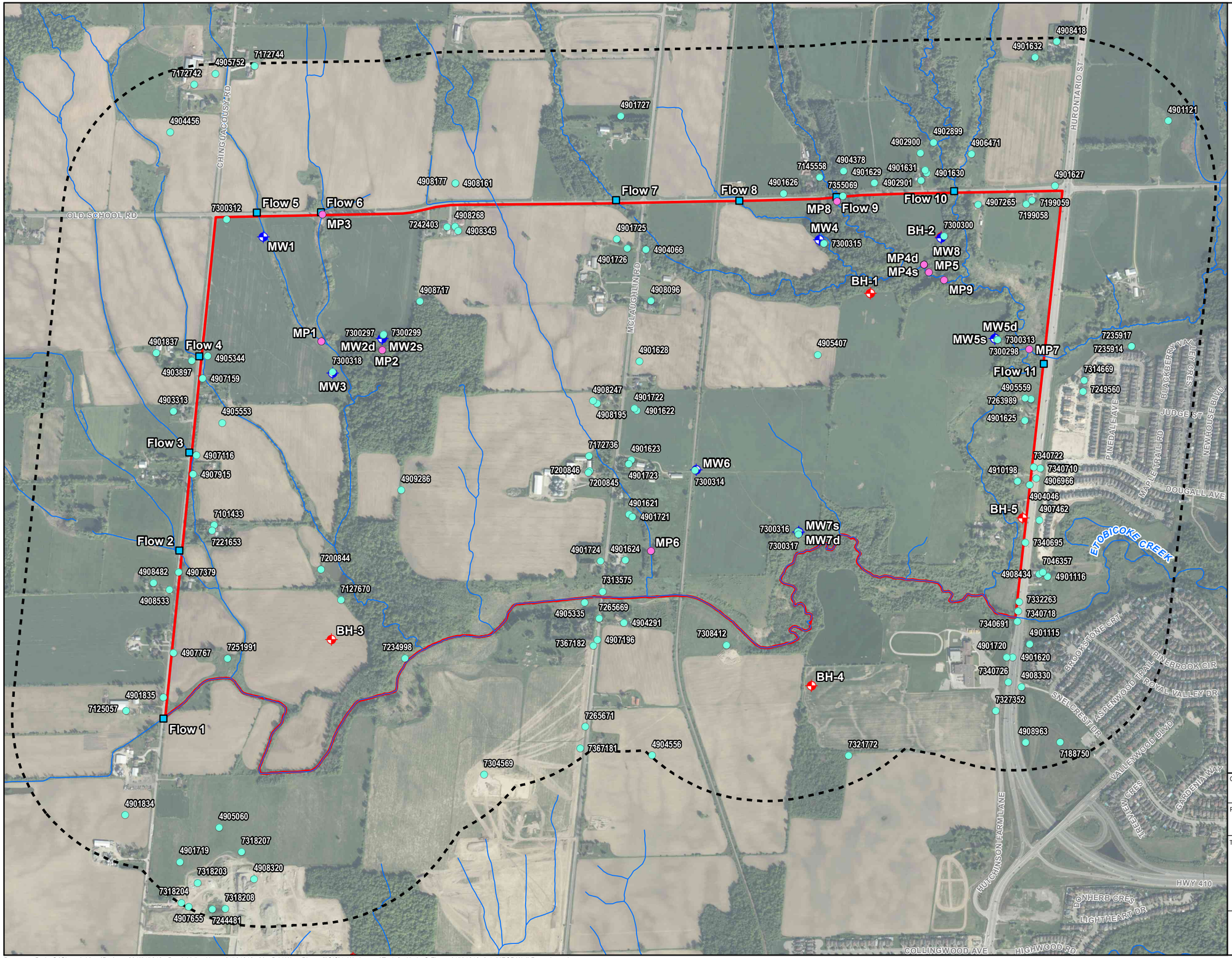

LEGEND

- Well Record within 500m[1]
- Monitoring Well (Palmer, 2017)
- Monitoring Well (AMEC, 2010)
- Mini-Piezometer
- Surface Water Flow Station
- Watercourse[1]
- Study Area
- 500m Site Buffer

1. MECP
2. LIO/MNRF

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Mayfield West Phase 2

TITLE
MECP Well Records within a 500 m radius

Palmer

REF. NO. 1701616-MR-206-A

Figure 6

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Table 1. Monitoring Well Installation Data

MW ID	Approximate Elevation (masl)	UTM Coordinates		Stick Up (m)	Borehole Depth (mbgs)	Screened Interval (mbgs)	Screened Geology
		Easting	Northing				
MW-1	268	590927	4843009	0.65	7.90	4.57 – 6.09	(ORM or Equivalent) Sand and silt
MW-2s	268	591429	4843102	0.66	9.22	3.35 – 4.88	(Newmarket Till) Clayey silt to silty clay till
MW-2d	268	591429	4843102	0.75	9.22	5.79 – 8.84	(Newmarket Till) Clayey silt to silty clay till
MW-3	263	591415	4842905	0.75	7.92	4.57 – 7.62	(Newmarket Till) Silty sand to silty clay till
MW-4	266	592077	4844413	0.68	10.91	6.40 – 7.92	(ORM or Equivalent) Fine to medium sand and silt
MW-5s	260	592688	4844656	0.71	12.32	4.57 – 6.10	(ORM or Equivalent) Silt and fine sand
MW-5d	260	592688	4844656	0.62	12.32	9.14 – 10.67	(ORM or Equivalent) Silt and fine sand
MW-6	263	592407	4843628	0.68	7.85	3.66 – 5.18	(ORM or Equivalent) Fine sand and silt, some clay
MW-7s	259	592776	4843760	0.81	11.13	4.57 – 6.10	(ORM or Equivalent) Fine sand, silt, some clay
MW-7d	259	592776	4843760	0.84	11.13	9.14 – 10.67	(Newmarket Till) Clayey silt till, some sand, some gravel
MW-8	263.24	592323	4844727	0.73	12.80	9.75 – 11.28	(ORM or Equivalent) Fine to coarse sand, some silt
BH1	263.24	592316	4844433	0.51	9.60	6.05 – 9.10	(ORM or Equivalent) Sandy silt, trace gravel, trace clay
BH2	264.14	592320	4844728	0.92	9.60	6.05 – 9.10	(ORM or Equivalent) Sandy silt, trace gravel, trace clay
BH3	259.30	592088	4842354	-	9.60	6.05 – 9.10	(ORM or Equivalent) Silt, some sand, trace clay
BH4s	259.50	593192	4843477	-	30.50	7.20 – 10.25	(ORM or Equivalent) Silt, some sand, trace clay
BH4d	259.50	593192	4843477	-	30.50	27.3 – 30.45	(Newmarket Till) Silt and sand, gravelly, trace clay
BH5	258.91	593200	4844357	0.55	9.60	6.05 – 9.10	(ORM or Equivalent) Sandy silt, trace gravel, trace clay
BH6	261.0	592942	4841754	-	9.60	6.05 – 9.10	(Newmarket Till) Clayey Silt till, embedded sand and gravel

Note: "-" indicates specifications are unknown.

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 on **Figures 3, 4, and 5**. Cross sections were completed through three transects labelled A-A', B-B', and C-C' (noted on **Figure 2**) 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:

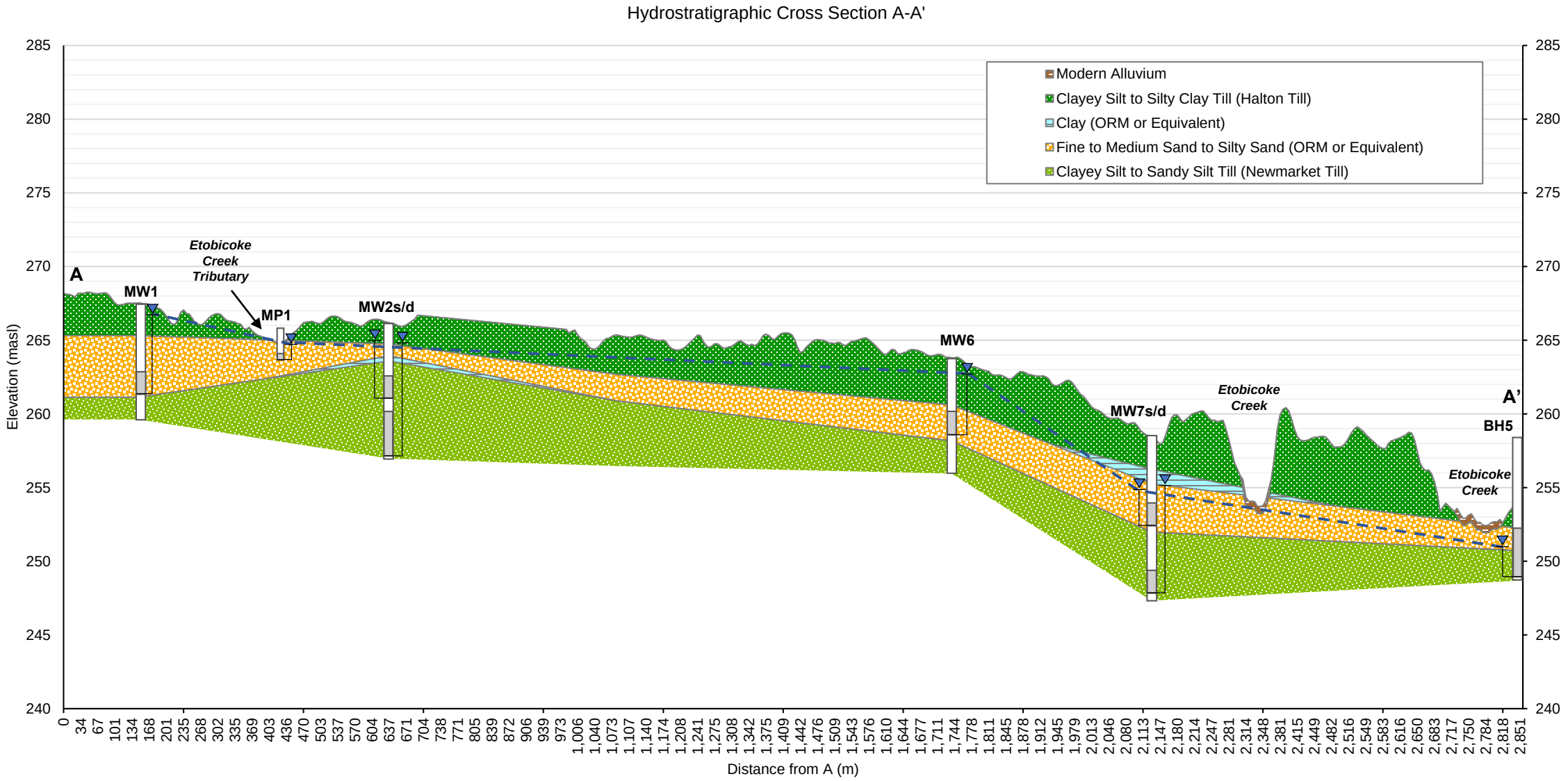
Topsoil: All boreholes encountered topsoil that ranged in thickness from 0.69 m (MW-7s/d) to 1.45 m (MW-2, MW-3, MW-5s/d, and MW-6). Topsoil is generally described as loose fine sand, silt, and clay, with some organics. Generally, the soil material was moist to dry, and brown in colour.

Clayey Silt Till (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). This unit is generally described as very stiff brown clayey silt to silty clay till with some sand and gravel. The thickness of this unit ranged from 0.8 m (BH-2) to 6.72 m (BH-4).

Fine to Medium Sand and Silt (Oak Ridges Moraine and Equivalent): A laterally extensive unit of fine and medium sand and silt with some clay was encountered in all boreholes. The thickness ranged between 0.79 m (MW-2) to 8.2 m (MW-5). Note that the lower extent of the unit could not be determined at MW-8 as the depth of the borehole did not exceed the depth of the silt and fine sand. The ORM sediments were encountered directly under either the topsoil sediments or less than 1 m of Halton Till at MW2s/d, BH-2. MW-3, and MW-4.

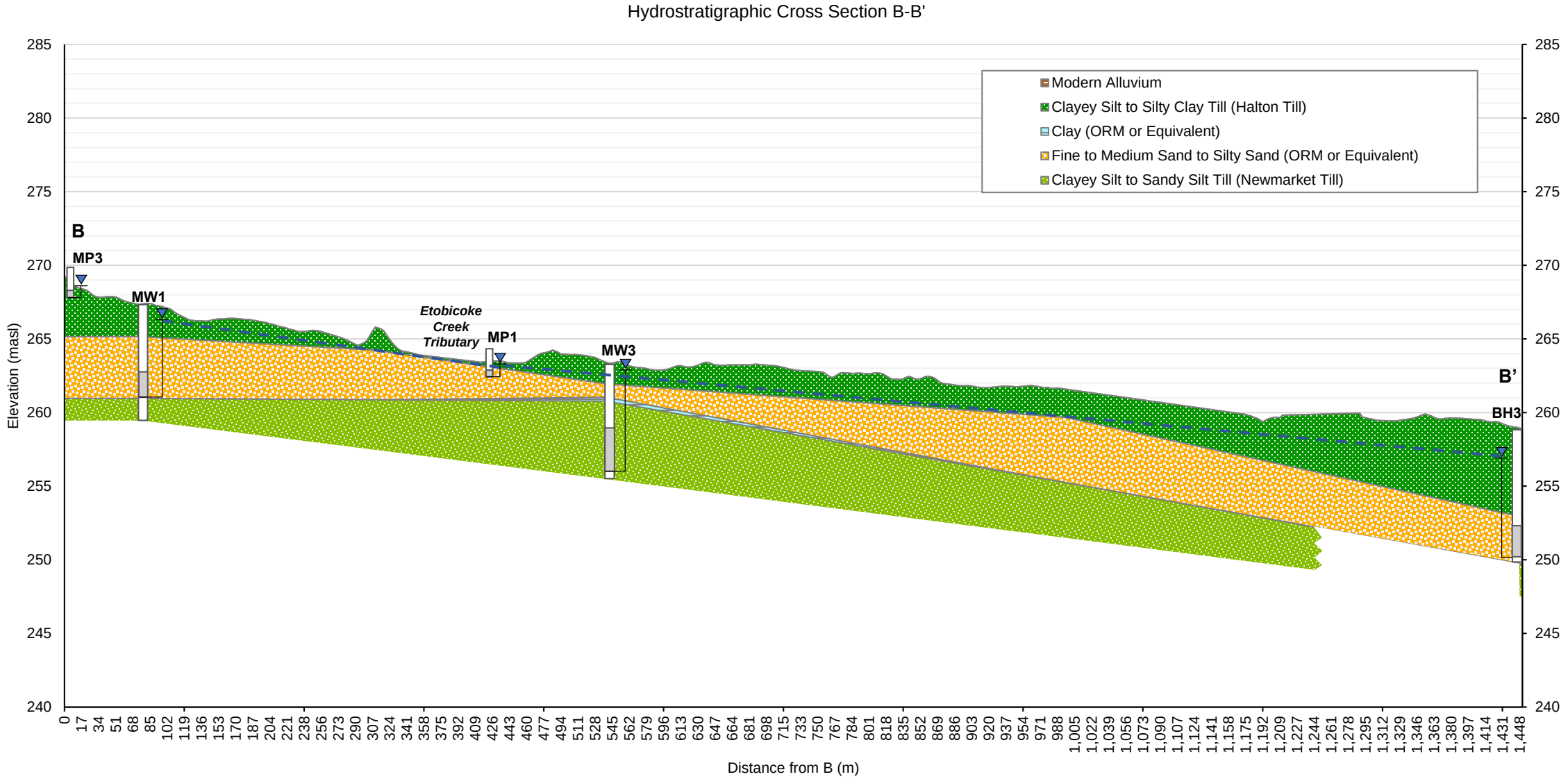
Clay: Layers of fine-textured glaciolacustrine clay was noted either underlying or overlying the ORM sediments at MW-2s/d, MW-3, MW-4, MW-5s/d and MW-7s/d. The thickness of the clay layers ranged from 0.26 m (MW-3) to 1.88 m (MW-4).

Sandy Silt to Silty Sand Till (Newmarket Till): A lower till unit, interpreted to be the Newmarket Till Formation was encountered in all boreholes with the exception of MW-8, BH-1, BH-2, and BH-3. This unit is generally described as red/brown silty clay to sandy silt till with some sand, gravel, and cobbles. A 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 surface ranged from 2.6 mbgs (MW-2s/d) to 11.73 mbgs (MW-5s/d). All boreholes where the Newmarket Till was encountered were terminated within this unit.



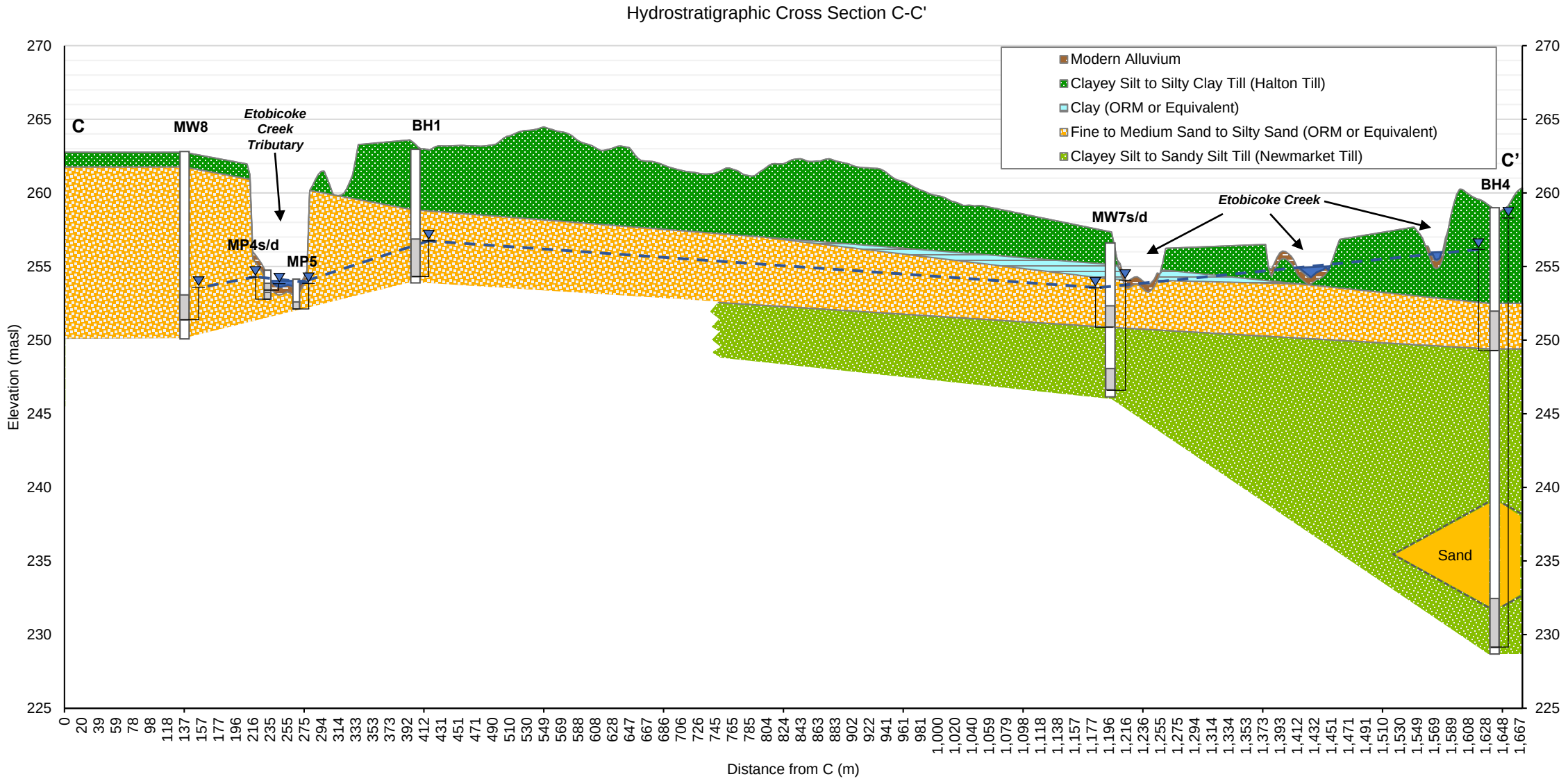
Hydrostratigraphic Fence Diagram A-A'
Mayfield West Phase 2 Stage 3

FIGURE 7
Project Number: 1701616



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

FIGURE 8
Project Number: 1701616



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

FIGURE 9
Project Number: 1701616

3.2 Groundwater Level and Flow

Within the study area, groundwater levels were monitored by Palmer staff for a period between October 2017 and April 2019, with an additional monitoring event completed in May 2022 to provide updated spring 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 2**. Generally, these results indicate shallow groundwater depths ranging between 0.06 mbgs (MW-3) and 9.08 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 spring of 2022 were mostly found to be within previously reported and manually measured data. Groundwater levels at MW-3 were found -0.15 mbgs or 0.15 metres above ground surface (mags) in April 2019, while the deepest groundwater level observed remains 9.08 (MW-8).

Deeper vertical groundwater movement at the site is hydraulically influenced by the higher permeability sand and silt soils of the ORM, 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 ORM and the Newmarket Till units, respectively. The upwards gradient suggests groundwater flowing from the Newmarket Till towards the higher permeability ORM. 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 ORM 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 ORM Aquifer, it is expected that groundwater will flow laterally towards groundwater discharge areas. 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.

It is expected that regional groundwater flow within the site is ultimately directed to the southeast towards Lake Ontario.

Table 2. Groundwater Level Monitoring Data

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	0.8	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	4.585	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	9.055	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	5.845	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	-	-	-	-	-	-	-	-	-	-	-

** Note: April 23, 2009 – October 22, 2009 groundwater levels were reported by AMEC (2010).*

3.3 Hydraulic Conductivity

3.3.1 In-situ Hydraulic Testing

Palmer personnel conducted single well response tests at each monitoring well on a series of dates, December 5 and 6, 2017, January 10, 2018, and February 26, 2018, 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 (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. 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 3**.

3.3.2 Grain Size Analysis

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 is provided in **Table 3**.

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 $2.25x10^{-6}$ m/sec (BH-2) and are provided in **Table 3**.

Table 3. Hydraulic Conductivity Results

Well	Test Type	Aquifer Type	Solution Method	Hydraulic Conductivity (m/sec)	Aquifer Material	K Geometric Mean (m/sec)
BH-1	Grain Size	-	Puckett	$5.3x10^{-8}$	**Halton Till**	$5.3x10^{-8}$
MW-1	Slug – FH	Confined	Hvorslev	$1.3x10^{-6}$	**ORM (or equivalent)**	$3.8x10^{-6}$
	Slug – RH			$1.0x10^{-6}$		
MW-4	Slug – FH	Unconfined	Bower and Rice	$1.4x10^{-5}$		
	Slug – RH			$6.1x10^{-6}$		
MW-5s	Injection 1	Unconfined	Bower and Rice	$1.9x10^{-6}$		
	Injection 2			$2.3x10^{-6}$		
MW-5d	Slug – FH	Unconfined	Bower and Rice	$9.9x10^{-7}$		
	Slug – RH			$1.9x10^{-6}$		
MW-6	Slug – FH	Confined	Hvorslev	$6.4x10^{-6}$		
	Slug – RH			$9.9x10^{-6}$		
MW-7s	Slug – FH	Unconfined	Bower and Rice	$5.2x10^{-6}$		
MW-8	Injection 1	Unconfined	Bower and Rice	$2.8x10^{-5}$		
	Injection 2			$3.0x10^{-5}$		
BH-2	Grain Size		Hazen	$2.3x10^{-6}$		
MW-2s	Slug – FH	Confined	Hvorslev	$1.3x10^{-6}$	**Sand/ Gravel Layer within Newmarket Till Complex**	$1.2x10^{-6}$
	Slug – RH			$6.3x10^{-7}$		
BH-4	Grain Size	-	Hazen	$2.0x10^{-6}$		
MW-2d	Slug – FH	Confined	Hvorslev	$5.1x10^{-7}$	**Newmarket Till**	$3.9x10^{-7}$
	Slug – RH			$5.1x10^{-7}$		
MW3	Slug – FH	Confined	Hvorslev	$4.6x10^{-7}$		
	Slug – RH			$3.4x10^{-7}$		
MW-7d	Slug – FH	Confined	Hvorslev	$4.3x10^{-7}$		
BH-5	Grain Size	-	Hazen	$1.0x10^{-7}$		
BH-6	Grain Size	-	Puckett	$8.4x10^{-7}$		

Based on the results of the single well response testing and grain size analyses, the geometric mean hydraulic conductivity of the Halton Till is approximately $5.3x10^{-8}$ m/sec, the ORM is approximately $3.8x10^{-6}$ m/sec, and the Newmarket Till is approximately $3.9x10^{-7}$ 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/d 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 $1.2x10^{-6}$ 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), $3x10^{-6}$ to $7x10^{-3}$ m/sec for ORM 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 ORM 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.

3.4 Groundwater Chemistry

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 4**, 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 4. Groundwater Chemistry Results from MW6

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
Cadmium (Cd)	mg/L	0.000050	0.005	-	<0.0000050
Calcium (Ca)	mg/L	5.0	-	-	73.9

Parameter	Units	Detection Limit	ODWS		Sample Concentration
			Microbiological and Chemical Standards	Aesthetic and Operational Guidelines	MW6
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

Analytical result for this parameter exceeds Guideline Limit for Aesthetic and Operational ODWS

3.5 Natural Features

3.5.1 Surface Water

The study area lies within the Etobicoke Creek Headwaters Subwatershed, where Etobicoke Creek first appears as many small tributaries, 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 appears 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 Mayfield West Phase 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 Highway 410 just south of the site boundary. The main branches are characterized by permanently flowing channels situated within a relatively defined valley setting. Several tributaries to Etobicoke Creek are also present throughout the site which are headwaters to the creek. These tributaries are characterized as undefined drainage features which are primarily surface water supported.

3.5.2 Groundwater / Surface Water Interactions

Identified wetlands, and portions of Etobicoke Creek and its tributaries were instrumented with shallow mini-piezometers 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 9 mini-piezometers (MP-1 – MP9) were installed at the locations shown on **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, MP-7, and MP-9). 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 over a period of ~18 months from late October 2017 to mid-April 2019. An additional visit was conducted in May 2022 to ensure that current water levels continue to be within 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 5**.

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 6**. 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 6**.

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. 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. Additionally, the hydraulic gradients were generally neutral to slightly positive indicating that this portion of the tributary is

likely intermittent and may receive some seasonal groundwater discharge. Lastly, the tributary near Hurontario Street (MP-8) had surface water present through the full monitoring period, and the hydraulic gradients were +0.45 on February 26, 2018, +0.16 on May 17, 2018, and +0.22 on August 27, 2018, indicating the presence of seasonal groundwater discharge.

Within the main branch (MP-7 and MP-9), preliminary results indicate a permanent flow regime. Surface water levels were always present, though certain measurements do not indicate it as the water level elevation had dropped below the elevation of the MP. When measured, water levels ranged from 0.02 mags (MP-7) to 0.35 mags (MP-9). The hydraulic gradients measured at MP-9 fluctuate from negative to positive through the year suggesting seasonal groundwater recharge and discharge, whereas at MP-7 the gradients are positive indicating groundwater discharge. This assessment corresponds with the presence of the confined to unconfined ORM Formation present throughout the site, that is likely intercepted by Etobicoke Creek within the valleylands and shown on the cross-sections (**Figure 3, 4** and **5**)

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 always present ranging from 0.36 mags (June 2018) to 0.63 mags (August 2018), and hydraulic gradients in the deep mini-piezometer were positive ranging from +0.09 (August 2018) to +0.21 (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 0.21 mags (December 2017), 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 D. 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. MP4D still had a water level close to ground surface consistent with the expected upwards hydraulic gradient at this location. In addition, during the May 2022 monitoring, MP1 and MP5 were unable to be located and MP7 and MP8, some were found damaged. 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.

Surface water flow was generally absent in the winter months as the tributaries were either dry or frozen over (**Table 6**). 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 5. MP Manual Monitoring Data

MP ID	Location	Measurement	Water Level (*meters below ground surface*)										
			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
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	-
		SW	dry	dry	-0.225	-0.045	-0.105	dry	dry	dry	dry	-0.205	-
		Gradient	**-**	**-**	***0.02***	***-0.13***	***-0.01***	**-**	**-**	**-**	**-**	***-0.07***	**-**
MP-2	Marsh Wetland	GW	dry	0.49	0	0.76	0	dry	dry	dry	0.75	0.08	0.22
		SW	dry	dry	-0.07	dry	-0.02	dry	dry	dry	dry	0.02	dry
		Gradient	**-**	**-**	***-0.09***	**-**	***-0.03***	**-**	**-**	**-**	**-**	***-0.09***	**-**
MP-3	Tributary	GW	0.94	0.89	-0.36	-0.04	-0.02	0.32	0.53	0.42	0.99	-0.28	-0.25
		SW	dry	dry	-0.36	-0.16	0.07	dry	dry	dry	dry	-0.35	-0.25
		Gradient	**-**	**-**	***0.00***	***-0.12***	***0.09***	**-**	**-**	**-**	**-**	***-0.07***	***0.04***
MP-4s	Etobicoke Creek/ 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
		SW	-0.12	-0.06	-0.26	-0.19	-0.32	-0.05	-0.15	-0.33	-0.15	-0.48	dry
		Gradient	***0.00***	***0.03***	***0.00***	***0.03***	***-0.06***	***-0.03***	***0***	***0.02***	***0.24***	***0.94***	**-**
MP-4d	Etobicoke Creek/ Shallow Aquatic Wetland	GW	-0.365	-0.425	-0.695	-0.675	-0.725	-0.545	-0.59	-0.715	-0.525	-0.835	-0.02
		SW	-0.405	-0.425	-0.575	-0.525	-0.605	-0.355	-0.455	-0.63	-0.455	-0.815	dry
		Gradient	***-0.04***	***0.00***	***0.13***	***0.17***	***0.13***	***0.21***	***0.15***	***0.09***	***0.13***	***0.11***	**-**
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	-
		SW	-0.205	-0.165	-0.035	-0.005	0.025	dry	dry	-0.1	-0.345	-0.025	-
		Gradient	***0.00***	***-0.05***	***0.08***	***-0.18***	***-0.06***	**-**	**-**	***-0.01***	***0.06***	***0.00***	**-**
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	-0.04
		SW	-0.06	dry	-0.16	0.04	-0.09	dry	dry	-0.05	-0.05	-0.16	-0.01
		Gradient	***0.01***	**-**	***0.04***	***0***	***0.03***	**-**	**-**	***0.03***	***-0.01***	***-0.07***	***0.03***
MP-7	Etobicoke Creek	GW	-0.12	-0.11	-0.44	-0.09	-0.65	-0.42	-0.3	-0.26	-0.19	-0.02	damaged
		SW	-0.12	-0.11	-0.27	0	0	dry	dry	0.02	-0.11	-0.2	
		Gradient	***0.00***	***0.00***	***0.18***	***0.10***	***0.71***	**-**	**-**	***0.30***	***0.10***	***-0.18***	
MP-8	Tributary	GW	-0.115	-0.115	-0.645	0.005	-0.285	-0.265	-0.185	-0.285	-0.215	0.195	damaged
		SW	-0.105	-0.135	-0.185	-0.055	-0.125	dry	dry	-0.06	-0.11	-0.205	
		Gradient	***0.01***	***-0.02***	***0.45***	***-0.06***	***0.16***	**-**	**-**	***0.22***	***0.10***	***-0.40***	
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	0.48
		SW	-0.06	-0.23	-0.35	-0.04	-0.11	-0.1	dry	-0.035	-0.08	-0.36	dry
		Gradient	***0.06***	***-0.04***	***-0.07***	***-0.10***	***0.07***	***0***	***0.05***	***0.11***	***0.09***	***0.10***	**-**

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 6. 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-18	16-Apr-19	25-May-22
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

4.1 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 7**). 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 was then calculated by multiplying the appropriate water surplus value by the sum of the three individual factors.

Table 7. 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
ORM 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	0.1
Anthropogenic (rural residential)	0.1
Roads	0.0
Natural Heritage Features	0.3
PRE-DEVELOPMENT LAND COVER	
Agricultural	0.45
Anthropogenic (rural residential)	0.35
Roads	0.00
Natural Heritage Features	0.75

4.2 Site Wide Water Budget

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 8**). The calculated PET for the study area is 594 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 8. 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. Given the results of the ELC study there is also a variety of vegetation factors for each ELC. **Table 9** 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 7**.

Table 9. Infiltration Factors for the Site Pre-Development

Land use (ELC)	Area (ha)	Vegetation Factor	Soil Factor	Slope Factor	Infiltration Factor	Run off Factor
Agricultural	253.3	0.1	0.1 - 0.15	0.15 – 0.20	0.45	0.55
Anthropogenic	22.9	0.1	0.1	0.15	0.35	0.65
Roads	4.4	-	-	-	0.00	1.00
Natural Heritage Features	149.4	0.3	0.2 - 0.4	0.05 – 0.15	0.75	0.25

Using the method in the MOE SWM manual and MOEE (1995) for guidance, it is estimated that approximately 54% (181 mm/yr) of the surplus runs off, and the remaining 46% (152 mm/year) infiltrates. Based on a site area of 430 ha, it is estimated that 652,390 m^3/yr of precipitation infiltrates and 778,232 m^3/yr runs off. Results are summarized in **Table 10**. Eventually, this runoff may either enter the local creeks or recharge the local groundwater system.

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 facilities, natural heritage system (NHS) and Greenbelt Lands. The post-development water balance is presented in **Table 11**.

In the absence of mitigation measures, it is estimated that post-development, 616,436 m^3/yr of precipitation will infiltrate and 1,328,407 m^3/yr of precipitation will run off within the MW2-3 area. This represents a decrease in infiltration of 6% or 35,954 m^3/yr. The overall change in pre-to-post development infiltration has been buffered by the change from agricultural land use to Greenbelt over 64.9 ha of MW2-3 area. Over time, this large land area is expected to naturalize which will reduce runoff and increase recharge over the existing condition. This change has off set some of the infiltration losses from residential development and has been accounted for in the pre-to-post development water budget.

Table 10. Pre-Development Water Balance Results

Land Use	Area (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	253.3	0.00	0.00	0.790	0	253.30	0.318	0.65	522,858	0.35	281,539	522,858	281,539
Anthropogenic	22.9	0.41	9.39	0.790	74,133	13.51	0.318	0.65	27,889	0.35	15,017	102,022	15,017
Roads	4.4	1.00	4.40	0.790	34,741	0.00	0.318	0.75	0	0.25	0	34,741	0
Natural Heritage Features	149.4	0.00	0.00	0.790	0	149.40	0.318	0.25	118,611	0.75	355,834	118,611	355,834
Total	**430.0**		**13.79**		**108,874**	**416.21**		**0.51**	**669,358**	**0.49**	**652,390**	**778,232**	**652,390**

Table 11. Post-Development Water Balance Results

Land Use	Area (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	60.4	1.00	60.40	0.790	476,900	0.00	0.318	0.65	0	0.35	0	476,900	0
Stormwater Management Facilities	15.1	0.50	7.55	0.790	59,613	7.55	0.318	0.65	15,585	0.35	8,392	75,197	8,392
Parkland and Recreation Facilities	14.6	0.07	1.02	0.790	8,069	13.58	0.318	0.65	28,027	0.35	15,092	36,097	15,092
Schools	5.6	0.43	2.41	0.790	19,013	3.19	0.318	0.65	6,589	0.35	3,548	25,602	3,548
Commercial	8.2	0.44	3.61	0.790	28,488	4.59	0.318	0.65	10,652	0.35	5,104	39,139	5,104
Residential	104.0	0.42	43.68	0.790	344,884	60.32	0.318	0.65	135,576	0.35	67,045	480,460	67,045
Future Trail (Railway Corridor)	7.7	0.20	1.54	0.790	12,159	6.16	0.318	0.65	12,715	0.35	6,847	24,875	6,847
Greenbelt Lands	165.5	0.00	0.00	0.790	0.00	165.50	0.318	0.25	131,393	0.75	394,180	131,393	394,180
Natural Heritage System	48.8	0.00	0.00	0.790	0.00	48.80	0.318	0.25	38,743	0.75	116,229	38,743	116,229
Total	**430.0**		**120.21**		**949,126**	**309.69**		**0.45**	**379,281**	**0.55**	**616,436**	**1,328,407**	**616,436**

5. Development Considerations

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 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 and 9.14 mbgs within the ORM sand and silt deposits, and between approximately 0.06 mbgs and 4.47 mbgs 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 north 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 ORM and alluvial soil deposits at surface, as well as a very deep water table (approximately 4.29 – 9.14 m below ground). A wide variety of infiltration-based LIDs, such as infiltration chambers (i.e., clean water collection systems), infiltration galleries, trenches or soakaway pits, 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 Groundwater Recharge and Discharge

5.2.1 Groundwater Recharge and Discharge

While the study area is predominantly underlain by low permeability aquitard materials, it still functions as a groundwater recharge area, albeit limited by the surficial soils. Over the majority of the site, the ORM aquifer is present below the Halton Till, which acts as a groundwater recharge feature and discharge feature depending upon the specific location in the MW2-3 area. In addition, long-term groundwater monitoring data that shows a wide range of groundwater level but generally, little seasonal and temporal change in groundwater levels at each well location.

The area with highest infiltration potential is found along the Etobicoke Creek valley, which is part of the protected Greenbelt Lands and Natural Heritage System. These lands will remain undeveloped, and naturalization of the greenbelt lands will over time be expected to increase the recharge function of this area.

Due to the low permeability Halton Till aquitard at surface, the dominant groundwater flow direction in the study area is downwards towards deeper aquifers. Near breaks in slope, shallow groundwater flow generally follows topography, and flows towards rivers and topographic lows. Lateral groundwater flow over the majority of the study area is towards the Etobicoke Creek valleylands. Many areas where the ORM aquifer intercepts Etobicoke Creek, its tributaries or valley wetlands, the features are supported by groundwater support discharge and baseflow. Maintaining groundwater recharge on tableland areas that directly contribute to groundwater discharge to these features should be the focus of LID measures and future SWM design.

5.3 Aquifers and Groundwater Users

The ORM aquifer 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 ORM aquifer 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 Groundwater Supported Natural Features

As presented in Cross Section in **Figures 7, 8** and **9**, Etobicoke Creek, its tributaries and valley wetlands are interpreted to be supported by groundwater discharge from the ORM aquifer where the valleylands 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.

6. 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 south towards Lake Ontario. Small tributaries leading to the creek are also present through the site.

- 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 $5.3x10^{-8}$ m/sec, the underlying ORM aquifer is approximately 3.8x10-6 m/sec, and the Newmarket Till is approximately $3.9x10^{-7}$ 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 $1.2x10^{-6}$ 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 and April 2019, with an additional monitoring event completed in May 2022 to provide updated spring water level data. Generally, these results indicate shallow groundwater depths ranging between 0.06 mbgs (MW-3) and 9.08 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.

- 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 indicates a permanent flow regime, and seasonal to continual groundwater

discharge. Results suggest that the tributaries to the creek can be characterized as ephemeral/intermittent, and the main branch is permanent.

- 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 54% (181 mm/yr) of the surplus runs off, and the remaining 46% (152 mm/year) infiltrates. Based on a site area of 430 ha, it is estimated that 652,390 m^3/yr of precipitation infiltrates and 778,232 m^3/yr runs off. Development will change the infiltration factors of the site. Planned changes to the landscape will increase the impervious area from 13.79 ha to 120.21 ha and with no mitigation measures, it is estimated that post-development, 614,436 m^3/yr of precipitation will infiltrate and 1,328,407 m^3/yr of precipitation will run off within the site area. This represents a decrease of 6% 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. 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 surface (BH-2, MW-4, and MW-8).

7. Certification

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

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Appendix A

Land Use Plan: Mayfield West Phase 2 – Stage 3, Caledon (MGP, 2022)

LAND USE PLAN

Mayfield West Phase 2 - Stage 3
Caledon

LAND USE

- Mayfield West Phase 2 - Stage 3 Secondary Plan Boundary
- Low Density Residential
- Medium Density Residential
- General Commercial
- Institutional
- Open Space Policy Area
- SWM Stormwater Pond Facility
- Collector Roads
- Future Trail System
- Environmental Policy Area
- Boundary of Greenbelt Plan Area
- Elementary School

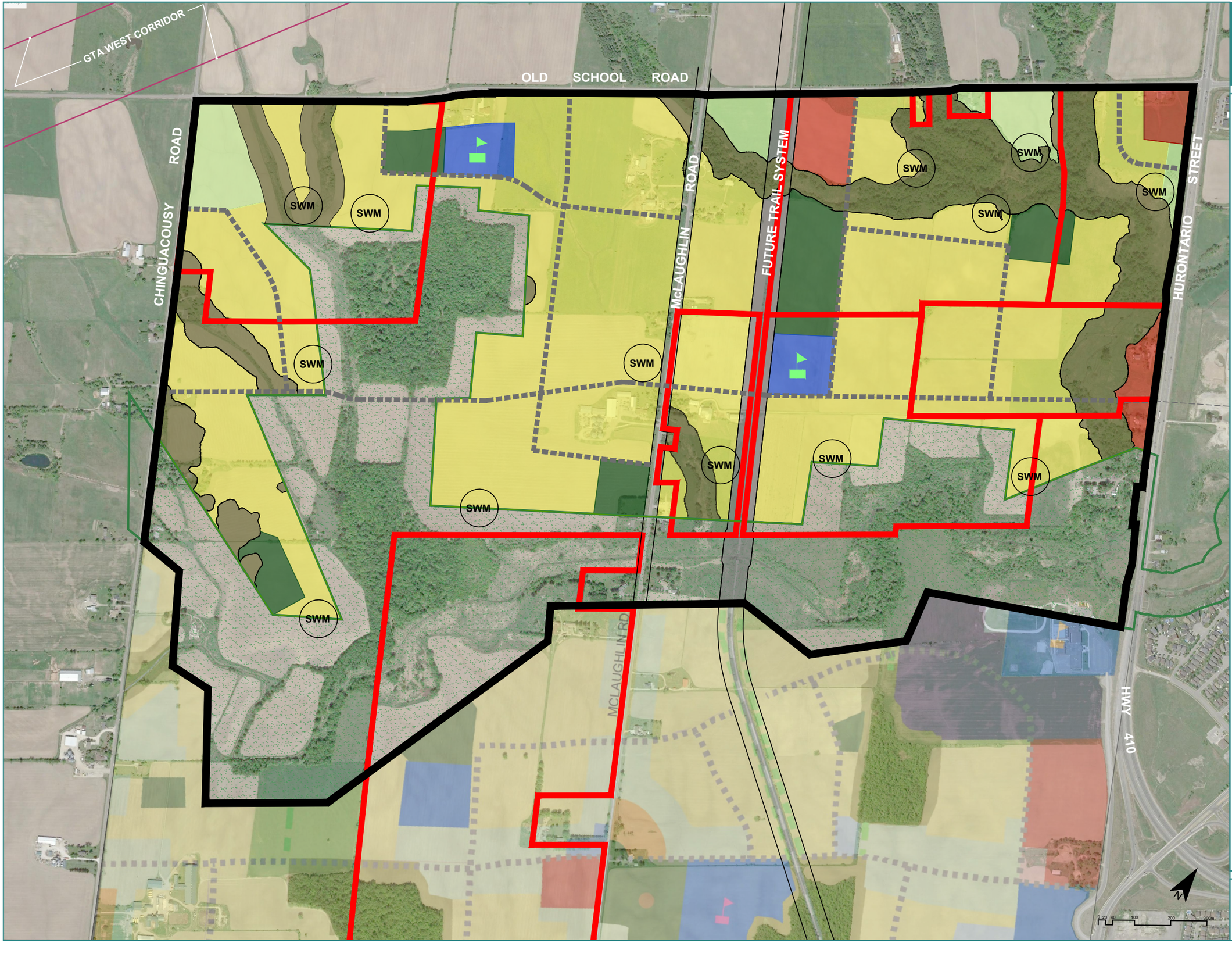
GTA WEST CORRIDOR
OLD SCHOOL ROAD
CHINGUACOUSY ROAD
McLAUGHLIN ROAD
FUTURE TRAIL SYSTEM
HURONTARIO STREET
MCLAUGHLIN RD
HWY 410
SWM
0 20 40 100 200 300m

MGP File No.: 21-3130
Date: June 30, 2022

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

LAND USE PLAN

Mayfield West Phase 2 - Stage 3
Caledon



LAND USE

- Mayfield West Phase 2 - Stage 3 Secondary Plan Boundary
- Low Density Residential
- Medium Density Residential
- General Commercial
- Institutional
- Open Space Policy Area
- SWM Stormwater Pond Facility
- Collector Roads
- Future Trail System
- Environmental Policy Area
- Boundary of Greenbelt Plan Area
- Elementary School
- Brookvalley Properties

MGP File No.: 21-3130
Date: June 30, 2022

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Appendix B

Borehole Logs and Grain Size Distributions

B1. Borehole Logs (Palmer, 2018)
B2. Borehole Logs and Grain Size (AMEC, 2010)

Appendix B1

Borehole Logs (Palmer, 2018)

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 / 261.6	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				N/A	N/A	N/A	N/A	
6.7	Silty clay till, some sand, very dense, moist, red/brown		6.4 / 260.1					
7.62				7	SS	0.279 / 0.279	83 / 0.28m	
7.9	END OF BOREHOLE AT 7.9 m		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

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
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 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	

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

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					
9.14	END OF BOREHOLE AT 9.22 m		9.22	9	SS	0.076 / 0.076	50 / 0.08	
9.75								
10.66								
11.27								
12.19								
12.8								
13.71								
14.32								
15.24								
15.84								

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

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 *1.12 m: soils turn grey*			1	SS	0.254 / 0.609	5	
0.6								
0.75				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

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		264.93	1	SS	0.330 / 0.609	8	
0.75			1.07					
1.36								
1.52				2	SS	0.330 / 0.609	9	
2.13								
2.28								
2.89								
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							
4.57				4	SS	0.609 / 0.609	23	
5.18								
6.09	*6.25 m: Grey*			5	SS	0.609 / 0.609	15	
6.7								
7.62			258.18	6	SS	0.533 / 0.609	21	
	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

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

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	Samples: Type	Sample Description: Recovery (m)	Sample Description: N-Value
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				
4.57	Silt and fine to medium sand, some clay, medium dense to dense, moist to wet, brown		3.53	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

Piezometer Installation

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

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	Samples: Type	Sample Description: Recovery (m)	Sample Description: 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	
	9.45 m - 9.50 m: Coarse sand lense, wet, grey							
9.75								
10								
10.66				10	SS	0.305 / 0.609	16	
11								
11.27								
12			248.27					
	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

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					
3.2	Fine sand and silt, some clay, very dense, wet, grey			5	SS	0.533 / 0.609	45	
3.65								
4.57	*4.97 m - 5.18: Medium to coarse sand lense*			6	SS	0.609 / 0.609	49	
5.18			257.36					
5.64	Silty clay to clayey silt till, gravel and cobbles, very dense moist, red/brown			7	SS	0.152 / 0.152	50 / 0.15	
6.09								
6.7				8	SS	0.203 / 0.229	95 / 0.23	
7.62			255.15					
	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

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			3.2	5	SS		41	
3.20 m - 4.72 m: Cohesive clay, sand, and silt layer								
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

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 B2

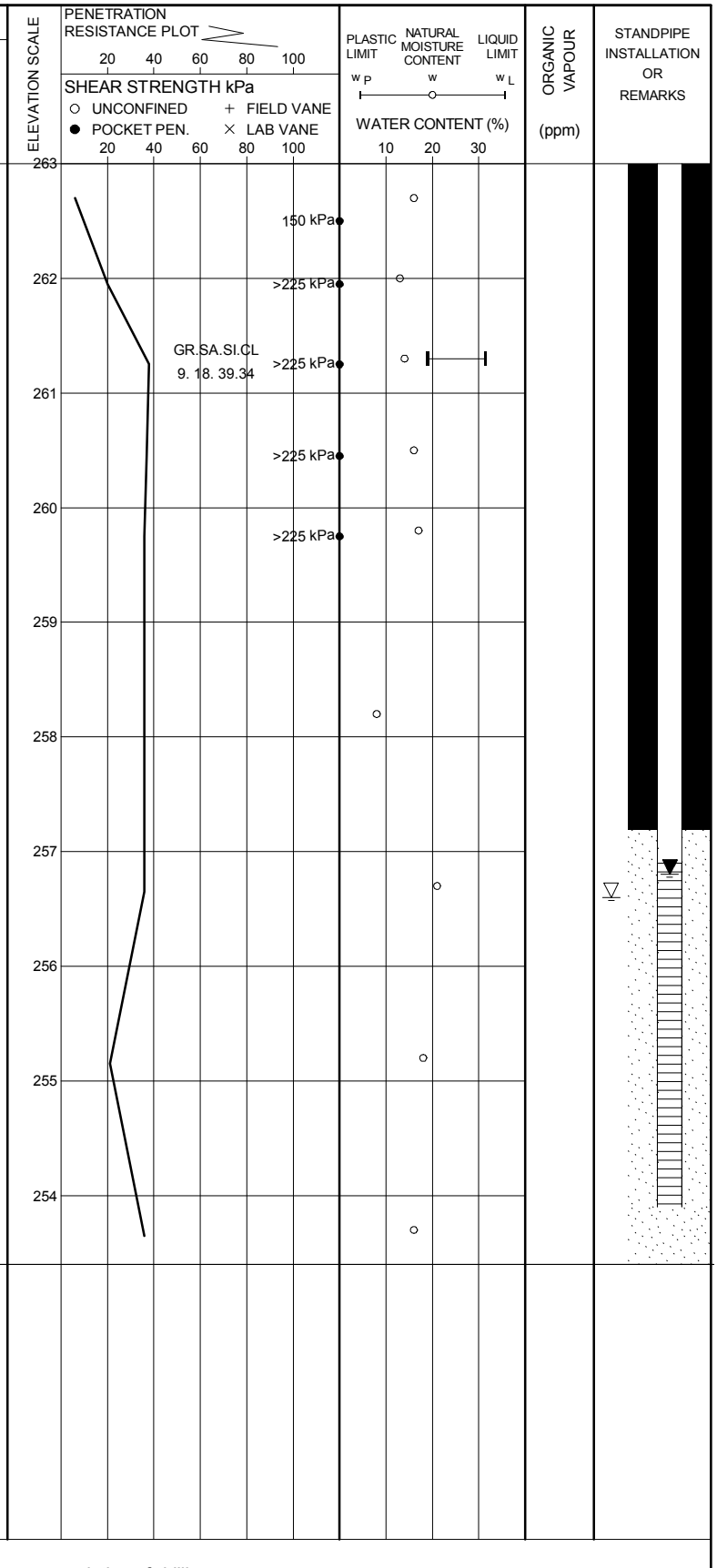
Borehole Logs and Grain Size (AMEC, 2010)

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.

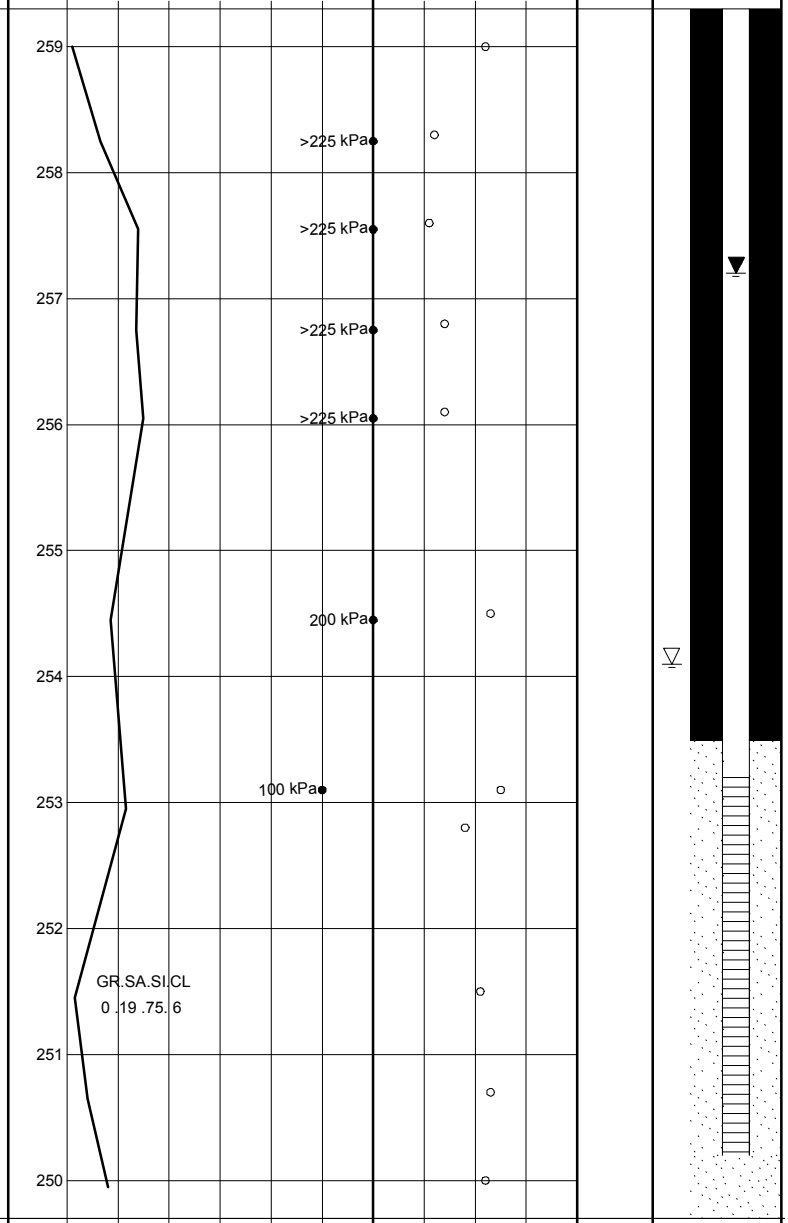
Terraprobe

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



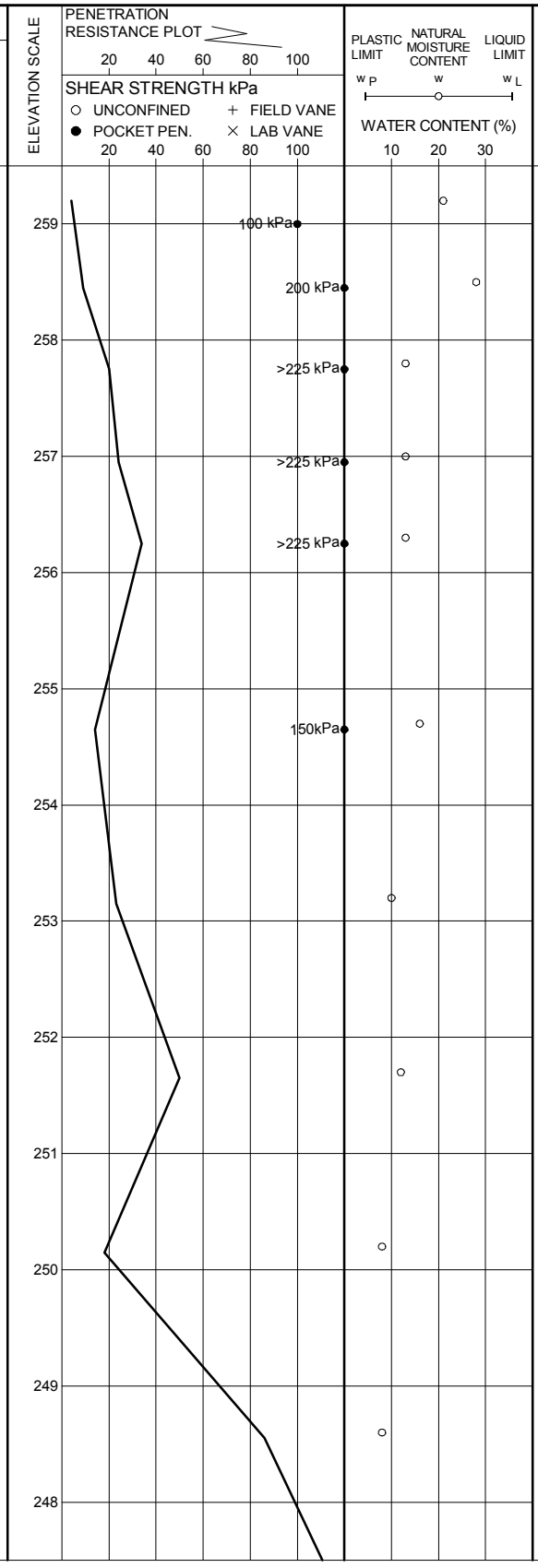
NOTES:
Borehole was caving at 5.5m and unstabilized water level at 5.2m upon completion of drilling.
Water level in monitoring well at 2.1m (Elev. 257.2m) on April 23, 2009.

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

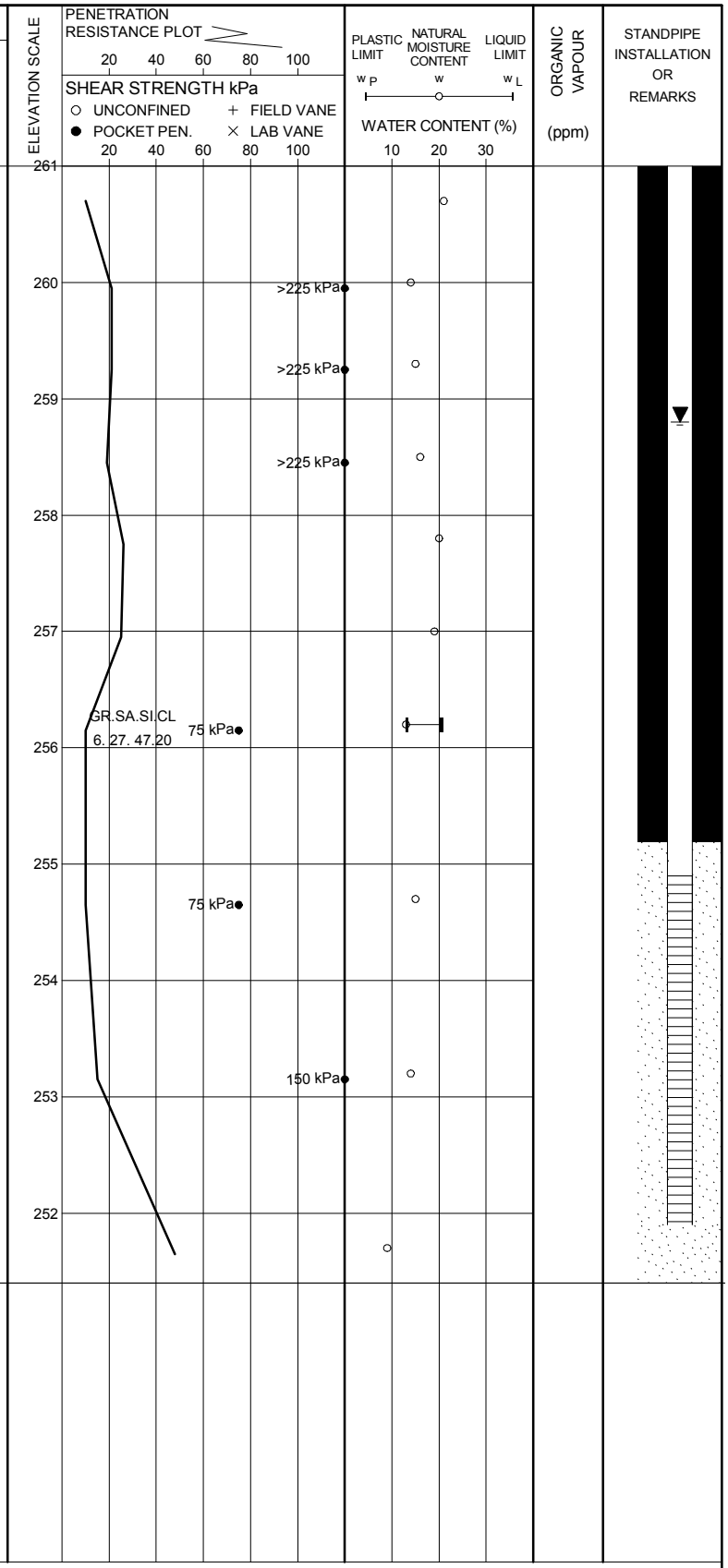
NOTES:
Borehole was caving at 8.4m and unstabilized water level at 7.6m upon completion of drilling.
Water level in monitoring well at 6.2m (Elev. 252.1m) on April 23, 2009.

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

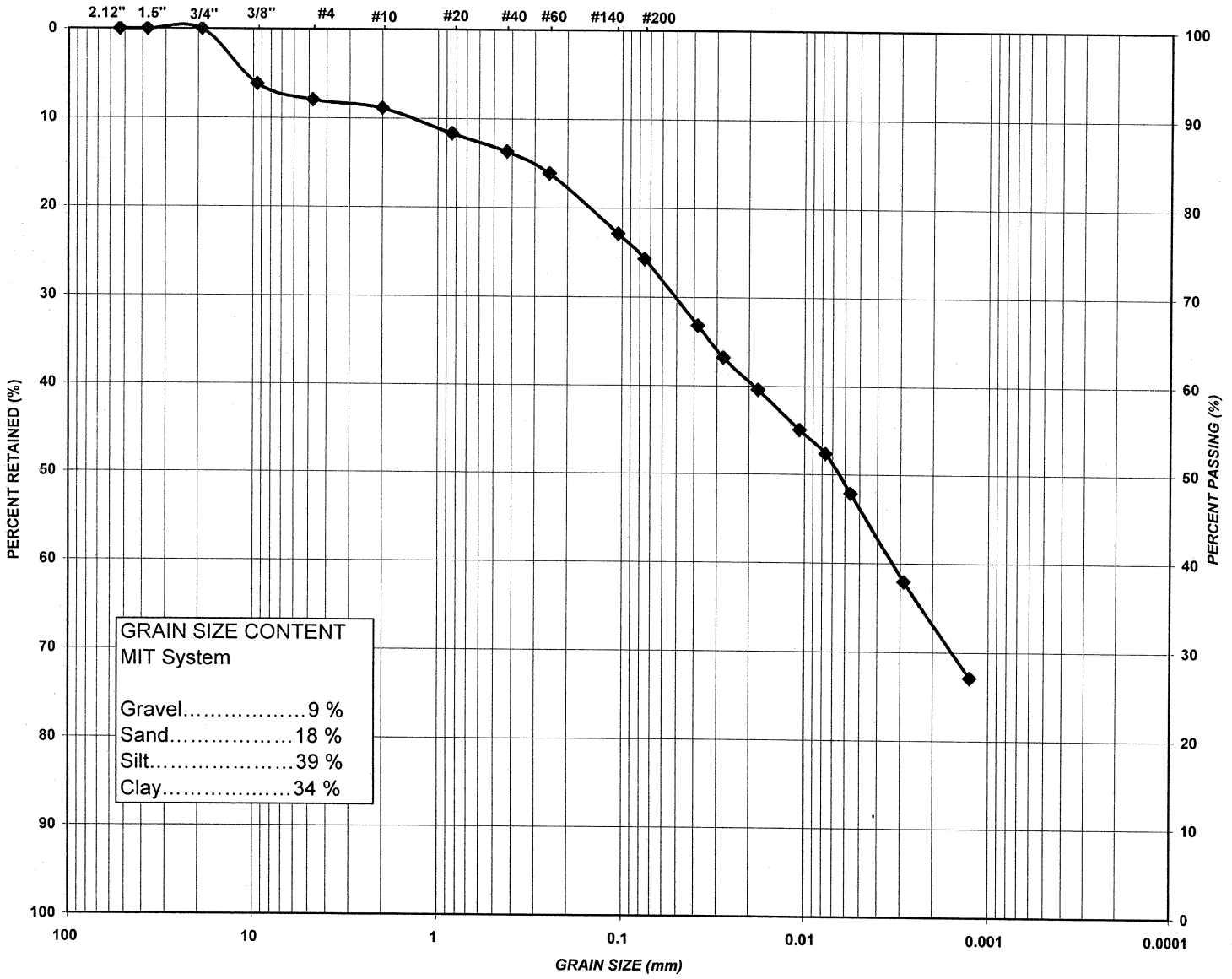
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

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

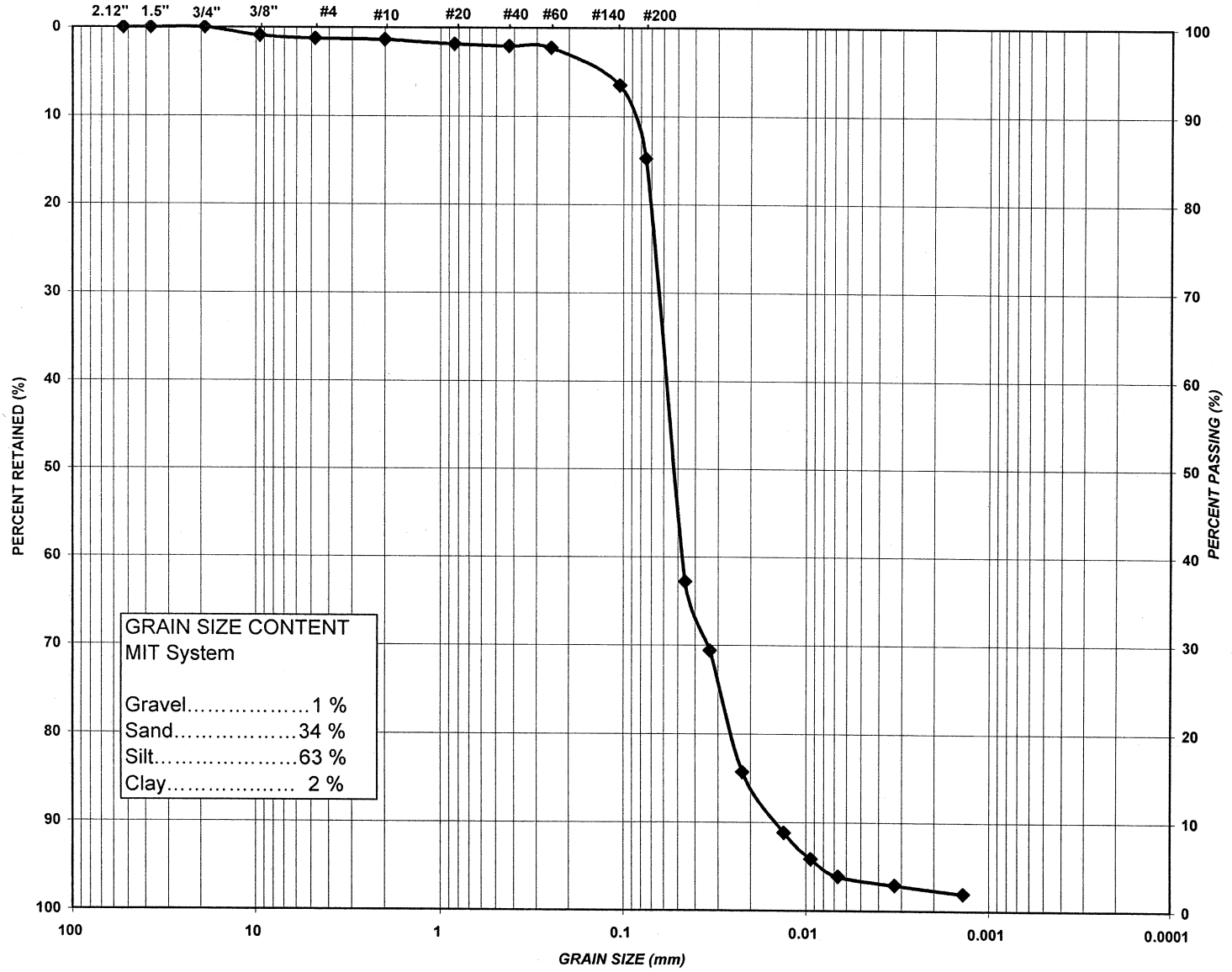
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

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

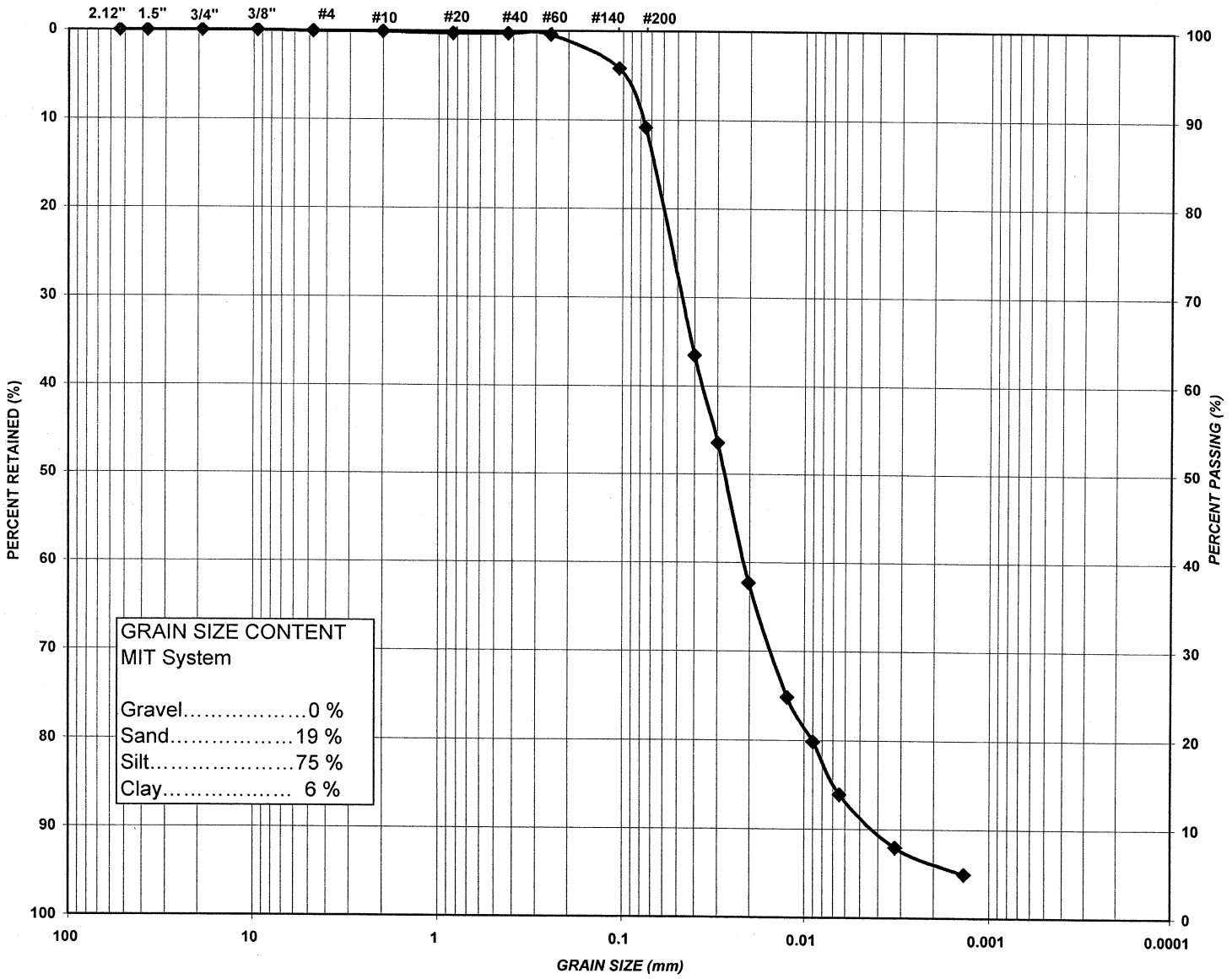
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

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

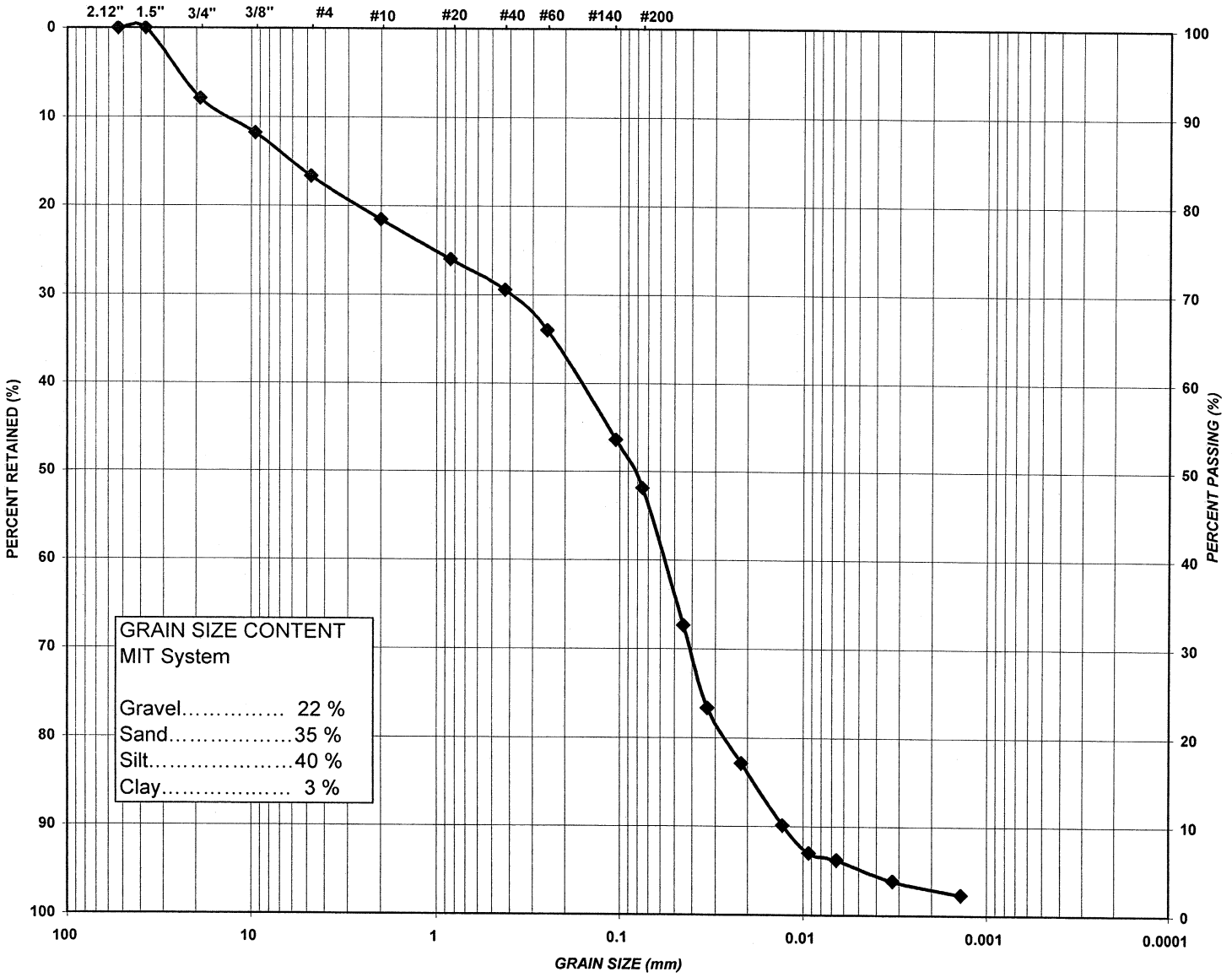
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

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

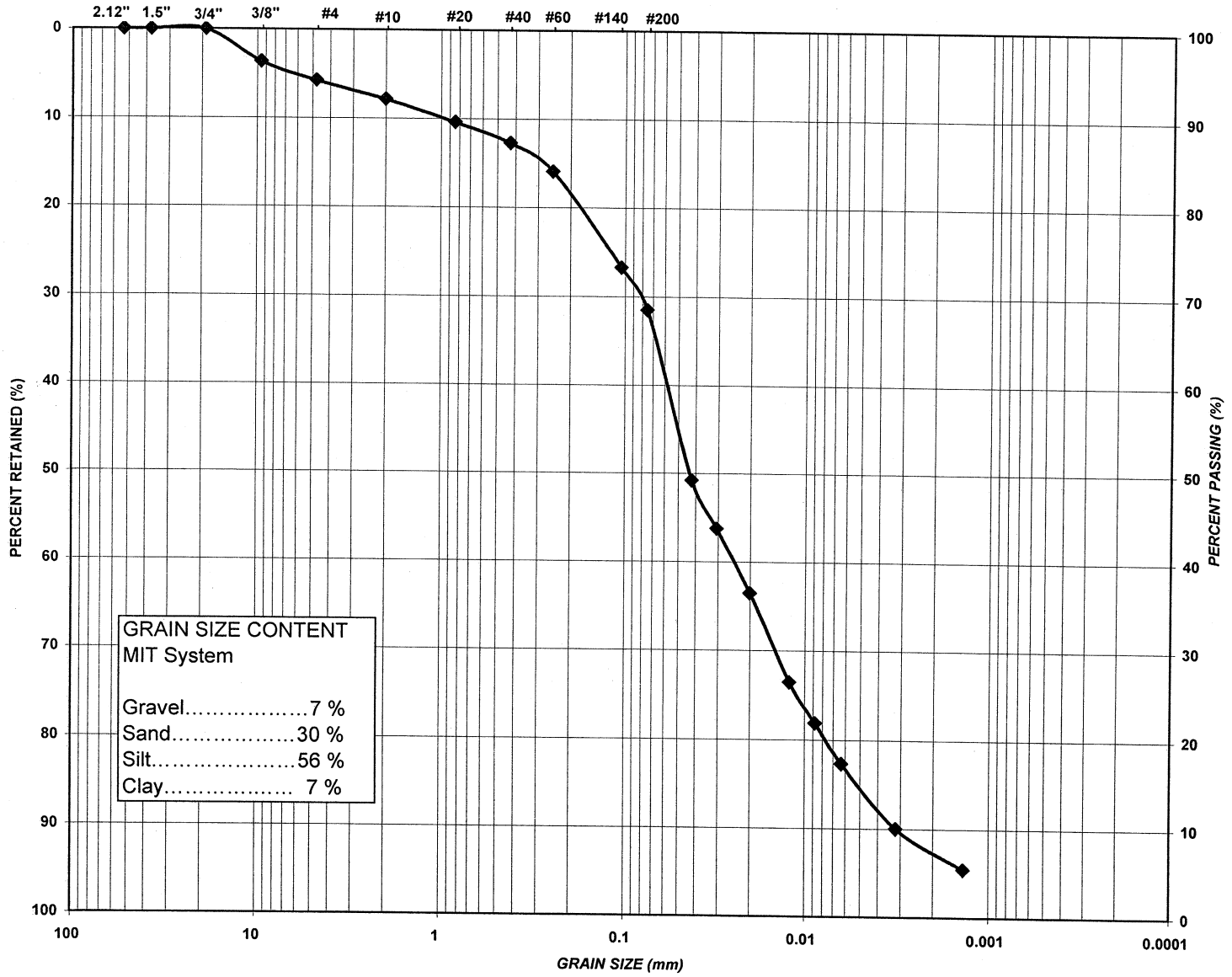
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

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

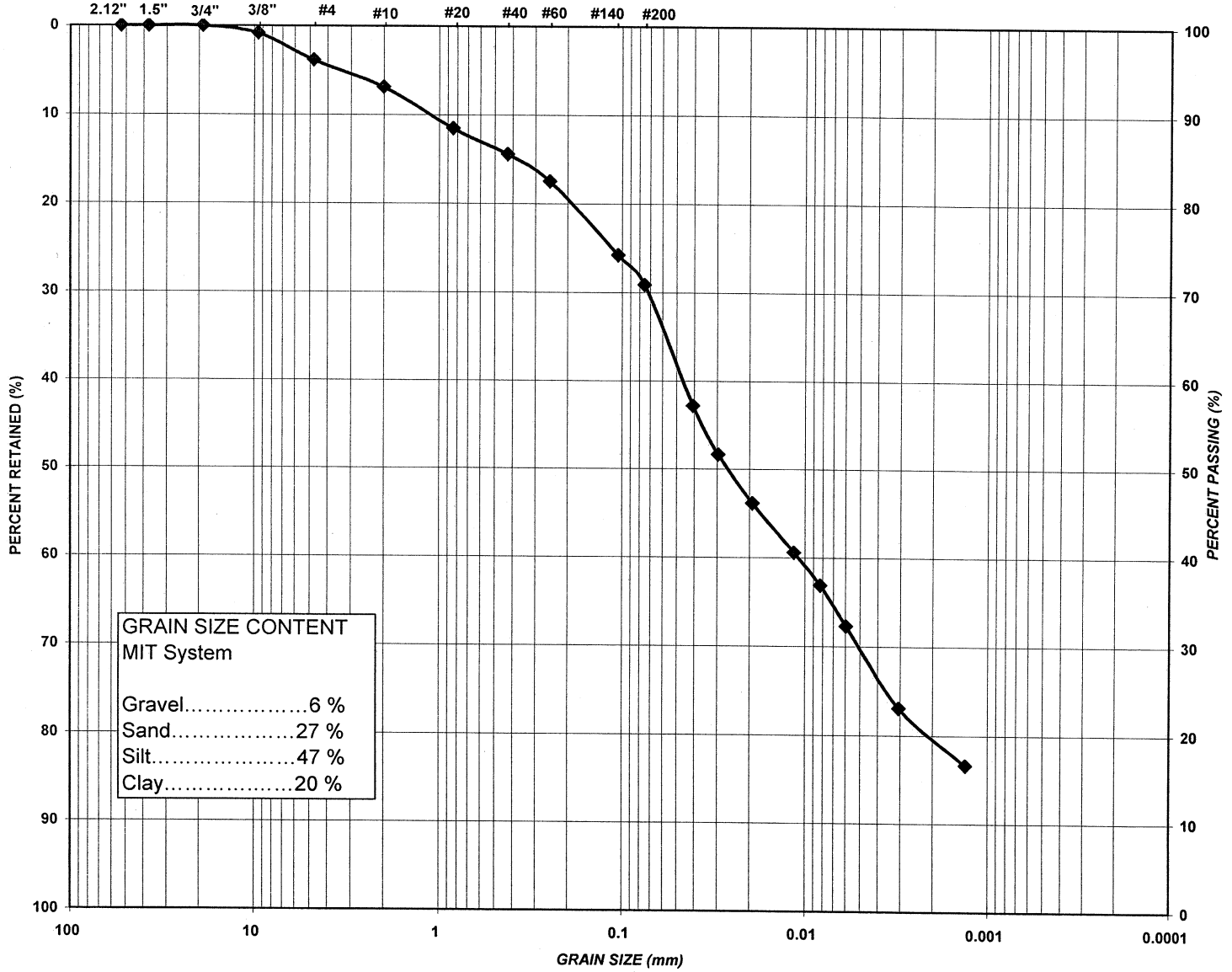
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

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

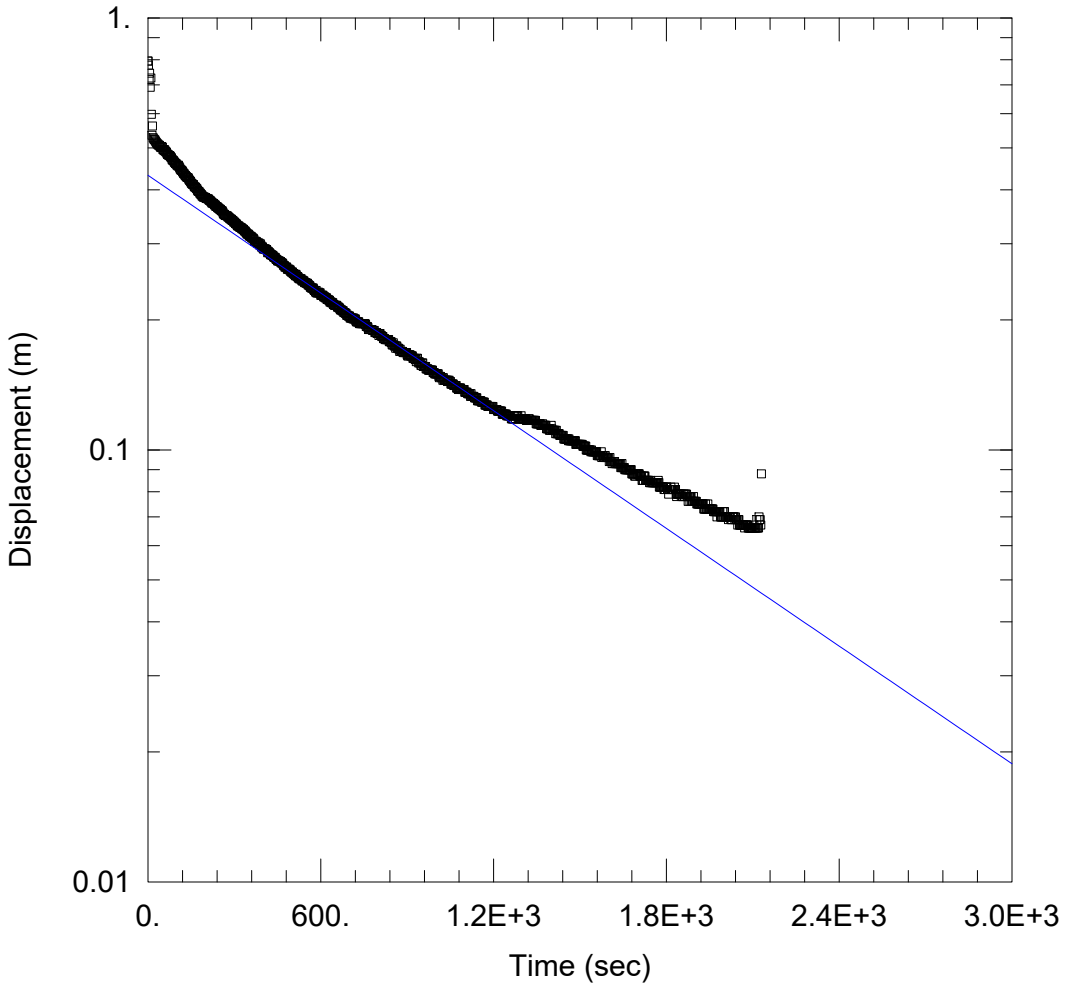
U.S. STANDARD SIEVE SIZES



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 (Aqtesolv™, 2018)



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

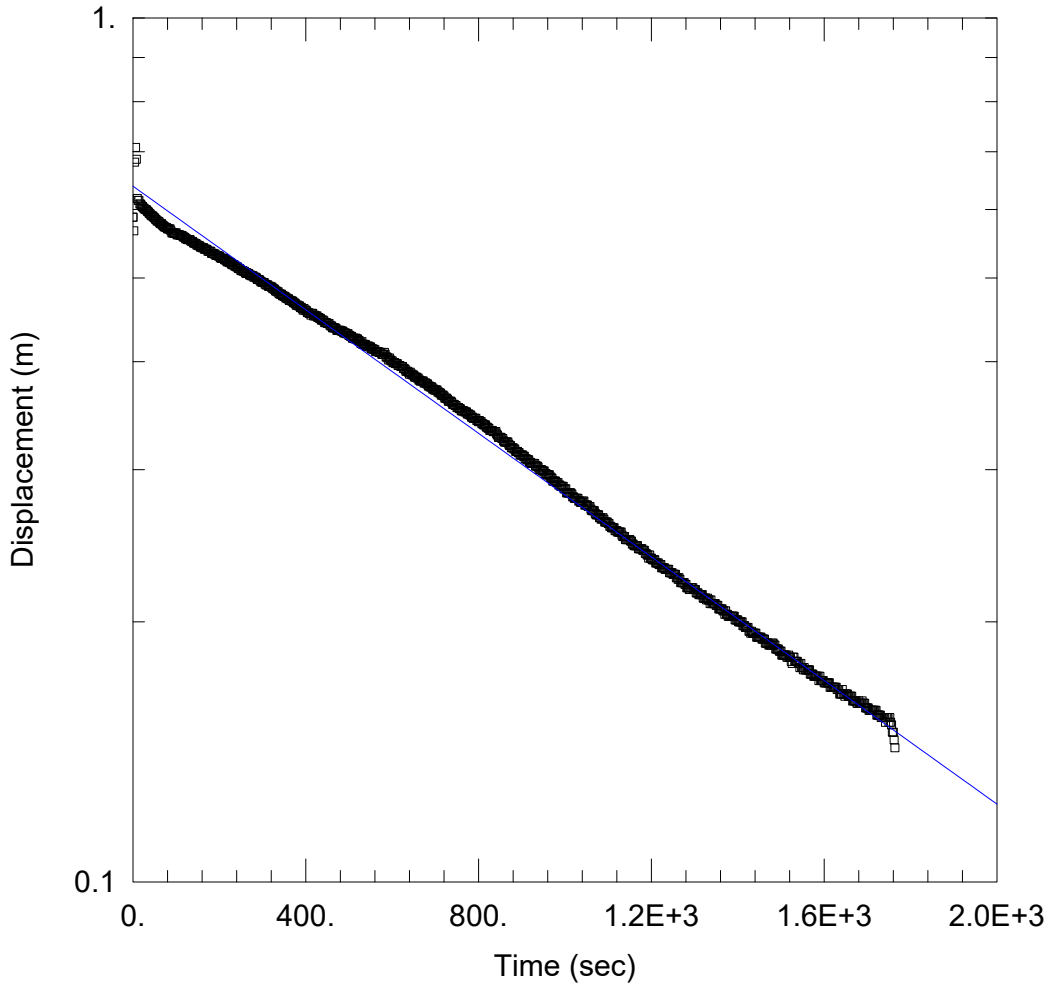
WELL DATA (MW-1)

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

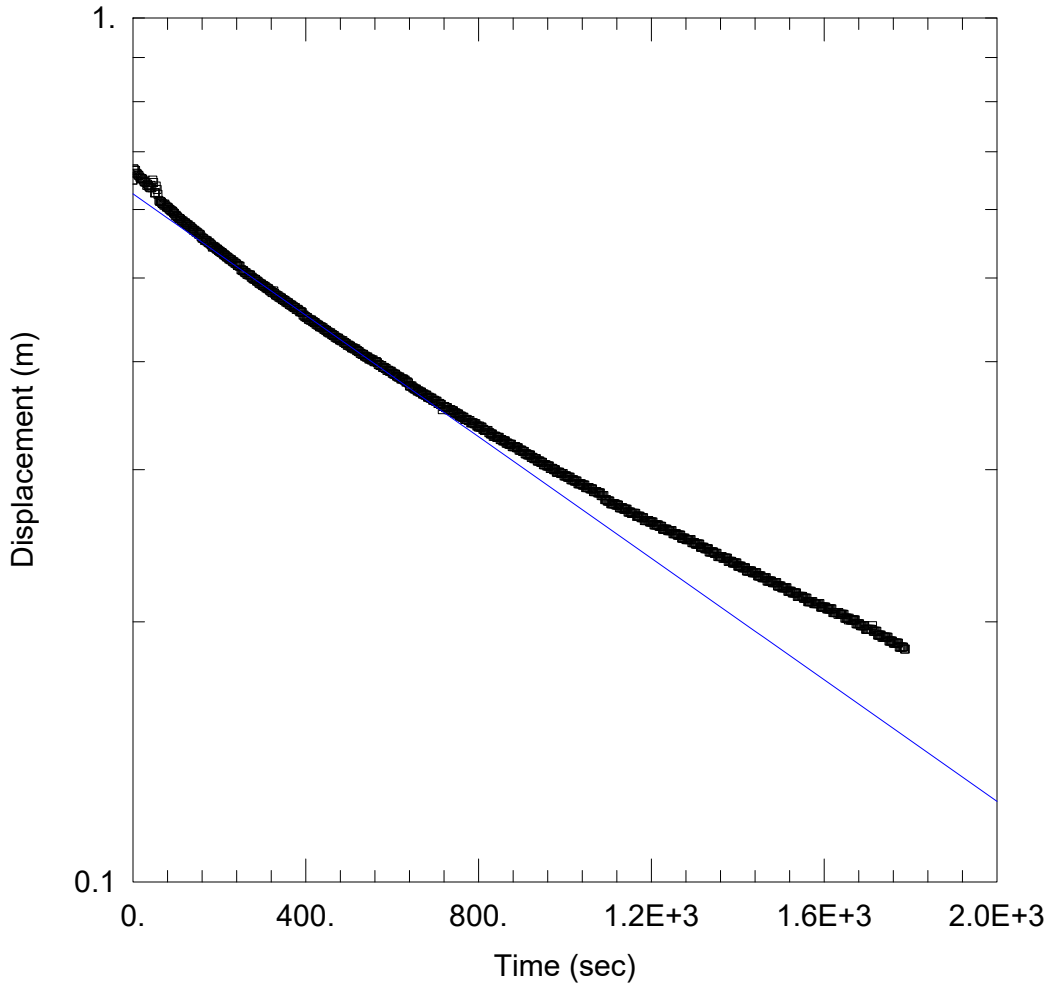
WELL DATA (MW-1)

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

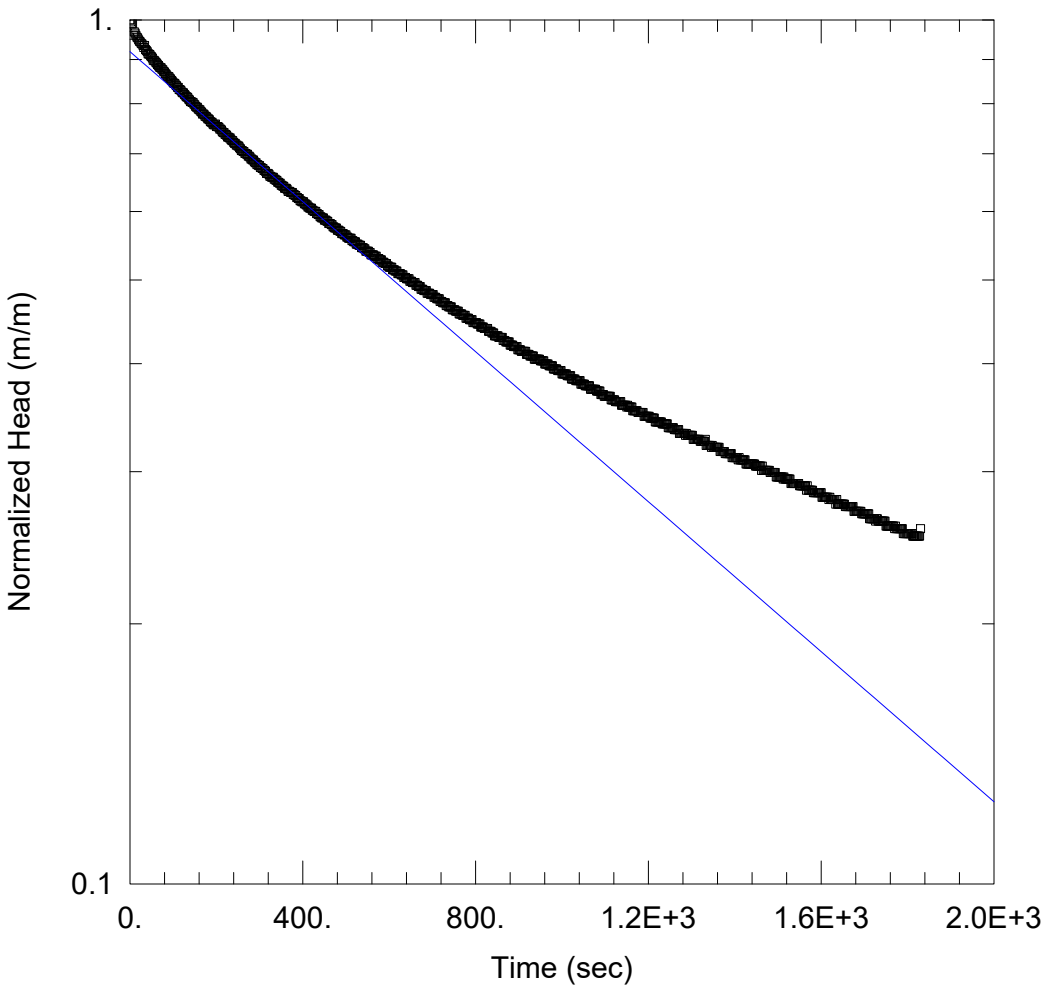
WELL DATA (MW-2)

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.

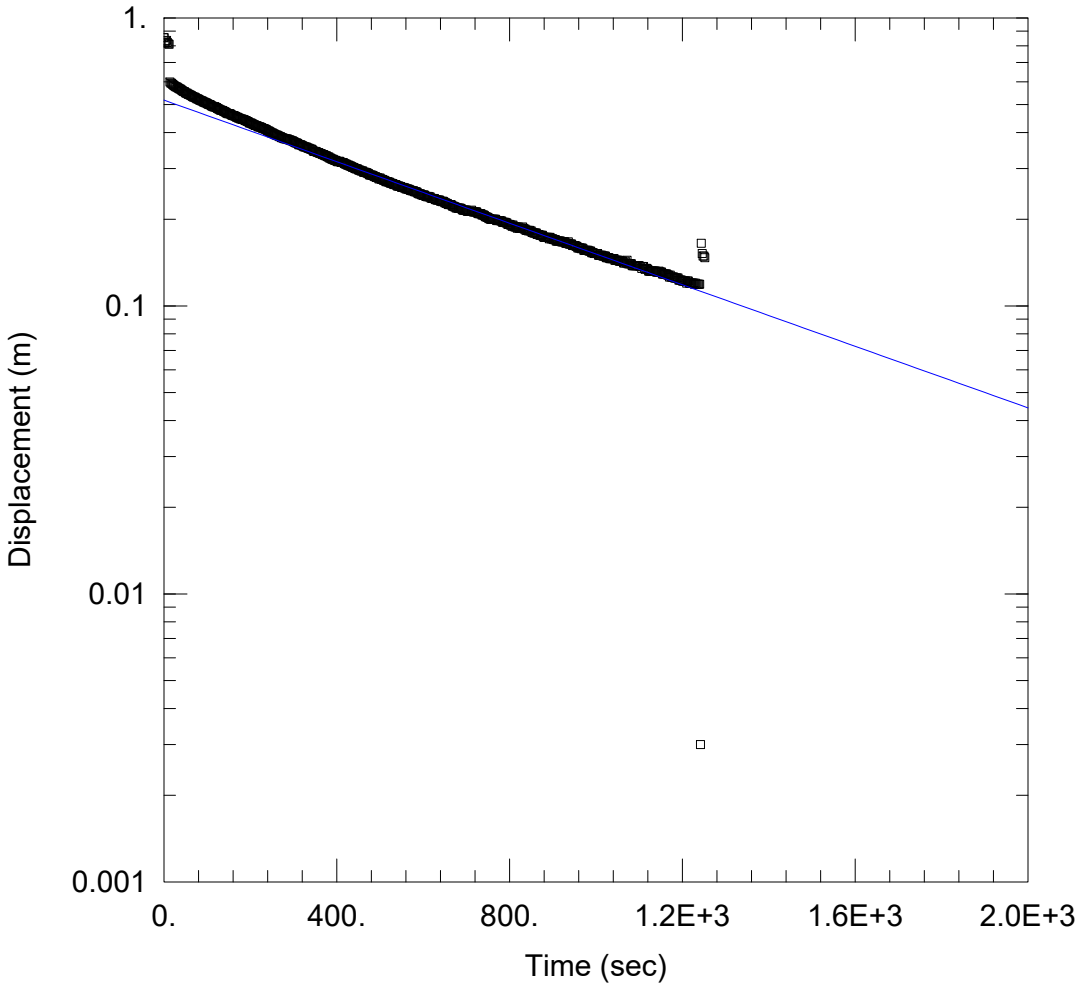
WELL DATA (MW-2 RH)

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

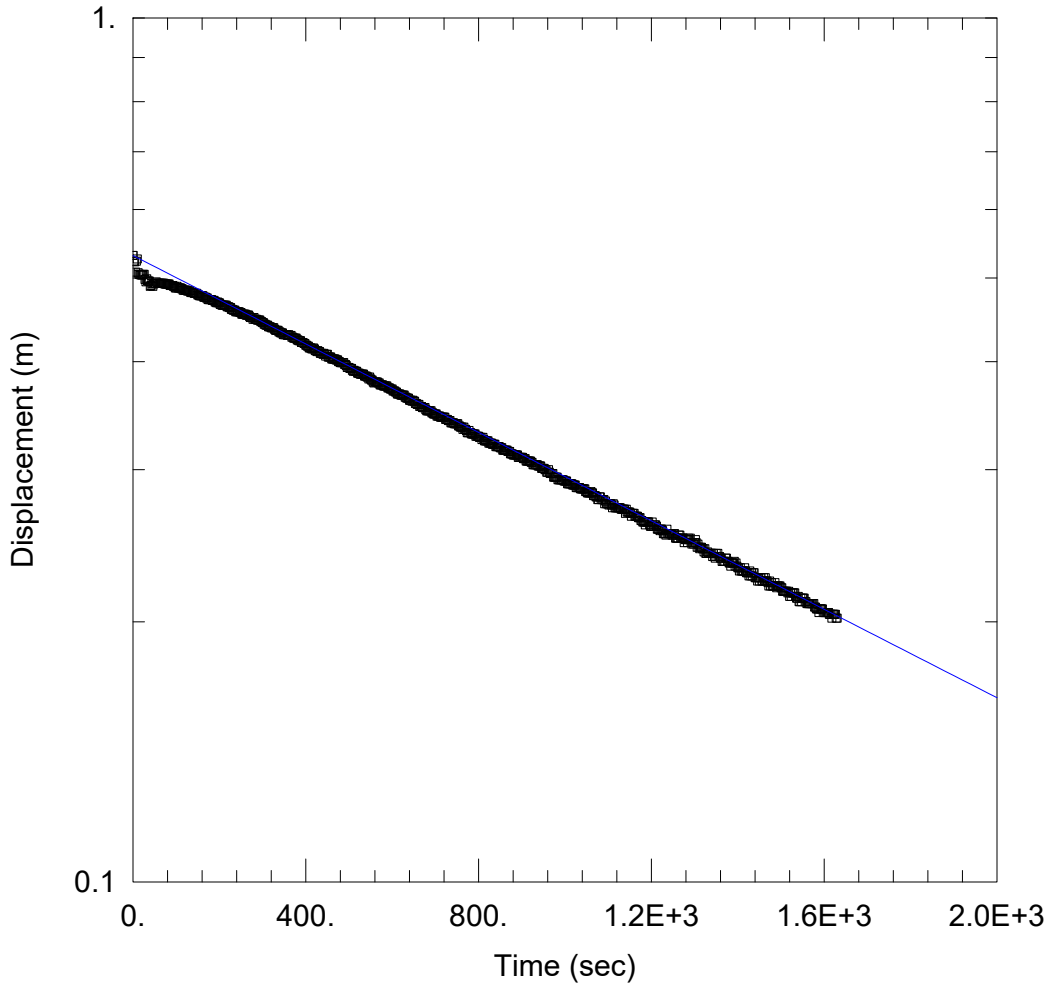
WELL DATA (MW-2s)

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

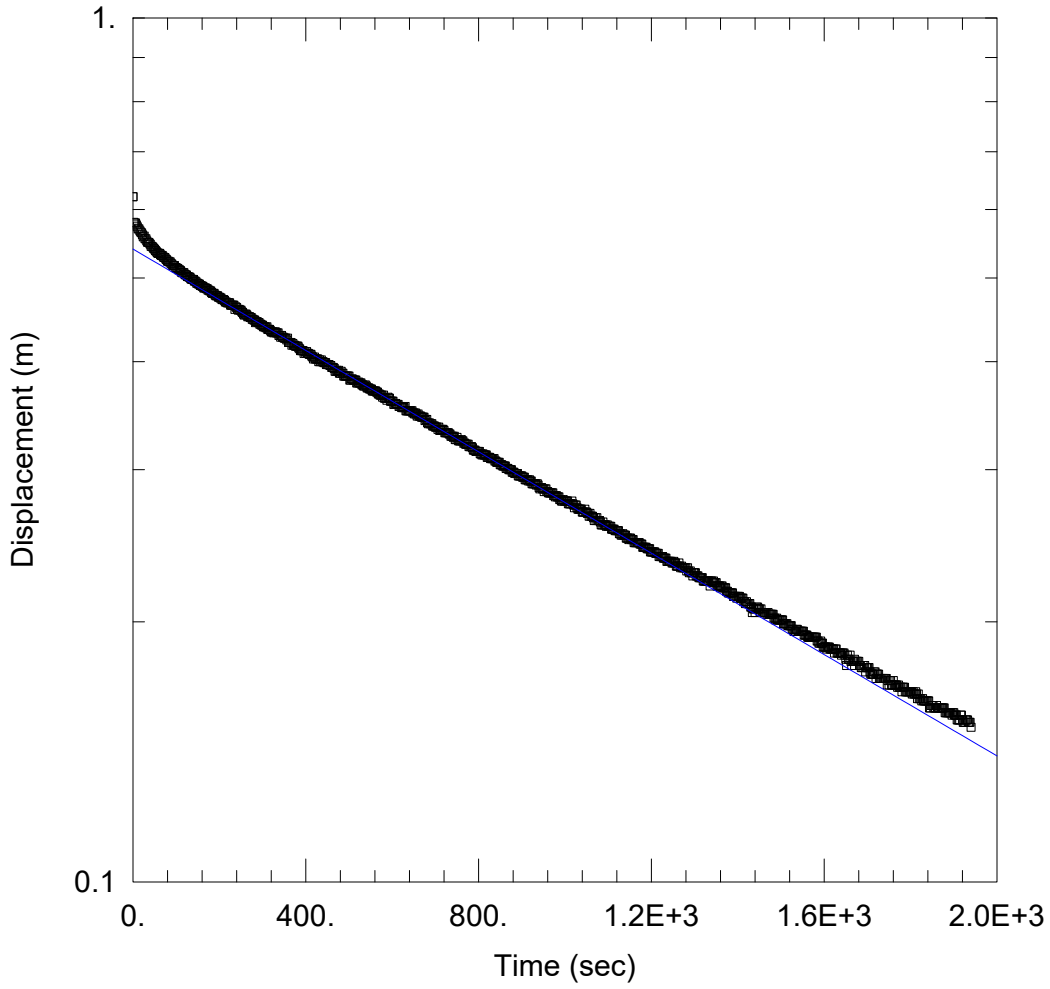
WELL DATA (MW-2s)

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

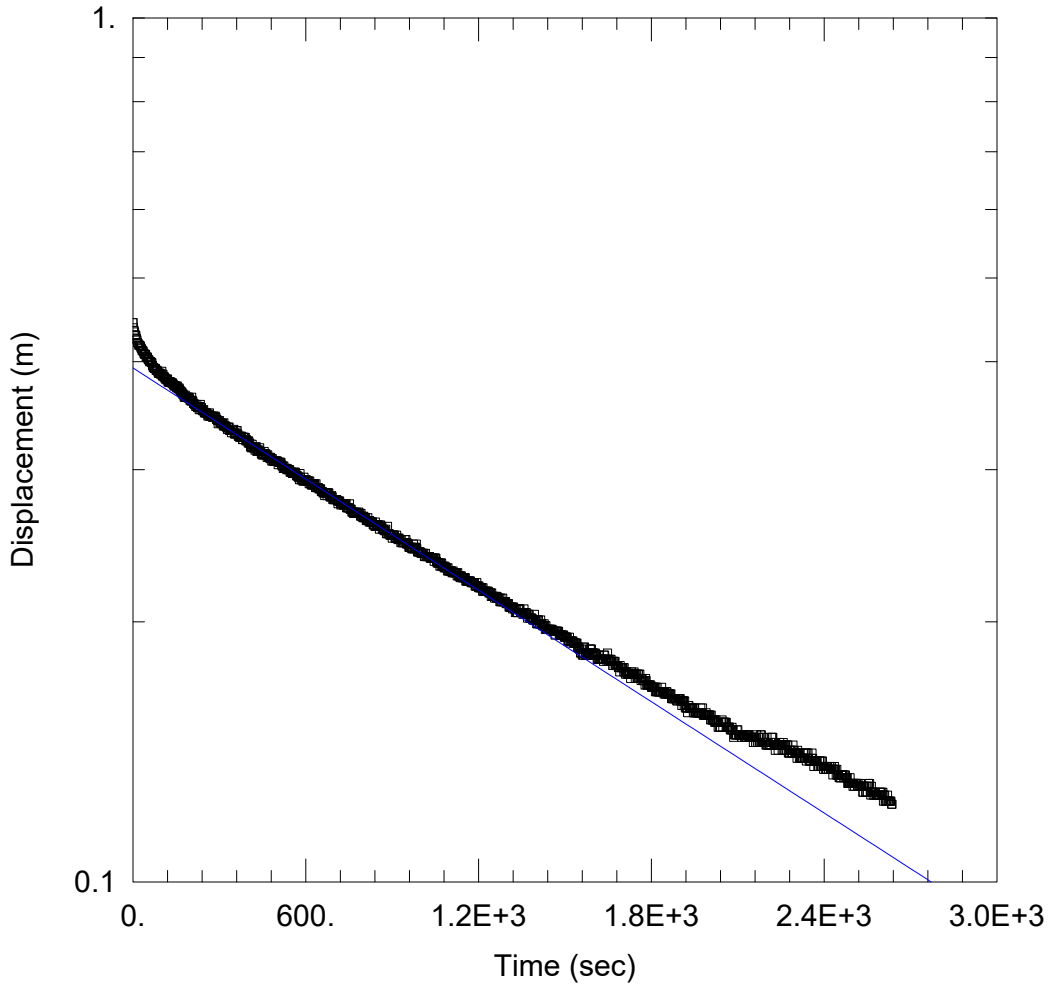
WELL DATA (MW-3 FH)

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

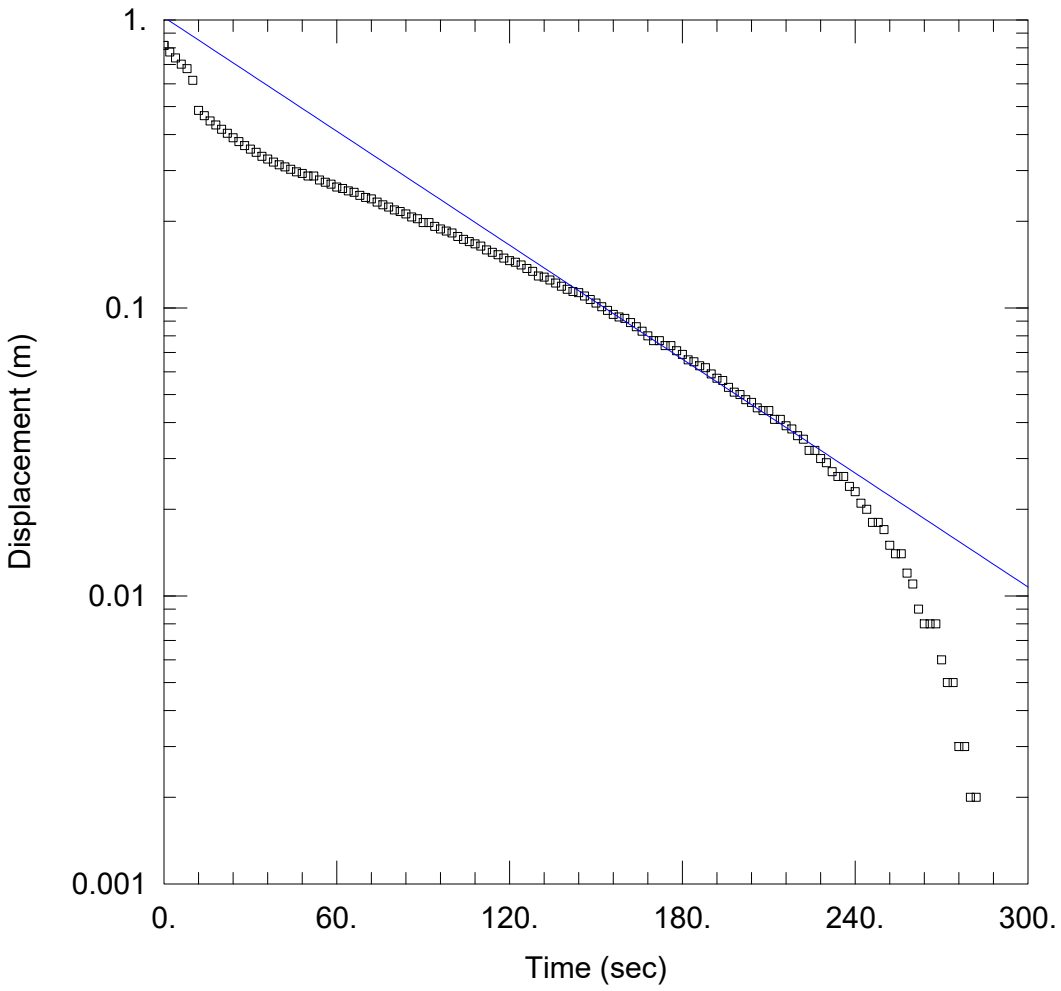
WELL DATA (MW-3 RH)

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

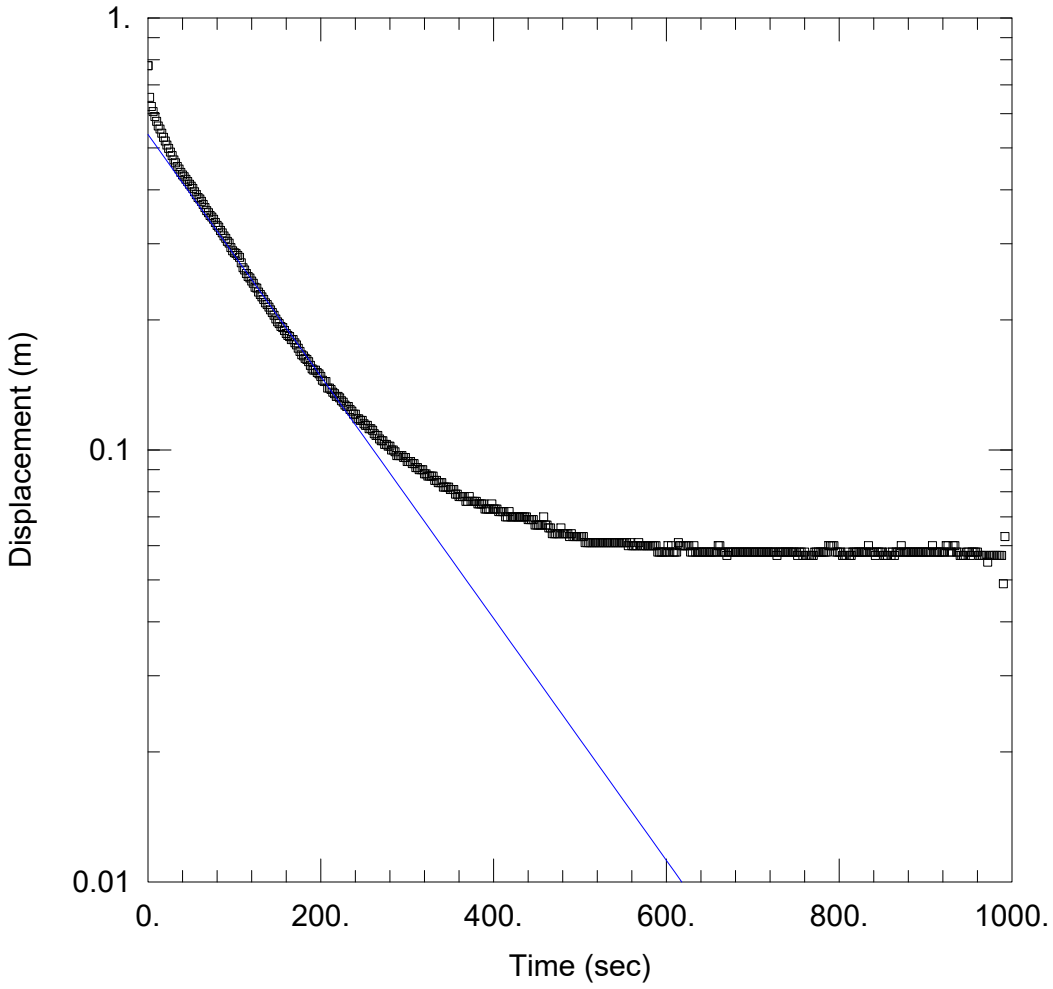
WELL DATA (MW-4)

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

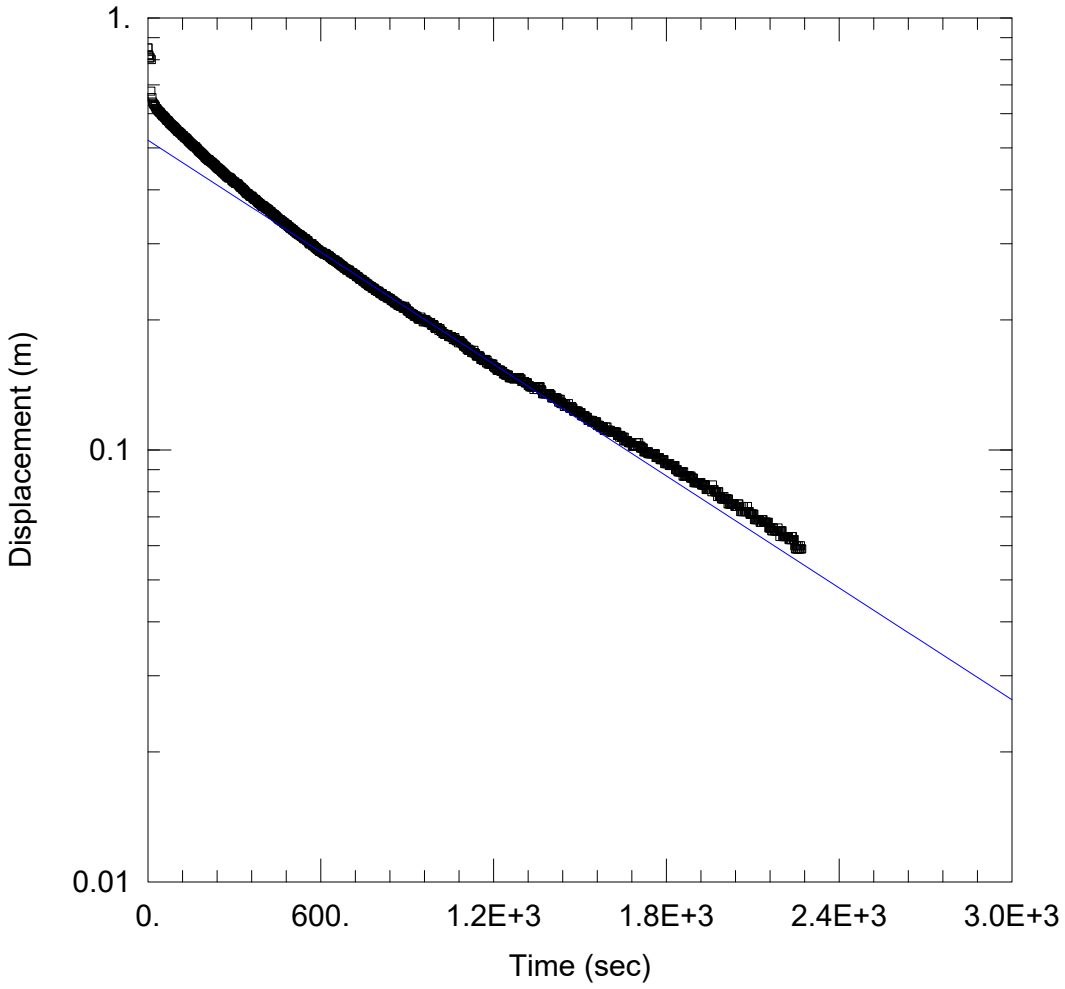
WELL DATA (MW-4)

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

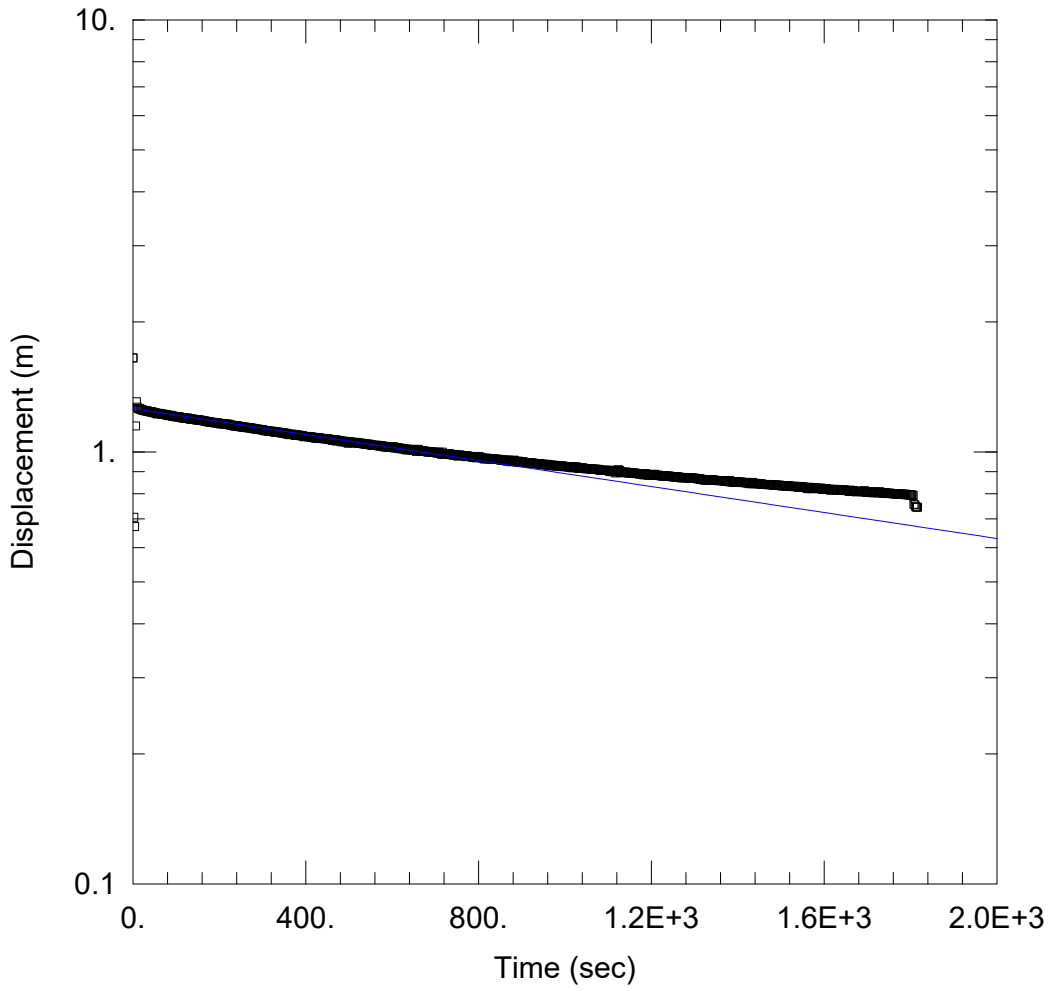
WELL DATA (New Well)

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

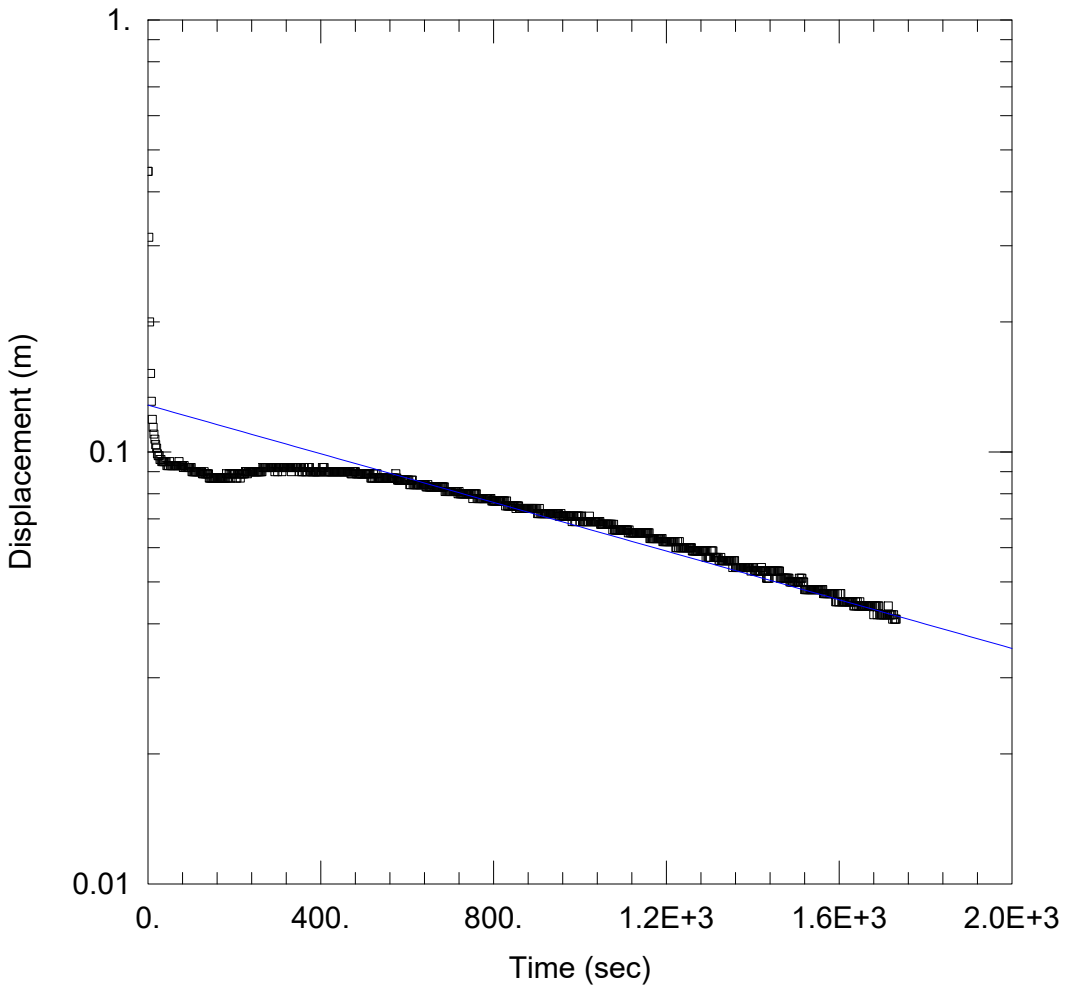
Saturated Thickness: 4.96 m Anisotropy Ratio (Kz/Kr): 0.1

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

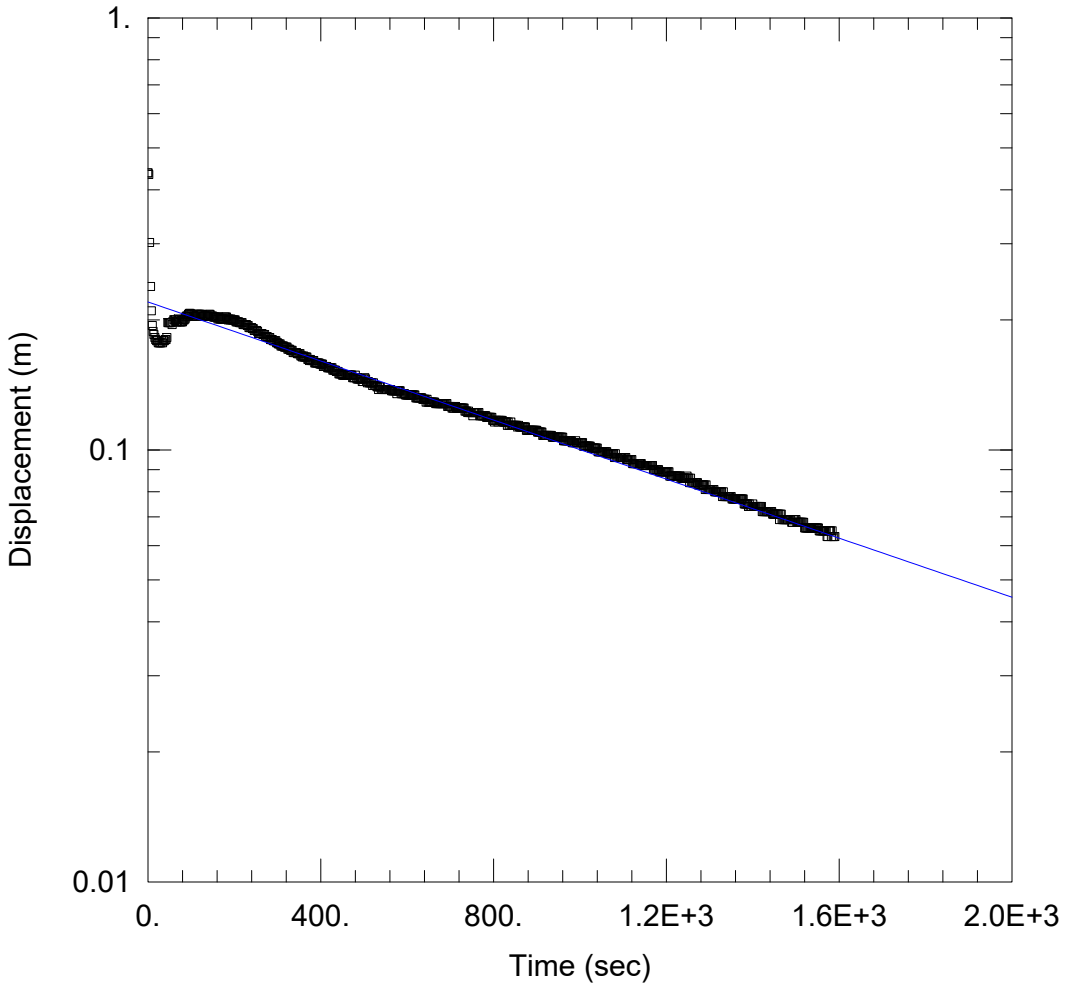
WELL DATA (New Well)

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

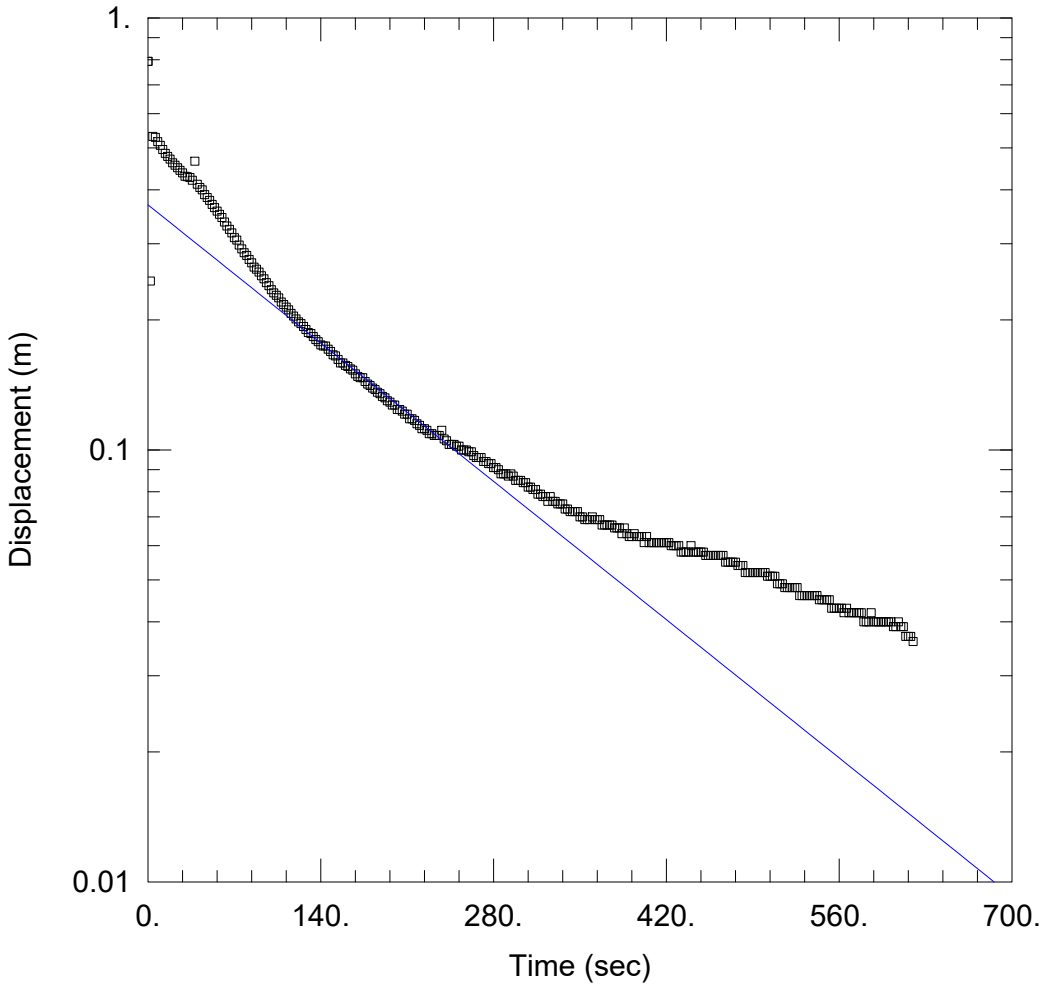
WELL DATA (New Well)

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

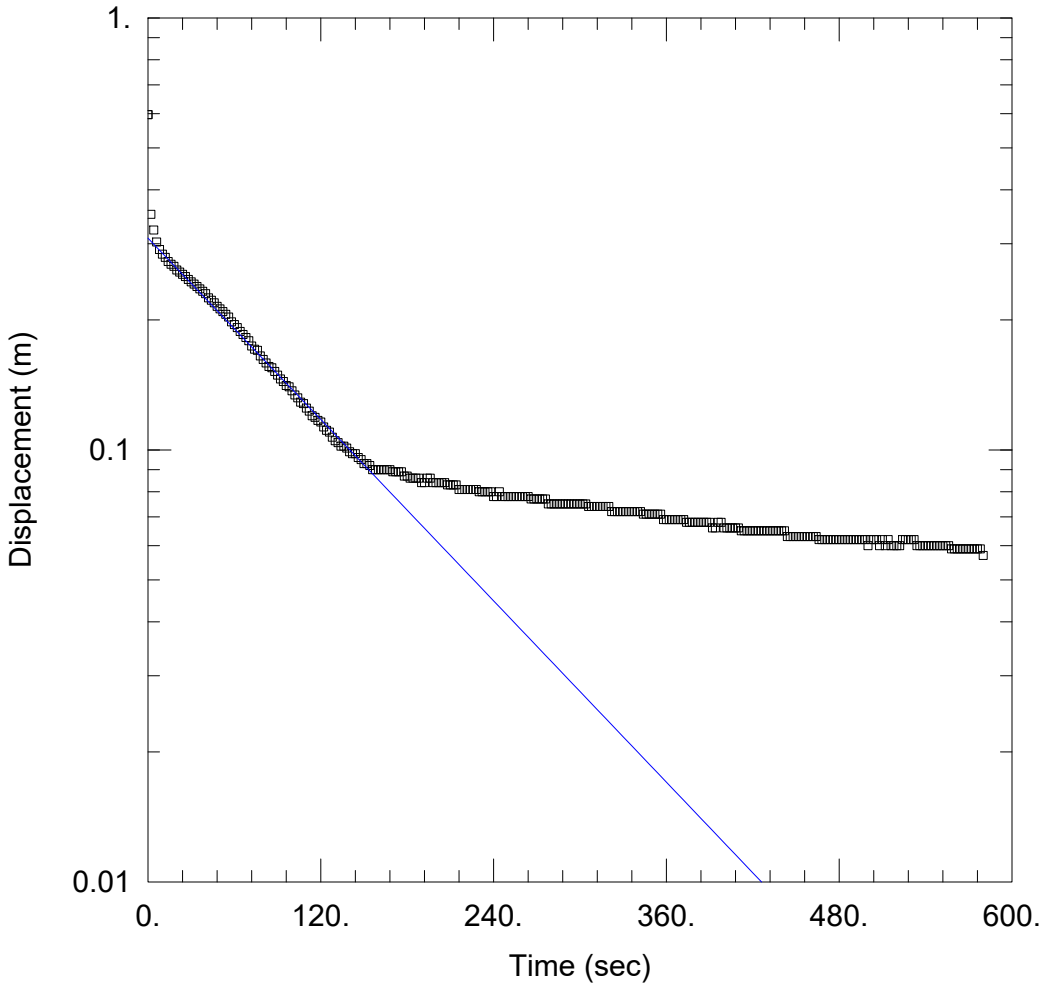
WELL DATA (MW-6)

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

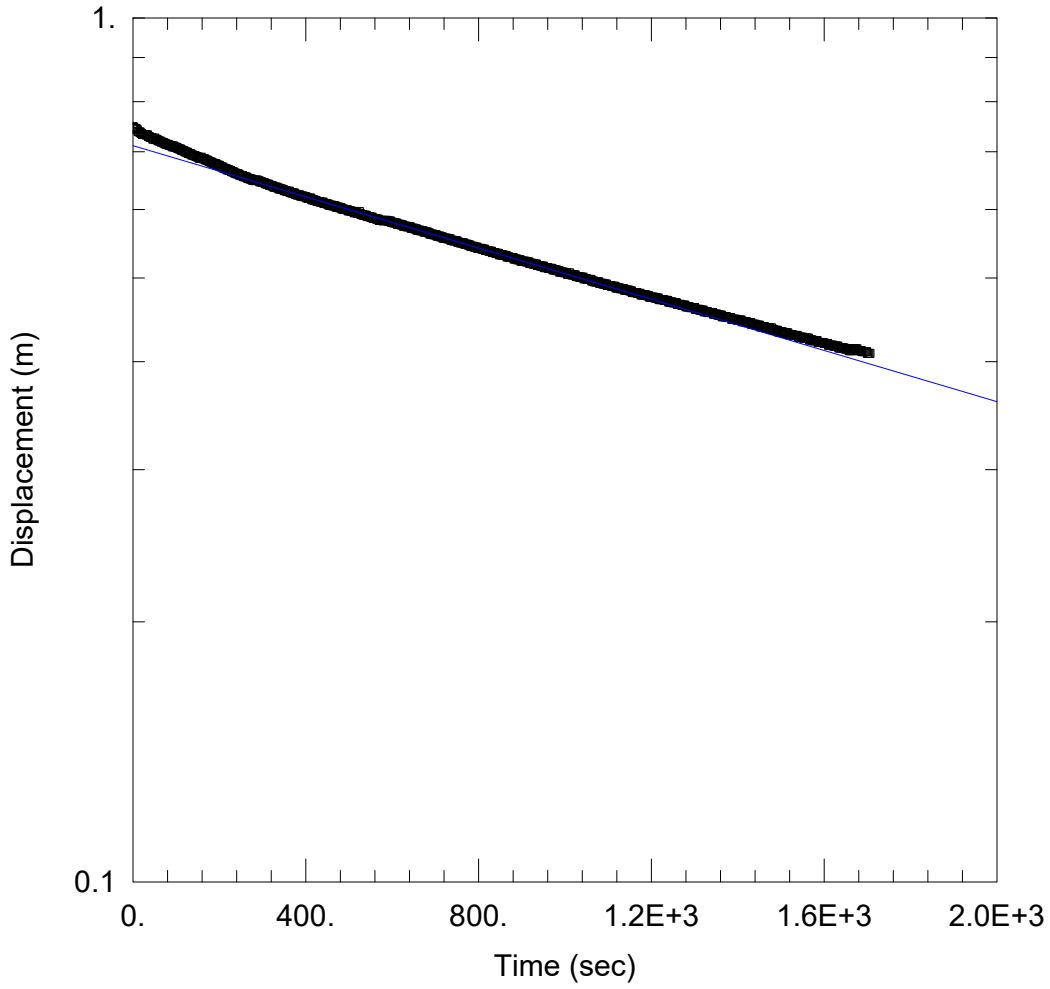
WELL DATA (MW-6)

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

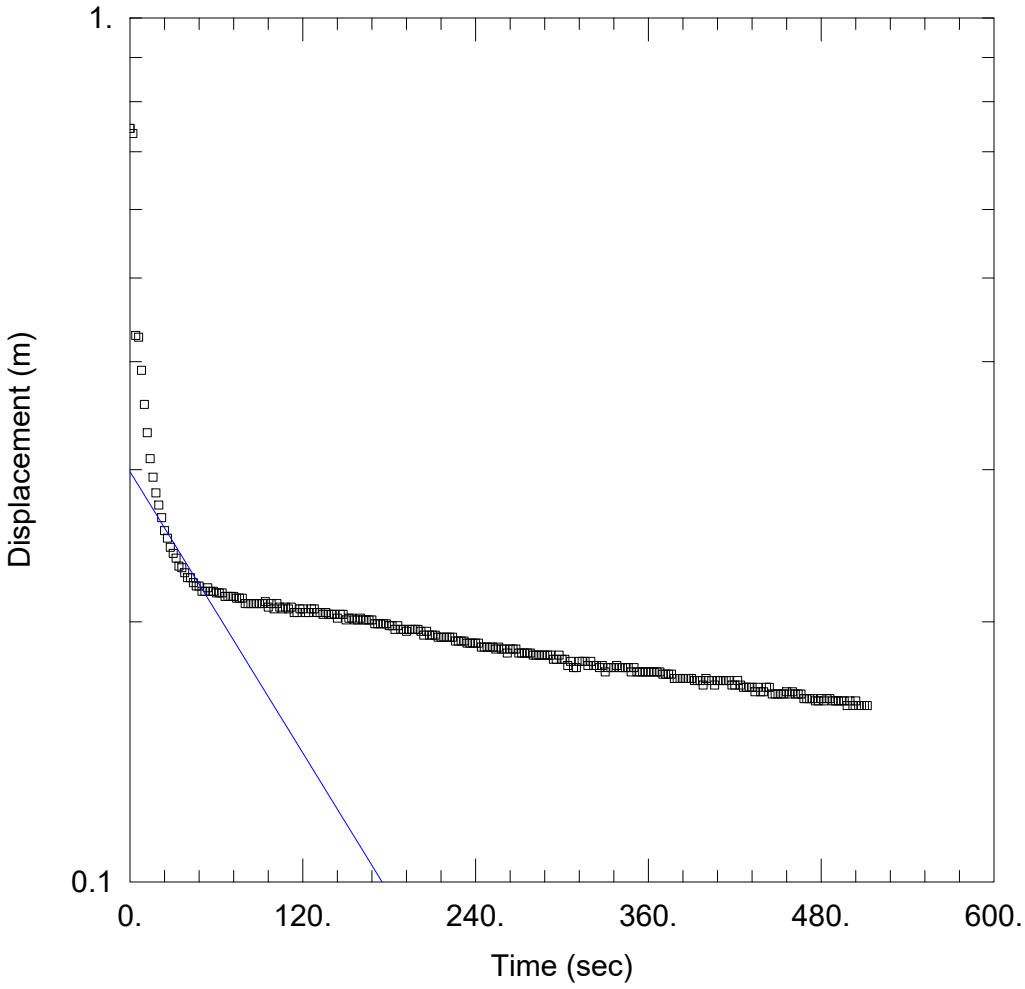
WELL DATA (MW-7d FH)

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

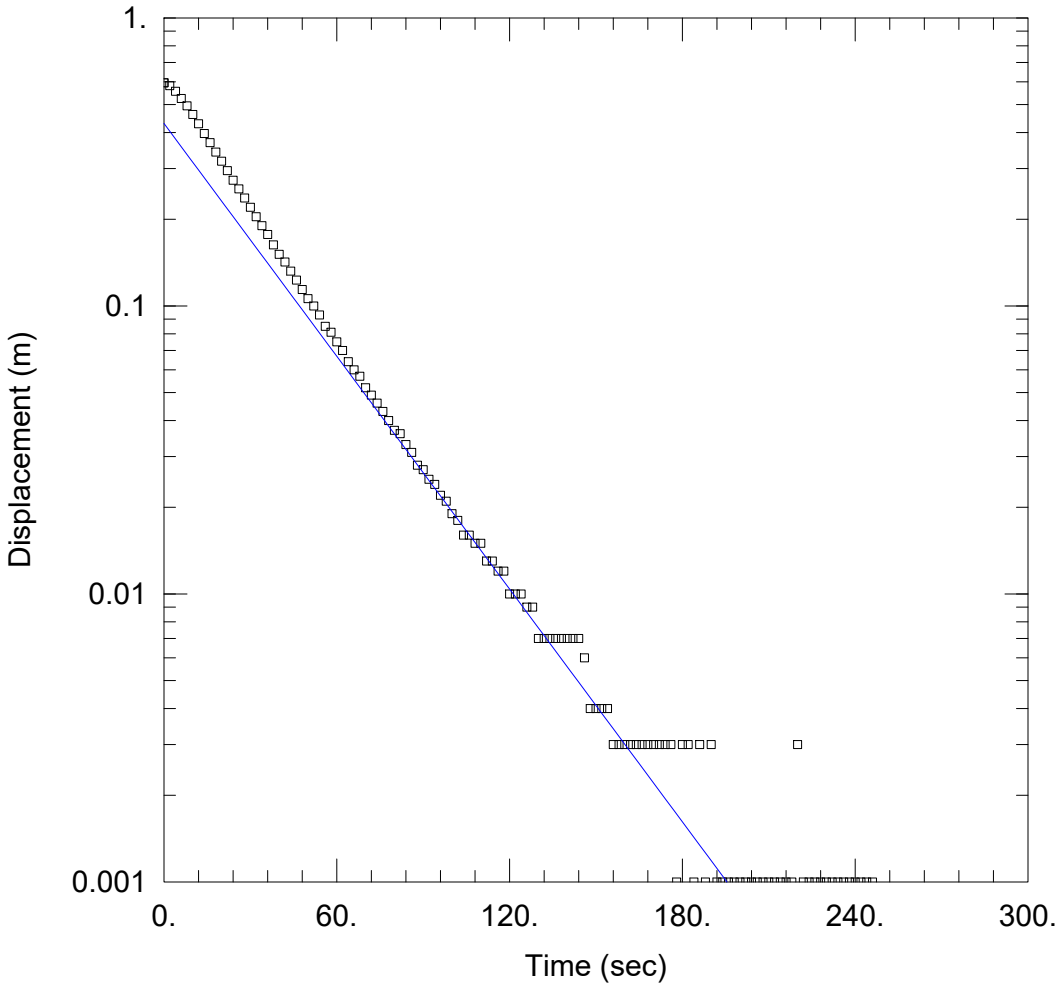
WELL DATA (MW7s FH)

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

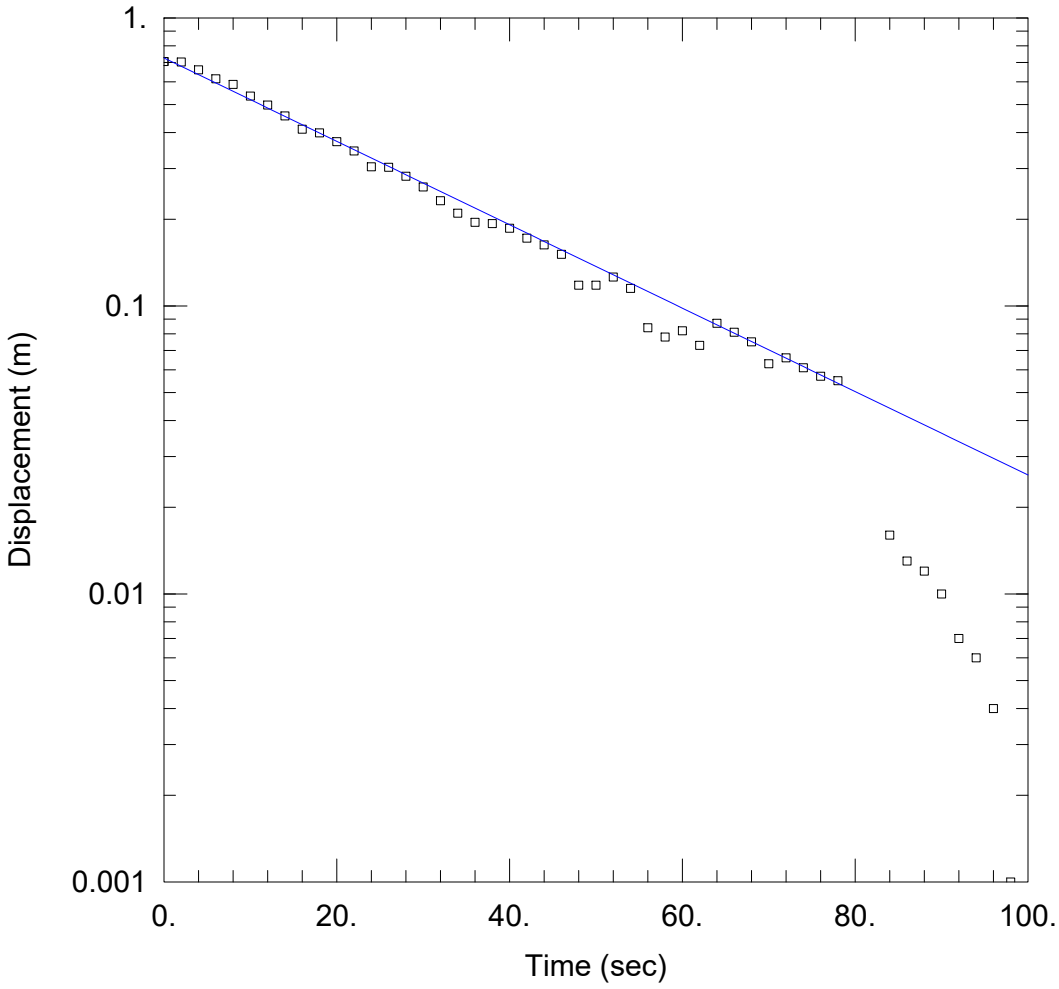
WELL DATA (MW-8)

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

Groundwater Chemistry 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

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
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)
374 Wellington Street West, Suite 3
Toronto ON M5E 1B5
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)
374 Wellington Street West, Suite 3
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

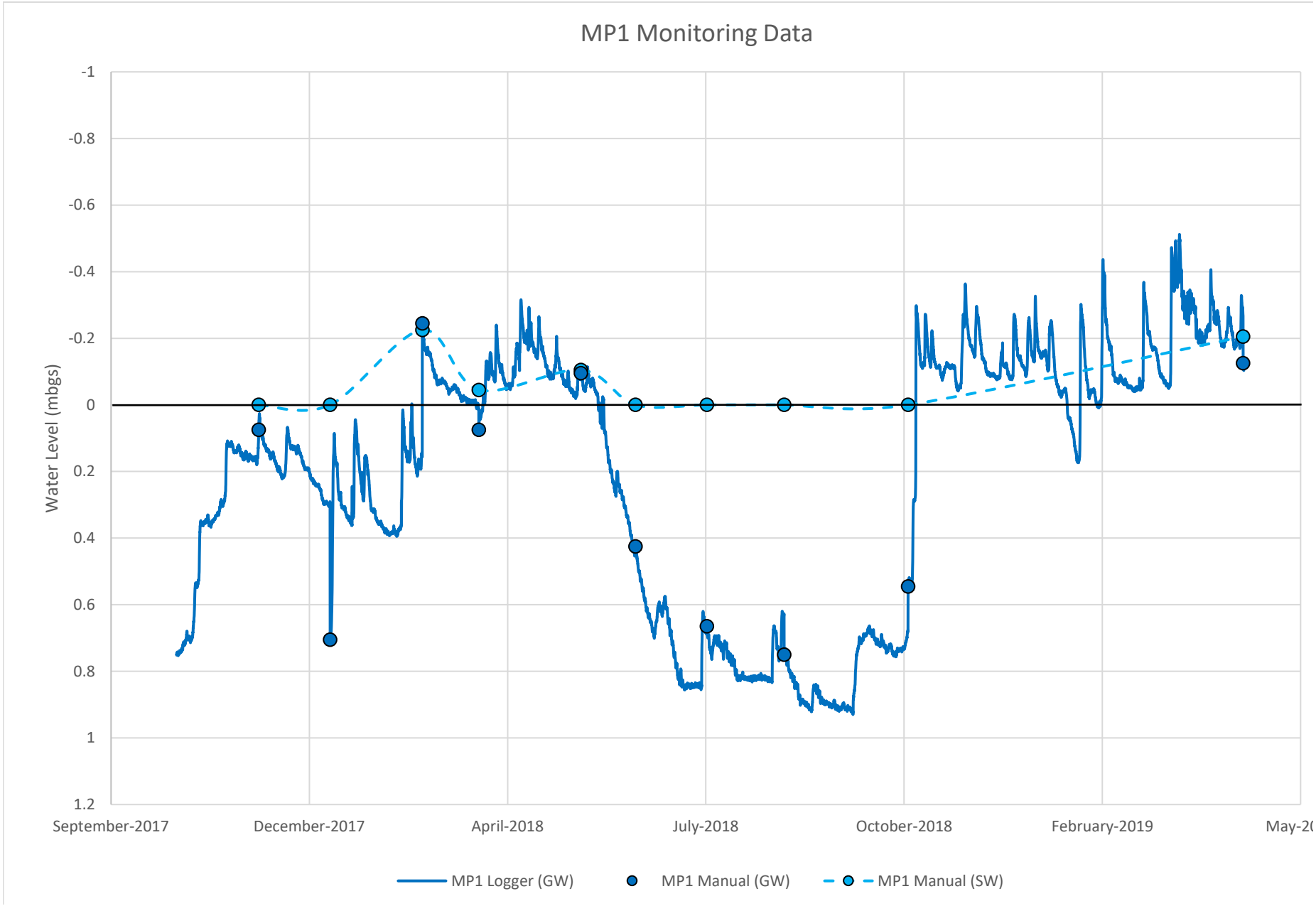
JULY 2017 FRONT

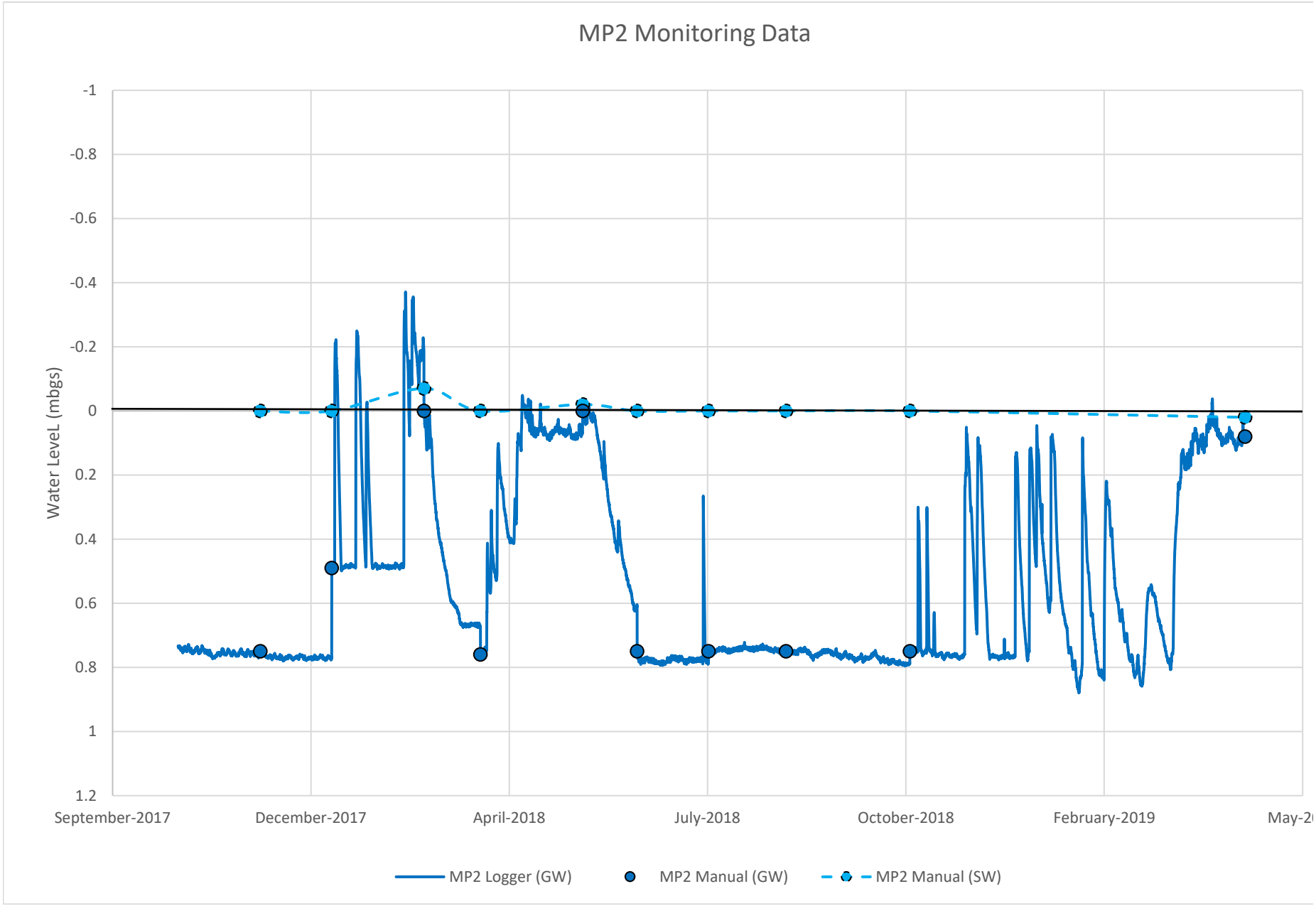
Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

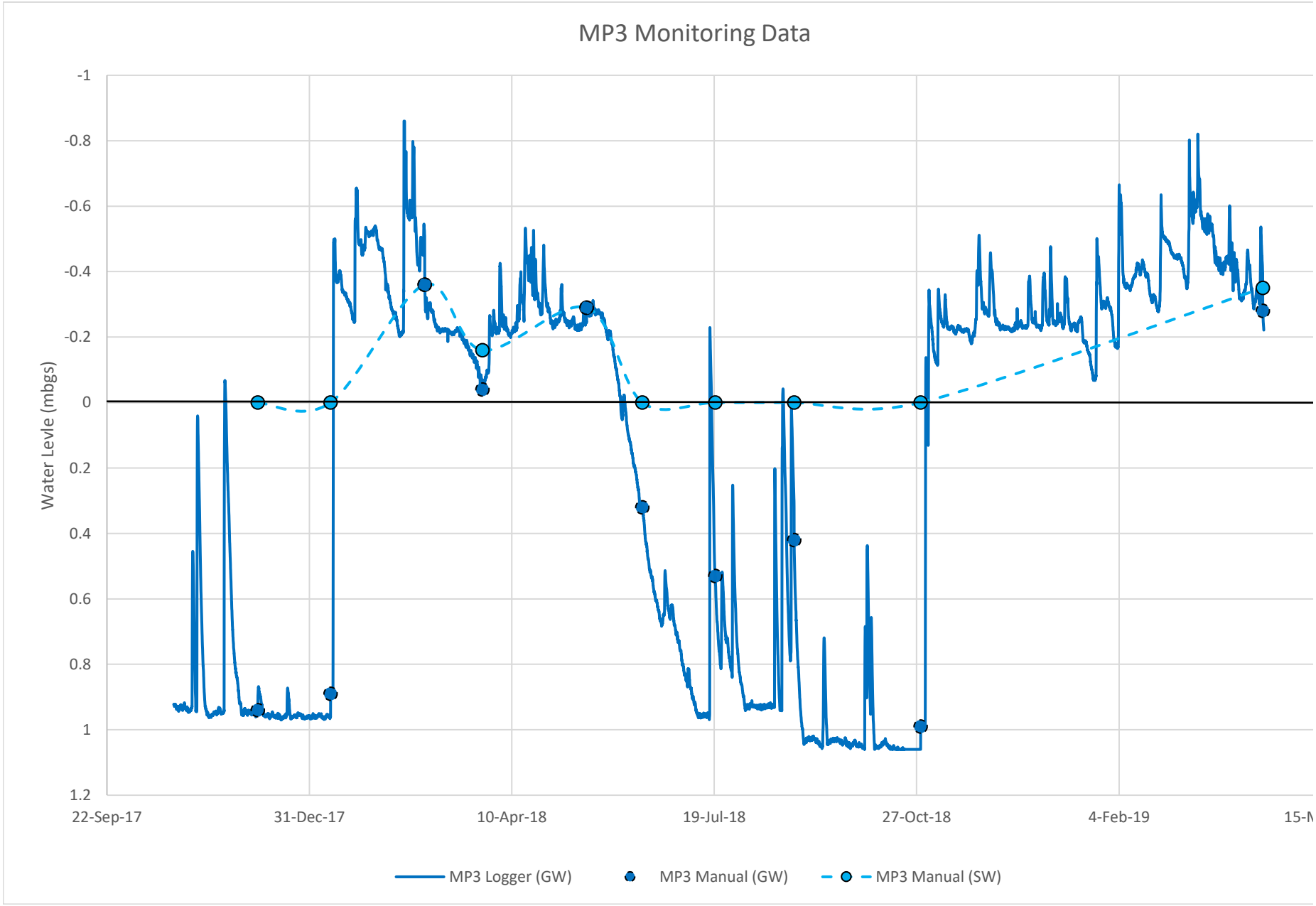
1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

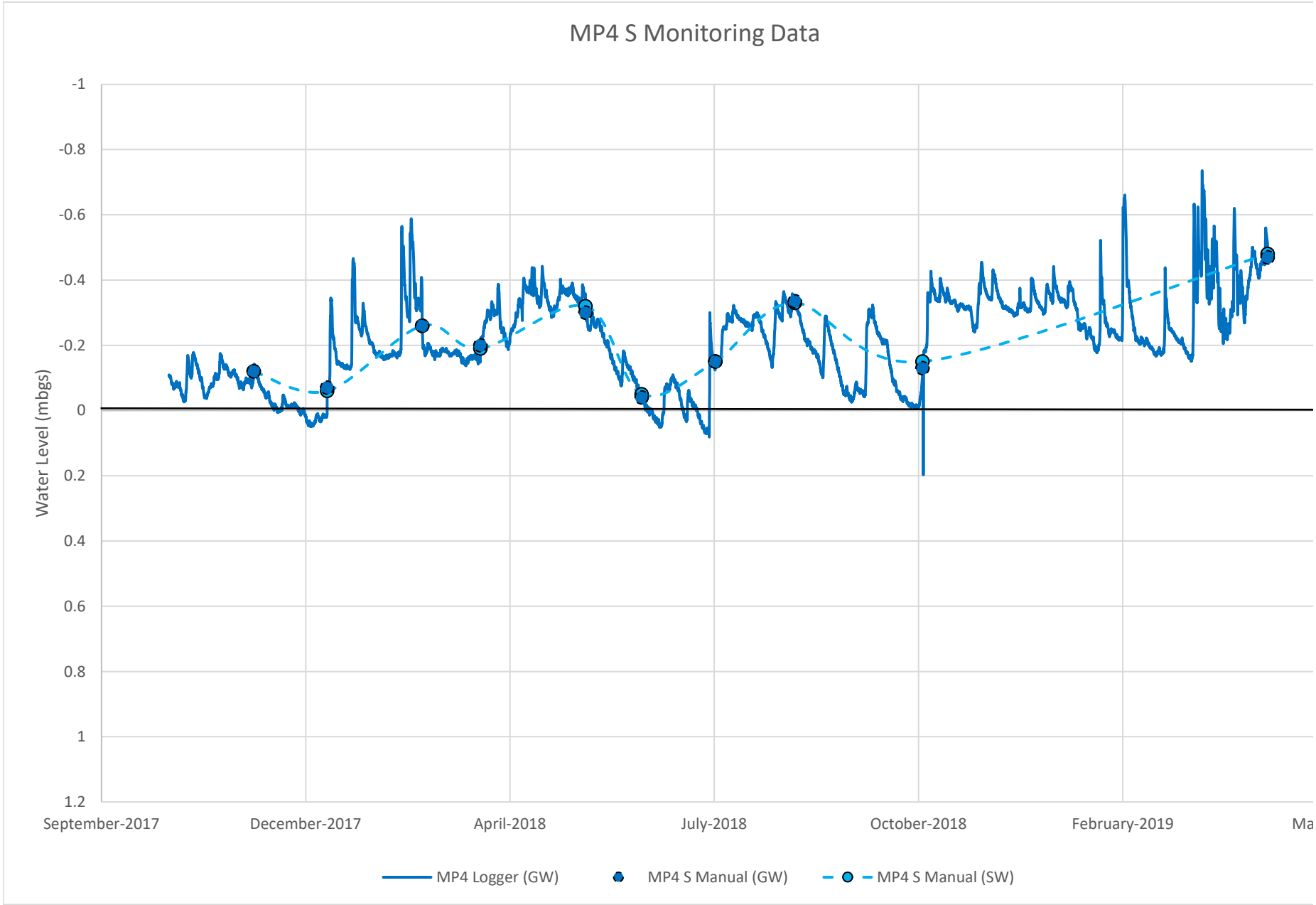
Appendix E

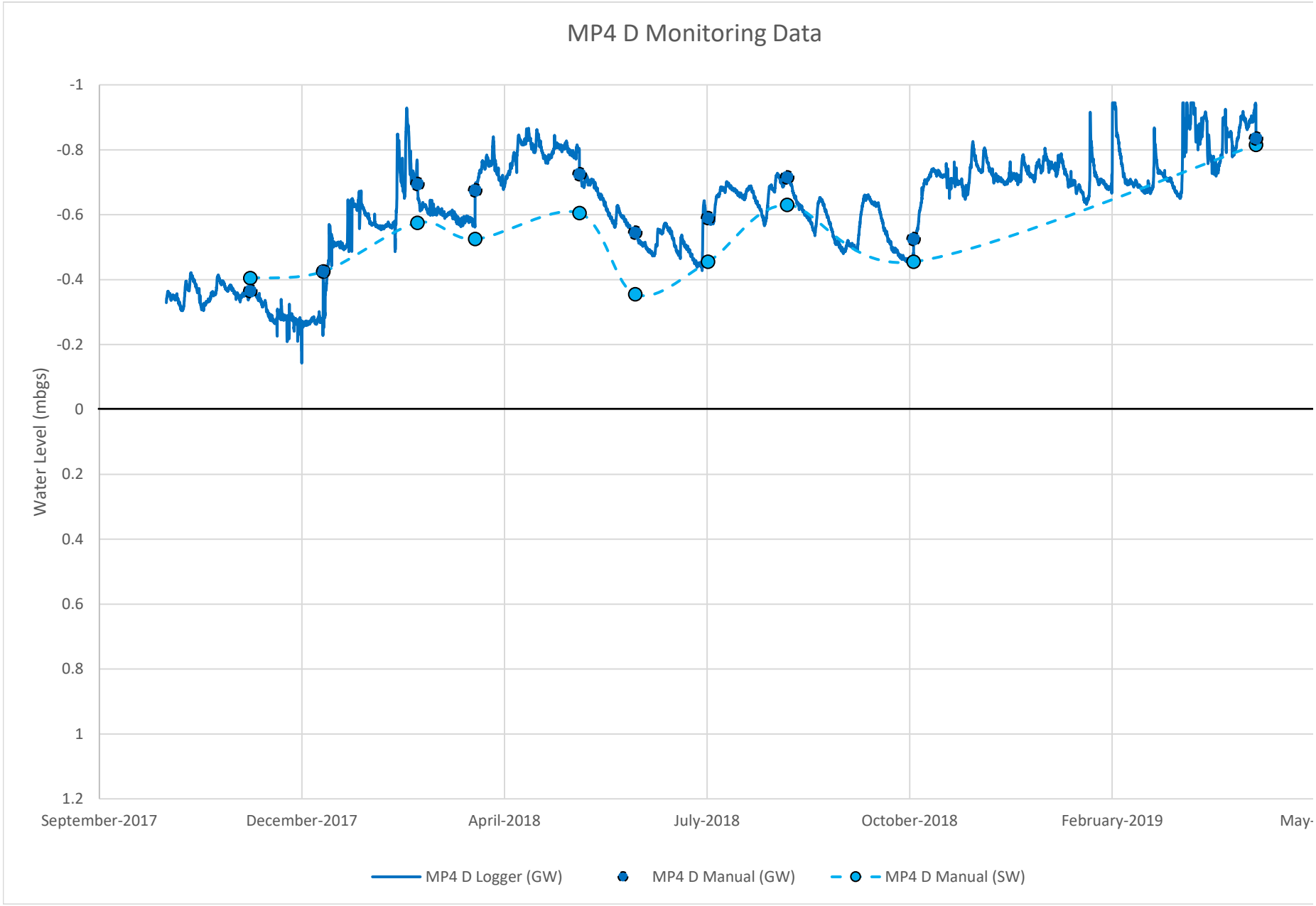
Calibrated Levellogger Monitoring Data Palmer (2022)

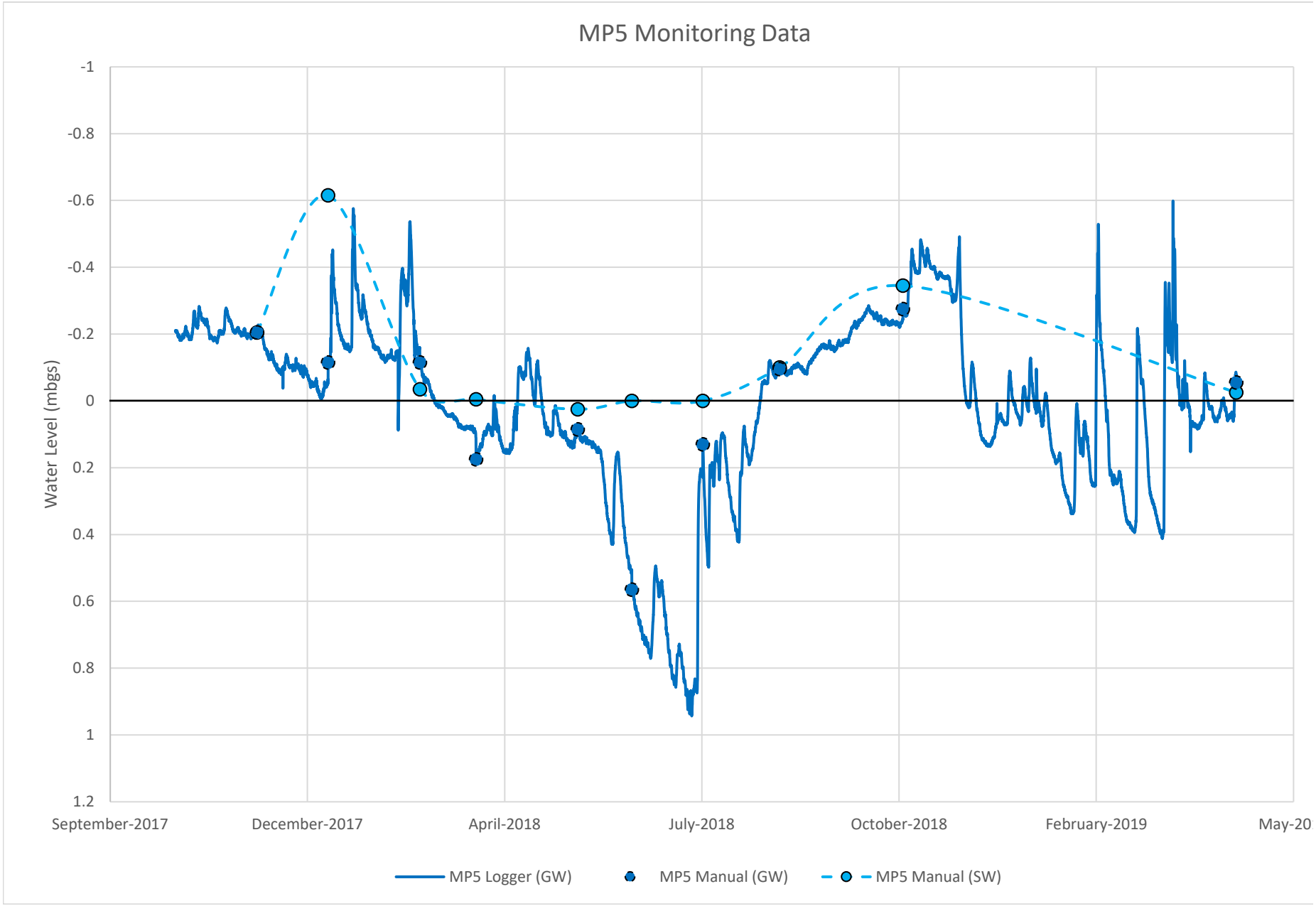

MP1 Monitoring Data
Water Level (mbgs)
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
September-2017
December-2017
April-2018
July-2018
October-2018
February-2019
May-2(
MP1 Logger (GW)
MP1 Manual (GW)
MP1 Manual (SW)

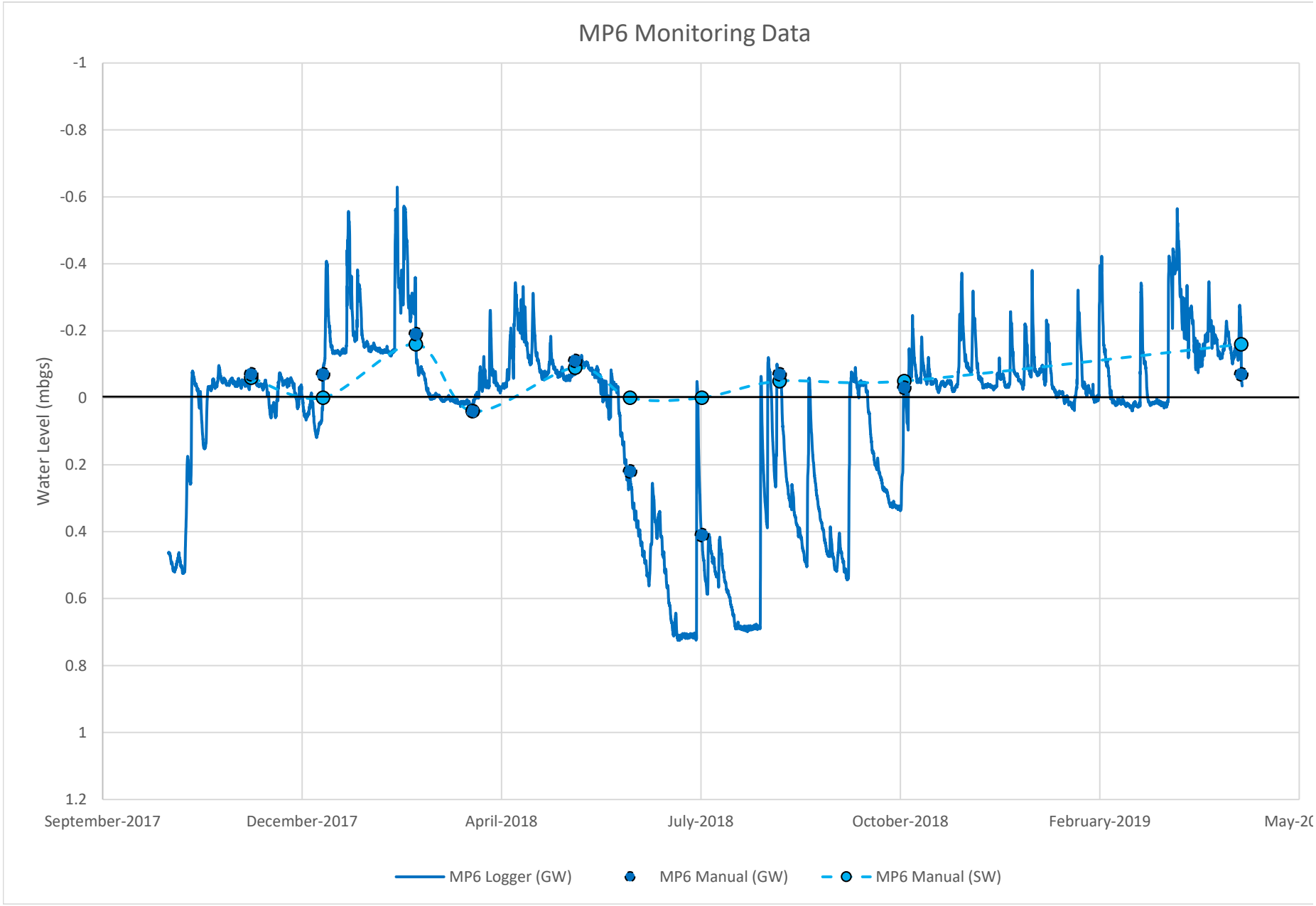

MP2 Monitoring Data
Water LeveL (mbgs)
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
September-2017
December-2017
April-2018
July-2018
October-2018
February-2019
MP2 Logger (GW)
MP2 Manual (GW)
MP2 Manual (SW)

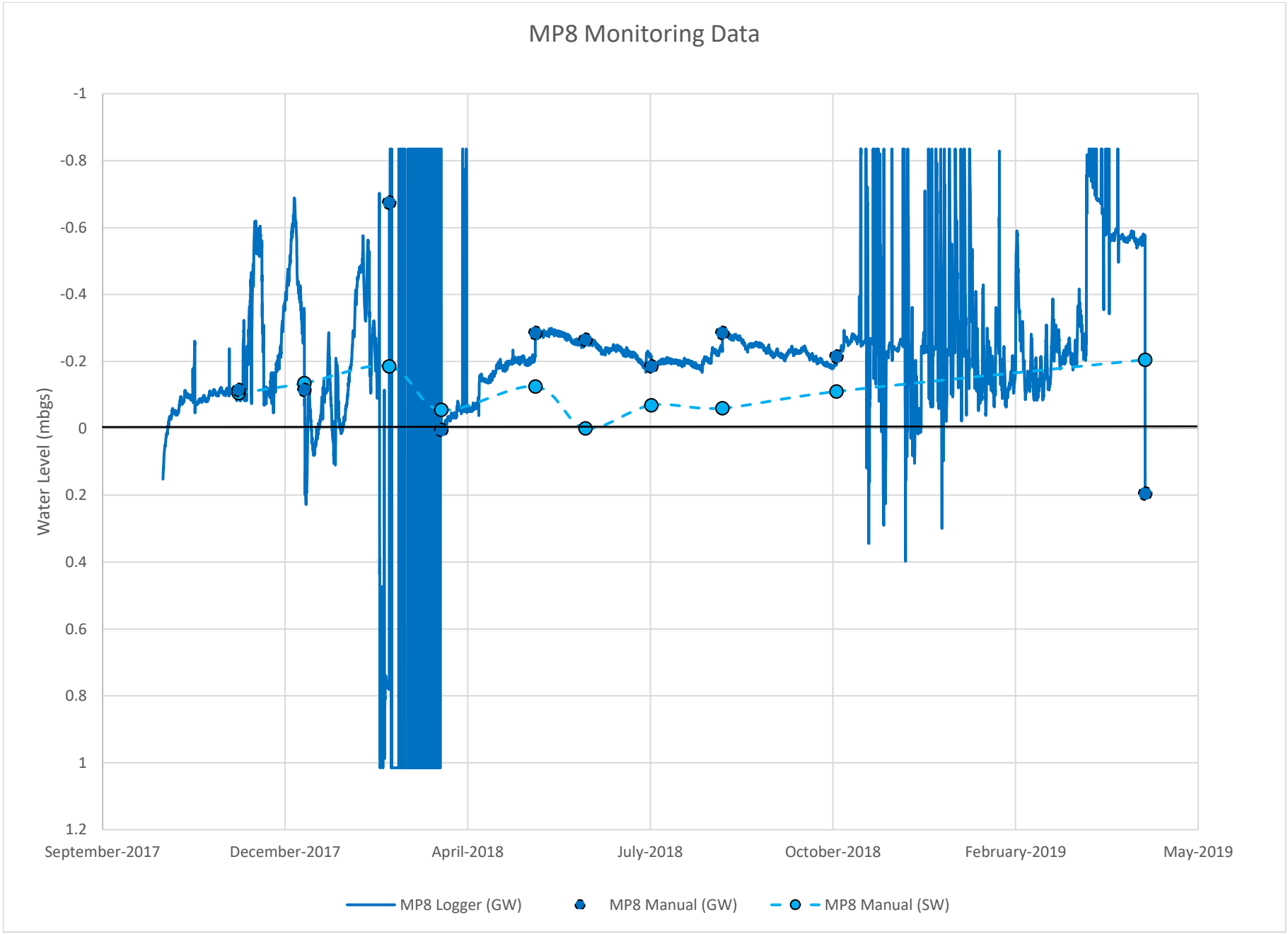

MP3 Monitoring Data
Water Levle (mbgs)
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
22-Sep-17
31-Dec-17
10-Apr-18
19-Jul-18
27-Oct-18
4-Feb-19
MP3 Logger (GW)
MP3 Manual (GW)
MP3 Manual (SW)


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)