APPENDIX 9

HYDROGEOLOGICAL INVESTIGATION REPORT

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HYDROGEOLOGICAL INVESTIGATION REPORT ENVIRONEMNTAL ASSESSMENT AND PRELIMINARY DESIGN FOR DRAINAGE IMPROVEMENTS OF HIGHWAY 50 FROM MAYFIELD ROAD TO HEALEY ROAD REGION OF PEEL

Report

to

R.V. Anderson Associates Limited

Date: October 07, 2020
File: 28262

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1 INTRODUCTION

Thurber Engineering Ltd. (Thurber) was retained by R.V. Anderson Associates Limited to prepare a hydrogeological investigation in support of the Class Environmental Assessment (Class EA) and Preliminary Design for stormwater management/drainage improvements of Highway 50 in the Town of Caledon, Ontario. The limits of the project are from Mayfield Road to Healey Road for a total length of approximately 2.4 km (the Site) and are shown on Drawing 1 in Appendix A. A recent condition assessment of the drainage infrastructure along the Site has identified the need for the rehabilitation of 17 entrance culverts (and crossings) on the east and west sides of Highway 50 within the Site limits.

The purpose of the investigation was to establish baseline hydrogeological conditions along the alignment in support of the class EA and preliminary design through subsurface investigation, including characterization of the soil and groundwater conditions. Preliminary discussion of potential construction dewatering needs is included, as well as an impact assessment and potential mitigation measures.

A geotechnical investigation was completed concurrently with the hydrogeological investigation. The results of the geotechnical investigation are reported under separate cover and should be read in conjunction with this report.

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

2 BACKGROUND REVIEW

2.1 Site and Project Description

This section of Highway 50 between Mayfield Road and Healey Road presently consists of a five-lane urban roadway with two lanes in the north bound direction, two lanes in the southbound direction, and a central turning lane. Concrete curbs and gutters abut the paved lanes on both sides of the road and shallow ditches lay beyond the curb on both sides.

A recent condition assessment of the road's drainage infrastructure has confirmed the need for rehabilitation of 17 entrance culverts (and crossings) on the east and west side from McEwan Drive to Mayfield Road. Construction elements may include low impact development (LID) features such as infiltration trenches or bioswales, storm sewers, culverts (assumed to be non-structural) and site grading.

The land use adjacent to the corridor is a mix of industrial and commercial properties, with a few residential properties located on the eastern side at the southern end of the site.

2.2 Topography and Drainage

The Site is located within the Humber River Watershed and falls under the jurisdiction of the Toronto Region and Region Conservation Authority (TRCA). The regional topography slopes southeasterly toward Humber River, and eventually drains into Lake Ontario. A regional topographic map is presented on Drawing 2 in Appendix A.

Ground elevation at the Site range from about 248 m in the northern portion of the Site near Healey Road to approximately 226 m near Mayfield Road in the southern portion of the Site. Overland flow drainage at the Site generally follows the existing topography toward the adjacent watercourse.

2.3 Physiography

A review of the physiographic regions of southern Ontario indicated that the north portion of the Site is primarily located within the physiographic region of the South Slope, while the south portion of the Site is located within the Peel Plain physiographic region. The South Slope is typically a drumlinized area consisting of areas of thin (<1 m) aeolian sand deposits underlain by glacial deposits, primarily till. The peel plain physiographic region is a relatively flat tract of soils that are predominantly clay with localized clay loam and loam. The underlying material of the plain is a till containing shale and limestone fragments. (Chapman and Putnam, 1984). A physiographic map of the Site and surrounding area is shown on Drawing 3 in Appendix A.

2.4 Regional Geology and Hydrogeology

The current understanding of the regional geological and hydrogeological conditions was based on scientific work conducted by the geological and hydrogeological Information from Ontario Geological Survey (OGS), and available information from the TRCA.

The surficial geology across the Site primarily consists of clay to silt-textured till that was derived from glaciolacustrine deposits or shale. Drawing 4 in Appendix A illustrates the regional surficial geology for the Site.

The bedrock underlying the Site consists of the Georgian Bay Formation, typically consisting of shale and limestone. The bedrock surface in the area is expected to be at approximate elevation of 110 m. A bedrock geology map is presented on Drawing 5 in Appendix A.

A regional north to south geologic cross section along the Main Humber River is provided on Drawing 6 in Appendix A. Based on a review of the regional cross section, the following units overlie the bedrock:

- Recent Sediments;
- Halton Till (Aquitard);
- Oak Ridges Aquifer Complex (Aquifer);
- Newmarket Till (Aquitard);
- Thorncliffe Formation (Aquifer);
- Sunnybrook Drift (Aquitard), and
- Scarborough Formation (Aquifer)

The Halton Till is the uppermost overburden unit across the Site and it consists of silt to silty clay with occasional gravel. Groundwater flow in this aquitard is generally vertically downward, with the exception of localized areas where the underlying aquifers are artesian.

The uppermost aquifer underlying the Site is the Oak Ridges Aquifer Complex (ORAC) which is interpreted to occur where continuous layers of fine to medium sand are encountered. The degree of hydraulic connection with the moraine sediments generally decreases with distance from the Oak Ridges Moraine (ORM). Groundwater flow in this unit is influenced by topography and primarily horizontal towards Lake Ontario, with localized flow towards watercourses that cut into the aquifer and may be under artesian conditions.

The lower contact of the ORM sits on the Newmarket Till that acts as a regional aquitard separating the ORM from underlying Thorncliffe formation. Groundwater flow in this unit is predominantly downward, with the leakage to the underlying Thorncliffe Formation.

The Thorncliffe formation is comprised of glaciofluvial deposits containing silt, sand and clay deposits. Groundwater flow is generally south towards Lakes Ontario.

The Sunnybrook Drift aquitard separates the Thorncliffe aquifer from the underlying Scarborough Aquifer. This unit thins in the western portion of the watershed.

The Scarborough Formation is composed of clay, silt, and sand sediments in a deltaic sequence. This unit is mostly found within bedrock valleys and is a very significant unit as the overall

transmissivity of the Scarborough aquifer is high within the valley system. The groundwater flows to the south towards Lake Ontario.

2.5 Groundwater Users

A search of the Ministry of Environment, Conservation and Parks (MECP) well records database conducted for a 500 m radius around the Site returned a total of 115 records (Drawing 7 in Appendix A). Based on the well records, the majority of the nearby wells are listed as water supply wells (40 records). Although it is Thurber's understanding that an existing watermain is located on the eastern side of HWY 50, it is possible that some residences are not connected to the municipal water supply system. A detailed table summarizing the data provided from MECP's database is provided in Appendix B.

A search conducted in August 2020 identified no active Permits To Take Water (PTTWs) within 500 m of the Site.

2.6 Environmental Features

Based on regional-scale source protection mapping, the Site is not located within Wellhead Protection Areas (WHPAs), Significant Groundwater Recharge Areas (SGRAs) and Highly Vulnerable Aquifers (HVAs). However, the SGRAs lie just southeast of the intersection of Highway 50 and Mayfield Road. The Site is also located within the TRCA regulated areas.

A number of tributaries of Humber River and West Humber River are located within 1 km of the Site, including an onsite tributary. This tributary of the Humber River flows southeasterly towards the Humber River. Based on a review of the Humber River Fisheries Management Plan Report (Clayton J. et. al., 2004), the watercourse is classified as a warm water watercourse; and thus, is unlikely to be groundwater dependent.

A search of the Ministry of Natural Resources and Forestry (MNRF) online mapping returned no significant heritage features, including Areas of Natural and Scientific Interest (ANSIs), wetlands, or Environmentally Sensitive Areas (ESAs), within 1 km of the Site. The natural features located within a 1 km buffer of the Site are illustrated on Drawing 8 in Appendix A.

Roadside ditches and/or swales generally existed along both sides of the Site alignment. The ditches were covered with grass, vegetation and shrubs; however, gabion stones lined portions of the east ditch at culvert or head wall inlets and outlets.

3 INVESTIGATION

The current understanding of the local geological and hydrogeological environment of the Site is based on the geotechnical investigation and the hydrogeological investigation conducted by Thurber.

3.1 Geotechnical Investigation

Thurber conducted a geotechnical investigation at the Site in March and April 2020 (Thurber, 2020). Twenty-five boreholes were drilled to depths of 3.6 to 4.4 m. The geotechnical borehole logs were used to understand local geology of the Site. Record of borehole sheets are provided in Appendix C and borehole location plans are provided in Appendix A.

Based on the borehole logs, the overburden material at the Site consists of a thin layer of asphalt overlying a layer of sand to gravelly sand fill with thickness ranging from approximately 0.6 m to 3.3 m. Underlying the fill is a layer of silty clay till extending to the termination of the boreholes. Below the sandy fill layer, a silty clay fill layer was also encountered in Boreholes 20-02 and 20-20.

3.2 Hydrogeological Investigation

To support the hydrogeological investigation, eight monitoring wells were installed in the selected boreholes. Each monitoring well was developed following completion of drilling by removing a minimum of 3 well volumes of water to clear any silt or drilling debris from the sand pack and well casing. A map illustrating the location of the monitoring wells is provided on Drawing 9 in Appendix A.

The monitoring wells were used to measure groundwater levels, collect samples for groundwater quality analyses, and estimate the hydraulic conductivity of the screened units. Monitoring well details are summarized in Table 1.

Table 1 – Monitoring Well Details

Borehole No.	Ground Elevation (m)	Well Depth (m)	Well Diameter (mm)	Screen Length (m)	Screen Unit
BH20-02	226.9	3.95	51	1.5	Silty clay (Till)
BH20-06	231.0	3.92	51	1.5	Silty clay (Till)
BH20-08	233.0	3.90	51	1.5	Silty clay (Till)
BH20-12	237.4	3.43	51	1.5	Sand (Fill)

BH20-16	239.7	3.92	51	1.5	Silty clay (Till)
BH20-19	242.4	3.72	51	1.5	Silty clay (Till)
BH20-20	243.0	3.89	51	1.5	Silty clay (Till)
BH20-24	245.9	3.81	51	1.5	Silty clay (Till)

3.2.1 Groundwater Levels

Groundwater levels in the monitoring wells were measured manually between May 26, 2020, and August 24, 2020, as summarized in Table 2.

Table 2 – Measured Groundwater Levels in Monitoring Wells

Well ID	May 26, 2020		June 9, 2020		June 11, 2020		August 24, 2020	
	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)
BH20-02	3.25	223.65	NM	NM	NM	NM	3.23	223.67
BH20-06	3.01	227.99	NM	NM	NM	NM	3.01	227.99
BH20-08	2.99	230.01	NM	NM	2.82	230.18	2.94	230.06
BH20-12	2.83	234.57	NM	NM	NM	NM	3.08	234.32
BH20-16	3.05	236.65	NM	NM	2.89	236.81	3.07	236.63
BH20-19	2.14	240.26	NM	NM	NM	NM	2.13	240.27
BH20-20	1.05	241.95	1.05	241.95	NM	NM	1.08	241.93
BH20-24	2.23	243.67	2.44	243.46	NM	NM	2.24	243.66

NM: Not Measured

The water level elevations in the monitoring wells ranged from 223.65 m to 243.67 m. The highest groundwater level (Elev. 243.67 m; depth 2.23 m) was measured in BH20-24 and the lowest water level (Elev. 223.65 m; depth 3.25 m) was measured in BH20-02.

Based on our conceptual understanding of the local hydrogeology, the monitoring wells are considered to be screened within the unconfined overburden and the water levels recorded from the monitoring wells are interpreted to be representative of the shallow groundwater table. Groundwater levels collected on August 24, 2020 indicated that shallow groundwater flows from northwest to southeast toward the tributary of Humber River, following local topography.

3.2.2 Hydraulic Conductivity

Single-well response tests (slug tests) were conducted between June 9, 2020 and June 17, 2020 in four selected monitoring wells. Falling head tests were carried out to estimate the in-situ hydraulic conductivity (K) of the screened overburden materials. Hydraulic conductivity estimates were obtained using the Hvorslev method (1951). Estimated K values are presented in Table 3. The slug test analyses are presented in Appendix D.

Table 3 – Estimated Hydraulic Conductivities

Well ID	Bottom of Screen Elevation (m)	Top of Screen Elevation (m)	Screened Material	Hydraulic Conductivity (K) (m/s)
20-08	229.10	230.63	Silty clay (Till)	1.1×10^{-8}
20-16	235.78	237.30	Silty clay (Till)	1.1×10^{-7}
20-20	239.11	240.64	Silty clay (Till) Silty clay (Fill)	5.2×10^{-7}
20-24	242.09	243.61	Silty clay (Till)	9.8×10^{-10}

The estimated in-situ K values for the silty clay till materials range from 9.8×10^{-10} m/s to 5.2×10^{-7} m/s. A portion of the well screen and sand pack for the well at Borehole 20-20 was within silty clay fill and may have resulted in a somewhat higher hydraulic conductivity estimate. The geometric mean of the slug tests conducted solely in the silty clay till is 1.1×10^{-8} m/s.

3.2.3 Infiltration Testing for LID Applications

Guelph Permeameter testing was conducted at nine locations on the grass boulevards on the west side of Highway 50 adjacent to the selected drilled boreholes. The locations of the boreholes are shown on Drawing 9 in Appendix A.

For each infiltration test, a hole was augered using a 6 cm diameter hand auger to a depth of between 30 cm and 60 cm. Infiltration tests were performed in the hole using a Guelph Permeameter. The device maintains a constant water column in the hole using the Marriott Principle. The water that infiltrates into the ground is replenished by the Guelph Permeameter reservoir and the rate of water level drop in the reservoir is indicative of the infiltration rate into the hole. The infiltration rate is estimated by measuring the change in water level in the Guelph Permeameter reservoir once steady state is reached as indicated by a minimum of three consecutive intervals with the same or similar change in water level. The field saturated hydraulic conductivity (K_{fs}) calculations and results are presented in Appendix E.

The saturated hydraulic conductivity measured using the Guelph Permeameter was converted to an infiltration rate (T) for the purpose of designing the infiltration measures. The approximate relationship presented in the Low Impact Development Stormwater Management Planning and Design Guide (TRCA and CVC, 2010) was used for the conversion, as follows, where K_{fs} is in cm/s and T is in mm/hr:

$$K_{fs} = 6 \times 10^{-11} \times T^{3.7363}$$

The surface materials at the Site are mainly sand fill with some silt and gravel, with an estimated saturated hydraulic conductivity range between 2.7 x 10^{-5} cm/s and 1.8 x 10^{-3} cm/s. The corresponding infiltration rate for the sand fill ranged between 59 mm/hr and 101 mm/hr with a corresponding geometric mean infiltration rate of 72 mm/hr. The infiltration rate values are generally high and reflect the high content of sand and gravel in the shallow fill at the Site. A summary of the results is provided in Table 4.

Table 4 – Estimated Saturated Hydraulic Conductivity and Infiltration Rate

Test ID	Test Depth (m)	Materials	Saturated Hydraulic Conductivity (cm/s)	Infiltration Rate (mm/hr)
Test 20-02	0.56	Sand and Gravel (Fill)	1.1 x 10^{-3}	88
Test 20-06	0.48	Sand (Fill)	7.8 x 10^{-4}	80
Test 20-08	0.41	Sand (Fill)	1.8 x 10^{-3}	101
Test 20-12	0.48	Sand (Fill)	1.7 x 10^{-3}	99
Test 20-14	0.37	Sand and Silt (Fill)	2.4 x 10^{-4}	59
Test 20-18	0.54	Sand (Fill)	2.7 x 0^{-5}	43
Test 20-20	0.46	Sand (Fill)	5.4 x 10^{-4}	73
Test 20-22	0.33	Sand (Fill)	3.9 x 10^{-4}	66
Test 20-24	0.3	Sand (Fill)	2.9 x 10^{-4}	61

As previously described in Section 3.2.2, the geometric mean of hydraulic conductivity of the silty clay till was 1.1 × 10^{-8} m/s. The converted infiltration rate is 14 mm/hr. As expected, locations underlain by till deposits exhibited lower infiltration rates than locations underlain strictly by the more permeable sand fill.

Based on a review of the estimated infiltration rates provided above, the estimated infiltration rates for the sand fill were higher than the 15 mm/hour threshold recommended in the stormwater Management Planning and Design Manual, which indicates the fill materials at the Site may be suitable for implementation of infiltration Best Management Practices (BMPs). However, the feasibility for implementing infiltration LIDs within the silty clay till materials is limited due to the low infiltration rate associated with the silty clay till.

For design purposes, if the LID measures can be placed in a location where there is 1.5 m or more of sand fill below the base, then a safety correction factor of 2.5 would apply and the typical design infiltration rate would be approximately 29 mm/hr (72 mm/hr divided by 2.5). If the base is in sand fill but silty clay till is within 1.5 m of the base, then a safety correction factor of 4.5 would typically apply because the silty clay till infiltration rate is 5.1 times smaller than that of the sand fill. In this case a design infiltration rate of 16 mm/hr would apply (72 mm/hr divided by 4.5). If the LIDs are proposed to be installed within the silty clay till materials, the estimated infiltration rates should be divided by a safety correction factor of 2.5 to calculate the design infiltration rate, which in this case would be approximately 5.6 mm/hr (14 mm/hr divided by 2.5).

In addition to infiltration rate requirements, the groundwater table must be sufficiently below the infiltration measure such that the storm water may infiltrate into the ground.

3.2.4 Groundwater Quality

Groundwater samples were collected on August 24, 2020 from monitoring wells at Boreholes 20-24, 20-20, 20-16, and 20-08 at the Site using a disposable PVC bailer. The collected samples were sent to SGS Laboratories for analysis of parameters in the Peel Sewer Use By-Law 53-2010. The laboratory analytical results and Certificate of Analysis are included in Appendix F.

A review of the analytical results indicated that all groundwater samples exceeded the storm sewer discharge criteria for total suspended solids (TSS) and manganese. The samples collected from Boreholes 20-24 and 20-16 also exceeded the storm sewer discharge criteria for total Kjeldahl Nitrogen. All other tested parameters met the Peel Storm Sewer Use By-Law criteria.

The groundwater sample collected from Borehole 20-16 exceeded the By-Law 53-2010 criteria for sanitary sewers for TSS. All other analyzed parameters met the applicable water quality criteria.

Based on conditions typically encountered for open excavations in till, it is expected that groundwater would require treatment prior to direct discharge into surface water or any sewers. Treatment to remove suspended sediment and associated metals, and possible adjustment of

temperature if discharging to surface water, would likely be the minimum requirements. Where feasible, it is recommended that groundwater should be discharged at least 30 m away from any surface water bodies.

Pre-treatment of dewatering discharge will be the responsibility of the dewatering contractor to ensure that the quality of the dewatering discharge effluent meets applicable discharge criteria. Should the dewatering discharge be contaminated such that the groundwater cannot be treated to the appropriate water quality criteria, the dewatering contractor shall be responsible for transporting the contaminated groundwater off-site for disposal at an appropriate licensed facility.

4 DEWATERING ASESSMENT

At this time, there is not sufficient design information to provide preliminary dewatering estimates for the replacement and/or improvements to the roadside drainage ditches and culvert crossings along the Regional Road Highway 50. Once engineering drawings for structural drainage improvements are finalized, detailed dewatering estimates should be completed during detailed design, well in advance of construction to support permitting requirements.

Based on our understanding of the geology and water table at the Site, it is anticipated that minimal dewatering will be required for the construction of culverts or improvement to the storm drainage infrastructure. It is anticipated that water may be perched locally within the sand fill and that it would be of limited volume. It is further anticipated that groundwater flow rates through the silty clay till would be low due to the relatively low hydraulic conductivity of that soil. However, water taking estimates must include rainfall and surface water if they cannot be kept separate from groundwater, and, depending on the number and size of the excavations, the need for some form or water taking permit is likely.

The Zone of Influence (ZOI) from the edge of any excavations in the silty clay till is anticipated to be localized and less than 10 m.

If the detailed investigation indicates that dewatering is required, then the estimated budgeted peak flow rate will determine the type of water taking permission that is required. If the budgeted peak water taking rate is greater than 50,000 L/day but less than 400,000 L/day, then registration on the Environmental Activity and Sector Registry (EASR) is required, and a Water Taking Plan and Water Discharge Plan are required. If the flow rate exceeds 400,000 L/day, then a Category 3 PTTW must be applied for and obtained from MECP. The application must include a Hydrogeological Study in accordance with permit requirements.

Water that is removed from excavations for dewatering must be discharged or disposed of in accordance with current regulations, whether to the natural environment or to a sewer system. The Water Discharge Plan in the case of an EASR registration or the PTTW and associated Hydrogeological Study will specify conditions on the discharge of the groundwater to the environment.

5 IMPACT ASSESSMENT

Lowering of the shallow groundwater level could potentially reduce the groundwater discharge to nearby natural environmental features and ground water users, and could potentially result in settlement or ground loss, although the likelihood of significant impacts is low due to the low hydraulic conductivity of the silty clay till. Any potential impacts during construction dewatering are expected to be temporary in nature. These potential impacts, however, need to be monitored and managed to minimize impact.

During the detailed design, a dewatering assessment should be completed to evaluate the potential need for construction dewatering during the installation of structures and dewatering rates and volumes as well as the potential ZOI should be estimated. These efforts would be completed as part of hydrogeological investigation for detailed design and will assess potential impact as a result of groundwater taking and provide mitigation measures.

As discussed previously, it is anticipated that the anticipated ZOI is less than 10 meters and minimal construction dewatering is required for the Site. Potential impacts associated with the construction dewatering may include the following:

- **Impacts to Surface Water and the Natural Environment:** Excavations have some potential to reduce groundwater contributions to surface water bodies and natural environmental features if within the ZOI and open for extended periods. However, considering the low hydraulic conductivity, the slow rate of drainage within the silty clay till and the small ZOI, there is not expected to be a discernible decrease in water contribution to surface water or the natural environment.
- **Impacts to Groundwater Users:** No domestic well users are located within the ZOI; therefore, impacts to groundwater users are not expected. However, the ZOI should be re-assessed during detailed design to determine whether a private well survey is warranted.
- **Geotechnical Impacts:** The lowering of groundwater levels can induce ground settlement due to an increase in the effective stress. At the proposed excavations, ground settlements associated with the dewatering activities are anticipated to be minor based

on the anticipated groundwater drawdowns discussed in this report; however, an assessment of settlement potential should be completed during detailed design, prior to construction. Also, dewatering through the use of poorly designed wells and extraction systems may draw in silt and sand and cause ground loss; however, the low hydraulic conductivity of the silty clay till and the shallow anticipated excavation depths are not anticipated to result in this impact.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Water Taking Permitting

As discussed in Section 5, a water taking permit may be required to conduct the construction. Depending on the outcome of further analysis and potentially additional investigation following detailed design, registration on the EASR and preparation of a Water Taking Plan and Water Discharge Plan in the case of peak water taking rates between 50,000 and 400,000 litres per day or application for a Category 3 PTTW and required Hydrogeological Study for water taking rates exceeding 400,000 litres per day may be required.

The permit application fee from MECP for a Category 3 PTTW is currently $3,000 and the application will be subject to an administrative review as well as a technical review. MECP may request additional information or testing. The review process typically takes three to five months following submission. The registration fee from MECP for registration of water taking for construction dewatering is currently $1,190 and no review period is required.

It would be possible to conduct limited construction dewatering without a permit provided the total daily water taking rate is restricted to 50,000 litres per day or less; however, many elements will not be feasible to construct with that limitation, and the rate of construction of feasible elements may be restricted until a water taking permit is obtained.

Additional terms and conditions may apply as determined by the water taking permit process, including performance, monitoring and reporting requirements among others.

6.2 Groundwater Discharge

Water quality observed during construction will vary from the results obtained herein based on a number of factors. An experienced dewatering contractor and water treatment contractor are recommended to be retained to design and operate dewatering and treatment operations as required. Pre-treatment of dewatering discharge would be the responsibility of the contractor to ensure that the quality of the dewatering discharge effluent meets Provincial Water Quality Objectives (PWQO) criteria or Peel Region Sewer Use By-Law No. 53-2010 as applicable, and

determine if more extensive or specific treatment measures are required. Should the dewatering discharge be contaminated such that the groundwater cannot be treated to the appropriate water quality criteria, the contractor would be responsible for managing the water, including potentially storage and further treatment or transporting the contaminated groundwater off-site for disposal at an appropriate licensed facility.

A discharge permit would be required from the Region of Peel to discharge to a Region of Peel sewer. Discharge to the natural environment may require consultation with MECP, and potentially TRCA and MNRF depending on the discharge location.

6.3 Low Impact Development

Silty clay till was encountered below the fill soils in all boreholes (with the exception of Borehole 20-12) at depths ranging between 0.6 m and 3.6 m and extended to depths of approximately 3.7 m to 4.4 m. Based on the infiltration rates presented herein, the estimated infiltration rates for the silty clay till material encountered across the Site (BH20-09 and BH20-24) were less than the 15 mm/hour threshold specified in the Stormwater Management Planning and Design Manual, which indicate the Site may not be suitable for implementation of infiltration. Infiltration into the sand fill that was identified may be feasible if sufficient thickness and separation from the groundwater table can be identified. An appropriate safety factor as specified in the Low Impact Development Stormwater Management Planning and Design Guide should be applied to the estimated infiltration rate when designing infiltration LIDs to account for the natural variation in infiltration rate as discussed in Section 4.2.3.

Based on review of the existing site conditions and infiltration testing results, the designer may elect to modify the proposed bottom elevation of the LID measures. Additional field infiltration tests may be required to confirm the soil infiltration rates if any alternate locations or depths for infiltration LIDs are proposed in future.

Groundwater depths at the Site were typically between 1 and 3 m, which may limit the effectiveness of infiltration measures.

6.4 Control of Impacts and Monitoring

The following measures are recommended to mitigate the potential for the dewatering activities to cause negative impacts as assessed previously:

- Monitoring of water levels in the monitoring wells prior to, during, and following construction.

- Monitoring of water quality for groundwater collected within the excavation dewatering systems to confirm the water quality is appropriate for the selected discharge option. Monitoring should include visual observations for contamination such as sheen or pure product, as well as for excessive sediment in the discharge, which could be an indication of ground loss.
- Where possible, it is recommended that groundwater should be discharged at least 30 m away from any water bodies including streams.
- If discharge to sewers or surface water bodies is proposed, treatment of groundwater to meet acceptable levels is required. Suitable treatment would likely include measures to address suspended sediment and associated metals and is anticipated to require additional treatment based on findings to date. The operation and monitoring of discharge facilities should be carried out by an experienced dewatering contractor and water treatment contractor familiar with fisheries and water quality requirements.
- Where discharge is to ground surface or water course, temporary erosion control measures should be developed and installed to control erosion at the discharge points. Additional water quality requirements may be imposed by MECP, TRCA and MNRF.
- Long-term impacts will need to be addressed through the implementation of best management practices to help increase the amount of infiltration to the aquifer system and minimize the environmental impacts of the development.
- Installation of clay plugs or similar are recommended for any open cut trenches to limit the preferential movement of groundwater along the trench.

6.5 Future Work

Additional hydrogeological investigation and analysis will be required to support detailed design. The following recommendation are provided based on the findings of the hydrogeological investigations:

- Additional groundwater level monitoring should be conducted to capture further seasonal variation, and additional groundwater sampling may be warranted depending on potential discharge location. Infiltration testing may also be advisable depending on infiltration concepts that may be developed.
- During the detailed design stage, it will be necessary to refine the analysis of the hydrogeological conditions along the Site to estimate dewatering rates. The ZOI and dewatering rates as a result of construction-related dewatering will be estimated. These

findings will be used to confirm the water takings requirements and the appropriate approvals from the MECP prior to commencement of construction. They will also assist in determining whether a private well survey is warranted.

- Monitoring wells should be decommissioned in accordance with O. Reg. 903 if they are no longer in use to prevent the creation of vertical conduits for contaminant transport.

7 CLOSURE

We trust that this report provides the information you require at this time. If you have any questions regarding this report, please contact the undersigned at your earliest convenience.

Yours truly,
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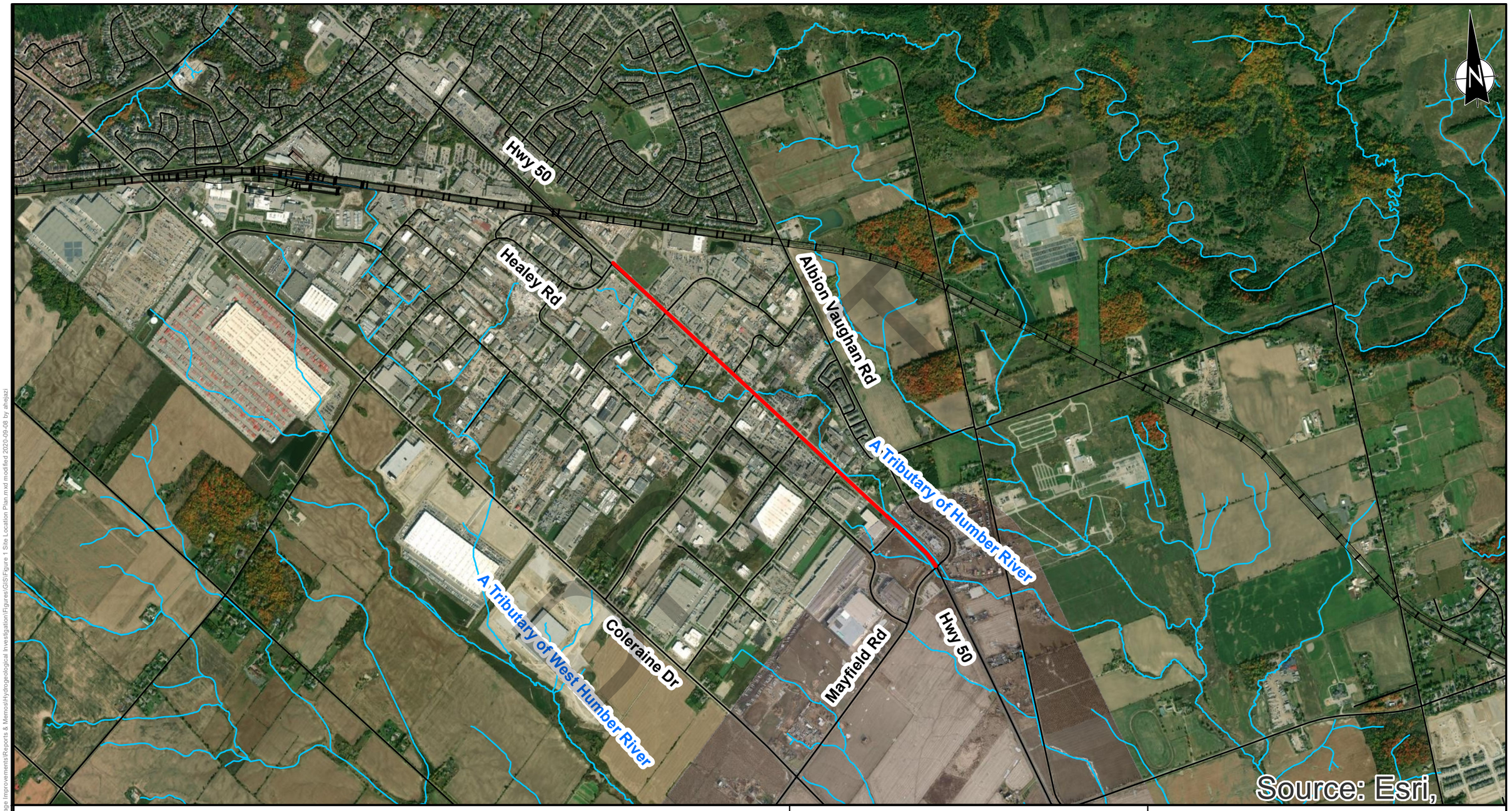
Thurber Engineering Ltd. Geotechnical Investigation Report. Preliminary Design for Drainage Improvements, Regional Road Highway 50 From Mayfield Road to Healey Road, The Region of Peel, August 2020.

Appendix A

Drawings



LEGEND:

- Site
- Roads
- Railway
- Watercourse

200 100 0 200 m

UTM 17 NAD 83

Data Source: Ontario Ministry of Natural Resources and Forestry - Provincial Mapping Unit

R.V. ANDERSON ASSOCIATES LIMITED

HYDROGEOLOGICAL INVESTIGATION
PRELIMINARY DESIGN FOR DRAINAGE IMPROVEMNETS
HIGHWAY 50 FROM MAYFIELD ROAD TO HEALEY ROAD
TOWN OF CALEDON, ON

SITE LOCATION PLAN

PROJECT No. **28262**

THURBER ENGINEERING LTD.

DESIGNED:	DRAWN:	APPROVED:
AH	AH	DH
DATE: AUGUST 08, 2020	SCALE: 1:20,000	DRAWING NO. 28262-1

H:\28000-29999\28000-28999\28262 HWY 50 Drainage Improvements\Reports & Memos\Hydrogeological Investigation\Figures\GIS\Figure 1 Site Location Plan.mxd modified 2020-09-08 by ahejazi

LEGEND:

- Site
- Roads
- Railway
- Watercourse
- Topography Contour (masl)

200 100 0 200 m

UTM 17 NAD 83

R.V. ANDERSON ASSOCIATES LIMITED

HYDROGEOLOGICAL INVESTIGATION
PRELIMINARY DESIGN FOR DRAINAGE IMPROVEMNETS
HIGHWAY 50 FROM MAYFIELD ROAD TO HEALEY ROAD
TOWN OF CALEDON, ON

TOPOGRAPHY

PROJECT No. **28262**

THURBER ENGINEERING LTD.

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AUGUST 08, 2020	1:20,000	28262-2

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LEGEND:

Site

Roads

REGION

Peel Plain

South Slope

200 100 0 200 m

UTM 17 NAD 83

Data Source: Ontario Geological Survey (OGS)

R.V. ANDERSON ASSOCIATES LIMITED

HYDROGEOLOGICAL INVESTIGATION
PRELIMINARY DESIGN FOR DRAINAGE IMPROVEMNETS
HIGHWAY 50 FROM MAYFIELD ROAD TO HEALEY ROAD
TOWN OF CALEDON, ON

PHYSIOGRAPHY

PROJECT No. **28262**

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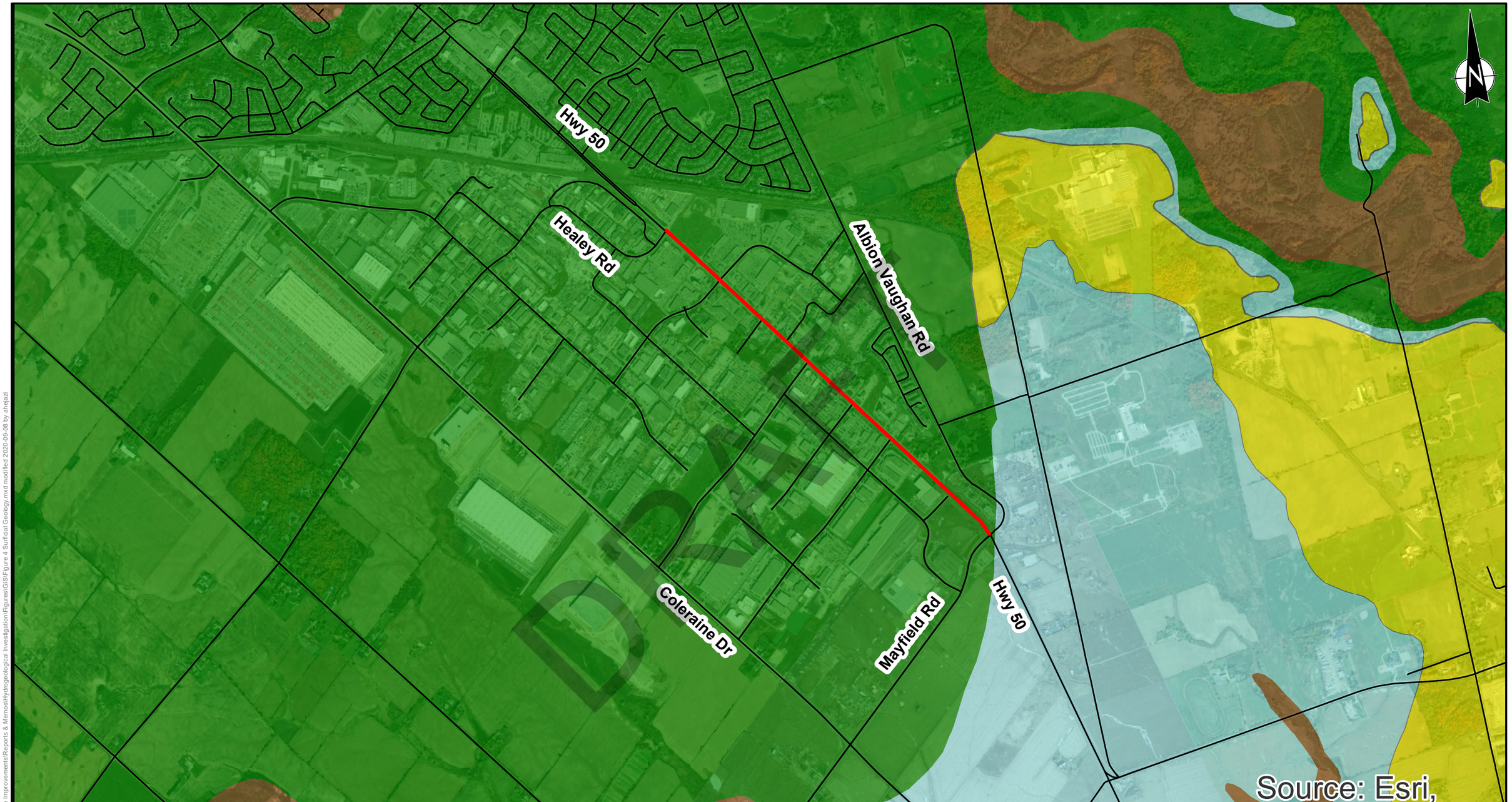

LEGEND:

Site

Roads

Surficial Geology

- Older and modern alluvial deposits; 19
- Till
- Fine-textured glaciolacustrine deposits
- Coarse-textured glaciolacustrine deposits

200 100 0 200 m

UTM 17 NAD 83

Data Source: Ontario Geological Survey (OGS)

R.V. ANDERSON ASSOCIATES LIMITED

HYDROGEOLOGICAL INVESTIGATION
PRELIMINARY DESIGN FOR DRAINAGE IMPROVEMNETS
HIGHWAY 50 FROM MAYFIELD ROAD TO HEALEY ROAD
TOWN OF CALEDON, ON

SURFICIAL GEOLOGY

PROJECT No. **28262**

THURBER ENGINEERING LTD.

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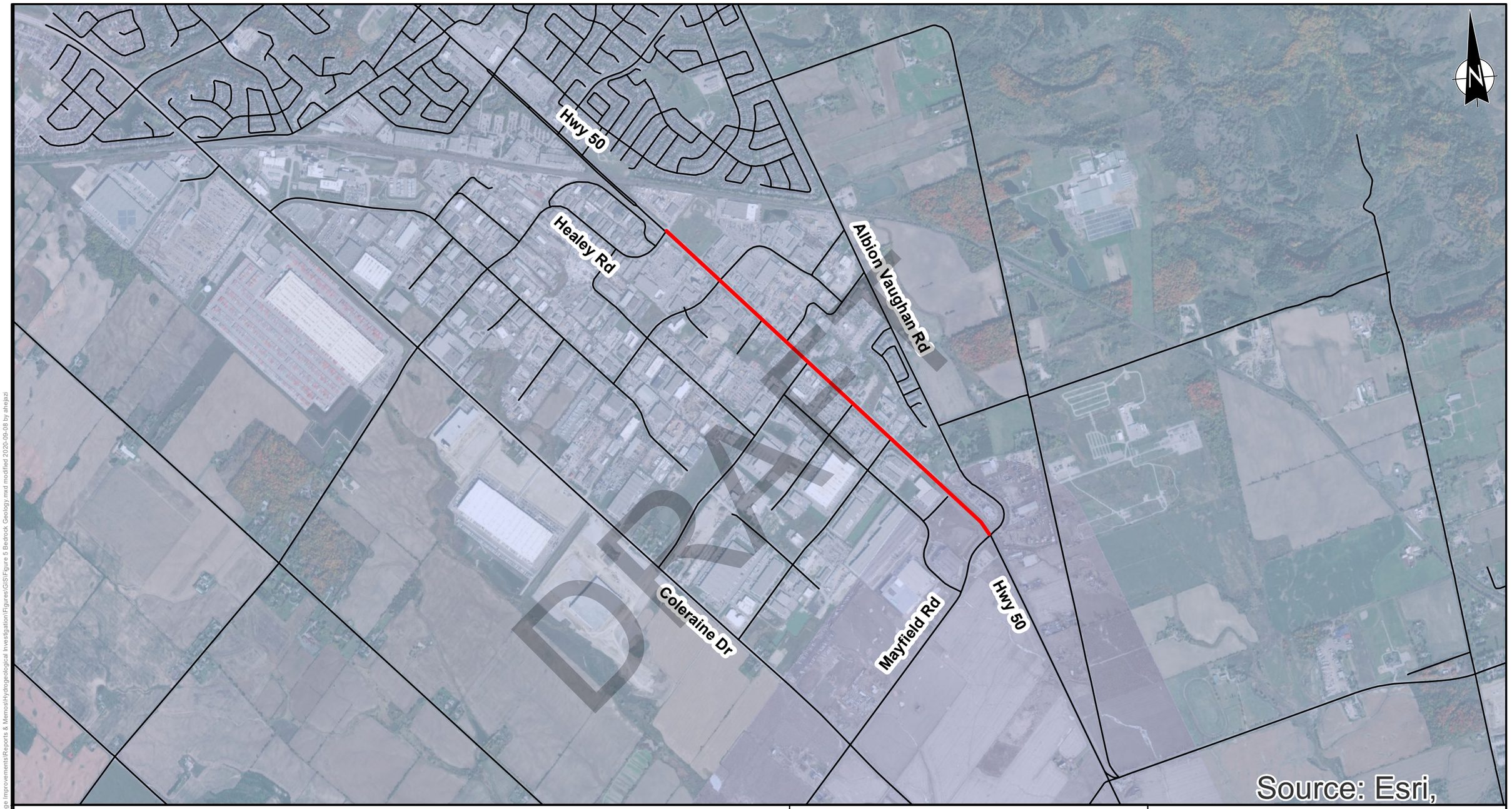

LEGEND:

- Site
- Roads

Bedrock Formation

- Georgian Bay

200 100 0 200 m

UTM 17 NAD 83

Data Source: Ontario Geological Survey (OGS)

R.V. ANDERSON ASSOCIATES LIMITED

HYDROGEOLOGICAL INVESTIGATION
PRELIMINARY DESIGN FOR DRAINAGE IMPROVEMNETS
HIGHWAY 50 FROM MAYFIELD ROAD TO HEALEY ROAD
TOWN OF CALEDON, ON

BEDROCK GEOLOGY

PROJECT No. **28262**

THURBER ENGINEERING LTD.

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AH	AH	DH
DATE: AUGUST 08, 2020	SCALE: 1:20,000	DRAWING NO. 28262-5

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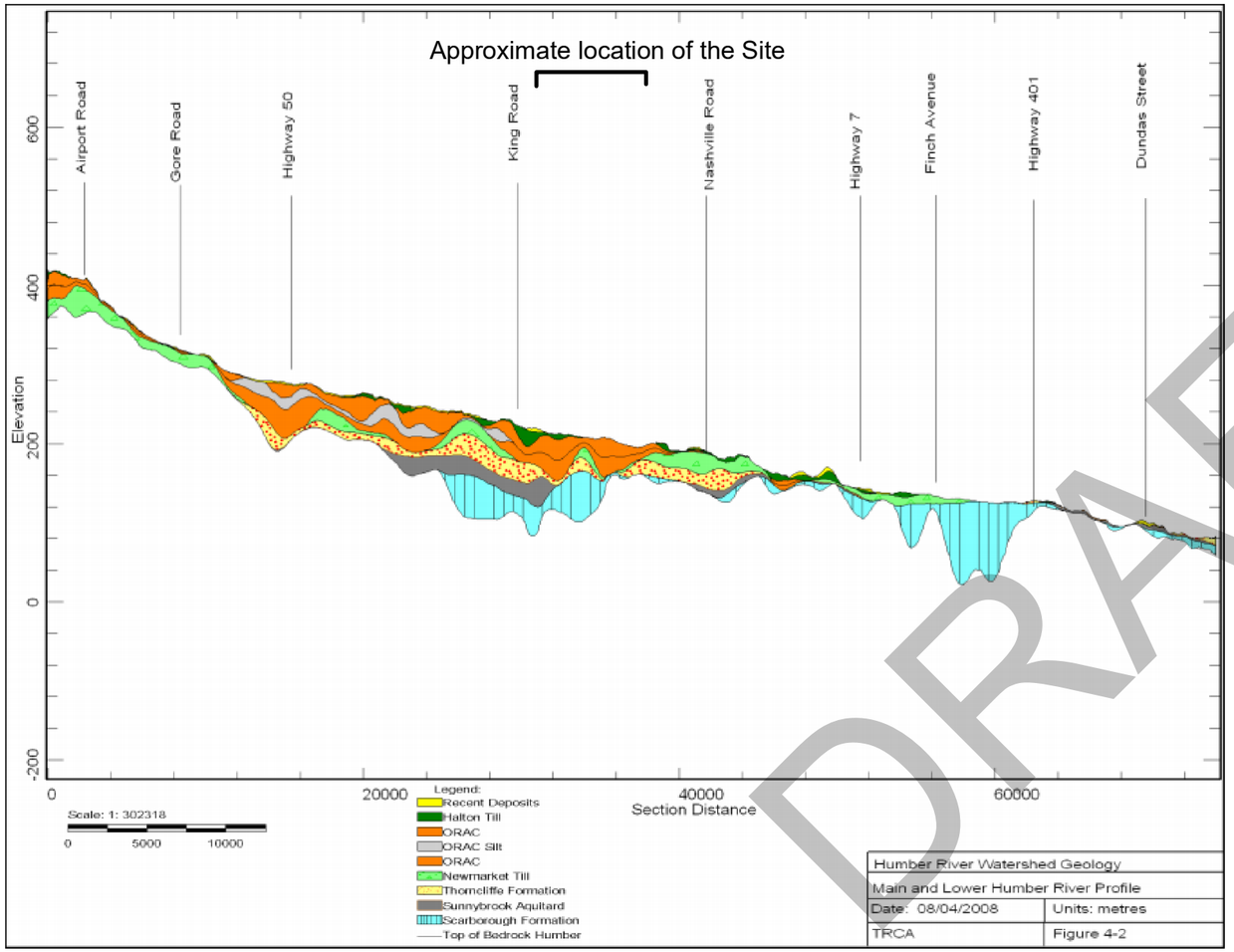
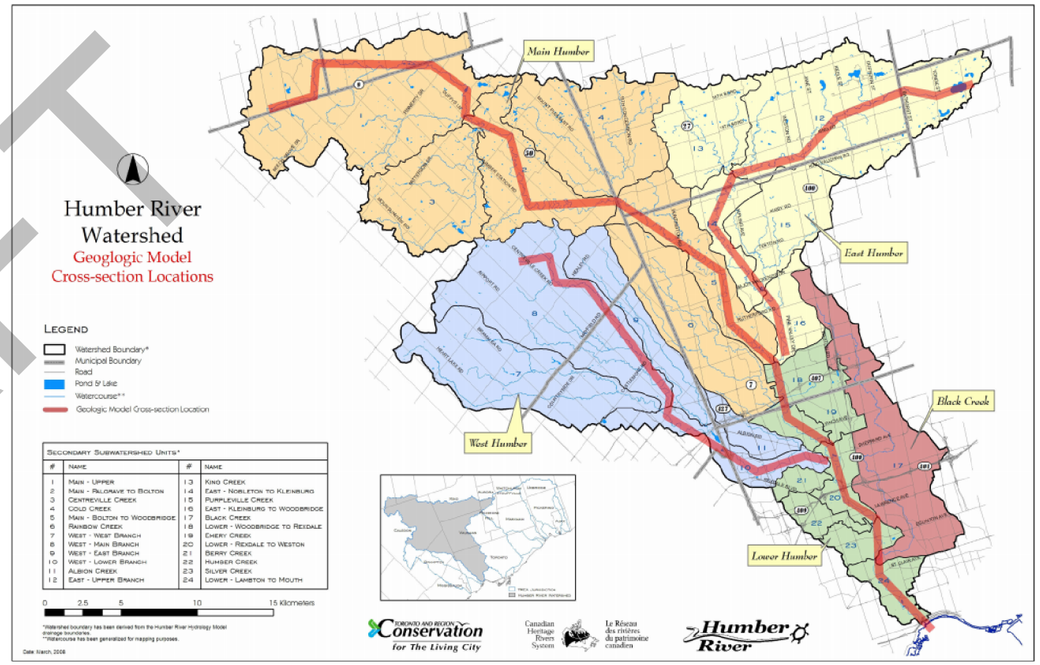


Humber River Watershed Geology	
Main and Lower Humber River Profile	
Date: 08/04/2008	Units: metres
TRCA	Figure 4-2

Geologic Cross-section Location Plan



Data Source: Humber River, State of the Watershed Report - Geology and Groundwater Resources, TRCA, 2008

R.V. ANDERSON ASSOCIATES LIMITED

HYDROGEOLOGICAL INVESTIGATION
PRELIMINARY DESIGN FOR DRAINAGE IMPROVEMNETS
HIGHWAY 50 FROM MAYFIELD ROAD TO HEALEY ROAD
TOWN OF CALEDON, ON

REGIONAL GEOLOGIC CROSS SECTION

PROJECT No. **28262**

THURBER ENGINEERING LTD.

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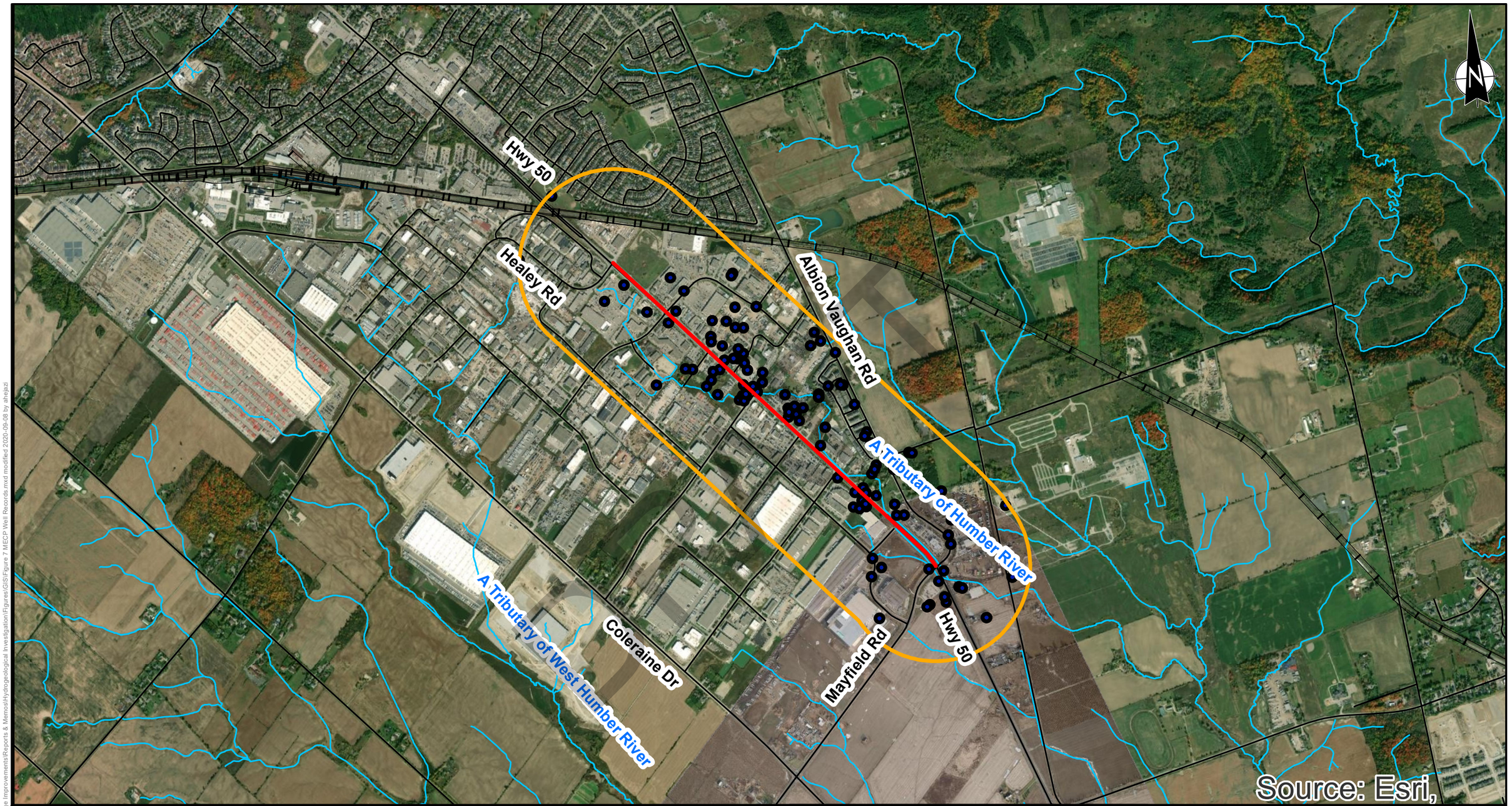

LEGEND:

- Site
- Study Area (500 m buffer)
- MECP Wells
- Roads
- Railway
- Watercourse

200 100 0 200 m

UTM 17 NAD 83

Data Source: Ministry of the Environment, Conservation and Parks Well Records

R.V. ANDERSON ASSOCIATES LIMITED

HYDROGEOLOGICAL INVESTIGATION
PRELIMINARY DESIGN FOR DRAINAGE IMPROVEMNETS
HIGHWAY 50 FROM MAYFIELD ROAD TO HEALEY ROAD
TOWN OF CALEDON, ON

MECP WELL RECORDS

PROJECT No. **28262**

THURBER ENGINEERING LTD.

DESIGNED:	DRAWN:	APPROVED:
AH	AH	DH
DATE: AUGUST 08, 2020	SCALE: 1:20,000	DRAWING NO. 28262-7

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LEGEND:

- Site
- Study Area (1 km buffer)
- Roads
- Railway
- Watercourse
- Wetland
- Wooded Area
- Waterbody

WHPAs

- WHPA-C
- WHPA-D

200 100 0 200 m

UTM 17 NAD 83

Data Source: Ontario Ministry of Natural Resources and Forestry - Provincial Mapping Unit

R.V. ANDERSON ASSOCIATES LIMITED

HYDROGEOLOGICAL INVESTIGATION
PRELIMINARY DESIGN FOR DRAINAGE IMPROVEMNETS
HIGHWAY 50 FROM MAYFIELD ROAD TO HEALEY ROAD
TOWN OF CALEDON, ON

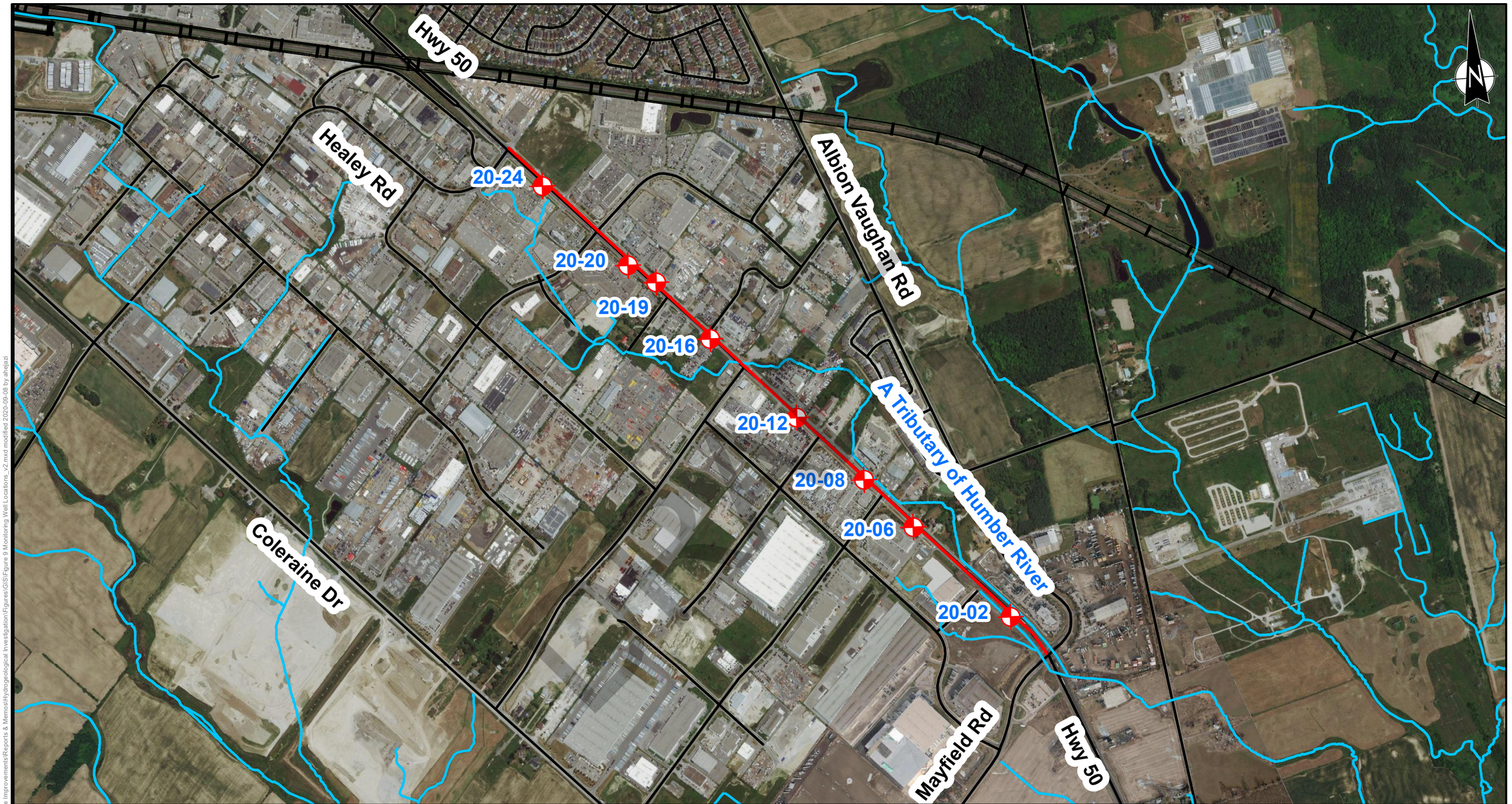
NEARBY ENVIRONMENTAL FEATURES

PROJECT No. 28262

THURBER ENGINEERING LTD.

DESIGNED:	DRAWN:	APPROVED:
AH	AH	DH
DATE: AUGUST 08, 2020	SCALE: 1:20,000	DRAWING NO. 28262-8

H:\2000\b-29999\28000-28999\28262 HWY 50 Drainage Improvements\Reports & Memos\Hydrogeological Investigation\Figures\GIS\Figure 8 Nearby Environmental Features.mxd modified 2020-09-08 by aheijazi



LEGEND:

- Monitoring Well
- Site
- Watercourse
- Roads
- Railway

200 100 0 200 m

UTM 17 NAD 83

R.V. ANDERSON ASSOCIATES LIMITED

HYDROGEOLOGICAL INVESTIGATION
PRELIMINARY DESIGN FOR DRAINAGE IMPROVEMNETS
HIGHWAY 50 FROM MAYFIELD ROAD TO HEALEY ROAD
TOWN OF CALEDON, ON

MONITORING WELL LOCATIONS

PROJECT No. **28262**

THURBER ENGINEERING LTD.

DESIGNED:	DRAWN:	APPROVED:
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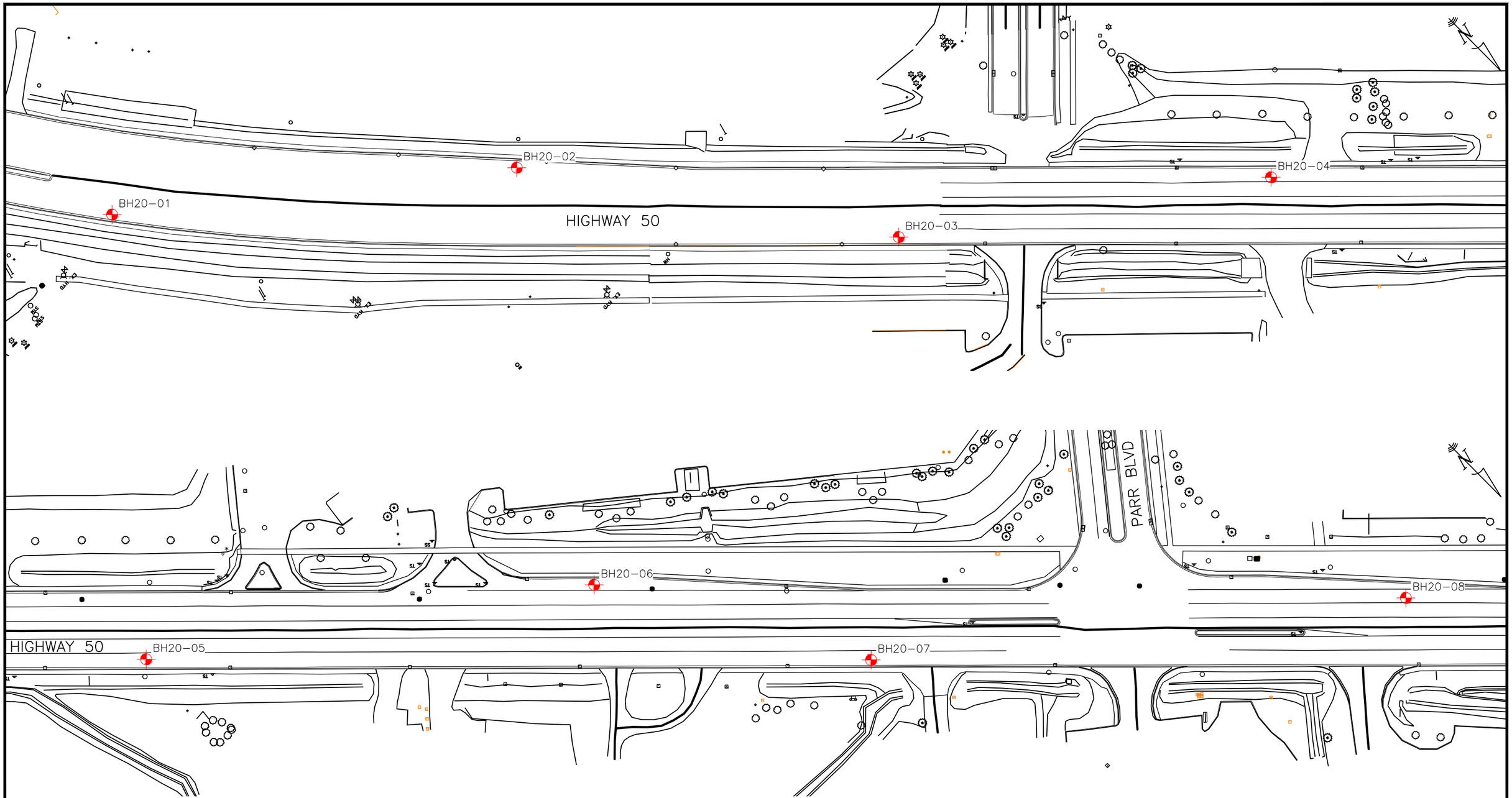

LEGEND

BOREHOLE LOCATION

20 0 20 40m

SCALE 1:1000

R.V. Anderson & Associates

HIGHWAY 50 DRAINAGE IMPROVEMENT

BOREHOLE LOCATION PLAN

JOB# 28262

THURBER ENGINEERING LTD.

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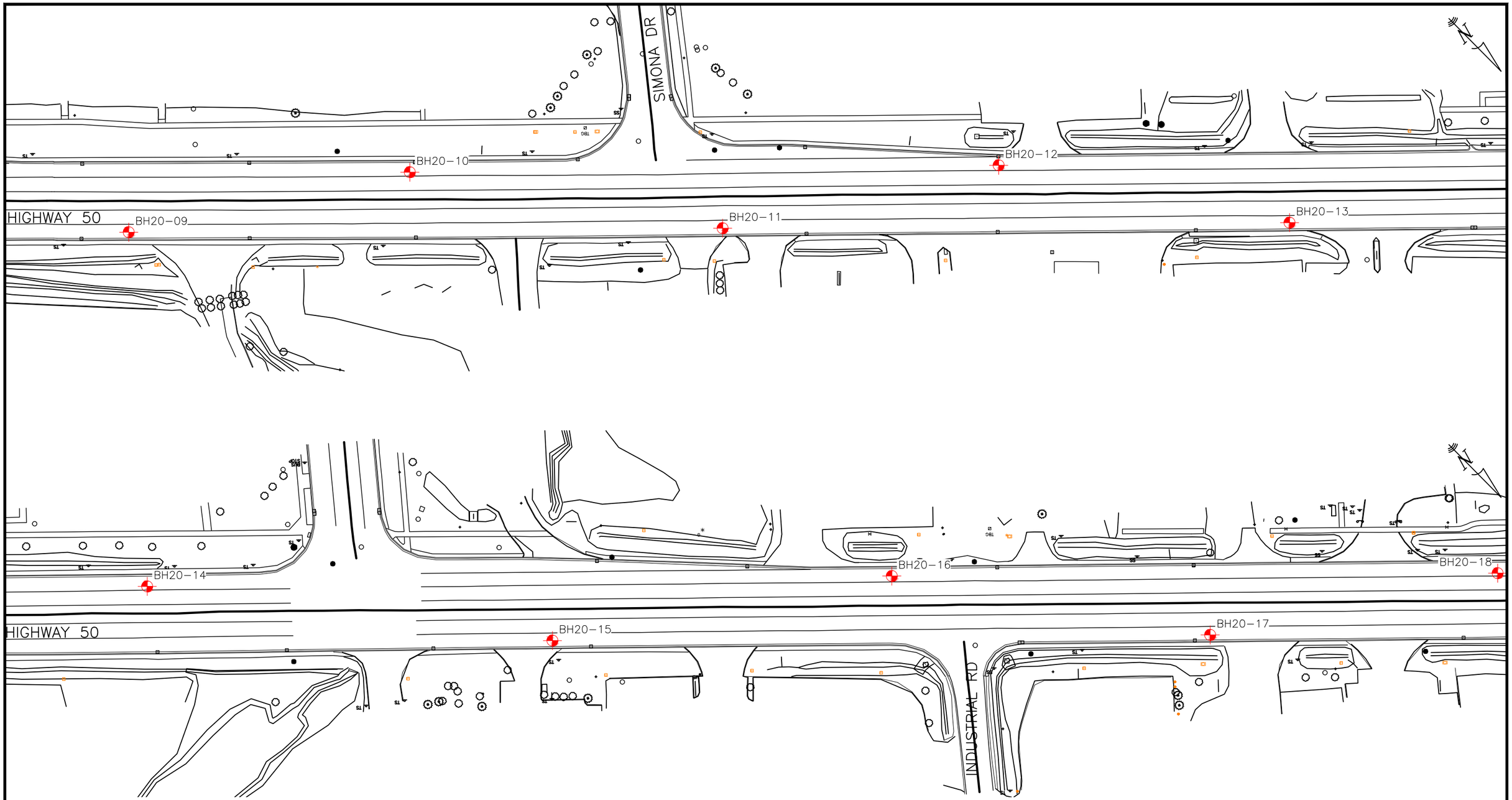

LEGEND

BOREHOLE LOCATION

20 0 20 40m

SCALE 1:1000

R.V. Anderson & Associates

HIGHWAY 50 DRAINAGE IMPROVEMENT

BOREHOLE LOCATION PLAN

JOB# 28262

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
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HIGHWAY 50

BH20-19

BH20-20

BH20-21

BH20-22

MCEWAN DR

HIGHWAY 50

BH20-23

BH20-24

BH20-25

HEALEY RD

LEGEND

BOREHOLE LOCATION

20 0 20 40m

SCALE 1:1000

R.V. Anderson & Associates

HIGHWAY 50 DRAINAGE IMPROVEMENT

BOREHOLE LOCATION PLAN

JOB# 28262

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
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FILENAME: H:\Drafting\28000\28262\TED-28262-BHPL.dwg
PLOTDATE: Aug 6, 2020 - 4:21 PM

Appendix B

MECP Well Records

MECP Well Record Summary Table

Well ID	UTM Coordinates Easting	UTM Coordinates Northing	Date Completed	Depth to Bedrock	Static Level	Well use
4900316	603685.6	4856848	1967-12-01	0	36.6	Supply Wells
4900361	604228.6	4856559	1953-11-25	0	0	Abandoned
7048899	603899	4856857	2007-07-10	0	0	Observation Well
7230417	603801	4856817	2014-08-06	0	0	Observation Well
7205855	602829	4857940	2013-07-11	0	0	unknown
7196589	603628	4856894	2012-12-13	0	0	Observation Well
7212292	604840	4855812	2013-06-12	0	0	Observation Well
4904182	604405.6	4856303	1973-02-15	0	18.3	Supply Wells
4904495	603804.6	4857065	1974-08-26	58.8	27.4	Supply Wells
7230415	603819	4856840	2014-08-06	0	0	Observation Well
6907219	604868.6	4855867	1964-08-31	37.5	27.4	Supply Wells
7257669	604214	4857167	2016-01-15	0	0	Monitoring and Test Hole
7235624	604478	4856624	2014-11-03	0	30.5	Abandoned
4904497	603906.6	4857314	1974-08-13	45.1	48.2	Supply Wells
4903570	604394.6	4856223	1970-09-29	47.5	0	Abandoned
4900368	603475.6	4857303	1963-10-31	56.4	21.3	Supply Wells
4903571	604464.6	4856223	1970-10-06	44.8	29	Supply Wells
6926696	605231.9	4855823	2002-09-05	0	0	Abandoned
7231573	604427	4856215	2014-10-16	0	0	Monitoring and Test Hole
4900362	604447.6	4856326	1954-08-07	0	32.3	Supply Wells
4904191	603848.6	4856975	1973-09-10	0	21.3	Supply Wells
7113171	604789	4855689	2008-08-27	0	0	Abandoned
7104307	604789	4855689	2008-04-08	0	0	Observation Well
7177345	604496	4856555	2011-12-28	0	33	Abandoned
4900369	603449.6	4857482	1964-11-15	0	40.5	Supply Wells
4905070	604314.6	4856383	1977-03-15	0	32	Supply Wells
7236035	604498	4856398	2014-10-14	0	0	Abandoned
4903323	604664.6	4856173	1969-09-03	50.3	14.3	Supply Wells
6917561	604947	4855780	1984-04-26	36	23.5	Supply Wells
7231571	604441	4856258	2014-10-16	0	0	Monitoring and Test Hole
7172124	604060	4856764	2011-10-25	0	0	Monitoring and Test Hole
7212298	604898	4856060	2013-06-12	0	0	Observation Well
7236037	604417	4856773	2014-10-14	0	0	Abandoned
4903208	604614.6	4856233	1969-03-28	0	0	Abandoned
7263877	603719	4857108	2016-05-11	0	0	Observation Well
4903682	603554.6	4856988	1971-08-23	0	40.2	Supply Wells
4903711	604464.6	4856603	1971-08-25	0	2.4	Supply Wells
4909668	603095	4857366	2004-11-10	0	0	Observation Well

MECP Well Record Summary Table

Well ID	UTM Coordinates Easting	UTM Coordinates Northing	Date Completed	Depth to Bedrock	Static Level	Well use
4905910	604514.6	4855623	1981-03-03	41.5	0	Supply Wells
4903257	604624.6	4856173	1969-06-13	0	24.4	Supply Wells
7212296	604324	4857054	2013-06-12	0	0	Observation Well
4904179	604523.6	4856446	1973-07-18	0	20.7	Supply Wells
7196141	603831	4857064	2013-01-17	0	0	Monitoring and Test Hole
7231572	604460	4856239	2014-10-16	0	0	Monitoring and Test Hole
7245314	604487	4855947	2015-07-16	0	0	Observation Well
7245315	604480	4855849	2015-07-16	0	0	Observation Well
7212225	604256	4856656	2013-10-18	0	0	unknown
4908578	603517	4856992	2000-03-17	0	38.4	Supply Wells
7263868	603668	4857246	2016-05-11	0	0	Observation Well
4909892	604104	4856730	2005-07-03	0	0	Supply Wells
7162056	604773	4855677	2011-04-07	0	0	Monitoring and Test Hole
6918791	604700	4856508	1987-02-05	55.2	29	Supply Wells
4905188	603834.6	4857013	1977-06-02	57.3	40.5	Supply Wells
7232223	604359	4856881	2014-10-27	0	0	unknown
7245851	603359	4856909	2015-05-21	0	0	unknown
7212293	604788	4855880	2013-06-12	0	0	Observation Well
7263876	603742	4857240	2016-05-10	0	0	Observation Well
4903812	604464.6	4856298	1972-04-25	0	28	Supply Wells
7162058	604877	4855699	2011-04-07	0	0	Monitoring and Test Hole
4904567	604517.6	4856281	1974-10-15	0	18.9	Supply Wells
7172123	604045	4856837	2011-10-25	0	0	Monitoring and Test Hole
7196588	603701	4856983	2012-12-13	0	0	Observation Well
4904931	604514.6	4856423	1976-05-13	0	29.3	Supply Wells
4900364	603876.6	4856887	1963-09-26	0	37.8	Supply Wells
7168757	604060	4856717	2010-03-09	0	0	unknown
7212297	604616	4856420	2013-06-12	0	0	Observation Well
4903675	604344.6	4856883	1971-06-16	0	35.1	Supply Wells
4909587	603200	4857451	2004-10-14	0	0	Observation Well
7143512	603839	4856833	2009-09-11	0	0	Monitoring and Test Hole
7051218	603826	4856896	2007-08-31	0	0	Abandoned
4905282	603664.6	4856973	1977-11-04	0	28.7	Supply Wells
7162057	604869	4855728	2011-04-07	0	0	Monitoring and Test Hole
7219133	604227	4856836	2014-03-27	0	0	Observation Well
4900367	603928.6	4856959	1967-10-13	0	34.1	Supply Wells
6916207	604964.6	4855773	1981-11-03	36	24.1	Supply Wells
4904095	603834.6	4857203	1973-03-15	0	38.7	Supply Wells

MECP Well Record Summary Table

Well ID	UTM Coordinates Easting	UTM Coordinates Northing	Date Completed	Depth to Bedrock	Static Level	Well use
4903666	604139.6	4856763	1971-06-16	0	36.6	Supply Wells
6917973	605088.6	4855609	1985-07-10	0	0	Abandoned
7263862	603791	4857206	2016-05-10	0	0	Observation Well
4900365	603725.6	4857032	1963-12-11	59.1	37.2	Supply Wells
7149490	603792	4857314	2010-07-15	0	0	Monitoring and Test Hole
7245316	604535	4855896	2015-07-16	0	0	Observation Well
4900370	603521.6	4857410	1964-07-02	0	0	Abandoned
7149489	603784	4857496	2010-07-15	0	0	Monitoring and Test Hole
6907218	604605.6	4856485	1964-07-16	0	0	Abandoned
7263863	603658	4857161	2016-05-11	0	0	Observation Well
7230416	603826	4856810	2014-08-06	0	0	Observation Well
4900317	603432.6	4857241	1959-07-20	0	0	Abandoned
7132481	604868	4856295	2009-09-14	0	0	Monitoring and Test Hole
7132481	604917	4856138	2009-09-14	0	0	Monitoring and Test Hole
7132481	605031	4856053	2009-09-15	0	0	Monitoring and Test Hole
7205569	604227	4856816	2013-04-17	0	0	unknown
4904849	603660.6	4857133	1976-01-15	0	39.6	Supply Wells
7206967	603319	4857302	2013-07-03	0	0	Abandoned
6917985	605088.6	4855609	1985-04-22	0	27.7	Supply Wells
6912218	605210.6	4856207	1974-04-11	50.3	31.4	Supply Wells
7149488	603777	4857485	2010-07-15	0	0	Monitoring and Test Hole
7194728	604278	4856876	2012-10-11	0	0	unknown
7196142	603802	4857091	2013-01-17	0	0	Monitoring and Test Hole
6917563	605234.6	4855823	1984-05-04	0	24.4	Supply Wells
4900366	603925.6	4856908	1967-06-14	0	31.7	Supply Wells
7247414	604191	4857096	2015-08-13	0	0	Observation Well
4900318	602644.6	4857602	1958-01-15	18.3	42.1	Supply Wells
7235626	604500	4856565	2014-11-03	0	0	Abandoned
7196590	603653	4856928	2012-12-13	0	0	Observation Well
7229211	604224	4856821	2014-09-17	0	0	unknown
7196143	603797	4857038	2013-01-17	0	0	unknown
7143511	603836	4856847	2009-09-11	0	0	Monitoring and Test Hole
4903715	604094.6	4856773	1971-11-12	0	35.1	Supply Wells
7196144	603775	4857041	2013-01-17	0	0	Monitoring and Test Hole
4900363	604118.6	4856695	1966-10-10	0	0	Abandoned
7270670	604246	4857120	2015-11-13	0	0	unknown
4903187	604064.6	4856743	1969-02-24	47.5	40.2	Abandoned
7110588	604717	4856503	2008-07-31	0	0	unknown

Appendix C

Record of Borehole Sheets

RECORD OF BOREHOLE 20-01

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 11, 2020
COMPLETED : March 11, 2020
N 4 855 949.5 E 604 798.4

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		226.50							
		ASPHALT: (200mm)		0.00							
		SAND and **GRAVEL**, brown, moist: (FILL)		0.20	1	GS					
				225.74							
1	Solid Stem Augers	**CLAY**, silty, some to trace sand, trace gravel, firm to hard, brown to grey, moist: (TILL)		0.76	2	SS	6				
2					3	SS	10	Grain Size Analysis: Gr 0%/ Sa 18%/ Si 47%/ Cl 35%			
3					4	SS	21				
4					5	SS	55				
					6	SS	47				
				222.08							
5		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		4.42							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : SZ
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-02

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 11, 2020
COMPLETED : March 11, 2020
N 4 856 017.3 E 604 712.0

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		226.90				
	Solid Stem Augers	**ASPHALT:** (200mm)		0.00				
		SAND and **GRAVEL**, grey, moist: (FILL)		0.20	1	GS		
		SAND, some gravel, brown, moist: (FILL)		226.29 0.61				
1		**CLAY**, silty, sandy, trace gravel, stiff, brown, moist: (FILL)		225.99 0.91	2	SS	10	Grain Size Analysis: Gr 6%/ Sa 23%/ Si 44%/ Cl 27%
		SAND, some gravel, loose, brown, moist: (FILL)		225.53 1.37				
2		**CLAY**, some sand, trace gravel, stiff to hard, grey, moist		225.07 1.83	3	SS	7	
					4	SS	39	
3					5	SS	39	
4					6	SS	29	
				222.48				
		END OF BOREHOLE AT 4.42m. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) May 26/20 3.25 223.65		4.42				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION
Bentonite
Filter Sand
Slotted Screen
Sand

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION
▼ WATER LEVEL IN WELL/PIEZOMETER
May 26, 2020

LOGGED : SZ
CHECKED : CZ

THURBER

THURBER2S TEL-28262.GPJ 8/6/20

RECORD OF BOREHOLE 20-03

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 11, 2020 — SHEET 1 OF 1
COMPLETED : March 11, 2020 — N 4 856 103.1 E 604 652.0 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		228.20				
		ASPHALT: (200mm)		0.00				
		SAND, some gravel, dense, brown, moist: (FILL)		0.20	1	GS		
1					2	SS	36	
				226.68				
	Solid Stem Augers	**CLAY**, silty, some sand, trace gravel, stiff to hard, brown to grey, moist: (TILL)		1.52	3	SS	12	
2					4	SS	15	
3					5	SS	44	Grain Size Analysis: Gr 1%/ Sa 14%/ Si 44%/ Cl 41%
4					6	SS	44	
				223.78				
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		4.42				
5								
6								
7								
8								
9								

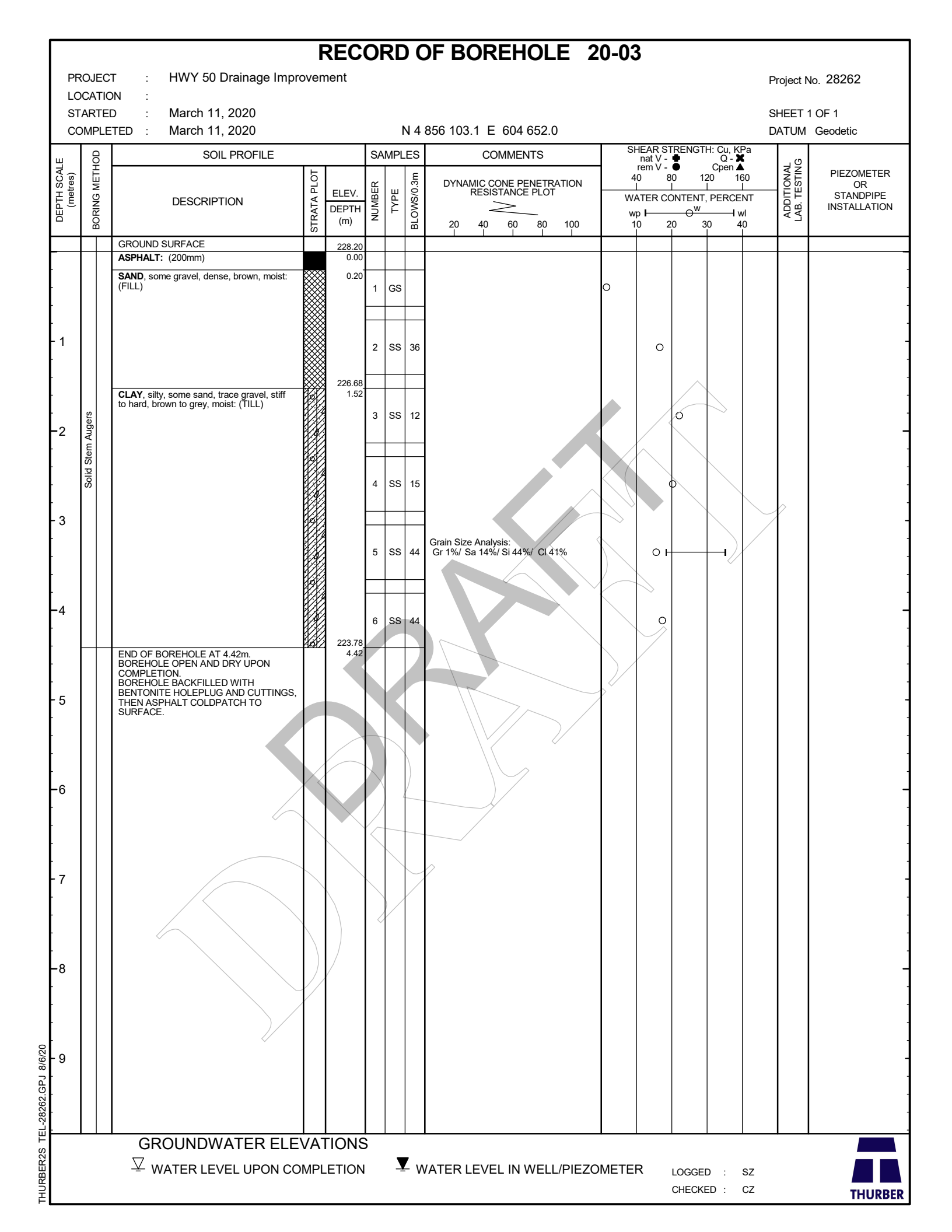
DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ — rem V - ● Cpen ▲ — 40 80 120 160

WATER CONTENT, PERCENT — wp w wl — 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : SZ
CHECKED : CZ

THURBER

THURBER2S TEL-28262.GPJ 8/6/20

RECORD OF BOREHOLE 20-04

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : April 6, 2020 — SHEET 1 OF 1
COMPLETED : April 6, 2020 — N 4 856 162.3 E 604 569.3 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		228.70				
		ASPHALT: (150mm)		0.00				
		SAND and **GRAVEL**, trace silt, brown, moist: (FILL)		0.15	1	SS	85	Grain Size Analysis: Gr 32%/ Sa 60%/ Si & Cl 8%
				227.95				
1		**SAND**, trace silt and gravel, cobbles, very dense, brown, moist: (FILL)		0.75	2	SS	50/ 0.150	
					3	SS	100/ 0.150	
2	Solid Stem Augers			226.31				
		SAND, gravelly, very dense to loose, grey, wet: (FILL)		2.39	4	SS	34	
3					5	SS	4	
				225.04				
		CLAY, silty, some sand, stiff, brown, wet: (TILL)		3.66	6	SS	10	
4				224.28				
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND WATER LEVEL AT 2.4m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		4.42				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ — rem V - ● Cpen ▲ — 40 80 120 160

WATER CONTENT, PERCENT — wp w wl — 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : SB
CHECKED : CZ

THURBER

THURBER2S TEL-28262.GPJ 8/6/20

RECORD OF BOREHOLE 20-05

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 11, 2020
COMPLETED : March 11, 2020
N 4 856 244.6 E 604 507.7

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		230.00							
		ASPHALT: (200mm)		0.00							
		SAND, some gravel, brown, moist		0.20	1	GS			○		
				229.39							
	Solid Stem Augers	**CLAY**, silty, some sand to sandy, trace gravel, stiff to hard, grey to brown, moist: (TILL)		0.61	2	SS	11		○		
1											
					3	SS	32	Grain Size Analysis: Gr 6%/ Sa 21%/ Si 49%/ Cl 24%	○ wp–w–wl		
2											
					4	SS	32		○		
3											
					5	SS	34		○		
4											
					6	SS	24		○		
				225.58							
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		4.42							
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : SZ
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-06

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : April 6, 2020 — SHEET 1 OF 1
COMPLETED : April 6, 2020 — N 4 856 315.4 E 604 407.8 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		231.00							
		ASPHALT: (150mm)		0.00							Asphalt Concrete
		SAND, trace silt, some gravel, very dense, grey, dry: (FILL)		0.15	1	SS	84		○		
1	Solid Stem Augers	**CLAY**, silty, some sand to sandy, trace gravel, very stiff to hard, brown, moist: (TILL)		230.09 0.91	2	SS	16		○	>>	Bentonite
2					3	SS	23		○	>>	Filter Sand
					4	SS	33	Grain Size Analysis: Gr 2%/ Sa 23%/ Si 49%/ Cl 26%	○ —	>>	
3					5	SS	58		○	>>	Slotted Screen
4					6	SS	38		○	>>	Sand
				226.58							
5		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		4.42							
6		WATER LEVEL READINGS: DATE / DEPTH(m) / ELEV.(m) — Apr 06/20 Dry - ; May 26/20 3.00 228.00									
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER May 26, 2020

LOGGED : SB
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-07

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 11, 2020 — SHEET 1 OF 1
COMPLETED : March 11, 2020 — N 4 856 382.3 E 604 369.0 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) (40 80 120 160) / WATER CONTENT, PERCENT (wp w wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		231.40							
		ASPHALT: (200mm)		0.00							
	Solid Stem Augers	**SAND** and **GRAVEL**, grey, moist		0.20	1	GS					
				230.64							
		SAND, some gravel, brown, moist		0.76							
1		**CLAY**, silty, some to trace sand, trace gravel, very stiff to hard, brown to grey, moist: (TILL)		0.91	2	SS	11				
					3	SS	34				
2					4	SS	27	Grain Size Analysis: Gr 2%/ Sa 17%/ Si 41%/ Cl 40%			
3					5	SS	40				
4					6	SS	25				
				226.98							
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		4.42							
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : SZ
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-08

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 5, 2020 — SHEET 1 OF 1
COMPLETED : March 5, 2020 — N 4 856 471.9 E 604 254.7 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		233.00				
		ASPHALT: (200mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.20	1	GS		
1	Solid Stem Augers	**CLAY**, silty, some sand to sandy, trace gravel, very stiff to hard, brown, moist: (TILL)		232.09 0.91	2	SS	15	Grain Size Analysis: Gr 4%/ Sa 24%/ Si 45%/ Cl 27%
2					3	SS	35	
		Very Stiff			4	SS	26	
3					5	SS	24	
4		Hard			6	SS	42	
				228.58				
		END OF BOREHOLE AT 4.42m. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		4.42				
5		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar 05/20 Dry - May 26/20 3.00 230.00						
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION: Bentonite; Filter Sand; Slotted Screen; Sand

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 26, 2020

LOGGED : AF
CHECKED : CZ

THURBER

THURBER2S TEL-28262.GPJ 8/6/20

RECORD OF BOREHOLE 20-09

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 5, 2020 — SHEET 1 OF 1
COMPLETED : March 5, 2020 — N 4 856 526.0 E 604 223.0 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS (DYNAMIC CONE PENETRATION RESISTANCE PLOT)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) / WATER CONTENT, PERCENT (wp, w, wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		234.30							
	Solid Stem Augers	**ASPHALT:** (175mm)		0.00							
		SAND, some silt, some gravel, brown, moist: (FILL)		0.18	1	GS			○		
1		**CLAY**, silty, sandy to some sand, trace gravel, stiff to firm, brown, moist: (TILL)		233.39 0.91	2	SS	8	Grain Size Analysis: Gr 4%/ Sa 31%/ Si 44%/ Cl 21%	○		
2					3	SS	4		○		
		Very stiff to hard			4	SS	20		○		
3					5	SS	31		○		
4				230.24	6	SS	50/ 0.100		○		
		END OF BOREHOLE AT 4.06m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		4.06							
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-10

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 5, 2020 — SHEET 1 OF 1
COMPLETED : March 5, 2020 — N 4 856 567.9 E 604 157.8 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		235.80				
		ASPHALT: (200mm)		0.00				
		SAND, some silt, some gravel to gravelly, brown, moist: (FILL)		0.20	1	GS		
1	Solid Stem Augers	Dense			2	SS	35	
		Compact			3	SS	13	Grain Size Analysis: Gr 22%/Sa 54%/ Si & Cl 24%
2		Loose, wet			4	SS	9	
3		Very loose		232.29	5	SS	3	
		CLAY, silty, some sand, trace gravel, stiff to very stiff, brown to grey, moist: (TILL)		3.51				
4					6	SS	29	
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND WATER LEVEL AT 2.1m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		231.38 4.42				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ — rem V - ● Cpen ▲ — 40 80 120 160

WATER CONTENT, PERCENT — wp w wl — 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-11

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 10, 2020 — SHEET 1 OF 1
COMPLETED : March 10, 2020 — N 4 856 638.0 E 604 108.5 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		236.90				
		ASPHALT: (175mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.18	1	GS		
1		**SAND**, some silt, some gravel, trace clay, dense to loose, brown, moist: (FILL)		235.99 0.91	2	SS	31	
	Solid Stem Augers				3	SS	10	
2		**CLAY**, silty, some sand to sandy, trace gravel, firm to stiff, brown, moist		234.61 2.29	4	SS	7	Grain Size Analysis: Gr 6%/ Sa 24%/ Si 42%/ Cl 28%
3					5	SS	14	
4					6	SS	11	
		END OF BOREHOLE AT 4.06m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		232.48 4.42				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa — nat V - ✤ Q - ✖ — rem V - ● Cpen ▲ — 40 80 120 160

WATER CONTENT, PERCENT — wp w wl — 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : MA
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-12

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 9, 2020
COMPLETED : March 9, 2020
N 4 856 678.3 E 604 043.7

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		237.40				
		ASPHALT: (200mm)		0.00				
		SAND, some silt, and gravel, brown, moist: (FILL)		0.20	1	GS		
				236.49				
1	Solid Stem Augers	**SAND**, gravelly, some silt, trace clay, compact, brown, moist: (FILL)		0.91	2	SS	14	
					3	SS	20	
2					4	SS	16	Grain Size Analysis: Gr 29%/ Sa 49%/ Si & Cl 22%
3					5	SS	15	
4					6	SS	13	
				232.98				
		END OF BOREHOLE AT 4.42m. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		4.42				
5		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar 09/20 Dry - May 26/20 2.80 234.60						
6								
7								
8								
9								

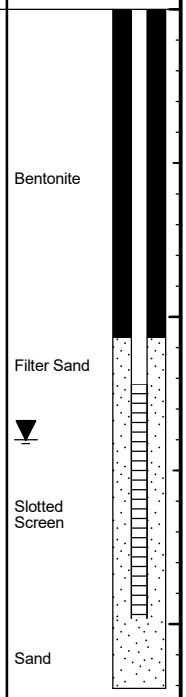
DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 26, 2020

LOGGED : MA
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-13

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 10, 2020
COMPLETED : March 10, 2020
N 4 856 744.4 E 603 998.8

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT (wp, w, wl) 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		237.80							
		ASPHALT: (200mm)		0.00							
		SAND, some silt, some gravel, brown, moist: (FILL)		0.20	1	GS			○		
1		**SAND**, silty, some clay, trace gravel, compact, brown, moist: (FILL)		236.89 0.91	2	SS	25		○		
	Solid Stem Augers	**CLAY**, silty, sandy, trace gravel, stiff to very stiff, brown, moist: (TILL)		236.28 1.52	3	SS	11	Grain Size Analysis: Gr 4%/ Sa 23%/ Si 46%/ Cl 27%	○		
2					4	SS	30		○		
3					5	SS	27		○		
4		Hard			6	SS	71		○		
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		233.38 4.42							
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : MA
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-14

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 9, 2020
COMPLETED : March 9, 2020
N 4 856 800.8 E 603 918.1

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		237.90							
		ASPHALT: (175mm)		0.00							
		SAND and **SILT**, trace gravel, brown, moist: (FILL)		0.18	1	GS			○		
1	Solid Stem Augers	**CLAY**, silty, sandy, trace gravel, very stiff, brown, moist: (TILL)		236.99 0.91	2	SS	19	Grain Size Analysis: Gr 2%/ Sa 26%/ Si 41%/ Cl 31%	○		
2					3	SS	27		○		
		Hard to very stiff			4	SS	34		○		
3					5	SS	36		○		
4					6	SS	23		○		
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		233.48 4.42							
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : MA
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-15

PROJECT : HWY 50 Drainage Improvement
Project No. 28262
LOCATION :
STARTED : April 7, 2020
SHEET 1 OF 1
COMPLETED : April 7, 2020
N 4 856 888.0 E 603 850.7
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		238.60				
		ASPHALT: (150mm)		0.00				
		SAND, trace silt and gravel, trace oxide, dense, brown, moist: (FILL)		0.15	1	SS	46	
1	Solid Stem Augers	**CLAY**, silty, sandy, trace to some gravel, very stiff to hard, brown, moist: (TILL)		237.53 1.07	2	SS	24	
2					3	SS	48	
3					4	SS	63	
					5	SS	66	Grain Size Analysis: Gr 16%/ Sa 21%/ Si 40%/ Cl 23%
4		END OF BOREHOLE AT 3.66m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		234.94 3.66				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

>>

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : SB
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-16

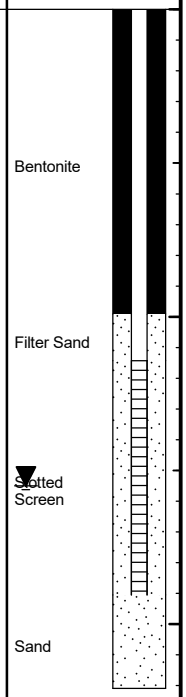
PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 10, 2020 — SHEET 1 OF 1
COMPLETED : March 10, 2020 — N 4 856 940.1 E 603 773.5 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		239.70				
		ASPHALT: (200mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.20	1	GS		
1		**SAND**, silty, some clay, trace gravel, compact, brown, moist: (FILL)		238.79 0.91	2	SS	13	
	Solid Stem Augers	**CLAY**, silty, some sand to sandy, trace to some gravel, hard, brown, moist: (TILL)		238.25 1.45	3	SS	30	Grain Size Analysis: Gr 5%/ Sa 21%/ Si 46%/ Cl 28%
2					4	SS	47	
3					5	SS	42	
4		Very Stiff			6	SS	20	
				235.28				
		END OF BOREHOLE AT 4.42m. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		4.42				
5		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar 10/20 Dry - May 26/20 3.10 236.60						
6								
7								
8								
9								

SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲)
40 80 120 160
WATER CONTENT, PERCENT
wp w wl
10 20 30 40
DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 26, 2020

LOGGED : MA
CHECKED : CZ

THURBER

THURBER2S TEL-28262.GPJ 8/6/20

RECORD OF BOREHOLE 20-17

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 10, 2020
COMPLETED : March 10, 2020
N 4 857 011.7 E 603 723.6

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		240.90				
		ASPHALT: (200mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.20	1	GS		
1	Solid Stem Augers	**CLAY**, silty, some sand, trace to some gravel, stiff to very stiff, brown, moist: (TILL)		239.99 0.91	2	SS	13	
2					3	SS	26	Grain Size Analysis: Gr 1%/ Sa 17%/ Si 47%/ Cl 35%
		Hard			4	SS	45	
3					5	SS	47	
4					6	SS	34	
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		236.48 4.42				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : MA
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-18

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 9, 2020
COMPLETED : March 9, 2020
N 4 857 054.5 E 603 656.9

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		241.60							
		ASPHALT: (200mm)		0.00							
		SAND, some silt, trace gravel, brown, moist: (FILL)		0.20	1	GS			○		
1	Solid Stem Augers	**CLAY**, silty, trace sand and gravel, very stiff to hard, brown, moist: (TILL)		240.69 0.91	2	SS	18		○		
2					3	SS	25	Grain Size Analysis: Gr 4%/ Sa 10%/ Si 49%/ Cl 37%	○ —		
3					4	SS	45		○		
					5	SS	44		○		
4					6	SS	31		○		
				237.18 4.42							
5		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.									
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : MA
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-19

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : April 7, 2020
COMPLETED : April 7, 2020

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

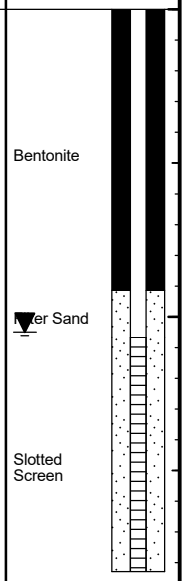
N 4 857 127.1 E 603 605.7

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		242.40				
		ASPHALT: (150mm)		0.00				
		SAND, gravelly, trace silt, very dense, brown, dry: (FILL)		0.15	1	SS	52	Grain Size Analysis: Gr 20%/ Sa 72%/ Si & Cl 8%
	Solid Stem Augers			241.64				
1		**CLAY**, silty, some sand to sandy, trace gravel, very stiff, brown, moist: (TILL)		0.76	2	SS	29	
2					3	SS	47	Grain Size Analysis: Gr 8%/ Sa 25%/ Si 45%/ Cl 22%
					4	SS	87	
3					5	SS	72	
				238.74				
4		END OF BOREHOLE AT 3.66m. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		3.66				
5		WATER LEVEL READINGS: DATE / DEPTH(m) / ELEV.(m) Apr 07/20 / Dry / - May 26/20 / 2.10 / 240.30						
6								
7								
8								
9								

SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160
DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100
WATER CONTENT, PERCENT wp w wl 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER May 26, 2020

LOGGED : SB
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-20

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 5, 2020
COMPLETED : March 5, 2020

Project No. 28262
SHEET 1 OF 1
N 4 857 184.7 E 603 516.6
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		243.00				
		ASPHALT: (200mm)		0.00				
		SAND, some silt, trace gravel, brown, moist: (FILL)		0.20	1	GS		
1		Loose			2	SS	9	
		CLAY, silty, trace sand and gravel, firm, grey, moist: (FILL)		241.63 1.37				
2	Solid Stem Augers				3	SS	6	
		CLAY, silty, some sand to sandy, trace gravel, very stiff to hard, grey, wet: (TILL)		240.71 2.29	4	SS	16	
3					5	SS	31	Grain Size Analysis: Gr 5%/ Sa 24%/ Si 45%/ Cl 26%
4					6	SS	28	
		END OF BOREHOLE AT 4.42m. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		238.58 4.42				
5		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar 05/20 3.73 239.27 May 26/20 1.10 241.90						
6								
7								
8								
9								

COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH: Cu, KPa (nat V - ✚ Q - ✖ rem V - ● Cpen ▲)
40 80 120 160
WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION: Bentonite; Filter Sand; Slotted Screen; Sand

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION
▼ WATER LEVEL IN WELL/PIEZOMETER
May 26, 2020

LOGGED : AF
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-21

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 4, 2020 — SHEET 1 OF 1
COMPLETED : March 4, 2020 — N 4 857 262.5 E 603 469.9 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		243.70				
		ASPHALT: (175mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.18	1	GS		
1		Dense to compact			2	SS	33	
2	Solid Stem Augers				3	SS	16	Grain Size Analysis: Gr 20%/Sa 68%/ Si & Cl 12%
		CLAY, silty, some sand, trace gravel, very stiff, grey, moist: (TILL)		241.57 2.13				
3					4	SS	24	
					5	SS	26	
4					6	SS	26	
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		239.28 4.42				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ — rem V - ● Cpen ▲ — 40 80 120 160

WATER CONTENT, PERCENT — wp w wl — 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-22

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 4, 2020
COMPLETED : March 4, 2020
N 4 857 326.8 E 603 375.2

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		244.90				
		ASPHALT: (175mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.18	1	GS		
1	Solid Stem Augers	**CLAY**, silty, some sand. trace gravel, very stiff, brown, moist		243.99 0.91	2	SS	21	Grain Size Analysis: Gr 2%/ Sa 15%/ Si 46%/ Cl 37%
2					3	SS	27	
3					4	SS	27	
4					5	SS	28	
					6	SS	28	
5		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		240.48 4.42				
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-23

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 4, 2020
COMPLETED : March 4, 2020
N 4 857 397.9 E 603 330.7

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		245.30				
		ASPHALT: (200mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.20	1	GS		
1		Loose			2	SS	7	
				243.78				
	Solid Stem Augers	**CLAY**, silty, some sand, trace gravel, firm to very stiff, grey, moist: (TILL)		1.52	3	SS	7	Grain Size Analysis: Gr 0%/ Sa 14%/ Si 44%/ Cl 42%
2					4	SS	21	
3					5	SS	21	
4					6	SS	18	
				240.88				
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		4.42				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-24

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 9, 2020
COMPLETED : March 9, 2020
N 4 857 448.1 E 603 249.8

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		245.90				
		ASPHALT: (175mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.18	1	GS		
1	Solid Stem Augers	**CLAY**, silty, some sand to sandy, trace gravel, very stiff to hard, brown, moist: (TILL)		244.99 0.91	2	SS	14	Grain Size Analysis: Gr 5%/ Sa 39%/ Si 37%/ Cl 19%
2					3	SS	18	
3					4	SS	34	
4					5	SS	52	
					6	SS	34	
		END OF BOREHOLE AT 4.42m. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		241.48 4.42				
5		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar 09/20 Dry - May 26/20 2.20 243.70						
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Bentonite
Filter Sand
Slotted Screen
Sand

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 26, 2020

LOGGED : MA
CHECKED : CZ

THURBER

THURBER2S TEL-28262.GPJ 8/6/20

RECORD OF BOREHOLE 20-25

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 4, 2020
COMPLETED : March 4, 2020
N 4 857 530.1 E 603 184.3

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		246.70				
		ASPHALT: (175mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.20	1	GS		
1	Solid Stem Augers	**CLAY**, silty, some sand to sandy, trace gravel, very stiff, brown, moist: (TILL)		245.79 0.91	2	SS	17	Grain Size Analysis: Gr 3%/ Sa 26%/ Si 45%/ Cl 26%
2					3	SS	24	
3					4	SS	34	
4		Stiff			5	SS	31	
					6	SS	12	
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		242.28 4.42				

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

>>▲ >>▲

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

Appendix D

Single Well Response Test Analyses

THURBER ENGINEERING LTD.

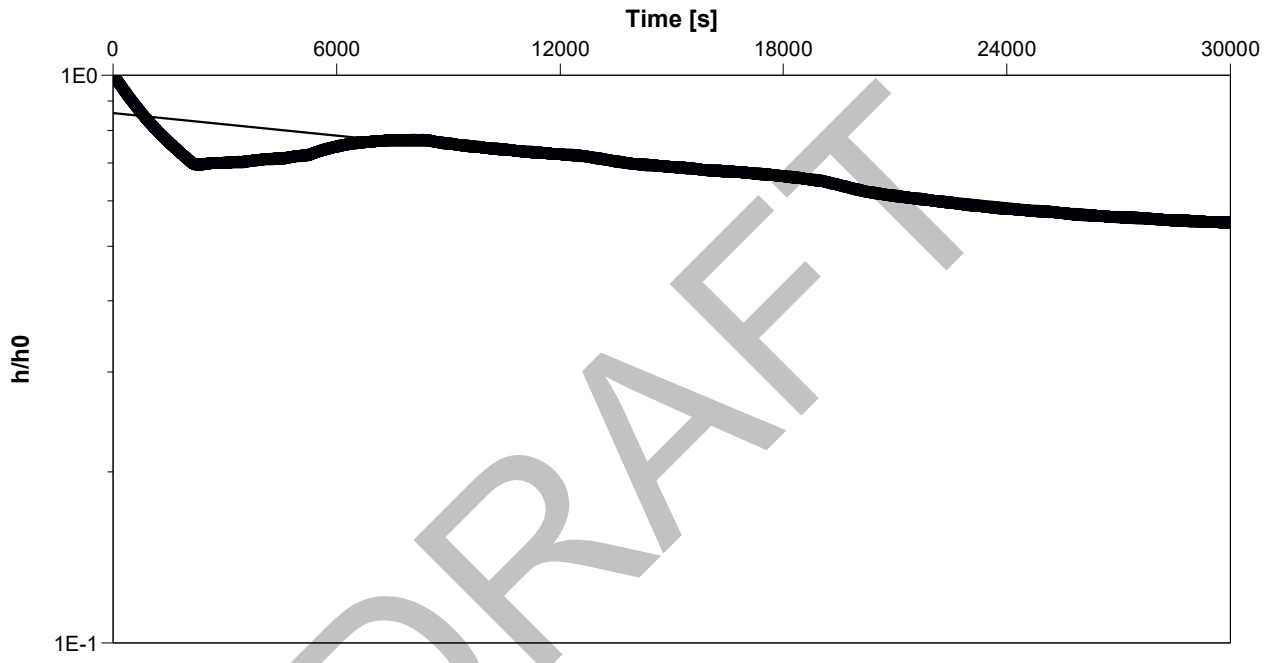
Slug Test Analysis Report

Project: Highway 50 Stormwater Sewer

Number: 28262

Client: Region of Peel

Location: Bolton, Ontario	Slug Test: 20-08A	Test Well: 20-08A
Test Conducted by: LP		Test Date: 2020-08-12
Analysis Performed by: LP	20-08 SWRT Analysis	Analysis Date: 2020-08-12
Aquifer Thickness:		
Checked by: DH		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
20-08A	1.1×10^{-8}	

THURBER ENGINEERING LTD.

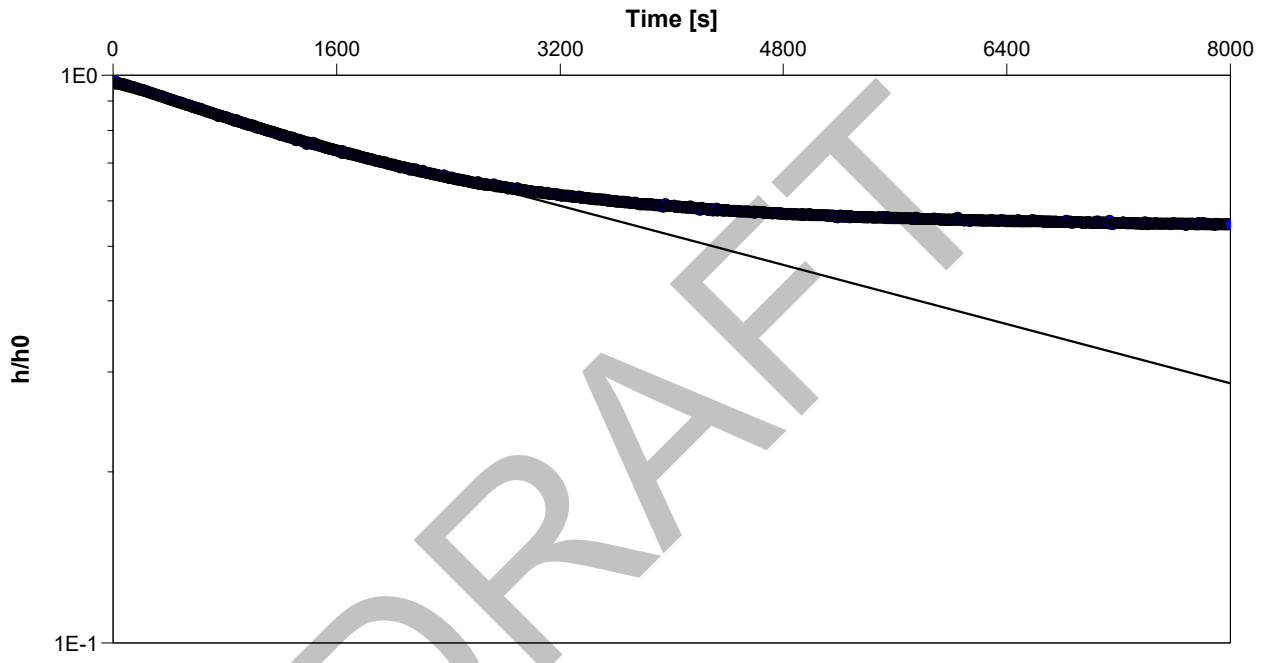
Slug Test Analysis Report

Project: Highway 50 Stormwater Sewer

Number: 28262

Client: Region of Peel

Location: Bolton, Ontario	Slug Test: 20-16A	Test Well: 20-16A
Test Conducted by: LP		Test Date: 2020-08-12
Analysis Performed by: LP	20-16 SWRT Analysis	Analysis Date: 2020-08-12
Aquifer Thickness:		
Checked by: DH		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
20-16A	1.1×10^{-7}	

THURBER ENGINEERING LTD.

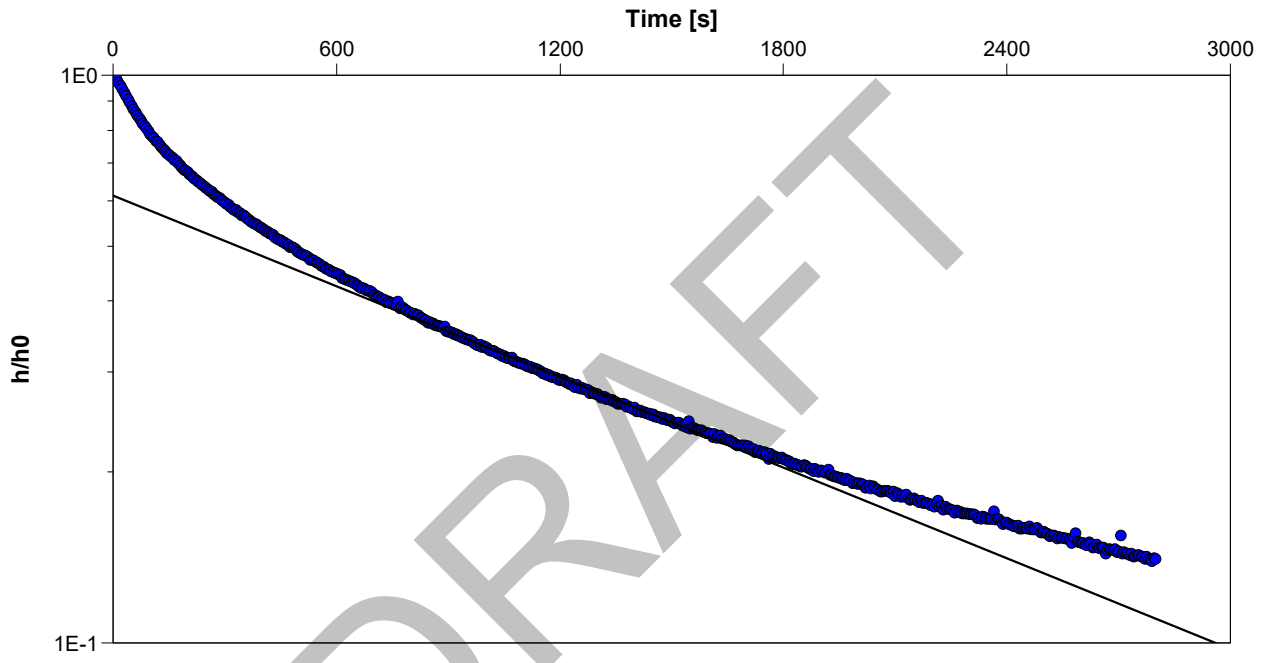
Slug Test Analysis Report

Project: Highway 50 Stormwater Sewer

Number: 28262

Client: Region of Peel

Location: Bolton, Ontario	Slug Test: 20-20A	Test Well: 20-20A
Test Conducted by: LP		Test Date: 2020-08-12
Analysis Performed by: LP	20-20 SWRT Analysis	Analysis Date: 2020-08-12
Aquifer Thickness:		
Checked by: DH		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
20-20A	5.2×10^{-7}	

THURBER ENGINEERING LTD.

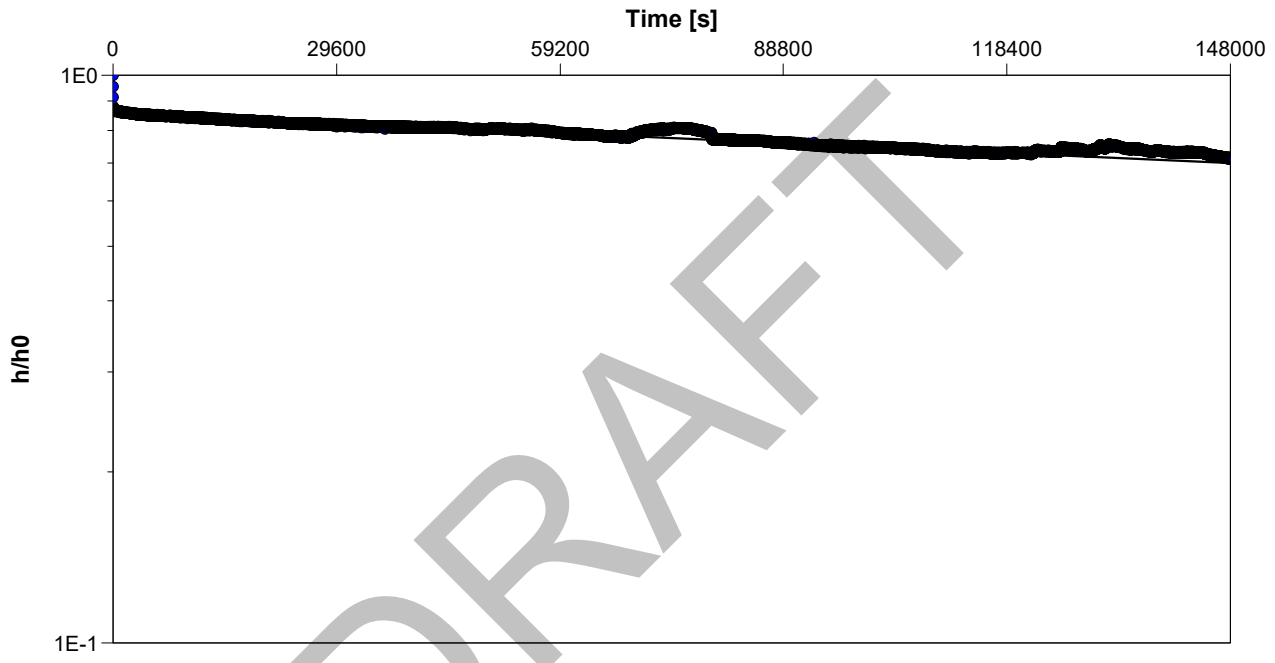
Slug Test Analysis Report

Project: Highway 50 Stormwater Sewer

Number: 28262

Client: Region of Peel

Location: Bolton, Ontario	Slug Test: 20-24A	Test Well: 20-24A
Test Conducted by:		Test Date: 2020-08-12
Analysis Performed by: LP	20-24 SWRT Analysis	Analysis Date: 2020-08-12
Aquifer Thickness:		
Checked by: DH		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
20-24A	9.8×10^{-10}	

Appendix E

Infiltration Testing Results

Guelph Permeameter

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	α^*(cm^{-1})	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_1/a}{2.102 + 0.118(H_1/a)}\right)^{0.655}$ $C_2 = \left(\frac{H_2/a}{2.102 + 0.118(H_2/a)}\right)^{0.655}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091(H_1/a)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091(H_2/a)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm^2/s), a^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm) , H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{a^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)a^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	$G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$

Saturated Hydraulic Copnductivity Calculations

Project:	Highway 50 Stormwater Sewer	**Test Date:**	2020-05-27
Number:	28262	**Client:**	Region of Peel
Performed by:	LP	**Checked by:**	AH
Test ID:	Test Pit 20-02	**Soil Sample ID:**	-
Test Pit Easting (m):	-	**Test Pit Northing (m):**	-
Test Depth (mbgs):	0.56	**Test Elevation (masl):**	-
Soil Description:	Sand and Gravel, grey, moist (Fill)		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir):	1
Enter water Head Height ("H" in cm):	20
Enter the Borehole Radius ("a" in cm):	3.15
Enter the soil texture-structure category (enter one of the below numbers):	4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 2.8000

Res Type	35.22
H	20
a	3.15
H/a	6.349
a*	0.36
C0.01	1.713
C0.04	1.855
C0.12	1.925
C0.36	1.925
C	1.925
R	2.800
Q	1.644
pi	3.142

$\alpha^* =$ **0.36** (cm^{-1})

$C =$ **1.924594**

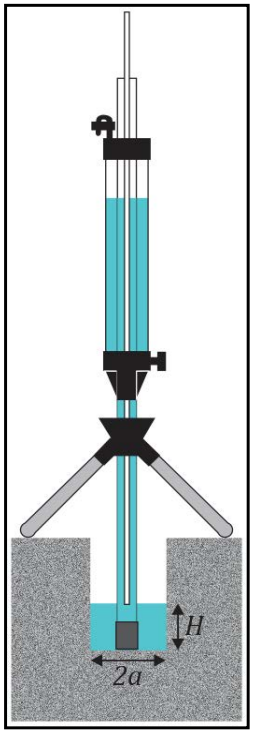
$Q =$ **1.6436**

$K_{fs} =$	**1.1E-03**	*cm/sec*
	6.5E-02	*cm/min*
	1.1E-05	*m/sec*
	2.6E-02	*inch/min*
	4.3E-04	*inch/sec*

$\Phi_m =$ **3.0E-03** (cm^2/min)

Input

Result



Saturated Hydraulic Copnductivity Calculations

Project:	Highway 50 Stormwater Sewer	**Test Date:**	2020-05-27
Number:	28262	**Client:**	Region of Peel
Performed by:	LP	**Checked by:**	AH
Test ID:	Test Pit 20-06	**Soil Sample ID:**	-
Test Pit Easting (m):	-	**Test Pit Northing (m):**	-
Test Depth (mbgs):	0.48	**Test Elevation (masl):**	-
Soil Description:	Sand, trace silt, some gravel, very dense, grey, dry (Fill)		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir):	1
Enter water Head Height ("H" in cm):	23
Enter the Borehole Radius ("a" in cm):	3.15
Enter the soil texture-structure category (enter one of the below numbers):	4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 2.4000

Res Type	35.22
H	23
a	3.15
H/a	7.302
a*	0.36
C0.01	1.833
C0.04	1.995
C0.12	2.086
C0.36	2.086
C	2.086
R	2.400
Q	1.409
pi	3.142

$\alpha^* =$ **0.36** (cm^{-1})

$C =$ **2.0863976**

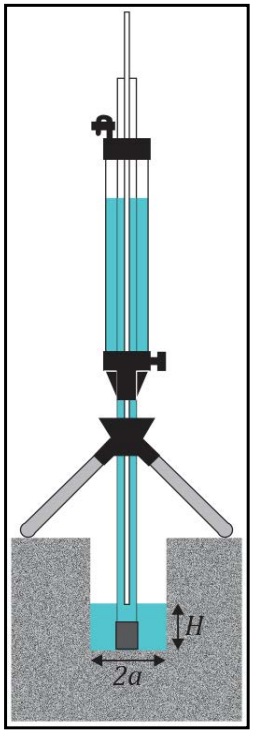
$Q =$ **1.4088**

$K_{fs} =$	**7.8E-04**	*cm/sec*
	4.7E-02	*cm/min*
	7.8E-06	*m/sec*
	1.8E-02	*inch/min*
	3.1E-04	*inch/sec*

$\Phi_m =$ **2.2E-03** (cm^2/min)

Input

Result



Saturated Hydraulic Copnductivity Calculations

Project:	Highway 50 Stormwater Sewer	**Test Date:**	2020-05-27
Number:	28262	**Client:**	Region of Peel
Performed by:	LP	**Checked by:**	AH
Test ID:	Test Pit 20-08	**Soil Sample ID:**	-
Test Pit Easting (m):	-	**Test Pit Northing (m):**	-
Test Depth (mbgs):	0.41	**Test Elevation (masl):**	-
Soil Description:	Sand, some silt, some gravel, brown, moist (Fill)		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir):	1
Enter water Head Height ("H" in cm):	22
Enter the Borehole Radius ("a" in cm):	3.15
Enter the soil texture-structure category (enter one of the below numbers):	4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min):	5.4000

Res Type	35.22
H	22
a	3.15
H/a	6.984
a*	0.36
C0.01	1.794
C0.04	1.95
C0.12	2.034
C0.36	2.034
C	2.034
R	5.400
Q	3.17
pi	3.142

$\alpha^* =$ **0.36** (cm^{-1})

$C =$ **2.0340969**

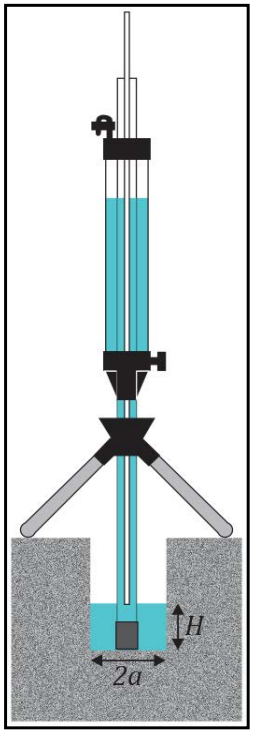
$Q =$ **3.1698**

$K_{fs} =$	**1.8E-03**	*cm/sec*
	1.1E-01	*cm/min*
	1.8E-05	*m/sec*
	4.4E-02	*inch/min*
	7.3E-04	*inch/sec*

$\Phi_m =$ **5.1E-03** (cm^2/min)

Input

Result



Saturated Hydraulic Copnductivity Calculations

Project:	Highway 50 Stormwater Sewer	**Test Date:**	2020-05-27
Number:	28262	**Client:**	Region of Peel
Performed by:	LP	**Checked by:**	AH
Test ID:	Test Pit 20-12	**Soil Sample ID:**	-
Test Pit Easting (m):	-	**Test Pit Northing (m):**	-
Test Depth (mbgs):	0.48	**Test Elevation (masl):**	-
Soil Description:	Sand, some silt and gravel, brown, moist (Fill)		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir):	1
Enter water Head Height ("H" in cm):	21
Enter the Borehole Radius ("a" in cm):	3.15
Enter the soil texture-structure category (enter one of the below numbers):	4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 4.8000

Res Type	35.22
H	21
a	3.15
H/a	6.667
a*	0.36
C0.01	1.755
C0.04	1.903
C0.12	1.98
C0.36	1.98
C	1.98
R	4.800
Q	2.818
pi	3.142

$\alpha^* =$ **0.36** (cm^{-1})

$C =$ **1.9801925**

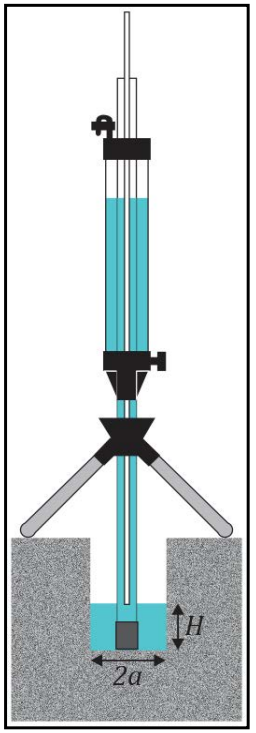
$Q =$ **2.8176**

$K_{fs} =$	**1.7E-03**	*cm/sec*
	1.0E-01	*cm/min*
	1.7E-05	*m/sec*
	4.1E-02	*inch/min*
	6.9E-04	*inch/sec*

$\Phi_m =$ **4.8E-03** (cm^2/min)

Input

Result



Saturated Hydraulic Copnductivity Calculations

Project:	Highway 50 Stormwater Sewer	**Test Date:**	2020-05-27
Number:	28262	**Client:**	Region of Peel
Performed by:	LP	**Checked by:**	AH
Test ID:	Test Pit 20-14	**Soil Sample ID:**	-
Test Pit Easting (m):	-	**Test Pit Northing (m):**	-
Test Depth (mbgs):	0.37	**Test Elevation (masl):**	-
Soil Description:	Sand and Silt, some clay, brown, moist (Fill)		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir):	1
Enter water Head Height ("H" in cm):	24
Enter the Borehole Radius ("a" in cm):	3.15
Enter the soil texture-structure category (enter one of the below numbers):	4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.8000

Res Type	35.22
H	24
a	3.15
H/a	7.619
a*	0.36
C0.01	1.87
C0.04	2.039
C0.12	2.137
C0.36	2.137
C	2.137
R	0.800
Q	0.47
pi	3.142

$\alpha^* =$ 0.36 (cm^{-1})

$C =$ 2.1371775

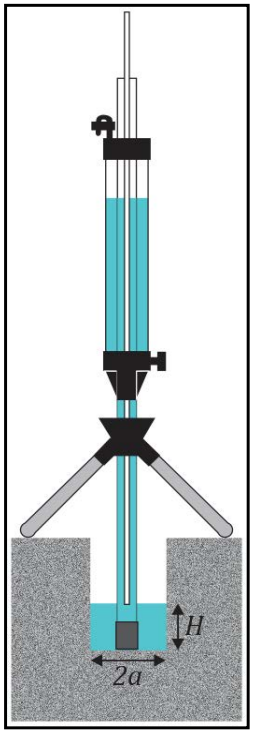
$Q =$ 0.4696

$K_{fs} =$	2.4E-04	*cm/sec*
	1.5E-02	*cm/min*
	2.4E-06	*m/sec*
	5.8E-03	*inch/min*
	9.6E-05	*inch/sec*

$\Phi_m =$ 6.8E-04 (cm^2/min)

Input

Result



Saturated Hydraulic Copnductivity Calculations

Project:	Highway 50 Stormwater Sewer	**Test Date:**	2020-05-27
Number:	28262	**Client:**	Region of Peel
Performed by:	LP	**Checked by:**	AH
Test ID:	Test Pit 20-18	**Soil Sample ID:**	-
Test Pit Easting (m):	-	**Test Pit Northing (m):**	-
Test Depth (mbgs):	0.54	**Test Elevation (masl):**	-
Soil Description:	Sand, some silt and clay, trace gravel, brown, moist (Fill)		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir):	**1**
Enter water Head Height ("H" in cm):	**20**
Enter the Borehole Radius ("a" in cm):	**3.15**
Enter the soil texture-structure category (enter one of the below numbers):	**4**

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): **0.2000**

Res Type	35.22
H	20
a	3.15
H/a	6.349
a*	0.36
C0.01	1.713
C0.04	1.855
C0.12	1.925
C0.36	1.925
C	1.925
R	0.200
Q	0.117
pi	3.142

$\alpha^* =$ **0.36** (cm^{-1})

$C =$ **1.924594**

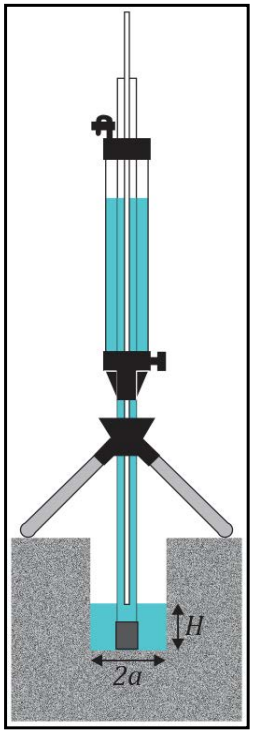
$Q =$ **0.1174**

$K_{fs} =$	**7.7E-05**	*cm/sec*
	4.6E-03	*cm/min*
	7.7E-07	*m/sec*
	1.8E-03	*inch/min*
	3.0E-05	*inch/sec*

$\Phi_m =$ **2.1E-04** (cm^2/min)

Input

Result



Saturated Hydraulic Copnductivity Calculations

Project:	Highway 50 Stormwater Sewer	**Test Date:**	2020-05-27
Number:	28262	**Client:**	Region of Peel
Performed by:	LP	**Checked by:**	AH
Test ID:	Test Pit 20-20	**Soil Sample ID:**	-
Test Pit Easting (m):	-	**Test Pit Northing (m):**	-
Test Depth (mbgs):	0.46	**Test Elevation (masl):**	-
Soil Description:	Sand, some silt, trace gravel, brown, moist (Fill)		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 20
Enter the Borehole Radius ("a" in cm): 3.15

Enter the soil texture-structure category (enter one of the below numbers): 4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 1.4000

Res Type	35.22
H	20
a	3.15
H/a	6.349
a*	0.36
C0.01	1.713
C0.04	1.855
C0.12	1.925
C0.36	1.925
C	1.925
R	1.400
Q	0.822
pi	3.142

$\alpha^* =$ **0.36** (cm^{-1})

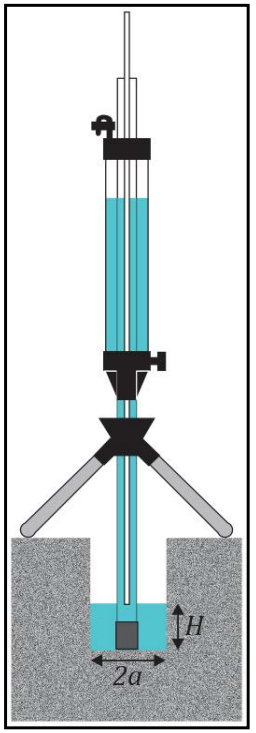
$C =$ **1.924594**
$Q =$ **0.8218**

$K_{fs} =$ **5.4E-04** *cm/sec*
3.2E-02 *cm/min*
5.4E-06 *m/sec*
1.3E-02 *inch/min*
2.1E-04 *inch/sec*

$\Phi_m =$ **1.5E-03** (cm^2/min)

Input

Result



Saturated Hydraulic Copnductivity Calculations

Project:	Highway 50 Stormwater Sewer	**Test Date:**	2020-05-27
Number:	28262	**Client:**	Region of Peel
Performed by:	LP	**Checked by:**	AH
Test ID:	Test Pit 20-22	**Soil Sample ID:**	-
Test Pit Easting (m):	-	**Test Pit Northing (m):**	-
Test Depth (mbgs):	0.33	**Test Elevation (masl):**	-
Soil Description:	Sand, some silt, some gravel, brown, moist (Fill)		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 20
Enter the Borehole Radius ("a" in cm): 3.15

Enter the soil texture-structure category (enter one of the below numbers): 4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 1.0000

Res Type	35.22
H	20
a	3.15
H/a	6.349
a*	0.36
C0.01	1.713
C0.04	1.855
C0.12	1.925
C0.36	1.925
C	1.925
R	1.000
Q	0.587
pi	3.142

$\alpha^* =$ **0.36** (cm^{-1})

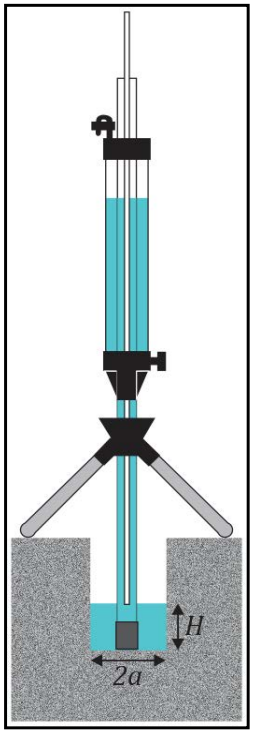
$C =$ **1.924594**
$Q =$ **0.587**

$K_{fs} =$	**3.9E-04**	*cm/sec*
	2.3E-02	*cm/min*
	3.9E-06	*m/sec*
	9.1E-03	*inch/min*
	1.5E-04	*inch/sec*

$\Phi_m =$ **1.1E-03** (cm^2/min)

Input

Result



Saturated Hydraulic Copnductivity Calculations

Project:	Highway 50 Stormwater Sewer	**Test Date:**	2020-05-27
Number:	28262	**Client:**	Region of Peel
Performed by:	LP	**Checked by:**	AH
Test ID:	Test Pit 20-24	**Soil Sample ID:**	-
Test Pit Easting (m):	-	**Test Pit Northing (m):**	-
Test Depth (mbgs):	0.3	**Test Elevation (masl):**	-
Soil Description:	Sand, some silt, some gravel, brown, moist (Fill)		

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir):	1
Enter water Head Height ("H" in cm):	25
Enter the Borehole Radius ("a" in cm):	3.15
Enter the soil texture-structure category (enter one of the below numbers):	4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min):	1.0000

Res Type	35.22
H	25
a	3.15
H/a	7.937
a*	0.36
C0.01	1.905
C0.04	2.081
C0.12	2.187
C0.36	2.187
C	2.187
R	1.000
Q	0.587
pi	3.142

$\alpha^* =$ **0.36** (cm^{-1})

$C =$ **2.1865125**

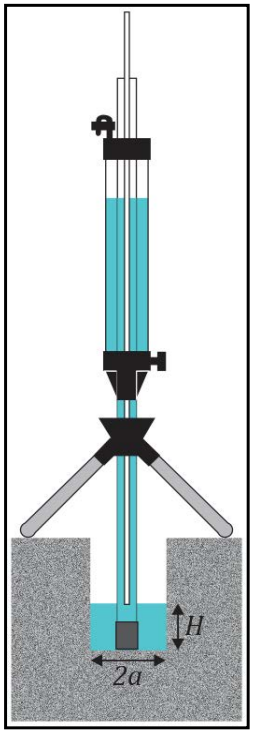
$Q =$ **0.587**

$K_{fs} =$	**2.9E-04**	*cm/sec*
	1.7E-02	*cm/min*
	2.9E-06	*m/sec*
	6.8E-03	*inch/min*
	1.1E-04	*inch/sec*

$\Phi_m =$ **8.0E-04** (cm^2/min)

Input

Result



Appendix F

Laboratory Certificates of Analysis

FINAL REPORT

CA14682-AUG20 R1

28262

Prepared for

Thurber Engineering Ltd.

FINAL REPORT

CA14682-AUG20 R1

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Thurber Engineering Ltd.	Project Specialist	Brad Moore Hon. B.Sc
		Laboratory	SGS Canada Inc.
Address	103, 2010 Winston Park Drive Oakville, ON L6H 5R7. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Alireza Hejazi	Telephone	705-652-2143
Telephone	416-992-9723	Facsimile	705-652-6365
Facsimile		Email	brad.moore@sgs.com
Email	ahejazi@thurber.ca	SGS Reference	CA14682-AUG20
Project	28262	Received	08/24/2020
Order Number		Approved	08/31/2020
Samples	Ground Water (4)	Report Number	CA14682-AUG20 R1
		Date Reported	08/31/2020

COMMENTS

RL - SGS Reporting Limit
Temperature of Sample upon Receipt: 12 degrees C
Cooling Agent Present:No
Custody Seal Present:No

Chain of Custody Number:01670

RL increased for tkn due to sample matrix interference

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

Client: Thurber Engineering Ltd.
Project: 28262
Project Manager: Alireza Hejazi
Samplers: Liviu Parpalea

PACKAGE: **SANSEW - General Chemistry** (WATER)

L1 = SANSEW / WATER / - - Peel Table 1 - Sanitary Sewer Discharge - BL_53_2010

L2 = SANSEW / WATER / - - Peel Table 2 - Storm Sewer Discharge - BL_53_2010

					Sample Number	8	9	10	11
					Sample Name	20-24	20-20	20-16	20-08
					Sample Matrix	Ground Water	Ground Water	Ground Water	Ground Water
					Sample Date	24/08/2020	24/08/2020	24/08/2020	24/08/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
General Chemistry								
Biochemical Oxygen Demand (BOD5)	mg/L	2	300	15	< 4 ↑	< 4 ↑	< 4 ↑	< 4 ↑
Total Suspended Solids	mg/L	2	350	15	142	296	569	135
Total Kjeldahl Nitrogen	as N mg/L	1.0	100	1	< 1.5 ↑	< 1.0	1.3	< 0.5 ↓

PACKAGE: **SANSEW - Metals and Inorganics** (WATER)

L1 = SANSEW / WATER / - - Peel Table 1 - Sanitary Sewer Discharge - BL_53_2010

L2 = SANSEW / WATER / - - Peel Table 2 - Storm Sewer Discharge - BL_53_2010

					Sample Number	8	9	10	11
					Sample Name	20-24	20-20	20-16	20-08
					Sample Matrix	Ground Water	Ground Water	Ground Water	Ground Water
					Sample Date	24/08/2020	24/08/2020	24/08/2020	24/08/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics								
Fluoride	mg/L	0.06	10		0.15	0.16	0.14	0.14
Cyanide (total)	mg/L	0.01	2	0.02	< 0.01	0.01	< 0.01	< 0.01
Sulphate	mg/L	2	1500		130	92	62	73
Aluminum (total)	mg/L	0.001	50		0.127	3.41	4.52	0.472
Antimony (total)	mg/L	0.0009	5		0.0014	< 0.0009	< 0.0009	< 0.0009
Arsenic (total)	mg/L	0.0002	1	0.02	0.0011	0.0038	0.0033	0.0010
Cadmium (total)	mg/L	0.000003	0.7	0.008	0.000040	0.000062	0.000118	0.000052
Chromium (total)	mg/L	0.00008	5	0.08	0.00274	0.00640	0.00883	0.00293
Copper (total)	mg/L	0.0002	3	0.05	0.0012	0.0119	0.0132	0.0020
Cobalt (total)	mg/L	0.000004	5		0.00585	0.00277	0.00887	0.00184
Lead (total)	mg/L	0.00001	3	0.12	0.00073	0.0117	0.00587	0.00095

Client: Thurber Engineering Ltd.
Project: 28262
Project Manager: Alireza Hejazi
Samplers: Liviu Parpalea

PACKAGE: **SANSEW - Metals and Inorganics**
(WATER)

L1 = SANSEW / WATER / - - Peel Table 1 - Sanitary Sewer Discharge - BL_53_2010

L2 = SANSEW / WATER / - - Peel Table 2 - Storm Sewer Discharge - BL_53_2010

					Sample Number	8	9	10	11
					Sample Name	20-24	20-20	20-16	20-08
					Sample Matrix	Ground Water	Ground Water	Ground Water	Ground Water
					Sample Date	24/08/2020	24/08/2020	24/08/2020	24/08/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics (continued)								
Manganese (total)	mg/L	0.00001	5	0.05	1.55	3.22	1.69	0.501
Molybdenum (total)	mg/L	0.00004	5		0.00161	0.00118	0.00107	0.00086
Nickel (total)	mg/L	0.0001	3	0.08	0.0090	0.0070	0.0116	0.0052
Phosphorus (total)	mg/L	0.003	10	0.4	< 0.003	0.230	0.130	0.021
Selenium (total)	mg/L	0.00004	1	0.02	0.00014	0.00009	0.00012	0.00077
Silver (total)	mg/L	0.00005	5	0.12	0.00006	< 0.00005	0.00006	< 0.00005
Tin (total)	mg/L	0.00006	5		0.00176	0.00149	0.00169	0.00204
Titanium (total)	mg/L	0.00005	5		0.00326	0.0827	0.0376	0.0108
Zinc (total)	mg/L	0.002	3	0.04	0.007	0.021	0.025	0.008

Client: Thurber Engineering Ltd.
Project: 28262
Project Manager: Alireza Hejazi
Samplers: Liviu Parpalea

PACKAGE: **SANSEW - Microbiology** (WATER)

L1 = SANSEW / WATER / - - Peel Table 1 - Sanitary Sewer Discharge - BL_53_2010

L2 = SANSEW / WATER / - - Peel Table 2 - Storm Sewer Discharge - BL_53_2010

Parameter	Units	RL	L1	L2	Sample Number: 8	9	10	11
					Sample Name: 20-24	20-20	20-16	20-08
					Sample Matrix: Ground Water	Ground Water	Ground Water	Ground Water
					Sample Date: 24/08/2020	24/08/2020	24/08/2020	24/08/2020
					Result	Result	Result	Result
Microbiology								
E. Coli	cfu/100mL	-		200	< 2↑	< 2↑	< 2↑	< 2↑

PACKAGE: **SANSEW - Nonylphenol and Ethoxylates** (WATER)

L1 = SANSEW / WATER / - - Peel Table 1 - Sanitary Sewer Discharge - BL_53_2010

L2 = SANSEW / WATER / - - Peel Table 2 - Storm Sewer Discharge - BL_53_2010

Parameter	Units	RL	L1	L2	Sample Number: 8	9	10	11
					Sample Name: 20-24	20-20	20-16	20-08
					Sample Matrix: Ground Water	Ground Water	Ground Water	Ground Water
					Sample Date: 24/08/2020	24/08/2020	24/08/2020	24/08/2020
					Result	Result	Result	Result
Nonylphenol and Ethoxylates								
Nonylphenol	mg/L	0.001	0.02		< 0.001	< 0.001	< 0.001	< 0.001
Nonylphenol Ethoxylates	mg/L	0.01	0.2		< 0.01	< 0.01	< 0.01	< 0.01
Nonylphenol diethoxylate	mg/L	0.01			< 0.01	< 0.01	< 0.01	< 0.01
Nonylphenol monoethoxylate	mg/L	0.01			< 0.01	< 0.01	< 0.01	< 0.01

PACKAGE: **SANSEW - Oil and Grease** (WATER)

L1 = SANSEW / WATER / - - Peel Table 1 - Sanitary Sewer Discharge - BL_53_2010

L2 = SANSEW / WATER / - - Peel Table 2 - Storm Sewer Discharge - BL_53_2010

Parameter	Units	RL	L1	L2	Sample Number: 8	9	10	11
					Sample Name: 20-24	20-20	20-16	20-08
					Sample Matrix: Ground Water	Ground Water	Ground Water	Ground Water
					Sample Date: 24/08/2020	24/08/2020	24/08/2020	24/08/2020
					Result	Result	Result	Result
Oil and Grease								
Oil & Grease (total)	mg/L	2			< 2	< 2	< 2	< 2
Oil & Grease (animal/vegetable)	mg/L	4	150		< 4	< 4	< 4	< 4
Oil & Grease (mineral/synthetic)	mg/L	4	15		< 4	< 4	< 4	< 4

Client: Thurber Engineering Ltd.
Project: 28262
Project Manager: Alireza Hejazi
Samplers: Liviu Parpalea

PACKAGE: **SANSEW - Other (ORP)** (WATER)

L1 = SANSEW / WATER / - - Peel Table 1 - Sanitary Sewer Discharge - BL_53_2010
L2 = SANSEW / WATER / - - Peel Table 2 - Storm Sewer Discharge - BL_53_2010

Parameter	Units	RL	L1	L2	Sample Number	8	9	10	11
					Sample Name	20-24	20-20	20-16	20-08
					Sample Matrix	Ground Water	Ground Water	Ground Water	Ground Water
					Sample Date	24/08/2020	24/08/2020	24/08/2020	24/08/2020
						Result	Result	Result	Result
Other (ORP)									
pH	No unit	0.05	10	9		6.89	6.98	7.03	6.96
Mercury (total)	mg/L	0.00001	0.01	0.0004		< 0.00001	< 0.00001	0.00001	< 0.00001

PACKAGE: **SANSEW - PCBs** (WATER)

L1 = SANSEW / WATER / - - Peel Table 1 - Sanitary Sewer Discharge - BL_53_2010
L2 = SANSEW / WATER / - - Peel Table 2 - Storm Sewer Discharge - BL_53_2010

Parameter	Units	RL	L1	L2	Sample Number	8	9	10	11
					Sample Name	20-24	20-20	20-16	20-08
					Sample Matrix	Ground Water	Ground Water	Ground Water	Ground Water
					Sample Date	24/08/2020	24/08/2020	24/08/2020	24/08/2020
						Result	Result	Result	Result
PCBs									
Polychlorinated Biphenyls (PCBs) - Total	mg/L	0.0001	0.001	0.0004		< 0.0001	< 0.0001	< 0.0001	< 0.0001

PACKAGE: **SANSEW - Phenols** (WATER)

L1 = SANSEW / WATER / - - Peel Table 1 - Sanitary Sewer Discharge - BL_53_2010
L2 = SANSEW / WATER / - - Peel Table 2 - Storm Sewer Discharge - BL_53_2010

Parameter	Units	RL	L1	L2	Sample Number	8	9	10	11
					Sample Name	20-24	20-20	20-16	20-08
					Sample Matrix	Ground Water	Ground Water	Ground Water	Ground Water
					Sample Date	24/08/2020	24/08/2020	24/08/2020	24/08/2020
						Result	Result	Result	Result
Phenols									
4AAP-Phenolics	mg/L	0.002	1	0.008		0.006	0.006	0.004	0.008

PACKAGE: **SANSEW - SVOCs** (WATER)

L1 = SANSEW / WATER / - - Peel Table 1 - Sanitary Sewer Discharge - BL_53_2010
L2 = SANSEW / WATER / - - Peel Table 2 - Storm Sewer Discharge - BL_53_2010

Parameter	Units	RL	L1	L2	Sample Number	8	9	10	11
					Sample Name	20-24	20-20	20-16	20-08
					Sample Matrix	Ground Water	Ground Water	Ground Water	Ground Water
					Sample Date	24/08/2020	24/08/2020	24/08/2020	24/08/2020
						Result	Result	Result	Result

Client: Thurber Engineering Ltd.
Project: 28262
Project Manager: Alireza Hejazi
Samplers: Liviu Parpalea

PACKAGE: **SANSEW - SVOCs** (WATER)

L1 = SANSEW / WATER / - - Peel Table 1 - Sanitary Sewer Discharge - BL_53_2010

L2 = SANSEW / WATER / - - Peel Table 2 - Storm Sewer Discharge - BL_53_2010

				Sample Number	8	9	10	11
				Sample Name	20-24	20-20	20-16	20-08
				Sample Matrix	Ground Water	Ground Water	Ground Water	Ground Water
				Sample Date	24/08/2020	24/08/2020	24/08/2020	24/08/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
SVOCs								
di-n-Butyl Phthalate	mg/L	0.002	0.08	0.015	< 0.002	< 0.002	< 0.002	< 0.002
Bis(2-ethylhexyl)phthalate	mg/L	0.002	0.012	0.0088	< 0.002	< 0.002	< 0.002	< 0.002

PACKAGE: **SANSEW - VOCs** (WATER)

L1 = SANSEW / WATER / - - Peel Table 1 - Sanitary Sewer Discharge - BL_53_2010

L2 = SANSEW / WATER / - - Peel Table 2 - Storm Sewer Discharge - BL_53_2010

				Sample Number	8	9	10	11
				Sample Name	20-24	20-20	20-16	20-08
				Sample Matrix	Ground Water	Ground Water	Ground Water	Ground Water
				Sample Date	24/08/2020	24/08/2020	24/08/2020	24/08/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
VOCs								
Chloroform	mg/L	0.0005	0.04	0.002	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,2-Dichlorobenzene	mg/L	0.0005	0.05	0.0056	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,4-Dichlorobenzene	mg/L	0.0005	0.08	0.0068	< 0.0005	< 0.0005	< 0.0005	< 0.0005
cis-1,2-Dichloroethene	mg/L	0.0005	4	0.0056	< 0.0005	< 0.0005	< 0.0005	< 0.0005
trans-1,3-Dichloropropene	mg/L	0.0005	0.14	0.0056	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Methylene Chloride	mg/L	0.0005	2	0.0052	< 0.0005	< 0.0005	< 0.0005	< 0.0005
1,1,2,2-Tetrachloroethane	mg/L	0.0005	1.4	0.017	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Methyl ethyl ketone	mg/L	0.02	8		< 0.02	< 0.02	< 0.02	< 0.02
Styrene	mg/L	0.0005	0.2		< 0.0005	< 0.0005	< 0.0005	< 0.0005
Tetrachloroethylene (perchloroethylene)	mg/L	0.0005	1	0.0044	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Trichloroethylene	mg/L	0.0005	0.4	0.008	< 0.0005	< 0.0005	< 0.0005	< 0.0005

Client: Thurber Engineering Ltd.
Project: 28262
Project Manager: Alireza Hejazi
Samplers: Liviu Parpalea

PACKAGE: **SANSEW - VOCs - BTEX** (WATER)

L1 = SANSEW / WATER / - - Peel Table 1 - Sanitary Sewer Discharge - BL_53_2010

L2 = SANSEW / WATER / - - Peel Table 2 - Storm Sewer Discharge - BL_53_2010

					Sample Number	8	9	10	11
					Sample Name	20-24	20-20	20-16	20-08
					Sample Matrix	Ground Water	Ground Water	Ground Water	Ground Water
					Sample Date	24/08/2020	24/08/2020	24/08/2020	24/08/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
VOCs - BTEX								
Benzene	mg/L	0.0005	0.01	0.002	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Ethylbenzene	mg/L	0.0005	0.16	0.002	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Toluene	mg/L	0.0005	0.27	0.002	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Xylene (total)	mg/L	0.0005	1.4	0.0044	< 0.0005	< 0.0005	< 0.0005	< 0.0005
m-p-xylene	mg/L	0.0005			< 0.0005	< 0.0005	< 0.0005	< 0.0005
o-xylene	mg/L	0.0005			< 0.0005	< 0.0005	< 0.0005	< 0.0005

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	SANSEW / WATER / - - Peel Table 1 - Sanitary Sewer Discharge - BL_53_2010 L1	SANSEW / WATER / - - Peel Table 2 - Storm Sewer Discharge - BL_53_2010 L2
20-24					
Total Suspended Solids	SM 2540D	mg/L	142		15
Manganese	SM 3030/EPA 200.8	mg/L	1.55		0.05
Total Kjeldahl Nitrogen	SM 4500-N C/4500-NO3- F	mg/L	< 1.5		1
20-20					
Total Suspended Solids	SM 2540D	mg/L	296		15
Manganese	SM 3030/EPA 200.8	mg/L	3.22		0.05
20-16					
Total Suspended Solids	SM 2540D	mg/L	569	350	15
Manganese	SM 3030/EPA 200.8	mg/L	1.69		0.05
Total Kjeldahl Nitrogen	SM 4500-N C/4500-NO3- F	mg/L	1.3		1
20-08					
Total Suspended Solids	SM 2540D	mg/L	135		15
Manganese	SM 3030/EPA 200.8	mg/L	0.501		0.05

QC SUMMARY

Anions by discrete analyzer

Method: US EPA 375.4 | Internal ref.: ME-CA-[ENVIEWL-LAK-AN-026

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphate	DIO5083-AUG20	mg/L	2	<2	5	20	97	80	120	125	75	125

Biochemical Oxygen Demand

Method: SM 5210 | Internal ref.: ME-CA-[ENVIEWL-LAK-AN-007

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Biochemical Oxygen Demand (BOD5)	BOD0045-AUG20	mg/L	2	< 2	11	30	99	70	130	111	70	130

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENVISFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Cyanide (total)	SKA0238-AUG20	mg/L	0.01	<0.01	ND	10	96	90	110	95	75	125

QC SUMMARY

Fluoride by Specific Ion Electrode

Method: SM 4500 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0350-AUG20	mg/L	0.06	<0.06	ND	10	104	90	110	110	75	125

Mercury by CVAAS

Method: EPA 7471A/SM 3112B I Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury (total)	EHG0024-AUG20	mg/L	0.00001	< 0.00001	15	20	102	80	120	104	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver (total)	EMS0163-AUG20	mg/L	0.00005	<0.00005	1	20	102	90	110	93	70	130
Aluminum (total)	EMS0163-AUG20	mg/L	0.001	<0.001	2	20	93	90	110	97	70	130
Arsenic (total)	EMS0163-AUG20	mg/L	0.0002	<0.0002	2	20	102	90	110	104	70	130
Cadmium (total)	EMS0163-AUG20	mg/L	0.000003	<0.000003	3	20	101	90	110	102	70	130
Cobalt (total)	EMS0163-AUG20	mg/L	0.000004	<0.000004	2	20	100	90	110	98	70	130
Chromium (total)	EMS0163-AUG20	mg/L	0.00008	<0.00008	2	20	99	90	110	86	70	130
Copper (total)	EMS0163-AUG20	mg/L	0.0002	<0.0002	0	20	100	90	110	99	70	130
Manganese (total)	EMS0163-AUG20	mg/L	0.00001	<0.00001	1	20	101	90	110	98	70	130
Molybdenum (total)	EMS0163-AUG20	mg/L	0.00004	<0.00004	2	20	102	90	110	103	70	130
Nickel (total)	EMS0163-AUG20	mg/L	0.0001	<0.0001	4	20	101	90	110	101	70	130
Lead (total)	EMS0163-AUG20	mg/L	0.00001	<0.00001	4	20	95	90	110	95	70	130
Phosphorus (total)	EMS0163-AUG20	mg/L	0.003	< 0.003	2	20	100	90	110	NV	70	130
Antimony (total)	EMS0163-AUG20	mg/L	0.0009	<0.0009	10	20	102	90	110	112	70	130
Selenium (total)	EMS0163-AUG20	mg/L	0.00004	<0.00004	7	20	96	90	110	98	70	130
Tin (total)	EMS0163-AUG20	mg/L	0.00006	<0.00006	9	20	97	90	110	NV	70	130
Titanium (total)	EMS0163-AUG20	mg/L	0.00005	<0.00005	15	20	98	90	110	NV	70	130
Zinc (total)	EMS0163-AUG20	mg/L	0.002	<0.002	2	20	101	90	110	101	70	130
Silver (total)	EMS0174-AUG20	mg/L	0.00005	<0.00005	ND	20	98	90	110	95	70	130
Aluminum (total)	EMS0174-AUG20	mg/L	0.001	<0.001	4	20	98	90	110	107	70	130
Arsenic (total)	EMS0174-AUG20	mg/L	0.0002	<0.0002	17	20	98	90	110	100	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Cadmium (total)	EMS0174-AUG20	mg/L	0.000003	<0.000003	ND	20	96	90	110	94	70	130
Cobalt (total)	EMS0174-AUG20	mg/L	0.000004	<0.000004	4	20	96	90	110	98	70	130
Chromium (total)	EMS0174-AUG20	mg/L	0.00008	<0.00008	10	20	95	90	110	97	70	130
Copper (total)	EMS0174-AUG20	mg/L	0.0002	<0.0002	1	20	98	90	110	97	70	130
Manganese (total)	EMS0174-AUG20	mg/L	0.00001	<0.00001	4	20	97	90	110	102	70	130
Molybdenum (total)	EMS0174-AUG20	mg/L	0.00004	<0.00004	2	20	101	90	110	99	70	130
Nickel (total)	EMS0174-AUG20	mg/L	0.0001	<0.0001	1	20	96	90	110	100	70	130
Lead (total)	EMS0174-AUG20	mg/L	0.00001	<0.00001	ND	20	98	90	110	98	70	130
Phosphorus (total)	EMS0174-AUG20	mg/L	0.003	<0.003	9	20	99	90	110	NV	70	130
Antimony (total)	EMS0174-AUG20	mg/L	0.0009	<0.0009	1	20	104	90	110	116	70	130
Selenium (total)	EMS0174-AUG20	mg/L	0.00004	<0.00004	ND	20	94	90	110	97	70	130
Tin (total)	EMS0174-AUG20	mg/L	0.00006	<0.00006	ND	20	93	90	110	NV	70	130
Titanium (total)	EMS0174-AUG20	mg/L	0.00005	<0.00005	8	20	97	90	110	NV	70	130
Zinc (total)	EMS0174-AUG20	mg/L	0.002	<0.002	2	20	95	90	110	106	70	130

QC SUMMARY

Microbiology

Method: SM 9222D | Internal ref.: ME-CA-IENVIMIC-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High
E. Coli	BAC9417-AUG20	cfu/100mL	-	ACCEPTED	ACCEPTED							

Nonylphenol and Ethoxylates

Method: ASTM D7065-06 | Internal ref.: ME-CA-IENVIGC-LAK-AN-015

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High
Nonylphenol diethoxylate	GCM0434-AUG20	mg/L	0.01	< 0.01			81	55	120			
Nonylphenol Ethoxylates	GCM0434-AUG20	mg/L	0.01	< 0.01								
Nonylphenol monoethoxylate	GCM0434-AUG20	mg/L	0.01	< 0.01			91	55	120			
Nonylphenol	GCM0434-AUG20	mg/L	0.001	< 0.001			94	55	120			

QC SUMMARY

Oil & Grease

Method: MOE E3401 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-019

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High
Oil & Grease (total)	GCM0468-AUG20	mg/L	2	<2	NSS	20	105	75	125			

Oil & Grease-AV/MS

Method: MOE E3401/SM 5520F | Internal ref.: ME-CA-[ENV]GC-LAK-AN-019

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High
Oil & Grease (animal/vegetable)	GCM0468-AUG20	mg/L	4	< 4	NSS	20	NA	70	130			
Oil & Grease (mineral/synthetic)	GCM0468-AUG20	mg/L	4	< 4	NSS	20	NA	70	130			

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High
pH	EWL0344-AUG20	No unit	0.05	NA	0		100			NA		

QC SUMMARY

Phenols by SFA

Method: SM 5530B-D | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
4AAP-Phenolics	SKA0227-AUG20	mg/L	0.002	<0.002	ND	10	114	80	120	101	75	125
4AAP-Phenolics	SKA0244-AUG20	mg/L	0.002	<0.002	ND	10	101	80	120	92	75	125

Polychlorinated Biphenyls

Method: MOE E3400/EPA 8082A | Internal ref.: ME-CA-[ENV]GC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Polychlorinated Biphenyls (PCBs) - Total	GCM0451-AUG20	mg/L	0.0001	<0.0001	ND	30	99	60	140	92	60	140

QC SUMMARY

Semi-Volatile Organics

Method: EPA 3510C/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Bis(2-ethylhexyl)phthalate	GCM0424-AUG20	mg/L	0.002	< 0.002	NSS	30	90	50	140	NSS	50	140
di-n-Butyl Phthalate	GCM0424-AUG20	mg/L	0.002	< 0.002	NSS	30	96	50	140	NSS	50	140

Suspended Solids

Method: SM 2540D | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Suspended Solids	EWL0337-AUG20	mg/L	2	< 2	0	10	98	90	110	NA		
Total Suspended Solids	EWL0347-AUG20	mg/L	2	< 2	0	10	96	90	110	NA		

QC SUMMARY

Total Nitrogen

Method: SM 4500-N C/4500-NO3- F | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Kjeldahl Nitrogen	SKA0221-AUG20	as N mg/L	1.0	<0.5	8	10	107	90	110	94	75	125
Total Kjeldahl Nitrogen	SKA0237-AUG20	as N mg/L	1.0	<0.5	8	10	104	90	110	102	75	125
Total Kjeldahl Nitrogen	SKA0248-AUG20	as N mg/L	1.0	<0.5	1	10	103	90	110	116	75	125

QC SUMMARY

Volatile Organics

Method: EPA 5030B/8260C | Internal ref.: ME-CA-[ENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,2,2-Tetrachloroethane	GCM0432-AUG20	mg/L	0.0005	<0.0005	ND	30	91	60	130	96	50	140
1,2-Dichlorobenzene	GCM0432-AUG20	mg/L	0.0005	<0.0005	ND	30	94	60	130	99	50	140
1,4-Dichlorobenzene	GCM0432-AUG20	mg/L	0.0005	<0.0005	ND	30	94	60	130	98	50	140
Benzene	GCM0432-AUG20	mg/L	0.0005	<0.0005	ND	30	98	60	130	100	50	140
Chloroform	GCM0432-AUG20	mg/L	0.0005	<0.0005	ND	30	97	60	130	100	50	140
cis-1,2-Dichloroethene	GCM0432-AUG20	mg/L	0.0005	<0.0005	ND	30	99	60	130	102	50	140
Ethylbenzene	GCM0432-AUG20	mg/L	0.0005	<0.0005	ND	30	97	60	130	100	50	140
m-p-xylene	GCM0432-AUG20	mg/L	0.0005	<0.0005	ND	30	96	60	130	100	50	140
Methyl ethyl ketone	GCM0432-AUG20	mg/L	0.02	<0.02	ND	30	93	50	140	93	50	140
Methylene Chloride	GCM0432-AUG20	mg/L	0.0005	<0.0005	ND	30	99	60	130	101	50	140
o-xylene	GCM0432-AUG20	mg/L	0.0005	<0.0005	ND	30	96	60	130	100	50	140
Styrene	GCM0432-AUG20	mg/L	0.0005	<0.0005	ND	30	95	60	130	98	50	140
Tetrachloroethylene (perchloroethylene)	GCM0432-AUG20	mg/L	0.0005	<0.0005	ND	30	97	60	130	100	50	140
Toluene	GCM0432-AUG20	mg/L	0.0005	<0.0005	ND	30	98	60	130	101	50	140
trans-1,3-Dichloropropene	GCM0432-AUG20	mg/L	0.0005	<0.0005	ND	30	100	60	130	101	50	140
Trichloroethylene	GCM0432-AUG20	mg/L	0.0005	<0.0005	ND	30	98	60	130	98	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.
RL Reporting Limit.
↑ Reporting limit raised.
↓ Reporting limit lowered.
NA The sample was not analysed for this analyte
ND Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

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-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

SGS Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No: 016708 Page 1 of 1

Laboratory Information Section - Lab use only

Received By: Kim Sheard
Received Date: 08/24/20 (mm/dd/yy)
Received Time: 16:00 (hr : min)
Received By (signature):
Custody Seal Present: Yes ☐ No ☑
Custody Seal Intact: Yes ☐ No ☑
Cooling Agent Present: Yes ☐ No ☐ Type: ice
Temperature Upon Receipt (°C) 12, 12, 12
LAB LIMS # OA14682-Aug20

REPORT INFORMATION	INVOICE INFORMATION
Company: THURBER	☑ (same as Report Information)
Contact: ALIREZA HOJJATI	Company:
Address: 2010 WINSTON PARK DRIVE	Contact:
Phone:	Address:
Fax:	Phone:
Email: AHOJJATI@THURBER.CA	Email:

Quotation #: P.O. #:
Project #: 28262 Site Location/ID:

TURNAROUND TIME (TAT) REQUIRED

☒ Regular TAT (5-7days) TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date:

*NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

☐ O.Reg 153/04 ☐ O.Reg 406/19
☐ Table 1 ☐ Res/Park Soil Texture: ☐ Coarse
☐ Table 2 ☐ Ind/Com ☐ Medium/Fine
☐ Table 3 ☐ Agri/Other
☐ Table _____
Soil Volume ☐ <350m3 ☐ >350m3

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☐ PWQO ☐ MMER
☐ CCME ☐ Other:
☐ MISA
☐ ODWS Not Reportable *See note

Sewer By-Law:
☒ Sanitary
☒ Storm
Municipality: PEEL

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX
1	20-24	AUG24/20	10:00	17	GW
2	20-20	—"—	11:00	17	GW
3	20-16	—"—	12:30	17	GW
4	20-08	—"—	14:30	17	GW
5					
6					
7					
8					
9					
10					
11					
12					

	Field Filtered (Y/N)	Metals & Inorganics (incl CrVI, CN, Hg pH,(B(HWS),EC,SAR–soil) (Cl, Na–water)	Full Metals Suite (ICP metals plus B(HWS–soil only) Hg, CrVI	ICP Metals only Sb,As,Ba,Be,B,Cd,Cr,Co,Cu,Pb,Mo,Ni,	SVOC: PAHs only	SVOCs all incl PAHs, ABNs, CPs	PCB: PCBs ☐ Total ☐ Aroclor	PHC: F1-F4 + BTEX	F1-F4 only no BTEX	VOC: VOCs all incl BTEX	BTEX only	Pest: Pesticides Organochlorine or specify other	Other (please specify): Appendix 2: 406/19 Leachate Screening Levels Table : _____	Sewer Use: Specify pkg: PEEL STORM SEW	Water Characterization Pkg General ☐ Extended ☐	TCLP: Specify TCLP tests ☐M&I ☐VOC ☐PCB ☐B(a)P ☐ABN ☐Ignit.	COMMENTS:
1	N													X			
2	N													X			
3	N													X			
4	N													X			

Observations/Comments/Special Instructions

DRAFT

Sampled By (NAME): LIVIU PANPALCEA Signature: Date: 08/24/20 (mm/dd/yy)
Relinquished by (NAME): LIVIU PANPALCEA Signature: Date: 08/24/20 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

Revision #: 1.4
Date of Issue: 22 May. 2020