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**2025 Biennial Groundwater Monitoring
Report - Wellesley Well Field
(WY1, WY5, WY6)**

The Region of Waterloo



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Report - Wellesley Well Field
(WY1, WY5, WY6)**

The Region of Waterloo

**R.J. Burnside & Associates Limited
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**June 2026
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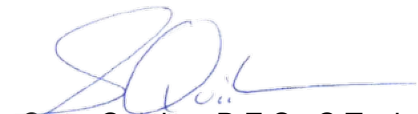
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R.J. Burnside & Associates Limited

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1.0 Introduction

The Regional Municipality of Waterloo (the Region) is unique in Ontario in that it is the largest urban municipality to rely almost exclusively on groundwater supplies for its drinking-water (Region of Waterloo, 2015). Figure 1 shows the location of municipal well fields within the Region.

The Permit to Take Water (PTTW P-300-4214409441) for the Wellesley Well Field (WY1, WY5, WY6), requires submission of a well field specific biennial report to the Ministry of Environment, Conservation and Parks (MECP) which documents production well pumping volumes and water levels in specific monitoring wells during 2024 and 2025. This report has been prepared to meet the reporting condition of the PTTW for 2024 and 2025. A copy of the PTTW is included in Appendix A.

The location of the Wellesley Well Field is shown in Figure 1 and the production wells in Wellesley are shown in Figure 2 with the monitoring network for WY1, WY5 and WY6 shown in Figure 3. Well records for the production and monitoring wells are found in Appendix B.

1.1 Scope of Work

The Region records water levels on a regular basis within a network of monitoring wells to satisfy requirements of their PTTW and to confirm that water taking is sustainable in the long term. The monitoring wells are concentrated near the production wells but are also located in known aquifer recharge areas. The data from these wells and regular measurements of pumping volume obtained from the production wells are used to evaluate the impact of Region pumping on aquifers and potential impacts to private wells, other water takers and the natural environment.

The Region has developed a monitoring program for Wellesley Well Field (WY1, WY5, WY6) in accordance with PTTW P-300-4214409441 which consists of the following activities:

- Measuring the daily volume pumped from the WY1, WY5 and WY6 production wells (Condition 4.1 of the PTTW);
- Measuring the water levels in monitoring well WY-WY-OW01-09-A (Condition 4.2 of the PTTW);
- Review of precipitation data from the nearest GRCA/Environment Canada weather station (Condition 4.3); and
- Completion of a biennial report (every 2 years) that presents data in compliance with condition 4.3 of the PTTW

The monitoring data (pumped volumes and hydrographs) are found in Appendix C with precipitation data in Appendix D. The monitoring program procedures and methodology are included in Appendix E.

2.0 Site Setting

2.1 Well Field Description

The Wellesley Well Field is located along the southern boundary of the Township of Wellesley within the Village of Wellesley. Wells WY1, WY5 and WY6 are located in a predominantly residential area on the south side of the Village. The closest municipal well field is St. Clements, located to the northeast (Figure 2). The closest surface water feature to the WY1, WY5 and WY6 site is Firella Creek, a tributary of the Nith River, located 290 m to the east (Figure 3).

2.1.1 Pumping Wells

Well records for the production wells are found in Appendix B. The production wells associated with the Wellesley Well Field are WY1, WY5 and WY6. The Wellesley Well Field obtains water from a sand and gravel aquifer (AFD1) that is directly in contact with the underlying bedrock.

A summary of the production well construction details is provided in Table 1 below.

Table 1: Production Well Construction Details

Well Name	Year Built	Casing Diameter (mm)	Screen Diameter (mm)	Screen interval (mbgs)	Aquifer
WY1	1975	203	190	46.6-49.1	Aquifer 3 (AFD1)
WY5	1992	203	203	45.4-48.51	Aquifer 3 (AFD1)
WY6	2007	210	190	46.6-49.7	Aquifer 3 (AFD1)

The water taking volumes for the Wellesley Well Field are regulated by Condition 3.2 of the PTTW and are summarized in Table 2 below.

Table 2: Annual Water Taking 2024 / 2025

Well	PTTW Details	2024			2025		
		Avg. Daily Water Taking (m ³)	Max Taken per Day (m ³)	Total Volume Pumped (m ³)	Avg. Daily Water Taking (m ³)	Max Taken per Day (m ³)	Total Volume Pumped (m ³)
WY1	1,503	283	882	103,441	250	852	91,163
WY5	1,503	120	853	43,914	157	905	57,414
WY6	1,503	253	856	92,421	253	940	92,172
Combined	1,503	665	882	239,776	660	940	240,749

The pumping volumes are based on the total daily volumes recorded by the Region's SCADA system and are presented in Appendix C as total monthly volumes. Production wells WY1, WY5 and WY6 are pumped in alternation. Pumping volumes from the well field ranged from 18,352 m³/month to 21,596 m³/month in 2024, and from 18,577 m³/month to 21,963 m³/month in 2025. In total, 239,776 m³ was produced at this well field in 2024 and 240,749 m³ was produced in 2025. These volumes are lower than the previous three years, and below the permitted volume of 548,726 m³ per year (Table C-1).

2.1.2 Monitoring Wells

Observation well WY-WY-OW01-09-A is located approximately 260 m northwest of wells WY1, WY5 and WY6 (Figure 3). Construction and monitoring details of WY-WY-OW01-09-A are described in the table below. Well records for the monitoring well are provided in Appendix B.

Table 3: Monitoring Well Construction Details

Monitoring Well ID	Year Built	Screened Depth (mbgs)	Screened Formation	Distance to WY1 (m)	Distance to WY5 (m)	Distance to WY6 (m)
WY-WY-OW01-09-A	2009	44.2-47.2	Aquifer 3 (AFD1)	265	269	252

2.2 Regional Geology and Hydrostratigraphy

The following sections provide a brief overview of the regional geology and hydrogeology of the Wellesley Well Field. The surficial geology based on regional OGS mapping is provided in Figure 4. The Wellesley Well Field is in the southern portion of the Township of Wellesley (Figure 2). Representative cross-sections showing the stratigraphy in the vicinity of the Wellesley Well Field are included as Figures 5 and 6. The cross-section locations are provided in Figure 3.

Note that the cross-sections are provided as a visual aid and do not necessarily contain all wells in the monitoring program for the Wellesley Well Field (WY1, WY5, WY6). The layers displayed were generated from results of the Hydrogeological Characterization and Conceptual Model Tier 3 Assessment Update Project (Aqua Insight et al, 2023) and associated hydrogeological modelling work.

2.2.1 Surficial Geology and Conceptual Hydrostratigraphy

The surficial geology has been mapped and described by the Ontario Geological Survey (2003) and updated in Bajc and Shirota (2007). The surficial geology of the Wellesley Well Field is characterized primarily by glaciolacustrine-derived silty to clayey till, and silty to sandy till. Glaciofluvial sandy and gravelly deposits as well as modern alluvial deposits are present along nearby Firella Creek.

The Quaternary units present in the vicinity of Wellesley are briefly described below, in order from youngest to oldest.

Aquitard ATA1 – Whittlesey Clay

This silt and clay unit is present at surface across the section and corresponds to glaciolacustrine Whittlesey clay (Bajc and Shirota, 2007). This unit forms a laterally extensive, low-permeability aquitard that restricts infiltration and provides partial confinement to the underlying aquifer.

Aquifer AFA1 - Whittlesey Sand

This very fine to coarse sand unit is interpreted as glaciolacustrine Whittlesey sand (Bajc and Shirota, 2007) and is encountered immediately below ATA1 across the section. AFA1 is continuous aquifer that facilitates groundwater flow within the upper overburden sequence.

Aquitard ATB1 – Mornington Till

Aquitard 1 consists of low permeability, spatially discontinuous, surficial till units found predominantly along the flanks of the Waterloo Moraine. Along the western flank of the Moraine, Aquitard 1 corresponds to the Mornington, Stratford and Tavistock Tills; whereas along the eastern flank of the Moraine this unit corresponds to the Upper Maryhill and Port Stanley Tills (Bajc and Shirota, 2007). The Mornington Till is mapped as the surficial deposit in the area (Figure 4).

Aquifer AFB1 / AFB2 – Upper Waterloo Moraine Stratified Sediments and Equivalent

Aquifer AFB1 / AFB2 represents the main water supply aquifer in the core areas of the Waterloo Moraine. These units are generally comprised of layered silt and fine sand to coarse sand and gravel. Throughout the core areas of the Moraine (Figure 5), the unit typically exceeds 45 m in thickness. In some areas, the Upper Waterloo Moraine is interpreted to be bisected by the middle Maryhill Till (ATB2), effectively separating the aquifer into two units, AFB1 and AFB2. This aquifer is the most prolific aquifer in the Waterloo Region due to its high hydraulic conductivity and transmissivity, lateral extent, and high recharge rate.

Aquitard ATB3 – Lower Maryhill Till

The Lower Maryhill Till is described as a clayey silt to silty clay till. This unit represents one of the primary regional aquitards due to its strong influence on the groundwater flow system within the Waterloo Moraine. This unit is extensive within the core area of the Waterloo Moraine, and along the eastern flank tends to be thin, discontinuous, or reworked and re-deposited as glaciofluvial sediments.

Aquifer AFB3 – Lower Waterloo Moraine Stratified Sediments

The Lower Waterloo Moraine Stratified Sediments is present below the Lower Maryhill Till, mainly along the eastern flank of the Moraine. This unit consists of stratified gravels, sands, or silts and is of very limited extent but is present in the Wellesley well field.

Aquitard ATC1 / ATC2 – Catfish Creek Till

Aquitard 3 corresponds to the Catfish Creek Till. Bajc and Shirota (2007) divided this unit into an upper (ATC1) and lower aquitard (ATC2), with an aquifer (AFC1) found occasionally between the two units. This unit is nearly continuous throughout the Region and together with Aquitard 2, form the main stratigraphic marker units within the Moraine. The texture of this unit is a stony, silty to sandy till.

Aquifer AFD1 – Pre-Catfish Creek Sand and Gravel

Pre-Catfish Creek Till aquifer corresponds to sands and gravel re-worked from Catfish Creek and Pre-Catfish Creek Till and represents the main supply aquifer in several production wells in the Cities of Kitchener and Waterloo, including the Wellesley production wells. This unit is spatially discontinuous throughout much of the core areas of the Waterloo Moraine.

Aquitard ATE1 – Canning Drift

The Canning Drift is comprised of till and associated fine-textured lake deposits. It is typically found at depths of greater than 70 mbgs in the Waterloo Moraine area and is identified to be discontinuous and limited in lateral extent and thickness. Where it is absent, a hydraulic connection is present between the deep overburden aquifers and the underlying bedrock.

Aquifer AFF1 – Pre-Canning Till

The Pre-Canning aquifer is characterized by coarse-grained sand and gravel sediments, and is typically found within bedrock depressions. This unit is discontinuous throughout the Region, and where present is hydraulically connected with the upper weathered portion of the bedrock aquifer.

Bedrock Geology and Conceptual Hydrostratigraphy

The underlying bedrock in the area is the Salina Formation, and consists of interbedded grey and brown dolostone, green to red shale units, and gypsum.

2.3 Local Geology

The description of the local geology is based primarily on the detailed lithological descriptions in the borehole logs (Appendix B).

Aquitard ATA1 – Whittlesey Clay - This silt and clay unit is present at surface across the section. ATA1 extends from ground surface to a depth of approximately a few metres below ground surface. Silt and clay were described at surface at several well records.

Aquifer AFA1 - Whittlesey Sand - This very fine to coarse sand unit is encountered immediately below ATA1 across the section. AFA1 extends from a depth of approximately a few metres below ground surface and is a few metres thick. This unit was not described in well records.

Aquifer AFB1 / AFB2 – Upper Waterloo Moraine Stratified Sediments and Equivalent - Fine to medium sand interpreted to be AFB1 / AFB2 by Burnside was

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June 2026

encountered to a depth of about 3 m at WY-WY-OW01-09-A. This unit was not described in the well records for the production wells.

Aquitard ATB3 – Lower Maryhill Till – This brown silty clay unit is 27.5 m thick and is found from about 3 mbgs to about 31 mbgs at WY-WY-OW01-09-A.

Aquitard ATC1 / AFC1 / ATC2 – Catfish Creek Till – AFC1 is described as grey to grey-brown silt is 18 m thick and is found from about 31 mbgs to the bottom of the holes at 49 mbgs at WY-WY-OW01-09-A.

Aquifer AFD1 – Pre-Catfish Creek Sand and Gravel - Production wells WY1, WY5 and WY6 are completed in this aquifer. This unit is approximately 7.6 m thick.

Bedrock-Salina Formation – The Salina Formation directly underlies AFD1 and was encountered at 49.4 mbgl (WY5) and 50.0 mbgl (WY6).

3.0 2024 / 2025 Results

The following sections summarize groundwater levels at monitoring wells in relation to precipitation and water taking from the aquifer (in accordance with condition 4.3 of the PTTW).

3.1 Precipitation

Longer term precipitation trends can have an impact on water levels in the supply aquifer. To assess the potential influence, monthly precipitation is plotted for comparison to water levels and pumping and presented in Appendix C.

Since variations in precipitation totals can occur throughout the Region due to localized events, monthly precipitation data from the GRCA and Environment Canada stations located closest to the production wells are used. The closest GRCA weather station relative to the Wellesley well field is the Laurel Dam station located 6.4 km to the southeast. The closest Environment Canada station is the Waterloo International Airport (WIA) located 20.3 km to the southeast. The locations of the meteorological stations are shown in Figure 1.

Annual precipitation data from the past 10 years for all stations are compared with long term averages in Table D.1, Appendix D. At Laurel Dam, the long-term average was calculated from when measurements started until the end of 2025. The WIA have “Climate Normals” calculated by Environment Canada for 1991 to 2020.

Annual 2024 / 2025 precipitation data for all the meteorological stations closest to the Wellesley well field are presented in Table 4 below. WIA was missing 6 days of data in 2024 and 6 days in 2025. As a result, the precipitation totals at these stations may be under reported.

Table 4: Summary of Precipitation Data

Station	2024 Precipitation (mm)	2024 Deviation (mm)	Long-Term Average (mm)	2025 Precipitation (mm)	2025 Deviation (mm)
Region of Waterloo International Airport ^(A)	874	+23	851 ^o	723	-128
Laurel Dam ^(B)	907	-31	938 ^A	894	-44

Sources: Environment Canada (1), GRCA (2)
^A 1991 to 2020 Normal ^B 1998-2024 data
^P Average annual precipitation since monitoring began to the end of 2025

Water levels typically follow a seasonal trend with highest levels occurring in the spring with the depth and water content of the snowpack having a significant influence on water levels. Lowest levels occurring in July / August. Widespread synoptic rainfall events can also result in Region-wide water level responses. Summer thunderstorms tend to be short lived and occur over a smaller area resulting in short term, localized water level rises not typically seen in the monitoring wells.

The 2024 total precipitation at Laurel Dam station was 907 mm, which is 31 mm below the long-term average. In contrast, WIA station received 23 mm more precipitation than its long term average. The March 1 GRCA snow survey indicated a snowpack across the Region that was low compared to normal. In 2025, the total precipitation was 894 mm, which is 44 mm below the long-term average. Similarly, the total precipitation at the WIA station was 128 mm below the long-term average, indicating 2025 was a drier-than-average year. However, WIA was missing 12 days of data in 2024 / 2025 and as a result, precipitation totals may be under reported. The snow survey conducted by the GRCA on March 15, 2025, showed that the stations in the Region had a high to very high measured snow water equivalent.

3.2 Monitoring Results

In accordance with condition 4.2 of the PTTW, water levels were measured and recorded once per month at WY-WY-OW01-09-A. Hydrographs showing the results of water level monitoring at each monitoring well over the past 10 years are provided in Appendix C. The method used to collect the water levels (manual or electronic) is indicated on the graphs in Appendix C.

WY-WY-OW01-09-A

Monitoring well WY-WY-OW01-09-A is installed about 250 m northwest of the production wells and is screened in sand (AFD1) below Aquitard 2 (ATB3). Water level monitoring is completed using electronic data loggers since September 2011 (Appendix C).

Seasonal trends are observed at monitoring well WY-WY-OW01-09-A, with highest water levels observed in the spring. In addition, water levels are influenced by pumping of the Wellesley municipal supply wells, with noted water level fluctuations of 0.8 to 1.0 m in response to increases in monthly pumping. Daily fluctuations of approximately 0.2 m occur in response to daily pumping cycles. Overall water levels have declined about 1 m from January 2016 to December 2025 as a result of an overall increase in pumping at the well field, with the lowest levels seen since July 2016. However, water levels at the end of 2025 are not a concern as they remain about 34 m above the top of the well screen.

4.0 Impact Assessment

4.1 Well Interference

PTTW Condition 5.1 states, "The Permit Holder shall immediately notify the local District Office of any complaint arising from the taking of water authorized under this Permit and shall report any action which has been taken or is proposed with regard to such complaint. The Permit Holder shall immediately notify the local District Office if the taking of water is observed to have any significant impact on the surrounding waters. After hours, calls shall be directed to the Ministry's Spills Action Centre at 1-800-268-6060."

PTTW Condition 5.2 states: For Groundwater Takings - if the taking of water is observed to cause any negative impact to other water supplies obtained from any adequate sources that were in use prior to initial issuance of a Permit for this water taking, the Permit Holder shall take such action necessary to make available to those affected, a supply of water equivalent in quantity and quality to their normal takings, or shall compensate such persons for their reasonable costs of so doing, or shall reduce the rate and amount of taking to prevent or alleviate the observed negative impact. Pending permanent restoration of the affected supplies, the Permit Holder shall provide, to those affected, temporary water supplies adequate to meet their normal requirements or shall compensate such persons for their reasonable costs of doing so. If permanent interference is caused by the water taking, the Permit Holder shall restore the water supplies of those permanently affected.

There are non-municipally serviced properties with domestic wells within 500 m of WY1, WY5 and WY6. Water level data from WY-WY-OW01-09-A indicated local drawdown response to pumping is minimal in AFD1 (less than 1 m). In the event that a well interference complaint is received, the Region has a Well Interference Policy in place. A copy of the policy is presented in Appendix F of the 2019 Biennial Groundwater Monitoring Report - Multiple Well Fields (Burnside, 2020). There have been no well interference complaints related to pumping at the Wellesley Well Field in 2024 and 2025.

There is one other groundwater taking registered in the MECP PTTW database within 2 km of the well field which is mapped in Figure 3 and summarized below in Table 5.

Table 5: PTTW (Groundwater) in Vicinity of Wellesley Well Field

Permit Number	Permit Holder	Purpose	Max Liters per Day	Distance (km) from WY1, WY5 and WY6 Supply Wells	Expiry Date
7742-C6WMJ6	Maralyn and Robert Dietz	Industrial	105,000	1.25	2031-09-31

4.2 Aquifer Response to Pumping and Precipitation

PTTW Condition 4.3 states: " The Permit Holder shall prepare and submit a report every two years by June 30, that presents the results of the well field water level monitoring for the two preceding calendar years, assesses changes in water levels in the supply aquifer(s) in relation to precipitation and water taking from the aquifer(s)".

Monitoring results indicate that water levels in the municipal deep overburden aquifer (AFD1) are primarily influenced by pumping at the Wellesley supply wells. Water levels fluctuate by approximately 0.2 m in response to daily pumping cycles and declined by about 1 m between May and July 2022 when pumping increased by roughly 40%, with an overall decline of approximately 1 m since 2016 corresponding to increased well field pumping. While seasonal patterns are evident, characterized by higher spring levels and summer declines, precipitation data from 2024 and 2025 show no measurable correlation with groundwater level fluctuations or response to individual rainfall events.

5.0 Conclusions

Impacts from pumping the municipal wells at the Wellesley Well Field (WY1, WY5, WY6) were evaluated through implementation of the Groundwater Monitoring Program. Based on the information contained in the report, Burnside offers the following conclusions:

- The information presented in this report satisfies condition 4.3 of PTTW P-300-4214409441;
- 2024 and 2025 pumping volumes were within the permitted range;
- There were no reported well interference complaints arising from water taking at the Wellesley well field; and
- Water levels in WY-WY-OW01-09-A respond to pumping of WY1, WY5 and WY6 and have declined about 1m since 2016 in response to increased pumping. Water levels remain about 34 m above the top of the screen and are not a concern.

6.0 References

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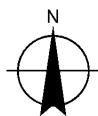
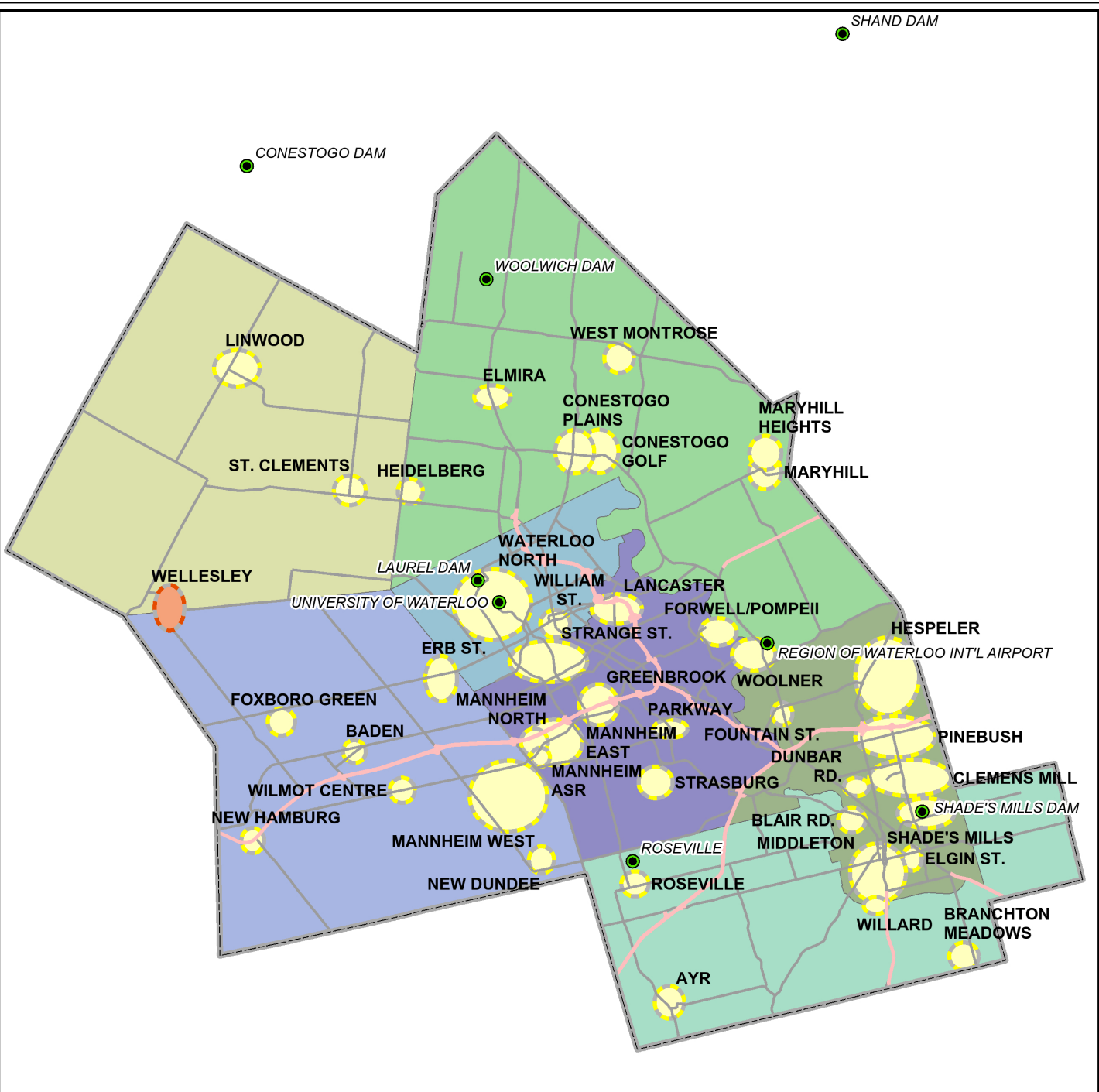


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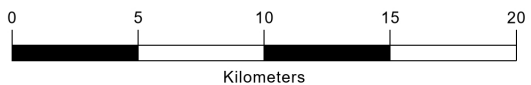
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Figures



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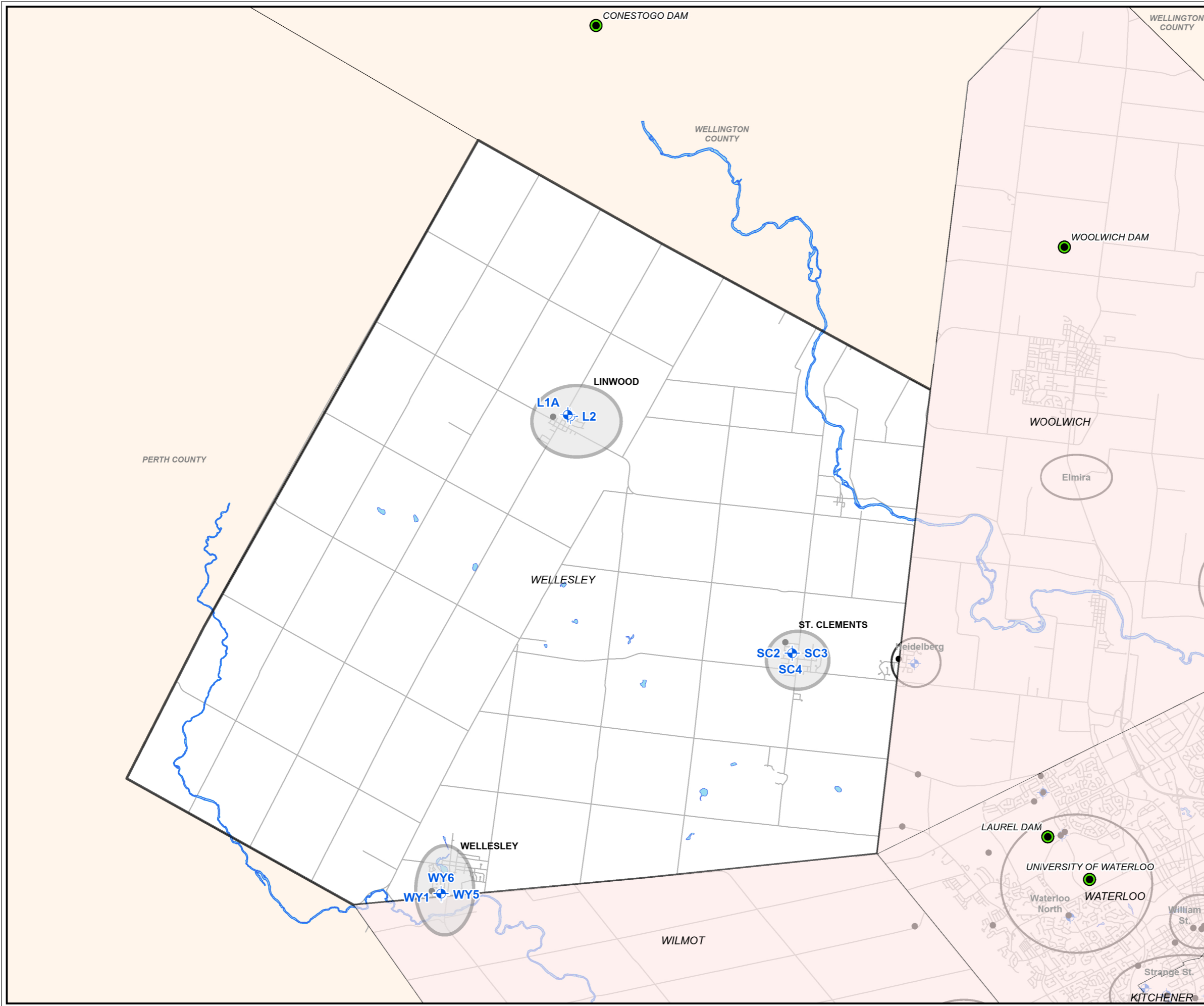
- Well Field Location
- Well Fields
- Regional Municipal Boundaries
- City of Cambridge
- City of Kitchener
- City of Waterloo
- Township of North Dumfries
- Township of Wellesley
- Township of Wilmot
- Township of Woolwich
- Meteorological Monitoring Locations



Map Title
2025 GROUNDWATER MONITORING REPORT - WELLESLEY WELL FIELD
WELL FIELD LOCATION MAP

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REGION OF WATERLOO

Drawn	Checked	Date	Figure No. 1
HN	SQ	February 2026	
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LEGEND

- Production Well Location
- Monitoring Well Location
- Wellesley Municipal Boundary
- Well Fields
- Meteorological Monitoring Locations

Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

Datum: North American 1983 CSRS
 Coord. System: NAD 1983 CSRS UTM Zone 17N



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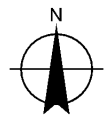
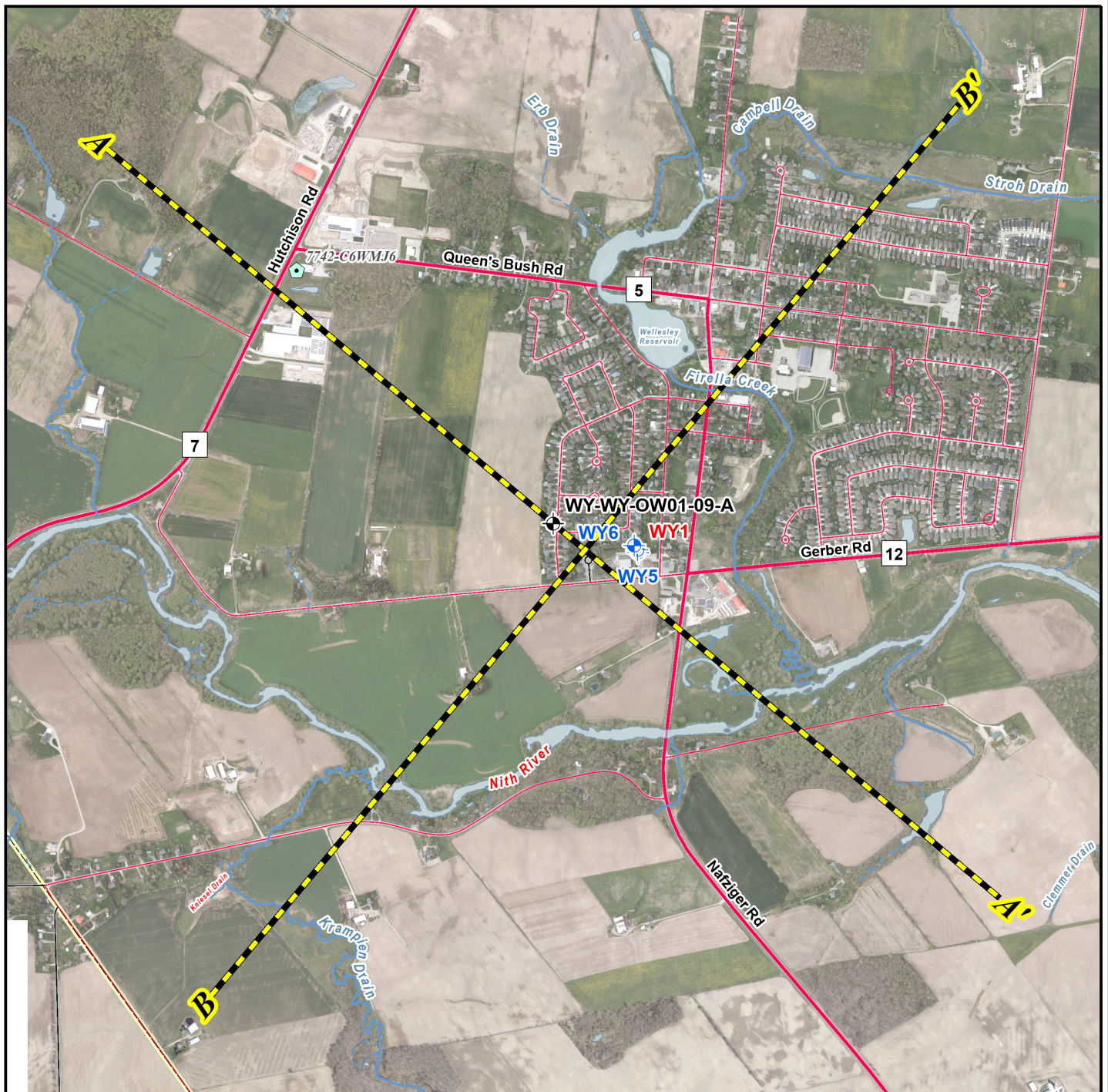
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Figure Title

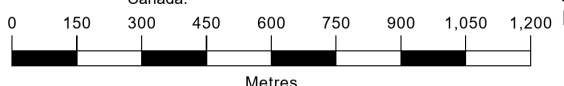
2025 GROUNDWATER MONITORING REPORT - WELLESLEY WELL FIELD

WELLESLEY WELL FIELDS AND MONITORING NETWORK

Drawn	Checked	Date	Figure No.
HN	SQ	March 2026	
Scale	Project No.		2
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Data Source:
 Region of Waterloo GIS Data; Background 2020 Air Photo;
 ArcGIS Image Service Region of Waterloo; Ministry of
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- Additional MECP PTTW Locations**
- Production Well Location
 - Groundwater
 - Cross Section Orientation

- Intermittent Creek
- Creek
- Waterbody
- Provincially Significant Wetland (MNR)
- Regional Road
- Local Road
- Private / Other Road
- Region of Waterloo Boundary



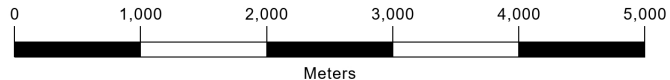
Map Title
**2025 GROUNDWATER MONITORING
 REPORT - WELLESLEY WELL FIELD**
 WELL LOCATION MAP

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REGION OF WATERLOO

Drawn	Checked	Date	Figure No. 3
HN	SQ	February 2026	
Scale	Project No.		
1:17,500		HA0464020	



Data Source:
 1. Ontario Geological Survey 2003. Surficial Geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128.
 2. Region of Waterloo GIS



- RMOV Supply Well
- Watercourse
- Waterbody
- Surficial Geology**
- 5b: Stone-poor, carbonate-derived silty to sandy till (ATA2/ATB1 - Aquitard)
- 5d: Glaciolacustrine-derived silty to clayey till (ATB1 - Aquitard)
- 6: Ice-contact stratified deposits (AFB1 - Aquifer)
- 7a: Glaciofluvial deposits: Sandy deposits (AFA2 - Aquifer)
- 7b: Glaciofluvial deposits: Gravelly deposits (AFA2 - Aquifer)
- 8a: Fine-textured glaciolacustrine deposits: Massive-well laminated (ATA1)
- 19: Modern alluvial deposits
- 20: Organic deposits
- Sand and Gravel Pit
- Moraine (Minor)
- Terrace
- Sample Location
- Hummocky Topography
- Unit Contact
- Boundary

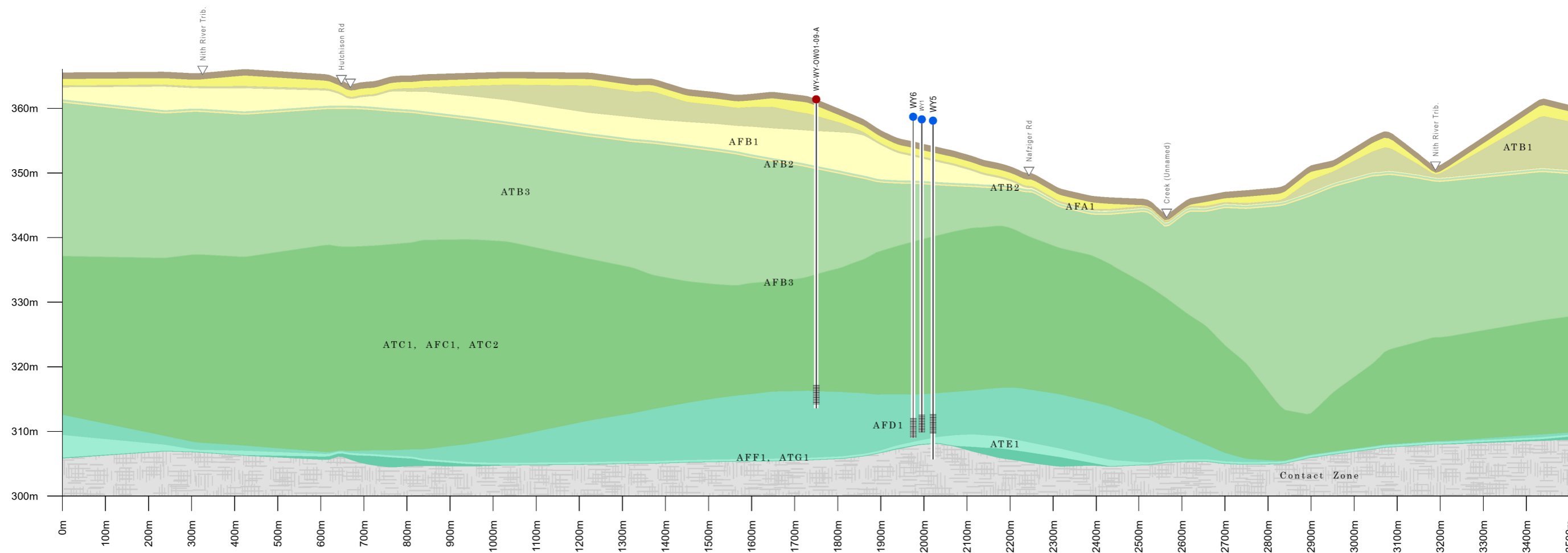
Map Title
2025 GROUNDWATER MONITORING REPORT - WELLESLEY WELL FIELD
 SURFICIAL GEOLOGY

Client
REGION OF WATERLOO

Drawn	Checked	Date	Figure No. 4
HN	SQ	February 2026	
Scale	Project No.		
1:60,000	HA0464020		

A

A'

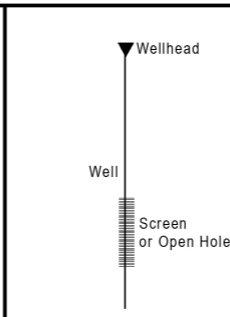


Wells

- Production Well (Active)
- Monitoring Well

Moraine Model 2026

Surficial Geology, Whittlesey Clay (ATA1)	Upper Waterloo Moraine Stratified Sediments & Equivalents (AFB1)	Lower Maryhill Till & Stratified Equivalents (ATB3)	Pre-Catfish Creek Coarse-Grained Glaciofluvial/Lacustrine Deposits (AFD1)	Weathered Bedrock
Whittlesey Sand (AFA1)	Middle Maryhill Till & Equivalents (ATB2)	Lower Waterloo Moraine Stratified Sediments or Catfish Creek Till Outwash (AFB3)	Canning Drift, Till & Fine Textured Glaciolacustrine Deposits (ATE1)	
Upper Maryhill, Port Stanley, Tavistock, Mornington, & Stratford Tills (ATB1)	Middle Waterloo Moraine Stratified Sediments & Equivalents (AFB2)	Upper/Main Catfish Creek Till (ATC1), Middle Catfish Creek Stratified Deposits (AFC1), Lower Catfish Creek Till (ATC2)	Pre-Canning Coarse Textured Glaciofluvial / Glaciolacustrine Deposits (AFF1), Pre-Canning Coarse Textured Till (ATG1)	



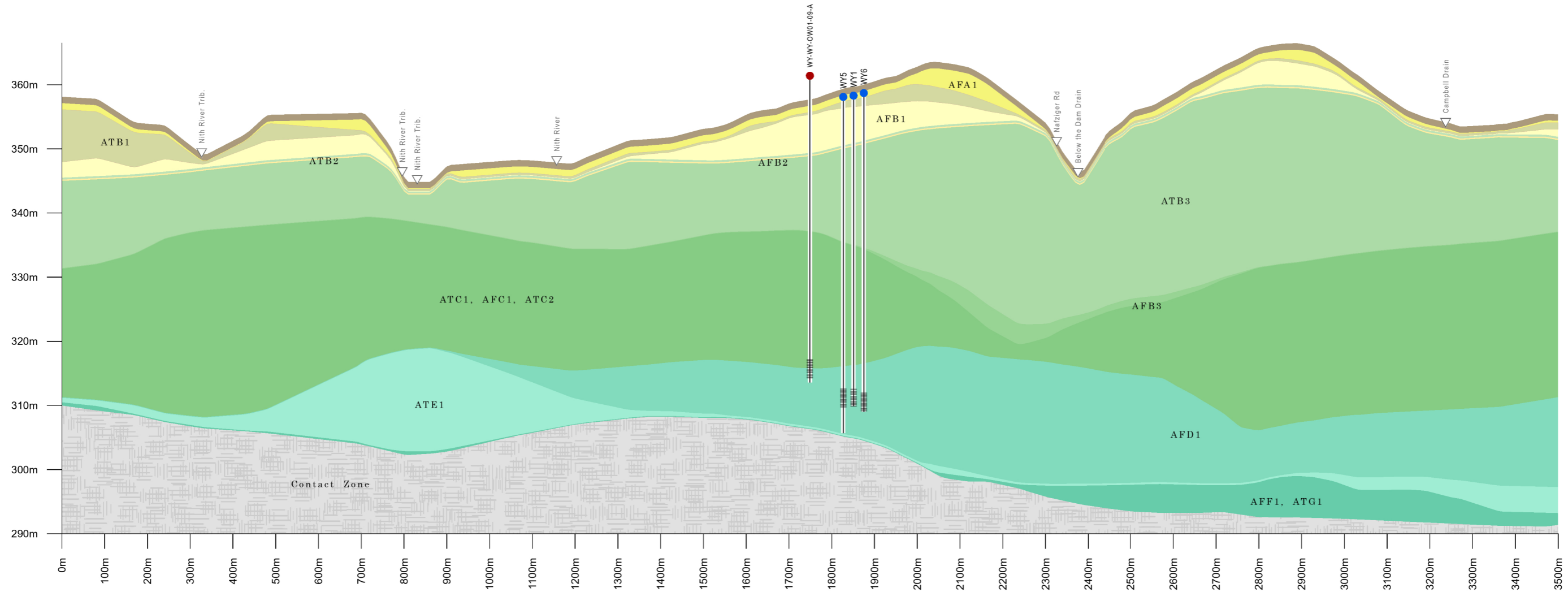
BURNSIDE

Client
REGION OF WATERLOO

Figure Title GEOLOGIC CROSS SECTION REGION OF WATERLOO Wellesley Cross Section A - A'			
Drawn PS	Checked DH	Date 2026/05/29	Figure No. 5
Horizontal Scale 1:10,000		Project No. HA046402	
Vertical Ex.:15x			

B

B'

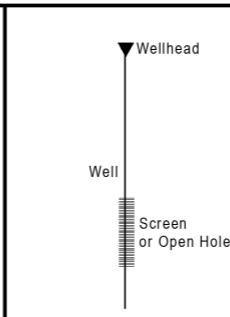


Wells

- Production Well (Active)
- Monitoring Well

Moraine Model 2026

Surficial Geology, Whittlesey Clay (ATA1)	Upper Waterloo Moraine Stratified Sediments & Equivalents (AFB1)	Lower Maryhill Till & Stratified Equivalents (ATB3)	Pre-Catfish Creek Coarse-Grained Glaciofluvial/Lacustrine Deposits (AFD1)	Weathered Bedrock
Whittlesey Sand (AFA1)	Middle Maryhill Till & Equivalents (ATB2)	Lower Waterloo Moraine Stratified Sediments or Catfish Creek Till Outwash (AFB3)	Canning Drift, Till & Fine Textured Glaciolacustrine Deposits (ATE1)	
Upper Maryhill, Port Stanley, Tavistock, Mornington, & Stratford Tills (ATB1)	Middle Waterloo Moraine Stratified Sediments & Equivalents (AFB2)	Upper/Main Catfish Creek Till (ATC1), Middle Catfish Creek Stratified Deposits (AFC1), Lower Catfish Creek Till (ATC2)	Pre-Canning Coarse Textured Glaciofluvial / Glaciolacustrine Deposits (AFF1), Pre-Canning Coarse Textured Till (ATG1)	



Client
REGION OF WATERLOO

Figure Title GEOLOGIC CROSS SECTION REGION OF WATERLOO Wellesley Cross Section B - B'			
Drawn PS	Checked DH	Date 2026/05/29	Figure No. 6
Horizontal Scale 1:10,000		Project No. HA046402	
Vertical Ex.:15x			



BURNSIDE

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Appendix A

Permit To Take Water

Appendix A

PERMIT TO TAKE WATER

Ground Water

NUMBER P-300-4214409441

Version: 1.0

Effective Date: February 28, 2024

Expiry Date: February 1, 2034

Pursuant to Section 34.1 of the Ontario Water Resources Act, Revised Statutes of Ontario (R.S.O.) 1990 this Permit To Take Water is hereby issued to:

REGIONAL MUNICIPALITY OF WATERLOO

150 Frederick Street
6th Floor
KITCHENER
ONTARIO
Canada
N2G 4J3

For the water taking from

WY1

WY5

WY6

Located at:

2233 Gerber Road , Wellesley, WELLESLEY, ONTARIO, CANADA, N0B 2T0

This Permit cancels and replaces Permit Number 0345-94UQ6A, issued on March 6, 2013.

DEFINITIONS

For the purposes of this Permit, and the terms and conditions specified below, the following definitions apply:

- a. "Director" means any person appointed in writing as a director pursuant to section 5 of the OWRA for the purposes of section 34.1 of the OWRA.
- b. "Provincial Officer" means any person designated in writing by the Minister as a provincial officer pursuant to section 5 of the OWRA.
- c. "Ministry" means the ministry of the government of Ontario responsible for the administration of the OWRA, currently named the Ministry of the Environment, Conservation and Parks.
- d. "District Office" means the Guelph District Office of the Ministry.
- e. "Permit" or "PTTW" means this Permit to Take Water No. P-300-4214409441 including its Schedules, if any, issued in accordance with Section 34.1 of the OWRA, as may amended.
- f. "Permit Holder" means REGIONAL MUNICIPALITY OF WATERLOO.

g. "OWRA" means the *Ontario Water Resources Act*, R.S.O. 1990, c. O. 40.

TERMS AND CONDITIONS

You are hereby notified that this Permit is issued subject to the terms and conditions outlined below:

1. Compliance with Permit

- 1.1. Except where modified by this Permit, the water taking shall be in accordance with the application for this Permit To Take Water, attested to by Frank Kosa, on February 22, 2023, and all Schedules included in this Permit.
- 1.2. The Permit Holder shall ensure that any person authorized by the Permit Holder to take water under this Permit is provided with a copy of this Permit and shall take all reasonable measures to ensure that any such person complies with the conditions of this Permit.
- 1.3. Any person authorized by the Permit Holder to take water under this Permit shall comply with the conditions of this Permit.
- 1.4. This Permit is not transferable to another person without the Director's written consent.
- 1.5. This Permit provides the Permit Holder with permission to take water in accordance with the conditions of this Permit, up to the date of the expiry of this Permit. This Permit does not constitute a legal right, vested or otherwise, to a water allocation, and the issuance of this Permit does not guarantee that, upon its expiry, it will be renewed.
- 1.6. The Permit Holder shall keep this Permit available at all times at or near the site of the taking, and shall produce this Permit immediately for inspection by a Provincial Officer upon his or her request.
- 1.7. The Permit Holder shall report any changes of address to the Director within thirty days of any such change. The Permit Holder shall report any change of ownership of the property for which this Permit is issued within thirty days of any such change.

2. General Conditions and Interpretation

2.1. Inspections

The Permit Holder must forthwith, upon presentation of credentials, permit a Provincial Officer to carry out any and all inspections authorized by the OWRA, the Environmental Protection Act, R.S.O. 1990, the Pesticides Act, R.S.O. 1990, or the Safe Drinking Water Act, S. O. 2002.

2.2. Other Approvals

The issuance of, and compliance with this Permit, does not:

- (a) relieve the Permit Holder or any other person from any obligation to comply with any other applicable legal requirements, including the provisions of the Ontario Water Resources Act, and the Environmental Protection Act, and any regulations made thereunder; or
- (b) limit in any way any authority of the Ministry, a Director, or a Provincial Officer, including the authority to require certain steps be taken or to require the Permit Holder to furnish any further information related to this Permit.

2.3. Information

The receipt of any information by the Ministry, the failure of the Ministry to take any action or require any person to take any action in relation to the information, or the failure of a Provincial Officer to prosecute any person in relation to the information, shall not be construed as:

- (a) an approval, waiver or justification by the Ministry of any act or omission of any person that contravenes this Permit or other legal requirement; or
- (b) acceptance by the Ministry of the information's completeness or accuracy.

2.4. Rights of Action

The issuance of, and compliance with this Permit shall not be construed as precluding or limiting any legal claims or rights of action that any person, including the Crown in right of Ontario or any agency thereof, has or may have against the Permit Holder, its officers, employees, agents, and contractors.

2.5. Severability

The requirements of this Permit are severable. If any requirements of this Permit, or the application of any requirements of this Permit to any circumstance, is held invalid or unenforceable, the application of such requirements to other circumstances and the remainder of this Permit shall not be affected thereby.

2.6. Conflicts

Where there is a conflict between a provision of any submitted document referred to in this Permit, including its Schedules, and the conditions of this Permit, the conditions in this Permit shall take precedence.

3. Water Takings Authorized by This Permit

3.1. Expiry

This Permit expires on February 1, 2034. No water shall be taken under authority of this Permit after the expiry date.

3.2. Amounts of Taking Permitted

The Permit Holder shall only take water from the source, during the periods and at the rates and amounts of taking specified in Table A. Water takings are authorized only for the purposes specified in Table A.

Table A (litres)

Source Name / Description	Source Type	Purpose Category	Specific Purpose	Activity	Maximum Taken per minute	Maximum Number of Hours Taken per day	Maximum volume per Day	Maximum days in a year	Zone / Easting / Northing
1 WY1 (WY1)	Well	Public administration	Municipal Supply	Water Supply	1044	24	1503360	365	17 / 518826 / 4813111
2 WY5 (WY5)	Well	Public administration	Municipal Supply	Water Supply	1044	24	1503360	365	17 / 518829 / 4813104
3 WY6 (WY6)	Well	Public administration	Municipal Supply	Water Supply	1044	24	1503360	365	17 / 518822 / 4813125
Total Taking							1503360		

3.3. Notwithstanding Table A, the Permit Holder can operate one well or multiple wells in any combination at a time. However, the rate and amount of taking at any time shall not exceed 1,044 litres per minute and 1,503,360 litres per day, respectively.

4. Monitoring

4.1. The Permit Holder shall maintain a record of all water takings. The daily volume of water taken shall be measured by a flow meter or calculated in accordance with the method described in the application for this Permit, or as otherwise accepted by the Director. This record shall include the dates and times of water takings, the rates of pumping, and an estimated calculation of the total amounts of water pumped per day for each day that water is taken under the authorization of this Permit. A separate record shall be maintained for each source. The Permit Holder shall keep all required records up to date and available at or near the site of the taking and shall produce the records immediately for inspection by a Provincial Officer upon his or her request. The Permit Holder, unless otherwise required by the Director, shall submit, on or before March 31st in every year, the records required by this condition to the Ministry's Regulatory Self Reporting System.

4.2. The Permit Holder shall measure and record water levels once a month in the following monitoring well:

- i. WY-WY-OW01-09-A

4.3. Commencing June 30, 2024, the Permit Holder shall prepare and submit a biennial report due by June 30th to the Director, that presents the following:

- i. Results of the wellfield water level monitoring for the two preceding calendar years
- ii. An assessment of the changes in water levels in the supply aquifer(s) in relation to precipitation and the water taking from the aquifer(s), and
- iii. A summary of all interference complaints received by the Permit Holder related to this Permit and as reported to the District Office in accordance with Condition 5.1 together with the manner in which the Permit Holder has dealt with the complaint.

5. Impacts of the Water Taking

5.1. Notification

The Permit Holder shall immediately notify the local District Office of any complaint arising from the taking of water authorized under this Permit and shall report any action which has been taken or is proposed with regard to such complaint. The Permit Holder shall immediately notify the local District Office if the taking of water is observed to have any significant impact on the surrounding waters. After hours, calls shall be directed to the Ministry's Spills Action Centre at 1-800-268-6060.

5.2. Impacts for Water Situation Type

For Surface-Water Takings

The taking of water (including the taking of water into storage and the subsequent or simultaneous withdrawal from storage) shall be carried out in such a manner that streamflow is not stopped and is not reduced to a rate that will cause interference with downstream uses of water or with the natural functions of the stream.

For Groundwater Takings

If the taking of water is observed to cause any negative impact to other water supplies obtained from any adequate sources that were in use prior to initial issuance of a Permit for this water taking, the Permit Holder shall take such action necessary to make available to those affected, a supply of water equivalent in quantity and quality to their normal takings, or shall compensate such persons for their reasonable costs of so doing, or shall reduce the rate and amount of taking to prevent or alleviate the observed negative impact. Pending permanent restoration of the affected supplies, the Permit Holder shall provide, to those affected, temporary water supplies adequate to meet their normal requirements, or shall compensate such persons for their reasonable costs of doing so.

If permanent interference is caused by the water taking, the Permit Holder shall restore the water supplies of those permanently affected.

6. Director May Amend Permit

- 6.1. The Director may amend this Permit by letter requiring the Permit Holder to suspend or reduce the taking to an amount or threshold specified by the Director in the letter. The suspension or reduction in taking shall be effective immediately and may be revoked at any time upon notification by the Director. This condition does not affect your right to appeal the suspension or reduction in taking to the Environmental Review Tribunal under the Ontario Water Resources Act, Section 100 (4).

REASONS

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is included to ensure that the conditions in this Permit are complied with and can be enforced.
2. Condition 2 is included to clarify the legal interpretation of aspects of this Permit.
3. Conditions 3 through 6 are included to protect the quality of the natural environment so as to safeguard the ecosystem and human health and foster efficient use and conservation of waters. These conditions allow for the beneficial use of waters while ensuring the fair sharing, conservation and sustainable use of the waters of Ontario. The conditions also specify the water takings that are authorized by this Permit and the scope of this Permit.

APPEAL PROVISIONS

In accordance with Section 100 of the *Ontario Water Resources Act, R.S.O. 1990*, you may by written notice served upon me and the Ontario Land Tribunal within 15 days after receipt of this notice, require a hearing by the Tribunal. Section 101 of the *Ontario Water Resources Act, R.S.O. 1990*, as amended, provides that the notice requiring the hearing ("the Notice") shall state:

1. The portions of the Permit or each term or condition in the Permit in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

In addition to these legal requirements, the Notice should also include:

- a. The name of the appellant;
- b. The address of the appellant;
- c. The permit to take water number;
- d. The date of the permit to take water;
- e. The name of the Director;
- f. The municipality within which the works are located;

This Notice must be served upon:

Registrar*		The Director, Section 34.1,
Ontario Land Tribunal		Ministry of the Environment, Conservation and Parks
655 Bay Street, Suite 1500	and	5775 Yonge Street, 8 th Floor
Toronto ON		Toronto, ON
M5G 1E5		M2M 4J1
OLT.Registrar@ontario.ca		Fax: (416) 325-6347

*** Further information on the Ontario Land Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349 or 1 (866) 448-2248, or www.olt.gov.on.ca**

Dated at Hamilton this 27th day of February, 2024



Neil Taylor

Director, Section 34.1

Ontario Water Resources Act, R.S.O. 1990

c: Frank Kosa
Karl Belan, REGIONAL MUNICIPALITY OF WATERLOO

SCHEDULE 1

This Schedule "A" forms part of Permit To Take Water P-300-4214409441 Version Number 1.0, dated February 27, 2024.

1. Permit to Take Water Application signed by Phil Bauer dated February 21, 2023

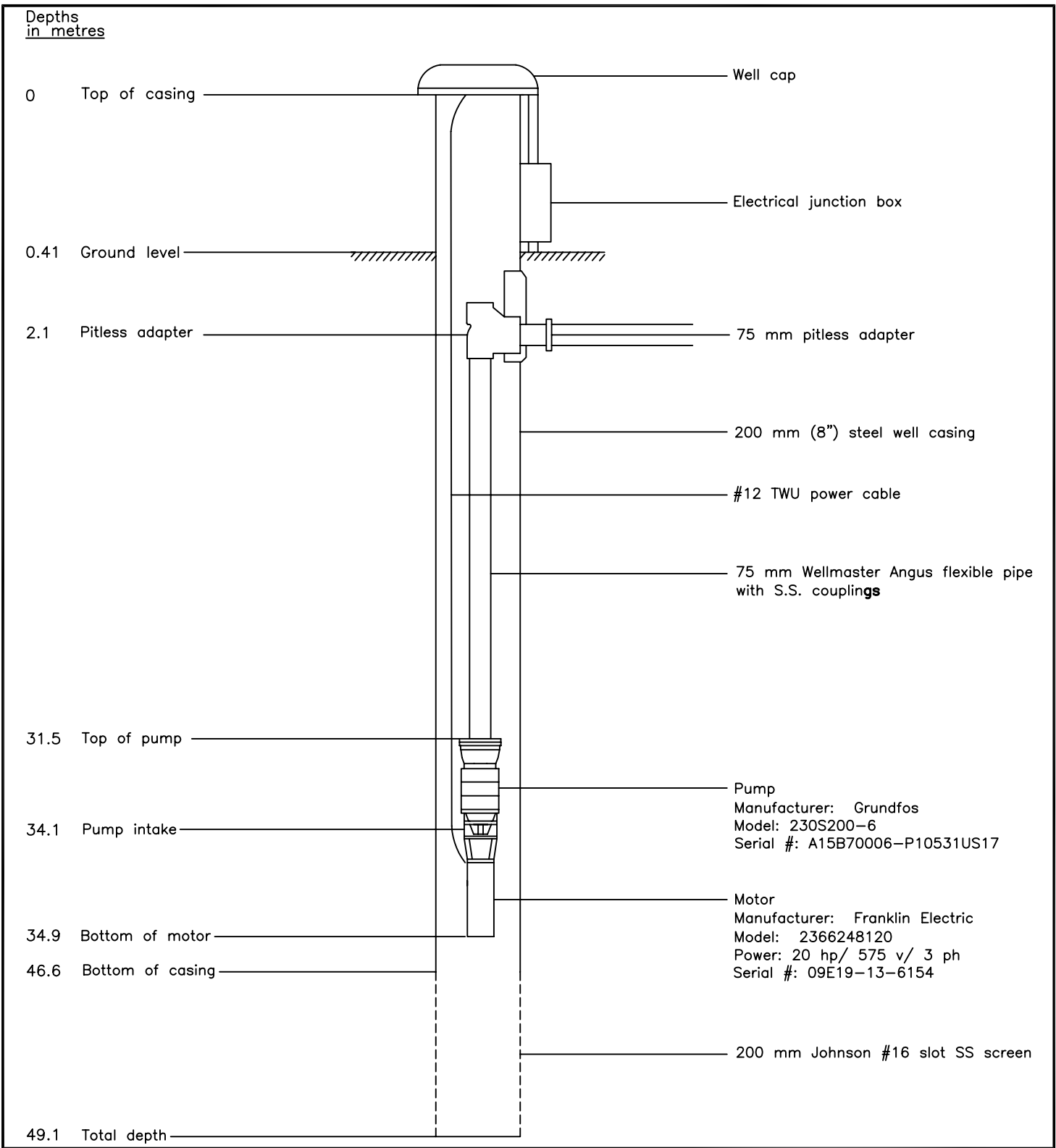


BURNSIDE

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Appendix B

Well Records



	CLIENT	Regional Municipality of Waterloo
	TITLE	WY1 Pump Installation Details

PROJECT No. 006-154		G:\Lotowater Projects\006 Region of Waterloo\WY1 Pump Maintenance\Pump Installation (WY1)		FIGURE 1
DESIGN		REVISION No. 2010-03-02	SCALE N.T.S.	
DRAWN	MG 2010/03/02			
CHECKED	BP 2010/03/30			

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

COUNTY OR DISTRICT: Waterloo TOWNSHIP: Wellesley FOR ALICE STREET MARKET ETC. LOT: 11

OWNER (SURNAME FIRST): Regional Municipality ADDRESS: 20 First W 6th Floor PAGE FOLDED: 10 NO. 4 OF 92

Waterloo (PHONE) (518815) 4812887 ELEVATION: 417.4 M

LOG OF OVERBURDEN AND BEDROCK MATERIALS - SEE INSTRUCTIONS -

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET	
				FROM	TO
	Fill	clay		0	2
Brown	Clay			2	9
Gray	Clay			9	59
Gray	clay	Fine Sand gravel		59	105
Gray	clay	gravel stones		105	133
gray	clay	stones		133	142
Gray	gravel	silt layers		142	162
Gray	Limestone			162	167
Brown	Limestone	shale layers		167	167
Gray	Limestone			169	172

31 _____ 32 _____

41 WATER RECORD

WATER TABLE AT - FEET	KIND OF WATER
149-159	1 FRESH 3 SULPHUR 4 MINERALS 5 SALT 6 HARD
	1 FRESH 3 SULPHUR 4 MINERALS 5 SALT 6 HARD
	1 FRESH 3 SULPHUR 4 MINERALS 5 SALT 6 HARD
	1 FRESH 3 SULPHUR 4 MINERALS 5 SALT 6 HARD

51 CASING & OPEN HOLE RECORD

DEPTH - FEET	WELL TYPE	WELL MATERIAL
250 +1	139	1 STEEL 2 GALVANNEED 3 CONCRETE 4 COPPER HOLE 5 PLASTIC

SCREEN: 20x10' 72' 26.6' S.S. 149'

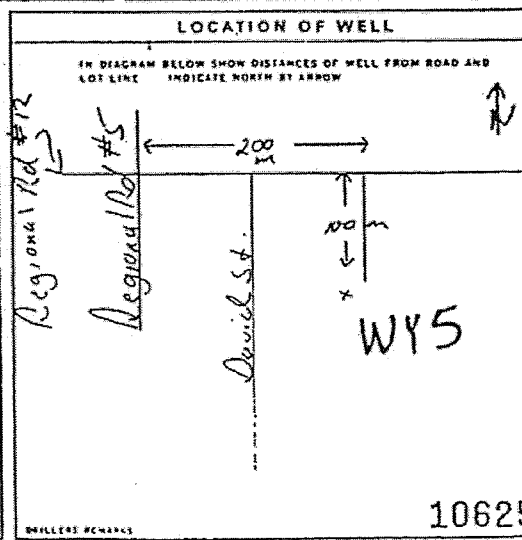
61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET	MATERIAL AND TYPE	CEMENT GROUT LEAK PACKER ETC.
0	139	Benseal

71 PUMPING TEST

WATER LEVELS DURING PUMPING: 20' (Static), 100' (Pump 100' off), 275' (Pump 275' off)

RECOMMENDED PUMP SETTING: 100' FEET



FINAL STATUS OF WELL: WATER SUPPLY

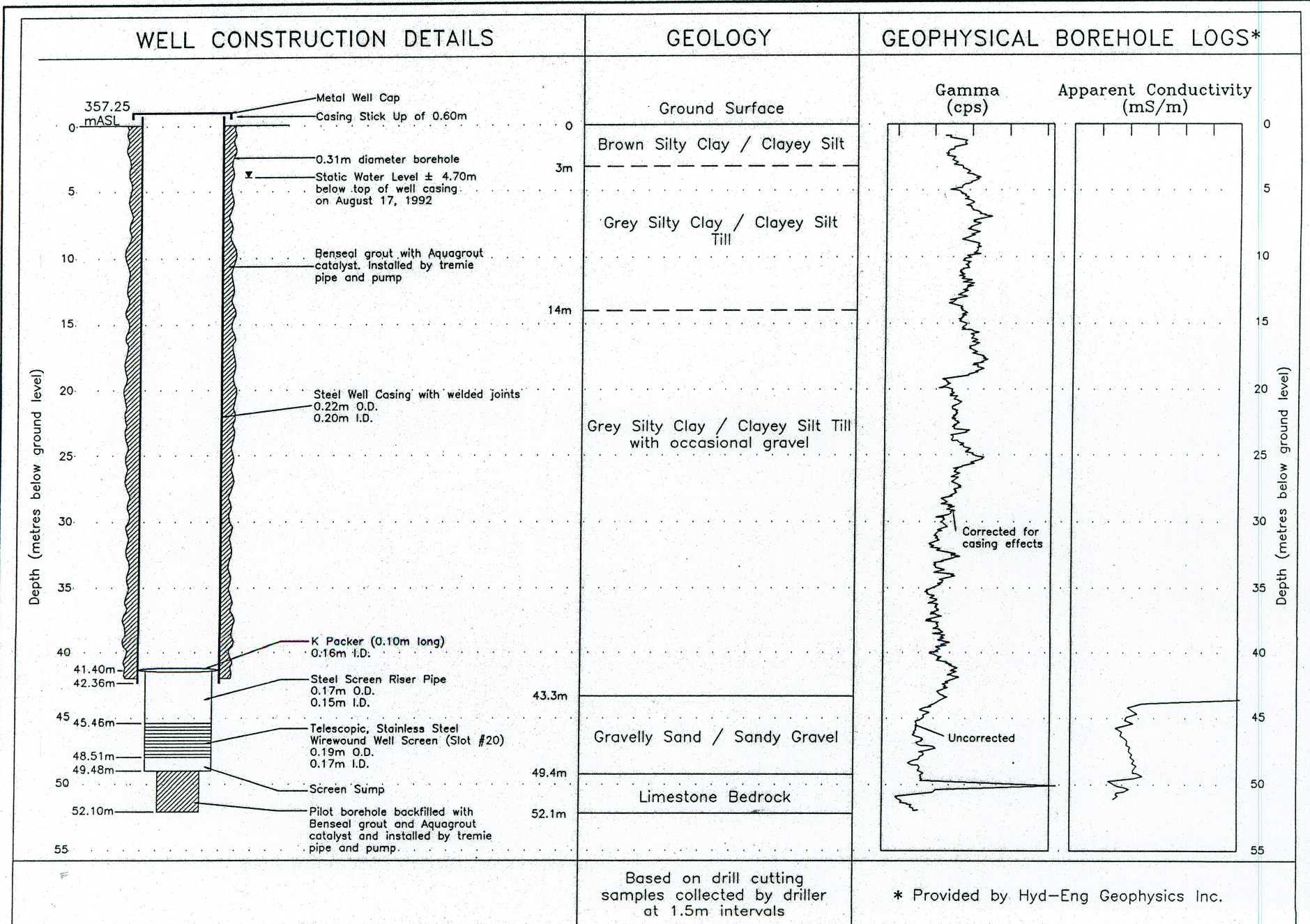
WATER USE: DOMESTIC

METHOD OF CONSTRUCTION: CABLE TOOL

CONTRACTOR: Highland Water Wells, Box 441 Durham, Fred Wilson, License # 7013

WELL CONTRACTOR'S LICENSE NUMBER: 2-21

DATE OF INSPECTION: APR 29 1992

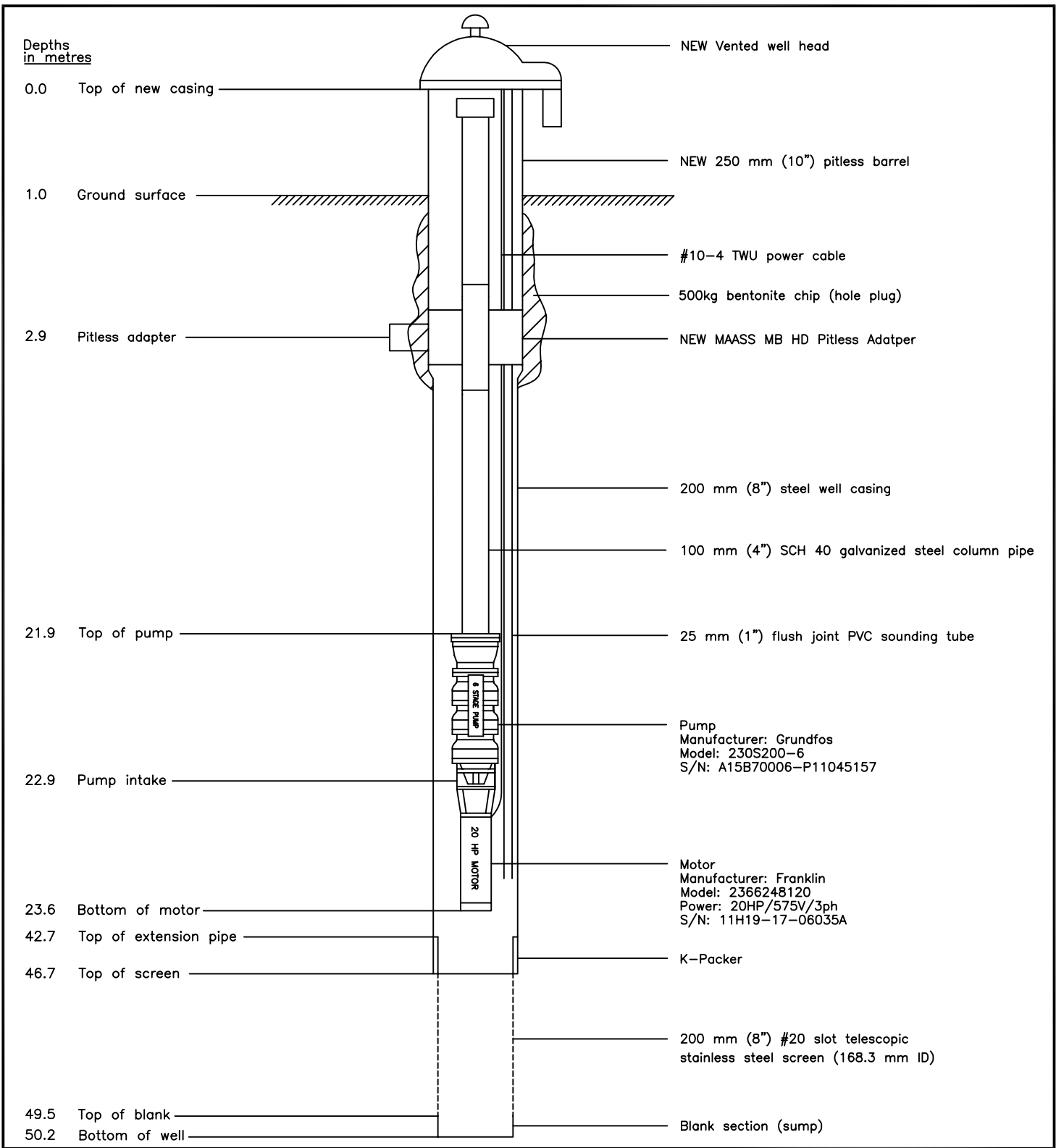



6

Figure 4
WELLESLEY HEIGHTS STANDBY WELL (WY5) DETAILS

GLL PROJECT 92-174
 NOVEMBER 16, 1992
 FILE NO. 9217404.DWG





	CLIENT Regional Municipality of Waterloo
	TITLE Well WY5 Pump Installation Drawing

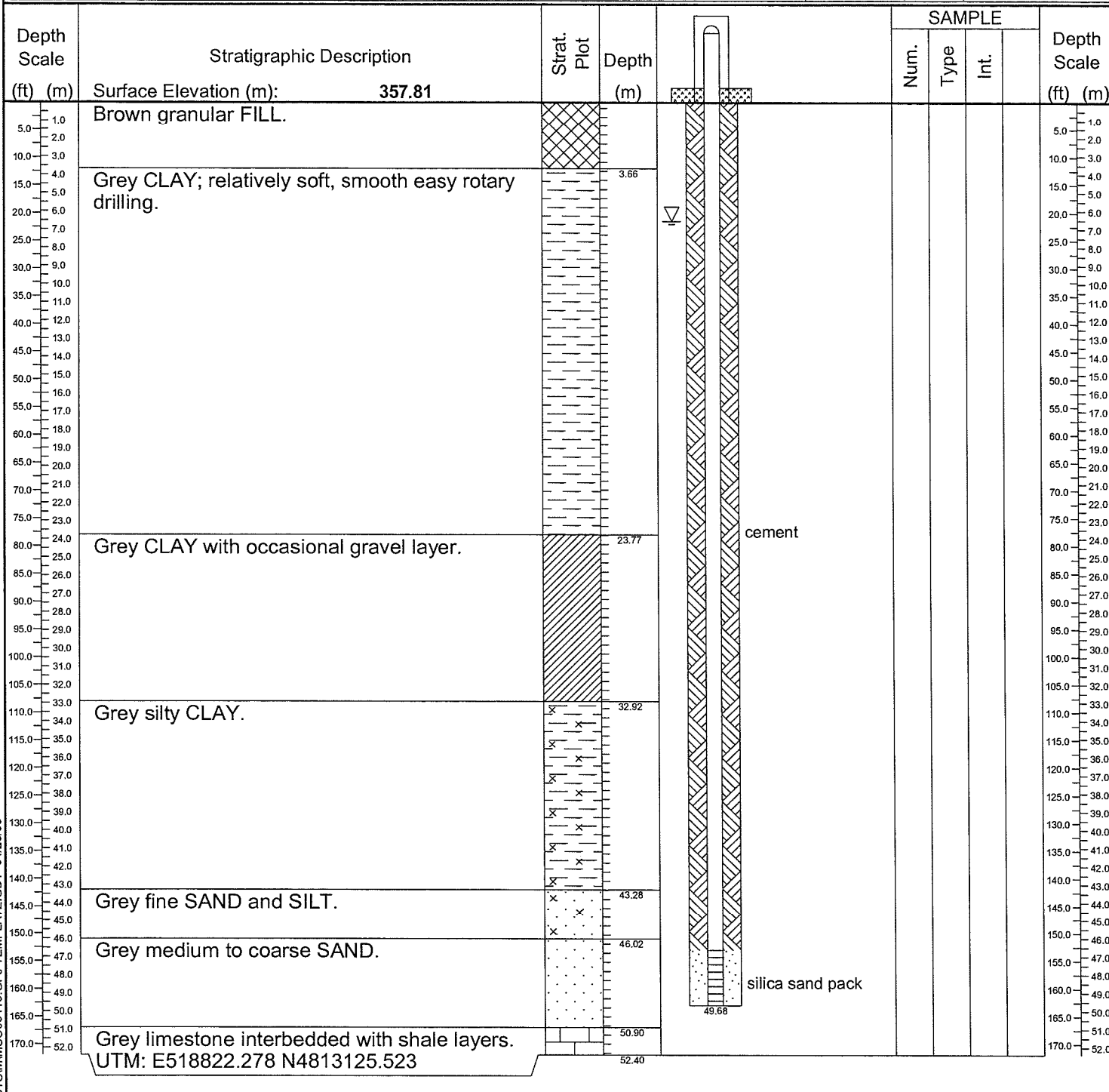
PROJECT No. 006-284	G:\Lotowater Projects\006 Region of Waterloo\284 WY5 Leak Investigation\Pump Install.dwg	FIGURE
DESIGN	REVISION No. 2016/08/08	
DRAWN EH 2013/09/12		
CHECKED		

LOG OF DRILLING OPERATIONS



R.J. Burnside & Associates Limited
 15 Townline, Orangeville, Ontario L9W 3R4
 telephone (519) 941-5331 fax (519) 941-8120

Client: Regional Municipality of Waterloo	Project Name: K11A	Logged by: D. Narhgang
Project No.: MSO 09419	Location: Glasgow Street, Kitchener	Ground (m amsl): 357.807
Drilling Co.: Lang Well Drilling	Date Started: 6/23/2007	Static Water Level (m amsl):
Drilling Method: Mud Rotary	Date Completed: 6/29/2007	Sand Pack (m amsl):



B:\LOG GUELPH P:\GINT\PROJECTS\MSO09419.GPJ TEMPLATE.GDT 04/29/08

Prepared By: **D. Wilson** Checked By: **J. Baxter** Date Prepared: **8/13/2007**
 This borehole log was prepared for hydrogeological and/or environmental purposes and does not necessarily contain information suitable for a geotechnical assessment of the subsurface conditions. Borehole data requires interpretation by R. J. Burnside & Associates Limited personnel before use by others.

LEGEND	MONITORING WELL DATA	SAMPLE TYPE	AC [Auger Cutting]	SS [Split Spoon]
▼ Water found @ time of drilling	Pipe: 200 mm Steel	CS [Continuous]	AR [Air Rotary]	WC [Wash Cuttings]
▽ Static Water Level - 7/13/2007	Screen: 190 mm dia. Stainless Steel	RC [Rock Core]		

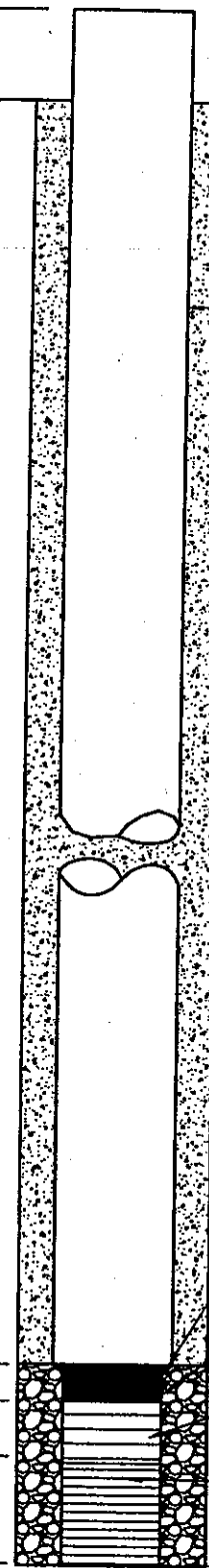
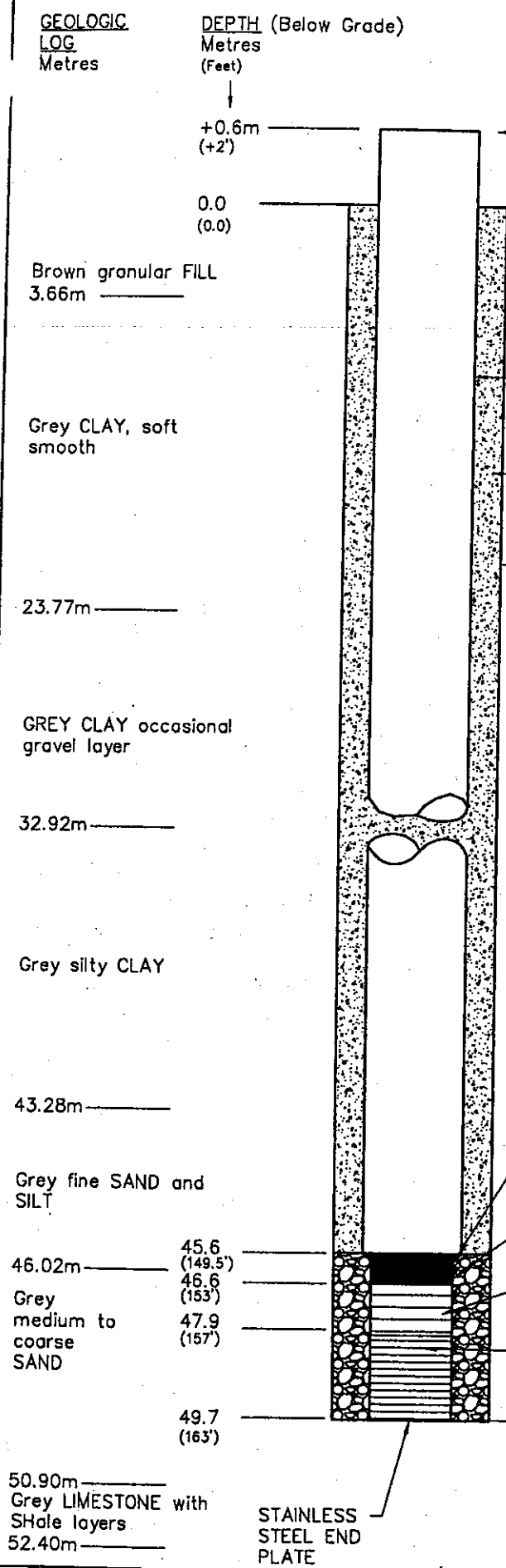
FIGURE 4 REGION OF WATERLOO WELLESLEY VILLAGE

WY6 - WELL CONSTRUCTION REPORT

AS CONSTRUCTED DRAWING

TOC = 358.41

357.81
(WRAS/60. Laj)



TOP OF CASING

GRADE LEVEL

219mm (8.6") O.D. , 5.6mm (0.219") WALL THICKNESS) STEEL CASING, THREADED AND COUPLED

NON SHRINK NEAT CEMENT GROUT

APPROXIMATE 300mm NOMINAL DIAMETER HOLE (MAXIMUM DIAMETER 325mm)

K-PACKER; STAINLESS STEEL & NEOPRENE RUBBER

TIGHT WOUND STAINLESS STEEL SCREEN

191mm (7.5") O.D. 0.9mm SLOT OPENING (35 SLOT) STAINLESS STEEL CONTINUOUS WOUND WELL SCREEN

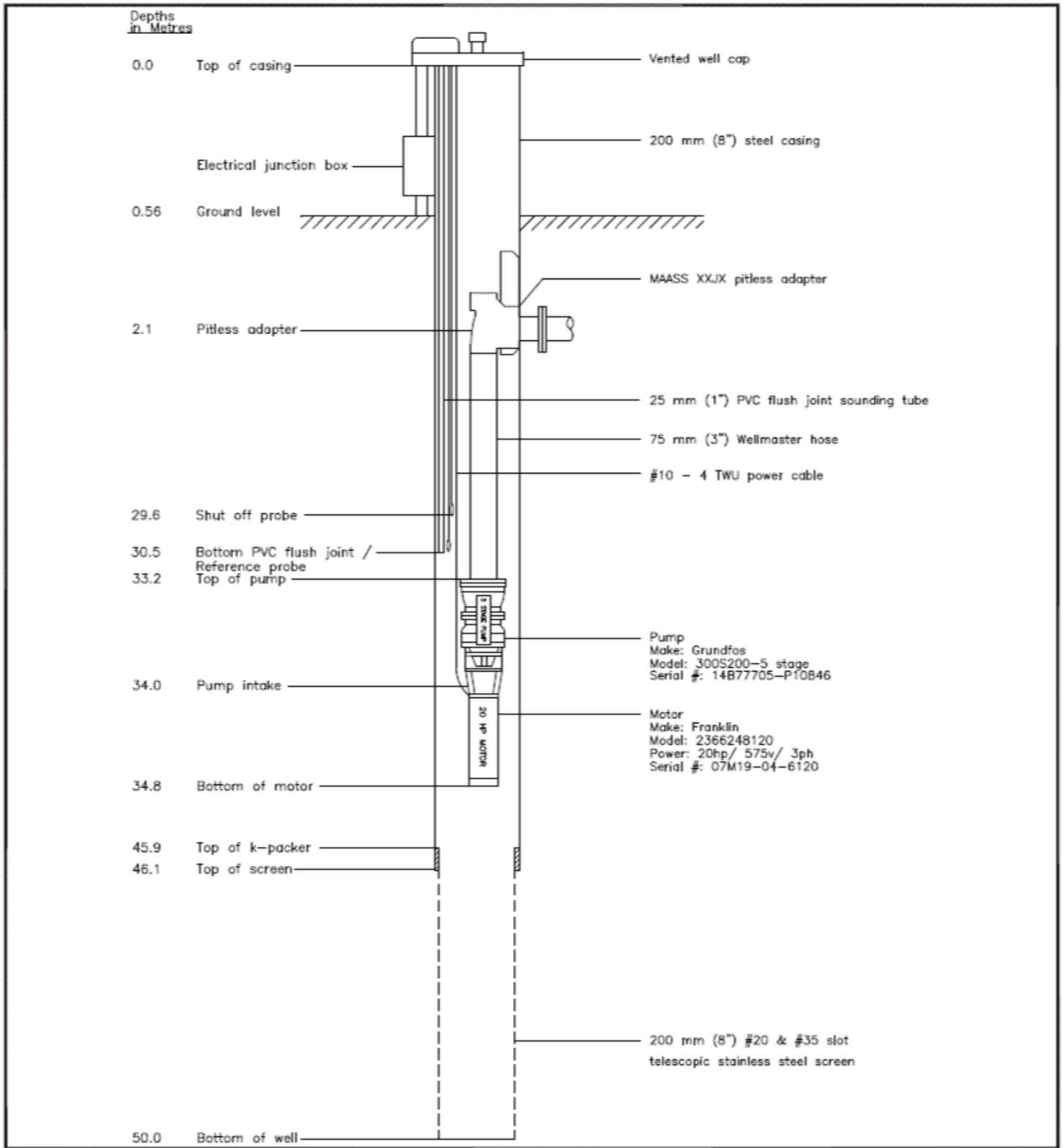
191mm (7.5") O.D. 0.5mm SLOT OPENING (20 SLOT) STAINLESS STEEL CONTINUOUS WOUND WELL SCREEN


NATIVE GRANULAR AQUIFER MATERIALS

STAINLESS STEEL END PLATE

APRIL 2008
N.T.S.
FILE NO.: MSO 09419





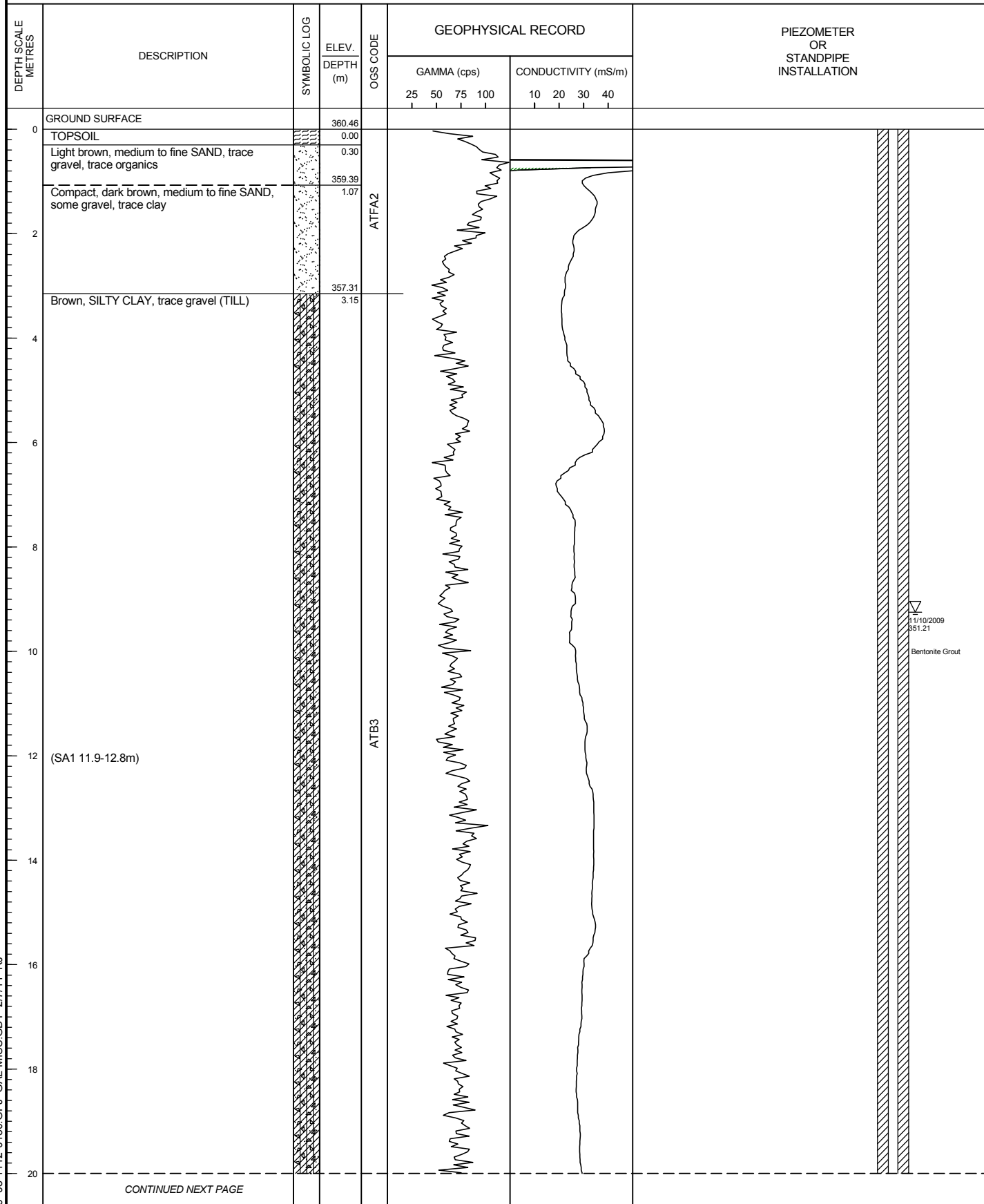
			CLIENT Regional Municipality of Waterloo	
			TITLE Well WY6 Pump Installation Drawing	
PROJECT No. 006-393		G:\Lotowater Projects\006 Region of Waterloo\393 Well WY6 Service\Pump Install.dwg		
DESIGN		REVISION No. 2017/04/28	SCALE N.T.S.	FIGURE 2
DRAWN	EH 2017/04/28			
CHECKED				

PROJECT: 08-1112-0150
 LOCATION: N 4813191.0 ; E 518579.0

BOREHOLE LOG OF: WY-WY-OW01-09

SHEET 1 OF 3
 DATUM: NAD83

DRILLING DATE: September 21-23, 2009
 DRILL RIG: PQ Coring
 DRILLING CONTRACTOR: Procore Drilling



MIS-HYD 009 08-1112-0150.GPJ GAL-MISS.GDT 2/7/11 RJ

CONTINUED NEXT PAGE

11/10/2009
 351.21
 Bentonite Grout

DEPTH SCALE
 1 : 100



LOGGED: BH
 CHECKED: DN

PROJECT: 08-1112-0150
 LOCATION: N 4813191.0 ; E 518579.0

BOREHOLE LOG OF: WY-WY-OW01-09

SHEET 2 OF 3
 DATUM: NAD83

DRILLING DATE: September 21-23, 2009
 DRILL RIG: PQ Coring
 DRILLING CONTRACTOR: Procore Drilling

DEPTH SCALE METRES	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	OGS CODE	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION							
					GAMMA (cps)				CONDUCTIVITY (mS/m)											
					25	50	75	100	10	20	30	40								
20	--- CONTINUED FROM PREVIOUS PAGE --- Brown, SILTY CLAY, trace gravel (TILL)																			
22																				
24																				
26					ATB3															
28																				
30																				
30			329.80																	
30	Grey, SILT, trace gravel, trace clay (TILL)		30.66																	
32																				
34					AFC1															
34			326.04																	
34	Fine SAND		34.42																	
34			325.36																	
34	Grey, SILT, trace gravel, trace clay (TILL)		35.10																	
36			324.49																	
36	Grey brown, SILT, trace sand, trace clay		35.97																	
38					AFC1															
40																				
	CONTINUED NEXT PAGE																			

MIS-HYD 009 08-1112-0150.GPJ GAL-MISS.GDT 2/7/11 RJ

Bentonite Grout

DEPTH SCALE
1 : 100



LOGGED: BH
CHECKED: DN



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Appendix C

Monitoring Data (Pumped Volumes and Hydrographs)



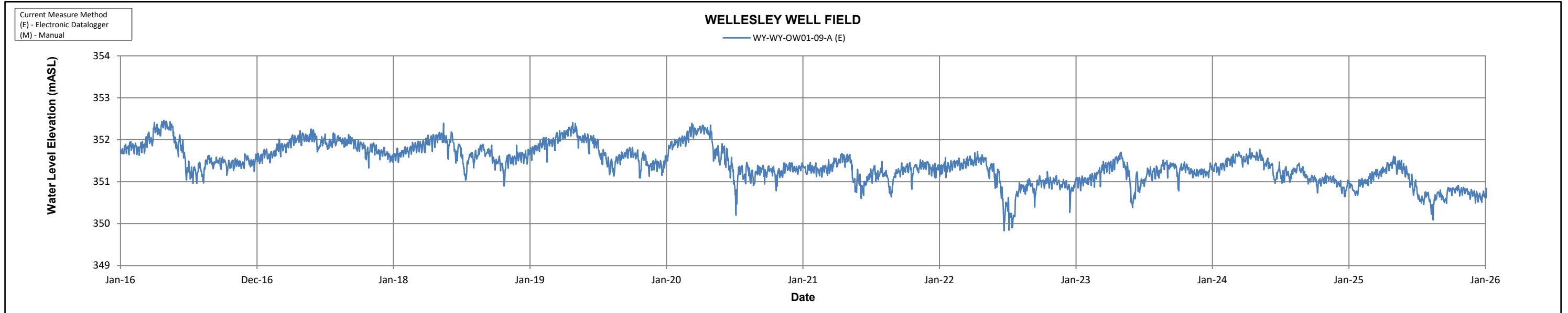
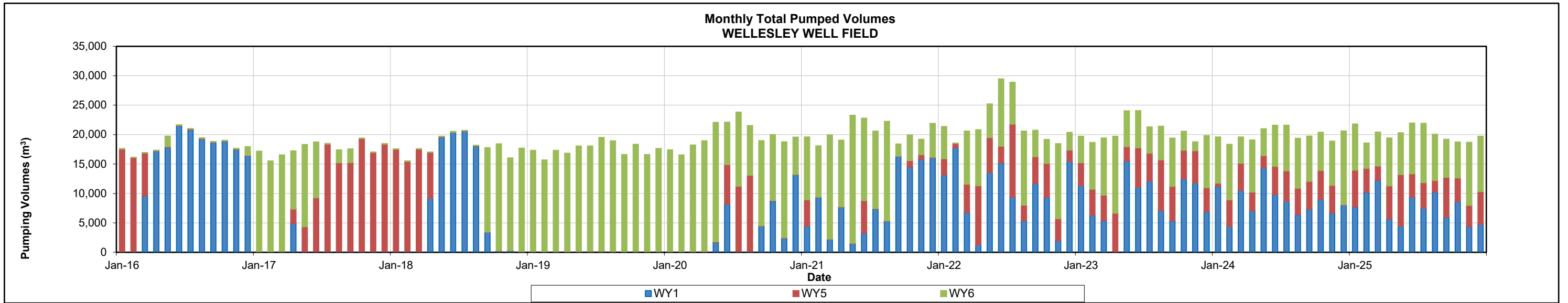
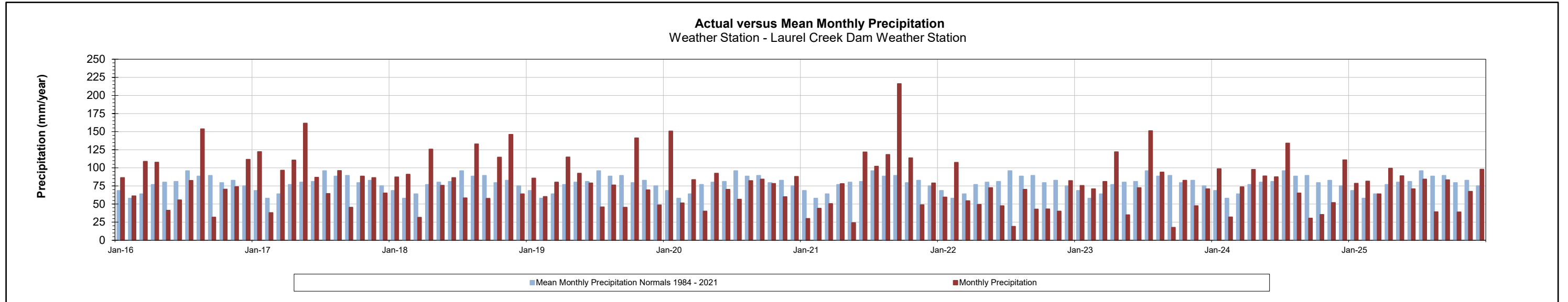
TABLE C-1
WELL FIELD WATER PRODUCTION SUMMARY
REGION OF WATERLOO - 2025 GROUNDWATER MONITORING REPORT



Well Field	Major or Minor Supply	Production Well Name	Status	Permit to Take Water Details			2021 Production Summary			2022 Production Summary			2023 Production Summary			2024 Production Summary			2025 Production Summary		
				MOE Permit Number	Permitted Capacity (total m ³ /year)*	Permitted Rate (L/s)*	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)
Wellesley	Minor	WY1 WY5 WY6	Supply Supply	P-300-4214409441	548,726	17.4	103,693	284	3.3	120,967	331	3.8	105,432	289	3.3	103,441	283	3.3	91,163	250	2.9
				P-300-4214409441	548,726	17.4	12,538	34	0.4	58,180	159	1.8	62,065	170	2.0	43,914	120	1.4	57,414	157	1.8
				P-300-4214409441	548,726	17.4	128,741	353	4.1	85,097	233	2.7	79,332	217	2.5	92,421	253	2.9	92,172	253	2.9
				Well Field Total	548,726	17.4	244,972	671	7.8	264,244	724	8.4	246,829	676	7.8	239,776	657	7.6	240,749	660	7.6

Notes:
 - = no applicable data
 n/a = data not available
 * = rates and volumes based on permitted L/day

REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
WELLESLEY





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Appendix D

Precipitation Data

**Table D-1
Precipitation Variation from Average
Region of Waterloo - 2025 Groundwater Monitoring Report**

Year	Kitchener/Waterloo Weather Station Established 1966		
	Annual Precipitation (mm)	30-yr NORMAL Precipitation 1981-2010 (mm)	Difference (mm)
2016	748	851	-103
2017	818	851	-33
2018	749	851	-102
2019	695	851	-156
2020	689	851	-162
2021	772	851	-79
2022	438	851	-413
2023	813	851	-38
2024	874	851	23
2025	723	851	-128

Year	University of Waterloo Station Established 1988		
	Annual Precipitation (mm)	Average Precipitation 1998-2024 (mm)	Difference (mm)
2016	891	871	20
2017	989	871	118
2018	950	871	79
2019	923	871	52
2020	953	871	82
2021	1022	871	151
2022	578	871	-293
2023	959	871	88
2024	763	871	-108
2025	943	871	72

Year	Shand Dam Established 1939		
	Annual Precipitation (mm)	Average Precipitation 1940-2025 (mm)	Difference (mm)
2016	976	926	50
2017	1093	926	167
2018	849	926	-77
2019	1081	926	155
2020	1017	926	91
2021	876	926	-50
2022	798	926	-128
2023	1015	926	89
2024	994	926	68
2025	995	926	69

Year	Conestogo Dam Established 1961		
	Annual Precipitation (mm)	Average Precipitation 1961-2025 (mm)	Difference (mm)
2016	983	990	-7
2017	1210	990	220
2018	962	990	-28
2019	992	990	2
2020	1021	990	31
2021	975	990	-15
2022	907	990	-83
2023	1053	990	63
2024	972	990	-18
2025	1025	990	35

Year	Woolwich Dam Established 1960		
	Annual Precipitation (mm)	Average Precipitation 1960-2025 (mm)	Difference (mm)
2016	844	835	9
2017	986	835	151
2018	869	835	34
2019	824	835	-11
2020	862	835	27
2021	649	835	-186
2022	668	835	-167
2023	859	835	24
2024	793	835	-42
2025	732	835	-103

Year	Shade's Mills Dam Established 1960		
	Annual Precipitation (mm)	Average Precipitation 1960-2025 (mm)	Difference (mm)
2016	934	909	24
2017	1092	909	183
2018	1042	909	133
2019	1059	909	150
2020	848	909	-62
2021	1020	909	111
2022	682	909	-227
2023	982	909	73
2024	976	909	67
2025	895	909	-14

Year	Laurel Dam Established 1960		
	Annual Precipitation (mm)	Average Precipitation 1960-2025 (mm)	Difference (mm)
2016	985	938	47
2017	1062	938	124
2018	1071	938	133
2019	940	938	2
2020	938	938	0
2021	1027	938	89
2022	689	938	-249
2023	921	938	-17
2024	907	938	-31
2025	894	938	-44

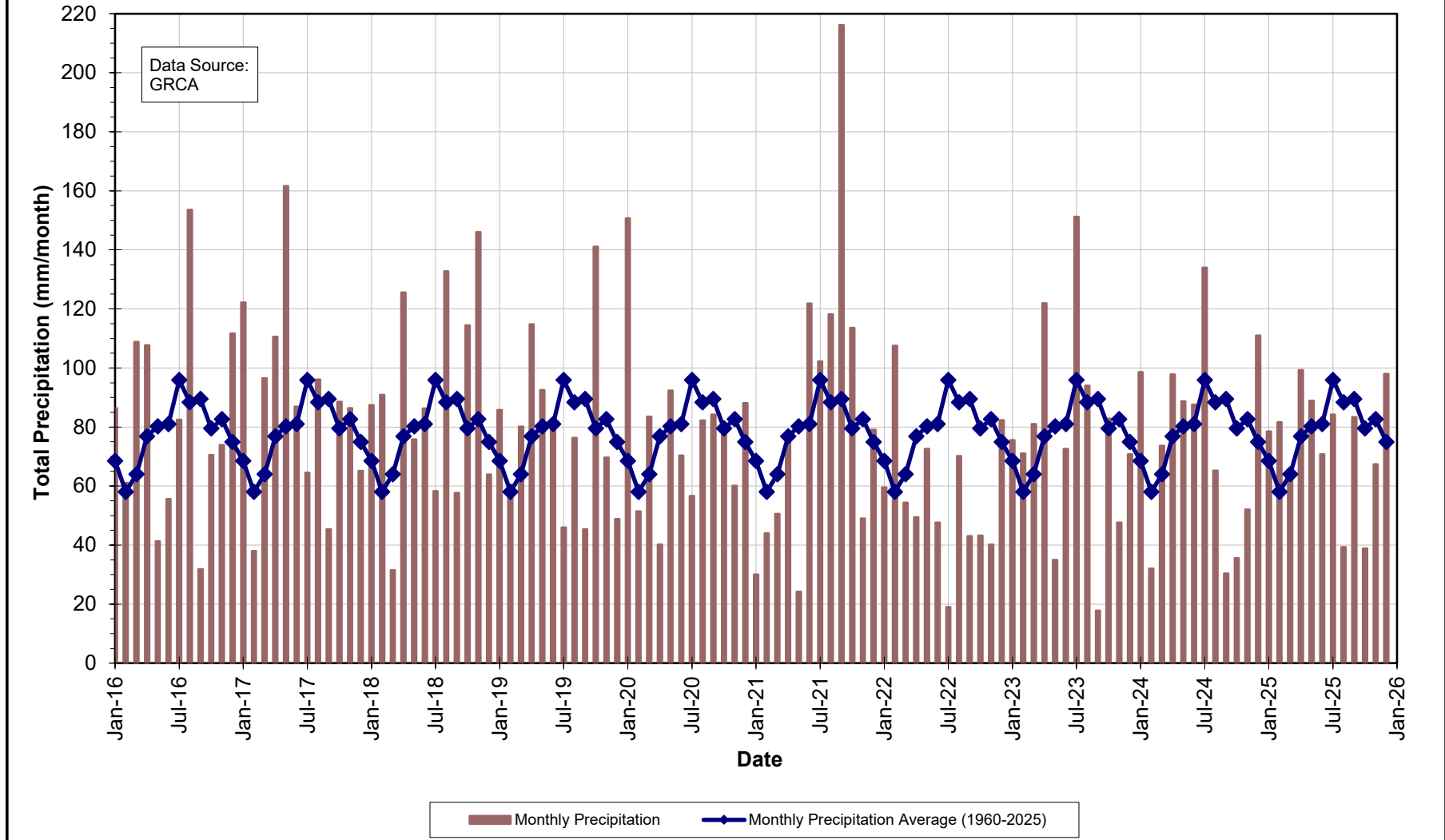
Year	Roseville Weather Station Established 1972		
	Annual Precipitation (mm)	30-yr NORMAL Precipitation 1981-2010 (mm)	Difference (mm)
2016	899	919	-20
2017	882	919	-37
2018	905	919	-14
2019	957	919	38
2020	817	919	-102
2021	832	919	-87
2022	637	919	-282
2023	945	919	26
2024	856	919	-63
2025	786	919	-133

NOTES:

WIA station data is not subject to review by the National Climate Archives, therefore, undergoes very limited quality checking.
GRCA Dam stations data is not reviewed extensively and undergoes limited quality checking.

Region of Waterloo – 2025 Groundwater Monitoring Report

Figure D.1
Laurel Creek Dam
Monthly Precipitation





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Appendix E

Monitoring Program Overview

GROUNDWATER LEVEL MONITORING PROGRAM PROCEDURES

E.1 Overview

The Region of Waterloo (Region) collects water level measurements at specific monitoring wells to ensure sustainable long-term water supply and to meet monitoring and reporting requirements for the Region's water-taking permits. The goal of the program is to manage and protect the Region's groundwater supply and to assess the potential impact of municipal pumping on the groundwater and surface water resources in the Region. The ongoing collection and assessment of groundwater level data is integral to assess any changes to the water resources that may occur due to pumping.

E.1.1 Production Well Pumping and Water Levels

In 2023 the Region managed approximately 132 production wells with status defined as:

- Commissioned – Active wells
- New Not-Commissioned – Well are inactive or locked out until future demand or repairs/maintenance of other wells requires activating them

The well fields are referred to as Urban (Kitchener, Waterloo, and Cambridge) and Rural (North Dumfries, Woolwich, Wilmot, and Wellesley). Well fields in Kitchener, Waterloo, and Cambridge are referred to as the Integrated Urban System (IUS).

The Region's active production wells are monitored through the Region's SCADA (Supervisory Control and Data Acquisition) system, which reads and records the volume pumped on a daily basis. A few wells do not have their own meter but are combined with other nearby well(s) in the well field and the combined flow is divided into a record for each source. Water level measurements are obtained from the production wells where required. All manual measurements are obtained using either an air line or a water level tape.

E.1.2 Monitoring Wells and Surface Water levels

Water levels are measured at monitoring wells and at some surface water features. The objective of this monitoring is to collect data to ensure that the Region's water taking has minimal impact on the environment and on private water takers.

Water levels in the Region's monitoring wells are measured either electronically or manually. Most of the wells that are monitored electronically use datalogger equipment manufactured by *In-Situ Inc.*® LevelTROLLs® and RuggedTROLLs®, as well as, by *Van Essen Instruments (formerly Schlumberger Water Services)* Mini-Divers®, Micro-Divers®, and TD-Divers®; or by *Solinst*® Levelloggers®. The datalogger pressure sensor models used may be either vented (gauged) or non-vented (absolute) for *In-Situ Inc.*®; whereas, for *Van Essen Instruments* and for *Solinst*®, non-vented (absolute) models are used. Barometric dataloggers by each manufacturer suspended in select well locations are also used with the non-vented (absolute) models to provide the required barometric pressure compensation necessary in producing the water level data. Manual monitoring is done using a *Solinst*® and/or *Heron Instruments Inc.* electronic water level meter with both visual and audio indicators.

The electronically monitored wells are typically measured every hour, with increased frequency as required. At the hourly frequency, the following trends can be distinguished in an individual monitoring well:

- Seasonal climate trends;
- Water level changes in the aquifer that is being pumped;
- Water level changes in aquifers connected to the pumped aquifer; and
- Individual precipitation events in unconfined aquifers.

The manually monitored wells are measured once per month. At this frequency only the first three responses listed above can be distinguished.

E.1.3 Climatological Data

To evaluate the reaction of water levels to changes in climatic conditions, precipitation data are monitored at various locations throughout the Region. Within the Region of Waterloo, climate data is collected by Environment Canada at the Region of Waterloo International Airport (WIA) and the Roseville weather station, by the Grand River Conservation Authority (GRCA) at various Dam locations and by the University of Waterloo at a weather station located on the north campus.

E.2 Groundwater Level Collection Protocols

E.2.1 Groundwater Level Monitoring Network Summary Well Checklist

A well checklist and data entry spreadsheet are prepared of all the measuring points where water levels will be collected on a monthly basis. The checklist and spreadsheet are organized by well field so wells in close proximity are grouped together and indicates whether locations are measured with electronic dataloggers or manual measurements only. Once a well is visited, data is entered in the spreadsheet and the well is checked off the list; thus, the checklist and spreadsheet provides an obvious indication that work is unfinished if a location is unchecked and has no data.

E.2.2 Well Inspection

Upon visiting a well for the first time, the well/casing/equipment details are noted, photos taken, and GPS coordinates are recorded in a field book and/or in the monthly data entry spreadsheet. Well/casing/equipment details includes: location, access, condition, materials, diameters, casing security, surface seal condition, requiring repair or not, well/casing stickup measurements from ground level, well total depth, and the type of datalogger and/or sampling equipment installed. Any notable deficiencies, concerns, problems, or changes in the well condition are recorded in a field book and/or in the monthly data entry spreadsheet, as well as, photos are taken. Also, any observed activities taking place around or near the well that are worth noting are recorded in a field book and/or in the monthly data entry spreadsheet.

E.2.3 Monitoring Well Manual Water Level Measurement Procedure

- Unlock well casing and open well casing lid.
- Remove well cap (if present).
- Use an Electronic Water Level meter and lower the probe down the well until the meter beeps to indicate the probe has encountered water.
- The probe is raised up until the beep of the meter stops, indicating the probe is now above the water.
- Then the probe is slowly lowered down until the probe just contacts the water level surface causing the meter to beep.
- At this point the depth (in meters) is read off the water level meter tape from the measuring point of the well (in most cases is the top of the casing or pipe) and this provides the water level depth below the measuring point.
- The date, time, and water level depth measured is recorded in a field book and/or in the monthly data entry spreadsheet.
- This procedure is repeated for each of the well screens inside the well casing.

- Replace well caps.
- Close well casing lid and lock well casing.

E.2.4 Downloading of Water Levels from Electronic Dataloggers Procedure

For Non-Vented (Absolute) Datalogger Models:

In-Situ Inc.® LevelTROLLs® and RuggedTROLLs®, *Van Essen Instruments Divers*®, and *Solinst*® Levelloggers®

- Prior to downloading data from the datalogger, a manual water level is measured in each well screen containing a datalogger.
- The datalogger is pulled out of the well, unthreaded from the cap that is attached to a wire cable and connected to (or placed in) the corresponding datalogger communication device. The communication device is connected to a laptop/tablet PC or a RuggedReader® Handheld PC and the associated datalogger software is started.
- Water level data stored in the datalogger is subsequently downloaded and viewed using the datalogger software and saved on the hard drive/memory.
- Note: downloading data from the datalogger does not automatically stop the datalogger from recording.
- The status of the datalogger is viewed and checked for correct operation and to confirm that the datalogger is hanging in the well water within its operating range.
- Select datalogger details such as the battery level and free/used memory are recorded in a field book and/or in the monthly data entry spreadsheet.
- If the datalogger does not require restarting to free up memory or to change the sample rate, then the datalogger is removed from the communication device and is threaded back onto its cap and lowered back down the well on the wire cable.
- If the datalogger does require restarting to free up memory or to change the sample rate, then the datalogger is stopped, reprogrammed, and restarted using the datalogger software and, as a result, erases the previous data stored in memory on the datalogger.
- This procedure is repeated for each datalogger within each of the well screens inside the well casing.
- After all the non-vented (absolute) dataloggers have been downloaded then the Barometric dataloggers are downloaded following the same procedure as above.

For Vented (Gauged) Datalogger Models:*In-Situ Inc.*® LevelTROLLs®

- Prior to downloading data from the datalogger, a manual water level is measured in each well screen containing a datalogger.
- The desiccant tube is unconnected from the datalogger cable.
- The datalogger cable is connected to a communication cable device that is connected to a laptop/tablet PC or a RuggedReader® Handheld PC and the datalogger software is started.
- Water level data stored in the datalogger is subsequently downloaded and viewed using the datalogger software and saved on the hard drive/memory.
- Note: downloading data from the datalogger does not automatically stop the datalogger from recording.
- The status of the datalogger is viewed and checked for correct operation and to confirm that the datalogger is hanging in the well water within its operating range.
- Select datalogger details such as the battery level, free/used memory, and desiccant condition (colour) are recorded in a field book and/or in the monthly data entry spreadsheet.
- The desiccant tube condition is checked and replaced if necessary.
- If the datalogger does not require restarting to free up memory or to change the sample rate, then the communication cable device is disconnected from the datalogger cable and the desiccant tube is reconnected.
- If the datalogger does require restarting to free up memory or to change the sample rate, then the datalogger is stopped, reprogrammed, and restarted using the datalogger software and, as a result, erases the previous data stored in memory on the datalogger.
- This procedure is repeated for each datalogger within each of the well screens inside the well casing.

E.2.5 Data Entry and Processing into the Burnside MS ACCESS/SQL® Database

- All field data collected (i.e. date, time, manual water level depth measured, comments) and recorded for each well screen and datalogger in a field book is entered into the monthly data entry spreadsheet, unless already entered in the field using a laptop/tablet PC.
- The monthly data entry spreadsheet is checked and reviewed prior to importing the data into a database table using Burnside Water Level Data Tools software. Manual water level depth values are converted into water level elevation values using the software during this import process.
- Any associated well notes, comments, and datalogger details are entered into a database table under the appropriate well and screen.

2025 Groundwater Level Monitoring Program Report – APPENDIX E

- Water level data from the dataloggers downloaded to a laptop/tablet PC or a RuggedReader® Handheld PC are transferred to Burnside file folder network upon returning to the office.
- These datalogger water level data files are subsequently read and the data is imported into a database table using Burnside Water Level Data Tools software.
- Using Burnside Water Level Data Tools software, the datalogger water level data are reviewed and processed (as described below) resulting in corrected water level depth values and corrected water level elevation values that are stored in a database table.
- *For Non-Vented (Absolute) Datalogger Models:*
Datalogger water level data is first barometric pressure compensated using selected Barometric datalogger data, then a manual water level depth value measured at the time of the most recent download is applied and used to convert the barometric compensated water level data into corrected water level depth values, which are converted into water level elevation values that are appended to a database table.
- *For Vented (Gauged) Datalogger Models:*
A manual water level depth value measured at the time of the most recent download is applied to the datalogger water level data to convert the water level data into corrected water level depth values, which are converted into water level elevation values that are appended to a database table.
- Temperature data recorded by the dataloggers are also imported into a database table.
- Hydrographs are subsequently created for each well and screen from the water level elevation data in the database for review and presentation. If there are some data points that are erroneous, then these data points are marked as non-reportable (invalid) within the database and/or are removed resulting in them not being plotted on the hydrographs.
- An updated data file is provided to the Region on a quarterly basis for upload into their eWRAS EQUIS database.

