Level I and II Water_Report for Proposed Anthony Aggregate Pit, 4454 Victoria Road South, Puslinch, Ontario

Final Report

Stantec

Prepared for:
CBM Aggregates 55 Industrial Street, Toronto, Ontario, M4G 3W9

Prepared by:
Stantec Consulting Ltd. 100-300 Hagey Boulevard, Waterloo, Ontario, N2L 0A4

February 13, 2026

Project/File:
160961457

Stantec Consulting Ltd.

Limitations and Sign-off

The conclusions in the Report titled Level I and II Water Report for Proposed Anthony Aggregate Pit, 4454 Victoria Road South, Puslinch, Ontario are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

Stantec has assumed all information received from CBM Aggregates (the "Client") and third parties in the preparation of the Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

This Report is intended solely for use by the Client in accordance with Stantec's contract with the Client. While the Report may be provided to applicable authorities having jurisdiction and others for whom the Client is responsible, Stantec does not warrant the services to any third party. The report may not be relied upon by any other party without the express written consent of Stantec, which may be withheld at Stantec's discretion.

Prepared by: 

Digitally signed by Warkentin, Aaron
Date: 2026.02.13 14:57:55 -05'00'

Signature

Aaron Warkentin, P.Eng.
Senior Hydrogeologist

Printed Name and Title

Reviewed by: 

Stephen Di Biase
2026.02.13 14:43:50 -05'00'

Signature

Stephen Di Biase, M.Sc., P.Geo.
Senior Hydrogeologist

Printed Name and Title

Table of Contents

Limitations and Sign-off ..... **i**
Acronyms / Abbreviations ..... **iv**
1 Introduction **1**
1.1 Report Purpose 1
1.2 Report Limitations 2
1.3 Report Structure 3
2 Site Setting **4**
2.1 Site Location And Surrounding Land Use 4
2.2 Regional Topography and Drainage 4
2.3 Regional Geology 5
2.4 Natural Heritage Features 5
3 Hydrogeological Field Study and Results **6**
3.1 Borehole Drilling 6
3.2 Field Study Instrumentation 6
3.3 Water Level And Temperature Monitoring 7
3.4 Soil Hydraulic Conductivity 8
3.5 Streamflow Monitoring 9
3.6 Water Quality Laboratory Testing 10
4 Hydrogeological Assessment **11**
4.1 Geology 11
4.2 Surface Drainage 11
4.3 Hydrogeology 12
4.3.1 Groundwater Flow 12
4.3.2 Groundwater / Surface Water Interaction 12
4.3.3 Hydrogeological Conceptual Model 13
4.3.4 Groundwater Use 14
4.4 Source Water Protection 14
4.4.1 Significant Groundwater Recharge Areas 14
4.4.2 High Vulnerability Aquifers 15
4.4.3 Wellhead Protection Area 15
5 Impact Assessment **16**
5.1 Proposed Aggregate Extraction 16
5.2 Effects of Extraction on the Water Table 17
5.2.1 Short Term Water Table Adjustment 17
5.2.2 Long Term Water Table Adjustment 18
5.3 Effects of Extraction on Local Hydrology 19
5.3.1 Groundwater Base Flow 19
5.3.2 Groundwater Flow Temperature Changes 19
5.3.3 Water Budget Adjustment 20
5.3.4 Catchment Area Adjustments for Local Wetlands 21
5.4 Cumulative Effects 21

6 Proposed Monitoring Program 23
7 Contingency Plan And Mitigation Measures 24
7.1 Potable Water Supply Interference 24
7.2 Sediment And Erosion Control Measures 24
7.3 Refuelling and Construction Equipment 25
8 Conclusions 26
9 Recommendations 29
10 References 30

List of Appendices

Appendix A: Figures
Figure 1 Site Location
Figure 2 Topography and Drainage
Figure 3 Surficial Geology
Figure 4 Site Instrumentation
Figure 5 Cross Section A-A
Figure 6 Water Level Monitoring Data
Figure 7 Water Temperature Monitoring Data
Figure 8 Piper Plot Analysis of Water Quality Samples
Figure 9 High Groundwater Table Elevations – July 25, 2024
Figure 10 Existing (Pre-development) Surface Catchment Areas
Figure 11 MECP Water Well Records
Figure 12 Proposed Anthony Pit Site Plan
Figure 13 Interpreted Water Table Drawdown from Short-Term Aggregate Extraction
Figure 14 Post-Development Catchments
Figure 15 Permanent Water Table Adjustment from Pit Pond Development
Figure 16 Simulated Changes of Wetland Water Levels

Appendix B: Tables
Table 1 Monitor Completion Details
Table 2 Summary of Soil Testing Results
Table 3 Water Level Monitoring Results
Table 4 Streamflow Monitoring Results
Table 5 Summary of Groundwater Quality Results
Table 6 Summary of Surface Water Quality Results
Table 7 Summary of Surface Catchment Details

Appendix C: Borehole Logs
Appendix D: Soil Testing
Appendix E: Water Quality Analytical Data
Appendix F: Water Balance and Streamflow Analysis
Appendix G: Groundwater Model Memorandum
Appendix H: Project Team Curriculum Vitae

Acronyms / Abbreviations

ARA	Aggregate Resources Act
Anthony Pit	Anthony Aggregate Pit Site
AWT	Above Water Table
BGS	Below Ground Surface
BV Labs	Bureau Veritas Laboratories
BWT	Below Water Table
CBM	CBM Aggregates (a division of St. Marys Cement Inc.)
Dufferin Pit	Dufferin Aggregate Pit
FM	fineness modulus
GPM	Gallons Per Minute
GRCA	Grand River Conservation Authority
GW	groundwater
HVA	High Vulnerability Aquifer
Insitu	Insitu Contractors Inc.
ISI	Intrinsic Susceptibility Index
K	hydraulic conductivity
masl	m above sea level
MECP	Ministry of the Environment, Conservation and Parks
MNR	Ministry of Natural Resources
O.Reg.	Ontario Regulation
PSW	Provincially Significant Wetland
Report	Level I and II Water Report
SGRA	Significant Groundwater Recharge Area
Stantec	Stantec Consulting Ltd.
SW	surface water
the Site	Anthony Aggregate Pit Site / Anthony Pit



Tikal Pit	Aberfoyle-Tikal Aggregate Pit
WHPA	Well Head Protection Area
WWIS	Water Well Information System
WWR	Water Well Record

1 Introduction

CBM Aggregates a division of St. Marys Cement Inc. (Canada) (CBM) has retained Stantec Consulting Ltd. (Stantec) to prepare a Level I and II Water Report for a proposed new aggregate pit near Aberfoyle, Ontario. The property for the proposed aggregate pit development, shown in purple on Figure 1 (Appendix A) is approximately 23.37 hectares (ha.) in size and located at 4454 Victoria Road South, in the Township of Puslinch, Wellington County. The area to be licensed as the Anthony Aggregate Pit (the Site) is approximately 18.03 ha and shown in red on Figure 1. The legal description of the Site is Lot 22, Concession 8, Geographic Township of Puslinch, Wellington County. Aggregate extraction will reflect both above water table (AWT) and below water table (BWT), with an expected annual extraction rate of approximately one million tonnes.

1.1 Report Purpose

This Level I and II Water Report (Report) has been prepared in accordance with the Ontario Aggregate Resources Act (ARA; O. Reg. 244/97). This Report includes a summary and interpretation of the hydrogeological conditions and groundwater use in the area, a summary of collected field data at the Site, impacts assessment and mitigation, as well as a proposed monitoring program and recommendations. In accordance with the ARA, this Report satisfies the requirements for a Class A license supporting an aggregate pit that intends to extract aggregate material from above and below the established groundwater table.

In accordance with the technical reports and information standards for a Level 1 assessment, the following information is provided herein:

- Summary of borehole and shallow groundwater information based on drilling and monitor installation program completed at the Site, with monitoring commencing in November 2021, and continuing on a quarterly basis through November 2024.
- Characteristics of the shallow groundwater conditions, including stabilized water level, flow direction, gradient.
- Information compiled from a review of available publications and geological mapping for the area, including adjacent land uses, site topography, surficial geology, and site features.
- Information compiled from a review of Ministry of the Environment, Conservation and Parks (MECP) Water Well Records and Permit to Take Water (PTTW) database.
- Evaluation of the proximity of the Site to a WHPA-Q.
- Discussion on potential adverse impacts which could result from the proposed aggregate pit operation.

The Level II assessment (provided herein) expands on the discussion of potential adverse impacts, with discussion of mitigation measures and contingency measures to address potential concerns with contamination that could occur as a result of typical operations and aggregate extraction activities. As such, the following information has been incorporated into this report:

- Baseline groundwater quality has been documented with analytical testing on water samples collected from monitoring wells and shallow drive point piezometers installed at the Site.
- Groundwater modeling was conducted to assess potential impacts of development of the Site.
- Pre- and post-development water balance was completed to assess impacts of development.

Collectively, this Level I and II Water Report summarizes the factual results of the field study and technical analyses discussed above. An integrated impact assessment is included with the following key components:

- Surface water and groundwater contribution from the Site to nearby Aberfoyle Creek, during pre-development, normal pit operations and post-closure.
- Thermal changes to the groundwater flow regime, in response to proposed aggregate extraction.
- A recommended monitoring program, prior to and during pit operations.
- Recommendations for mitigation measures and contingency plans in support of the licensing review process.

This Report is expected to form part of a submission to the Ministry of Natural Resources (MNR) to comply with the requirements of the Aggregate Resources Act as well as address the requirements of the County of Wellington Official Plan (County of Wellington, 2025). Specifically, the Official Plan requires that for applications for new aggregate extraction operations, the following shall be considered as they relate to this hydrogeology assessment and water report:

- The impact to adjacent land use and residents.
- Impact on the physical environment, including the water table and surface drainage
- Existing municipal supply resources are protected in accordance with the applicable Source Protection Plans
- Operations and rehabilitation plan.

1.2 Report Limitations

It is noted that this Water Report involves a limited sampling of the subsurface conditions at specific borehole locations. The conclusions and recommendations presented in this report reflect site conditions existing at the time of the investigation and a review of available information presented herein. Should subsurface conditions be encountered which vary materially from those observed in the boreholes completed as part of this Water Report, we recommend that Stantec be consulted to review the additional information and verify if there are any changes to the recommendations and discussion provided in this report.

1.3 Report Structure

This Report is arranged in ten sections, including this introduction (Section 1). Section 2 provides an overview of regional environmental conditions. Section 3 describes the field study methodology and results, while Section 4 provides a detailed hydrogeological assessment of the Site. Section 5 discusses the proposed aggregate extraction plan and associated environmental effects expected. To confirm the predicted effects of the proposed Anthony Pit are consistent with predictions, a long-term environmental monitoring program is specified in Section 6. Recommended contingency planning and mitigation measures are specified in Section 7, to minimize potential effects of proposed operations. The study conclusions and recommendations are provided in Sections 8 and 9, respectively. The report references are provided in Section 10.

Report figures referenced in this Report are presented in Appendix A, with report tables presented in Appendix B. Borehole logs are provided in Appendix C and soil testing laboratory results are provided in Appendix D. Water quality laboratory certificates of analysis are provided in Appendix E. Water balance calculations, streamflow analysis and source water protection results are provided in Appendix F. Groundwater modelling analysis reporting is included within Appendix G. Curriculum Vitae for the report writers are provided in Appendix H.

2 Site Setting

2.1 Site Location And Surrounding Land Use

The Site is situated south of the former CBM Tikal Aggregate Pit (Tikal Pit) property, shown in yellow on Figure 1 (Appendix A). The Tikal Pit (28 hectares in size) was operated by CBM until 2011 when available aggregate was removed and the pit was rehabilitated. Also shown in black on Figure 1, is the location of an existing aggregate pit owned and operated by Dufferin Aggregates (a division of CRH Canada Group Inc.). The Dufferin Aggregate Pit (Dufferin Pit) is 78 hectares in size and is situated to the north of the Site.

Additional gravel pit operations being operated under Class A Licenses are also located within Puslinch Township, situated approximately 3 km southwest of the Site.

The Site is used for agricultural purposes and includes a private residential building near Victoria Road South. There are existing wetlands and wooded areas on the Site. Surrounding land uses reflect mainly the following:

- To the northeast: The former Tikal Pit and existing Dufferin Pit
- To the south-southwest: Agricultural lands, provincially significant wetland (PSW) area and Aberfoyle Creek
- To the west: Agricultural lands, PSW area, and residential area associated with the Mini Lakes residential community
- To the east: Agricultural lands and private residential buildings

2.2 Regional Topography and Drainage

Regional topographic relief and drainage are shown on Figure 2. The topography is dominated by the Paris Moraine, a major depositional feature forming a height of land approximately 3 km northwest of the Site. The Paris moraine, which trends in a southwesterly direction (i.e., along Maltby Road), is generally characterized as hummocky topography with ground surface elevation ranging from 345 to 365 m above sea level (masl).

The Site is located within the Aberfoyle Creek catchment area of the Mill Creek watershed. The north branch of Aberfoyle Creek flows in a westerly direction on the north side of County Road No. 34, located approximately 600 m north of the Site. The southern branch of the Aberfoyle Creek flows in a westerly directly about 300 m to the south of the Site. The north and south branches connect approximately 1 km west of Brock Road S. Aberfoyle Creek then flows west and connects with Mill Creek on the west side of Highway No. 6 North.

West of the Site is the Aberfoyle pond, which is online to Aberfoyle Creek. The Aberfoyle pond also receives drainage from a series of ponds (herein referred to as “Mini-Lakes”) located on the south side of Wellington Road No. 34.

2.3 Regional Geology

Mapping of near surface overburden soils and total overburden thickness near the Site, as shown on Figure 3, is provided by the Ontario Geological Survey (OGS, 2010). Overburden thickness varies slightly, ranging from approximately 20 m in the Aberfoyle Creek valleylands to approximately 35 m along the crest of the Paris Moraine. Near surface soils can generally be separated into three types from ground surface down:

1. Glacio-fluvial deposits, shown as beige (Soil Type 7b) on Figure 3, reflect silty-sand to sand and gravel deposition in glacial meltwater channels. This stratigraphic unit is predominantly constrained to the Mill Creek valleyland and reflect thicknesses ranging from 10 m to 20 m.
2. Glacial till, shown as green (Soil Type 5b) on Figure 3, is regionally extensive and the predominant soil type locally. Known as Port Stanley Till, this soil is typically characterized as a brown silty sand to sandy silt till. Details from local MECP water well records indicate that the till deposit generally varies in thickness from about 5 to 15 m in the vicinity of the Site.
3. Organic deposits, shown as grey (Soil Type 20) on Figure 3, are encountered in poorly drained areas locally.

The local area is underlain by Silurian bedrock of the Eramosa Formation. Locally, the Eramosa Formation consists of two members, the younger (upper) Reformatory Quarry member and older (lower) Vinemount member. According to the City of Guelph Tier 3 Study (Matrix, 2017), each of these formation members are approximately 5 to 10 m thick, locally.

The Reformatory Quarry member is described by Brunton (2009) as light brown to cream coloured, thickly bedded and coarsely crystalline dolostone. This unit is susceptible to karstification due to its uniform fine dolomite crystallinity. This unit often contains mud-rich and microbial mat-bearing lithofacies that may act as aquitard materials, resulting in a low vertical permeability across this unit.

The Vinemount Member is comprised of thinly bedded, fine crystalline dolostone with shaley beds that give off a distinctive petroliferous odour when broken (Brunton, 2009). This dark grey to black dolostone unit was commonly identified in water well records as ‘black shale’.

2.4 Natural Heritage Features

A total of four wooded areas exist on the Site that are ranked as significant by the County’s Official Plan. As shown on Figure 2, wetlands (both unevaluated and provincially significant) exist in different parts of the Site. The wetlands reflect low-lying areas (e.g., closed depressions) that receive overland drainage from the surrounding higher terrain. Further details regarding local natural heritage features are discussed in Stantec’s Natural Environment Report (NER; Stantec, 2026).

3 Hydrogeological Field Study and Results

Field studies undertaken as part of this Water Report can be organized into the following five components:

- Stratigraphic logging and monitoring well installation at five geological borehole locations.
- Installation of four drive point piezometers in local surface water features.
- Baseline groundwater elevation monitoring from November 2021 through to November 2025.
- Baseline Aberfoyle Creek surface water elevation and flow rate monitoring from November 2021 through to November 2025.

This section provides an overview of the field study methodology and interpretation of the results. Figure 4 shows the locations of field study instrumentation.

3.1 Borehole Drilling

Geological borehole drilling was carried out at five locations MW21-1 through MW21-5), between November 1 and 8, 2021. Table 1 (Appendix B) summarizes the monitoring well completion details. The boreholes were advanced by Insitu Contractors Inc. (Insitu), using a truck-mounted sonic drill-rig. Boreholes at the Site were advanced using 6-inch (152.4 mm) outer diameter sonic drill rods. Stantec was onsite supervising the drilling activities and completing soil core logging and sampling. The boreholes were advanced to depths ranging from 20.1 m to 23.8 m below existing grade.

Soil core samples recovered from the boreholes were logged and submitted to the Stantec soil testing laboratory in Markham, Ontario for analysis with respect to grain size distribution, fineness modulus (FM) of the total sample and sand, wash loss, crushable stone content, and stone/sand ratio. Geological logs of the boreholes are provided in Appendix C. Results of the soil testing are provided in Appendix D and summarized in Table 2.

Soil samples generally comprised of sand and gravel, with thin (e.g., less than 5 m thickness) lenses of higher silt content encountered in three of the boreholes (MW21-2 through MW21-4). A profile summary of the borehole drilling results (Cross Section A – A') are shown on Figure 5, with the location of the cross section delineated on Figure 4.

3.2 Field Study Instrumentation

Each borehole was instrumented with a 2-inch (50 mm) diameter PVC monitoring well. The base of the monitoring wells reflect a 1.5 m long, 10-slot well screen; seated at the base of the boreholes. The annular space of the monitoring wells were backfilled with silica sand to a height of approximately 1 m above the well screen. Above the sand pack, the annular space was backfilled with a bentonite slurry, up to ground surface. The monitoring wells were secured with a 4" x 4" lockable protective cover. Details of monitoring well construction are summarized in Table 1 and shown in the borehole logs (Appendix C). The monitoring wells have been registered with the MECP in accordance with Ontario Regulation (O.Reg.) 903. It is noted

that one additional shallow monitoring well (referred to by Stantec as MW06-ORG) was observed to be pre-existing at the Site; located in the southeastern portion of the Site and completed to depth of 4.3 m BGS. Each monitoring well was instrumented with an automated water level recorder (datalogger) to develop a continuous record of water level monitoring.

A total of four shallow drive point piezometers were installed within wetland areas located across the Site and referred to as DP21-01 to DP21-04 (see Figure 4). Each piezometer was driven to a depth of approximately 1.5 m BGS and instrumented with a datalogger (GW) to monitor groundwater levels at the drive point. A perforated 25 mm diameter PVC pipe was installed next to each piezometer and equipped with a datalogger (SW) to monitor the elevation of ponded water within the wetland areas. Table 1 provides a summary of the drive point construction details.

The nearest Aberfolye Creek gauging station (GRCA Station 9668042) is located at the Concession 7 crossing, approximately 3.5 km downstream of the Site (see Figure 2). Due to the significant downstream distance of this station, two surface water staff gauges (SG21-1 and SG21-2) were installed to characterize the Aberfoyle Creek (south branch) flow rates in the vicinity of the Site. As shown on Figure 4, SG21-1 was installed upstream of the Site at the Gilmour Road crossing, while SG21-2 was installed downstream of the Site at the Wellington Road 46 crossing.

Ground surface elevations and top of pipe reference point elevations at the five monitoring wells, four shallow drive point piezometers, and two staff gauges were surveyed by Stantec using a Trimble R10 GPS rover. Table 1 provides the GPS coordinate and elevation survey results.

3.3 Water Level And Temperature Monitoring

A 4-year water level and temperature monitoring program was carried out from November 2021 through November 2025. Automated water level recorders (dataloggers) were installed in each of the field study instruments, as described above, to provide a continuous record of water level measurements. A summary of manual water level measurements, collected by Stantec staff, is provided in Table 3. Hydrographs for each monitoring location, inclusive of both manual and datalogger measurements, are shown on Figure 6 and compared to precipitation and ambient temperature data from the nearby Environment Canada Region of Waterloo Airport Climate Station No. 6144239 (Environment Canada, 2026).

As shown on Figure 6, hydrographs for the on-Site monitors show consistent trends and minor seasonal variation. The total range of groundwater elevation varied approximately 1 m over the 4-year monitoring period. The hydrographs show a direct response to precipitation events and seasonal fluctuations. These seasonal fluctuations reflect a cyclical pattern that is common within shallow groundwater systems of southern Ontario. High water table conditions consistently occur in the spring (i.e., March and April) due to lower evapotranspiration losses and a melting snowpack, which provide a greater volume of water for recharge. Hydrographs also show high points in late July, from 2023 to 2025. These occurrences are related to major precipitation events (i.e., greater than 50 mm over 24-hour period). During the summer, more water is drawn from near surface soil to meet evapotranspiration demands. High evapotranspiration demand reduces groundwater recharge and results in a steady decline of the water table elevation through the summer and fall. In response to storage of snow at ground surface, low water table conditions carryon

until the end of December, annually. Therefore, low water table conditions are known to occur from the mid-summer (July) through early winter (December), annually.

Hydrographs for the drive point piezometers are shown relative to the local grade elevation on Figure 6. The drive point hydrographs are consistent with the monitoring well hydrograph trends, showing approximately 1 m variation year to year. During the spring and early summer (January through to July), hydrographs are above the local grade, reflecting ponded conditions within the wetland areas. During the late summer and fall months (July through to January), drive point hydrographs are typically below the local grade, reflecting dry conditions within the wetland areas (except for during major precipitation events).

Staff gauge hydrographs (SW21-1 and SW21-2) are a subdued reflection of the groundwater hydrographs, however, show similar trends and responses to precipitation. The seasonal variation of the staff gauge hydrographs is less than 0.35 m seasonally.

Water temperature data, as recorded by the dataloggers, are shown on Figure 7. Groundwater temperatures in the monitoring wells range between 8 ºC and 12 ºC, seasonally, with the exception of shallow monitoring well MW06-ORG which varies from 5 ºC to 15 ºC, seasonally. The temperature trends are similar to that of ambient air temperature trend, however, with an approximately three-month delay.

Due to their shallow depth (i.e., above the frost line), groundwater temperature in the drive-point piezometers ranges from approximately 3 ºC and 15 ºC, seasonally and a two-month delay relative to the ambient air temperature trends. The temperature of ponded water at the drive point piezometers generally ranges from 0 ºC to 30 ºC, fluctuating in accordance with the ambient air temperature. Water temperature at the staff-gauge locations also fluctuate in accordance with the ambient air temperature, ranging from 0 ºC to 30 ºC.

3.4 Soil Hydraulic Conductivity

Two approaches were undertaken to assess the hydraulic conductivity of local soils: 1) Grain size analysis of soil samples; and 2) In-situ well response tests. The results of both analyses are summarized in Table 2.

The hydraulic conductivity of sandy sediments can be estimated from grain-size distribution curve by the Hazen method (Fetter, 2001). Interpreted values of hydraulic conductivity general range on the order of 10^{-4} to 10^{-5} m/s, however, higher values (e.g., on the order of 10^{-2} to 10^{-3} m/s) were occasionally interpreted.

Stantec performed in-situ hydraulic response testing at each monitoring well in May 2023. The testing consisted of creating an instantaneous change in the well water level by adding or removing a known volume of water, followed by recording the time taken for the water level to return to static conditions. The water level response data were analyzed using the Hvorslev (1951) solution to estimate the horizontal hydraulic conductivity of native soils surrounding the well screen. Interpreted hydraulic conductivity of soils within the screened intervals of the monitoring wells, as summarized on Table 2, are generally consistent with that interpreted by grain size analyses (i.e., on the order of 10^{-4} to 10^{-5} m/s). This range of values is normal as per literature values for sand and gravel soils (Fetter, 2001).

3.5 Streamflow Monitoring

A total of 13 streamflow measurements were undertaken at SG21-1 and SG21-2, between April 2022 and November 2025. During each monitoring event, staff gauge readings, streamflow velocity and depth measurements were taken in 10 – 20 cm increments within a cross section to estimate the instantaneous flow. Velocity measurements were captured using an impellor flowmeter. The streamflow rates interpreted at each of the monitoring stations are summarized in Table 4. A comparison of streamflow elevation and streamflow rate at each monitoring station is provided on Figure F1 in Appendix F. The reported streamflow rate at GRCA Station 9668042 is shown on Figure F2,

The streamflow measurement approach (i.e., calculating the average velocity in a cross-section using a current meter along the stream width and depth profile) reflects a conventional practice. However, this approach is not a direct measure of the streamflow and interpreted values are subject to uncertainty. Potential sources of error could include:

- Imprecise characterization of the streamflow depths due to highly heterogeneous channels (i.e., woody debris, cascades, and step-pools) as documented by Montgomery and Dietrich (1989).
- Impellor flowmeter sensitivity.

For headwater courses, most streamflow measurement errors were estimated to be in the orders 10^{-1} to 10^{2} L/s (Bjerve & Grøterud, 1980; Hudson & Fraser, 2002). According to McMillan et al. (2012), the confidence bounds of the rating curve have typical values of 50–100% for low flows. Streamflow measurements reported herein should therefore be considered approximations, as opposed to precise values.

Streamflow at the upstream SG21-1 (Gilmour Road) ranged from 297.0 L/s (March 23, 2023) to 7.3 L/s (July 6, 2022), and at the downstream location SG21-2 (Brock Road) ranged from 483.0 L/s (March 23, 2023) to 33.0 L/s (September 20, 2024). The baseflow rates for SG21-1, SG21-2 and GRCA Station 9668042 were calculated using SepHydro, a hydrograph separation tool developed by the Canadian Rivers Institute, University of New Brunswick and Agricultural and Agri-Food Canada (Danielescu, 2018). Using local time-series flow data from these locations as an input, SepHydro was used to apply the Lynne and Hollick method (1979) for estimating the amount of baseflow for each station. SepHydro estimates are approximately 30 L/s at SW21-1, 50 L/s at SW21-2 and 231 L/s at GRCA Station 9668042.

To provide context regarding the streamflow monitoring data discussed above relative to precipitation normals, historic annual precipitation totals (1950 through 2025) are shown on Figure F3. Total annual precipitation values predominantly reflect Region of Waterloo Airport Climate Station No. 6144239. The data from this station indicates precipitation values were at or below historical norms during the monitoring period (2021 through 2025). These data trends are consistent with the GRCA Station 9668042 streamflow data, which show lower creek flow rates in 2021 and 2022.

3.6 Water Quality Laboratory Testing

To baseline local water quality, samples were collected from each of the five monitoring wells, four drive point piezometers and two staff gauge locations. The monitoring wells were developed by Insitu prior to sampling, including the removal of the equivalent of three water-columns of water. The water samples were collected using designated Waterra tubing and foot valve.

The analytical laboratory (Bureau Veritas Laboratories, or BV Labs) was contacted in advance to order sufficient water pre-cleaned (and pre- preserved, where applicable) sample containers for the desired analyses. Water samples collected at the Site were secured and transported to BV Labs in designated lab-supplies containers and stored in a chilled cooler for transport. The water samples were submitted for general chemistry analyses, which included pH, inorganics and dissolved metals, as well as calculated parameters for anion and cation summaries, hardness and total dissolved solids. Groundwater samples obtained from the monitoring wells were also analyzed for Petroleum Hydrocarbons (PHCs) and BTEX.

Results of groundwater quality monitoring are provided in Table 5, while results of surface water quality monitoring are provided in Table 6. The Certificate of Analysis provided by the laboratory is provided in Appendix E.

There were no detections of PHC's or BTEX within any of the samples. Groundwater samples from the monitoring wells were generally compliant with Ontario Drinking Water Standards (ODWS), except for the parameters of hardness and manganese. Exceedances of these parameters are typical within the overburden aquifers of southern Ontario. Water samples collected from the drive point piezometers consistently showed elevated concentrations of iron, manganese, organic carbon and zinc. The exceedances in the drive point piezometers are interpreted to reflect potential rust or wear of the drive point piezometers. Surface water quality was generally compliant with Provincial Water Quality Objectives (PWQO), with the exception of zinc.

Analytical results are collectively shown within the Piper plot on Figure 8. The results indicate that local groundwater and surface water both reflect a magnesium bicarbonate water type. This analysis indicates that the surface water and groundwater quality is consistent.

4 Hydrogeological Assessment

4.1 Geology

Borehole drilling results, as summarized on Figure 5, indicate local soil conditions are consistent with the regional geological mapping (shown on Figure 3). Underlying the Site is a large deposit of sand and gravel, encountered from near ground surface to less than 298 masl (representative thickness of approximately 23 m). Grain size analysis data, as provided in Appendix D, indicate the gravel size generally ranged from fine to coarse, while the sand size generally ranged from medium to coarse. These sand and gravel soils are typically well graded (i.e., uniformity coefficient greater than 10%) and contain trace amounts of fine-grained material (i.e., silt and clay). Sub-rounded cobbles were regularly encountered within this deposit.

Lenses of silty sand to silt and sand, approximately 2 m thick, were encountered at MW21-2 through MW21-4. These lenses of finer grained soil were generally encountered between 318 masl and 308.5 masl. These sand and silt lenses are poorly graded, with a uniformity coefficient less than 4%. These layers are not considered to be laterally extensive throughout the property or affect vertical / horizontal groundwater flow. Accordingly, these layers do not form part of the hydrogeological conceptual model (Section 4.3.3).

The bedrock surface was encountered at MW21-05, at an elevation of 307.33 masl. This observation is consistent with the City of Guelph's Tier 3 Study (Matrix, 2017), which indicates the bedrock surface dips in a southwesterly direction beneath the Site, ranging from 308 masl along Victoria Road to approximately 292 masl along the western limit of the Site. As described in Section 2.3, the bedrock surface reflects the Reformatory Quarry member of the Eramosa Formation.

4.2 Surface Drainage

Total topographic relief across the Site is approximately 7 m, ranging from approximately 329 masl at Victoria Road to approximately 322 masl at the southern limit of the Site. Local topography is hummocky, resulting in several internally draining, closed depressions amongst the otherwise gently rolling terrain towards Aberfoyle Creek. Using the ESRI ArcHydro for ArcMap software, the inferred boundaries of local surface drainage sub-catchments are delineated on Figure 10. Sub-catchment areas (CA) that intercept the Site are numbered CA-1 through CA-4. Details of each of these catchment areas are summarized in Table 7 and discussed below. Internally draining catchment areas (CA-1 and CA-3) occupy approximately comprising 50% of the Site Area. Closed depressions are encountered within each sub-catchment area. These depressions, numbered WE-1 through WE-8, reflect either dug ponds or low-laying wetland areas. Details of these closed depressions are also included within Table 7.

CA-1 and CA-2 are located in the southwestern portion of the Site. CA-1 is interpreted to be internally draining, with the lowest grade elevation reflected by WE-1d. CA-2 is interpreted to drain directly into Aberfolye Creek, through WE-1d.

CA-3, which is located within the middle of the Site, is internally draining. Within this sub-catchment, overland drainage flows towards WE-1c and WE-2, which reflect closed depressions.

The northern portion of the Site predominantly reflects CA-4, which drains in a northwesterly direction and through the Mini-Lakes. Within this broad sub-catchment, a series of closed depressions exist (shown as WE-3 and WE-5 through WE-8. The catchment areas for these isolated closed depressions are small (i.e., generally less than 0.1 ha).

Existing aggregate pit ponds are located on adjacent lands, north and northeast of the Site. These ponds, developed from aggregate extraction, reflect water table conditions. The Mini-Lakes ponds on the adjacent lands to the northwest are also inferred to reflect water table conditions, based on their elevations.

4.3 Hydrogeology

Based on the hydrogeological field study results, as described in Section 0, hydrogeological conditions in the vicinity of the Site are discussed below.

4.3.1 Groundwater Flow

The highest groundwater levels over the 4-year monitoring period, as shown on Figure 6, were manually observed on July 25, 2024. These values are shown in plan on Figure 9. The seasonal high water table is inferred to range from approximately 324 masl along the eastern limit of the Site to 320 masl along the western limit of the property. Groundwater flows in a southwesterly direction, towards Aberfoyle Creek, situated approximately 300 m southwest of the Site. The horizontal hydraulic gradient is approximately 0.003 m/m. As described in Section 3.3, seasonal variation of the water table is minor (i.e., less than 1 m annually).

4.3.2 Groundwater / Surface Water Interaction

Several observations from the hydrogeological field investigation indicate that surface water features (e.g., ponds, wetlands and watercourses) are directly connected with local groundwater flow. These observations include:

- Consistent elevation and hydrograph trends between the monitoring wells and drive point piezometers.
- Consistent quality of water within the monitoring wells and surface water stations.
- Limited size of the local surface catchments, which generally reflect closed depressions.
- Coarse grained nature of local overburden, facilitating prompt recharge of overland drainage.

These observations indicate that local surface water levels and flow rates are directly related to the local water table elevation.

4.3.3 Hydrogeological Conceptual Model

Based on the field study findings a hydrogeological conceptual model has been developed for the Site, for the purpose of assessing the effects of proposed aggregate extraction. The conceptual model represents a single groundwater flow system (i.e., unconfined, overburden aquifer), with the following hydraulic parameters:

Parameter	Value
Transmissivity	800 m^2/day
Saturated Aquifer Thickness	23 m
Formation hydraulic conductivity	4 $x10^{-4}$ m/s
Specific Yield	30%

The overburden aquifer is underlain by the Eramosa Formation, which is well known to be a regionally extensive aquitard. As reported by the City's Tier 3 Study (Matrix, 2017), the bulk vertical hydraulic conductivity of the Eramosa Formation is approximately 1 $x10^{-9}$ m/s. The bedrock surface is therefore considered to be the base of the shallow groundwater flow system locally. While it is recognized that minor vertical seepage through the bedrock will occur (in accordance with the 10^{-9} m/s vertical hydraulic conductivity) most groundwater recharge from surface will flow laterally towards Aberfoyle Creek.

As shown on Figure 5, the saturated thickness of the aquifer is approximately 23 m. The overburden aquifer receives groundwater recharge directly from infiltration of precipitation. Due to coarse texture of the overburden locally, local groundwater recharge is high (300 to 325 mm/yr according to Matrix, 2017). Infiltrated water seeps vertically downward, by gravity, and supplements the water table. The water table is a subdued reflection of the surface topography, sloping in a southwesterly direction along a consistent hydraulic gradient of approximately 0.003 m/m. Groundwater flow in the shallow aquifer converges on local surface water tributaries, providing a perennial base flow.

Hydraulic conductivity of the overburden aquifer have been inferred through a combination of grain size analysis and in-situ well response tests, as summarized in Table 2. To develop a cursory estimate of the bulk formation hydraulic conductivity (K_f), beneath the Site, the interpreted values in Table 2 were considered in accordance the following equation:

$$K_f = \sum_{i=1}^{n} \frac{K_i d_i}{d}, \text{ where}$$

K_i = hydraulic conductivity of each sample, as determined by the Hazen analysis;

d_i = thickness of each sample;

Based on the above analysis, the interpreted formation hydraulic conductivity is consistently interpreted to be on the order of 4 $x10^{-4}$ m/s at each of the monitoring well locations. It is noted, however, that this value is considered an on-Site condition (i.e., beneath the Site) and likely to vary across the broader local area.

4.3.4 Groundwater Use

A review of local water well records (WWRs) available through the MECP database (MECP, 2024) for the area was completed to review local geology and the water levels. Figure 11 shows the location of private water supply wells and active permits to take water (PTTW) locally. Within 120 m of the Site, there are four active PTTW (MECP, 2025). Each of the four PTTW are registered as water supply locations associated with communal groundwater wells to service the residents of the Mini Lakes Condominium Community located at 7541 Wellington County Road 34.

There are seven WWRs located within 120 m of the Site and 62 WWRs located within 250 m of the Site. All water supply wells within 120 m of the Site are completed within the underlying limestone bedrock aquifer, although one residential water supply well (WWR # 7100301) located within 130 m of the Site is noted to be completed within the deep sand and/or gravel overburden aquifer to depth of 22.3 m below ground surface (BGS) overlying limestone bedrock. At the well (WWR # 7100301), water was found at base depth of about 22 m BGS and a static groundwater level was recorded at about 6 m BGS, with a recommended pumping rate of 10 gallons per minute (GPM). It is also noted that there is one additional WWR (WWR # 6710785) located within 250 m of the Site (at distance of 190 m from the Site) that is completed within the shallow sand and/or gravel overburden aquifer to depth of 13.7 m BGS, with all remaining WWRs within 250 m of the Site completed within the underlying limestone bedrock aquifer. At the well (WWR # 6710785), water was found at base depth of about 13 m BGS and a static groundwater level was recorded at about 7 m BGS, with a recommended pumping rate of 20 GPM.

Additionally, based on the WWRs, at a distance of greater than 280 m but within 500 m of the Site, there are 10 additional water supply wells completed within the sand and/or gravel overburden aquifer and generally at lower depth overlying the limestone bedrock, and groundwater levels range from approximately 4 m to 15 m BGS (2 of 10 WWRs have groundwater levels above 7 m BGS). The remainder of the water supply wells are completed within the underlying dolostone bedrock.

4.4 Source Water Protection

Hydrogeological Source Protection areas, as delineated by the MECP Source Water Protection Information Atlas, is shown on Figure F4 (Appendix F). The Clean Water Act (2006) defines four critical Source Water Protection Areas: Wellhead Protection Area (WHPA), Highly Vulnerable Aquifer (HVA), Significant Groundwater Recharge Areas (SGRA) and Water Quantity Vulnerable Areas (WHPA-Q). This section provides a Source Water Impact Assessment relative to the proposed Site development plans.

4.4.1 Significant Groundwater Recharge Areas

Groundwater recharge is largely controlled by soil conditions, and typically occurs in upland areas. As defined in the Clean Water Act (2006), an area is a significant groundwater recharge area if,

- the area annually recharges water to the underlying aquifer at a rate that is greater than the rate of recharge across the whole of the related groundwater recharge area by a factor of 1.15 or more; or,

- the area annually recharges a volume of water to the underlying aquifer that is 55% or more of the volume determined by subtracting the annual evapotranspiration for the whole of the related groundwater recharge area from the annual precipitation for the whole of the related groundwater recharge area.

Figure F4 indicates the Site is located within a SGRA. The proposed aggregate pit development will not affect the groundwater recharge potential of the local overburden soils. Overburden soils will be removed at the Site, and therefore recharge potential will be increased due to a shorter vertical travel distance to recharge the local aquifer. The infiltration was estimated pre- and post-development and supports this assessment (Section 5.3.3).

4.4.2 High Vulnerability Aquifers

The susceptibility of an aquifer to contamination is a function of the susceptibility of its recharge area to the infiltration of contaminants. HVA's are mapped using the Intrinsic susceptibility index (ISI) method, which specifies low, medium and high vulnerability. Figure F4 indicates the Site is not located within an area dilieaned as HVA.

Future development at the Site should have regard for the sensitivity of the shallow aquifer, and operations associated with the aggregate extraction operations should incorporate suitable measures to minimize negative effects to the shallow groundwater aquifer. This can be addressed through the use of best-management practices for equipment maintenance and fueling activities, incorporating contingency and mitigation measures into operational plans, and effective monitoring.

4.4.3 Wellhead Protection Area

Lake Erie Region Source Protection Committee (2015) outlines that WHPAs are defined as the vulnerable areas around groundwater sources that have been delineated using three- dimensional groundwater flow models. The WHPA for each well field (or well) is based on an estimate of the groundwater travel time to the well, with defined zones extending out to a period of 25-years for groundwater travel to the well.

Based on Lake Erie Region Source Protection Committee (2015) and for the Grand River Source Protection Area the Site is not within or near a WHPA associated with water quality (WHPA-A through WHPA-D; Figure F4). Therefore, source water protection policies associated with WHPAs for water quality do not apply to the Site. The closest WHPA areas are as follows:

- City of Guelph Burke Well / Arkell Well Fields, WHPA maximum extents terminating 3.1 km northwest of the Site.
- City of Hamilton Freelton Well, WHPA maximum extent terminating 2.6 km south of the Site.

The Site is located within a WHPA associated with water quantity (Area A; WHPA-Q, Figure F5 in Appendix F), which requires demonstration that a new development will not negatively impact the availability of water for the municipal drinking water supply. A water budget was completed for the Site with details provided in Section 5.2.2.

5 Impact Assessment

The impact assessment, provided herein, focuses on the following two conditions:

- Aggregate extraction operations (i.e., short-term period of aggregate removal); and
- Post-rehabilitation of the pit (i.e., the long-term condition following cessation of operations).

Analytical solutions and computer modelling analyses have been undertaken to assess the short-term and long-term effects of the proposed Anthony Aggregate pit on local water resources, respectively. Stantec developed a three-dimensional numerical groundwater flow and thermal transport model. This model was constructed using the USGS modular groundwater flow modeling code, MODFLOW, and transient thermal transport was simulated using the MT3D solute transport code coupled to the MODFLOW flow model. The construction and calibration of the model, as well as simulated results are described in detail within Appendix G. Since the domain of the model extends beyond the far Site (i.e., approximately 2.5 km beyond the area of local field investigations), model parameters discussed within Appendix G may vary slightly from the interpretations provided within Section 4.3.3 above.

5.1 Proposed Aggregate Extraction

The sand and gravel soils encountered at the Site reflect a valuable aggregate resource from near ground surface to the bedrock surface. Extraction of the soils are proposed in accordance with the Site Plan provided in Appendix H. A hydraulic excavator and / or dragline set-up will be used to capture aggregate below the water table. Figure 12 shows the proposed above (AWT) and below (BWT) water table aggregate extraction plan for the Site, as well as the proposed maximum extraction limit. Specific estimated details of the proposed license application are as follows:

- Approximately 8.77 hectares of total area to be extracted and rehabilitated
- Approximately 1 million tonnes of aggregate to be removed (AWT and BWT) with 2:1 side slope

Removal of the aggregate and rehabilitation of the Site is expected to be completed within a 2-to-5-year timeframe. Above water table extraction is expected to be carried out from north to south across the Site, using conventional construction equipment, including trucks, loaders and cranes with draglines. Material will be loaded and hauled offsite to a CBM processing facility. Existing vegetation within the extraction area will be maintained until sequential stripping begins as extraction proceeds through the Site. The primary site access will be located at the northwestern corner of the Site, and travel between the existing PSWs along an existing driveway (Figure 2).



The BWT extraction will be executed from south to north, across the Site, using a crane with dragline. The proposed extraction will result in the development of two BWT pit ponds, a northern pond approximately 2.65 hectares and a south pond 1.86 hectares. The total depth of the ponds will be approximately 17.5 m (304 masl). Excavated overburden will be stockpiled to allow for drainage of captured groundwater back to the resulting pit ponds. The WE-2 wetland area will be preserved, with a 30 m setback from the extraction limit.

5.2 Effects of Extraction on the Water Table

There is no direct water taking proposed at the Site. However, in response to aggregate extraction, the following two conditions will affect the water table locally:

- Water replacement of extracted aggregate (short-term effect), and
- Adjustment of the water table gradient in response to new pit ponds (long-term effect).

A quantitative assessment of these potential effects are described below.

5.2.1 Short Term Water Table Adjustment

As aggregate is extracted from the proposed pit ponds, the local water table will replace the displaced aggregate volume. This displacement is therefore considered analogous to groundwater pumping. The equivalent pumping rate of the aggregate removal can be estimated, considering that the planned extraction rate is 3,000 tonnes per day. Considering the aggregate density of 2,000 kg/m^3 and a porosity (n) of 30%, the following calculation indicates an equivalent water pumping rate (Q_T) of approximately 1,050 m^3/day.

$$Q_T = (1 - n) \cdot \frac{aggregate\ tonnage}{aggregate\ density}$$

It is noted that excavated aggregate will be stockpiled on-Site, allowing water captured within the pore spaces of the aggregate to drain back to the pit ponds. A porosity of 30% is therefore considered appropriate in the above calculation.

Water table drawdown, in response to the equivalent water pumping rate (Q_T) can be estimated by applying the following equilibrium equation (Powers et al., 2007) for unconfined aquifer conditions:

$$Q_T = \frac{\pi K(H^2 - h^2)}{\ln R_o / r_w}$$

where Q_T = Equivalent pumping rate in response to aggregate extraction (1,050 m^3/day)
K = hydraulic conductivity of the on-Site overburden (4 x10^{-4} m/s)
H = thickness of the overburden groundwater flow system (322 masl – 299 masl = 23 m)
h = desired water height within active groundwater flow system (321.7 masl – 299 masl = 22.7 m)
R_o = radius of influence (520 m, representing a 400 m zone of influence beyond edge of pit pond)
r_w = equivalent radius of collective pit ponds (120 m)

Based on the above equation, the water table drawdown in response to active aggregate extraction is interpreted to be approximately 0.3 m at the pit pond and decrease with radial distance. The lateral extent of the zone of influence, roughly shown on Figure 13, is interpreted to be up to 400 m from the edge of the pit ponds. Recognizing a 30 m buffer between the pit ponds and adjacent wetlands, proposed drawdown extending into neighboring wetlands is interpreted to be less than 0.13 m; equivalent to 13% of the annual water table fluctuation. As discussed in Section 5.2.3 below, this small amount of drawdown will not interfere with the wetland hydroperiods.

The equivalent pumping rate of the aggregate extraction (approximately 1,050 m^3/day or 12 L/s) reflects approximately 24% of the Aberfoyle Creek flow rate observed at SG21-2 (approximately 50 L/s). While this potential reduction reflects a moderate risk of adversely affecting base flow conditions, the following mitigative measures should be considered:

- Interpreted base flow rates reflect periods of at or below normal precipitation. With annual precipitation rates at or above normal, potential reductions to base flow rates are unlikely to be realized.
- Proposed aggregate extraction will be short term, limited to a 2-to-5-year period. The extraction operations will therefore have no effect on long term flow conditions within Aberfoyle Creek.
- Former and existing aggregate operations within the Mill Creek watershed (LRG, 2019) on nearby properties has not resulted in measurable impacts on water temperatures and streamflows within Mill Creek.

Considering the above, the actual effects of short-term aggregate extraction are not likely to be distinguishable from typical seasonal fluctuations. Recognizing the small depth of drawdown and limited zone of influence, proposed aggregate extraction operations will not affect local groundwater supply wells within the WHPA-Q for the City of Guelph.

5.2.2 Long Term Water Table Adjustment

The water table gradient, as shown on Figure 9, will flatten in response to the creation of the proposed Anthony Pit ponds. Currently the water table drops approximately 1.5 m from the northern to southern limits of the proposed pit ponds (i.e., roughly 322.25 to 320.75 masl). The final pit pond elevations are expected to stabilize at approximately 321.7 masl for the north pond and 320.7 masl for the south pond. Using MODFLOW (Appendix H) to simulate the effects of the proposed ponds on the local water table, the permanent adjustment to the water table change (i.e., positive values for water table elevation decrease and negative values for water table elevation increase) are shown on Figure 15. A flatter hydraulic gradient will permanently exist, with the water table adjusting approximately 0.6 m lower at the northern limit of the North Pond and approximately 0.3 m higher at the southwestern limit of the South Pond.

It is noted that the pit ponds were specifically designed to minimize the potential long term water table changes in proximity to the adjacent wetlands. Simulated water table adjustments, as shown on Figure 15, are less than 0.3 m.

The water table adjustment, in response to formation of the Pit ponds, will not affect groundwater baseflow to Aberfoyle Creek. As described above, there will be no removal of aggregate or water from the ponds (except for evaporation) following the 2 to 5-year operating period. Over the long term, groundwater baseflow to Aberfoyle Creek should remain consistent with pre-pit conditions.

5.3 Effects of Extraction on Local Hydrology

Potential effects of proposed aggregate extraction and Site rehabilitation on local surface water features reflect the following:

- Groundwater flow rate reduction towards Aberfoyle Creek (short-term effect),
- Groundwater flow temperature increase towards Aberfoyle Creek (long-term effect),
- Adjustment of the Site water balance (long-term effect), and
- Adjustment of catchment areas for local closed depressions / wetlands (long-term effect).

Each of the above are assessed quantitatively below.

5.3.1 Groundwater Base Flow

As described in Section 5.2.1. above, the water replacement rate during aggregate extraction operations is estimated to be approximately 1,050 m^3/day (equivalent to 12 L/s) over a 2 to 5 year period. The actual rate will depend on the aggregate extraction rate. The water replacement would have otherwise flowed towards Aberfoyle Creek, reflecting approximately 24% of the 50 L/s baseflow rate observed at SG2-12. While this potential groundwater base flow rate reduction can be considered significant, no adverse water resources impacts have been observed within the Mill Creek catchment despite the prevalence of aggregate extraction operations (LRG, 2019). Long term monitoring of local water resources is recommended to confirm that surface water flow rates do not vary from their observed norms.

5.3.2 Groundwater Flow Temperature Changes

As shown on Figure 7, the typical groundwater temperature in local monitoring wells is 8ºC to 12ºC. Changes in the groundwater flow regime during aggregate operations and post-closure were simulated using MODFLOW, with the thermal changes using the MT3D transport model coupled to the MODFLOW flow model. The thermal modelling analysis (Appendix G) indicates that the average annual groundwater temperature within the proposed pit ponds could increase by approximately 6 ºC. As this groundwater flows towards Aberfoyle Creek, it will cool and mix with the regional groundwater flow. The temperature plume simulation, shown in Appendix G, reflects a maximum temperature increase of 2 ºC along a 200 m section on the east side of Aberfoyle Creek. The collective effects of the open pit ponds is therefore a potential groundwater baseflow temperature increase to 10 ºC to 14 ºC over a 200 m section of the creek. It is noted that once the groundwater base flow in this 200 m section mixes with the creek flow, no temperature difference is likely to be realized from normal creek flow conditions.

5.3.3 Water Budget Adjustment

Water budget calculations have been completed to approximate changes to on-Site infiltration volumes, in response to the proposed aggregate pits. Comparison of water balance data under pre- and post-development conditions have been completed to determine if post-rehabilitation measures are required to mitigate the effects of proposed development. A water budget assessment is an accounting of the distribution of components of the hydrologic cycle and can be simplified in the following equation:

$$P = ET + S + R + I$$

where:

P = precipitation; ET = evapotranspiration; S = change in groundwater storage;

R = runoff; and I = infiltration

The key component of the water balance is evapotranspiration (ET), which is calculated using the soil moisture balance model developed by Thornthwaite and Mather (1957). The Thornthwaite and Mather model assumes that different soil textures have a characteristic capacity to hold water. Any deficit to the soil holding capacity must be met before water can infiltrate. Monthly values of precipitation (rainfall plus snowmelt) and potential evapotranspiration rates are input to the model. Potential evapotranspiration is calculated based on temperature, heat index, and an adjusting factor for latitude. The actual evapotranspiration is calculated using the input precipitation, calculated potential evapotranspiration, and change in soil moisture storage. Infiltration and runoff are calculated using the water surplus, ground slope, soil type, and ground cover. Values for infiltration and runoff are generated as a depth and are reported in millimetres (mm). These depth values can generate annual volumetric values by inputting known areas for land use under pre- and post-development conditions. An infiltration deficit is calculated as the difference between pre-development infiltration and post-development infiltration.

Tables F1 and F2 (in Appendix F) show the pre- and post-development water budget calculations for the only area of the Site subject to alteration: the proposed extraction footprint (8.77 ha). Temperature and precipitation averages for the region from 1991-2020 climate normals were obtained from the Environment and Climate Change Canada (ECCC) website for the Region of Waterloo Airport Climate Station (ID 6144239), located approximately 20 km northwest of the Site.

For both pre- and post-development conditions, soil moisture capacity was set at 75 mm corresponding to predominantly sand soil with cultivated landscape according to the MECP *SWM Planning Design Manual* (MECP, 2003). Post-development, approximately 4.57 ha of the 8.77 ha extraction area, will reflect ponded terrain. At these pond locations, the average annual evaporation rate (850 mm/year according to GEO.CA) is nearly consistent with the average annual precipitation normal (851 mm/yr, according to Environment Canada). This will reduce the water surplus, relative to the pre-development condition.

The average annual volume of infiltration under pre-development conditions is estimated at approximately 22,345 m^3/year or unit rate of approximately 255 mm/year (Table F1). Under post-development conditions, the Site infiltration rate is estimated to decrease to approximately 10,747 m^3/year or unit rate of approximately 123 mm/year (Table F2). The effect of the proposed development on Site infiltration is therefore interpreted to reflect a water resource decrease of 11,598 m^3/year (equivalent to approximately 32 m^3/day). This reduction (equivalent to 0.4 L/s) is insignificant, reflecting less than 1% of the 50 L/s base flow rate interpreted at the downstream Aberfoyle Creek station. The proposed pit ponds should therefore have no effect on local surface water or groundwater flow conditions.

5.3.4 Catchment Area Adjustments for Local Wetlands

Final grading of the proposed development, as detailed by the proposed Site Plan (MHBC, 2025), makes no changes to the overall direction of overland drainage locally. The effect of the proposed development on local hydrology is limited to loss of catchment area within each of the four sub-catchments. These losses are shown on Figure 14 and summarized in Table 7. Reductions in sub-catchment areas range from 1% or less within CA-4 to 39% within CA-3a.

The catchment area changes should have no effect on the hydroperiods within the local wetlands. As noted in Section 4.3.2 above, the hydroperiods are directly dependent on the water table elevation. Wetland hydroperiods are therefore sensitive to water table fluctuations and insensitive to catchment area losses. Figure 16 shows the drive point piezometer hydrographs (DP21-1 in WE-1d, DP21-2 in WE-2, DP21-3 in WE-1b and DP21-4 in WE-1a). The grade elevations within each graph has been adjusted to reflect the simulated hydrograph drawdown or rise in accordance with that shown on Figure 16. This analysis indicates negligible changes to the hydroperiods would have been observed over the past 4 years. Ponded conditions would have consistently occurred over the winter and spring months annually.

5.4 Cumulative Effects

The Site is situated south (downgradient) of existing aggregate extraction pit properties (former Tikal Pit and Dufferin Pit). Additional gravel pit operations being operated under Class A Licenses are also located within Puslinch Township, situated approximately 3 km southwest of the Site. Long term monitoring in the area of Mill Creek (LRG, 2019) has shown that aggregate extraction below the water table has not resulted in measurable impacts on water temperatures and streamflows within Mill Creek.

It is noted that pit ponds on adjacent properties are immediately north of the proposed Anthony Pit Site. On-Site monitoring data presented in Section 4 shows no water resources impacts or influence from the operations on the adjacent lands (i.e., no indication of water table drawdown or groundwater temperature effects). Recognizing the proximity and upgradient location of these existing pit ponds, the water temperatures within the proposed onsite pit ponds are expected to be similar to that of the existing pit ponds. The cumulative effects of pit ponds are not expected to significantly influence local groundwater temperature or base flow rates towards local surface water features.



As noted in Section 5.2.1, the small depth of drawdown (0.3 m at the pit ponds) and limited zone of influence (interpreted to be approximately 400 m from the pit ponds) will not affect the operation of local groundwater supply wells. The Site is not within or near a WHPA associated with water quality (WHPA-A through WHPA-D; Figure F4). Recognizing there is no direct water taking from the Site, the proposed development will not affect the groundwater quantity within the local WHPA-Q or operation of municipal water supply wells (which are located over 2.5 km from the Site).

Alterations to the Site within the proposed extraction limit and the resulting creation of pit pond area are not expected to significantly alter the water table elevation, which sustains the hydroperiods within the surrounding wetland areas. In consideration of the above, the proposed extraction is not expected to have additional adverse impacts on the water resources of the area.

6 Proposed Monitoring Program

As noted above, there is no proposed dewatering of the Site for aggregate extraction operations, with aggregate extraction proposed for excavation below the water table using a drag line. The predicted changes to water balance are not significant, and localized changes that are expected to result in a flattening of the water table gradient are not expected to have an adverse impact on the wetland areas that are being maintained at and bordering the Site.

To confirm the assessment and predictions submitted herein, the following water resources monitoring program can be undertaken:

- Annual groundwater quality monitoring of samples collected from MW21-01 through MW21-05. The parameter analysis for the samples should be consistent with those described within Section 3.6.
- On-going groundwater elevation monitoring within monitoring wells MW21-01 through MW21-05, drive point piezometers DP21-01 through DP21-04 and staff gauge locations SG21-1 and SG21-2. The monitoring program should use dataloggers, collecting levels on an hourly basis. Manual measurements of water levels and streamflow's should be collected on a semi-annual basis.
- On-going groundwater elevation monitoring and streamflow measurements at staff gauge locations SG21-1 and SG21-2.

Timing of the reporting on quarterly monitoring should coincide with annual regulatory compliance reporting requirements to the MNR. A site plan showing wells / shallow drive point piezometers to be maintained and protected at the Site should be provided to the operations for the Licensee, so that monitoring wells are not inadvertently damaged during site preparation works and removal of overburden materials.

When the monitoring wells are determined to be no longer required, the wells should be properly decommissioned in accordance with Ontario Regulation 903. Decommissioning a well which is no longer in use is completed for the safety of those in the vicinity of the well, prevents surface water infiltration into an aquifer via the well, prevents the vertical movement of water within a well, conserves aquifer yield and hydraulic head and can potentially remove a physical hazard.

7 Contingency Plan And Mitigation Measures

7.1 Potable Water Supply Interference

Prior to below water table extraction, a private well survey shall be completed within 120 m of the Site to identify any private water supply wells in use. The following water well interference complaint protocol is recommended to address water supply interference to domestic and farm water supplies for properties located in proximity (within 120 m) to the Site (see Figure 11).

1. Provide 24-hour emergency contact information for the Licensee to the well owner, to facilitate reporting of perceived water supply impacts.

2. Should disruption or quality problems be experienced by the well owner this shall be notified to the Licensee, who will be responsible to report the well interference complain to MNRF and MECP.

3. In the event that the well owner experiences a significant disruption in their water supply, or experience significant adverse effects upon their water quality; and if the operation of the pit cannot obviously and definitively be excluded as the cause, the Licensee shall provide a temporary water supply within 24 hours and thereafter until such time as the cause of the disturbance can be determined and the situation addressed.

4. The Licensee shall investigate the cause of the water supply disturbance and shall report to the MNR, MECP and the well owner.

If it is determined that the aggregate extraction at the pit has been found to have caused a domestic or farm water supply to be adversely affected, the Licensee shall, at the Licensees expense, either restore or replace the water supply to ensure that historic water supply and quality are restored for such a resident. If it is determined that the operation of the pit has not caused any domestic or farm water supply to be adversely affected, the temporary water supply will be maintained for an additional 24 hours to allow the well owner to make alternate water supply arrangements.

7.2 Sediment And Erosion Control Measures

Surficial topsoil and overburden soils are to be stripped as part of the site preparation works and stockpiled at the Site for reuse during the site restoration. It is recommended that stockpiled materials be stored in areas where stormwater run-off will not drain directly into wetland and the woodlot areas being maintained at the Site. Additionally, berms constructed at the Site should be vegetated as soon as possible after placement, to help stabilize the berm side slopes.



7.3 Refuelling and Construction Equipment

The proposed aggregate extraction operation is expected to involve excavation of sand, and sand and gravel materials from above and below the water table. Proper operation and refuelling procedures must be followed for use of equipment in site operations to avoid potential risk of petroleum hydrocarbons such as fuels, oil and grease in entering the exposed groundwater system. Best management and good construction practices should be followed to reduce this potential and mitigate risks associated with the equipment operation.

Regarding fuel storage and refuelling procedures at the Site, the following recommendations are provided for consideration:

- Onsite fuel storage tanks will be installed and maintained in accordance with the Gasoline Handling Act
- Designated fuelling and equipment maintenance area, located at least 30 m away from surface water features, where possible

Implement spill contingency measures and spill action response plans for construction equipment.

8 Conclusions

Based on Stantec's hydrogeological field study results and analyses, the following conclusions have been developed with respect to the proposed Anthony Pit development Site and associated aggregate extraction operations. These conclusions are organized with respect to:

- The conceptual hydrogeological model of the Site
- Planned operations at the proposed Anthony Pit and associated effects on local water resources
- Proposed rehabilitated conditions at the Anthony Pit and associated effects on local water resources

Overall, the method of aggregate extraction at the Anthony Pit is designed to minimize potential effects on local water resources.

Conceptual Hydrogeological Model

1. The proposed Anthony Pit Site is underlain by a large deposit of sand and gravel (i.e., approximately 23 m thick). The sand and gravel overburden extends from near ground surface to the bedrock surface at approximately 298 masl. The bulk hydraulic conductivity value for the overburden is interpreted to be in the order of 4 $x10^{-4}$ m/s. The overburden is underlain by Silurian dolostone bedrock of the Eramosa Formation, with a vertical hydraulic conductivity on the order of $1x10^{-9}$ m/s. Considering the permeability contrast between the overburden and bedrock, the hydrogeological conceptual model considers the bedrock to reflect the base of the local groundwater flow system, while the overburden reflects a single layer, unconfined aquifer. The water table slopes in a southwesterly direction, ranging from approximately 324 masl at the eastern limit of the Site to approximately 320 masl at the western limit of the Site. Seasonal variation of the water table is minor (approximately 1 m or less, annually).
2. The Site straddles the upland areas between the north and south branches of Aberfoyle Creek (within the Mill Creek watershed). The local topography is hummocky, with two internally draining catchment areas comprising 50% of the Site Area. Surface catchments for the remainder of the Site drain into either the north or south branches of Aberfoyle Creek. Due to the hummocky topography, eight low-lying wetland areas exist within the four local surface water catchments. Dry conditions are observed within these wetlands during the late summer, fall and early winter months, annually. During the remainder of the year, these wetlands are flooded in response to the rising water table. Due to their limited catchment areas, the hydroperiod of these wetlands are completely dependant on the local water table. There are no open water bodies, watercourses or groundwater springs observed within the Site limits, aside from three dug ponds situated in the northern portion of the Site.
3. Groundwater samples from on-Site monitoring wells reflect quality that is typically of that observed in southern Ontario's overburden aquifers and within greenfield areas. The groundwater quality is compliant with all health-related criteria of the Ontario Drinking Water Standards and Provincial Water Quality Objectives (except for zinc). There were no detections of PHC's or BTEX within any of the groundwater samples. The quality of two Aberfoyle Creek surface water samples are consistent with the groundwater chemistry. Both reflect a magnesium bicarbonate water type. These results support the conclusion that local surface water features are well supported by groundwater base flow.

4. Stantec's 4-year field monitoring program extended through a period of predominantly below normal precipitation. Over this period, the average annual baseflow rate of Aberfoyle Creek – South Branch (1 km downstream of the Site, at the Brock Road crossing) was interpreted to be approximately 50 L/s.

Anthony Pit Operations and Short-Term Effects on Local Water Resources

5. The large deposit of sand and gravel soils beneath the Site has been deemed to be a financially viable aggregate extraction resource. Aggregate extraction is expected to include both above and below water operations; however, it is understood that the entire area proposed to be extracted at the Site may be applied for a licence as below water table extraction.
6. Above water extraction will be carried out from north to south, across the Site, using conventional construction equipment, including trucks, loaders, excavators, backhoes, bulldozers, scrapers, and conveyors. Material will be loaded and hauled offsite to a CBM processing facility. Below water extraction will be executed from south to north, across the Site, using a conventional dredge wireline excavator (i.e., cranes with draglines). The total area to be extracted and rehabilitated is 8.77 hectares, which will be organized to include two separate pit ponds (i.e., north pit pond 2.65 hectares and south pit pond 1.86 hectares). The total depth of the ponds will be approximately 17.5 m (304 masl). Excavated overburden will be stockpiled to allow for drainage of captured groundwater back to the resulting pit ponds. Aggregate operations are expected to be completed within a 2-to-5-year period.
7. The planned below water aggregate extraction rate is 3,000 tonnes per day. Removed aggregate will be replaced by local groundwater. This displacement reflects an equivalent water pumping rate of approximately 1,050 m^3/day (equivalent to 12 L/s). There will be no pumping / dewatering of the pit ponds. In response to water replacement of extracted aggregate, a water table drawdown of approximately 0.30 m is expected at the pit ponds. The water table drawdown will decrease with increasing distance from the pit. At a 30 m distance from the pit pond (i.e., equivalent to the buffer zone surrounding wetland areas), the forecasted drawdown is interpreted to be less than 0.13 m. The lateral extent of water table drawdown (e.g., zone of influence) is predicted to extend approximately 400 m from the edge of the pit pond. Due to the limited depth and lateral extent of the water table drawdown, the proposed works will not interfere with the operation of local groundwater supply wells.
8. Provincial source protection mapping indicates that the Site is not located within water quality Well Head Protection Areas or areas of high aquifer vulnerability. The Site is located within an area of high groundwater recharge; however, the proposed development will not significantly diminish groundwater recharge conditions. While the Site is located within a groundwater quantity protection area (WHPA-Q), no water taking from the Site is proposed. Therefore, the proposed pit will not affect the operation of municipal water supply wells (which are located over 2.5 km from the Site) or stress the local groundwater resource.
9. The forecasted water table drawdown within the below water extraction areas is small (less than 30%) relative to the 1 m seasonal water table fluctuations observed annually. As such, the water table drawdown should not affect the seasonal hydroperiods within local wetlands. Hydroperiods within local wetlands will continue throughout late winter, spring and early summer months, based on precipitation totals observed to date.

10. Short term groundwater base flow reduction towards Aberfoyle can be expected during aggregate extraction operations (e.g., 2 to 5 year period). During below normal annual precipitation years, the baseflow reduction could theoretically be as high as 24%. Actual baseflow reduction rates are likely to be lower, in response to normal or above normal precipitation. On-going streamflow and aquatic habitat monitoring can be undertaken to confirm continuity of streamflow rate and temperature observed to date, as well as aquatic habitat conditions.

Anthony Pit Post-Closure and Long-Term Effects on Local Water Resources

11. Based on a Thornthwaite water budget analysis, the average annual volume of infiltration under pre-development conditions is estimated at approximately 22,345 m^3/year or unit rate of approximately 255 mm/year. Under post-development conditions, increased evaporation (i.e., due to the open pit ponds) is expected to decrease the average annual infiltration to approximately 10,747 m^3/year or unit rate of approximately 123 mm/year. The presence of the pit ponds is therefore expected to reduce the on-Site infiltration rate by 11,598 m^3/year (equivalent to 65 m^3/day or 0.4 L/s). This reduction is small, equivalent to less than 1% of the interpreted base flow rate in Aberfoyle Creek (down stream of the Site). This adjustment should not affect normal groundwater or surface water flow conditions locally.
12. In response to the permanent formation of ponds, the local hydraulic gradient will decrease. The final pit pond elevations are expected to stabilize at approximately 321.7 masl for the north pond and 320.7 masl for the south pond, which is near the central range of the stabilized water levels recorded at the Site. Net changes to the local water table elevation will be approximately 0.6 m lower on the northeast side of the Extraction Area and approximately 0.3 m higher on the southwest side. Based on Stantec's 4-year monitoring program and hydrograph analysis, changes to the hydroperiods of local wetlands will be negligible in response to these permanent water table adjustments (interpreted to be less than ±0.3 m). Ponded conditions within the wetland areas will continue to occur over the winter and spring months annually.
13. Creation of the proposed pit ponds will reduce the surface catchment areas of some local closed depressions / wetlands. These features, however, are insensitive to catchment area reductions due to their limited size (less than 0.1 ha). Ponded conditions within these features are directly related to the water table surface elevation, which fluctuates approximately 1 m annually. The hydroperiods for local wetlands and PSWs (supported by direct precipitation and groundwater interaction), will remain unchanged in the post-development conditions.
14. Local groundwater temperature ranges from 8 ^oC to 12 ^oC. The average annual water temperature within the aggregate pit ponds is interpreted to increase approximately 6 ^oC, reflecting a range of 14 ^oC to 18 ^oC. This pond water will flow in a southwesterly direction, cooling along its flowpath and eventually outflowing into Aberfoyle Creek. At Aberfoyle Creek (along a 200 m section on the east side) the temperature of this groundwater could be 2^oC above the local ambient (e.g., reflecting a range of 10 ^oC to 14 ^oC. It is noted that once the groundwater base flow in this 200 m section mixes with the creek flow, no temperature difference is likely to be realized from normal creek flow conditions.
15. Subject to implementation of recommended contingency plans and mitigation measures, the proposed pit ponds do not reflect a source protection threat to local groundwater supply wells.

9 Recommendations

Based on the above conclusions of the Water Resources Report presented herein, the following recommendations are provided and should be considered to be incorporated into the site plans:

1. Groundwater level monitoring should continue at the Site on a semi-annual basis after the pit is licensed and continue until Site restoration is complete.
2. Groundwater samples have been collected at the Site to establish baseline water quality conditions for shallow groundwater within the unconfined aquifer which is expected to be encountered during the aggregate extraction operation. Future water quality testing should be undertaken on an annual basis for comparison to the background information presented within this report.
3. Fuel storage, equipment filling, and equipment maintenance should be carried out in accordance with best management practices outlined in Section 7.3, including designated fuelling locations and implementation of spills management response plans, as appropriate to reduce the potential and mitigate risks associated with the equipment operation.
4. Prior to below water table extraction, a private well survey shall be completed within 120 m of the Site to identify any private water supply wells in use. If complaints are received from nearby or neighbouring property owners (within 120 m of the Site), the Water Supply Interference Protocols outlined in Section 7.1 should be adhered to and followed.

10 References

Brunton, F.R., 2009. Update of Revisions to the Early Silurian Stratigraphy of the Niagara Escarpment: Integration of Sequence Stratigraphy, Sedimentology and Hydrogeology to Delineate Hydrogeologic Units. In Summary of Field Work and Other Activities 2009, Ontario Geological Survey, Open File Report 6240, p.25-1 to 25-20.

Bjerve, L., & Grøterud, O. (1980). Discharge measurements by a new-formed relative salt-dilution method in small turbulent streams. Nordic Hydrology, 11(3-4), 121-132.

Chapman, L.J. and Putnam, D.F., 1984. The Physiography of Southern Ontario Third Edition. Ontario Geological Survey Special Volume 2. Ministry of Natural Resources.

CH2M Gore & Storrie Limited, et. Al. Mill Creek Subwatershed Plan, prepared for the Grand River Conservation Authority, June 1996.

County of Wellington. 2025. Official Plan. May 2025

Danielescu S, MacQuarrie KTB, Popa A. 2018. SEPHYDRO: A Customizable Online Tool for Hydrograph Separation. Groundwater 56: 589-593. DOI: https://doi.org/10.1111/gwat.12792.

Environment Canada, 2025. Online database, Guelph Turfgrass Climate Station, accessed November 2025.

Fetter, C.W., 2001. Applied Hydrogeology, Fourth Edition. Prentice-Hall, New Jersey.

Golder, 2021. Drilling Investigation Results – Anthony Site, Puslinch, Ontario. prepared for CBM, March 2021.

Hazen, A. (1911) Discussion of “Dams on Sand Foundations” by A. C. Koenig. Transactions of the American Society of Civil Engineers, 73, 199-203.

Hudson, R., & Fraser, J. (2002). Alternative methods of flow rating in small coastal streams. Forest Research, 2, 1-6.

Lake Erie Region Source Protection Committee, 2015. Grand River Source Protection Area - Approved Assessment Report, November 25, 2015.

LRG Environmental, 2019. Mill Creek Coordinated Monitoring Report, January 1 to December 31, 2018, March 26, 2019.

Lyne V., Hollick M. (1979) - Stochastic time-variable rainfall-runoff modelling. Institute of Engineers Australia National Conference. Publ. 79/10, pp. 89-93.

Matrix Solutions Inc. March 2017. City Of Guelph and Township of Guelph/Eramosa Tier Three Water Budget and Local Area Risk Assessment.

Ontario Ministry of Environment, Conservation and Parks (MECP). 2024. Water Well Record Database. Available Online: www.ontario.ca/page/map-well-records. Accessed 2026.

Ontario Ministry of Environment, Conservation and Parks (MECP). 2025. Permit To Take Water - Maps. Available Online: www.ontario.ca/page/map-permits-take-water. Accessed August 2026.

Ontario Division of Mines, Quaternary Geology, Lucan Area, Southern Ontario, Preliminary Map P1048, scale 1:50,000, 1975.

Ontario Geological Survey, 2010. Bedrock Topography of the Lucan Area, Southern Ontario, Preliminary Map P291, scale 1:50,000, 1980 compilation.

Ontario Ministry of the Environment, 1981. Grand River Basin, Water Management Study, Technical Report, Groundwater Resources. Water Resources Report 14.

Ontario Ministry of the Environment, Conservation and Parks (MECP). 2003. Stormwater Management Planning and Design Manual. March 2003.

Ontario Ministry of Environment, Conservation and Parks. 2006. Clean Water Act, 2006, S.O. 2006, c. 22 - Ontario.ca

Ontario Ministry of Natural Resources, 1997. Aggregate Resources of Ontario, Provincial Standards, Version 1.0. Queens Printer for Ontario.

Ontario Ministry of Natural Resources, 2023. Aggregate Resources of Ontario: Technical Reports and Information Standards. ISBN 978-1-4868-4700-6 (PDF)

Powers, J.P., A.B. Corwin, P.C. Schmall, and W.E. Kaeck, 2007. Construction Dewatering and Groundwater Control, New Methods and Applications. John Wiley & Sons, Inc., 3rd Edition.

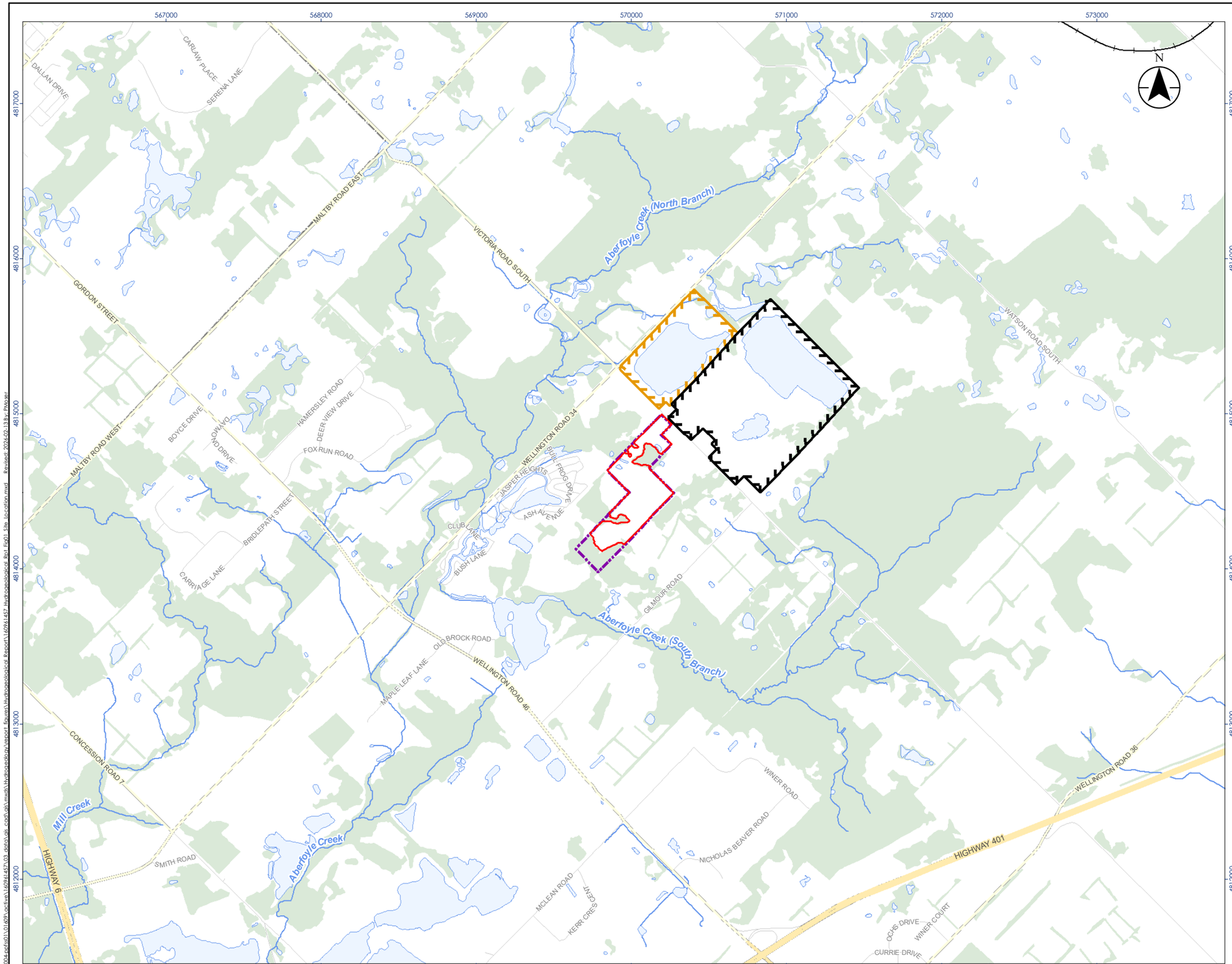
Singer, S.N., Cheng, C.K., Scafe, M,G, 2003 The Hydrogeology of Southern Ontario, 2nd Edition, Environmental Monitoring and Reporting Branch, Ontario Ministry of the Environment.

Stantec Consulting Ltd. (Stantec). 2025. DRAFT Natural Environment Report, Proposed Anthony Pit, Puslinch, Ontario. Prepared for CGM Aggregates, March 2025.

Thornthwaite, C.W., and Mather J.W., 1957. Instructions and Tables for Computing Potential Evapotranspiration and the water balance. Drexel Institute of Technology, Laboratory of Climatology, Publications in Climatology, Volume X, No. 3. Centerton, New Jersey.

Appendix A

Figures



Stantec

Legend

- Site
- 4454 Victoria Road South
- Expressway / Highway
- Major Road
- Minor Road
- Railway
- Watercourse
- Waterbody
- Wooded Area
- Municipal Boundary - Lower Tier
- Dufferin Aggregate Pit
- CBM Tikal Pit (Licence Surrendered)

0 500 1,000 metres

1:25,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Orthoimagery © First Base Solutions, 2021.



Project Location
Puslinch, ON

160961457 REVA
Prepared by PRM on 2026-02-13
Technical Review by SMD on 2026-02-10

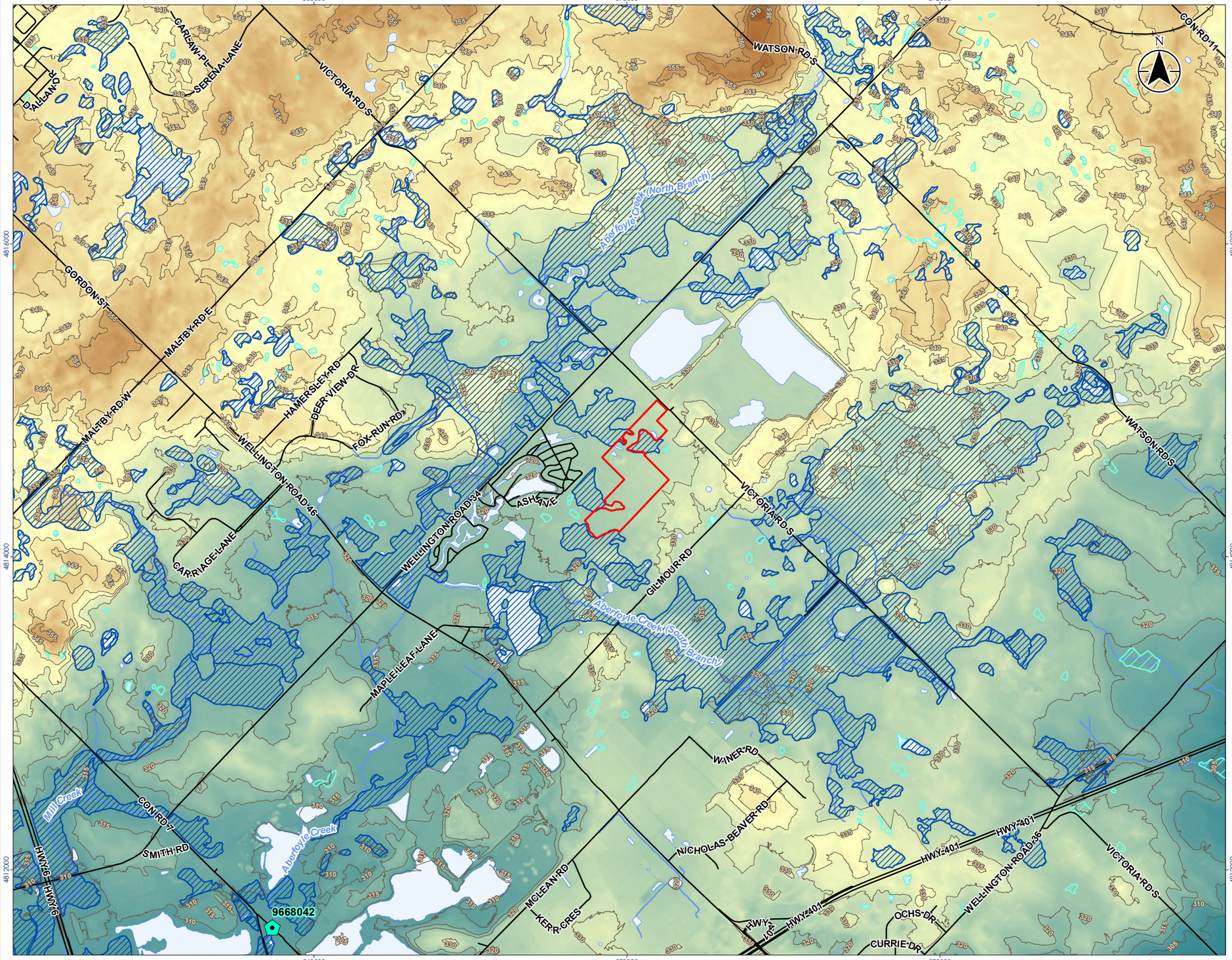
Client/Project
HYDROGEOLOGICAL REPORT
PROPOSED ANTHONY AGGREGATE PIT,
4454 VICTORIA ROAD SOUTH, PUSLINCH, ONTARIO

Figure No.
1

Title
Site Location

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

C:\60004.gis\gis01\01.GIS\active\160961457_03_data\gis_mxds\Hydrogeology\report figures\Hydrogeological Report\160961457 hydrogeological Rpt_Fig01_Site_location.mxd Revised: 2024-02-13 By: PMoyer



Stantec

Legend

- Site
- GRCA Gauging Station
- Road
- Railway
- Topgraphic Contour (m AMSL)
- Watercourse
- Waterbody
- Wetland - Evaluated (Provincial)
- Wetland - Not evaluated per Ontario Wetland Evaluation System

Ground Surface Elevation (m AMSL)

High : 375

Low : 300

0 500 1,000 metres

1:25,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Chapman, L.J. and Putnam, D.F. 2007. Physiography of southern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 228.



Project Location
Puslinch, ON

160961457 REVA
Prepared by PRM on 2026-02-13
Technical Review by SMD on 2026-02-13

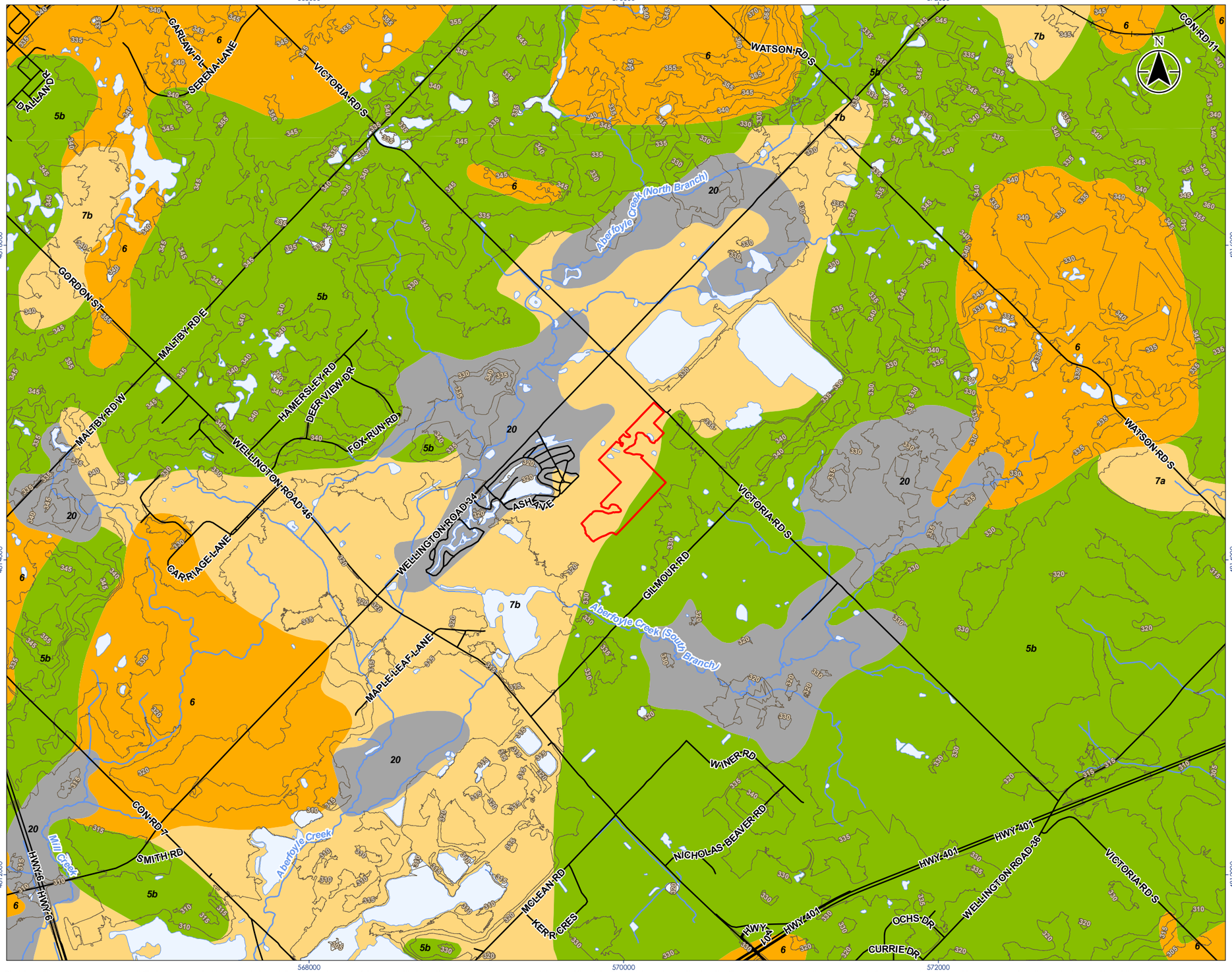
Client/Project
HYDROGEOLOGICAL REPORT
PROPOSED ANTHONY AGGREGATE PIT,
4454 VICTORIA ROAD SOUTH, PUSLINCH, ONTARIO

Figure No.
2

Title
Topography and Drainage

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

C:\0004-pod\01\01\699-active\160961457\03_data\gis_cad\gis\mxds\Hydrogeology\report_figures\Hydrogeological_Rpt_Fig02_Topography.mxd Revised: 2026-02-13 By: PMosier



Stantec

Legend

- Site
- Topgraphic Contour (m AMSL)
- Road
- Railway
- Watercourse
- Waterbody

Surficial Geology

- 20: Organic deposits
- 7a: Glaciofluvial deposits (Sandy deposits)
- 7b: Glaciofluvial deposits (Gravelly deposits)
- 6: Ice-contact stratified deposits
- 5b: Stone-poor, carbonate-derived silty to sandy till

0 500 1,000 metres
1:25,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Ontario Geological Survey 2010. Surficial geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128-REV ISBN 978-1-4435-2483-4.



Project Location
Puslinch, ON

160961457 REVA
Prepared by PRM on 2026-02-13
Technical Review by SMD on 2026-02-09

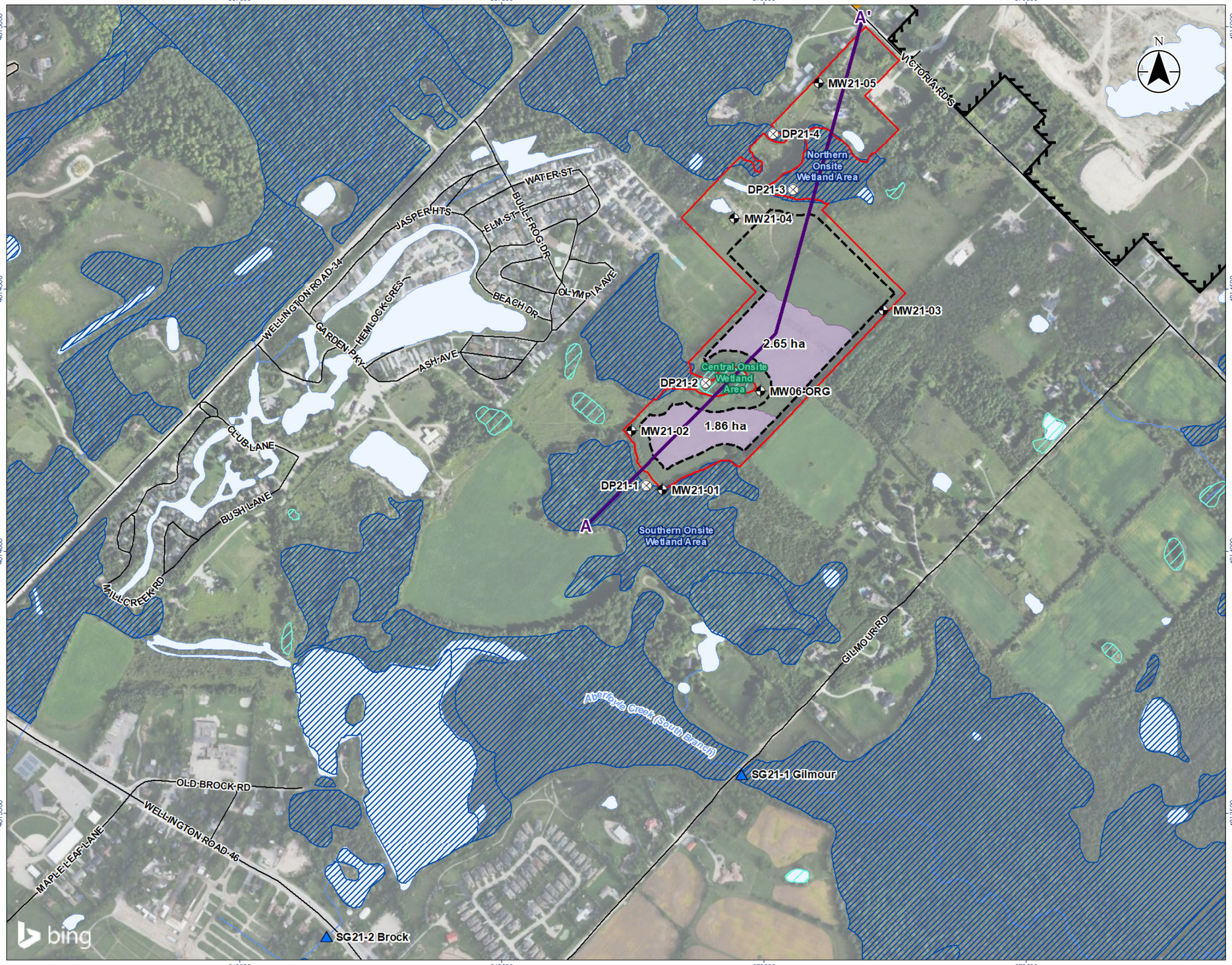
Client/Project
HYDROGEOLOGICAL REPORT
PROPOSED ANTHONY AGGREGATE PIT,
4454 VICTORIA ROAD SOUTH, PUSLINCH, ONTARIO

Figure No.
3

Title
Surficial Geology

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

C:\0004-pdf\01\01\609-active\160961457\03_data\gis_cad\gis_mxds\Hydrogeology\Report_Figures\Hydrogeological_Rpt_Fig03_Surficial_Geology.mxd Revised: 2024-02-13 By: PAnsser



Stantec

Legend

- Site
- Monitoring Well
- Drive-point Piezometer
- Surface Water Monitoring Location
- Cross-Section Location
- Road
- Watercourse
- Waterbody
- Wetland - Evaluated (Provincial)
- Wetland - Not evaluated per Ontario Wetland Evaluation System
- Dufferin Aggregate Pit

Extraction Footprints

- Area of Extraction Footprint
- Below Water Table Extraction Footprint

0 200 400 metres

1:7,500 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Orthoimagery © © 2026 Microsoft Corporation © 2026 Maxar ©CNES (2026) Distribution Airbus DS



Project Location
Puslinch, ON

160961457 REVA
Prepared by PRM on 2026-02-13
Technical Review by AW on 2025-08-27

Client/Project
HYDROGEOLOGICAL REPORT
PROPOSED ANTHONY AGGREGATE PIT,
4454 VICTORIA ROAD SOUTH, PUSLINCH, ONTARIO

Figure No.
4

Title
Site Instrumentation

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

C:\Projects\active\160961457\03_data\gis\mxds\Hydrogeology\report_figures\Hydrogeological Report\160961457_Hydrogeological_Rpt_Fig04_Site_Instrumentation.mxd Revised: 2026-02-13 By: PMoser

A **SOUTHWEST**

A' **NORTHEAST**

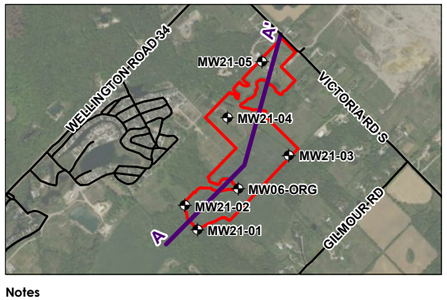
MW21-01(OS - 56m) MW21-02(OS - 65m) BH21-07(OS - 81m) BH21-10(OS - 81m) BH21-05(OS - 96m) MW21-03(OS - 187m) MW21-04(OS - 133m) MW21-05(OS - 48m)

Elevation (mAMSL)

345 340 335 330 325 320 315 310 305 300 295

Sand and Gravel
Sand and Silt
Sand and Gravel
Sand and Gravel
Sand and Silt
Sand and Gravel
Sand and Gravel
Sand and Silt
Sand and Gravel
Sand and Gravel
Sand and Silt
Sand and Gravel
Sand and Gravel
Sand and Gravel
Bedrock

Eramosa Formation



MW21-05 (OS m)

Sand

Well ID (Offset)

Stratigraphy

Water Level (April 5, 2022)
Water Level (June 1, 2022)
Well Screen

Legend
- Ground Surface
- Interpreted Geological Transition
- Groundwater Elevation
- Sand / Sand & Gravel
- Sand and Silt
- Dolostone Bedrock

10x Vertical Exaggeration

0 50 100 metres

1:3,000 (At original document size of 11x17)

Notes
1.

Stantec

Project Location
Puslinch, ON

160961457 REVA
Prepared by PRM on 2026-02-13
Technical Review by SMD on 2026-02-10

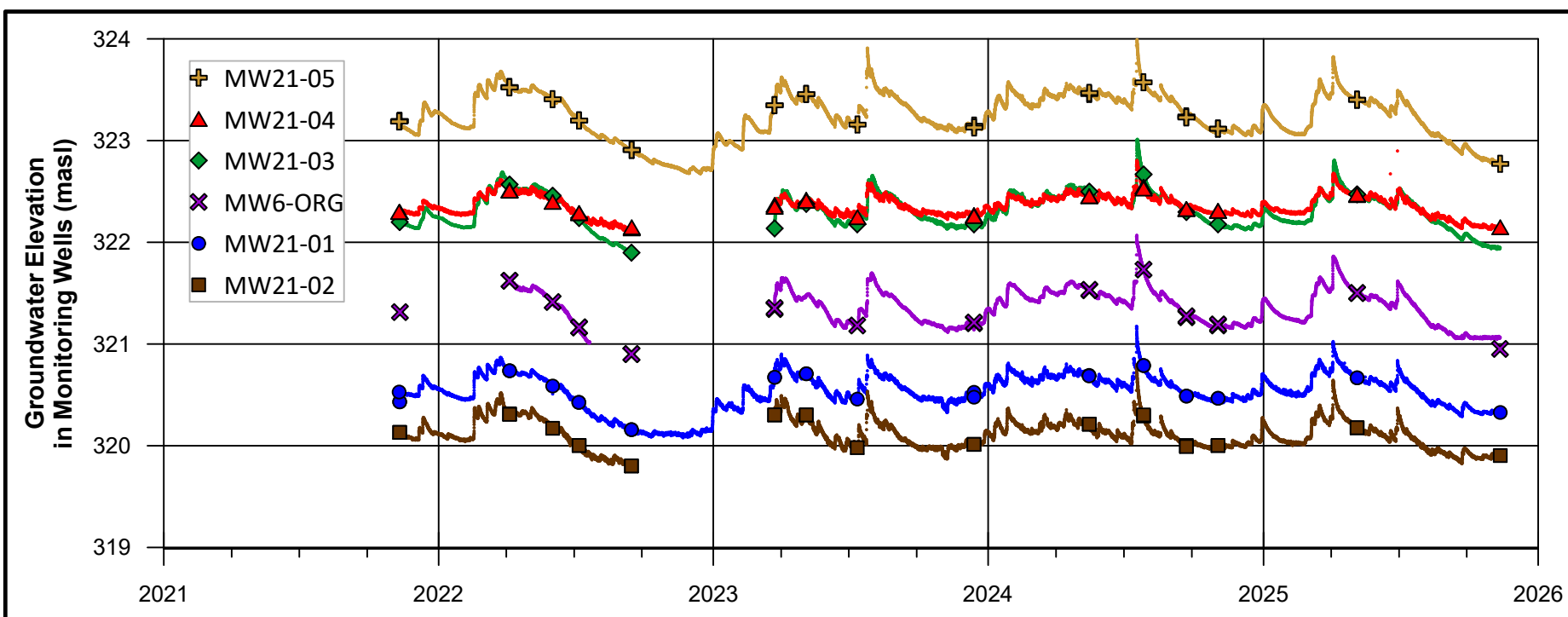
Client/Project
HYDROGEOLOGICAL REPORT
PROPOSED ANTHONY AGGREGATE PIT,
4454 VICTORIA ROAD SOUTH, PUSLINCH, ONTARIO

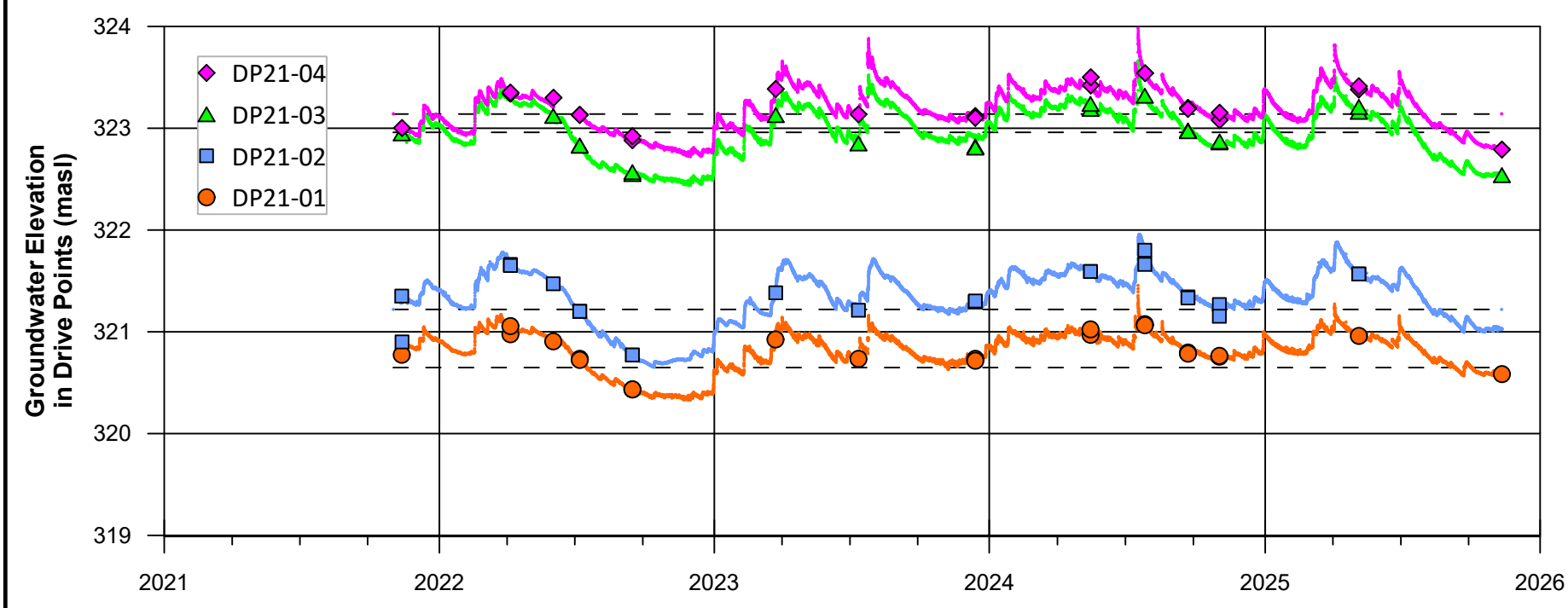
Figure No.
5

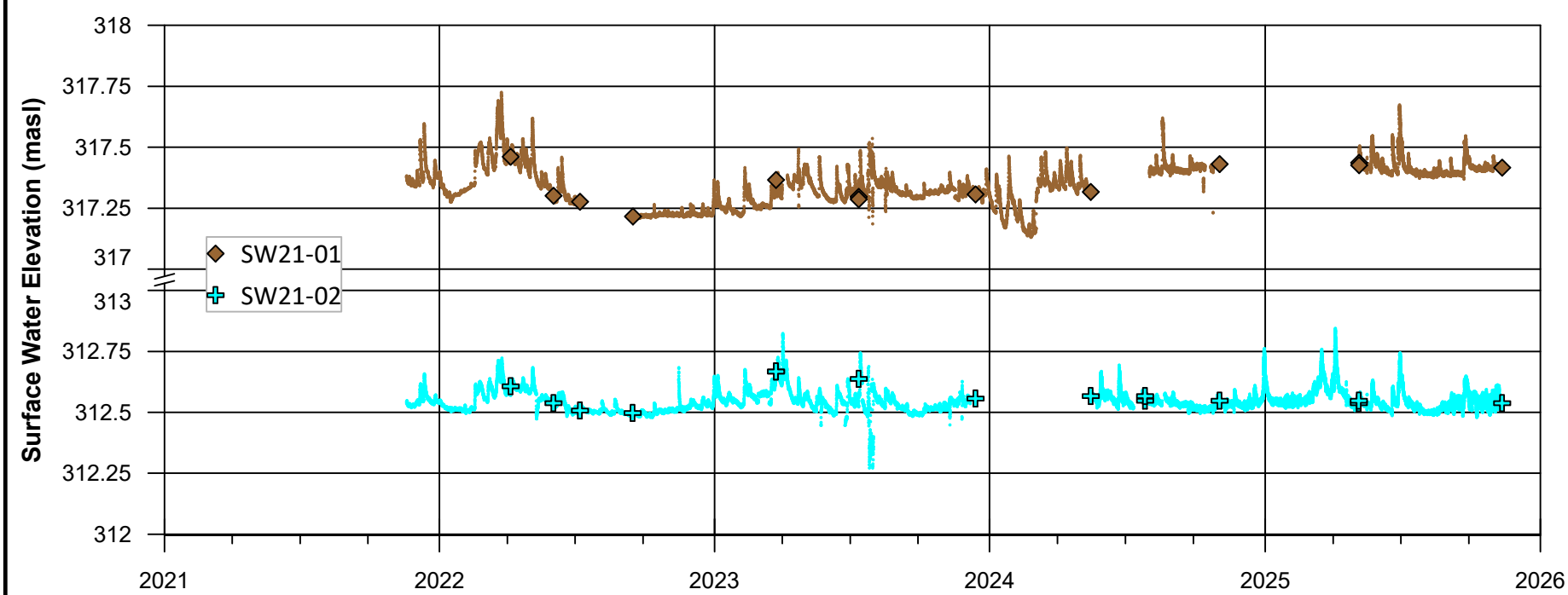
Title
Cross-Section A-A'

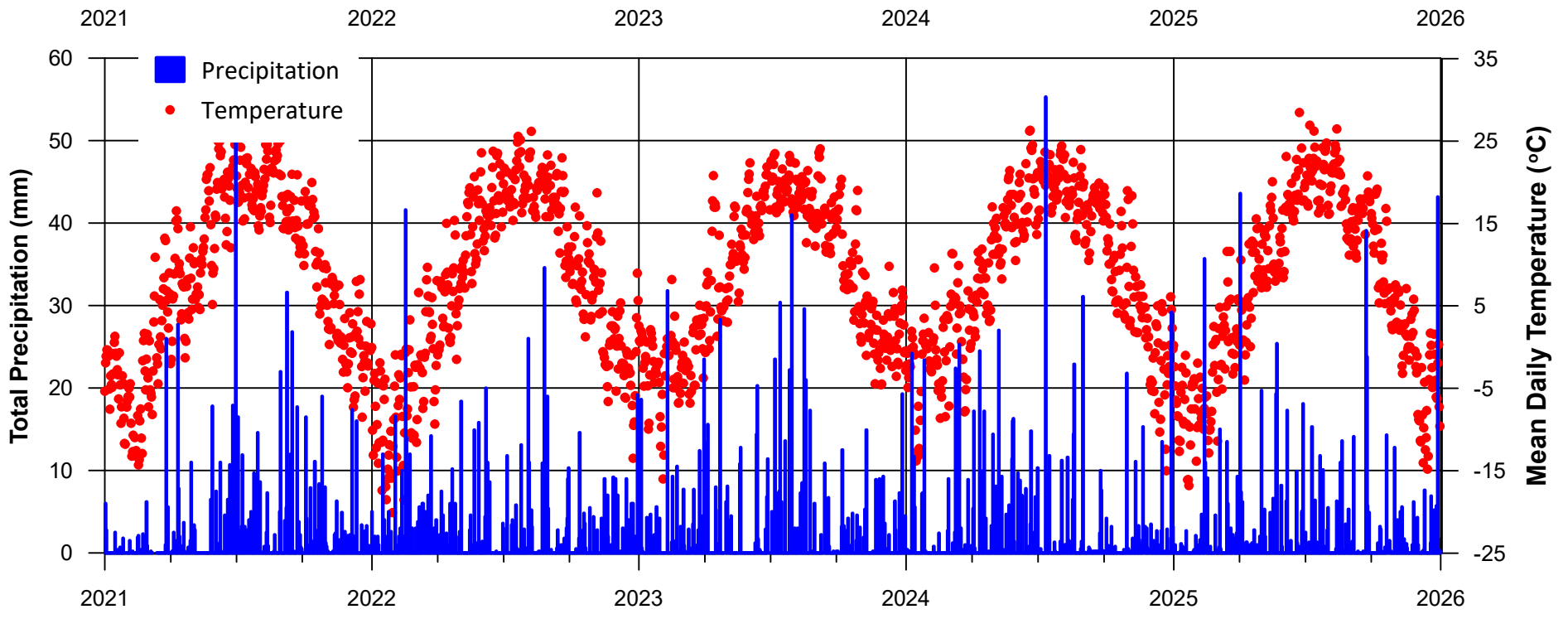
Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

\\Cd0004-pgfs01\01609\active\160961457\03_data\gis_cad\gis\mxds\Hydrogeology\report figures\Hydrogeological Report\160961457 Hydrogeological Rpt Fig05 CrossSection AA.mxd Revised: 2026-02-13 By: PMoser







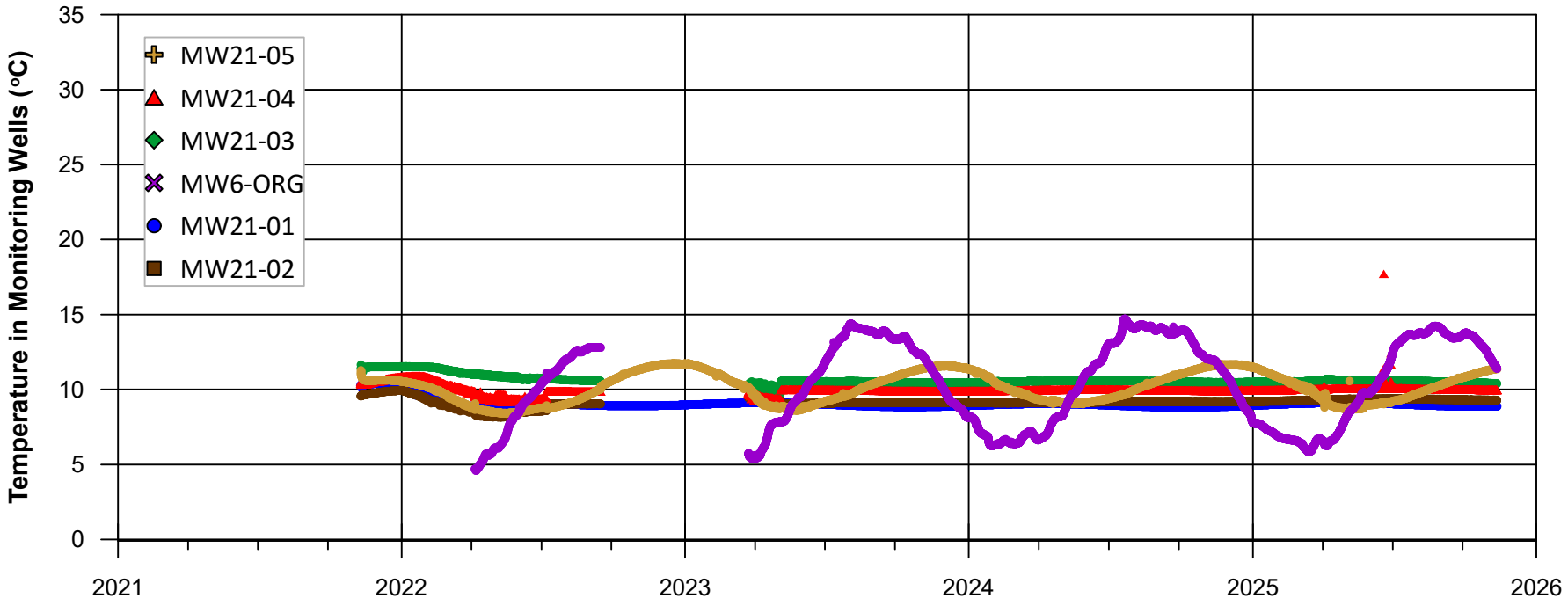


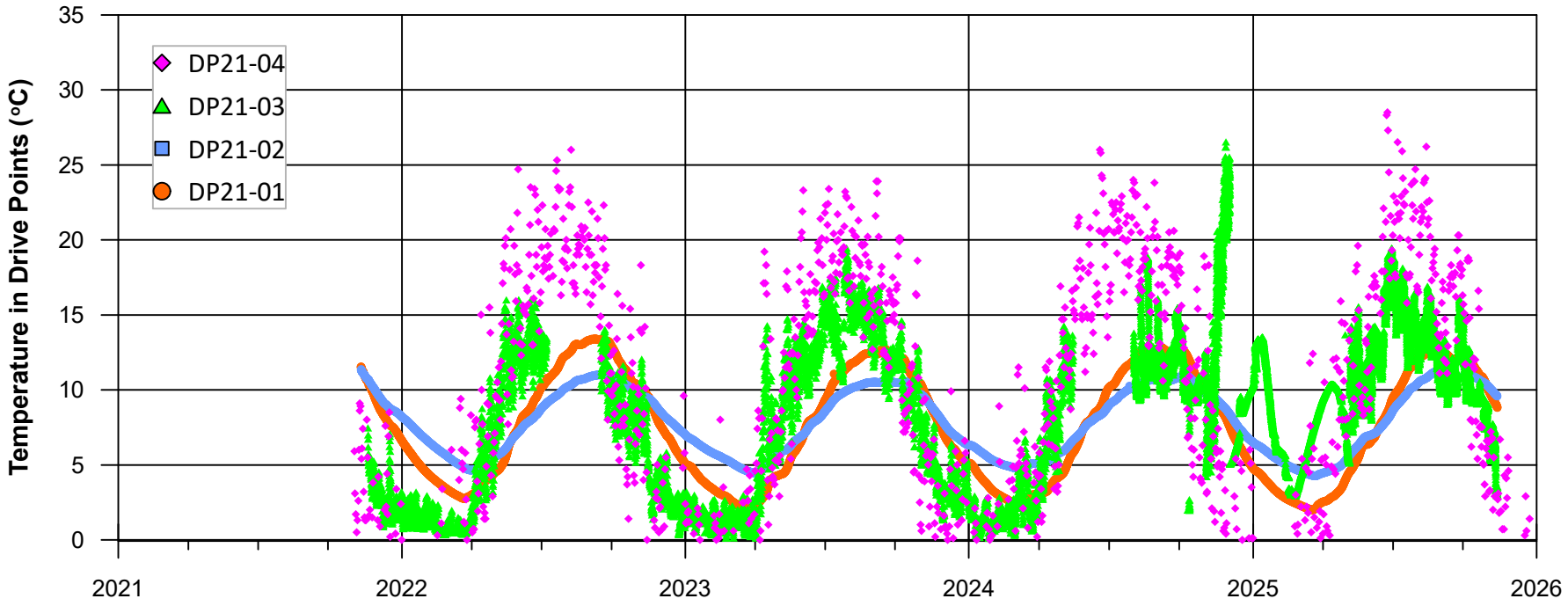
Notes:

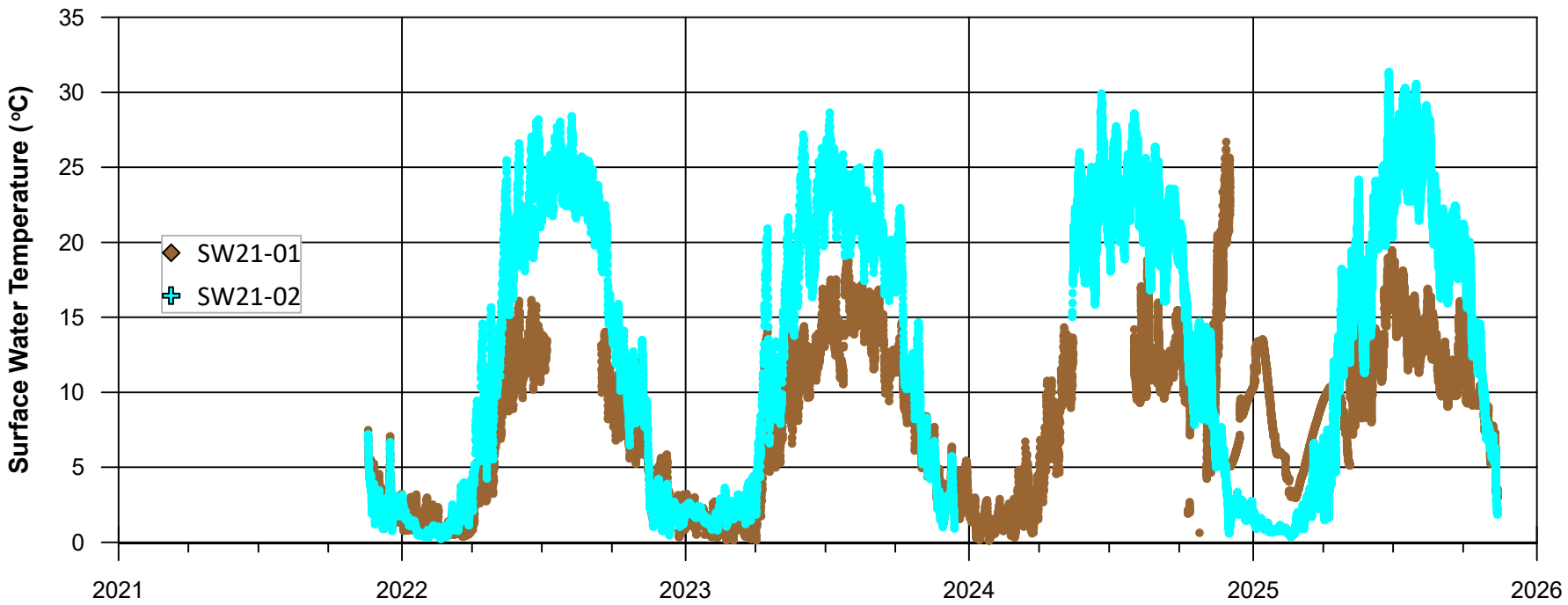
- - - - - - indicates grade elevation at Drive Point locations (below which wetland areas are dry)

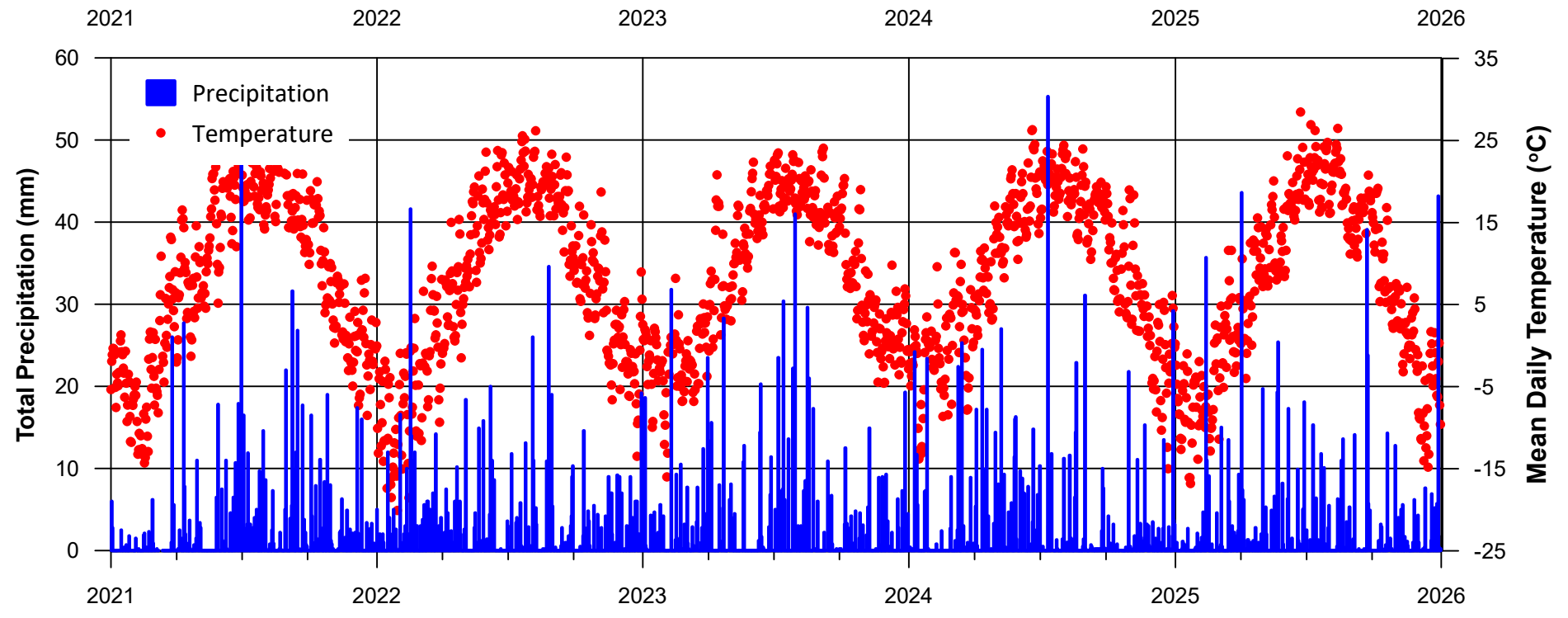
Precipitation / Temperature data obtained from the Environment Canada Station No. 6144239, Region of Waterloo Airport Climate Station

Water Level Monitoring Data	Stantec	
DRAWN: DG	APPROVED: SMD	DATE: Janary 2026
PROJECT NUMBER: 160961457		FIGURE: 6





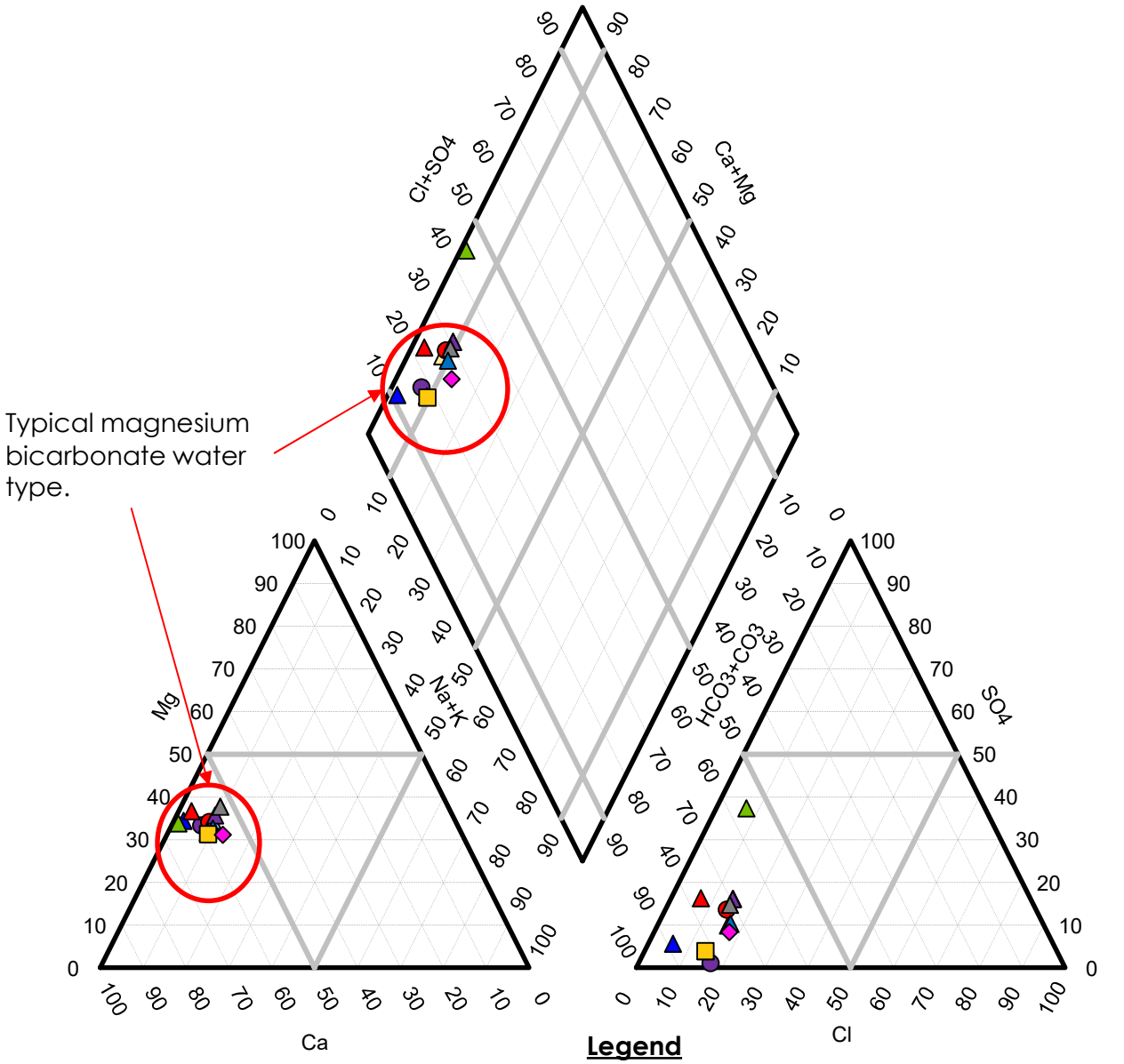




Notes:

- Precipitation / Temperature data obtained from the Environment Canada Station No. 6144239, Region of Waterloo Airport Climate Station

Water Temperature Monitoring Data		Stantec
DRAWN: DG	APPROVED: SMD	DATE: Janary 2026
PROJECT NUMBER: 160961457		FIGURE: 7



Client/Project

LEVEL I AND II WATER REPORT FOR PROPOSED ANTHONY AGGREGATE PIT

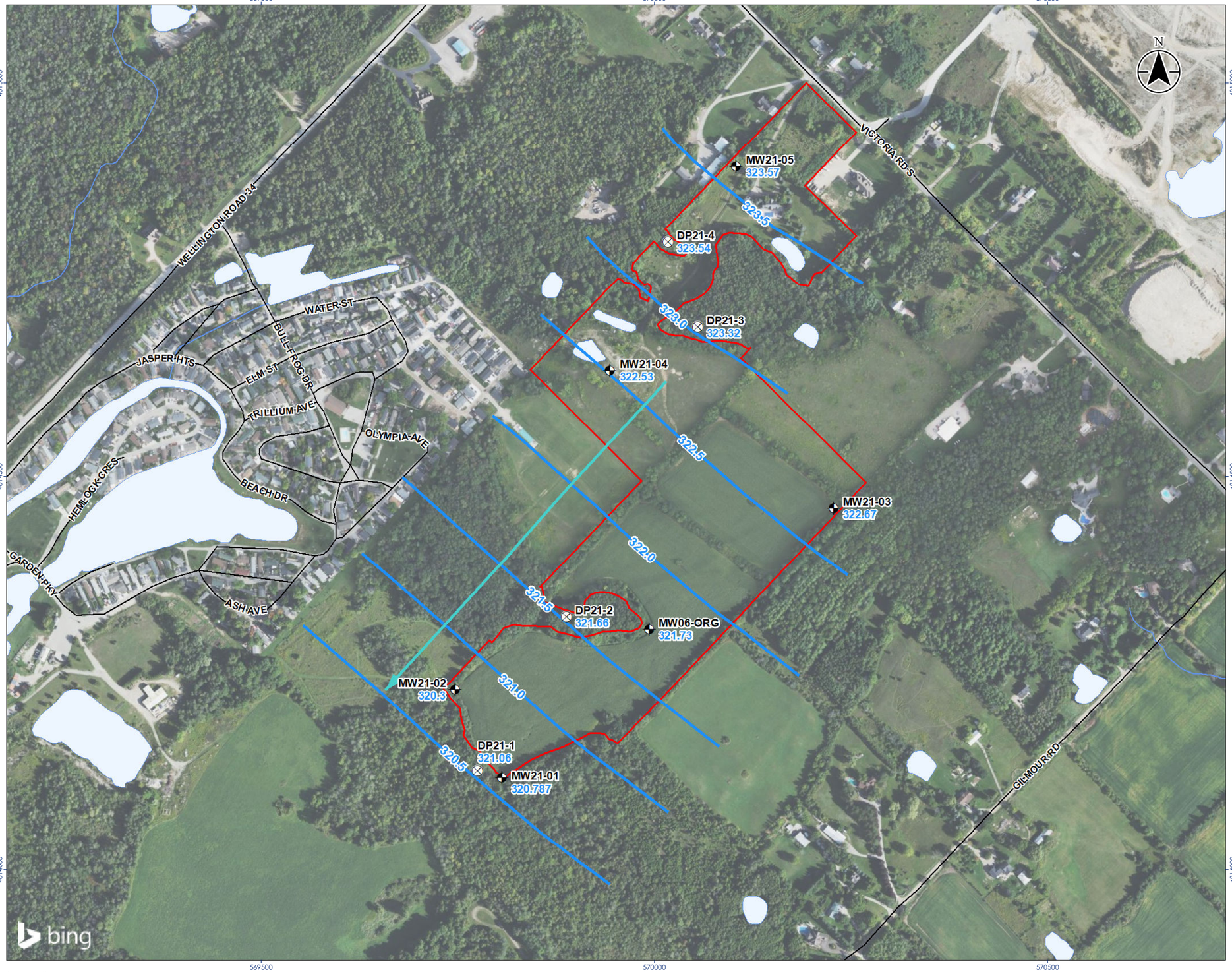
Figure No.

8

Title

Piper Plot Analysis of Water Quality Samples

Stantec



Stantec

Legend

- Site
- 319.90 Observed Groundwater Elevation (masl), July 25, 2024
- Monitoring Well
- Drive-point Piezometer
- Road
- Interpreted Groundwater Flow Direction
- Interpreted Groundwater Elevation Contour (masl)
- Watercourse
- Waterbody

0 100 200 metres
1:5,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Orthoimagery © © 2026 Microsoft Corporation © 2026 Maxar ©CNES (2026) Distribution Airbus DS



Project Location
Puslinch, ON

160961457 REVA
Prepared by PRM on 2026-02-13
Technical Review by SMD on 2026-02-13

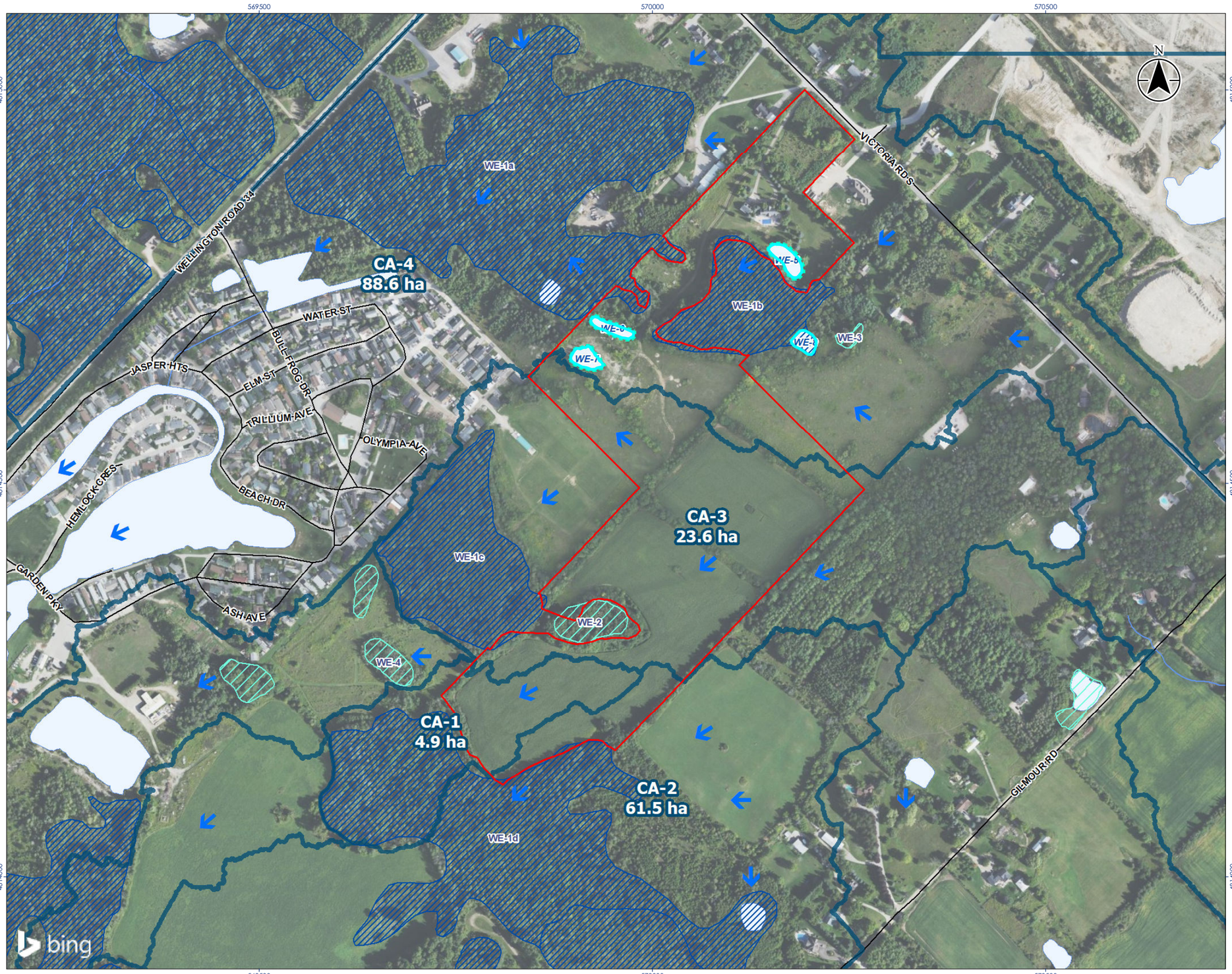
Client/Project
HYDROGEOLOGICAL REPORT
PROPOSED ANTHONY AGGREGATE PIT,
4454 VICTORIA ROAD SOUTH, PUSLINCH, ONTARIO

Figure No.
9

Title
High Groundwater Table Elevations - July 25, 2024

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

C:\2024\pdd\01\160961457\03 data\gis_cad\arcgis\mxds\Hydrogeology\Report Figures\Hydrogeological Report\160961457 Hydrogeological Rpt_Fig09 High GW Elevations_July2024.mxd Revised: 2026-02-13 By: PMoster



Stantec

Legend

- Site
- Overland Flow Direction
- Road
- Watercourse
- Waterbody
- Wetland - Evaluated (Provincial)
- Wetland - Not evaluated per Ontario Wetland Evaluation System
- Closed Depression
- Catchment Boundary

0 100 200 metres

1:5,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Orthoimagery © © 2026 Microsoft Corporation © 2026 Maxar ©CNES (2026) Distribution Airbus DS



Project Location
Puslinch, ON

160961457 REVA
Prepared by PRM on 2026-02-13
Technical Review by SMD on 2026-01-27

Client/Project
HYDROGEOLOGICAL REPORT
PROPOSED ANTHONY AGGREGATE PIT,
4454 VICTORIA ROAD SOUTH, PUSLINCH, ONTARIO

Figure No.
10

Title
Existing (Pre-development) Surface Catchment Areas

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

C:\60004-prod\01\01\160961457\03-data\gis\mxds\HydrogeologicalReport_Figures\HydrogeologicalReport\160961457_HydrogeologicalReport_Rpt_Fig10_PreDevelopmentCatchments.mxd Revised: 2026-02-13 By: PMoser



Stantec

Legend

- Site
- Monitoring Well
- Water Well Location (MECP)
- Road
- Watercourse
- Waterbody
- Proposed Anthony Pit Site Buffer (500m)

0 250 500 metres

1:10,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Orthoimagery © © 2026 Microsoft Corporation © 2026 Maxar ©CNES (2026) Distribution Airbus DS
4. MECP water well record locations have been positioned based on published UTM coordinates and their locations should be considered approximate.



Project Location
Puslinch, ON

160961457 REVA
Prepared by PRM on 2026-02-13
Technical Review by SMD on 2026-02-09

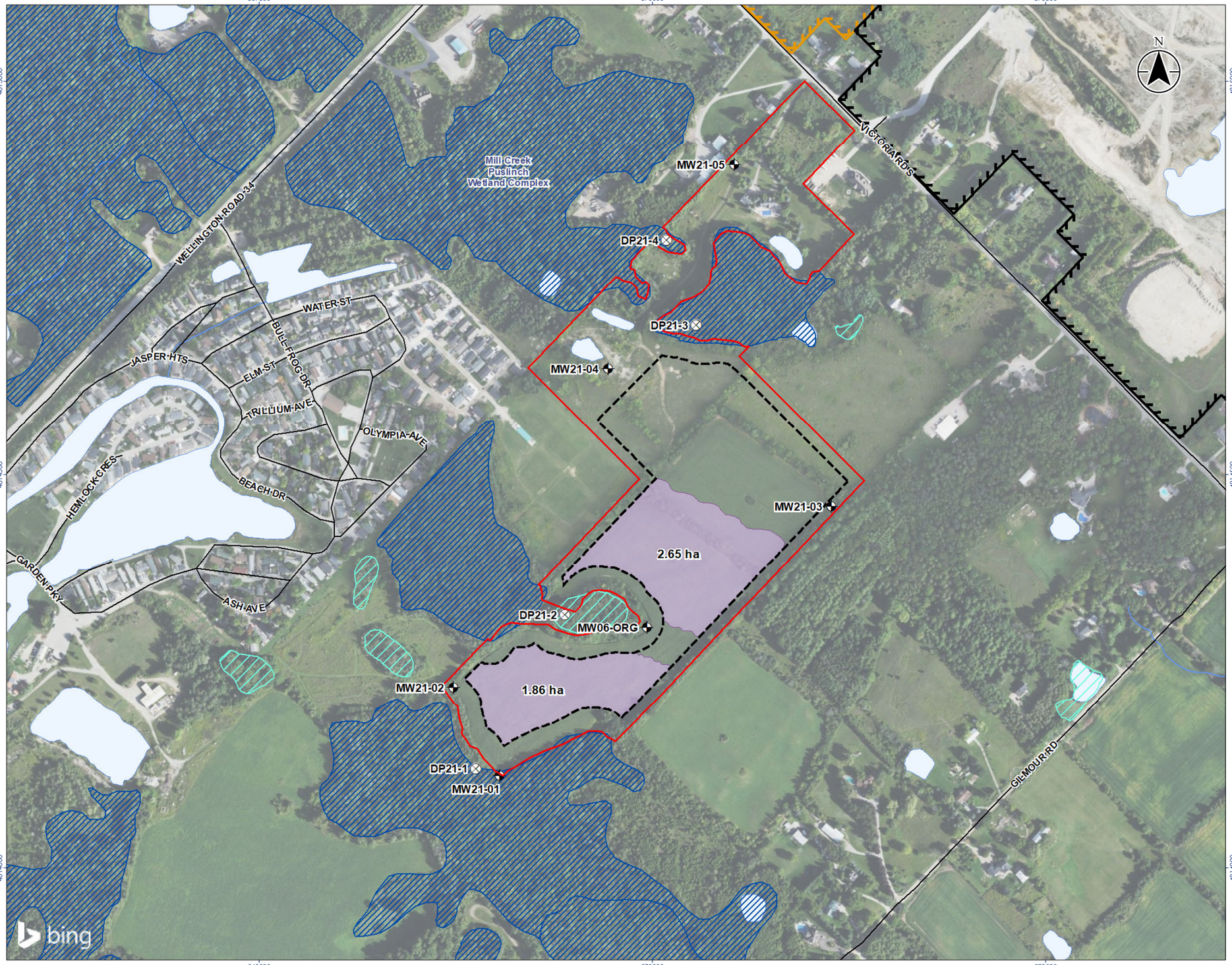
Client/Project
HYDROGEOLOGICAL REPORT
PROPOSED ANTHONY AGGREGATE PIT,
4454 VICTORIA ROAD SOUTH, PUSLINCH, ONTARIO

Figure No.
11

Title
MECP Water Well Records

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

C:\2024\pdf\01\01629\active\160961457\03 data\gis_cad\mxds\Hydrogeology\Report Figures\Hydrogeological Rpt_Fig11_MECP Water Wells.mxd Revised: 2026-02-13 By: PMosier



Stantec

Legend

- Site
- Monitoring Well
- Drive-point Piezometer
- Road
- Watercourse
- Waterbody
- Wetland - Evaluated (Provincial)
- Wetland - Not evaluated per Ontario Wetland Evaluation System
- Dufferin Aggregate Pit
- CBM Tikal Pit (Licence Surrendered)

Extraction Footprints

- Area of Extraction Footprint
- Below Water Table Extraction Footprint

0 100 200 metres
1:5,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Orthoimagery © © 2026 Microsoft Corporation © 2026 Maxar ©CNES (2026) Distribution Airbus DS



Project Location
Puslinch, ON

160961457 REVA
Prepared by PRM on 2026-02-13
Technical Review by SMD on 2026-02-09

Client/Project
HYDROGEOLOGICAL REPORT
PROPOSED ANTHONY AGGREGATE PIT,
4454 VICTORIA ROAD SOUTH, PUSLINCH, ONTARIO

Figure No.
12

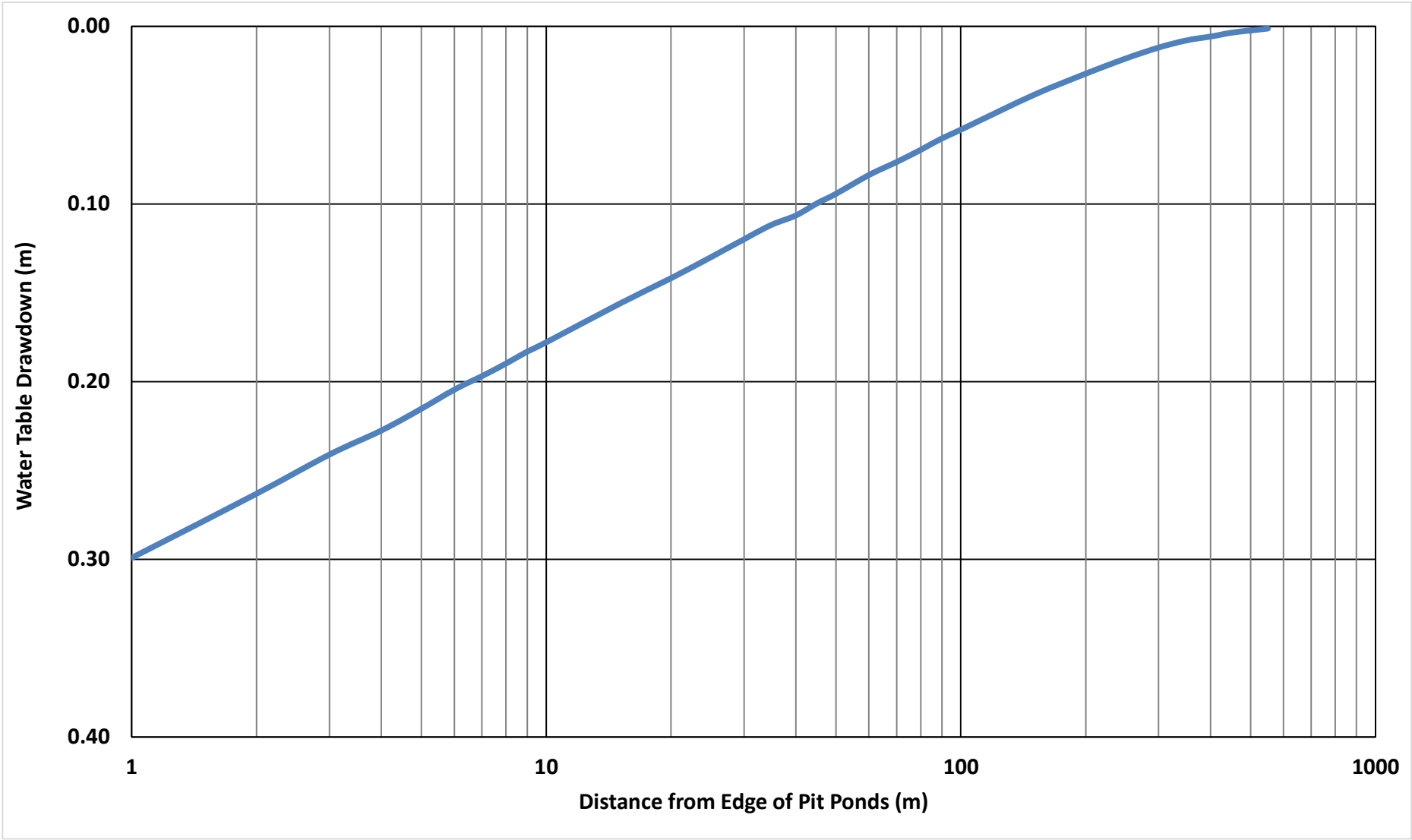
Title
Proposed Anthony Pit Site Plan

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

C:\Projects\active\160961457_data\gis\mxds\Hydrogeological Report_figures\Hydrogeological Report\160961457_Hydrogeological_Rpt_Fig12_Prop_Anthony_Pit_Site_Plan.mxd Revised: 2026-02-13 By: PMoser

Interpreted Water Table Drawdown from Short-Term Aggregate Extraction

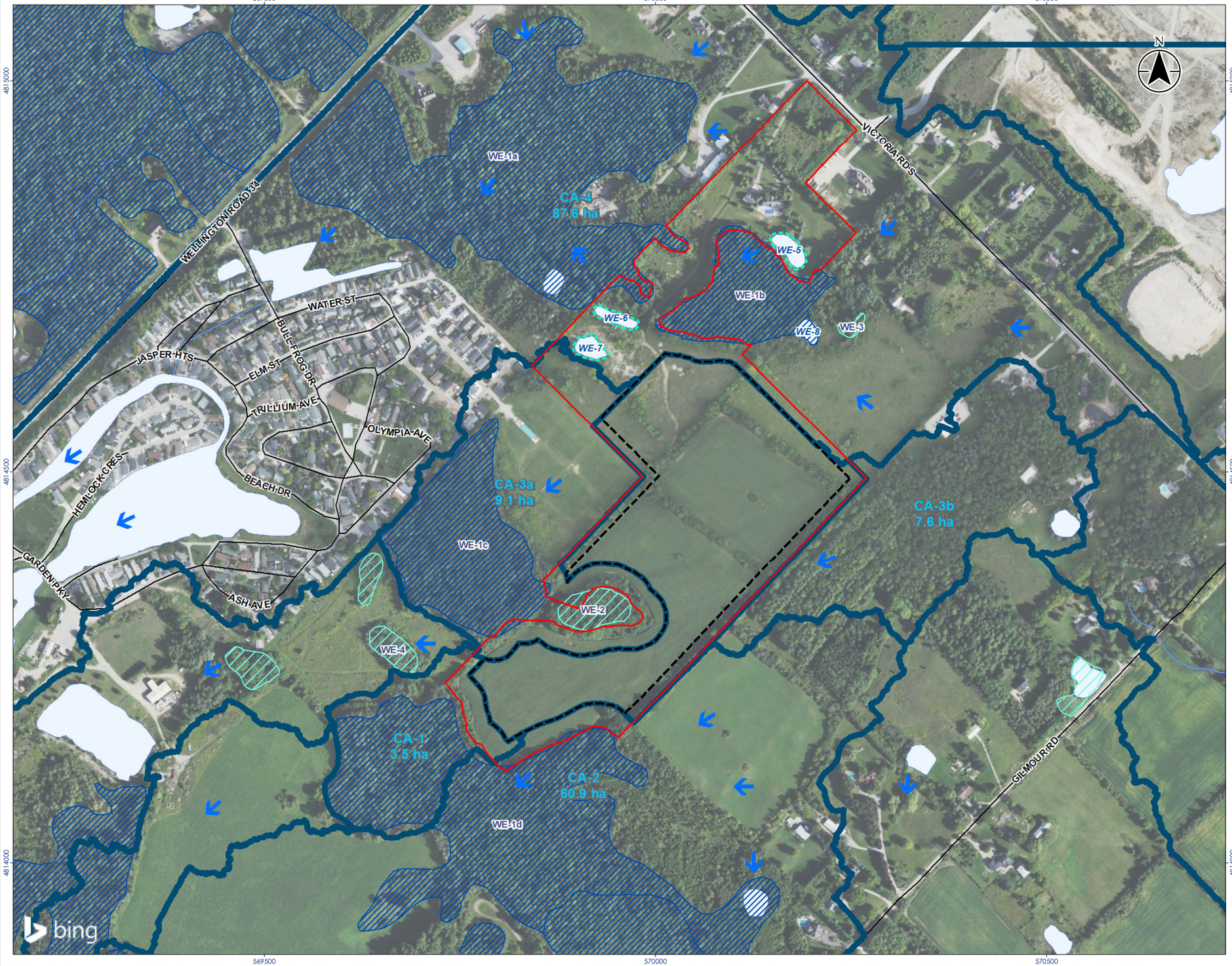
FIGURE 13



DATE: February 2026

PROJECT: 160961457

Stantec



Stantec

Legend

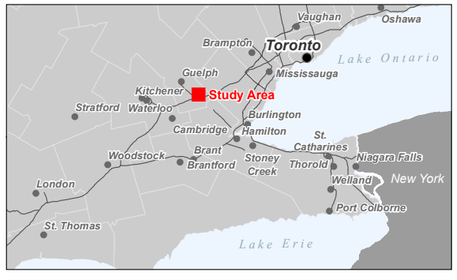
- Site
- Overland Flow Direction
- Road
- Watercourse
- Waterbody
- Wetland - Evaluated (Provincial)
- Wetland - Not evaluated per Ontario Wetland Evaluation System
- Closed Depression
- Catchment Boundary
- Extraction Site Footprint

0 100 200 metres

1:5,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Orthoimagery © © 2026 Microsoft Corporation © 2026 Maxar ©CNES (2026) Distribution Airbus DS



Project Location
Puslinch, ON

160961457 REVA
Prepared by PRM on 2026-02-13
Technical Review by SMD on 2026-02-06

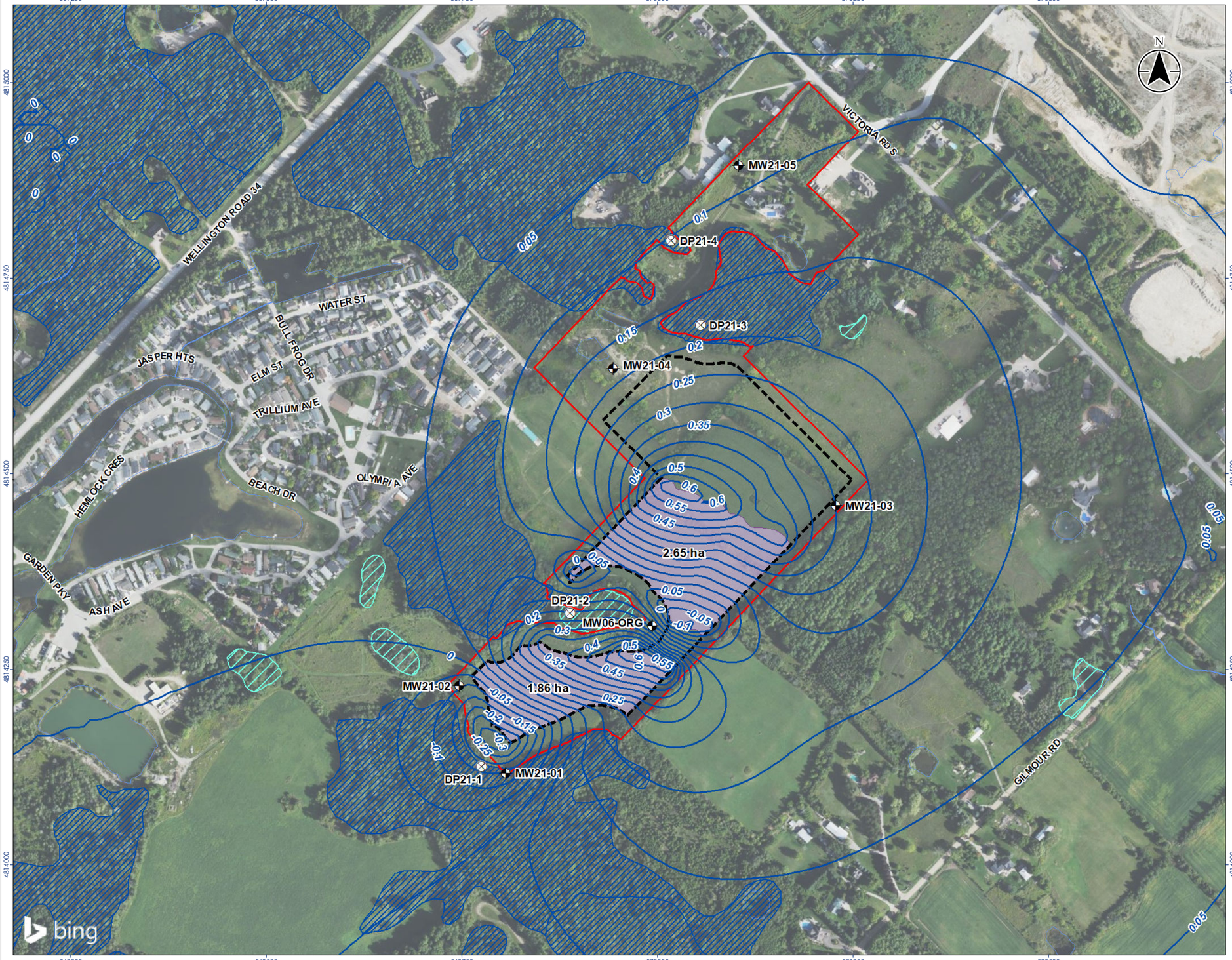
Client/Project
HYDROGEOLOGICAL REPORT
PROPOSED ANTHONY AGGREGATE PIT,
4454 VICTORIA ROAD SOUTH, PUSLINCH, ONTARIO

Figure No.
14

Title
Post-Development Catchments

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

C:\2004\active\160961457\03_data\gis_cad\mxds\Hydrogeology\Report Figures\Hydrogeological_Rpt_Fig14_PostDevelopment_Catchments.mxd Revised: 2026-02-13 By: PMoser



Stantec

Legend

- Site
- Monitoring Well
- Drive-point Piezometer
- Drawdown Contour (0.05m Interval)
- Watercourse
- Waterbody
- Wetland - Evaluated (Provincial)
- Wetland - Not evaluated per Ontario Wetland Evaluation System

Extraction Footprints

- Area of Extraction Footprint
- Below Water Table Extraction Footprint

0 100 200 metres

1:5,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Orthoimagery © © 2026 Microsoft Corporation © 2026 Maxar ©CNES (2026) Distribution Airbus DS



Project Location
Township of Puslinch

160961457 REVA
Prepared by PRM on 2026-02-13
Technical Review by SMD on 2026-02-13

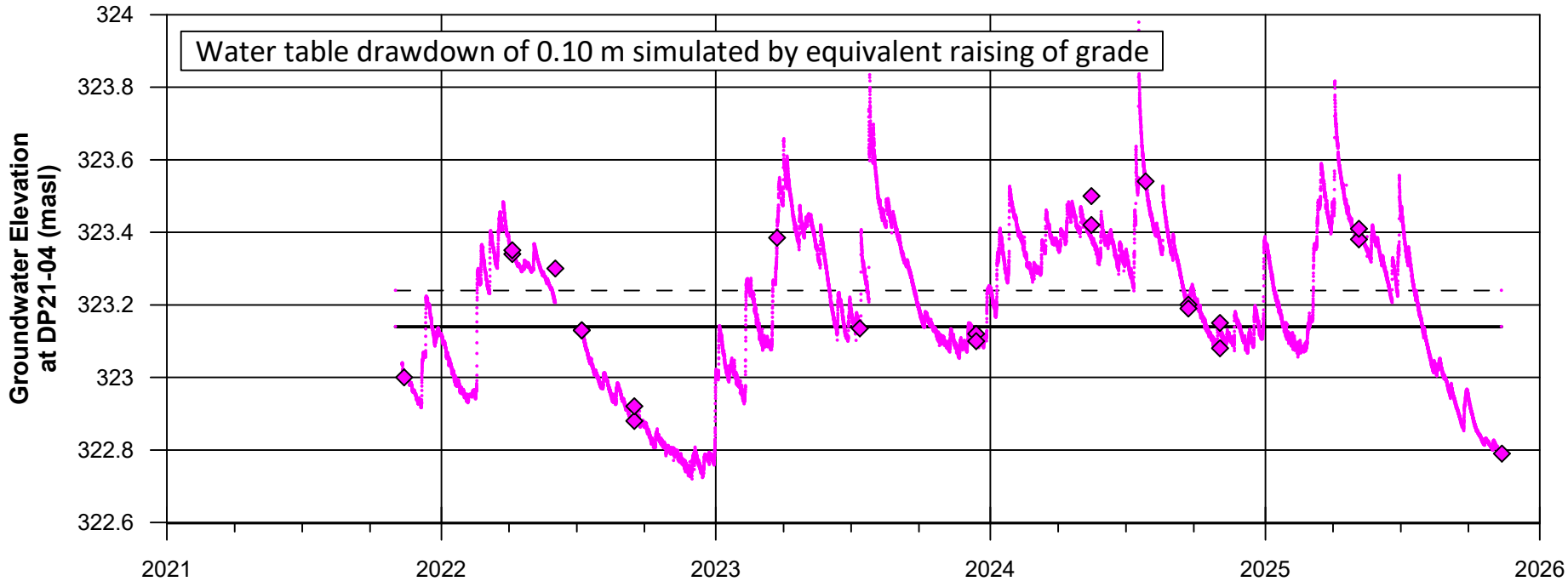
Client/Project
HYDROGEOLOGICAL REPORT
PROPOSED ANTHONY AGGREGATE PIT,
4454 VICTORIA ROAD SOUTH, PUSLINCH, ONTARIO

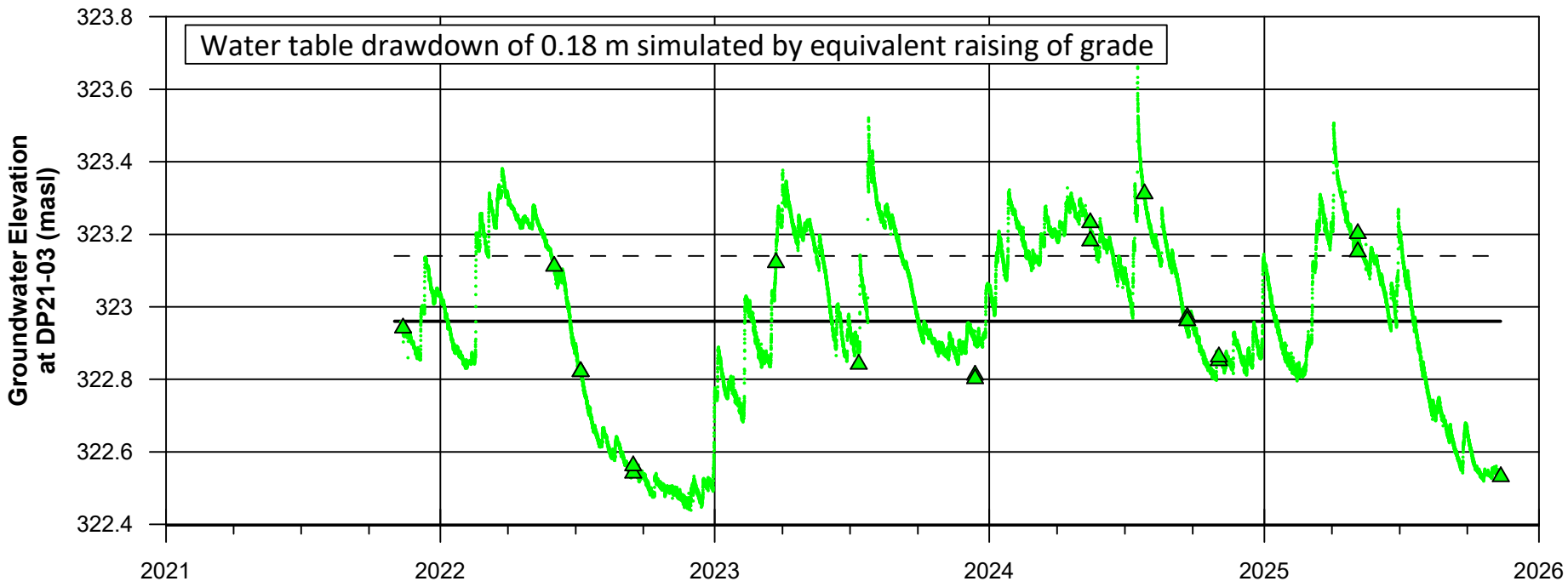
Figure No.
15

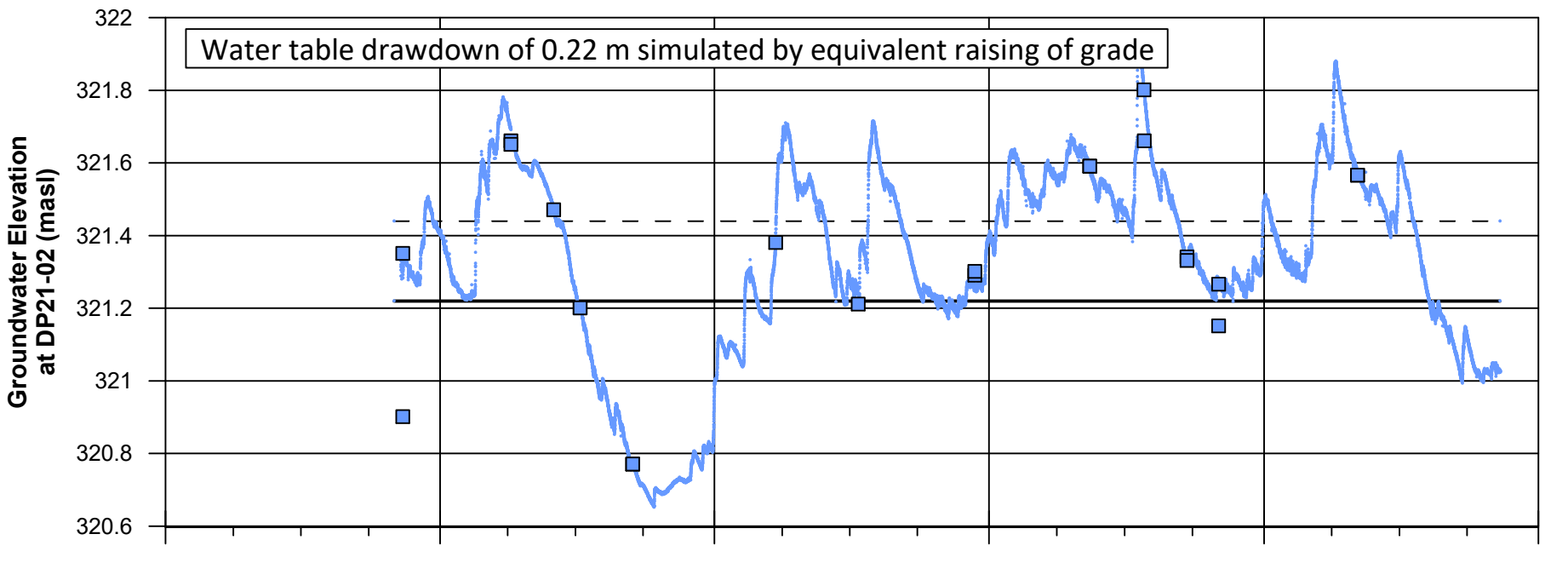
Title
Rehabilitated Condition Water Level Change

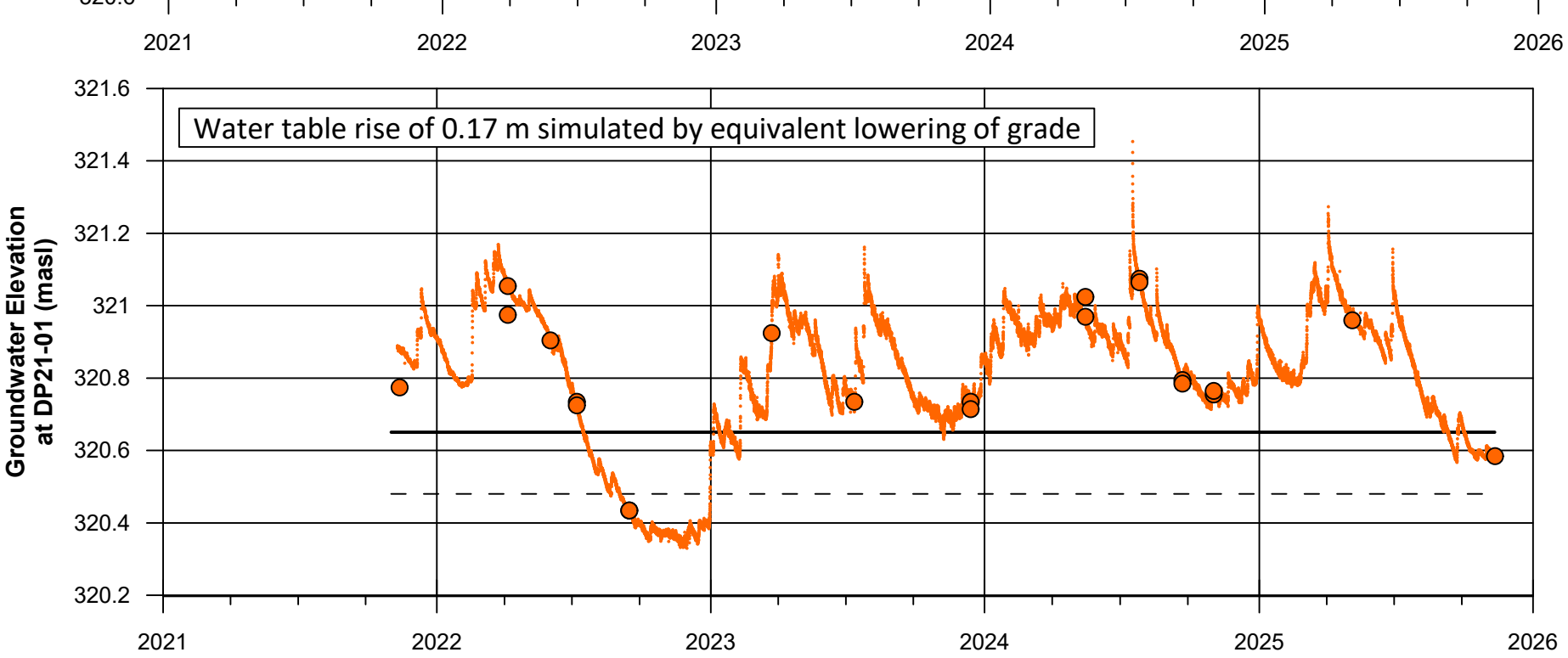
Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

C:\60004-prod\01\01\160961457\active\160961457-03_data\gis_cad\arcmap\mxds\Hydrogeology\report_figures\Hydrogeological Report\160961457 Hydrogeological_Rpt_Fig15_Rehab_Water_Level_Change.mxd Revised: 2026-02-13 By: PMoser









Notes:

_____ indicates actual grade elevation

- - - - - - indicates adjusted grade elevation to simulate changes in water table elevation.

Simulated Changes of Wetland Water Levels		Stantec
DRAWN: DG	APPROVED: SMD	DATE: Janary 2026
PROJECT NUMBER: 160961457		FIGURE: 16

Appendix B

Tables

Table 1
Monitor Completion Details
Hydrogeological Assessment Level I and II Report
Proposed Anthony Aggregate Pit

Monitor ID	Location	Installation Date	Coordinates		Elevation		Stick-up	Borehole Depth	Screen Diameter	Screened Interval				Screened Unit
			Easting	Northing	Ground Surface m AMSL	Top of Casing m AMSL	(m AGS)	(m BGS)	(mm)	Bottom of Screen/Open Hole (m BGS)	Bottom of Screen/Open Hole (m AMSL)	Top of Screen/Open Hole (m BGS)	Top of Screen/Open Hole (m AMSL)	
Monitoring Wells														
MW21-01	Aberfoyle, ON	2021	569805.7	4814118	322.27	323.05	0.78	23.77	50	20.42	301.85	18.90	303.37	Sand/Gravel
MW21-02	Aberfoyle, ON	2021	569746.8	4814230	322.48	323.27	0.79	20.88	50	18.59	303.89	15.54	306.94	Sand/Gravel
MW21-03	Aberfoyle, ON	2021	570227.5	4814460	326.6	327.5	0.90	23.77	50	16.76	309.84	13.72	312.88	Sand/Gravel
MW21-04	Aberfoyle, ON	2021	569943.3	4814635	323.85	324.63	0.78	21.03	50	20.73	303.12	17.68	306.17	Sand/Gravel
MW21-05	Aberfoyle, ON	2021	570103.8	4814894	326.53	327.37	0.84	20.12	50	8.23	318.30	5.18	321.35	Sand/Gravel
MW06-ORG	Aberfoyle, ON	unknown	569992.9	4814306	322.74	323.81	1.07	4.31	50	4.31	318.43	unknown	unknown	Sand/Gravel
Drive-Point Piezometers														
DP21-1	Aberfoyle, ON	2021	569774.9	4814127	320.65	321.73	1.08	1.47	25	1.47	319.18	1.05	319.60	Organics/Sand/Gravel
DP21-2	Aberfoyle, ON	2021	569888.2	4814322	321.22	322.35	1.13	1.42	25	1.42	319.80	1.00	320.22	Organics/Sand/Gravel
DP21-3	Aberfoyle, ON	2021	570055.1	4814690	322.96	323.97	1.01	1.54	25	1.54	321.42	1.12	321.84	Organics/Sand/Gravel
DP21-4	Aberfoyle, ON	2021	570017.5	4814798	323.14	324.2	1.06	1.49	25	1.49	321.65	1.07	322.07	Organics/Sand/Gravel
Staff Gauges														
SG21-1	Aberfoyle, ON	2021	569957.7	4813575	317.17	318.7	1.53	-	-	-	-	-	-	-
SG21-2	Aberfoyle, ON	2021	569165.7	4813266	312.31	313.53	1.22	-	-	-	-	-	-	-

Notes:

- not applicable
m AGS: metres above ground surface
m BGS: metres below ground surface
m AMSL: metres above mean sea level

Table 2
Summary of Soil Testing Results
Hydrogeological Assessment Report
Proposed Anthony Aggregate Pit

Monitor ID	Sample ID	Run Depth Range (m)	Run Depth Range (mASL)	% Gravel	% Sand	%Silt/Clay	d_{10} value (cm)	C coefficient value	K* (m/s)	K+ (m/s)	General Soil Description
MW21-01	1	0 to 2.44	322.27 to 319.83	43.5	53.1	3.4	0.01	115	1E-04		SAND and GRAVEL, trace silt
	2	2.44 to 5.49	319.83 to 316.78	47.0	52.1	0.9	0.04	140	2E-03		SAND and GRAVEL, trace silt
	3	5.49 to 8.53	316.78 to 313.74	14.3	84.9	0.8	0.011	140	2E-04		gravelly SAND, trace silt
	4	8.53 to 9.14	313.74 to 313.13	36.3	63.3	0.4	0.025	145	9E-04		SAND and GRAVEL, trace silt
	5	9.14 to 10.06	313.13 to 312.21	16.4	78.2	5.4	0.008	95	6E-05		gravelly SAND, some silt
	6	10.06 to 11.58	312.21 to 310.69	2.7	91.7	5.6	0.008	95	6E-05		SAND, some silt, trace gravel
	7	11.58 to 13.11	310.69 to 309.16	48.1	51.2	0.7	0.011	142	2E-04		SAND and GRAVEL, trace silt
	8	13.11 to 14.63	309.16 to 307.64	0.7	97.5	1.8	0.009	132	1E-04		SAND, trace gravel and silt
	9	14.63 to 16.15	307.64 to 306.12	32.4	67.0	0.6	0.02	145	6E-04		gravelly SAND, trace silt
	10	16.15 to 17.68	306.12 to 304.59	59.2	39.7	1.1	0.025	139	9E-04		SAND and GRAVEL, trace silt
	11	17.68 to 19.20	304.59 to 303.07	49.6	48.7	1.7	0.011	132	2E-04		SAND and GRAVEL, trace silt
	12	19.20 to 20.73	303.07 to 301.54	56.2	43.1	0.7	0.02	145	6E-04	3E-04	SAND and GRAVEL, trace silt
	13	20.73 to 22.25	301.54 to 300.02	49.1	49.6	1.3	0.011	137	2E-04		SAND and GRAVEL, trace silt
	14	22.25 to 23.77	300.02 to 298.5	36.3	62.4	1.3	0.011	137	2E-04		SAND and GRAVEL, trace silt
MW21-02	1	0 to 1.52	322.48 to 320.96	70.8	28.8	0.4	0.09	145	1E-02		sandy GRAVEL, trace silt
	2	1.52 to 2.44	320.96 to 320.04	68.7	30.3	1.0	0.05	140	4E-03		gravelly SAND, trace silt
	3	2.44 to 3.96	320.04 to 318.52	87.0	12.8	0.2	0.3	148	1E-01		GRAVEL, some sand, trace silt
	4	3.96 to 5.49	318.52 to 316.99	50.5	49.1	0.4	0.03	145	1E-03		SAND and GRAVEL, trace silt
	5	5.49 to 7.01	316.99 to 315.47	0.0	96.0	4.0	0.08	110	7E-03		SAND, trace silt
	6	7.01 to 8.53	315.47 to 313.95	0.0	97.5	2.5	0.08	125	8E-03		SAND, trace silt
	7	8.53 to 10.06	313.95 to 312.42	0.0	50.8	49.2	0.005	40	1E-05		SAND and SILT
	8	10.06 to 11.58	312.42 to 310.90	0.0	62.2	37.8	0.006	52	2E-05		SAND and SILT
	9	11.58 to 13.11	310.9 to 309.37	3.5	94.5	2.0	0.01	130	1E-04		SAND, trace gravel and silt
	10	13.11 to 14.63	309.37 to 307.85	65.1	34.5	0.4	0.035	145	2E-03		SAND and GRAVEL, trace silt
	11	14.63 to 16.15	307.85 to 306.33	25.1	71.9	3.0	0.01	120	1E-04	2E-04	gravelly SAND, trace silt
	12	16.15 to 17.68	306.33 to 304.80	13.5	84.8	1.7	0.01	132	1E-04		gravelly SAND, trace silt
	13	17.68 to 19.20	304.8 to 303.28	0.0	99.2	0.8	0.01	141	1E-04		SAND, trace silt
	14	19.20 to 20.73	303.28 to 301.75	36.4	61.5	2.1	0.01	129	1E-04		SAND and GRAVEL, trace silt
MW21-03	1	0 to 1.52	326.60 to 325.08	43.7	55.6	0.7	0.023	140	7E-04		SAND and GRAVEL, trace silt
	2	1.52 to 3.05	325.08 to 323.55	75.6	24.1	0.3	0.1	143	1E-02		sandy GRAVEL, trace silt
	3	3.05 to 3.96	323.55 to 322.64	88.4	11.5	0.1	0.4	143	2E-01		sandy GRAVEL, trace silt
	4	3.96 to 5.49	322.64 to 321.11	63.3	36.4	0.3	0.08	143	9E-03		SAND and GRAVEL, trace silt
	5	5.49 to 8.53	321.11 to 318.07	80.8	19.0	0.2	0.18	143	5E-02		sandy GRAVEL, trace silt
	6	8.53 to 10.06	318.07 to 316.54	0.4	98.4	1.2	0.011	138	2E-04		SAND, trace gravel and silt
	7	10.06 to 11.58	316.54 to 315.02	0.0	94.2	5.8	0.008	97	6E-05		SAND, some silt
	8	11.58 to 13.11	315.02 to 313.49	0.0	92.8	7.2	0.0078	94	6E-05		SAND, some silt
	9	13.11 to 14.63	313.49 to 311.97	0.8	97.2	2.0	0.0087	130	1E-04	1E-04	SAND, trace gravel and silt
	10	14.63 to 16.15	311.97 to 310.45	34.1	62.8	3.1	0.012	118	2E-04		gravelly SAND, trace silt
	11	16.15 to 17.68	310.45 to 308.92	0.0	85.7	14.3	0.007	80	4E-05		SAND and SILT
	12	17.68 to 19.20	308.92 to 307.40	35.3	63.8	0.9	0.0089	140	1E-04		SAND and GRAVEL, trace silt
	13	19.20 to 20.73	307.40 to 305.87	26.9	69.7	3.4	0.0087	115	9E-05		gravelly SAND, trace silt
	14	20.73 to 22.25	305.87 to 304.35	3.5	94.0	2.5	0.01	125	1E-04		SAND, trace gravel and silt
	15	22.25 to 23.77	304.35 to 302.83	0.4	93.7	5.9	0.008	96	6E-05		SAND, some silt, trace gravel
MW21-04	1	0 to 1.52	323.85 to 322.33	47.1	51.7	1.2	0.011	138	2E-04		SAND and GRAVEL, trace silt
	2	1.52 to 2.74	322.33 to 321.11	54.0	45.3	0.7	0.017	140	4E-04		SAND and GRAVEL, trace silt
	3	2.74 to 4.27	321.11 to 319.58	52.7	47.1	0.2	0.05	146	4E-03		SAND and GRAVEL, trace silt
	4	4.27 to 5.79	319.58 to 318.06	48.4	51.3	0.3	0.04	146	2E-03		SAND and GRAVEL, trace silt
	5	5.79 to 7.32	318.06 to 316.53	0.0	98.7	1.3	0.008	138	9E-05		SAND, trace silt
	6	7.32 to 8.84	316.53 to 315.01	0.0	65.1	34.9	0.005	55	1E-05		Silty SAND
	7	8.84 to 10.36	315.01 to 313.49	0.0	58.0	42.0	0.005	47	1E-05		SAND and SILT
	8	10.36 to 11.89	313.49 to 311.96	0.0	82.0	18.0	0.0066	75	3E-05		Silty SAND
	9	11.89 to 13.41	311.96 to 310.44	10.3	89.2	0.5	0.0088	142	1E-04		gravelly SAND, trace silt
	10	13.41 to 14.94	310.44 to 308.91	2.3	92.3	5.4	0.009	96	8E-05		SAND, some silt, trace gravel
	11	14.94 to 16.46	308.91 to 307.39	0.0	61.7	38.3	0.005	51	1E-05		SAND and SILT
	12	16.46 to 17.98	307.39 to 305.87	2.1	96.9	1.0	0.017	140	4E-04		SAND, trace gravel and silt
	13	17.98 to 18.59	305.87 to 305.26	90.5	9.4	0.1	0.27	150	1E-01	6E-05	GRAVEL, some sand, trace silt
	14	18.59 to 20.12	305.26 to 303.73	69.8	29.7	0.5	0.08	145	9E-03		sandy GRAVEL, trace silt
	15	20.12 to 21.03	303.73 to 302.82	99.4	0.6	0.0	1	150	2E+00		GRAVEL, trace sand
MW21-05	1	0 to 1.52	326.53 to 325.01	67.8	31.5	0.7	0.006	142	5E-05		sandy GRAVEL, trace silt
	2	1.52 to 2.44	325.01 to 324.09	74.8	24.9	0.3	0.009	145	1E-04		sandy GRAVEL, trace silt
	3	2.44 to 3.96	324.09 to 322.57	70.6	29.2	0.2	0.008	147	9E-05		sandy GRAVEL, trace silt
	4	3.96 to 5.49	322.57 to 321.04	83.2	16.6	0.2	0.2	147	6E-02		sandy GRAVEL, trace silt
	5	5.49 to 7.01	321.04 to 319.52	76.8	23.1	0.1	0.11	150	2E-02	1E-02	sandy GRAVEL, trace silt
	6	7.01 to 8.53	319.52 to 318.00	0.0	86.9	13.1	0.007	85	4E-05		silty SAND
	7	8.53 to 10.06	318.00 to 316.47	52.2	45.8	2.0	0.014	130	3E-04		SAND and GRAVEL, trace silt
	8	10.06 to 11.58	316.47 to 314.95	34.4	64.3	1.3	0.011	135	2E-04		gravelly SAND, trace silt
	9	11.58 to 13.11	314.95 to 313.42	31.0	65.5	3.5	0.01	115	1E-04		gravelly SAND, trace silt
	10	13.11 to 14.63	313.42 to 311.9	34.2	62.3	3.5	0.01	115	1E-04		gravelly SAND, trace silt
	11	14.63 to 16.15	311.9 to 310.38	35.0	60.4	4.6	0.01	105	1E-04		SAND and GRAVEL, trace silt
	12	16.15 to 17.68	310.38 to 308.85	26.0	69.8	4.2	0.01	105	1E-04		gravelly SAND, trace silt
	13	17.68 to 19.20	308.85 to 307.33	64.7	34.6	0.7	0.015	142	3E-04		sandy GRAVEL, trace silt

Note: * - indicates hydraulic conductivity has been interpreted from grain size analyses using Hazen Method

+ - indicates hydraulic conductivity has been interpreted from in-situ well response tests

Table 3
Water Level Monitoring Results
Hydrogeological Assessment Level I and II Report
Proposed Anthony Aggregate Pit

Location ID	Coordinates		Date	Time	Elevation		Stick-up	GW level	SW level	GW Elev	SW Elev
	Easting	Northing			Ground Surface m AMSL	Top of Casing m AMSL	(m AGS)	m BTOC	m BTOC	m AMSL	m AMSL
MW21-01	569805.7	4814118	10-Nov-21	10:13	322.27	323.05	0.78	2.62	-	320.44	-
MW21-01	569805.7	4814118	5-Apr-22	10:40	322.27	323.05	0.78	2.31	-	320.74	-
MW21-01	569805.7	4814118	1-Jun-22	12:57	322.27	323.05	0.78	2.46	-	320.59	-
MW21-01	569805.7	4814118	6-Jul-22	13:10	322.27	323.05	0.78	2.62	-	320.43	-
MW21-01	569805.7	4814118	14-Sep-22	10:10	322.27	323.05	0.78	2.89	-	320.16	-
MW21-01	569805.7	4814118	23-Mar-23	11:10	322.27	323.05	0.78	2.38	-	320.68	-
MW21-01	569805.7	4814118	4-May-23	10:55	322.27	323.05	0.78	2.34	-	320.71	-
MW21-01	569805.7	4814118	11-Jul-23	10:43	322.27	323.05	0.78	2.59	-	320.46	-
MW21-01	569805.7	4814118	13-Dec-23	13:04	322.27	323.05	0.78	2.52	-	320.53	-
MW21-01	569805.7	4814118	14-May-24	10:41	322.27	323.05	0.78	2.36	-	320.70	-
MW21-01	569805.7	4814118	25-Jul-24	14:35	322.27	323.05	0.78	2.26	-	320.79	-
MW21-01	569805.7	4814118	20-Sep-24	15:04	322.27	323.05	0.78	2.56	-	320.49	-
MW21-01	569805.7	4814118	1-Nov-24	12:44	322.27	323.05	0.78	2.58	-	320.47	-
MW21-01	569805.7	4814118	5-May-25	9:52	322.27	323.05	0.78	2.38	-	320.67	-
MW21-01	569805.7	4814118	11-Nov-25	11:02	322.27	323.05	0.78	2.72	-	320.33	-
MW21-02	569746.8	4814230.1	10-Nov-21	11:43	322.48	323.27	0.79	3.14	-	320.13	-
MW21-02	569746.8	4814230.1	5-Apr-22	11:05	322.48	323.27	0.79	2.96	-	320.31	-
MW21-02	569746.8	4814230.1	1-Jun-22	12:50	322.48	323.27	0.79	3.10	-	320.17	-
MW21-02	569746.8	4814230.1	6-Jul-22	14:25	322.48	323.27	0.79	3.27	-	320.00	-
MW21-02	569746.8	4814230.1	14-Sep-22	10:35	322.48	323.27	0.79	3.47	-	319.80	-
MW21-02	569746.8	4814230.1	23-Mar-23	11:10	322.48	323.27	0.79	2.97	-	320.30	-
MW21-02	569746.8	4814230.1	4-May-23	10:55	322.48	323.27	0.79	2.97	-	320.30	-
MW21-02	569746.8	4814230.1	11-Jul-23	10:43	322.48	323.27	0.79	3.29	-	319.98	-
MW21-02	569746.8	4814230.1	13-Dec-23	13:04	322.48	323.27	0.79	3.26	-	320.01	-
MW21-02	569746.8	4814230.1	14-May-24	10:41	322.48	323.27	0.79	3.06	-	320.21	-
MW21-02	569746.8	4814230.1	25-Jul-24	14:35	322.48	323.27	0.79	2.98	-	320.29	-
MW21-02	569746.8	4814230.1	20-Sep-24	15:04	322.48	323.27	0.79	3.27	-	320.00	-
MW21-02	569746.8	4814230.1	1-Nov-24	12:44	322.48	323.27	0.79	3.27	-	320.00	-
MW21-02	569746.8	4814230.1	5-May-25	9:42	322.48	323.27	0.79	3.10	-	320.18	-
MW21-02	569746.8	4814230.1	11-Nov-25	10:51	322.48	323.27	0.79	3.37	-	319.90	-
MW21-03	570227.5	4814460	10-Nov-21	12:23	326.60	327.50	0.90	5.30	-	322.20	-
MW21-03	570227.5	4814460	5-Apr-22	11:56	326.60	327.50	0.90	4.93	-	322.57	-
MW21-03	570227.5	4814460	1-Jun-22	13:57	326.60	327.50	0.90	5.04	-	322.46	-
MW21-03	570227.5	4814460	6-Jul-22	15:42	326.60	327.50	0.90	5.26	-	322.24	-
MW21-03	570227.5	4814460	14-Sep-22	11:57	326.60	327.50	0.90	5.60	-	321.90	-
MW21-03	570227.5	4814460	23-Mar-23	12:53	326.60	327.50	0.90	5.36	-	322.14	-
MW21-03	570227.5	4814460	4-May-23	12:41	326.60	327.50	0.90	5.12	-	322.38	-
MW21-03	570227.5	4814460	11-Jul-23	12:00	326.60	327.50	0.90	5.32	-	322.18	-
MW21-03	570227.5	4814460	13-Dec-23	12:11	326.60	327.50	0.90	5.31	-	322.19	-
MW21-03	570227.5	4814460	14-May-24	12:53	326.60	327.50	0.90	5.00	-	322.50	-
MW21-03	570227.5	4814460	25-Jul-24	14:06	326.60	327.50	0.90	4.83	-	322.67	-
MW21-03	570227.5	4814460	20-Sep-24	14:45	326.60	327.50	0.90	5.19	-	322.31	-
MW21-03	570227.5	4814460	1-Nov-24	12:27	326.60	327.50	0.90	5.32	-	322.18	-
MW21-03	570227.5	4814460	5-May-25	9:06	326.60	327.50	0.90	5.05	-	322.46	-
MW21-03	570227.5	4814460	11-Nov-25	9:33	326.60	327.50	0.90	5.55	-	321.95	-
MW21-04	569943.3	4814635.2	10-Nov-21	11:03	323.85	324.63	0.78	2.33	-	322.30	-
MW21-04	569943.3	4814635.2	5-Apr-22	12:27	323.85	324.63	0.78	2.12	-	322.52	-
MW21-04	569943.3	4814635.2	1-Jun-22	12:22	323.85	324.63	0.78	2.23	-	322.40	-
MW21-04	569943.3	4814635.2	6-Jul-22	16:28	323.85	324.63	0.78	2.34	-	322.29	-
MW21-04	569943.3	4814635.2	14-Sep-22	13:25	323.85	324.63	0.78	2.49	-	322.14	-
MW21-04	569943.3	4814635.2	23-Mar-23	14:05	323.85	324.63	0.78	2.26	-	322.37	-
MW21-04	569943.3	4814635.2	4-May-23	13:49	323.85	324.63	0.78	2.21	-	322.42	-
MW21-04	569943.3	4814635.2	11-Jul-23	13:11	323.85	324.63	0.78	2.38	-	322.25	-
MW21-04	569943.3	4814635.2	13-Dec-23	12:00	323.85	324.63	0.78	2.36	-	322.27	-
MW21-04	569943.3	4814635.2	14-May-24	14:04	323.85	324.63	0.78	2.18	-	322.46	-
MW21-04	569943.3	4814635.2	25-Jul-24	16:14	323.85	324.63	0.78	2.08	-	322.55	-
MW21-04	569943.3	4814635.2	20-Sep-24	16:05	323.85	324.63	0.78	2.30	-	322.33	-
MW21-04	569943.3	4814635.2	1-Nov-24	14:04	323.85	324.63	0.78	2.32	-	322.31	-
MW21-04	569943.3	4814635.2	5-May-25	10:21	323.85	324.63	0.78	2.17	-	322.47	-
MW21-04	569943.3	4814635.2	11-Nov-25	11:49	323.85	324.63	0.78	2.48	-	322.15	-
MW21-05	570103.8	4814894.3	10-Nov-21	9:24	326.53	327.37	0.84	4.18	-	323.20	-
MW21-05	570103.8	4814894.3	5-Apr-22	12:57	326.53	327.37	0.84	3.84	-	323.53	-
MW21-05	570103.8	4814894.3	1-Jun-22	14:30	326.53	327.37	0.84	3.96	-	323.41	-
MW21-05	570103.8	4814894.3	6-Jul-22	17:53	326.53	327.37	0.84	4.17	-	323.20	-
MW21-05	570103.8	4814894.3	14-Sep-22	14:05	326.53	327.37	0.84	4.46	-	322.91	-
MW21-05	570103.8	4814894.3	23-Mar-23	14:50	326.53	327.37	0.84	4.02	-	323.35	-
MW21-05	570103.8	4814894.3	4-May-23	14:33	326.53	327.37	0.84	3.91	-	323.46	-
MW21-05	570103.8	4814894.3	11-Jul-23	13:58	326.53	327.37	0.84	4.21	-	323.16	-
MW21-05	570103.8	4814894.3	13-Dec-23	13:50	326.53	327.37	0.84	4.22	-	323.15	-
MW21-05	570103.8	4814894.3	14-May-24	14:59	326.53	327.37	0.84	3.91	-	323.46	-
MW21-05	570103.8	4814894.3	25-Jul-24	17:11	326.53	327.37	0.84	3.80	-	323.58	-
MW21-05	570103.8	4814894.3	20-Sep-24	16:40	326.53	327.37	0.84	4.13	-	323.24	-
MW21-05	570103.8	4814894.3	1-Nov-24	16:32	326.53	327.37	0.84	4.25	-	323.12	-
MW21-05	570103.8	4814894.3	5-May-25	12:54	326.53	327.37	0.84	3.97	-	323.41	-
MW21-05	570103.8	4814894.3	11-Nov-25	13:02	326.53	327.37	0.84	4.60	-	322.78	-
MW06-ORG	569992.9	4814306.4	10-Nov-21	13:35	322.74	323.81	1.07	2.50	-	321.31	-
MW06-ORG	569992.9	4814306.4	5-Apr-22	11:14	322.74	323.81	1.07	2.19	-	321.62	-
MW06-ORG	569992.9	4814306.4	1-Jun-22	13:45	322.74	323.81	1.07	2.40	-	321.41	-
MW06-ORG	569992.9	4814306.4	6-Jul-22	14:45	322.74	323.81	1.07	2.65	-	321.16	-
MW06-ORG	569992.9	4814306.4	14-Sep-22	11:17	322.74	323.81	1.07	dry	-	dry	-
MW06-ORG	569992.9	4814306.4	23-Mar-23	12:36	322.74	323.81	1.07	2.47	-	321.34	-
MW06-ORG	569992.9	4814306.4	11-Jul-23	11:44	322.74	323.81	1.07	2.63	-	321.18	-
MW06-ORG	569992.9	4814306.4	13-Dec-23	12:23	322.74	323.81	1.07	2.61	-	321.20	-
MW06-ORG	569992.9	4814306.4	14-May-24	12:36	322.74	323.81	1.07	2.29	-	321.53	-
MW06-ORG	569992.9	4814306.4	25-Jul-24	15:55	322.74	323.81	1.07	2.08	-	321.73	-
MW06-ORG	569992.9	4814306.4	20-Sep-24	15:49	322.74	323.81	1.07	2.55	-	321.26	-
MW06-ORG	569992.9	4814306.4	1-Nov-24	13:56	322.74	323.81	1.07	2.63	-	321.18	-
MW06-ORG	569992.9	4814306.4	5-May-25	9:24	322.74	323.81	1.07	2.31	-	321.50	-
MW06-ORG	569992.9	4814306.4	11-Nov-25	9:49	322.74	323.81	1.07	2.86	-	320.95	-

Table 3
Water Level Monitoring Results
Hydrogeological Assessment Level I and II Report
Proposed Anthony Aggregate Pit

Location ID	Coordinates		Date	Time	Elevation		Stick-up	GW level	SW level	GW Elev	SW Elev
	Easting	Northing			Ground Surface m AMSL	Top of Casing m AMSL	(m AGS)	m BTOC	m BTOC	m AMSL	m AMSL
DP21-1	569774.9	4814126.6	12-Nov-21	10:57	320.65	321.73	1.08	0.96	0.88	320.77	320.85
DP21-1	569774.9	4814126.6	5-Apr-22	10:51	320.65	321.73	1.08	0.76	0.72	320.97	321.01
DP21-1	569774.9	4814126.6	1-Jun-22	13:12	320.65	321.73	1.08	0.83	dry	320.90	dry
DP21-1	569774.9	4814126.6	6-Jul-22	13:38	320.65	321.73	1.08	1.00	dry	320.73	dry
DP21-1	569774.9	4814126.6	14-Sep-22	10:27	320.65	321.73	1.08	1.30	dry	320.43	dry
DP21-1	569774.9	4814126.6	23-Mar-23	11:30	320.65	321.73	1.08	0.81	0.82	320.92	320.91
DP21-1	569774.9	4814126.6	11-Jul-23	10:55	320.65	321.73	1.08	1.00	dry	320.73	dry
DP21-1	569774.9	4814126.6	13-Dec-23	13:17	320.65	321.73	1.08	1.00	dry	320.73	dry
DP21-1	569774.9	4814126.6	14-May-24	10:57	320.65	321.73	1.08	0.77	0.77	320.97	320.96
DP21-1	569774.9	4814126.6	25-Jul-24	14:46	320.65	321.73	1.08	0.66	0.67	321.07	321.06
DP21-1	569774.9	4814126.6	20-Sep-24	15:17	320.65	321.73	1.08	0.94	dry	320.79	dry
DP21-1	569774.9	4814126.6	1-Nov-24	13:00	320.65	321.73	1.08	0.98	dry	320.75	dry
DP21-1	569774.9	4814126.6	5-May-25	10:00	320.65	321.73	1.08	0.78	0.79	320.96	320.94
DP21-1	569774.9	4814126.6	11-Nov-25	11:24	320.65	321.73	1.08	1.15	dry	320.58	dry
DP21-2	569888.2	4814322.1	12-Nov-21	11:21	321.22	322.35	1.13	1.00	0.94	321.35	321.41
DP21-2	569888.2	4814322.1	5-Apr-22	11:40	321.22	322.35	1.13	0.69	0.62	321.66	321.73
DP21-2	569888.2	4814322.1	1-Jun-22	12:36	321.22	322.35	1.13	0.88	0.83	321.47	321.52
DP21-2	569888.2	4814322.1	6-Jul-22	15:05	321.22	322.35	1.13	1.15	dry	321.20	dry
DP21-2	569888.2	4814322.1	14-Sep-22	10:54	321.22	322.35	1.13	1.58	dry	320.77	dry
DP21-2	569888.2	4814322.1	23-Mar-23	12:12	321.22	322.35	1.13	0.97	0.93	321.38	321.42
DP21-2	569888.2	4814322.1	11-Jul-23	11:31	321.22	322.35	1.13	1.14	dry	321.21	dry
DP21-2	569888.2	4814322.1	13-Dec-23	12:44	321.22	322.35	1.13	1.06	dry	321.29	dry
DP21-2	569888.2	4814322.1	14-May-24	12:05	321.22	322.35	1.13	0.76	0.72	321.59	321.63
DP21-2	569888.2	4814322.1	25-Jul-24	15:24	321.22	322.35	1.13	0.55	0.55	321.80	321.80
DP21-2	569888.2	4814322.1	20-Sep-24	15:41	321.22	322.35	1.13	1.01	dry	321.34	dry
DP21-2	569888.2	4814322.1	1-Nov-24	13:34	321.22	322.35	1.13	1.09	dry	321.27	dry
DP21-2	569888.2	4814322.1	5-May-25	9:39	321.22	322.35	1.13	0.79	0.73	321.57	321.62
DP21-2	569888.2	4814322.1	11-Nov-25	10:15	321.22	322.35	1.13	dry	dry	dry	dry
DP21-3	570055.1	4814690.3	12-Nov-21	11:05	322.96	323.97	1.01	1.02	0.87	322.95	323.10
DP21-3	570055.1	4814690.3	1-Jun-22	12:12	322.96	323.97	1.01	0.85	0.72	323.12	323.25
DP21-3	570055.1	4814690.3	6-Jul-22	16:18	322.96	323.97	1.01	1.14	dry	322.83	dry
DP21-3	570055.1	4814690.3	14-Sep-22	13:05	322.96	323.97	1.01	1.42	dry	322.55	dry
DP21-3	570055.1	4814690.3	23-Mar-23	13:42	322.96	323.97	1.01	0.84	0.81	323.13	323.17
DP21-3	570055.1	4814690.3	11-Jul-23	12:54	322.96	323.97	1.01	1.12	dry	322.85	dry
DP21-3	570055.1	4814690.3	13-Dec-23	11:09	322.96	323.97	1.01	1.15	dry	322.82	dry
DP21-3	570055.1	4814690.3	14-May-24	13:34	322.96	323.97	1.01	0.78	0.65	323.19	323.32
DP21-3	570055.1	4814690.3	25-Jul-24	16:33	322.96	323.97	1.01	0.65	0.55	323.32	323.42
DP21-3	570055.1	4814690.3	20-Sep-24	16:17	322.96	323.97	1.01	0.99	dry	322.98	dry
DP21-3	570055.1	4814690.3	1-Nov-24	14:22	322.96	323.97	1.01	1.11	dry	322.86	dry
DP21-3	570055.1	4814690.3	5-May-25	10:26	322.96	323.97	1.01	0.81	0.66	323.16	323.31
DP21-3	570055.1	4814690.3	11-Nov-25	12:10	322.96	323.97	1.01	1.43	dry	322.54	dry
DP21-4	570017.5	4814798.3	12-Nov-21	13:20	323.14	324.20	1.06	1.20	-	323.00	-
DP21-4	570017.5	4814798.3	5-Apr-22	12:48	323.14	324.20	1.06	0.86	0.85	323.34	323.35
DP21-4	570017.5	4814798.3	1-Jun-22	14:15	323.14	324.20	1.06	0.90	0.86	323.30	323.34
DP21-4	570017.5	4814798.3	6-Jul-22	17:13	323.14	324.20	1.06	1.07	dry	323.13	dry
DP21-4	570017.5	4814798.3	14-Sep-22	13:45	323.14	324.20	1.06	1.32	dry	322.88	dry
DP21-4	570017.5	4814798.3	23-Mar-23	14:19	323.14	324.20	1.06	0.82	0.84	323.39	323.37
DP21-4	570017.5	4814798.3	11-Jul-23	13:25	323.14	324.20	1.06	1.07	dry	323.14	dry
DP21-4	570017.5	4814798.3	13-Dec-23	11:28	323.14	324.20	1.06	1.08	dry	323.12	dry
DP21-4	570017.5	4814798.3	14-May-24	14:22	323.14	324.20	1.06	0.78	0.79	323.42	323.42
DP21-4	570017.5	4814798.3	25-Jul-24	16:49	323.14	324.20	1.06	0.66	0.67	323.54	323.53
DP21-4	570017.5	4814798.3	20-Sep-24	16:26	323.14	324.20	1.06	1.00	dry	323.20	dry
DP21-4	570017.5	4814798.3	1-Nov-24	14:33	323.14	324.20	1.06	1.12	dry	323.08	dry
DP21-4	570017.5	4814798.3	5-May-25	10:39	323.14	324.20	1.06	0.82	0.81	323.38	323.39
DP21-4	570017.5	4814798.3	11-Nov-25	12:45	323.14	324.20	1.06	1.41	dry	322.79	dry
SG21-1	569957.7	4813575.2	5-Apr-22	15:30	317.17	318.70	1.53	-	1.34	-	317.36
SG21-1	569957.7	4813575.2	1-Jun-22	16:00	317.17	318.70	1.53	-	1.40	-	317.30
SG21-1	569957.7	4813575.2	6-Jul-22	18:37	317.17	318.70	1.53	-	1.43	-	317.28
SG21-1	569957.7	4813575.2	14-Sep-22	19:37	317.17	317.17	0.00	-	0.09	-	317.26
SG21-1	569957.7	4813575.2	23-Mar-23	15:15	317.17	317.17	0.00	-	0.24	-	317.41
SG21-1	569957.7	4813575.2	11-Jul-23	14:37	317.17	317.95	0.78	-	0.62	-	317.33
SG21-1	569957.7	4813575.2	13-Dec-23	14:30	317.17	317.95	0.78	-	0.55	-	317.40
SG21-1	569957.7	4813575.2	14-May-24	15:35	317.17	317.95	0.78	-	0.59	-	317.36
SG21-1	569957.7	4813575.2	25-Jul-24	16:10	317.17	318.94	1.77	-	1.55	-	317.39
SG21-1	569957.7	4813575.2	20-Sep-24	17:15	317.17	318.94	1.77	-	1.56	-	317.38
SG21-1	569957.7	4813575.2	1-Nov-24	15:15	317.17	318.94	1.77	-	1.55	-	317.39
SG21-1	569957.7	4813575.2	5-May-25	12:00	317.17	318.94	1.77	-	1.50	-	317.44
SG21-1	569957.7	4813575.2	11-Nov-25	13:43	317.17	318.94	1.77	-	1.52	-	317.42
SG21-2	569165.7	4813265.7	5-Apr-22	14:25	312.31	313.53	1.22	-	0.92	-	312.61
SG21-2	569165.7	4813265.7	1-Jun-22	15:24	312.31	313.53	1.22	-	0.99	-	312.54
SG21-2	569165.7	4813265.7	6-Jul-22	19:20	312.31	313.53	1.22	-	1.02	-	312.51
SG21-2	569165.7	4813265.7	14-Sep-22	15:27	312.31	313.53	1.22	-	1.03	-	312.50
SG21-2	569165.7	4813265.7	23-Mar-23	15:45	312.31	313.53	1.22	-	0.86	-	312.67
SG21-2	569165.7	4813265.7	11-Jul-23	15:16	312.31	313.53	1.22	-	0.92	-	312.61
SG21-2	569165.7	4813265.7	13-Dec-23	15:08	312.31	313.53	1.22	-	0.97	-	312.56
SG21-2	569165.7	4813265.7	14-May-24	16:23	312.31	313.53	1.22	-	0.96	-	312.57
SG21-2	569165.7	4813265.7	25-Jul-24	12:15	312.31	313.53	1.22	-	0.98	-	312.55
SG21-2	569165.7	4813265.7	20-Sep-24	18:00	312.31	313.53	1.22	-	0.97	-	312.56
SG21-2	569165.7	4813265.7	1-Nov-24	16:09	312.31	313.53	1.22	-	0.98	-	312.55
SG21-2	569165.7	4813265.7	5-May-25	11:15	312.31	313.53	1.22	-	0.99	-	312.54
SG21-2	569165.7	4813265.7	11-Nov-25	14:35	312.31	313.53	1.22	-	0.99	-	312.54

Table 4
Streamflow Monitoring Results
Hydrogeological Assessment Level I and II Report
Proposed Anthony Aggregate Pit

Monitoring Station ID	5-Apr-22	1-Jun-22	6-Jul-22	14-Sep-22	23-Mar-23	11-Jul-23	13-Dec-23	14-May-24	25-Jul-24	20-Sep-24	1-Nov-24	5-May-25	11-Nov-25
Streamflow Rate (L/s)													
SG21-1 (Gilmor)	95.6	17.4	7.3	9.2	297.0	16.9	53.8	50.9	54.2	14.7	19.6	44.0	27.0
SG21-2(Brock)	197.8	66.6	40.5	34.6	483.0	73.8	91.5	84.0	104.5	33.0	63.8	83.0	63.0
Streamflow Elevation (masl)													
SG21-1 (Gilmor)	317.4	317.3	317.3	317.3	317.4	317.3	317.4	317.4	317.4	317.4	317.4	317.4	317.4
SG21-2(Brock)	312.6	312.5	312.5	312.5	312.7	312.6	312.6	312.6	312.6	312.6	312.6	312.5	312.5

Table 5
Summary of Groundwater Quality Results
Hydrogeological Assessment Level I and II Report
Proposed Anthony Aggregate Pit

Sample Location			DP21-01	DP21-02	DP21-03	DP21-04	MW21-01	MW21-02	MW21-03		MW21-04	MW21-05
Sample Date			19-Nov-21	19-Nov-21	19-Nov-21	19-Nov-21	10-Nov-21	10-Nov-21	12-Nov-21	12-Nov-21	10-Nov-21	10-Nov-21
Sample ID			DP21-01	DP21-02	DP21-03	DP21-04	MW21-01 (ANTH)	MW21-02 (ANTH)	MW21-03	FIELD DUPLICATE 1	MW21-04 (ANTH)	MW21-05 (ANTH)
Sampling Company			STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC
Laboratory			BV	BV	BV	BV	BV	BV	BV	BV	BV	BV
Laboratory Work Order			C1Y2396	C1Y2396	C1Y2396	C1Y2396	C1X2744	C1X2744	C1X4546	C1X4546	C1X2744	C1X2744
Laboratory Sample ID			RHD453	RHD454	RHD455	RHD456	RFC805	RFC806	RFM446	RFM447	RFC804	RFC803
Sample Type	Units	ODWS								Field Duplicate		
General Chemistry												
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	340	470	490	280	210	240	210	210	220	290
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	1.4	1.8	2.5	2.1	2.8	3.0	1.8	1.9	3.0	3.4
Alkalinity, Total (as CaCO3)	mg/L	30-500[D]	340	470	490	280	210	250	220	210	220	290
Ammonia (as N)	mg/L	n/v	0.34	1.4	0.89	0.16	<0.050	<0.050	0.11	0.083	<0.050	<0.050
Anion Sum	me/L	n/v	7.47	15.5	11.5	7.30	5.70	6.12	5.86	5.82	6.02	7.74
Cation Sum	me/L	n/v	6.96	15.0	11.3	7.38	5.61	6.28	5.80	5.78	6.05	7.84
Chloride	mg/L	250[B]	13	35	59	37	25	13	26	26	27	40
Dissolved Organic Carbon (DOC)	mg/L	5[B]	**14[B]**	**55[B]**	**44[B]**	3.6	<0.40	<0.40	5.0	5.0	1.6	0.49
Electrical Conductivity, Lab	µmhos/cm	n/v	650	1,300	980	690	520	550	520	520	550	710
Hardness (as CaCO3)	mg/L	80-100[D]	**320[D]**	**720[D]**	**520[D]**	**340[D]**	**260[D]**	**300[D]**	**260[D]**	**260[D]**	**280[D]**	**350[D]**
Ion Balance	%	n/v	3.54	1.60	0.760	0.560	0.750	1.29	0.540	0.400	0.230	0.690
Langelier Index (at 20 C)	none	n/v	0.639	1.04	1.08	0.844	0.863	0.969	0.679	0.700	0.891	1.07
Langelier Index (at 4 C)	none	n/v	0.391	0.792	0.830	0.595	0.614	0.720	0.430	0.451	0.642	0.823
Nitrate (as N)	mg/L	10.0_d[A]	0.11	<0.10	<0.10	0.30	1.23	<0.10	<0.10	<0.10	0.38	1.16
Nitrate + Nitrite (as N)	mg/L	10.0_d[A]	0.13	<0.10	<0.10	0.32	1.23	<0.10	<0.10	<0.10	0.38	1.16
Nitrite (as N)	mg/L	1.0_d[A]	0.019	0.013	0.020	0.019	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Orthophosphate (as P)	mg/L	n/v	<0.010	<0.050 DB	<0.010	<0.010	0.019	<0.010	<0.020	<0.010	<0.010	<0.010
pH, lab	S.U.	6.5-8.5[D]	7.64	7.62	7.74	7.91	8.14	8.12	7.96	7.98	8.15	8.10
Saturation pH (at 20 C)	none	n/v	7.00	6.58	6.66	7.06	7.28	7.16	7.28	7.28	7.26	7.03
Saturation pH (at 4 C)	none	n/v	7.25	6.83	6.91	7.31	7.53	7.40	7.53	7.53	7.51	7.27
Sulfate	mg/L	500_h[B]	17	250	<5.0 DB	30	32	41	39	39	37	33
Total Dissolved Solids (Calculated)	mg/L	500[B]	370	**840[B]**	**570[B]**	380	300	320	310	310	310	400
BTEX xand PHC												
Benzene	µg/L	1.0[A]	-	-	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	µg/L	60[A] 24[B]	-	-	-	-	<0.20	<0.20	<0.20	<0.20	0.22	<0.20
Ethylbenzene	µg/L	140[A] 1.6[B]	-	-	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Xylene, m & p-	µg/L	n/v	-	-	-	-	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Xylene, o-	µg/L	n/v	-	-	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Xylenes, Total	µg/L	90[A]	-	-	-	-	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
PHC F1 (C6-C10 range)	µg/L	n/v	-	-	-	-	<25	<25	<25	<25	<25	<25
PHC F1 (C6-C10 range) minus BTEX	µg/L	n/v	-	-	-	-	<25	<25	<25	<25	<25	<25
PHC F2 (>C10-C16 range)	µg/L	n/v	-	-	-	-	<100	<100	<100	<100	<100	<100
PHC F3 (>C16-C34 range)	µg/L	n/v	-	-	-	-	<200	<200	<200	<200	<200	<200
PHC F4 (>C34-C50 range)	µg/L	n/v	-	-	-	-	<200	<200	<200	<200	<200	<200
Chromatogram to baseline at C50	none	n/v	-	-	-	-	YES	YES	YES	YES	YES	YES
Metals												
Aluminum	mg/L	0.1[D]	0.022	0.026	0.078	0.017	<0.0049	0.0058	<0.0049	<0.0049	<0.0049	<0.0049
Antimony	mg/L	0.006[A]	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic	mg/L	0.01[A]	0.0093	0.0014	0.0034	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	mg/L	1[A]	0.23	0.32	0.18	0.17	0.048	0.10	0.088	0.089	0.075	0.053
Beryllium	mg/L	n/v	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Boron	mg/L	5[A]	0.094	0.026	0.028	0.017	<0.010	<0.010	0.013	0.013	0.012	0.013
Cadmium	mg/L	0.005[A]	<0.000090	<0.000090	<0.000090	0.00039	<0.000090	<0.000090	<0.000090	<0.000090	<0.000090	0.00017
Calcium	mg/L	n/v	82	190	130	85	64	76	65	64	65	90
Chromium	mg/L	0.05[A]	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cobalt	mg/L	n/v	0.00061	0.00071	0.00076	0.0011	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050
Copper	mg/L	1[B]	0.0038	0.0011	0.029	0.0032	<0.00090	<0.00090	<0.00090	<0.00090	<0.00090	<0.00090
Iron	mg/L	0.3[B]	**12[B]**	**6.5[B]**	**5.7[B]**	**1.6[B]**	<0.10	0.30	<0.10	<0.10	<0.10	<0.10
Lead	mg/L	0.01[A]	<0.00050	<0.00050	0.0021	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Magnesium	mg/L	n/v	27	60	44	30	23	28	24	25	28	31
Manganese	mg/L	0.05[B]	**0.31[B]**	**0.30[B]**	**0.22[B]**	**0.25[B]**	0.0035	**0.076[B]**	0.034	0.033	0.017	0.0059
Molybdenum	mg/L	n/v	0.0010	0.0040	0.0014	0.00098	0.0013	0.0024	0.0053	0.0050	0.0038	0.0012
Nickel	mg/L	n/v	0.0027	0.0068	0.016	0.0040	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010
Phosphorus	mg/L	n/v	<0.10	0.12	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Potassium	mg/L	n/v	0.71	0.68	0.47	1.1	1.1	1.0	1.5	1.5	1.5	1.6
Selenium	mg/L	0.05[A]	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Silicon	mg/L	n/v	4.6	5.1	4.5	3.3	3.7	6.6	4.7	4.7	4.1	3.5
Silver	mg/L	n/v	<0.000090	<0.000090	<0.000090	<0.000090	<0.000090	<0.000090	<0.000090	<0.000090	<0.000090	<0.000090
Sodium	mg/L	200_g[B] 20_g[C]	2.9	4.3	17	13	10	3.7	11	11	12	17
Strontium	mg/L	n/v	0.082	0.16	0.13	0.090	0.068	0.10	0.13	0.13	0.10	0.14
Thallium	mg/L	n/v	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Titanium	mg/L	n/v	<0.0050	<0.0050	0.0062	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Uranium	mg/L	0.02[A]	<0.00010	0.00072	0.00030	0.00031	0.00036	0.00080	0.0017	0.0017	0.0014	0.00032
Vanadium	mg/L	n/v	<0.00050	<0.00050	0.0099	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	5[B]	**41[B]**	**88[B]**	**41[B]**	**9.5[B]**	0.063	0.0069	0.018	0.017	0.043	0.096

Notes:

ODWS	Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (MOE, 2006), in support of O.Reg 169/03 (January 1, 2018)
A	Schedule 2 - Chemical Standards (expressed as a maximum acceptable concentration)
B	ODWS Table 4 - Chemical/Physical Objectives and Guidelines, Aesthetic Objectives
C	ODWS Table 4 - Medical Officer of Health Reporting Limit
D	ODWS Table 4 - Chemical/Physical Objectives and Guidelines, Operational Guidelines
6.5[A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
<0.50	Laboratory reporting limit was greater than the applicable standard.
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.
d	Where both nitrate and nitrite are present, the total of the two should not exceed 10 mg/L (as nitrogen).
BC g	The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.
h	When sulfate levels exceed 500 mg/L, water may have a laxative effect on some people.
DB	Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

Table 6
Summary of Surface Water Quality Results
Hydrogeological Assessment Level I and II Report
Proposed Anthony Aggregate Pit

Sample Location			SW21-01		SW21-02
Sample Date			8-Nov-21	8-Nov-21	8-Nov-21
Sample ID			SW21-01	FIELD DUP1	SW21-02
Sampling Company			STANTEC	STANTEC	STANTEC
Laboratory			BV	BV	BV
Laboratory Work Order			C1Y2396	C1Y2396	C1Y2396
Laboratory Sample ID			RHD457	RHD459	RHD458
Sample Type	Units	PWQO		Field Duplicate	
General Chemistry					
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	260	260	250
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	3.8	4.1	5.3
Alkalinity, Total (as CaCO3)	mg/L	$_{s16}$[A]	260	260	250
Ammonia (as N)	mg/L	n/v	<0.050	<0.050	<0.050
Chloride	mg/L	n/v	27	27	36
Electrical Conductivity, Lab	µmhos/cm	n/v	580	560	580
Hardness (as CaCO3)	mg/L	n/v	300	300	300
Langelier Index (at 20 C)	none	n/v	1.09	1.12	1.23
Langelier Index (at 4 C)	none	n/v	0.838	0.874	0.976
Nitrate (as N)	mg/L	n/v	0.15	0.15	0.18
Nitrite (as N)	mg/L	n/v	<0.010	<0.010	<0.010
Orthophosphate (as P)	mg/L	n/v	<0.010	<0.010	<0.010
pH, lab	S.U.	6.5-8.5[A]	8.20	8.23	8.35
Phosphorus, Total	mg/L	0.030_{s4}[C]	0.011	0.010	0.005
Saturation pH (at 20 C)	none	n/v	7.11	7.11	7.13
Saturation pH (at 4 C)	none	n/v	7.36	7.36	7.38
Sulfate	mg/L	n/v	10	10	23
Total Dissolved Solids (Calculated)	mg/L	n/v	320	320	350
Total Organic Carbon	mg/L	n/v	12	12	7.2
Turbidity, Lab	NTU	n/v	0.7	0.3	0.3
BTEX and PHC					
Benzene	µg/L	100_{b}[C]	<0.20	<0.20	<0.20
Toluene	µg/L	0.8[C]	<0.20	<0.20	<0.20
Ethylbenzene	µg/L	8[C]	<0.20	<0.20	<0.20
Xylene, m & p-	µg/L	2_{s17}[B]	<0.40	<0.40	<0.40
Xylene, o-	µg/L	40_{b}[C]	<0.20	<0.20	<0.20
Xylenes, Total	µg/L	30_{s10}[B]	<0.40	<0.40	<0.40
PHC F1 (C6-C10 range)	µg/L	n/v	<25	<25	<25
PHC F1 (C6-C10 range) minus BTEX	µg/L	n/v	<25	<25	<25
PHC F2 (>C10-C16 range)	µg/L	n/v	<100	<100	<100
PHC F3 (>C16-C34 range)	µg/L	n/v	<200	<200	<200
PHC F4 (>C34-C50 range)	µg/L	n/v	<200	<200	<200
Chromatogram to baseline at C50	none	n/v	YES	YES	YES
Metals - Dissolved					
Calcium	mg/L	n/v	79	80	79
Magnesium	mg/L	n/v	24	25	25
Potassium	mg/L	n/v	1	2	2
Sodium	mg/L	n/v	14	14	20
Metals - Total					
Aluminum	mg/L	n/v	0.0067	0.0079	0.010
Antimony	mg/L	0.020[C]	<0.00050	<0.00050	<0.00050
Arsenic	mg/L	0.10[A] 0.0050[C]	<0.0010	<0.0010	<0.0010
Barium	mg/L	n/v	0.064	0.064	0.051
Beryllium	mg/L	1.1_{s3}[A]	<0.00040	<0.00040	<0.00040
Boron	mg/L	0.20_{a}[C]	<0.010	<0.010	<0.010
Cadmium	mg/L	0.00020[A] 0.00050_{s12}[C]	<0.000090	<0.000090	<0.000090
Calcium	mg/L	n/v	77	75	74
Chromium	mg/L	n/v	<0.0050	<0.0050	<0.0050
Cobalt	mg/L	0.00090[C]	<0.00050	<0.00050	<0.00050
Copper	mg/L	0.0050[A] 0.0050_{s13}[C]	<0.00090	<0.00090	<0.00090
Iron	mg/L	0.30[A]	<0.10	<0.10	<0.10
Lead	mg/L	0.025_{s14}[A] 0.0050_{s15}[C]	<0.00050	<0.00050	<0.00050
Magnesium	mg/L	n/v	25	24	25
Manganese	mg/L	n/v	0.025	0.024	0.023
Molybdenum	mg/L	0.040[C]	0.00067	0.00066	0.00070
Nickel	mg/L	0.025[A]	<0.0010	<0.0010	<0.0010
Potassium	mg/L	n/v	1.4	1.4	1.4
Selenium	mg/L	0.10[A]	<0.0020	<0.0020	<0.0020
Silicon	mg/L	n/v	4.7	4.6	3.9
Silver	mg/L	0.00010[A]	<0.000090	<0.000090	<0.000090
Sodium	mg/L	n/v	13	13	19
Strontium	mg/L	n/v	0.095	0.094	0.094
Thallium	mg/L	0.00030_{b}[C]	<0.000050	<0.000050	<0.000050
Titanium	mg/L	n/v	<0.0050	<0.0050	<0.0050
Tungsten	mg/L	0.030_{a}[C]	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.0050_{a}[C]	0.00052	0.00051	0.00049
Vanadium	mg/L	0.0060[C]	<0.00050	<0.00050	<0.00050
Zinc	mg/L	0.030[A] 0.020[C]	**0.032[AC]**	**0.033[AC]**	0.020
Zirconium	mg/L	0.0040_{a}[C]	<0.0010	<0.0010	<0.0010

Notes:

PWQO	Provincial Water Quality Objectives of the Ministry of Environment and Energy (MOEE, 1999)
A	PWQO Table 2
B	PWQO Table 2 - Calculated
C	PWQO Table 2 - Interim
6.5[A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
<0.50	Laboratory reporting limit was greater than the applicable standard.
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.
a	This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.
b	This Interim PWQO is currently under development. The value is subject to change upon publication by MOE.
s3	The PWQO for beryllium is hardness dependent. If hardness <75 mg/L than PWQO is 0.011 mg/L. For hardness > 75 mg/L, PWQO is 1.1 mg/L.
s4	Applies to Phosphorus, total. PWQO is 0.03 mg/L for rivers and streams, 0.02 mg/L for lakes, and 0.01 mg/L for lakes naturally below this value.
s10	Use of the BC AWQG of 30 ug/L for the maximum acceptable concentration of the sum of all xylene isomers has been noted by MECP to be an acceptable approach.
s12	The interim PWQO for cadmium is hardness dependent. If hardness <100 mg/L than PWQO is 0.0001 mg/L. For hardness >100 mg/L, PWQO is 0.0005 mg/L.
s13	The interim PWQO for copper is hardness dependent. If hardness <20 mg/L than PWQO is 0.001 mg/L. For hardness >20 mg/L, PWQO is 0.005 mg/L.
s14	PWQO for lead is alkalinity dependent. For alkalinity <20 mg/L, PWQO is 0.005 mg/L. For alkalinity between 20-40 mg/L, PWQO is 0.01 mg/L. For alkalinity between 40-80 mg/L, PWQO is 0.02 mg/L. For alkalinity >80 mg/L, PWQO is 0.025 mg/L.
s15	Interim PWQO for lead is hardness dependent. For hardness <30 mg/L, interim PWQO is 0.001 mg/L. For hardness between 30-80 mg/L, interim PWQO is 0.003 mg/L. For hardness >80 mg/L, interim PWQO is 0.005 mg/L.
s16	Alkalinity should not be decreased by more than 25% of the natural concentration.
s17	The laboratory is unable to distinguish the m- and p-Xylene isomers, therefore where the PWQO standards for m-Xylene (2 ug/L) and p-Xylene (30 ug/L), the most stringent value of all Xylenes is used.

Table 7
Summary of Surface Catchment Details
Hydrogeological Assessment Report
Proposed Anthony Aggregate Pit

Catchment Area No.	Receiving Watercourse / Body	Pre-Development Catchment Area (ha)	Post-Development Catchment Area (ha)	Proposed Catchment Area Reduction (%)
CA-1	Internally Draining	4.9	3.5	29%
CA-2	Aberfoyle Creek (South Branch)	61.5	60.9	1%
CA-3a	Internally Draining	23.6	9.1	39%
CA-3b	Internally Draining		7.6	0%
CA-4	Aberfoyle Creek (North Branch)	88.6	87.6	1%

Wetland Areas		Size (ha)
WE-1a	Aberfoyle Creek (North Branch)	9.37
WE-1b	Closed Depression	1.88
WE-1c	Closed Depression	3.1
WE-1d	Aberfoyle Creek (South Branch)	8.83
WE-2	Closed Depression	0.36
WE-3	Closed Depression	0.05
WE-4	Closed Depression	0.21
WE-5	Closed Depression	0.093
WE-6	Closed Depression	0.063
WE-7	Closed Depression	0.08
WE-8	Closed Depression	0.07

Appendix C

Borehole Logs

Monitoring Well: MW21-01

Project:	Aberfoyle Tikal Pit Expansion	**Method:**	Sonic
Client:	CBM Aggregates	**Date started/completed:**	01-Nov-2021 / 02-Nov-2021
Location:	Aberfoyle, ON	**Ground surface elevation:**	322.27 m AMSL
Number:	160961457	**Top of casing elevation:**	323.05 m AMSL
Field investigator:	R. Baker	**Easting:**	569806
Contractor:	Insitu	**Northing:**	4814118

SUBSURFACE PROFILE				SAMPLE DETAILS			INSTALLATION DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Stratigraphic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	Recovery	Diagram / Description
				323.79				
0	0		Ground Surface	322.27				Above Ground Casing 0.77 m stick-up
			SAND and GRAVEL trace silt	0.00	1	GB	22" 23%	Cement Seal 0 to 0.3 m
5	2							
10	4				2	GB	50" 52%	
15								
20	6				3	GB	18" 19%	
25	8				4	GB	60" 100%	168 mm Diameter Borehole
30				313.13				Bentonite Grout 1 to 17.7 m
	10		SAND some silt and gravel	9.14	5	GB	60" 100%	
35					6	GB	55" 92%	
40	12		SAND and GRAVEL trace silt	11.58				51 mm Diameter Schedule 40 PVC riser
				309.16	7	GB	58" 97%	
45	14		SAND trace gravel and silt	13.11				
				307.64	8	GB	60" 100%	
50			SAND and GRAVEL trace silt	14.63				
	16				9	GB	48" 80%	
55					10	GB	55" 92%	Bentonite Chips 17.7 to 18.3 m
60	18				11	GB	48" 80%	No. 2 Silica Sand 18.3 to 23.8 m
65	20				12	GB	50" 83%	No. 10 Slot Schedule 40 PVC Screen 51 mm Diameter 18.9 to 20.4 m
70								
	22				13	GB	60" 100%	
75				298.50				
	24		End of Borehole	23.77				

Screen Interval: 18.90 - 20.42 m BGS
Sand Pack Interval: 18.29 - 23.77 m BGS
Well Seal Interval: 0.30 - 18.29 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
GB - grab sample
n/a - not available

Stantec

Drawn By/Checked By: RB/RD

STANTEC BOREHOLE AND WELL V2 160961457.306_BHLOGS.GPJ STANTEC - DATA TEMPLATE.GDT 9/12/25 DRSMITH

Monitoring Well: MW21-02

Project:	Aberfoyle Tikal Pit Expansion	**Method:**	Sonic
Client:	CBM Aggregates	**Date started/completed:**	02-Nov-2021 / 03-Nov-2021
Location:	Aberfoyle, ON	**Ground surface elevation:**	322.48 m AMSL
Number:	160961457	**Top of casing elevation:**	323.27 m AMSL
Field investigator:	R. Baker	**Easting:**	569747
Contractor:	Insitu	**Northing:**	4814230

SUBSURFACE PROFILE				SAMPLE DETAILS			INSTALLATION DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Stratigraphic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	Recovery	Diagram / Description
				324.00				
			Ground Surface	322.48				Above Ground Casing 0.83 m stick-up
0	0		SAND and GRAVEL trace silt	0.00				Bentonite Chips 0 to 0.6 m
					1	GB	48" 80%	
5					2	GB	36" 100%	
	2							
10					3	GB	48" 80%	
	4							
15				316.99	4	GB	60" 100%	
			SAND trace silt	5.49				
20	6				5	GB	60" 100%	168 mm Diameter Borehole
25					6	GB	60" 100%	Bentonite Grout 1 to 14.3 m
	8			313.95				
30			SAND and SILT	8.53	7	GB	60" 100%	51 mm Diameter Schedule 40 PVC riser
	10							
35					8	GB	60" 100%	
				310.90				
40	12		SAND grace gravel and silt	11.58	9	GB	50" 83%	
				309.37				
45			SAND and GRAVEL trace silt	13.11	10	GB	60" 100%	
	14			307.85				
50			Gravelly SAND trace silt	14.63	11	GB	48" 80%	Bentonite Chips 14.3 to 14.9 m; No. 2 Silica Sand 14.9 to 20.9 m
	16							
55					12	GB	60" 100%	No. 10 Slot Schedule 40 PVC Screen 51 mm Diameter 15.5 to 18.6 m
60	18				13	GB	60" 100%	
				303.28				
65	20		SAND and GRAVEL trace silt	19.20	14	GB	60" 100%	
				301.60				
70			End of Borehole	20.88				

Screen Interval: 15.54 - 18.59 m BGS
Sand Pack Interval: 14.94 - 20.88 m BGS
Well Seal Interval: 0.00 - 14.94 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
GB - grab sample
n/a - not available

Stantec

Drawn By/Checked By: RB/RD

STANTEC BOREHOLE AND WELL V2 160961457.306_BHLOGS.GPJ STANTEC - DATA TEMPLATE.GDT 9/12/25 DRSMITH

Monitoring Well: MW21-03

Project:	Aberfoyle Tikal Pit Expansion	**Method:**	Sonic
Client:	CBM Aggregates	**Date started/completed:**	03-Nov-2021 / 04-Nov-2021
Location:	Aberfoyle, ON	**Ground surface elevation:**	326.60 m AMSL
Number:	160961457	**Top of casing elevation:**	327.50 m AMSL
Field investigator:	R. Baker	**Easting:**	570228
Contractor:	Insitu	**Northing:**	4814460

SUBSURFACE PROFILE				SAMPLE DETAILS			INSTALLATION DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Stratigraphic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	Recovery	Diagram / Description
				328.12				
			Ground Surface	326.60				Above Ground Casing 0.87 m stick-up
0	0		SAND and GRAVEL trace silt	0.00	1	GB	48" 133%	Bentonite Chips 0 to 0.6 m
5	2				2	GB	60" 100%	
10	4				3	GB	30" 50%	
15					4	GB	60" 100%	168 mm Diameter Borehole
20	6				5	GB	60" 50%	Bentonite Grout 1 to 12.5 m
25	8							51 mm Diameter Schedule 40 PVC riser
30					6	GB	60" 100%	
	10			316.54				
35			SAND some silt	10.06	7	GB	60" 100%	
40	12				8	GB	60" 100%	
				313.49				Bentonite Chips 12.5 to 13.1 m
45	14		SAND trace gravel and silt	13.11	9	GB	60" 100%	No. 2 Silica Sand 13.1 to 23.8 m
50					10	GB	60" 100%	No. 10 Slot Schedule 40 PVC Screen 51 mm Diameter 13.7 to 16.8 m
	16			310.45				
55			SAND and SILT	16.15	11	GB	60" 100%	
				308.92				
60	18		SAND trace gravel and silt	17.68	12	GB	60" 100%	
65	20				13	GB	60" 100%	
70					14	GB	60" 100%	
	22			304.35				
75			SAND and GRAVEL trace silt	22.25	15	GB	60" 100%	
	24		End of Borehole	302.83 23.77				

Screen Interval: 13.72 - 16.76 m BGS
Sand Pack Interval: 13.11 - 23.77 m BGS
Well Seal Interval: 0.00 - 13.11 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
GB - grab sample
n/a - not available

Stantec

Drawn By/Checked By: RB/RD

STANTEC BOREHOLE AND WELL V2 160961457.306_BHLOGS.GPJ STANTEC - DATA TEMPLATE.GDT 9/12/25 DRSMITH

Monitoring Well: MW21-04

Project:	Aberfoyle Tikal Pit Expansion	**Method:**	Sonic
Client:	CBM Aggregates	**Date started/completed:**	04-Nov-2021 / 05-Nov-2021
Location:	Aberfoyle, ON	**Ground surface elevation:**	323.85 m AMSL
Number:	160961457	**Top of casing elevation:**	324.62 m AMSL
Field investigator:	R. Baker	**Easting:**	569943
Contractor:	Insitu	**Northing:**	4814635

SUBSURFACE PROFILE				SAMPLE DETAILS			INSTALLATION DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Stratigraphic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	Recovery	Diagram / Description
				325.37				
			Ground Surface	323.85				Above Ground Casing 0.77 m stick-up
0	0		SAND and GRAVEL trace silt	0.00	1	GB	55" 92%	Bentonite Chips 0 to 0.6 m
5	2				2	GB	36" 75%	
10	4				3	GB	60" 100%	
15					4	GB	60" 100%	168 mm Diameter Borehole
				318.06				
20	6		SAND trace silt fining downward sequent to SAND and SILT	5.79	5	GB	60" 100%	
25	8				6	GB	60" 100%	51 mm Diameter Schedule 40 PVC riser
30					7	GB	60" 100%	Bentonite Grout 0.6 to 16.5 m
	10			313.49				
35			SAND trace gravel and silt	10.36	8	GB	55" 92%	
40	12				9	GB	55" 115%	
				310.44				
45			SAND and SILT	13.41	10	GB	55" 76%	
50	14				11	GB	60" 125%	
	16			307.39				
55			SAND trace silt coarsening downward sequence to GRAVEL, trace sand	16.46	12	GB	60" 83%	Bentonite Chips 16.5 to 17.1 m
								No. 2 Silica Sand 17.1 to 21.0 m
60	18				13	GB	60" 250%	
					14	GB	60" 100%	No. 10 Slot Schedule 40 PVC Screen 51 mm Diameter 17.7 to 20.7 m
65	20			303.73				
			Drillers only able to advance casing to 20.1 m BGS	20.12	15	GB	60" 167%	
				302.82				
70	22		End of Borehole	21.03				

Screen Interval: 17.68 - 20.73 m BGS
Sand Pack Interval: 17.07 - 21.03 m BGS
Well Seal Interval: 0.00 - 17.07 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
GB - grab sample
n/a - not available

Stantec

Drawn By/Checked By: RB/RD

STANTEC BOREHOLE AND WELL V2 160961457.306_BHLOGS.GPJ STANTEC - DATA TEMPLATE.GDT 9/12/25 DRSMITH

Monitoring Well: MW21-05

Project:	Aberfoyle Tikal Pit Expansion	**Method:**	Sonic
Client:	CBM Aggregates	**Date started/completed:**	08-Nov-2021
Location:	Aberfoyle, ON	**Ground surface elevation:**	326.53 m AMSL
Number:	160961457	**Top of casing elevation:**	327.37 m AMSL
Field investigator:	R. Baker	**Easting:**	570104
Contractor:	Insitu	**Northing:**	4814894

SUBSURFACE PROFILE				SAMPLE DETAILS			INSTALLATION DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Stratigraphic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	Recovery	Diagram / Description
				328.05				
			Ground Surface	326.53				Above Ground Casing 0.90 m stick-up
0	0		SAND and GRAVEL trace silt	0.00	1	GB	60" 100%	Cement Seal 0 to 0.3 m
5	2				2	GB	36" 100%	168 mm Diameter Borehole
10	4				3	GB	60" 100%	Bentonite Grout 1 to 4.8 m
15					4	GB	36" 60%	51 mm Diameter Schedule 40 PVC riser
20	6			319.52	5	GB	60" 100%	No. 2 Silica Sand 4.8 to 8.5 m
25	8		Silty SAND	7.01	6	GB	60" 100%	No. 10 Slot Schedule 40 PVC Screen 51 mm Diameter 5.2 to 8.2 m
30	10			316.47	7	GB	60" 100%	
35			SAND and GRAVEL trace silt	10.06	8	GB	60" 100%	
40	12				9	GB	60" 100%	
45	14				10	GB	60" 100%	Bentonite Grout 8.5 to 20.1 m
50	16				11	GB	60" 100%	
55					12	GB	60" 100%	
60	18				13	GB	60" 100%	
65	20			306.41	14	GB	36" 100%	
			End of Borehole	20.12				

Screen Interval: 5.18 - 8.23 m BGS
Sand Pack Interval: 4.57 - 8.53 m BGS
Well Seal Interval: 0.30 - 4.57 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
GB - grab sample
n/a - not available

Stantec

Drawn By/Checked By: RB/RD

STANTEC BOREHOLE AND WELL V2 160961457.306_BHLOGS.GPJ STANTEC - DATA TEMPLATE.GDT 9/12/25 DRSMITH

Appendix D

Soil Testing

Stantec

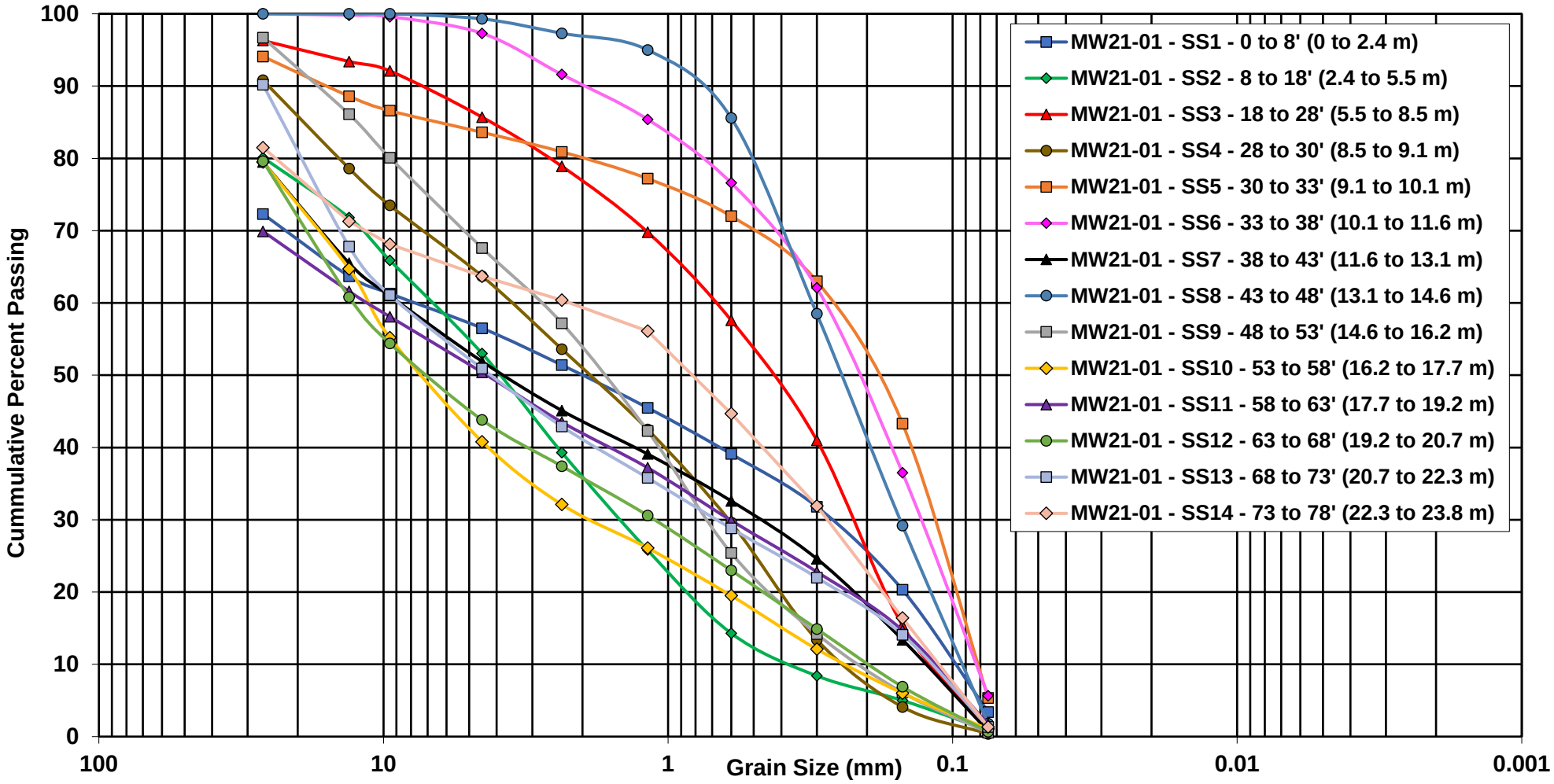
Project Name:	Anthony Pit	Project & Task No.:	160961457.202
Client:	CBM	Date Sampled:	November 5, 2021
General Contractor:	N/A	Proposed Use:	N/A
Inspector / Technician:	N/A	Material Type:	
Supplier:	N/A	Lab No.:	420-423
Sample Location:	**MW21-01**		

Run Depth (ft)		Sample ID	Field Description (optional)	Full FM Value	Sand Portion FM Value	Wash Loss (%)	Crushed Stone (%)	Stone to Sand Ratio		
Top (ft)	Bottom (ft)							Ratio	Stone	Sand
0	8	1		3.47	2.11	42.8	48.6	44:53	44	53
8	18	2		4.79	3.72	5.9	85.7	47:52	47	52
18	28	3		2.32	2.08	11.6	80.2	14:85	14	85
28	30	4		3.84	3.11	3.4	58.9	36:63	36	63
30	33	5		1.54	1.14	40.8	79.7	16:78	16	78
33	38	6		1.41	1.41	41.7	0.0	3:92	3	92
38	43	7		3.72	2.50	18.7	52.2	48:51	48	51
43	48	8		1.32	1.32	33.2	72.6	1:98	1	98
48	53	9		3.62	3.18	6.9	27.1	32:67	32	67
53	58	10		4.52	3.25	6.6	74.6	59:40	59	40
58	63	11		4.00	2.56	26.7	88.6	50:49	50	49
63	68	12		4.34	2.98	8.1	75.1	56:43	56	43
68	73	13		3.69	2.67	30.0	86.4	49:50	49	50
73	78	14		3.10	2.07	56.7	79.4	36:62	36	62

Grain Size Distribution Test Report (ISO 14688-1:2002)

MW21-01

FIGURE D1



Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	Gravel		**Sand**				

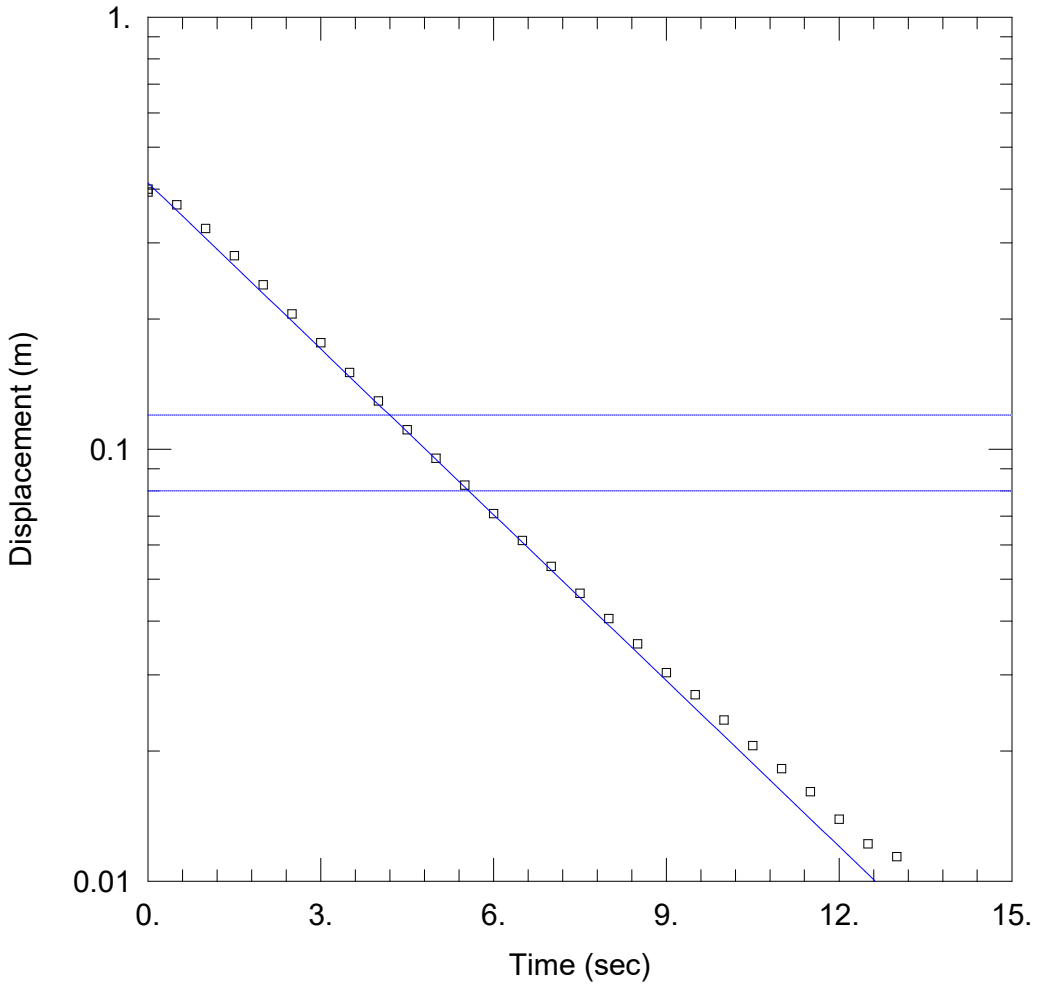
DATE: September 2022

PROJECT: 160961457

Stantec

prepared by: **RD**

CHK: **SMD**



MW21-01-RISINGHEAD TEST1

Data Set: \...\MW21-01_risinghead_test1_DG_JK.aqt
Date: 03/20/25 Time: 07:44:35

PROJECT INFORMATION

Company: Stantec
Client: CBM
Project: 160961457
Location: Ontario
Test Well: MW21-01
Test Date: May 4, 2023

AQUIFER DATA

Saturated Thickness: 18.85 m Anisotropy Ratio (Kz/Kr): 0.35

WELL DATA (MW21-01)

Initial Displacement: 0.4 m
Total Well Penetration Depth: 18.85 m
Casing Radius: 0.0254 m
Static Water Column Height: 18.85 m
Screen Length: 1.52 m
Well Radius: 0.084 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00025 m/sec
y0 = 0.4132 m

Stantec

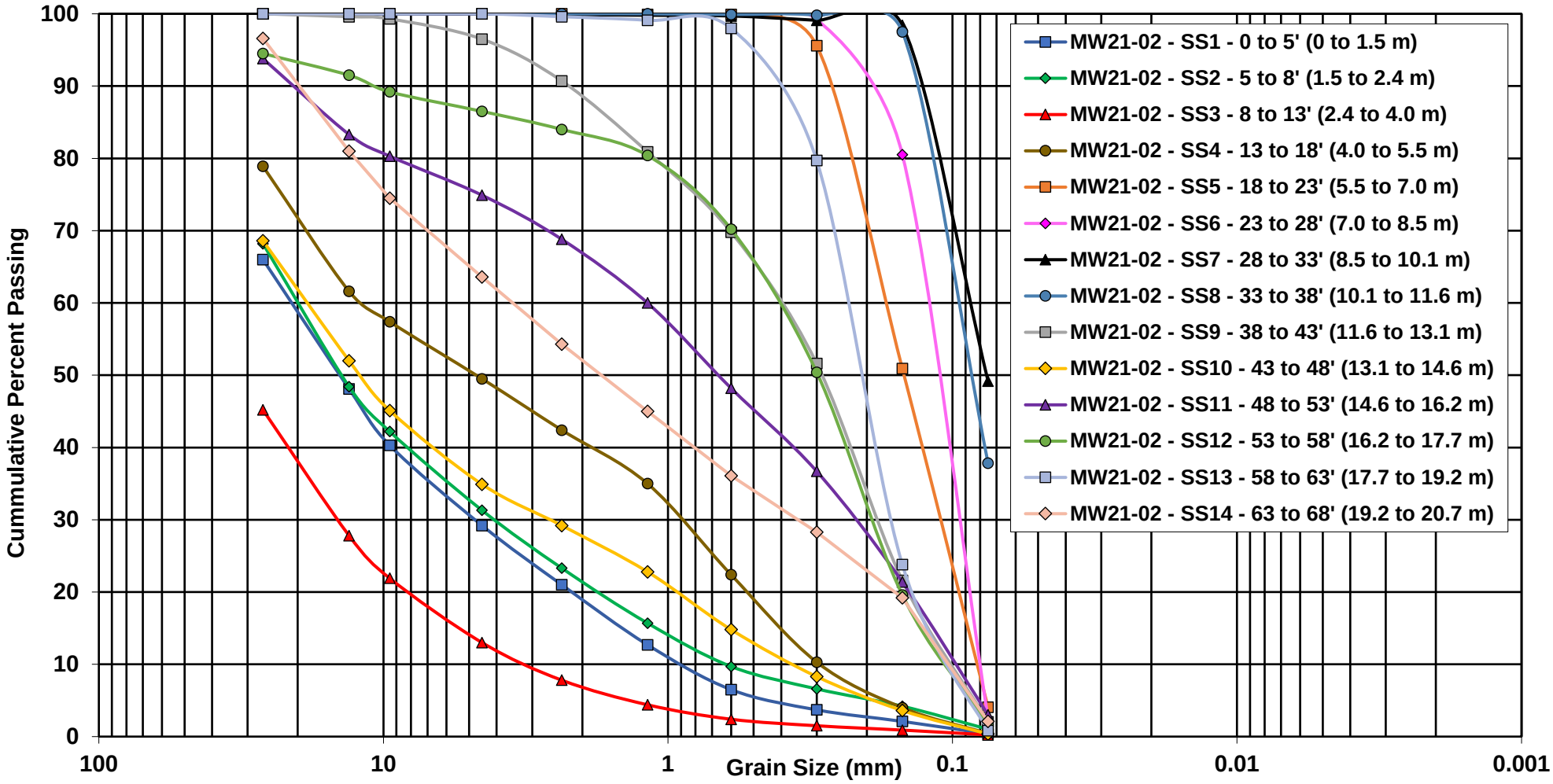
Project Name:	Anthony Pit	Project & Task No.:	160961457.202
Client:	CBM	Date Sampled:	November 5, 2021
General Contractor:	N/A	Proposed Use:	N/A
Inspector / Technician:	N/A	Material Type:	
Supplier:	N/A	Lab No.:	420-423
Sample Location:	**MW21-02**		

Run Depth (ft)		Sample ID	Field Description (optional)	Full FM Value	Sand Portion FM Value	Wash Loss (%)	Crushed Stone (%)	Stone to Sand Ratio		
Top	Bottom							Ratio	Stone	Sand
(ft)	(ft)									
0	5	1		6.01	4.13	7.1	75.0	71:29	71	29
5	8	2		5.62	3.78	9.7	65.2	69:30	69	30
8	13	3		7.25	4.56	1.2	97.3	87:13	87	13
13	18	4		4.54	3.20	6.2	73.6	51:49	51	49
18	23	5		0.54	0.54	28.9	0.0	0:96	0	96
23	28	6		0.20	0.20	61.2	0.0	0:98	0	98
28	33	7		0.03	0.03	79.0	0.0	0:51	0	51
33	38	8		0.03	0.03	47.7	0.0	0:62	0	62
38	43	9		1.79	1.78	15.3	61.6	4:95	4	95
43	48	10		5.14	3.40	7.1	68.2	65:35	65	35
48	53	11		2.66	2.11	23.7	81.9	25:72	25	72
53	58	12		1.93	1.61	13.0	57.1	14:85	14	85
58	63	13		1.00	1.00	5.8	0.0	0:99	0	99
63	68	14		3.08	2.49	60.6	88.3	36:62	36	62

Grain Size Distribution Test Report (ISO 14688-1:2002)

MW21-02

FIGURE D2



Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	Gravel		**Sand**				

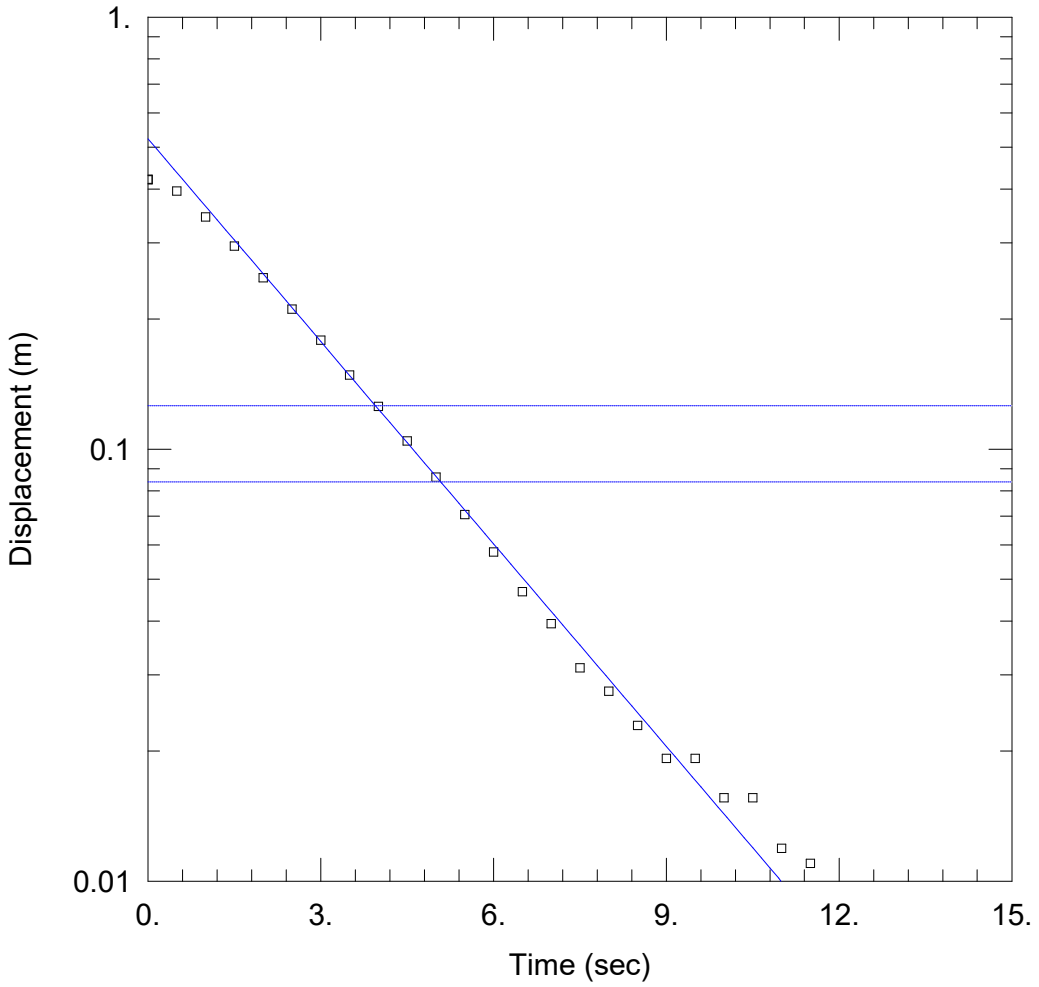
DATE: September 2022

PROJECT: 160961457

Stantec

prepared by: **RD**

CHK: **SMD**



MW21-02-RISINGHEAD TEST #1

Data Set: \...\MW21-02_risinghead_test1_DG_JK.aqt
Date: 03/20/25 Time: 08:59:52

PROJECT INFORMATION

Company: Stantec
Client: CBM
Project: 160961457
Location: Ontario
Test Well: MW21-02
Test Date: May 4, 2023

AQUIFER DATA

Saturated Thickness: 17.05 m Anisotropy Ratio (Kz/Kr): 0.35

WELL DATA (MW21-02)

Initial Displacement: 0.42 m
Total Well Penetration Depth: 17.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 17.05 m
Screen Length: 3.05 m
Well Radius: 0.084 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.00016 m/sec
y0 = 0.5229 m

Stantec

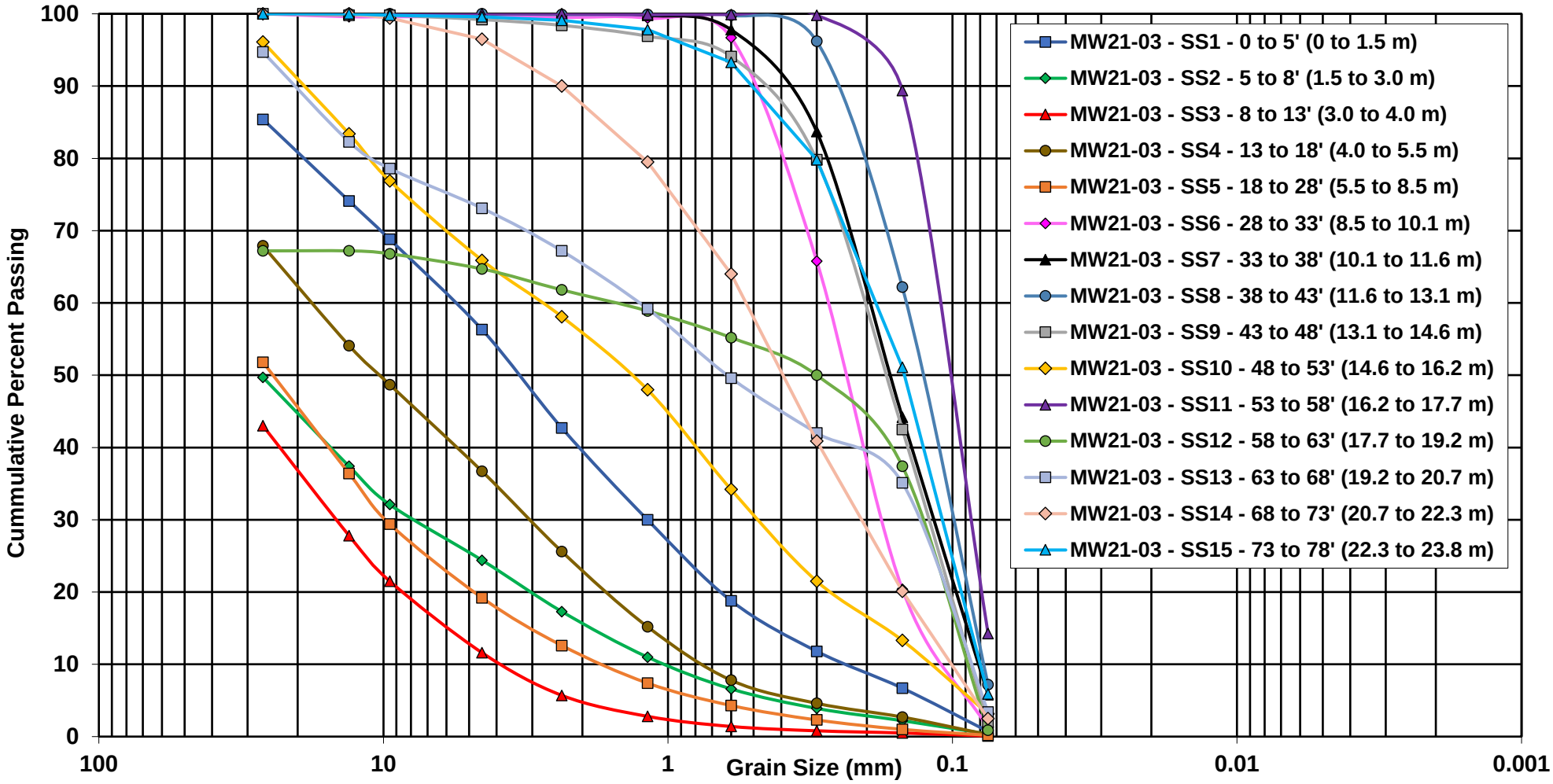
Project Name:	Anthony Pit	Project & Task No.:	160961457.202
Client:	CBM	Date Sampled:	November 5, 2021
General Contractor:	N/A	Proposed Use:	N/A
Inspector / Technician:	N/A	Material Type:	
Supplier:	N/A	Lab No.:	420-423
Sample Location:	**MW21-03**		

Run Depth (ft)		Sample ID	Field Description (optional)	Full FM Value	Sand Portion FM Value	Wash Loss (%)	Crushed Stone (%)	Stone to Sand Ratio		
Top	Bottom							Ratio	Stone	Sand
(ft)	(ft)									
0	5	1		4.39	3.48	26.4	81.4	44:56	44	56
5	10	2		6.46	4.07	9.3	86.5	76:24	76	24
10	13	3		7.66	4.93	1.3	81.8	88:12	88	12
13	18	4		5.78	4.11	8.3	81.8	63:36	63	36
18	28	5		6.75	4.37	0.8	44.4	81:19	81	19
28	33	6		1.18	1.17	9.0	0.0	0:98	0	98
33	38	7		0.75	0.75	17.7	0.0	0:94	0	94
38	43	8		0.42	0.42	18.8	0.0	0:93	0	93
43	48	9		0.86	0.86	48.8	50.0	1:97	1	97
48	53	10		3.22	2.69	23.8	44.8	34:63	34	63
53	58	11		0.11	0.11	45.8	0.0	0:86	0	86
58	63	12		2.60	1.29	83.2	92.2	36:64	35	64
63	68	13		2.37	1.81	74.1	29.2	27:70	27	70
68	73	14		1.99	1.98	61.1	33.7	4:94	4	94
73	78	15		0.78	0.78	46.7	0.0	0:94	0	94

Grain Size Distribution Test Report (ISO 14688-1:2002)

MW21-03

FIGURE D3



Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	Gravel		**Sand**				

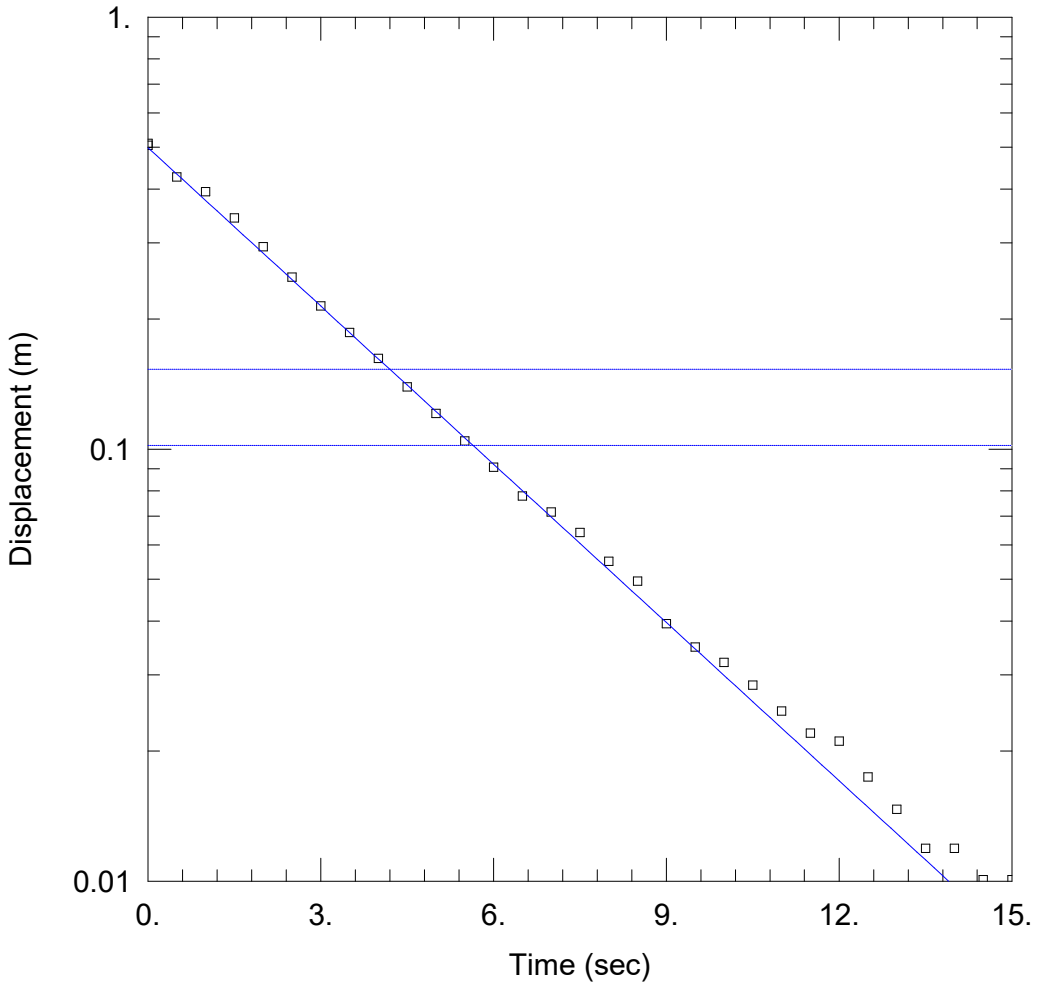
DATE: September 2022

PROJECT: 160961457

Stantec

prepared by: **RD**

CHK: **SMD**



MW21-03-RISINGHEAD TEST2

Data Set: \...\MW21-03_risinghead_test2_DG_JK.aqt
Date: 03/20/25 Time: 09:43:52

PROJECT INFORMATION

Company: Stantec
Client: CBM
Project: 160961457
Location: Ontario
Test Well: MW21-03
Test Date: May 4, 2023

AQUIFER DATA

Saturated Thickness: 12.72 m Anisotropy Ratio (Kz/Kr): 0.35

WELL DATA (MW21-03)

Initial Displacement: 0.51 m
Total Well Penetration Depth: 12.72 m
Casing Radius: 0.0254 m
Static Water Column Height: 12.72 m
Screen Length: 3.05 m
Well Radius: 0.084 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.00012 m/sec y0 = 0.4986 m

Stantec

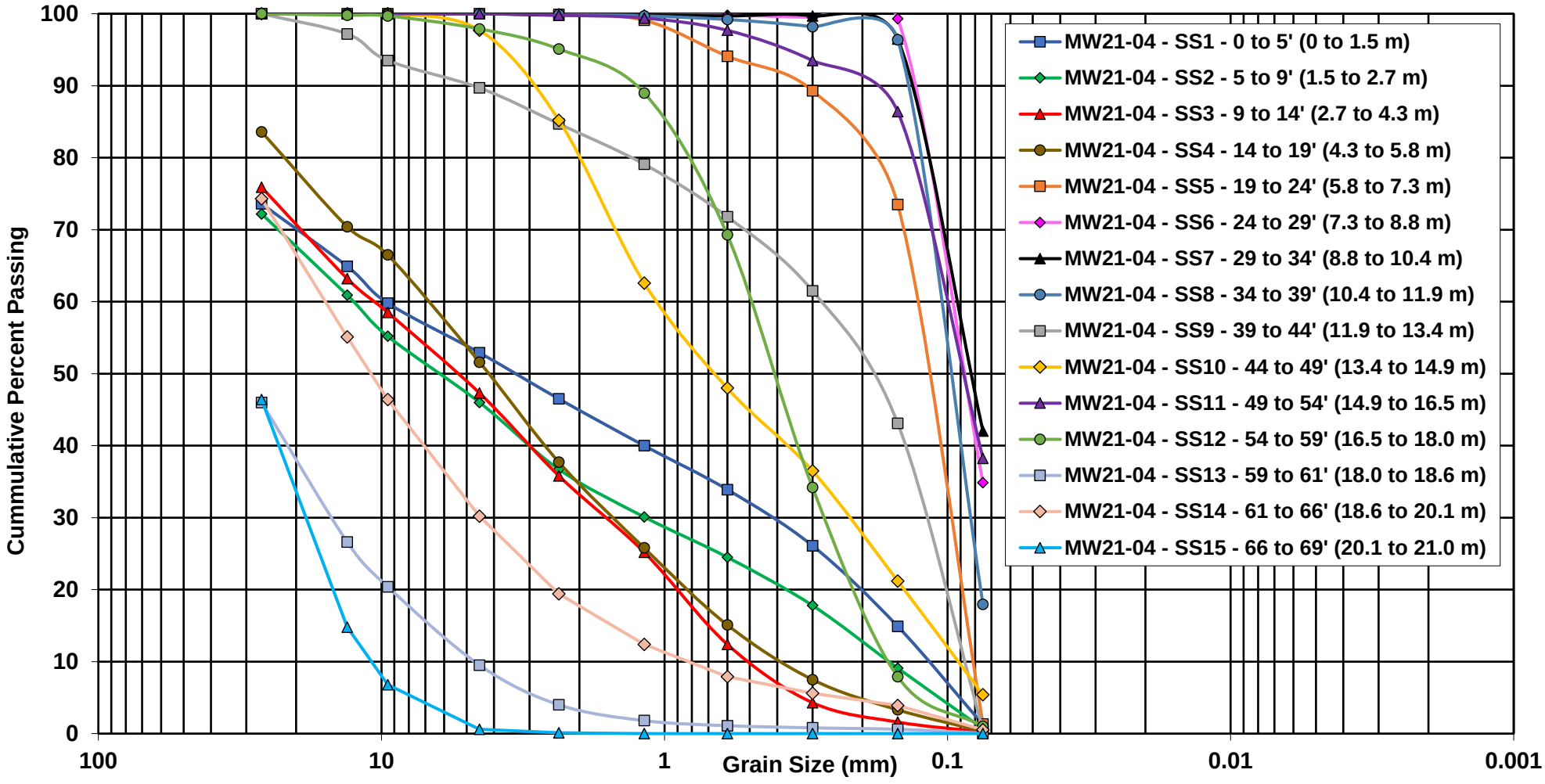
Project Name:	Anthony Pit	Project & Task No.:	160961457.202
Client:	CBM	Date Sampled:	November 5, 2021
General Contractor:	N/A	Proposed Use:	N/A
Inspector / Technician:	N/A	Material Type:	
Supplier:	N/A	Lab No.:	420-423
Sample Location:	**MW21-04**		

Run Depth (ft)		Sample ID	Field Description (optional)	Full FM Value	Sand Portion FM Value	Wash Loss (%)	Crushed Stone (%)	Stone to Sand Ratio		
Top	Bottom									
(ft)	(ft)							Ratio	Stone	Sand
0	5	1		3.75	2.42	29.1	75.1	47:52	47	52
5	9	2		3.63	3.37	11.9	50.7	54:45	54	45
9	14	3		4.08	3.79	2.6	55.1	53:47	53	47
14	19	4		4.09	3.77	29.9	38.1	48:51	48	51
19	24	5		0.44	0.44	60.5	0.0	0:99	0	99
24	29	6		0.02	0.02	90.8	0.0	0:65	0	65
29	34	7		0.04	0.04	43.3	0.0	0:58	0	58
34	39	8		0.07	0.07	95.5	0.0	0:82	0	82
39	44	9		1.40	1.31	88.1	93.3	10:89	10	89
44	49	10		2.43	2.43	97.5	50.0	2:92	2	92
49	54	11		0.23	0.23	75.6	0.0	0:62	0	62
54	59	12		2.06	2.04	2.8	69.0	2:97	2	97
59	61	13		4.49	4.12	1.1	100.0	91:9	91	9
61	66	14		4.41	3.97	9.2	100.0	70:30	70	30
66	69	15		4.52	4.07	9.2	97.5	99:1	99	1

Grain Size Distribution Test Report (ISO 14688-1:2002)

MW21-04

FIGURE D4



Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	Gravel		**Sand**				

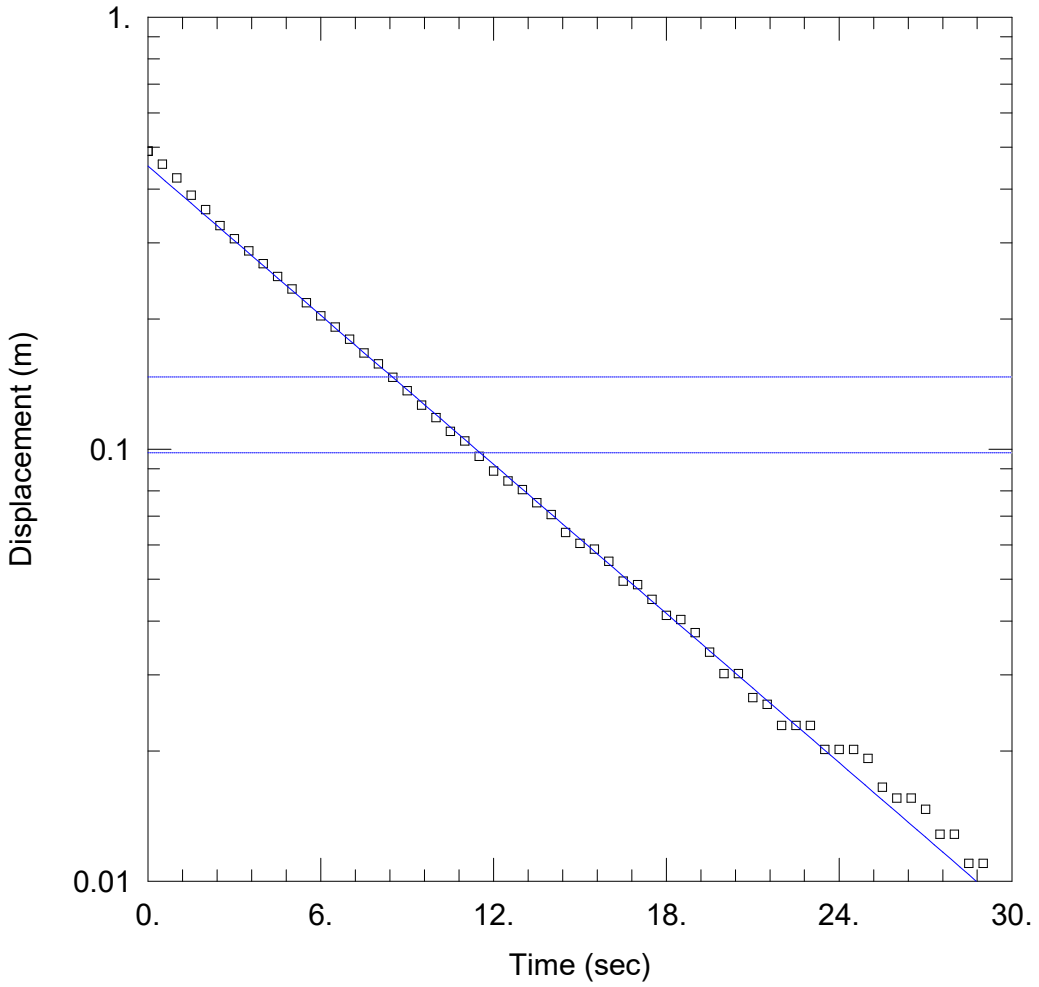
DATE: September 2022

PROJECT: 160961457

Stantec

prepared by: **RD**

CHK: **SMD**



MW21-04-RISINGHEAD TEST 3

Data Set: \...\MW21-04_risinghead_test3_DG_JK.aqt
Date: 03/20/25 Time: 10:08:58

PROJECT INFORMATION

Company: Stantec
Client: CBM
Project: 160961457
Location: Ontario
Test Well: MW21-04
Test Date: May 4, 2023

AQUIFER DATA

Saturated Thickness: 17.26 m Anisotropy Ratio (Kz/Kr): 0.35

WELL DATA (MW21-04)

Initial Displacement: 0.49 m
Total Well Penetration Depth: 17.26 m
Casing Radius: 0.0254 m
Static Water Column Height: 17.26 m
Screen Length: 3.05 m
Well Radius: 0.084 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 5.9E-5 m/sec
y0 = 0.4521 m

Stantec

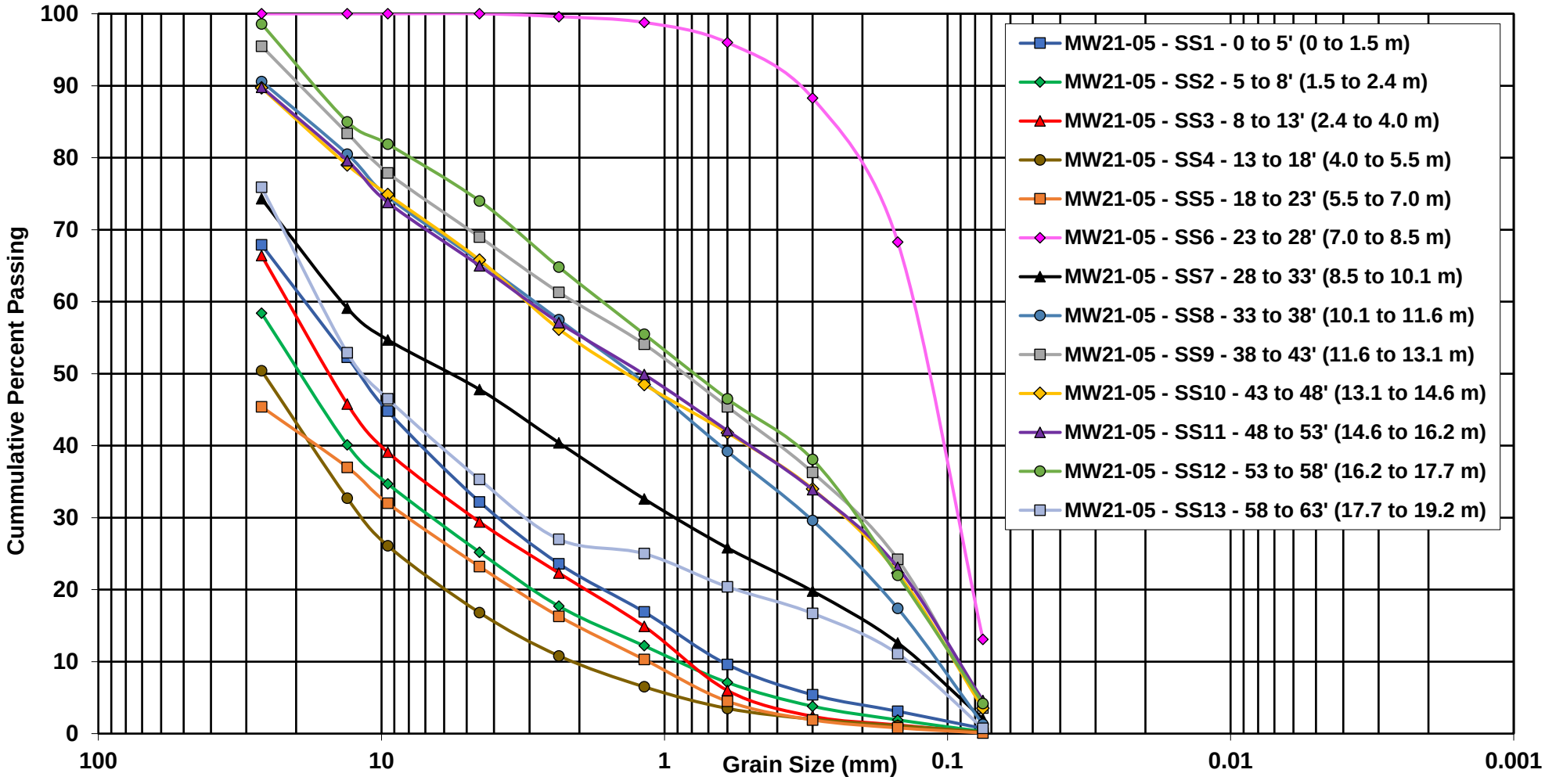
Project Name:	Anthony Pit	Project & Task No.:	160961457.202
Client:	CBM	Date Sampled:	November 5, 2021
General Contractor:	N/A	Proposed Use:	N/A
Inspector / Technician:	N/A	Material Type:	
Supplier:	N/A	Lab No.:	420-423
Sample Location:	**MW21-05**		

Run Depth (ft)		Sample ID	Field Description (optional)	Full FM Value	Sand Portion FM Value	Wash Loss (%)	Crushed Stone (%)	Stone to Sand Ratio		
Top (ft)	Bottom (ft)							Ratio	Stone	Sand
0	5	1		5.62	3.86	7.1	80.2	68:32	68	32
5	8	2		6.27	4.06	5.6	76.2	75:25	75	25
8	13	3		6.05	4.11	2.6	62.1	71:29	71	29
13	18	4		6.90	4.41	2.3	64.4	83:17	83	17
18	23	5		6.75	4.31	1.6	66.7	77:23	77	23
23	28	6		0.49	0.49	54.3	0.0	0:87	0	87
28	33	7		4.22	2.78	28.8	75.2	52:46	52	46
33	38	8		3.09	2.41	41.0	75.6	34:64	34	64
38	43	9		2.64	2.10	50.3	80.3	31:66	31	66
43	48	10		2.98	2.26	48.8	84.3	34:62	34	62
48	53	11		2.89	2.18	47.5	93.1	35:60	35	60
53	58	12		2.62	2.20	33.9	92.9	26:70	26	70
58	63	13		4.43	2.81	32.6	95.7	65:35	65	35

Grain Size Distribution Test Report (ISO 14688-1:2002)

MW21-05

FIGURE D5



Cobble Size	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	Gravel		Sand				

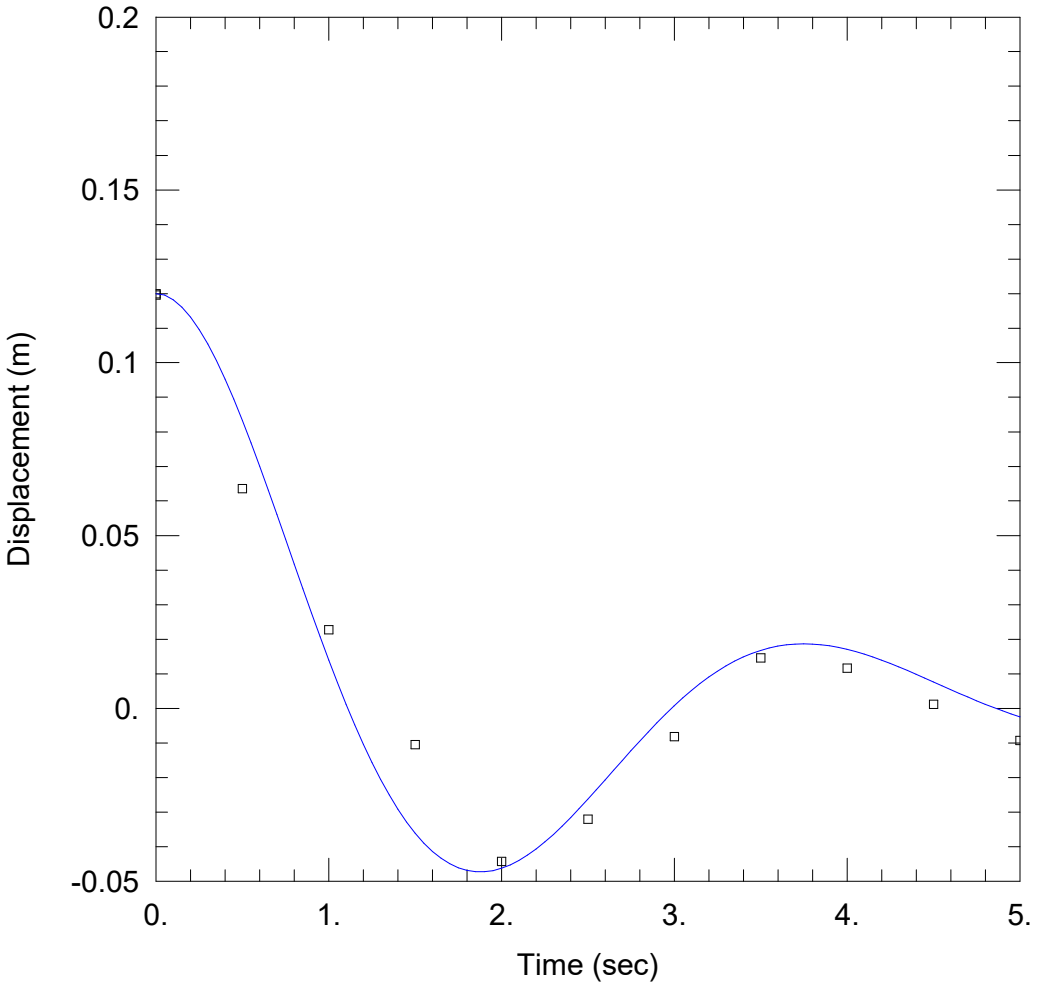
DATE: September 2022

PROJECT: 160961457

Stantec

prepared by: RD

CHK: SMD



MW21--05-RISINGHEAD TEST2

Data Set: \...\MW21-05_risinghead_test 2_DG_JK.aqt
Date: 03/20/25 Time: 10:56:03

PROJECT INFORMATION

Company: Stantec
Client: CBM
Project: 160961457
Location: Ontario
Test Well: MW21-05
Test Date: May 4, 2023

AQUIFER DATA

Saturated Thickness: 5.16 m Anisotropy Ratio (Kz/Kr): 0.5

WELL DATA (MW21-05)

Initial Displacement: 0.12 m
Total Well Penetration Depth: 5.16 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.16 m
Screen Length: 3.05 m
Well Radius: 0.084 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Springer-Gelhar

K = 0.0011 m/sec Le = 3.215 m

Appendix E

Water Quality Analytical Data

Your Project #: 160961457
Your C.O.C. #: 854554-01-01

Attention: Aaron Warkentin

Stantec Consulting Ltd
300 Hagey Blvd
Suite 100
Waterloo, ON
CANADA N2L 0A4

Report Date: 2021/11/18
Report #: R6907859
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1X2744
Received: 2021/11/11, 10:11

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	4	N/A	2021/11/17	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	4	N/A	2021/11/17	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	4	N/A	2021/11/18	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	4	N/A	2021/11/17	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	4	N/A	2021/11/16	CAM SOP-00446	SM 23 5310 B m
Petroleum Hydro. CCME F1 & BTEX in Water	4	N/A	2021/11/16	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Water (2)	4	2021/11/16	2021/11/17	CAM SOP-00316	CCME PHC-CWS m
Hardness (calculated as CaCO3)	4	N/A	2021/11/18	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Metals by ICPMS	4	N/A	2021/11/17	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	4	N/A	2021/11/18		
Anion and Cation Sum	4	N/A	2021/11/18		
Total Ammonia-N	4	N/A	2021/11/16	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (3)	4	N/A	2021/11/17	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	4	2021/11/15	2021/11/17	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	4	N/A	2021/11/17	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	4	N/A	2021/11/18		Auto Calc
Sat. pH and Langelier Index (@ 4C)	4	N/A	2021/11/18		Auto Calc
Sulphate by Automated Colourimetry	4	N/A	2021/11/17	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	4	N/A	2021/11/18		Auto Calc

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Your Project #: 160961457
Your C.O.C. #: 854554-01-01

Attention: Aaron Warkentin

Stantec Consulting Ltd
300 Hagey Blvd
Suite 100
Waterloo, ON
CANADA N2L 0A4

Report Date: 2021/11/18
Report #: R6907859
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1X2744
Received: 2021/11/11, 10:11

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas Laboratories conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following “Alberta Environment’s Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003”. Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.
(3) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key



Bureau Veritas
18 Nov 2021 17:26:13

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ronklin Gracian, Project Manager
Email: Ronklin.Gracian@bureauveritas.com
Phone# (905)817-5752

==========

This report has been generated and distributed using a secure automated process.
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		RFC803		RFC804	RFC805			
Sampling Date		2021/11/10 10:30		2021/11/10 12:15	2021/11/10 14:40			
COC Number		854554-01-01		854554-01-01	854554-01-01			
	UNITS	MW21-05 (ANTH)	QC Batch	MW21-04 (ANTH)	MW21-01 (ANTH)	RDL	MDL	QC Batch
Calculated Parameters								
Anion Sum	me/L	7.74	7699718	6.02	5.70	N/A	N/A	7699718
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	290	7699719	220	210	1.0	0.20	7699719
Calculated TDS	mg/L	400	7699722	310	300	1.0	0.20	7699722
Carb. Alkalinity (calc. as CaCO3)	mg/L	3.4	7699719	3.0	2.8	1.0	0.20	7699719
Cation Sum	me/L	7.84	7699718	6.05	5.61	N/A	N/A	7699718
Hardness (CaCO3)	mg/L	350	7699717	280	260	1.0	1.0	7699717
Ion Balance (% Difference)	%	0.690	7699716	0.230	0.750	N/A	N/A	7699716
Langelier Index (@ 20C)	N/A	1.07	7699720	0.891	0.863			7699720
Langelier Index (@ 4C)	N/A	0.823	7699721	0.642	0.614			7699721
Saturation pH (@ 20C)	N/A	7.03	7699720	7.26	7.28			7699720
Saturation pH (@ 4C)	N/A	7.27	7699721	7.51	7.53			7699721
Inorganics								
Total Ammonia-N	mg/L	<0.050	7702408	<0.050	<0.050	0.050	0.0080	7702408
Conductivity	umho/cm	710	7701424	550	520	1.0	0.20	7701424
Dissolved Organic Carbon	mg/L	0.49	7700772	1.6	<0.40	0.40	0.070	7700772
Orthophosphate (P)	mg/L	<0.010	7701916	<0.010	0.019	0.010	0.0050	7701916
pH	pH	8.10	7701418	8.15	8.14			7701418
Dissolved Sulphate (SO4)	mg/L	33	7701922	37	32	1.0	0.10	7701922
Alkalinity (Total as CaCO3)	mg/L	290	7701443	220	210	1.0	0.20	7701443
Dissolved Chloride (Cl-)	mg/L	40	7701919	27	25	1.0	0.30	7701919
Nitrite (N)	mg/L	<0.010	7701041	<0.010	<0.010	0.010	0.0020	7701041
Nitrate (N)	mg/L	1.16	7701041	0.38	1.23	0.10	0.010	7701041
Nitrate + Nitrite (N)	mg/L	1.16	7701041	0.38	1.23	0.10	0.010	7701041
Metals								
Dissolved Aluminum (Al)	mg/L	<0.0049	7703516	<0.0049	<0.0049	0.0049	0.0049	7704461
Dissolved Antimony (Sb)	mg/L	<0.00050	7703516	<0.00050	<0.00050	0.00050	0.00050	7704461
Dissolved Arsenic (As)	mg/L	<0.0010	7703516	<0.0010	<0.0010	0.0010	0.0010	7704461
Dissolved Barium (Ba)	mg/L	0.053	7703516	0.075	0.048	0.0020	0.0020	7704461
Dissolved Beryllium (Be)	mg/L	<0.00040	7703516	<0.00040	<0.00040	0.00040	0.00040	7704461
Dissolved Boron (B)	mg/L	0.013	7703516	0.012	<0.010	0.010	0.010	7704461

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		RFC803		RFC804	RFC805			
Sampling Date		2021/11/10 10:30		2021/11/10 12:15	2021/11/10 14:40			
COC Number		854554-01-01		854554-01-01	854554-01-01			
	UNITS	MW21-05 (ANTH)	QC Batch	MW21-04 (ANTH)	MW21-01 (ANTH)	RDL	MDL	QC Batch
Dissolved Cadmium (Cd)	mg/L	0.00017	7703516	<0.000090	<0.000090	0.000090	0.000090	7704461
Dissolved Calcium (Ca)	mg/L	90	7703516	65	64	0.20	0.20	7704461
Dissolved Chromium (Cr)	mg/L	<0.0050	7703516	<0.0050	<0.0050	0.0050	0.0050	7704461
Dissolved Cobalt (Co)	mg/L	<0.00050	7703516	<0.00050	<0.00050	0.00050	0.00050	7704461
Dissolved Copper (Cu)	mg/L	<0.00090	7703516	<0.00090	<0.00090	0.00090	0.00090	7704461
Dissolved Iron (Fe)	mg/L	<0.10	7703516	<0.10	<0.10	0.10	0.050	7704461
Dissolved Lead (Pb)	mg/L	<0.00050	7703516	<0.00050	<0.00050	0.00050	0.00050	7704461
Dissolved Magnesium (Mg)	mg/L	31	7703516	28	23	0.050	0.050	7704461
Dissolved Manganese (Mn)	mg/L	0.0059	7703516	0.017	0.0035	0.0020	0.0020	7704461
Dissolved Molybdenum (Mo)	mg/L	0.0012	7703516	0.0038	0.0013	0.00050	0.00050	7704461
Dissolved Nickel (Ni)	mg/L	<0.0010	7703516	0.0011	<0.0010	0.0010	0.0010	7704461
Dissolved Phosphorus (P)	mg/L	<0.10	7703516	<0.10	<0.10	0.10	0.050	7704461
Dissolved Potassium (K)	mg/L	1.6	7703516	1.5	1.1	0.20	0.20	7704461
Dissolved Selenium (Se)	mg/L	<0.0020	7703516	<0.0020	<0.0020	0.0020	0.0020	7704461
Dissolved Silicon (Si)	mg/L	3.5	7703516	4.1	3.7	0.050	0.050	7704461
Dissolved Silver (Ag)	mg/L	<0.000090	7703516	<0.000090	<0.000090	0.000090	0.000090	7704461
Dissolved Sodium (Na)	mg/L	17	7703516	12	10	0.10	0.10	7704461
Dissolved Strontium (Sr)	mg/L	0.14	7703516	0.10	0.068	0.0010	0.0010	7704461
Dissolved Thallium (Tl)	mg/L	<0.000050	7703516	<0.000050	<0.000050	0.000050	0.000050	7704461
Dissolved Titanium (Ti)	mg/L	<0.0050	7703516	<0.0050	<0.0050	0.0050	0.0050	7704461
Dissolved Uranium (U)	mg/L	0.00032	7703516	0.0014	0.00036	0.00010	0.00010	7704461
Dissolved Vanadium (V)	mg/L	<0.00050	7703516	<0.00050	<0.00050	0.00050	0.00050	7704461
Dissolved Zinc (Zn)	mg/L	0.096	7703516	0.043	0.063	0.0050	0.0050	7704461

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		RFC805				RFC806			
Sampling Date		2021/11/10 14:40				2021/11/10 16:50			
COC Number		854554-01-01				854554-01-01			
	UNITS	MW21-01 (ANTH) Lab-Dup	RDL	MDL	QC Batch	MW21-02 (ANTH)	RDL	MDL	QC Batch
Calculated Parameters									
Anion Sum	me/L					6.12	N/A	N/A	7699718
Bicarb. Alkalinity (calc. as CaCO3)	mg/L					240	1.0	0.20	7699719
Calculated TDS	mg/L					320	1.0	0.20	7699722
Carb. Alkalinity (calc. as CaCO3)	mg/L					3.0	1.0	0.20	7699719
Cation Sum	me/L					6.28	N/A	N/A	7699718
Hardness (CaCO3)	mg/L					300	1.0	1.0	7699717
Ion Balance (% Difference)	%					1.29	N/A	N/A	7699716
Langelier Index (@ 20C)	N/A					0.969			7699720
Langelier Index (@ 4C)	N/A					0.720			7699721
Saturation pH (@ 20C)	N/A					7.16			7699720
Saturation pH (@ 4C)	N/A					7.40			7699721
Inorganics									
Total Ammonia-N	mg/L					<0.050	0.050	0.0080	7702408
Conductivity	umho/cm					550	1.0	0.20	7701424
Dissolved Organic Carbon	mg/L					<0.40	0.40	0.070	7700772
Orthophosphate (P)	mg/L	<0.010	0.010	0.0050	7701916	<0.010	0.010	0.0050	7701916
pH	pH					8.12			7701418
Dissolved Sulphate (SO4)	mg/L	32	1.0	0.10	7701922	41	1.0	0.10	7701922
Alkalinity (Total as CaCO3)	mg/L					250	1.0	0.20	7701443
Dissolved Chloride (Cl-)	mg/L	25	1.0	0.30	7701919	13	1.0	0.30	7701919
Nitrite (N)	mg/L					<0.010	0.010	0.0020	7701041
Nitrate (N)	mg/L					<0.10	0.10	0.010	7701041
Nitrate + Nitrite (N)	mg/L					<0.10	0.10	0.010	7701041
Metals									
Dissolved Aluminum (Al)	mg/L					0.0058	0.0049	0.0049	7704461
Dissolved Antimony (Sb)	mg/L					<0.00050	0.00050	0.00050	7704461
Dissolved Arsenic (As)	mg/L					0.0010	0.0010	0.0010	7704461
Dissolved Barium (Ba)	mg/L					0.10	0.0020	0.0020	7704461
Dissolved Beryllium (Be)	mg/L					<0.00040	0.00040	0.00040	7704461

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		RFC805				RFC806			
Sampling Date		2021/11/10 14:40				2021/11/10 16:50			
COC Number		854554-01-01				854554-01-01			
	UNITS	MW21-01 (ANTH) Lab-Dup	RDL	MDL	QC Batch	MW21-02 (ANTH)	RDL	MDL	QC Batch
Dissolved Boron (B)	mg/L					<0.010	0.010	0.010	7704461
Dissolved Cadmium (Cd)	mg/L					<0.000090	0.000090	0.000090	7704461
Dissolved Calcium (Ca)	mg/L					76	0.20	0.20	7704461
Dissolved Chromium (Cr)	mg/L					<0.0050	0.0050	0.0050	7704461
Dissolved Cobalt (Co)	mg/L					<0.00050	0.00050	0.00050	7704461
Dissolved Copper (Cu)	mg/L					<0.00090	0.00090	0.00090	7704461
Dissolved Iron (Fe)	mg/L					0.30	0.10	0.050	7704461
Dissolved Lead (Pb)	mg/L					<0.00050	0.00050	0.00050	7704461
Dissolved Magnesium (Mg)	mg/L					28	0.050	0.050	7704461
Dissolved Manganese (Mn)	mg/L					0.076	0.0020	0.0020	7704461
Dissolved Molybdenum (Mo)	mg/L					0.0024	0.00050	0.00050	7704461
Dissolved Nickel (Ni)	mg/L					<0.0010	0.0010	0.0010	7704461
Dissolved Phosphorus (P)	mg/L					<0.10	0.10	0.050	7704461
Dissolved Potassium (K)	mg/L					1.0	0.20	0.20	7704461
Dissolved Selenium (Se)	mg/L					<0.0020	0.0020	0.0020	7704461
Dissolved Silicon (Si)	mg/L					6.6	0.050	0.050	7704461
Dissolved Silver (Ag)	mg/L					<0.000090	0.000090	0.000090	7704461
Dissolved Sodium (Na)	mg/L					3.7	0.10	0.10	7704461
Dissolved Strontium (Sr)	mg/L					0.10	0.0010	0.0010	7704461
Dissolved Thallium (Tl)	mg/L					<0.000050	0.000050	0.000050	7704461
Dissolved Titanium (Ti)	mg/L					<0.0050	0.0050	0.0050	7704461
Dissolved Uranium (U)	mg/L					0.00080	0.00010	0.00010	7704461
Dissolved Vanadium (V)	mg/L					<0.00050	0.00050	0.00050	7704461
Dissolved Zinc (Zn)	mg/L					0.0069	0.0050	0.0050	7704461

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		RFC806			
Sampling Date		2021/11/10 16:50			
COC Number		854554-01-01			
	UNITS	**MW21-02 (ANTH) Lab-Dup**	**RDL**	**MDL**	**QC Batch**
Inorganics					
Conductivity	umho/cm	550	1.0	0.20	7701424
pH	pH	8.14			7701418
Alkalinity (Total as CaCO3)	mg/L	250	1.0	0.20	7701443

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

O.REG 153 PHCS, BTEX/F1-F4 (WATER)

Bureau Veritas ID		RFC803	RFC804	RFC805	RFC806			
Sampling Date		2021/11/10 10:30	2021/11/10 12:15	2021/11/10 14:40	2021/11/10 16:50			
COC Number		854554-01-01	854554-01-01	854554-01-01	854554-01-01			
	UNITS	MW21-05 (ANTH)	MW21-04 (ANTH)	MW21-01 (ANTH)	MW21-02 (ANTH)	RDL	MDL	QC Batch
BTEX & F1 Hydrocarbons								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	0.040	7704420
Toluene	ug/L	<0.20	0.22	<0.20	<0.20	0.20	0.040	7704420
Ethylbenzene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	0.040	7704420
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	0.040	7704420
p+m-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	0.080	7704420
Total Xylenes	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	0.080	7704420
F1 (C6-C10)	ug/L	<25	<25	<25	<25	25	20	7704420
F1 (C6-C10) - BTEX	ug/L	<25	<25	<25	<25	25	20	7704420
F2-F4 Hydrocarbons								
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	<100	<100	100	50	7703732
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	<200	<200	200	70	7703732
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	<200	<200	200	50	7703732
Reached Baseline at C50	ug/L	Yes	Yes	Yes	Yes			7703732
Surrogate Recovery (%)								
1,4-Difluorobenzene	%	98	98	97	99			7704420
4-Bromofluorobenzene	%	84	83	82	79			7704420
D10-o-Xylene	%	95	97	95	95			7704420
D4-1,2-Dichloroethane	%	110	109	110	110			7704420
o-Terphenyl	%	102	100	101	100			7703732

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

TEST SUMMARY

Bureau Veritas ID: RFC803
Sample ID: MW21-05 (ANTH)
Matrix: Water

Collected: 2021/11/10
Shipped:
Received: 2021/11/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7701443	N/A	2021/11/17	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7699719	N/A	2021/11/17	Automated Statchk
Chloride by Automated Colourimetry	KONE	7701919	N/A	2021/11/18	Avneet Kour Sudan
Conductivity	AT	7701424	N/A	2021/11/17	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7700772	N/A	2021/11/16	Julianna Castiglione
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7704420	N/A	2021/11/16	Joe Paino
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7703732	2021/11/16	2021/11/17	Dennis Ngondu
Hardness (calculated as CaCO3)		7699717	N/A	2021/11/18	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	7703516	N/A	2021/11/17	Nan Raykha
Ion Balance (% Difference)	CALC	7699716	N/A	2021/11/18	Automated Statchk
Anion and Cation Sum	CALC	7699718	N/A	2021/11/18	Automated Statchk
Total Ammonia-N	LACH/NH4	7702408	N/A	2021/11/16	Viorica Rotaru
Nitrate & Nitrite as Nitrogen in Water	LACH	7701041	N/A	2021/11/17	Chandra Nandlal
pH	AT	7701418	2021/11/15	2021/11/17	Surinder Rai
Orthophosphate	KONE	7701916	N/A	2021/11/17	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7699720	N/A	2021/11/18	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7699721	N/A	2021/11/18	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7701922	N/A	2021/11/17	Avneet Kour Sudan
Total Dissolved Solids (TDS calc)	CALC	7699722	N/A	2021/11/18	Automated Statchk

Bureau Veritas ID: RFC804
Sample ID: MW21-04 (ANTH)
Matrix: Water

Collected: 2021/11/10
Shipped:
Received: 2021/11/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7701443	N/A	2021/11/17	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7699719	N/A	2021/11/17	Automated Statchk
Chloride by Automated Colourimetry	KONE	7701919	N/A	2021/11/18	Avneet Kour Sudan
Conductivity	AT	7701424	N/A	2021/11/17	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7700772	N/A	2021/11/16	Julianna Castiglione
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7704420	N/A	2021/11/16	Joe Paino
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7703732	2021/11/16	2021/11/17	Dennis Ngondu
Hardness (calculated as CaCO3)		7699717	N/A	2021/11/18	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	7704461	N/A	2021/11/17	Nan Raykha
Ion Balance (% Difference)	CALC	7699716	N/A	2021/11/18	Automated Statchk
Anion and Cation Sum	CALC	7699718	N/A	2021/11/18	Automated Statchk
Total Ammonia-N	LACH/NH4	7702408	N/A	2021/11/16	Viorica Rotaru
Nitrate & Nitrite as Nitrogen in Water	LACH	7701041	N/A	2021/11/17	Chandra Nandlal
pH	AT	7701418	2021/11/15	2021/11/17	Surinder Rai
Orthophosphate	KONE	7701916	N/A	2021/11/17	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7699720	N/A	2021/11/18	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7699721	N/A	2021/11/18	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7701922	N/A	2021/11/17	Avneet Kour Sudan
Total Dissolved Solids (TDS calc)	CALC	7699722	N/A	2021/11/18	Automated Statchk

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

TEST SUMMARY

Bureau Veritas ID: RFC805 **Collected:** 2021/11/10
Sample ID: MW21-01 (ANTH) **Shipped:**
Matrix: Water **Received:** 2021/11/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7701443	N/A	2021/11/17	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7699719	N/A	2021/11/17	Automated Statchk
Chloride by Automated Colourimetry	KONE	7701919	N/A	2021/11/18	Avneet Kour Sudan
Conductivity	AT	7701424	N/A	2021/11/17	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7700772	N/A	2021/11/16	Julianna Castiglione
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7704420	N/A	2021/11/16	Joe Paino
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7703732	2021/11/16	2021/11/17	Dennis Ngondu
Hardness (calculated as CaCO3)		7699717	N/A	2021/11/18	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	7704461	N/A	2021/11/17	Nan Raykha
Ion Balance (% Difference)	CALC	7699716	N/A	2021/11/18	Automated Statchk
Anion and Cation Sum	CALC	7699718	N/A	2021/11/18	Automated Statchk
Total Ammonia-N	LACH/NH4	7702408	N/A	2021/11/16	Viorica Rotaru
Nitrate & Nitrite as Nitrogen in Water	LACH	7701041	N/A	2021/11/17	Chandra Nandlal
pH	AT	7701418	2021/11/15	2021/11/17	Surinder Rai
Orthophosphate	KONE	7701916	N/A	2021/11/17	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7699720	N/A	2021/11/18	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7699721	N/A	2021/11/18	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7701922	N/A	2021/11/17	Avneet Kour Sudan
Total Dissolved Solids (TDS calc)	CALC	7699722	N/A	2021/11/18	Automated Statchk

Bureau Veritas ID: RFC805 Dup **Collected:** 2021/11/10
Sample ID: MW21-01 (ANTH) **Shipped:**
Matrix: Water **Received:** 2021/11/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	7701919	N/A	2021/11/18	Avneet Kour Sudan
Orthophosphate	KONE	7701916	N/A	2021/11/17	Avneet Kour Sudan
Sulphate by Automated Colourimetry	KONE	7701922	N/A	2021/11/17	Avneet Kour Sudan

Bureau Veritas ID: RFC806 **Collected:** 2021/11/10
Sample ID: MW21-02 (ANTH) **Shipped:**
Matrix: Water **Received:** 2021/11/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7701443	N/A	2021/11/17	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7699719	N/A	2021/11/17	Automated Statchk
Chloride by Automated Colourimetry	KONE	7701919	N/A	2021/11/18	Avneet Kour Sudan
Conductivity	AT	7701424	N/A	2021/11/17	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7700772	N/A	2021/11/16	Julianna Castiglione
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7704420	N/A	2021/11/16	Joe Paino
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7703732	2021/11/16	2021/11/17	Dennis Ngondu
Hardness (calculated as CaCO3)		7699717	N/A	2021/11/18	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	7704461	N/A	2021/11/17	Nan Raykha
Ion Balance (% Difference)	CALC	7699716	N/A	2021/11/18	Automated Statchk
Anion and Cation Sum	CALC	7699718	N/A	2021/11/18	Automated Statchk

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C1X2744
Report Date: 2021/11/18

Stantec Consulting Ltd
Client Project #: 160961457
Sampler Initials: RB

TEST SUMMARY

Bureau Veritas ID: RFC806
Sample ID: MW21-02 (ANTH)
Matrix: Water

Collected: 2021/11/10
Shipped:
Received: 2021/11/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	7702408	N/A	2021/11/16	Viorica Rotaru
Nitrate & Nitrite as Nitrogen in Water	LACH	7701041	N/A	2021/11/17	Chandra Nandlal
pH	AT	7701418	2021/11/15	2021/11/17	Surinder Rai
Orthophosphate	KONE	7701916	N/A	2021/11/17	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7699720	N/A	2021/11/18	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7699721	N/A	2021/11/18	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7701922	N/A	2021/11/17	Avneet Kour Sudan
Total Dissolved Solids (TDS calc)	CALC	7699722	N/A	2021/11/18	Automated Statchk

Bureau Veritas ID: RFC806 Dup
Sample ID: MW21-02 (ANTH)
Matrix: Water

Collected: 2021/11/10
Shipped:
Received: 2021/11/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7701443	N/A	2021/11/17	Surinder Rai
Conductivity	AT	7701424	N/A	2021/11/17	Surinder Rai
pH	AT	7701418	2021/11/15	2021/11/17	Surinder Rai

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	0.3°C

Results relate only to the items tested.

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

QUALITY ASSURANCE REPORT

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7703732	o-Terphenyl	2021/11/16	102	60 - 130	104	60 - 130	103	%		
7704420	1,4-Difluorobenzene	2021/11/16	96	70 - 130	98	70 - 130	97	%		
7704420	4-Bromofluorobenzene	2021/11/16	105	70 - 130	104	70 - 130	81	%		
7704420	D10-o-Xylene	2021/11/16	84	70 - 130	89	70 - 130	92	%		
7704420	D4-1,2-Dichloroethane	2021/11/16	102	70 - 130	102	70 - 130	108	%		
7700772	Dissolved Organic Carbon	2021/11/16	90	80 - 120	94	80 - 120	<0.40	mg/L	3.3	20
7701041	Nitrate (N)	2021/11/17	98	80 - 120	97	80 - 120	<0.10	mg/L	NC	20
7701041	Nitrite (N)	2021/11/17	107	80 - 120	107	80 - 120	<0.010	mg/L	NC	20
7701418	pH	2021/11/17			102	98 - 103			0.20	N/A
7701424	Conductivity	2021/11/17			98	85 - 115	<1.0	umho/cm	0.89	25
7701443	Alkalinity (Total as CaCO3)	2021/11/17			97	85 - 115	<1.0	mg/L	0.60	20
7701916	Orthophosphate (P)	2021/11/17	119	75 - 125	101	80 - 120	<0.010	mg/L	NC	25
7701919	Dissolved Chloride (Cl-)	2021/11/18	NC	80 - 120	103	80 - 120	<1.0	mg/L	0.15	20
7701922	Dissolved Sulphate (SO4)	2021/11/17	NC	75 - 125	103	80 - 120	<1.0	mg/L	1.6	20
7702408	Total Ammonia-N	2021/11/16	98	75 - 125	100	80 - 120	<0.050	mg/L	NC	20
7703516	Dissolved Aluminum (Al)	2021/11/17	106	80 - 120	108	80 - 120	<0.0049	mg/L	NC	20
7703516	Dissolved Antimony (Sb)	2021/11/17	101	80 - 120	101	80 - 120	<0.00050	mg/L		
7703516	Dissolved Arsenic (As)	2021/11/17	97	80 - 120	97	80 - 120	<0.0010	mg/L		
7703516	Dissolved Barium (Ba)	2021/11/17	98	80 - 120	103	80 - 120	<0.0020	mg/L		
7703516	Dissolved Beryllium (Be)	2021/11/17	102	80 - 120	104	80 - 120	<0.00040	mg/L		
7703516	Dissolved Boron (B)	2021/11/17	99	80 - 120	98	80 - 120	<0.010	mg/L		
7703516	Dissolved Cadmium (Cd)	2021/11/17	98	80 - 120	99	80 - 120	<0.000090	mg/L		
7703516	Dissolved Calcium (Ca)	2021/11/17	103	80 - 120	105	80 - 120	<0.20	mg/L	NC	20
7703516	Dissolved Chromium (Cr)	2021/11/17	94	80 - 120	95	80 - 120	<0.0050	mg/L		
7703516	Dissolved Cobalt (Co)	2021/11/17	95	80 - 120	95	80 - 120	<0.00050	mg/L		
7703516	Dissolved Copper (Cu)	2021/11/17	99	80 - 120	100	80 - 120	<0.00090	mg/L		
7703516	Dissolved Iron (Fe)	2021/11/17	97	80 - 120	97	80 - 120	<0.10	mg/L		
7703516	Dissolved Lead (Pb)	2021/11/17	91	80 - 120	94	80 - 120	<0.00050	mg/L		
7703516	Dissolved Magnesium (Mg)	2021/11/17	99	80 - 120	99	80 - 120	<0.050	mg/L	NC	20
7703516	Dissolved Manganese (Mn)	2021/11/17	99	80 - 120	98	80 - 120	<0.0020	mg/L		
7703516	Dissolved Molybdenum (Mo)	2021/11/17	103	80 - 120	103	80 - 120	<0.00050	mg/L		

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7703516	Dissolved Nickel (Ni)	2021/11/17	92	80 - 120	93	80 - 120	<0.0010	mg/L		
7703516	Dissolved Phosphorus (P)	2021/11/17	106	80 - 120	124 (1)	80 - 120	<0.10	mg/L		
7703516	Dissolved Potassium (K)	2021/11/17	103	80 - 120	104	80 - 120	<0.20	mg/L		
7703516	Dissolved Selenium (Se)	2021/11/17	98	80 - 120	99	80 - 120	<0.0020	mg/L		
7703516	Dissolved Silicon (Si)	2021/11/17	103	80 - 120	105	80 - 120	<0.050	mg/L		
7703516	Dissolved Silver (Ag)	2021/11/17	99	80 - 120	99	80 - 120	<0.000090	mg/L		
7703516	Dissolved Sodium (Na)	2021/11/17	98	80 - 120	99	80 - 120	<0.10	mg/L		
7703516	Dissolved Strontium (Sr)	2021/11/17	96	80 - 120	95	80 - 120	<0.0010	mg/L		
7703516	Dissolved Thallium (Tl)	2021/11/17	91	80 - 120	94	80 - 120	<0.000050	mg/L		
7703516	Dissolved Titanium (Ti)	2021/11/17	98	80 - 120	98	80 - 120	<0.0050	mg/L		
7703516	Dissolved Uranium (U)	2021/11/17	89	80 - 120	90	80 - 120	<0.00010	mg/L		
7703516	Dissolved Vanadium (V)	2021/11/17	96	80 - 120	98	80 - 120	<0.00050	mg/L		
7703516	Dissolved Zinc (Zn)	2021/11/17	97	80 - 120	95	80 - 120	<0.0050	mg/L		
7703732	F2 (C10-C16 Hydrocarbons)	2021/11/17	104	60 - 130	109	60 - 130	<100	ug/L	NC	30
7703732	F3 (C16-C34 Hydrocarbons)	2021/11/17	107	60 - 130	113	60 - 130	<200	ug/L	NC	30
7703732	F4 (C34-C50 Hydrocarbons)	2021/11/17	107	60 - 130	111	60 - 130	<200	ug/L	NC	30
7704420	Benzene	2021/11/16	101	50 - 140	105	50 - 140	<0.20	ug/L	NC	30
7704420	Ethylbenzene	2021/11/16	107	50 - 140	111	50 - 140	<0.20	ug/L	NC	30
7704420	F1 (C6-C10) - BTEX	2021/11/16					<25	ug/L	NC	30
7704420	F1 (C6-C10)	2021/11/16	91	60 - 140	94	60 - 140	<25	ug/L	NC	30
7704420	o-Xylene	2021/11/16	104	50 - 140	107	50 - 140	<0.20	ug/L	NC	30
7704420	p+m-Xylene	2021/11/16	110	50 - 140	112	50 - 140	<0.40	ug/L	NC	30
7704420	Toluene	2021/11/16	98	50 - 140	102	50 - 140	<0.20	ug/L	NC	30
7704420	Total Xylenes	2021/11/16					<0.40	ug/L	NC	30
7704461	Dissolved Aluminum (Al)	2021/11/17	106	80 - 120	105	80 - 120	<0.0049	mg/L		
7704461	Dissolved Antimony (Sb)	2021/11/17	105	80 - 120	102	80 - 120	<0.00050	mg/L	NC	20
7704461	Dissolved Arsenic (As)	2021/11/17	99	80 - 120	98	80 - 120	<0.0010	mg/L	0.20	20
7704461	Dissolved Barium (Ba)	2021/11/17	100	80 - 120	100	80 - 120	<0.0020	mg/L	0.16	20
7704461	Dissolved Beryllium (Be)	2021/11/17	102	80 - 120	102	80 - 120	<0.00040	mg/L	NC	20
7704461	Dissolved Boron (B)	2021/11/17	96	80 - 120	101	80 - 120	<0.010	mg/L	0.18	20
7704461	Dissolved Cadmium (Cd)	2021/11/17	101	80 - 120	99	80 - 120	<0.000090	mg/L	NC	20

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7704461	Dissolved Calcium (Ca)	2021/11/17	NC	80 - 120	103	80 - 120	<0.20	mg/L		
7704461	Dissolved Chromium (Cr)	2021/11/17	96	80 - 120	94	80 - 120	<0.0050	mg/L	NC	20
7704461	Dissolved Cobalt (Co)	2021/11/17	95	80 - 120	94	80 - 120	<0.00050	mg/L	NC	20
7704461	Dissolved Copper (Cu)	2021/11/17	103	80 - 120	100	80 - 120	<0.00090	mg/L	NC	20
7704461	Dissolved Iron (Fe)	2021/11/17	98	80 - 120	97	80 - 120	<0.10	mg/L		
7704461	Dissolved Lead (Pb)	2021/11/17	93	80 - 120	94	80 - 120	<0.00050	mg/L	NC	20
7704461	Dissolved Magnesium (Mg)	2021/11/17	NC	80 - 120	98	80 - 120	<0.050	mg/L		
7704461	Dissolved Manganese (Mn)	2021/11/17	100	80 - 120	99	80 - 120	<0.0020	mg/L		
7704461	Dissolved Molybdenum (Mo)	2021/11/17	107	80 - 120	104	80 - 120	<0.00050	mg/L	2.1	20
7704461	Dissolved Nickel (Ni)	2021/11/17	93	80 - 120	93	80 - 120	<0.0010	mg/L	NC	20
7704461	Dissolved Phosphorus (P)	2021/11/17	107	80 - 120	120	80 - 120	<0.10	mg/L		
7704461	Dissolved Potassium (K)	2021/11/17	103	80 - 120	101	80 - 120	<0.20	mg/L		
7704461	Dissolved Selenium (Se)	2021/11/17	100	80 - 120	99	80 - 120	<0.0020	mg/L	NC	20
7704461	Dissolved Silicon (Si)	2021/11/17	105	80 - 120	103	80 - 120	<0.050	mg/L		
7704461	Dissolved Silver (Ag)	2021/11/17	93	80 - 120	101	80 - 120	<0.000090	mg/L	NC	20
7704461	Dissolved Sodium (Na)	2021/11/17	NC	80 - 120	97	80 - 120	<0.10	mg/L	0.71	20
7704461	Dissolved Strontium (Sr)	2021/11/17	NC	80 - 120	96	80 - 120	<0.0010	mg/L		
7704461	Dissolved Thallium (Tl)	2021/11/17	93	80 - 120	95	80 - 120	<0.000050	mg/L	NC	20
7704461	Dissolved Titanium (Ti)	2021/11/17	100	80 - 120	99	80 - 120	<0.0050	mg/L		
7704461	Dissolved Uranium (U)	2021/11/17	91	80 - 120	93	80 - 120	<0.00010	mg/L	5.9	20
7704461	Dissolved Vanadium (V)	2021/11/17	98	80 - 120	96	80 - 120	<0.00050	mg/L	NC	20

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7704461	Dissolved Zinc (Zn)	2021/11/17	96	80 - 120	95	80 - 120	<0.0050	mg/L	NC	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

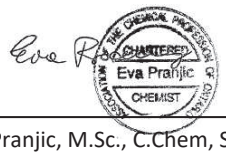
(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Laboratories
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel (905) 817-5700 Toll-free 800-563-6266 Fax (905) 817-577/ www.bvna.com

STANTEC CHAIN

Page 1 of 1

11-Nov-21 10:11
Ronklin Gracian
C1X2744

INVOICE INFORMATION:		REPORT INFORMATION(if differs from invoice):		PROJECT INFORMATION:	
Company Name:	#9197 Stantec Consulting Ltd	Company Name:		Quotation #:	C01624
Contact Name:	Accounts Payable	Contact Name:	Aaron Warkentin	Task #:	
Address:	300 Hagey Blvd Suite 100 Waterloo ON N2L 0A4	Address:		Project #:	160961457
Phone:	(519) 579-4410 Fax: (519) 579-6733	Phone:	(519) 575-4129 Fax: (519) 579-4239	Profit Centre:	1609
Email:	SAPinvoices@Stantec.com	Email:	Aaron.Warkentin@stantec.com	Site #:	
				Sampled By:	Rachel Baker

SDI ENV 1426

C#854554-01-01

Ronklin Gracian

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)
☐ Table 1 ☐ Res/Park ☐ Medium/Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☐ Table 3 ☐ Agri/Other ☐ For RSC
☐ Table ___

Other Regulations
☐ CCME ☐ Sanitary Sewer Bylaw
☐ Reg 558 ☐ Storm Sewer Bylaw
☐ MISA Municipality ___
☐ PWQO ☐ Reg 406 Table ___
☒ Other ODWS

Special Instructions

Include Criteria on Certificate of Analysis (Y/N)? ___

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT:
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	ANALYSIS REQUESTED (PLEASE BE SPECIFIC): RCAp - Comprehensive	O.Reg 153 PHCs, BTEX/F1-F4	# of Bottles	Comments
1		MW21-05(ANTH)	Nov 10	10:30		Y	✓	✓	8	Dissolved metals, field filtered
2		MW21-04(ANTH)	Nov 10	12:15		Y	✓	✓	8	"
3		MW21-01(ANTH)	Nov 10	14:40		Y	✓	✓	8	"
4		MW21-02(ANTH)	Nov 10	16:50		Y	✓	✓	8	"
5										
6										
7										
8										
9										
10										

REC'D IN WATERLOO

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Rachel Baker	21/11/11	10:10	Sarah Webster	2021/11/11	10:11	
			Y. Thompson	21/11/11	14:55	

Laboratory Use Only

Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
	0 | 0 | 1	Present		
		Intact		

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS

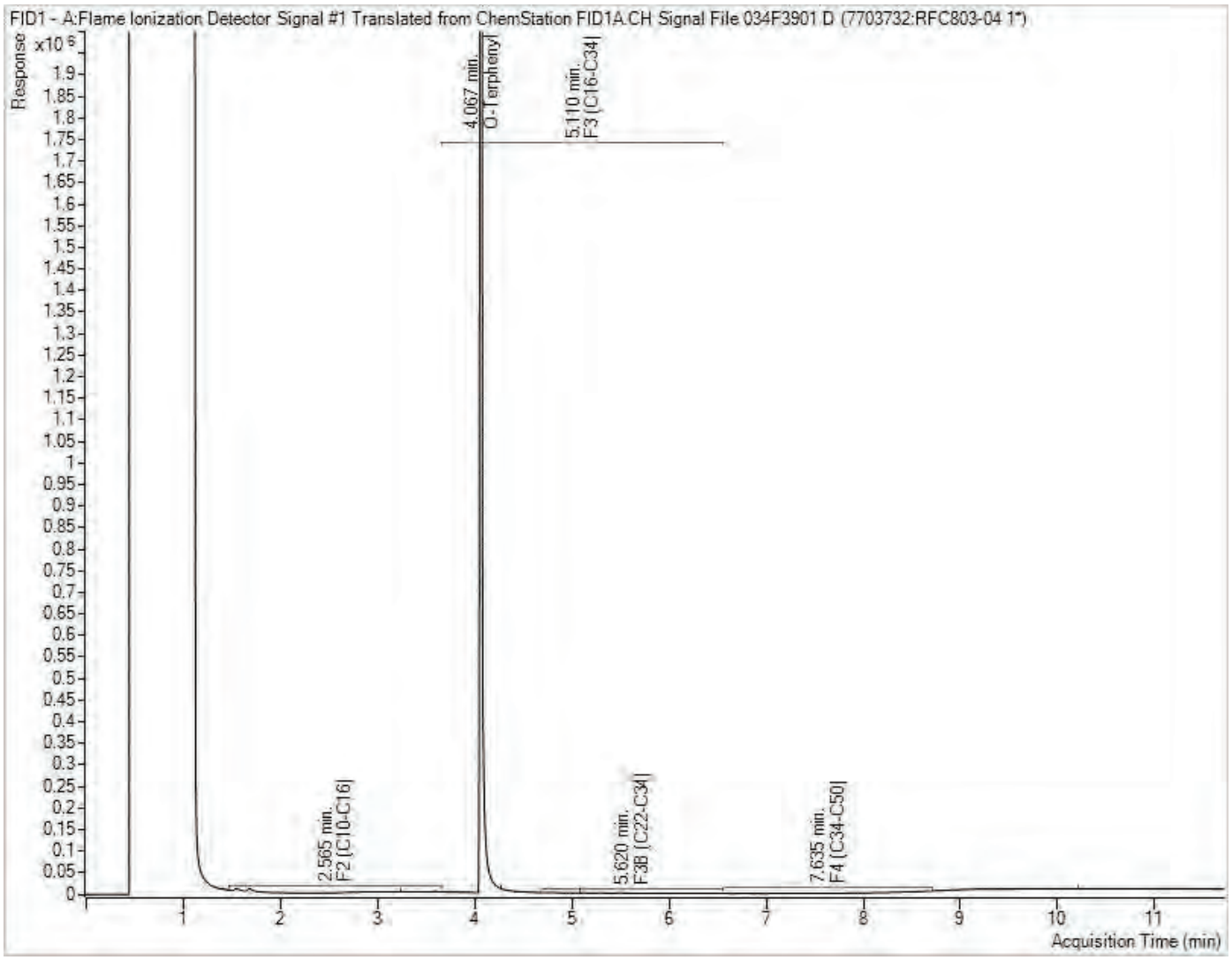
White: Bureau Veritas Yellow: Client

ON ICE.

Bureau Veritas Canada (2019) Inc.

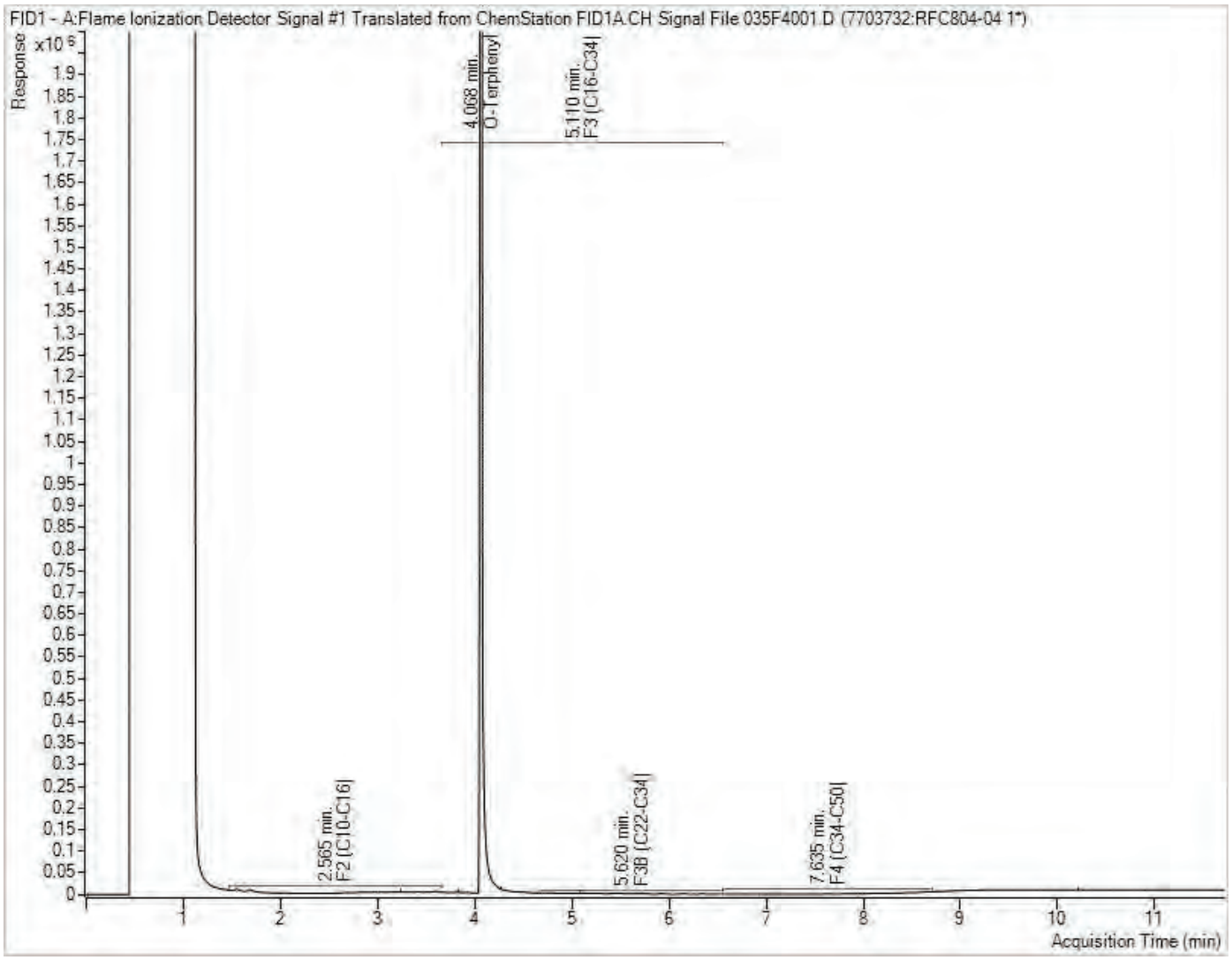
420455 0/0/3

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



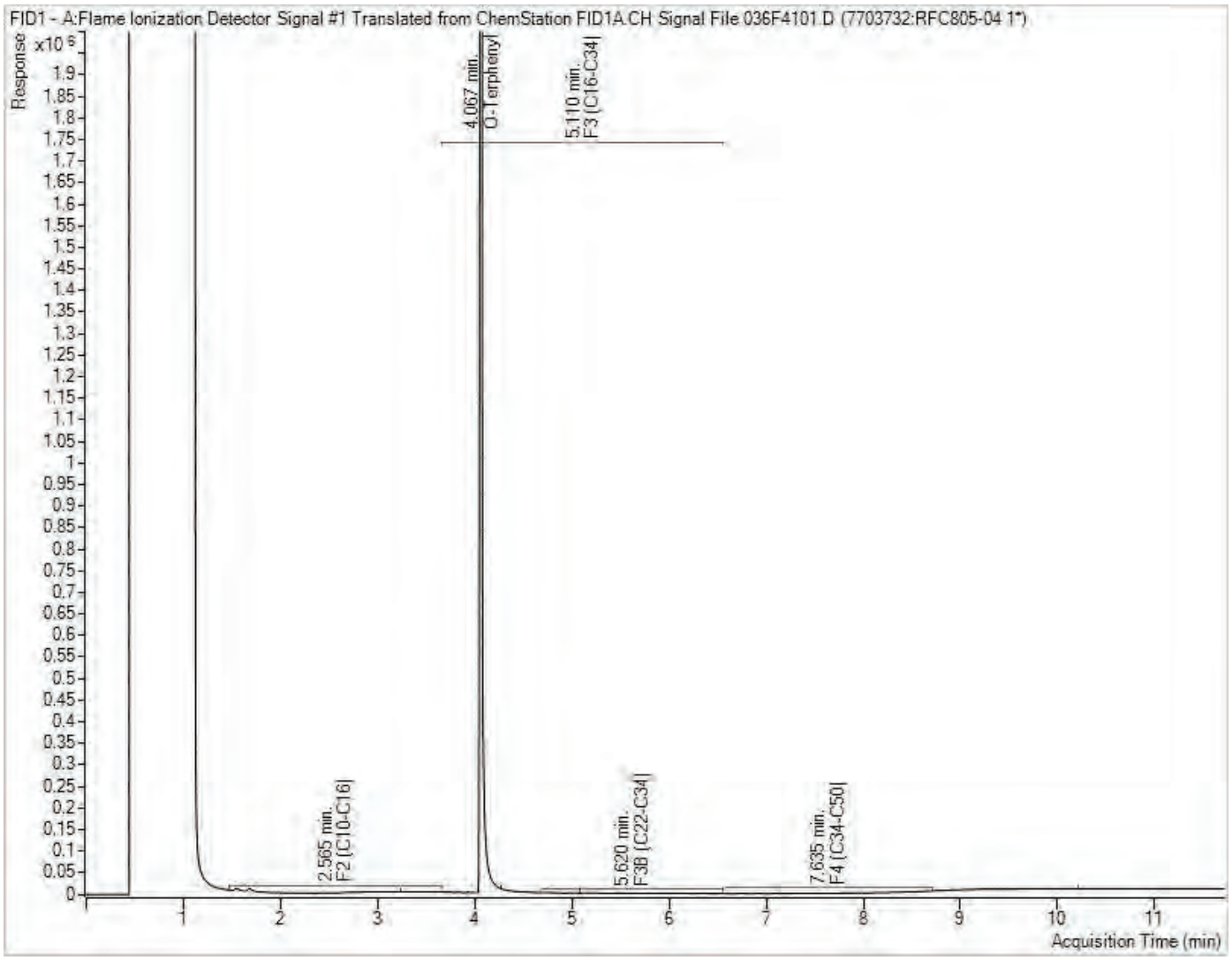
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



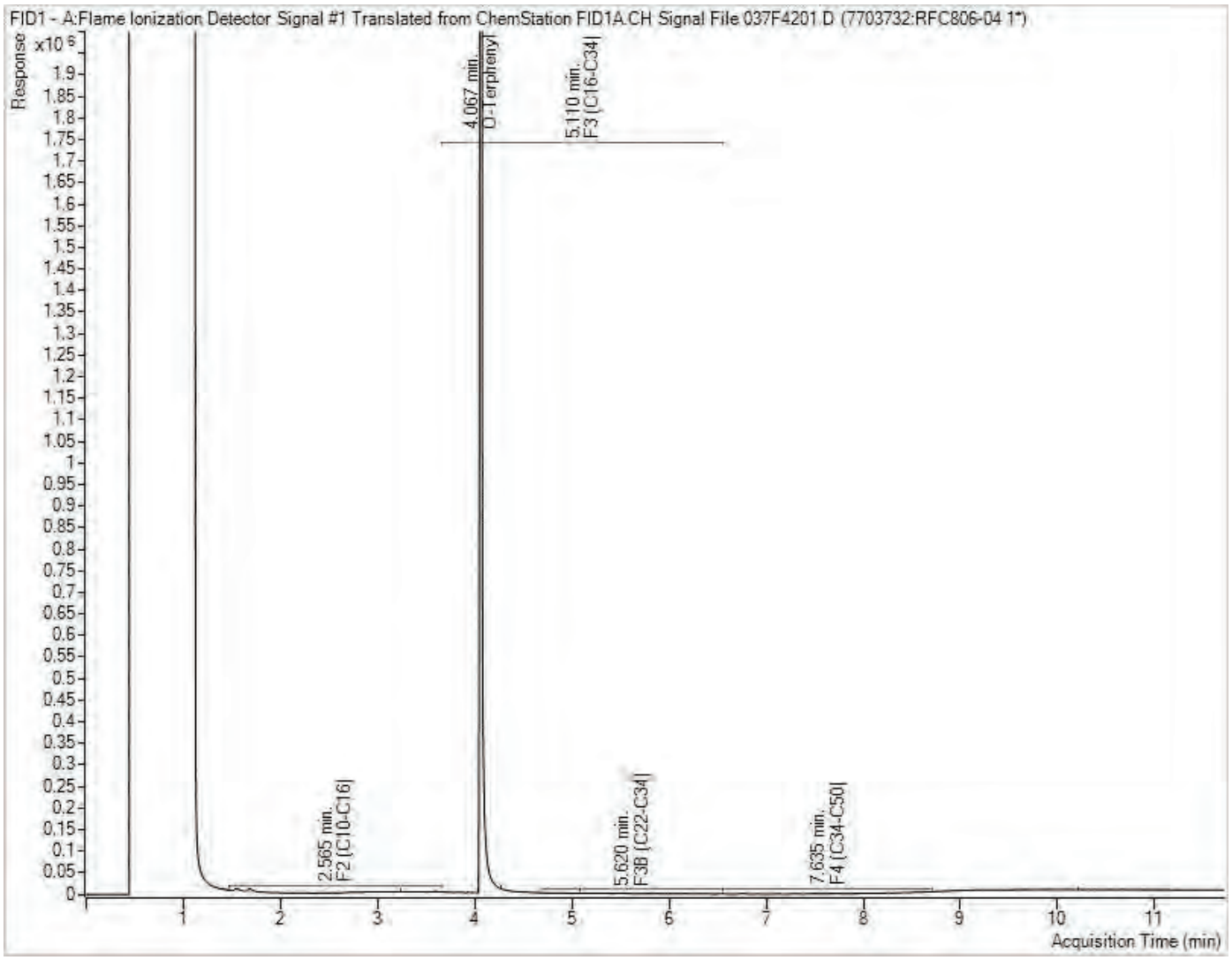
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Your Project #: 160961457
Your C.O.C. #: 854554-02-01

Attention: Aaron Warkentin

Stantec Consulting Ltd
300 Hagey Blvd
Suite 100
Waterloo, ON
CANADA N2L 0A4

Report Date: 2021/12/10
Report #: R6914261
Version: 2 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1X4546
Received: 2021/11/12, 16:05

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	2	N/A	2021/11/16	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	2	N/A	2021/11/17	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	2	N/A	2021/11/17	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	2	N/A	2021/11/16	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	2	N/A	2021/11/16	CAM SOP-00446	SM 23 5310 B m
Petroleum Hydro. CCME F1 & BTEX in Water	2	N/A	2021/11/17	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Water (2)	2	2021/11/17	2021/11/17	CAM SOP-00316	CCME PHC-CWS m
Hardness (calculated as CaCO3)	2	N/A	2021/12/08	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Metals by ICPMS	2	N/A	2021/11/18	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	2	N/A	2021/12/08		
Anion and Cation Sum	2	N/A	2021/12/08		
Total Ammonia-N	2	N/A	2021/11/16	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (3)	2	N/A	2021/11/17	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	2	2021/11/16	2021/11/16	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	2	N/A	2021/11/17	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	2	N/A	2021/12/08		Auto Calc
Sat. pH and Langelier Index (@ 4C)	2	N/A	2021/12/08		Auto Calc
Sulphate by Automated Colourimetry	2	N/A	2021/11/17	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	2	N/A	2021/12/08		Auto Calc

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Your Project #: 160961457
Your C.O.C. #: 854554-02-01

Attention: Aaron Warkentin

Stantec Consulting Ltd
300 Hagey Blvd
Suite 100
Waterloo, ON
CANADA N2L 0A4

Report Date: 2021/12/10
Report #: R6914261
Version: 2 - Final

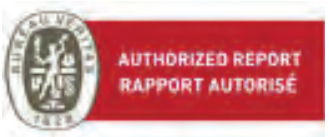
CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1X4546
Received: 2021/11/12, 16:05

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas Laboratories conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following “Alberta Environment’s Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003”. Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.
(3) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key



Bureau Veritas
10 Dec 2021 13:12:03

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ronklin Gracian, Project Manager
Email: Ronklin.Gracian@bureauveritas.com
Phone# (905)817-5752

==========

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Job #: C1X4546
Report Date: 2021/12/10

Stantec Consulting Ltd
Client Project #: 160961457
Sampler Initials: RD

RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		RFM446				RFM447			
Sampling Date		2021/11/12 13:40				2021/11/12 13:40			
COC Number		854554-02-01				854554-02-01			
	UNITS	MW21-03	RDL	MDL	QC Batch	FIELD DUPLICATE 1	RDL	MDL	QC Batch
Calculated Parameters									
Anion Sum	me/L	5.86	N/A	N/A	7699109	5.82	N/A	N/A	7699109
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	210	1.0	0.20	7699110	210	1.0	0.20	7699110
Calculated TDS	mg/L	310	1.0	0.20	7699113	310	1.0	0.20	7699113
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.8	1.0	0.20	7699110	1.9	1.0	0.20	7699110
Cation Sum	me/L	5.80	N/A	N/A	7699109	5.78	N/A	N/A	7699109
Hardness (CaCO3)	mg/L	260	1.0	1.0	7699066	260	1.0	1.0	7699066
Ion Balance (% Difference)	%	0.540	N/A	N/A	7699067	0.400	N/A	N/A	7699067
Langelier Index (@ 20C)	N/A	0.679			7699111	0.700			7699111
Langelier Index (@ 4C)	N/A	0.430			7699112	0.451			7699112
Saturation pH (@ 20C)	N/A	7.28			7699111	7.28			7699111
Saturation pH (@ 4C)	N/A	7.53			7699112	7.53			7699112
Inorganics									
Total Ammonia-N	mg/L	0.11	0.050	0.0080	7701514	0.083	0.050	0.0080	7701514
Conductivity	umho/cm	520	1.0	0.20	7703068	520	1.0	0.20	7703068
Dissolved Organic Carbon	mg/L	5.0	0.40	0.070	7701390	5.0	0.40	0.070	7701764
Orthophosphate (P)	mg/L	<0.020	0.020	0.010	7704598	<0.010	0.010	0.0050	7704598
pH	pH	7.96			7703073	7.98			7703073
Dissolved Sulphate (SO4)	mg/L	39	1.0	0.10	7704594	39	1.0	0.10	7704594
Alkalinity (Total as CaCO3)	mg/L	220	1.0	0.20	7703049	210	1.0	0.20	7703049
Dissolved Chloride (Cl-)	mg/L	26	1.0	0.30	7704589	26	1.0	0.30	7704589
Nitrite (N)	mg/L	<0.010	0.010	0.0020	7703282	<0.010	0.010	0.0020	7703282
Nitrate (N)	mg/L	<0.10	0.10	0.010	7703282	<0.10	0.10	0.010	7703282
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	0.010	7703282	<0.10	0.10	0.010	7703282
Metals									
Dissolved Aluminum (Al)	mg/L	<0.0049	0.0049	0.0049	7703706	<0.0049	0.0049	0.0049	7703706
Dissolved Antimony (Sb)	mg/L	<0.00050	0.00050	0.00050	7703706	<0.00050	0.00050	0.00050	7703706
Dissolved Arsenic (As)	mg/L	<0.0010	0.0010	0.0010	7703706	<0.0010	0.0010	0.0010	7703706
Dissolved Barium (Ba)	mg/L	0.088	0.0020	0.0020	7703706	0.089	0.0020	0.0020	7703706
Dissolved Beryllium (Be)	mg/L	<0.00040	0.00040	0.00040	7703706	<0.00040	0.00040	0.00040	7703706
Dissolved Boron (B)	mg/L	0.013	0.010	0.010	7703706	0.013	0.010	0.010	7703706

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C1X4546
Report Date: 2021/12/10

Stantec Consulting Ltd
Client Project #: 160961457
Sampler Initials: RD

RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		RFM446				RFM447			
Sampling Date		2021/11/12 13:40				2021/11/12 13:40			
COC Number		854554-02-01				854554-02-01			
	UNITS	MW21-03	RDL	MDL	QC Batch	FIELD DUPLICATE 1	RDL	MDL	QC Batch
Dissolved Cadmium (Cd)	mg/L	<0.000090	0.000090	0.000090	7703706	<0.000090	0.000090	0.000090	7703706
Dissolved Calcium (Ca)	mg/L	65	0.20	0.20	7703706	64	0.20	0.20	7703706
Dissolved Chromium (Cr)	mg/L	<0.0050	0.0050	0.0050	7703706	<0.0050	0.0050	0.0050	7703706
Dissolved Cobalt (Co)	mg/L	<0.00050	0.00050	0.00050	7703706	0.00050	0.00050	0.00050	7703706
Dissolved Copper (Cu)	mg/L	<0.00090	0.00090	0.00090	7703706	<0.00090	0.00090	0.00090	7703706
Dissolved Iron (Fe)	mg/L	<0.10	0.10	0.050	7703706	<0.10	0.10	0.050	7703706
Dissolved Lead (Pb)	mg/L	<0.00050	0.00050	0.00050	7703706	<0.00050	0.00050	0.00050	7703706
Dissolved Magnesium (Mg)	mg/L	24	0.050	0.050	7703706	25	0.050	0.050	7703706
Dissolved Manganese (Mn)	mg/L	0.034	0.0020	0.0020	7703706	0.033	0.0020	0.0020	7703706
Dissolved Molybdenum (Mo)	mg/L	0.0053	0.00050	0.00050	7703706	0.0050	0.00050	0.00050	7703706
Dissolved Nickel (Ni)	mg/L	<0.0010	0.0010	0.0010	7703706	<0.0010	0.0010	0.0010	7703706
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	0.050	7703706	<0.10	0.10	0.050	7703706
Dissolved Potassium (K)	mg/L	1.5	0.20	0.20	7703706	1.5	0.20	0.20	7703706
Dissolved Selenium (Se)	mg/L	<0.0020	0.0020	0.0020	7703706	<0.0020	0.0020	0.0020	7703706
Dissolved Silicon (Si)	mg/L	4.7	0.050	0.050	7703706	4.7	0.050	0.050	7703706
Dissolved Silver (Ag)	mg/L	<0.000090	0.000090	0.000090	7703706	<0.000090	0.000090	0.000090	7703706
Dissolved Sodium (Na)	mg/L	11	0.10	0.10	7703706	11	0.10	0.10	7703706
Dissolved Strontium (Sr)	mg/L	0.13	0.0010	0.0010	7703706	0.13	0.0010	0.0010	7703706
Dissolved Thallium (Tl)	mg/L	<0.000050	0.000050	0.000050	7703706	<0.000050	0.000050	0.000050	7703706
Dissolved Titanium (Ti)	mg/L	<0.0050	0.0050	0.0050	7703706	<0.0050	0.0050	0.0050	7703706
Dissolved Uranium (U)	mg/L	0.0017	0.00010	0.00010	7703706	0.0017	0.00010	0.00010	7703706
Dissolved Vanadium (V)	mg/L	<0.00050	0.00050	0.00050	7703706	<0.00050	0.00050	0.00050	7703706
Dissolved Zinc (Zn)	mg/L	0.018	0.0050	0.0050	7703706	0.017	0.0050	0.0050	7703706

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		RFM447			
Sampling Date		2021/11/12 13:40			
COC Number		854554-02-01			
	UNITS	FIELD DUPLICATE 1 Lab-Dup	RDL	MDL	QC Batch
Inorganics					
Dissolved Organic Carbon	mg/L	5.1	0.40	0.070	7701764
Orthophosphate (P)	mg/L	<0.010	0.010	0.0050	7704598
Dissolved Sulphate (SO4)	mg/L	38	1.0	0.10	7704594
Dissolved Chloride (Cl-)	mg/L	26	1.0	0.30	7704589

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

O.REG 153 PHCS, BTEX/F1-F4 (WATER)

Bureau Veritas ID		RFM446	RFM447			
Sampling Date		2021/11/12 13:40	2021/11/12 13:40			
COC Number		854554-02-01	854554-02-01			
	UNITS	MW21-03	FIELD DUPLICATE 1	RDL	MDL	QC Batch
BTEX & F1 Hydrocarbons						
Benzene	ug/L	<0.20	<0.20	0.20	0.040	7707042
Toluene	ug/L	<0.20	<0.20	0.20	0.040	7707042
Ethylbenzene	ug/L	<0.20	<0.20	0.20	0.040	7707042
o-Xylene	ug/L	<0.20	<0.20	0.20	0.040	7707042
p+m-Xylene	ug/L	<0.40	<0.40	0.40	0.080	7707042
Total Xylenes	ug/L	<0.40	<0.40	0.40	0.080	7707042
F1 (C6-C10)	ug/L	<25	<25	25	20	7707042
F1 (C6-C10) - BTEX	ug/L	<25	<25	25	20	7707042
F2-F4 Hydrocarbons						
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	100	50	7705024
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	200	70	7705024
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	200	50	7705024
Reached Baseline at C50	ug/L	Yes	Yes			7705024
Surrogate Recovery (%)						
1,4-Difluorobenzene	%	106	98			7707042
4-Bromofluorobenzene	%	102	91			7707042
D10-o-Xylene	%	96	93			7707042
D4-1,2-Dichloroethane	%	108	90			7707042
o-Terphenyl	%	97	97			7705024

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

TEST SUMMARY

Bureau Veritas ID: RFM446
Sample ID: MW21-03
Matrix: Water

Collected: 2021/11/12
Shipped:
Received: 2021/11/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7703049	N/A	2021/11/16	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7699110	N/A	2021/11/17	Automated Statchk
Chloride by Automated Colourimetry	KONE	7704589	N/A	2021/11/17	Avneet Kour Sudan
Conductivity	AT	7703068	N/A	2021/11/16	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7701390	N/A	2021/11/16	Julianna Castiglione
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7707042	N/A	2021/11/17	Joe Paino
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7705024	2021/11/17	2021/11/17	Jeevaraj Jeevaratrnam
Hardness (calculated as CaCO3)		7699066	N/A	2021/12/08	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	7703706	N/A	2021/11/18	Azita Fazaeli
Ion Balance (% Difference)	CALC	7699067	N/A	2021/12/08	Automated Statchk
Anion and Cation Sum	CALC	7699109	N/A	2021/12/08	Automated Statchk
Total Ammonia-N	LACH/NH4	7701514	N/A	2021/11/16	Viorica Rotaru
Nitrate & Nitrite as Nitrogen in Water	LACH	7703282	N/A	2021/11/17	Chandra Nandlal
pH	AT	7703073	2021/11/16	2021/11/16	Surinder Rai
Orthophosphate	KONE	7704598	N/A	2021/11/17	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7699111	N/A	2021/12/08	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7699112	N/A	2021/12/08	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7704594	N/A	2021/11/17	Avneet Kour Sudan
Total Dissolved Solids (TDS calc)	CALC	7699113	N/A	2021/12/08	Automated Statchk

Bureau Veritas ID: RFM447
Sample ID: FIELD DUPLICATE 1
Matrix: Water

Collected: 2021/11/12
Shipped:
Received: 2021/11/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7703049	N/A	2021/11/16	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7699110	N/A	2021/11/17	Automated Statchk
Chloride by Automated Colourimetry	KONE	7704589	N/A	2021/11/17	Avneet Kour Sudan
Conductivity	AT	7703068	N/A	2021/11/16	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7701764	N/A	2021/11/16	Julianna Castiglione
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7707042	N/A	2021/11/17	Joe Paino
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7705024	2021/11/17	2021/11/17	Jeevaraj Jeevaratrnam
Hardness (calculated as CaCO3)		7699066	N/A	2021/12/08	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	7703706	N/A	2021/11/18	Azita Fazaeli
Ion Balance (% Difference)	CALC	7699067	N/A	2021/12/08	Automated Statchk
Anion and Cation Sum	CALC	7699109	N/A	2021/12/08	Automated Statchk
Total Ammonia-N	LACH/NH4	7701514	N/A	2021/11/16	Viorica Rotaru
Nitrate & Nitrite as Nitrogen in Water	LACH	7703282	N/A	2021/11/17	Chandra Nandlal
pH	AT	7703073	2021/11/16	2021/11/16	Surinder Rai
Orthophosphate	KONE	7704598	N/A	2021/11/17	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7699111	N/A	2021/12/08	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7699112	N/A	2021/12/08	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7704594	N/A	2021/11/17	Avneet Kour Sudan
Total Dissolved Solids (TDS calc)	CALC	7699113	N/A	2021/12/08	Automated Statchk

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C1X4546
Report Date: 2021/12/10

Stantec Consulting Ltd
Client Project #: 160961457
Sampler Initials: RD

TEST SUMMARY

Bureau Veritas ID: RFM447 Dup
Sample ID: FIELD DUPLICATE 1
Matrix: Water

Collected: 2021/11/12
Shipped:
Received: 2021/11/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	7704589	N/A	2021/11/17	Avneet Kour Sudan
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7701764	N/A	2021/11/16	Julianna Castiglione
Orthophosphate	KONE	7704598	N/A	2021/11/17	Avneet Kour Sudan
Sulphate by Automated Colourimetry	KONE	7704594	N/A	2021/11/17	Avneet Kour Sudan

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	6.0°C

Results relate only to the items tested.

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

QUALITY ASSURANCE REPORT

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7705024	o-Terphenyl	2021/11/17	96	60 - 130	99	60 - 130	97	%		
7707042	1,4-Difluorobenzene	2021/11/17	90	70 - 130	95	70 - 130	104	%		
7707042	4-Bromofluorobenzene	2021/11/17	106	70 - 130	105	70 - 130	91	%		
7707042	D10-o-Xylene	2021/11/17	87	70 - 130	100	70 - 130	100	%		
7707042	D4-1,2-Dichloroethane	2021/11/17	75	70 - 130	81	70 - 130	94	%		
7701390	Dissolved Organic Carbon	2021/11/16	94	80 - 120	96	80 - 120	<0.40	mg/L	NC	20
7701514	Total Ammonia-N	2021/11/16	99	75 - 125	100	80 - 120	<0.050	mg/L	NC	20
7701764	Dissolved Organic Carbon	2021/11/16	95	80 - 120	97	80 - 120	<0.40	mg/L	0.16	20
7703049	Alkalinity (Total as CaCO3)	2021/11/16			97	85 - 115	<1.0	mg/L	0.76	20
7703068	Conductivity	2021/11/16			99	85 - 115	<1.0	umho/cm	0.75	25
7703073	pH	2021/11/16			102	98 - 103			0.27	N/A
7703282	Nitrate (N)	2021/11/17	97	80 - 120	99	80 - 120	<0.10	mg/L	NC	20
7703282	Nitrite (N)	2021/11/17	106	80 - 120	108	80 - 120	<0.010	mg/L	NC	20
7703706	Dissolved Aluminum (Al)	2021/11/18	99	80 - 120	102	80 - 120	<0.0049	mg/L	NC	20
7703706	Dissolved Antimony (Sb)	2021/11/18	100	80 - 120	99	80 - 120	<0.00050	mg/L	NC	20
7703706	Dissolved Arsenic (As)	2021/11/18	98	80 - 120	98	80 - 120	<0.0010	mg/L	NC	20
7703706	Dissolved Barium (Ba)	2021/11/18	96	80 - 120	99	80 - 120	<0.0020	mg/L	1.2	20
7703706	Dissolved Beryllium (Be)	2021/11/18	101	80 - 120	99	80 - 120	<0.00040	mg/L	NC	20
7703706	Dissolved Boron (B)	2021/11/18	93	80 - 120	98	80 - 120	<0.010	mg/L	2.6	20
7703706	Dissolved Cadmium (Cd)	2021/11/18	97	80 - 120	97	80 - 120	<0.000090	mg/L	0.12	20
7703706	Dissolved Calcium (Ca)	2021/11/18	NC	80 - 120	100	80 - 120	<0.20	mg/L	0.93	20
7703706	Dissolved Chromium (Cr)	2021/11/18	96	80 - 120	97	80 - 120	<0.0050	mg/L	NC	20
7703706	Dissolved Cobalt (Co)	2021/11/18	96	80 - 120	98	80 - 120	<0.00050	mg/L	5.8	20
7703706	Dissolved Copper (Cu)	2021/11/18	95	80 - 120	97	80 - 120	<0.00090	mg/L	0.88	20
7703706	Dissolved Iron (Fe)	2021/11/18	98	80 - 120	99	80 - 120	<0.10	mg/L	NC	20
7703706	Dissolved Lead (Pb)	2021/11/18	95	80 - 120	95	80 - 120	<0.00050	mg/L	NC	20
7703706	Dissolved Magnesium (Mg)	2021/11/18	NC	80 - 120	98	80 - 120	<0.050	mg/L	1.4	20
7703706	Dissolved Manganese (Mn)	2021/11/18	97	80 - 120	100	80 - 120	<0.0020	mg/L	3.9	20
7703706	Dissolved Molybdenum (Mo)	2021/11/18	101	80 - 120	99	80 - 120	<0.00050	mg/L	NC	20
7703706	Dissolved Nickel (Ni)	2021/11/18	95	80 - 120	97	80 - 120	<0.0010	mg/L	3.0	20
7703706	Dissolved Phosphorus (P)	2021/11/18	100	80 - 120	109	80 - 120	<0.10	mg/L	NC	20

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7703706	Dissolved Potassium (K)	2021/11/18	96	80 - 120	99	80 - 120	<0.20	mg/L	3.8	20
7703706	Dissolved Selenium (Se)	2021/11/18	98	80 - 120	99	80 - 120	<0.0020	mg/L	NC	20
7703706	Dissolved Silicon (Si)	2021/11/18	97	80 - 120	100	80 - 120	<0.050	mg/L	0.72	20
7703706	Dissolved Silver (Ag)	2021/11/18	97	80 - 120	98	80 - 120	<0.000090	mg/L	NC	20
7703706	Dissolved Sodium (Na)	2021/11/18	94	80 - 120	99	80 - 120	<0.10	mg/L	0.40	20
7703706	Dissolved Strontium (Sr)	2021/11/18	NC	80 - 120	98	80 - 120	<0.0010	mg/L	1.1	20
7703706	Dissolved Thallium (Tl)	2021/11/18	97	80 - 120	96	80 - 120	<0.000050	mg/L	3.8	20
7703706	Dissolved Titanium (Ti)	2021/11/18	98	80 - 120	98	80 - 120	<0.0050	mg/L	NC	20
7703706	Dissolved Uranium (U)	2021/11/18	96	80 - 120	94	80 - 120	<0.00010	mg/L	13	20
7703706	Dissolved Vanadium (V)	2021/11/18	97	80 - 120	99	80 - 120	<0.00050	mg/L	NC	20
7703706	Dissolved Zinc (Zn)	2021/11/18	NC	80 - 120	96	80 - 120	<0.0050	mg/L	0.34	20
7704589	Dissolved Chloride (Cl-)	2021/11/17	NC	80 - 120	104	80 - 120	<1.0	mg/L	1.4	20
7704594	Dissolved Sulphate (SO4)	2021/11/17	NC	75 - 125	104	80 - 120	<1.0	mg/L	1.7	20
7704598	Orthophosphate (P)	2021/11/17	98	75 - 125	102	80 - 120	<0.010	mg/L	NC	25
7705024	F2 (C10-C16 Hydrocarbons)	2021/11/17	92	60 - 130	103	60 - 130	<100	ug/L	NC	30
7705024	F3 (C16-C34 Hydrocarbons)	2021/11/17	92	60 - 130	113	60 - 130	<200	ug/L	NC	30
7705024	F4 (C34-C50 Hydrocarbons)	2021/11/17	94	60 - 130	117	60 - 130	<200	ug/L	NC	30
7707042	Benzene	2021/11/17	97	50 - 140	98	50 - 140	<0.20	ug/L	NC	30
7707042	Ethylbenzene	2021/11/17	115	50 - 140	116	50 - 140	<0.20	ug/L	9.9	30
7707042	F1 (C6-C10) - BTEX	2021/11/17					<25	ug/L	NC	30
7707042	F1 (C6-C10)	2021/11/17	95	60 - 140	96	60 - 140	<25	ug/L	NC	30
7707042	o-Xylene	2021/11/17	111	50 - 140	107	50 - 140	<0.20	ug/L	NC	30
7707042	p+m-Xylene	2021/11/17	108	50 - 140	109	50 - 140	<0.40	ug/L	NC	30
7707042	Toluene	2021/11/17	92	50 - 140	99	50 - 140	<0.20	ug/L	NC	30

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7707042	Total Xylenes	2021/11/17					<0.40	ug/L	NC	30

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

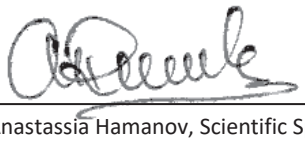
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



Anastassia Hamanov, Scientific Specialist



Brad Newman, B.Sc., C.Chem., Scientific Service Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.
For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Laboratories
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free:800-563-6266 Fax:(905) 817-5777 www.bvna.com

STANTEC CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE INFORMATION:		REPORT INFORMATION(if differs from invoice):		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#9197 Stantec Consulting Ltd	Company Name:		Quotation #:	C01624	Bureau Veritas Job #:	Bottle Order #:
Contact Name:	Accounts Payable	Contact Name:	Aaron Warkentin	Task #:			854554
Address:	300 Hagey Blvd Suite 100 Waterloo ON N2L 0A4	Address:		Project #:	160961457	COC #:	Project Manager:
Phone:	(519) 579-4410 Fax: (519) 579-6733	Phone:	(519) 575-4129 Fax: (519) 579-4239	Profit Centre:	1609	C#854554-02-01	Ronklin Gracian
Email:	SAPinvoices@Stantec.com	Email:	Aaron.Warkentin@stantec.com	Site #:			
				Sampled By:	Ryan Reg		

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)
- ☐ Table 1 ☐ Res/Park ☐ Medium/Fine
- ☐ Table 2 ☐ Ind/Comm ☐ Coarse
- ☐ Table 3 ☐ Agri/Other ☐ For RSC
- ☐ Table ___

Other Regulations
- ☐ CCME ☐ Sanitary Sewer Bylaw
- ☐ Reg 558 ☐ Storm Sewer Bylaw
- ☐ MISA Municipality ___
- ☐ PWQO ☐ Reg 406 Table ___
- ☒ Other OWWJ

Special Instructions

Include Criteria on Certificate of Analysis (Y/N)? ___

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	RCAp - Comprehensive	O Reg 153 PHCs, BTEXF1-F4	# of Bottles	Comments
1		MW21-03	Nov 12/21	1340	GW	Y	X	X	8	
2		FIELD DUPLICATE 1	Nov 12/21	1340	GW	Y	X	X	8	
3										
4										
5										
6										
7										
8										
9										
10										

REC'D IN WATERLOO

12-Nov-21 16:05
Ronklin Gracian
C1X4546

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
	21/11/12	1603	Sarah Webster Sarah Webster	2021/11/12	16:05	
			DIPIKA SINGH	2021/11/12	18:18	

Laboratory Use Only				
Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
	7.1 2.1 9.	Present		
		Intact		✓

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

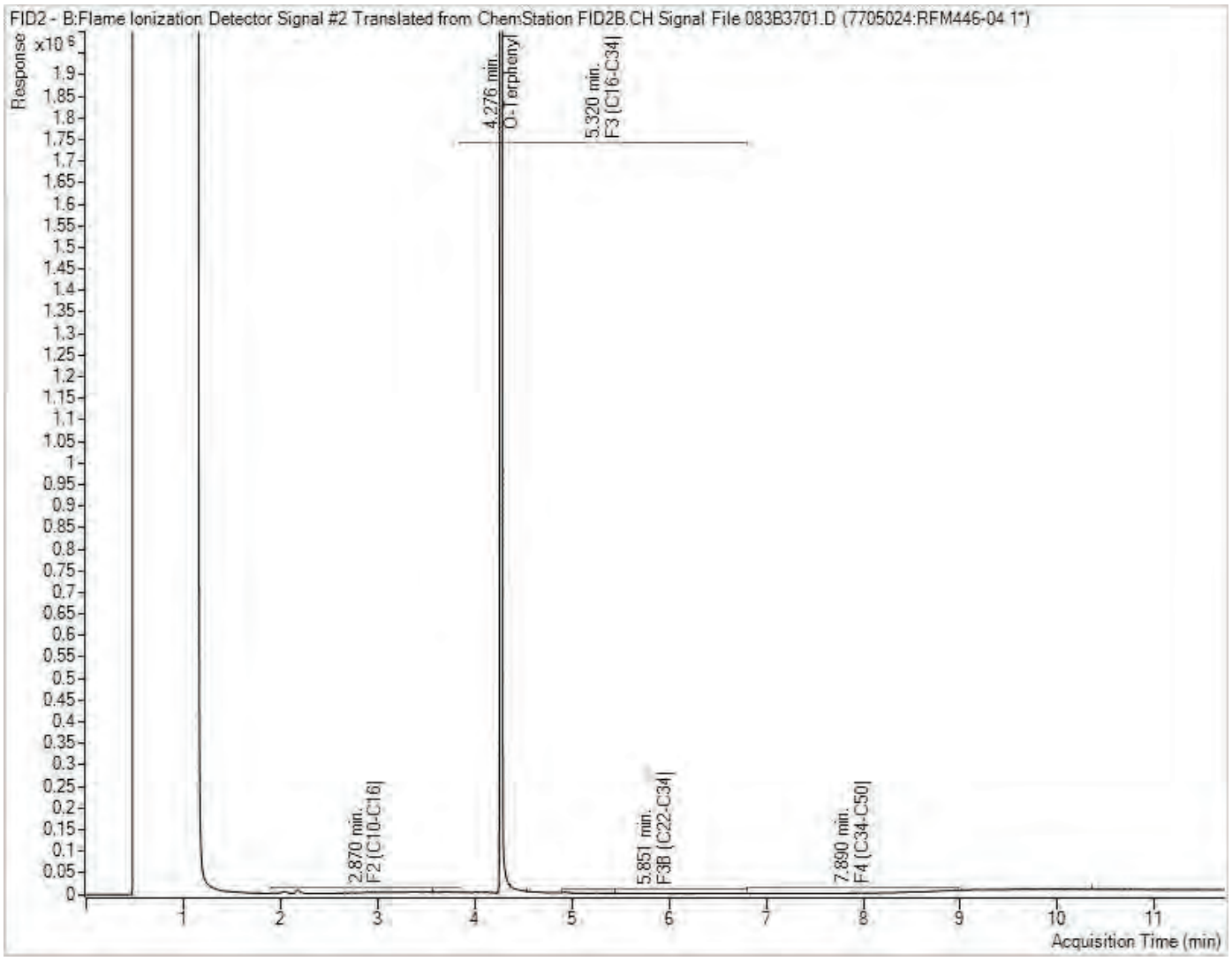
SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS

White: Bureau Veritas Yellow: Client

Bureau Veritas Canada (2019) Inc.

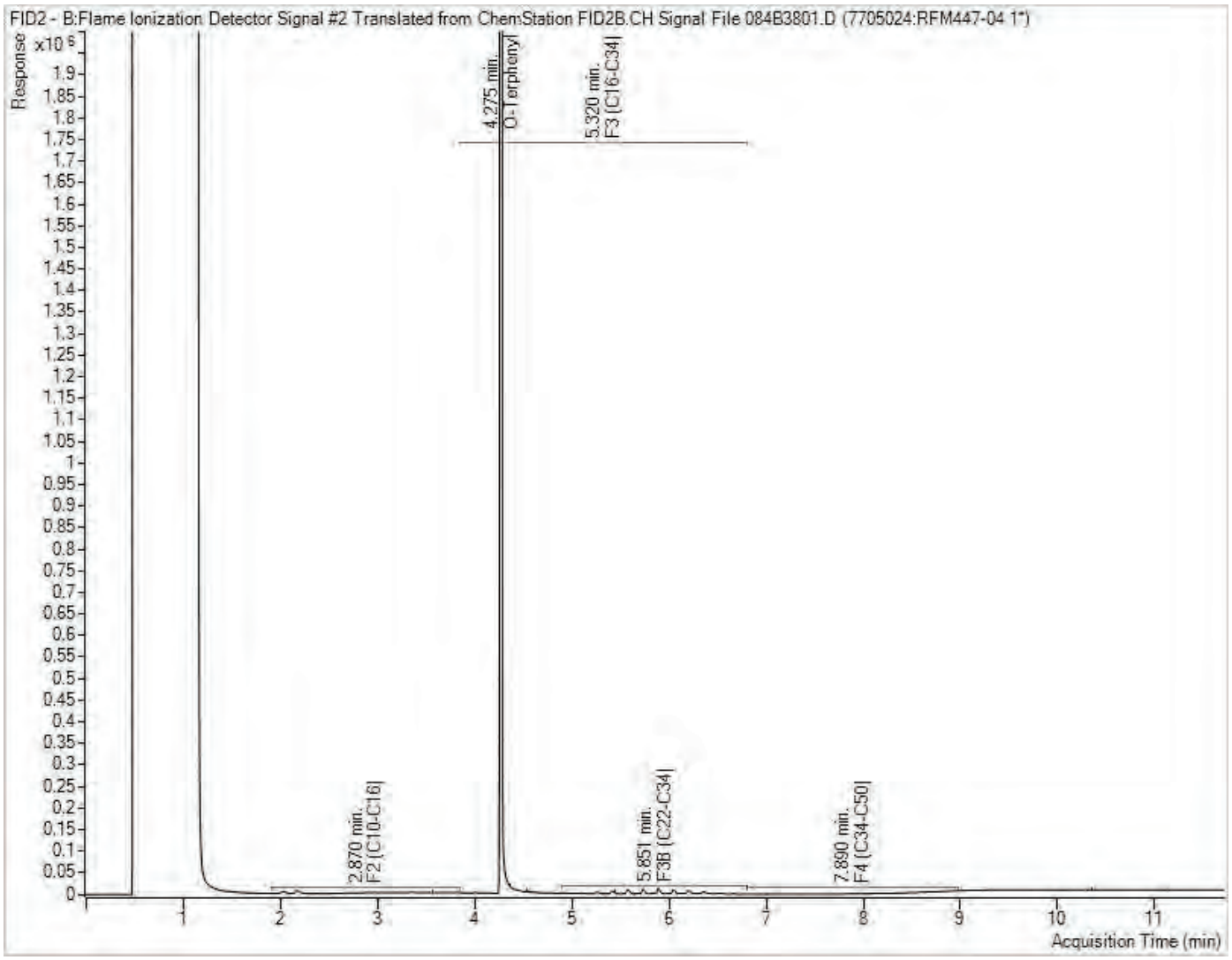
LVR #4 21206 3/3/2

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Your Project #: 160961457
Site Location: TIKAL
Your C.O.C. #: N/A

Attention: Aaron Warkentin

Stantec Consulting Ltd
300 Hagey Blvd
Suite 100
Waterloo, ON
CANADA N2L 0A4

Report Date: 2022/02/10
Report #: R6999730
Version: 2 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C1Y2396
Received: 2021/11/19, 16:23

Sample Matrix: Water
Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	7	N/A	2021/11/29	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	7	N/A	2022/01/04	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	6	N/A	2021/11/26	CAM SOP-00463	SM 23 4500-Cl E m
Chloride by Automated Colourimetry	1	N/A	2021/11/29	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	7	N/A	2021/11/29	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	4	N/A	2021/11/26	CAM SOP-00446	SM 23 5310 B m
Petroleum Hydro. CCME F1 & BTEX in Water	1	N/A	2021/11/29	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydro. CCME F1 & BTEX in Water	2	N/A	2021/11/30	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Water (2)	3	2021/11/26	2021/11/27	CAM SOP-00316	CCME PHC-CWS m
Hardness (calculated as CaCO3)	4	N/A	2022/01/11	CAM SOP 00102/00408/00447	SM 2340 B
Hardness (calculated as CaCO3)	3	N/A	2022/01/26	CAM SOP 00102/00408/00447	SM 2340 B
Lab Filtered Metals Analysis by ICP	3	2022/01/26	2022/01/26	CAM SOP-00408	EPA 6010D m
Dissolved Metals by ICPMS	4	N/A	2022/01/07	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICPMS	3	N/A	2022/01/26	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	4	N/A	2022/01/11		
Anion and Cation Sum	4	N/A	2022/01/11		
Total Ammonia-N	7	N/A	2021/11/27	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (3)	7	N/A	2021/11/26	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	7	2021/11/28	2021/11/29	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	7	N/A	2021/11/29	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	4	N/A	2022/01/11		Auto Calc
Sat. pH and Langelier Index (@ 20C)	3	N/A	2022/01/26		Auto Calc
Sat. pH and Langelier Index (@ 4C)	4	N/A	2022/01/11		Auto Calc
Sat. pH and Langelier Index (@ 4C)	3	N/A	2022/01/26		Auto Calc
Sulphate by Automated Colourimetry	6	N/A	2021/11/26	CAM SOP-00464	EPA 375.4 m
Sulphate by Automated Colourimetry	1	N/A	2021/11/29	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	4	N/A	2022/01/11		Auto Calc
Total Dissolved Solids (TDS calc)	3	N/A	2022/01/26		Auto Calc

Your Project #: 160961457
Site Location: TIKAL
Your C.O.C. #: N/A

Attention: Aaron Warkentin

Stantec Consulting Ltd
300 Hagey Blvd
Suite 100
Waterloo, ON
CANADA N2L 0A4

Report Date: 2022/02/10
Report #: R6999730
Version: 2 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C1Y2396
Received: 2021/11/19, 16:23

Sample Matrix: Water
Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Total Organic Carbon (TOC) (4)	3	N/A	2022/02/02	CAM SOP-00446	SM 23 5310B m
Total Phosphorus (Colourimetric)	3	2022/02/02	2022/02/02	CAM SOP-00407	SM 23 4500 P B H m
Turbidity	3	N/A	2022/01/28	CAM SOP-00417	SM 23 2130 B m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following “Alberta Environment’s Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003”. Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.
(3) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(4) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.

Your Project #: 160961457
Site Location: TIKAL
Your C.O.C. #: N/A

Attention: Aaron Warkentin

Stantec Consulting Ltd
300 Hagey Blvd
Suite 100
Waterloo, ON
CANADA N2L 0A4

Report Date: 2022/02/10
Report #: R6999730
Version: 2 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C1Y2396
Received: 2021/11/19, 16:23

Encryption Key



Ronklin Gracian
Project Manager
10 Feb 2022 17:44:36

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ronklin Gracian, Project Manager
Email: Ronklin.Gracian@bureauveritas.com
Phone# (905)817-5752
==========
Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.
For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10

Stantec Consulting Ltd
Client Project #: 160961457
Site Location: TIKAL
Sampler Initials: RD

RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		RHD453			RHD454			RHD454		
Sampling Date		2021/11/19 09:00			2021/11/19 08:43			2021/11/19 08:43		
COC Number		N/A			N/A			N/A		
	UNITS	DP21-01	RDL	QC Batch	DP21-02	RDL	QC Batch	DP21-02 Lab-Dup	RDL	QC Batch
Calculated Parameters										
Anion Sum	me/L	7.47	N/A	7724815	15.5	N/A	7724816			
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	340	1.0	7724811	470	1.0	7724811			
Calculated TDS	mg/L	370	1.0	7724807	840	1.0	7724807			
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.4	1.0	7724811	1.8	1.0	7724811			
Cation Sum	me/L	6.96	N/A	7724815	15.0	N/A	7724816			
Hardness (CaCO3)	mg/L	320	1.0	7724528	720	1.0	7724528			
Ion Balance (% Difference)	%	3.54	N/A	7724814	1.60	N/A	7724814			
Langelier Index (@ 20C)	N/A	0.639		7724806	1.04		7724806			
Langelier Index (@ 4C)	N/A	0.391		7724808	0.792		7724808			
Saturation pH (@ 20C)	N/A	7.00		7724806	6.58		7724806			
Saturation pH (@ 4C)	N/A	7.25		7724808	6.83		7724808			
Inorganics										
Total Ammonia-N	mg/L	0.34	0.050	7748274	1.4	0.050	7748274			
Conductivity	umho/cm	650	1.0	7716064	1300	1.0	7716064	1300	1.0	7716064
Dissolved Organic Carbon	mg/L	14	0.40	7727106	55	0.40	7727106			
Orthophosphate (P)	mg/L	<0.010	0.010	7725617	<0.050 (1)	0.050	7725617			
pH	pH	7.64		7751116	7.62		7751116	7.61		7751116
Dissolved Sulphate (SO4)	mg/L	17	1.0	7725015	250	2.0	7725015			
Alkalinity (Total as CaCO3)	mg/L	340	1.0	7716090	470	1.0	7716090			
Dissolved Chloride (Cl-)	mg/L	13	1.0	7725026	35	1.0	7725026			
Nitrite (N)	mg/L	0.019	0.010	7748877	0.013	0.010	7748877			
Nitrate (N)	mg/L	0.11	0.10	7748877	<0.10	0.10	7748877			
Nitrate + Nitrite (N)	mg/L	0.13	0.10	7748877	<0.10	0.10	7748877			
Metals										
Dissolved Aluminum (Al)	mg/L	0.022	0.0049	7767702	0.026	0.0049	7767702			
Dissolved Antimony (Sb)	mg/L	<0.00050	0.00050	7767702	<0.00050	0.00050	7767702			
Dissolved Arsenic (As)	mg/L	0.0093	0.0010	7767702	0.0014	0.0010	7767702			
Dissolved Barium (Ba)	mg/L	0.23	0.0020	7767702	0.32	0.0020	7767702			

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10

Stantec Consulting Ltd
Client Project #: 160961457
Site Location: TIKAL
Sampler Initials: RD

RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		RHD453			RHD454			RHD454		
Sampling Date		2021/11/19 09:00			2021/11/19 08:43			2021/11/19 08:43		
COC Number		N/A			N/A			N/A		
	UNITS	DP21-01	RDL	QC Batch	DP21-02	RDL	QC Batch	DP21-02 Lab-Dup	RDL	QC Batch
Dissolved Beryllium (Be)	mg/L	<0.00040	0.00040	7767702	<0.00040	0.00040	7767702			
Dissolved Boron (B)	mg/L	0.094	0.010	7767702	0.026	0.010	7767702			
Dissolved Cadmium (Cd)	mg/L	<0.000090	0.000090	7767702	<0.000090	0.000090	7767702			
Dissolved Calcium (Ca)	mg/L	82	0.20	7767702	190	0.20	7767702			
Dissolved Chromium (Cr)	mg/L	<0.0050	0.0050	7767702	<0.0050	0.0050	7767702			
Dissolved Cobalt (Co)	mg/L	0.00061	0.00050	7767702	0.00071	0.00050	7767702			
Dissolved Copper (Cu)	mg/L	0.0038	0.00090	7767702	0.0011	0.00090	7767702			
Dissolved Iron (Fe)	mg/L	12	0.10	7767702	6.5	0.10	7767702			
Dissolved Lead (Pb)	mg/L	<0.00050	0.00050	7767702	<0.00050	0.00050	7767702			
Dissolved Magnesium (Mg)	mg/L	27	0.050	7767702	60	0.050	7767702			
Dissolved Manganese (Mn)	mg/L	0.31	0.0020	7767702	0.30	0.0020	7767702			
Dissolved Molybdenum (Mo)	mg/L	0.0010	0.00050	7767702	0.0040	0.00050	7767702			
Dissolved Nickel (Ni)	mg/L	0.0027	0.0010	7767702	0.0068	0.0010	7767702			
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	7767702	0.12	0.10	7767702			
Dissolved Potassium (K)	mg/L	0.71	0.20	7767702	0.68	0.20	7767702			
Dissolved Selenium (Se)	mg/L	<0.0020	0.0020	7767702	<0.0020	0.0020	7767702			
Dissolved Silicon (Si)	mg/L	4.6	0.050	7767702	5.1	0.050	7767702			
Dissolved Silver (Ag)	mg/L	<0.000090	0.000090	7767702	<0.000090	0.000090	7767702			
Dissolved Sodium (Na)	mg/L	2.9	0.10	7767702	4.3	0.10	7767702			
Dissolved Strontium (Sr)	mg/L	0.082	0.0010	7767702	0.16	0.0010	7767702			
Dissolved Thallium (Tl)	mg/L	<0.000050	0.000050	7767702	<0.000050	0.000050	7767702			
Dissolved Titanium (Ti)	mg/L	<0.0050	0.0050	7767702	<0.0050	0.0050	7767702			
Dissolved Uranium (U)	mg/L	<0.00010	0.00010	7767702	0.00072	0.00010	7767702			
Dissolved Vanadium (V)	mg/L	<0.00050	0.00050	7767702	<0.00050	0.00050	7767702			
Dissolved Zinc (Zn)	mg/L	41	0.025	7767702	88	0.050	7767702			

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		RHD455		RHD456		
Sampling Date		2021/11/19 08:22		2021/11/19 08:07		
COC Number		N/A		N/A		
	UNITS	DP21-03	RDL	DP21-04	RDL	QC Batch
Calculated Parameters						
Anion Sum	me/L	11.5	N/A	7.30	N/A	7724816
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	490	1.0	280	1.0	7724811
Calculated TDS	mg/L	570	1.0	380	1.0	7724807
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.5	1.0	2.1	1.0	7724811
Cation Sum	me/L	11.3	N/A	7.38	N/A	7724816
Hardness (CaCO3)	mg/L	520	1.0	340	1.0	7724528
Ion Balance (% Difference)	%	0.760	N/A	0.560	N/A	7724814
Langelier Index (@ 20C)	N/A	1.08		0.844		7724806
Langelier Index (@ 4C)	N/A	0.830		0.595		7724808
Saturation pH (@ 20C)	N/A	6.66		7.06		7724806
Saturation pH (@ 4C)	N/A	6.91		7.31		7724808
Inorganics						
Total Ammonia-N	mg/L	0.89	0.050	0.16	0.050	7748274
Conductivity	umho/cm	980	1.0	690	1.0	7716064
Dissolved Organic Carbon	mg/L	44	0.40	3.6	0.40	7727106
Orthophosphate (P)	mg/L	<0.010	0.010	<0.010	0.010	7725617
pH	pH	7.74		7.91		7751116
Dissolved Sulphate (SO4)	mg/L	<5.0 (1)	5.0	30	1.0	7725015
Alkalinity (Total as CaCO3)	mg/L	490	1.0	280	1.0	7716090
Dissolved Chloride (Cl-)	mg/L	59	1.0	37	1.0	7725026
Nitrite (N)	mg/L	0.020	0.010	0.019	0.010	7748877
Nitrate (N)	mg/L	<0.10	0.10	0.30	0.10	7748877
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	0.32	0.10	7748877
Metals						
Dissolved Aluminum (Al)	mg/L	0.078	0.0049	0.017	0.0049	7767702
Dissolved Antimony (Sb)	mg/L	<0.00050	0.00050	<0.00050	0.00050	7767702
Dissolved Arsenic (As)	mg/L	0.0034	0.0010	<0.0010	0.0010	7767702
Dissolved Barium (Ba)	mg/L	0.18	0.0020	0.17	0.0020	7767702
Dissolved Beryllium (Be)	mg/L	<0.00040	0.00040	<0.00040	0.00040	7767702

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10

Stantec Consulting Ltd
Client Project #: 160961457
Site Location: TIKAL
Sampler Initials: RD

RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		RHD455		RHD456		
Sampling Date		2021/11/19 08:22		2021/11/19 08:07		
COC Number		N/A		N/A		
	UNITS	DP21-03	RDL	DP21-04	RDL	QC Batch
Dissolved Boron (B)	mg/L	0.028	0.010	0.017	0.010	7767702
Dissolved Cadmium (Cd)	mg/L	<0.000090	0.000090	0.00039	0.000090	7767702
Dissolved Calcium (Ca)	mg/L	130	0.20	85	0.20	7767702
Dissolved Chromium (Cr)	mg/L	<0.0050	0.0050	<0.0050	0.0050	7767702
Dissolved Cobalt (Co)	mg/L	0.00076	0.00050	0.0011	0.00050	7767702
Dissolved Copper (Cu)	mg/L	0.029	0.00090	0.0032	0.00090	7767702
Dissolved Iron (Fe)	mg/L	5.7	0.10	1.6	0.10	7767702
Dissolved Lead (Pb)	mg/L	0.0021	0.00050	<0.00050	0.00050	7767702
Dissolved Magnesium (Mg)	mg/L	44	0.050	30	0.050	7767702
Dissolved Manganese (Mn)	mg/L	0.22	0.0020	0.25	0.0020	7767702
Dissolved Molybdenum (Mo)	mg/L	0.0014	0.00050	0.00098	0.00050	7767702
Dissolved Nickel (Ni)	mg/L	0.016	0.0010	0.0040	0.0010	7767702
Dissolved Phosphorus (P)	mg/L	0.11	0.10	<0.10	0.10	7767702
Dissolved Potassium (K)	mg/L	0.47	0.20	1.1	0.20	7767702
Dissolved Selenium (Se)	mg/L	<0.0020	0.0020	<0.0020	0.0020	7767702
Dissolved Silicon (Si)	mg/L	4.5	0.050	3.3	0.050	7767702
Dissolved Silver (Ag)	mg/L	<0.000090	0.000090	<0.000090	0.000090	7767702
Dissolved Sodium (Na)	mg/L	17	0.10	13	0.10	7767702
Dissolved Strontium (Sr)	mg/L	0.13	0.0010	0.090	0.0010	7767702
Dissolved Thallium (Tl)	mg/L	<0.000050	0.000050	<0.000050	0.000050	7767702
Dissolved Titanium (Ti)	mg/L	0.0062	0.0010	<0.0050	0.0050	7767702
Dissolved Uranium (U)	mg/L	0.00030	0.00010	0.00031	0.00010	7767702
Dissolved Vanadium (V)	mg/L	0.0099	0.00050	<0.00050	0.00050	7767702
Dissolved Zinc (Zn)	mg/L	41	0.025	9.5	0.0050	7767702

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10

Stantec Consulting Ltd
Client Project #: 160961457
Site Location: TIKAL
Sampler Initials: RD

RCAP - SURFACE WATER (WATER)

Bureau Veritas ID		RHD457		RHD458			RHD458		
Sampling Date		2021/11/08 13:00		2021/11/08 14:00			2021/11/08 14:00		
COC Number		N/A		N/A			N/A		
	UNITS	SW21-01	QC Batch	SW21-02	RDL	QC Batch	SW21-02 Lab-Dup	RDL	QC Batch
Calculated Parameters									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	260	7724811	250	1.0	7724811			
Calculated TDS	mg/L	320	7724807	350	1.0	7724807			
Carb. Alkalinity (calc. as CaCO3)	mg/L	3.8	7724811	5.3	1.0	7724811			
Hardness (CaCO3)	mg/L	300	7724528	300	1.0	7724528			
Langelier Index (@ 20C)	N/A	1.09	7724806	1.23		7724806			
Langelier Index (@ 4C)	N/A	0.838	7724808	0.976		7724808			
Saturation pH (@ 20C)	N/A	7.11	7724806	7.13		7724806			
Saturation pH (@ 4C)	N/A	7.36	7724808	7.38		7724808			
Inorganics									
Total Ammonia-N	mg/L	<0.050	7748274	<0.050	0.050	7748274			
Conductivity	umho/cm	580	7716064	580	1.0	7716064			
Orthophosphate (P)	mg/L	<0.010	7725617	<0.010	0.010	7725667			
pH	pH	8.20	7751116	8.35		7751116			
Dissolved Sulphate (SO4)	mg/L	10	7725015	23	1.0	7725678			
Turbidity	NTU	0.7	7799231	0.3	0.1	7799231			
Alkalinity (Total as CaCO3)	mg/L	260	7716090	250	1.0	7716090			
Dissolved Chloride (Cl-)	mg/L	27	7725026	36	1.0	7722104			
Nitrite (N)	mg/L	<0.010	7748877	<0.010	0.010	7748877			
Nitrate (N)	mg/L	0.15	7748877	0.18	0.10	7748877			
Metals									
Dissolved Calcium (Ca)	mg/L	79	7799018	79	0.05	7799018			
Dissolved Magnesium (Mg)	mg/L	24	7799018	25	0.05	7799018			
Dissolved Potassium (K)	mg/L	1	7799018	2	1	7799018			
Dissolved Sodium (Na)	mg/L	14	7799018	20	0.5	7799018			
Total Aluminum (Al)	mg/L	0.0067	7800742	0.010	0.0049	7800742	0.010	0.0049	7800742
Total Antimony (Sb)	mg/L	<0.00050	7800742	<0.00050	0.00050	7800742	<0.00050	0.00050	7800742
Total Arsenic (As)	mg/L	<0.0010	7800742	<0.0010	0.0010	7800742	<0.0010	0.0010	7800742
Total Barium (Ba)	mg/L	0.064	7800742	0.051	0.0020	7800742	0.051	0.0020	7800742
Total Beryllium (Be)	mg/L	<0.00040	7800742	<0.00040	0.00040	7800742	<0.00040	0.00040	7800742
Total Boron (B)	mg/L	<0.010	7800742	<0.010	0.010	7800742	0.010	0.010	7800742

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10

Stantec Consulting Ltd
Client Project #: 160961457
Site Location: TIKAL
Sampler Initials: RD

RCAP - SURFACE WATER (WATER)

Bureau Veritas ID		RHD457		RHD458			RHD458		
Sampling Date		2021/11/08 13:00		2021/11/08 14:00			2021/11/08 14:00		
COC Number		N/A		N/A			N/A		
	UNITS	SW21-01	QC Batch	SW21-02	RDL	QC Batch	SW21-02 Lab-Dup	RDL	QC Batch
Total Cadmium (Cd)	mg/L	<0.000090	7800742	<0.000090	0.000090	7800742	<0.000090	0.000090	7800742
Total Calcium (Ca)	mg/L	77	7800742	74	0.20	7800742	75	0.20	7800742
Total Chromium (Cr)	mg/L	<0.0050	7800742	<0.0050	0.0050	7800742	<0.0050	0.0050	7800742
Total Cobalt (Co)	mg/L	<0.00050	7800742	<0.00050	0.00050	7800742	<0.00050	0.00050	7800742
Total Copper (Cu)	mg/L	<0.00090	7800742	<0.00090	0.00090	7800742	<0.00090	0.00090	7800742
Total Iron (Fe)	mg/L	<0.10	7800742	<0.10	0.10	7800742	<0.10	0.10	7800742
Total Lead (Pb)	mg/L	<0.00050	7800742	<0.00050	0.00050	7800742	<0.00050	0.00050	7800742
Total Magnesium (Mg)	mg/L	25	7800742	25	0.050	7800742	26	0.050	7800742
Total Manganese (Mn)	mg/L	0.025	7800742	0.023	0.0020	7800742	0.024	0.0020	7800742
Total Molybdenum (Mo)	mg/L	0.00067	7800742	0.00070	0.00050	7800742	0.00067	0.00050	7800742
Total Nickel (Ni)	mg/L	<0.0010	7800742	<0.0010	0.0010	7800742	<0.0010	0.0010	7800742
Total Potassium (K)	mg/L	1.4	7800742	1.4	0.20	7800742	1.4	0.20	7800742
Total Selenium (Se)	mg/L	<0.0020	7800742	<0.0020	0.0020	7800742	<0.0020	0.0020	7800742
Total Silicon (Si)	mg/L	4.7	7800742	3.9	0.050	7800742	4.0	0.050	7800742
Total Silver (Ag)	mg/L	<0.000090	7800742	<0.000090	0.000090	7800742	<0.000090	0.000090	7800742
Total Sodium (Na)	mg/L	13	7800742	19	0.10	7800742	19	0.10	7800742
Total Strontium (Sr)	mg/L	0.095	7800742	0.094	0.0010	7800742	0.095	0.0010	7800742
Total Thallium (Tl)	mg/L	<0.000050	7800742	<0.000050	0.000050	7800742	<0.000050	0.000050	7800742
Total Titanium (Ti)	mg/L	<0.0050	7800742	<0.0050	0.0050	7800742	<0.0050	0.0050	7800742
Total Tungsten (W)	mg/L	<0.0010	7800742	<0.0010	0.0010	7800742	<0.0010	0.0010	7800742
Total Uranium (U)	mg/L	0.00052	7800742	0.00049	0.00010	7800742	0.00047	0.00010	7800742
Total Vanadium (V)	mg/L	<0.00050	7800742	<0.00050	0.00050	7800742	<0.00050	0.00050	7800742
Total Zinc (Zn)	mg/L	0.032	7800742	0.020	0.0050	7800742	0.020	0.0050	7800742
Total Zirconium (Zr)	mg/L	<0.0010	7800742	<0.0010	0.0010	7800742	<0.0010	0.0010	7800742

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

RCAP - SURFACE WATER (WATER)

Bureau Veritas ID		RHD459		
Sampling Date		2021/11/08 17:00		
COC Number		N/A		
	UNITS	FIELD DUP1	RDL	QC Batch
Calculated Parameters				
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	260	1.0	7724811
Calculated TDS	mg/L	320	1.0	7724807
Carb. Alkalinity (calc. as CaCO3)	mg/L	4.1	1.0	7724811
Hardness (CaCO3)	mg/L	300	1.0	7724528
Langelier Index (@ 20C)	N/A	1.12		7724806
Langelier Index (@ 4C)	N/A	0.874		7724808
Saturation pH (@ 20C)	N/A	7.11		7724806
Saturation pH (@ 4C)	N/A	7.36		7724808
Inorganics				
Total Ammonia-N	mg/L	<0.050	0.050	7748274
Conductivity	umho/cm	560	1.0	7716064
Orthophosphate (P)	mg/L	<0.010	0.010	7725617
pH	pH	8.23		7751116
Dissolved Sulphate (SO4)	mg/L	10	1.0	7725015
Turbidity	NTU	0.3	0.1	7799231
Alkalinity (Total as CaCO3)	mg/L	260	1.0	7716090
Dissolved Chloride (Cl-)	mg/L	27	1.0	7725026
Nitrite (N)	mg/L	<0.010	0.010	7748877
Nitrate (N)	mg/L	0.15	0.10	7748877
Metals				
Dissolved Calcium (Ca)	mg/L	80	0.05	7799018
Dissolved Magnesium (Mg)	mg/L	25	0.05	7799018
Dissolved Potassium (K)	mg/L	2	1	7799018
Dissolved Sodium (Na)	mg/L	14	0.5	7799018
Total Aluminum (Al)	mg/L	0.0079	0.0049	7800742
Total Antimony (Sb)	mg/L	<0.00050	0.00050	7800742
Total Arsenic (As)	mg/L	<0.0010	0.0010	7800742
Total Barium (Ba)	mg/L	0.064	0.0020	7800742
Total Beryllium (Be)	mg/L	<0.00040	0.00040	7800742
Total Boron (B)	mg/L	<0.010	0.010	7800742
Total Cadmium (Cd)	mg/L	<0.000090	0.000090	7800742

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

RCAP - SURFACE WATER (WATER)

Bureau Veritas ID		RHD459		
Sampling Date		2021/11/08 17:00		
COC Number		N/A		
	UNITS	FIELD DUP1	RDL	QC Batch
Total Calcium (Ca)	mg/L	75	0.20	7800742
Total Chromium (Cr)	mg/L	<0.0050	0.0050	7800742
Total Cobalt (Co)	mg/L	<0.00050	0.00050	7800742
Total Copper (Cu)	mg/L	<0.00090	0.00090	7800742
Total Iron (Fe)	mg/L	<0.10	0.10	7800742
Total Lead (Pb)	mg/L	<0.00050	0.00050	7800742
Total Magnesium (Mg)	mg/L	24	0.050	7800742
Total Manganese (Mn)	mg/L	0.024	0.0020	7800742
Total Molybdenum (Mo)	mg/L	0.00066	0.00050	7800742
Total Nickel (Ni)	mg/L	<0.0010	0.0010	7800742
Total Potassium (K)	mg/L	1.4	0.20	7800742
Total Selenium (Se)	mg/L	<0.0020	0.0020	7800742
Total Silicon (Si)	mg/L	4.6	0.050	7800742
Total Silver (Ag)	mg/L	<0.000090	0.000090	7800742
Total Sodium (Na)	mg/L	13	0.10	7800742
Total Strontium (Sr)	mg/L	0.094	0.0010	7800742
Total Thallium (Tl)	mg/L	<0.000050	0.000050	7800742
Total Titanium (Ti)	mg/L	<0.0050	0.0050	7800742
Total Tungsten (W)	mg/L	<0.0010	0.0010	7800742
Total Uranium (U)	mg/L	0.00051	0.00010	7800742
Total Vanadium (V)	mg/L	<0.00050	0.00050	7800742
Total Zinc (Zn)	mg/L	0.033	0.0050	7800742
Total Zirconium (Zr)	mg/L	<0.0010	0.0010	7800742

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10

Stantec Consulting Ltd
Client Project #: 160961457
Site Location: TIKAL
Sampler Initials: RD

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		RHD457	RHD458	RHD459		
Sampling Date		2021/11/08 13:00	2021/11/08 14:00	2021/11/08 17:00		
COC Number		N/A	N/A	N/A		
	UNITS	SW21-01	SW21-02	FIELD DUP1	RDL	QC Batch
Inorganics						
Total Organic Carbon (TOC)	mg/L	12	7.2	12	0.40	7812398
Total Phosphorus	mg/L	0.011	0.005	0.010	0.004	7812399

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

O.REG 153 PHCS, BTEX/F1-F4 (WATER)

Bureau Veritas ID		RHD457	RHD458	RHD458	RHD459		
Sampling Date		2021/11/08 13:00	2021/11/08 14:00	2021/11/08 14:00	2021/11/08 17:00		
COC Number		N/A	N/A	N/A	N/A		
	UNITS	SW21-01	SW21-02	SW21-02 Lab-Dup	FIELD DUP1	RDL	QC Batch
BTEX & F1 Hydrocarbons							
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7732216
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7732216
Ethylbenzene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7732216
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7732216
p+m-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	7732216
Total Xylenes	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	7732216
F1 (C6-C10)	ug/L	<25	<25	<25	<25	25	7732216
F1 (C6-C10) - BTEX	ug/L	<25	<25	<25	<25	25	7732216
F2-F4 Hydrocarbons							
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	<100	<100	100	7736282
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	<200	<200	200	7736282
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	<200	<200	200	7736282
Reached Baseline at C50	ug/L	Yes	Yes	Yes	Yes		7736282
Surrogate Recovery (%)							
1,4-Difluorobenzene	%	107	103	103	104		7732216
4-Bromofluorobenzene	%	101	84	85	96		7732216
D10-o-Xylene	%	109	104	104	102		7732216
D4-1,2-Dichloroethane	%	107	114	111	110		7732216
o-Terphenyl	%	85	85	88	83		7736282

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10

Stantec Consulting Ltd
Client Project #: 160961457
Site Location: TIKAL
Sampler Initials: RD

TEST SUMMARY

Bureau Veritas ID: RHD453
Sample ID: DP21-01
Matrix: Water

Collected: 2021/11/19
Shipped:
Received: 2021/11/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7716090	N/A	2021/11/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7724811	N/A	2022/01/04	Automated Statchk
Chloride by Automated Colourimetry	KONE	7725026	N/A	2021/11/26	Alina Dobreanu
Conductivity	AT	7716064	N/A	2021/11/29	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7727106	N/A	2021/11/26	Julianna Castiglione
Hardness (calculated as CaCO3)		7724528	N/A	2022/01/11	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	7767702	N/A	2022/01/07	Nan Raykha
Ion Balance (% Difference)	CALC	7724814	N/A	2022/01/11	Automated Statchk
Anion and Cation Sum	CALC	7724815	N/A	2022/01/11	Automated Statchk
Total Ammonia-N	LACH/NH4	7748274	N/A	2021/11/27	Amanpreet Sappal
Nitrate & Nitrite as Nitrogen in Water	LACH	7748877	N/A	2021/11/26	Chandra Nandlal
pH	AT	7751116	2021/11/28	2021/11/29	Surinder Rai
Orthophosphate	KONE	7725617	N/A	2021/11/29	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7724806	N/A	2022/01/11	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7724808	N/A	2022/01/11	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7725015	N/A	2021/11/26	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	7724807	N/A	2022/01/11	Automated Statchk

Bureau Veritas ID: RHD454
Sample ID: DP21-02
Matrix: Water

Collected: 2021/11/19
Shipped:
Received: 2021/11/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7716090	N/A	2021/11/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7724811	N/A	2022/01/04	Automated Statchk
Chloride by Automated Colourimetry	KONE	7725026	N/A	2021/11/26	Alina Dobreanu
Conductivity	AT	7716064	N/A	2021/11/29	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7727106	N/A	2021/11/26	Julianna Castiglione
Hardness (calculated as CaCO3)		7724528	N/A	2022/01/11	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	7767702	N/A	2022/01/07	Nan Raykha
Ion Balance (% Difference)	CALC	7724814	N/A	2022/01/11	Automated Statchk
Anion and Cation Sum	CALC	7724816	N/A	2022/01/11	Automated Statchk
Total Ammonia-N	LACH/NH4	7748274	N/A	2021/11/27	Amanpreet Sappal
Nitrate & Nitrite as Nitrogen in Water	LACH	7748877	N/A	2021/11/26	Chandra Nandlal
pH	AT	7751116	2021/11/28	2021/11/29	Surinder Rai
Orthophosphate	KONE	7725617	N/A	2021/11/29	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7724806	N/A	2022/01/11	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7724808	N/A	2022/01/11	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7725015	N/A	2021/11/26	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	7724807	N/A	2022/01/11	Automated Statchk

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10

Stantec Consulting Ltd
Client Project #: 160961457
Site Location: TIKAL
Sampler Initials: RD

TEST SUMMARY

Bureau Veritas ID: RHD454 Dup
Sample ID: DP21-02
Matrix: Water

Collected: 2021/11/19
Shipped:
Received: 2021/11/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	7716064	N/A	2021/11/29	Surinder Rai
pH	AT	7751116	2021/11/28	2021/11/29	Surinder Rai

Bureau Veritas ID: RHD455
Sample ID: DP21-03
Matrix: Water

Collected: 2021/11/19
Shipped:
Received: 2021/11/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7716090	N/A	2021/11/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7724811	N/A	2022/01/04	Automated Statchk
Chloride by Automated Colourimetry	KONE	7725026	N/A	2021/11/26	Alina Dobreanu
Conductivity	AT	7716064	N/A	2021/11/29	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7727106	N/A	2021/11/26	Julianna Castiglione
Hardness (calculated as CaCO3)		7724528	N/A	2022/01/11	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	7767702	N/A	2022/01/07	Nan Raykha
Ion Balance (% Difference)	CALC	7724814	N/A	2022/01/11	Automated Statchk
Anion and Cation Sum	CALC	7724816	N/A	2022/01/11	Automated Statchk
Total Ammonia-N	LACH/NH4	7748274	N/A	2021/11/27	Amanpreet Sappal
Nitrate & Nitrite as Nitrogen in Water	LACH	7748877	N/A	2021/11/26	Chandra Nandlal
pH	AT	7751116	2021/11/28	2021/11/29	Surinder Rai
Orthophosphate	KONE	7725617	N/A	2021/11/29	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7724806	N/A	2022/01/11	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7724808	N/A	2022/01/11	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7725015	N/A	2021/11/26	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	7724807	N/A	2022/01/11	Automated Statchk

Bureau Veritas ID: RHD456
Sample ID: DP21-04
Matrix: Water

Collected: 2021/11/19
Shipped:
Received: 2021/11/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7716090	N/A	2021/11/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7724811	N/A	2022/01/04	Automated Statchk
Chloride by Automated Colourimetry	KONE	7725026	N/A	2021/11/26	Alina Dobreanu
Conductivity	AT	7716064	N/A	2021/11/29	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7727106	N/A	2021/11/26	Julianna Castiglione
Hardness (calculated as CaCO3)		7724528	N/A	2022/01/11	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	7767702	N/A	2022/01/07	Nan Raykha
Ion Balance (% Difference)	CALC	7724814	N/A	2022/01/11	Automated Statchk
Anion and Cation Sum	CALC	7724816	N/A	2022/01/11	Automated Statchk
Total Ammonia-N	LACH/NH4	7748274	N/A	2021/11/27	Amanpreet Sappal
Nitrate & Nitrite as Nitrogen in Water	LACH	7748877	N/A	2021/11/26	Chandra Nandlal
pH	AT	7751116	2021/11/28	2021/11/29	Surinder Rai
Orthophosphate	KONE	7725617	N/A	2021/11/29	Avneet Kour Sudan

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10

Stantec Consulting Ltd
Client Project #: 160961457
Site Location: TIKAL
Sampler Initials: RD

TEST SUMMARY

Bureau Veritas ID: RHD456
Sample ID: DP21-04
Matrix: Water

Collected: 2021/11/19
Shipped:
Received: 2021/11/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sat. pH and Langelier Index (@ 20C)	CALC	7724806	N/A	2022/01/11	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7724808	N/A	2022/01/11	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7725015	N/A	2021/11/26	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	7724807	N/A	2022/01/11	Automated Statchk

Bureau Veritas ID: RHD457
Sample ID: SW21-01
Matrix: Water

Collected: 2021/11/08
Shipped:
Received: 2021/11/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7716090	N/A	2021/11/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7724811	N/A	2022/01/04	Automated Statchk
Chloride by Automated Colourimetry	KONE	7725026	N/A	2021/11/26	Alina Dobreanu
Conductivity	AT	7716064	N/A	2021/11/29	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7732216	N/A	2021/11/30	Haibin Wu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7736282	2021/11/26	2021/11/27	Suleeqa Nurr
Hardness (calculated as CaCO3)		7724528	N/A	2022/01/26	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7799018	2022/01/26	2022/01/26	Suban Kanapathippllai
Total Metals Analysis by ICPMS	ICP/MS	7800742	N/A	2022/01/26	Azita Fazaeli
Total Ammonia-N	LACH/NH4	7748274	N/A	2021/11/27	Amanpreet Sappal
Nitrate & Nitrite as Nitrogen in Water	LACH	7748877	N/A	2021/11/26	Chandra Nandlal
pH	AT	7751116	2021/11/28	2021/11/29	Surinder Rai
Orthophosphate	KONE	7725617	N/A	2021/11/29	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7724806	N/A	2022/01/26	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7724808	N/A	2022/01/26	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7725015	N/A	2021/11/26	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	7724807	N/A	2022/01/26	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	7812398	N/A	2022/02/02	Anna-Kay Gooden
Total Phosphorus (Colourimetric)	LACH/P	7812399	2022/02/02	2022/02/02	Shivani Shivani
Turbidity	AT	7799231	N/A	2022/01/28	Neil Dassanayake

Bureau Veritas ID: RHD458
Sample ID: SW21-02
Matrix: Water

Collected: 2021/11/08
Shipped:
Received: 2021/11/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7716090	N/A	2021/11/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7724811	N/A	2022/01/04	Automated Statchk
Chloride by Automated Colourimetry	KONE	7722104	N/A	2021/11/29	Alina Dobreanu
Conductivity	AT	7716064	N/A	2021/11/29	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7732216	N/A	2021/11/29	Haibin Wu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7736282	2021/11/26	2021/11/27	Suleeqa Nurr
Hardness (calculated as CaCO3)		7724528	N/A	2022/01/26	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7799018	2022/01/26	2022/01/26	Suban Kanapathippllai

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10

Stantec Consulting Ltd
Client Project #: 160961457
Site Location: TIKAL
Sampler Initials: RD

TEST SUMMARY

Bureau Veritas ID: RHD458
Sample ID: SW21-02
Matrix: Water

Collected: 2021/11/08
Shipped:
Received: 2021/11/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Metals Analysis by ICPMS	ICP/MS	7800742	N/A	2022/01/26	Azita Fazaeli
Total Ammonia-N	LACH/NH4	7748274	N/A	2021/11/27	Amanpreet Sappal
Nitrate & Nitrite as Nitrogen in Water	LACH	7748877	N/A	2021/11/26	Chandra Nandlal
pH	AT	7751116	2021/11/28	2021/11/29	Surinder Rai
Orthophosphate	KONE	7725667	N/A	2021/11/29	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7724806	N/A	2022/01/26	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7724808	N/A	2022/01/26	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7725678	N/A	2021/11/29	Avneet Kour Sudan
Total Dissolved Solids (TDS calc)	CALC	7724807	N/A	2022/01/26	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	7812398	N/A	2022/02/02	Anna-Kay Gooden
Total Phosphorus (Colourimetric)	LACH/P	7812399	2022/02/02	2022/02/02	Shivani Shivani
Turbidity	AT	7799231	N/A	2022/01/28	Neil Dassanayake

Bureau Veritas ID: RHD458 Dup
Sample ID: SW21-02
Matrix: Water

Collected: 2021/11/08
Shipped:
Received: 2021/11/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7732216	N/A	2021/11/29	Haibin Wu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7736282	2021/11/26	2021/11/27	Suleeqa Nurr
Total Metals Analysis by ICPMS	ICP/MS	7800742	N/A	2022/01/26	Azita Fazaeli

Bureau Veritas ID: RHD459
Sample ID: FIELD DUP1
Matrix: Water

Collected: 2021/11/08
Shipped:
Received: 2021/11/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7716090	N/A	2021/11/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7724811	N/A	2022/01/04	Automated Statchk
Chloride by Automated Colourimetry	KONE	7725026	N/A	2021/11/26	Alina Dobreanu
Conductivity	AT	7716064	N/A	2021/11/29	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7732216	N/A	2021/11/30	Haibin Wu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7736282	2021/11/26	2021/11/27	Suleeqa Nurr
Hardness (calculated as CaCO3)		7724528	N/A	2022/01/26	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	7799018	2022/01/26	2022/01/26	Suban Kanapathippllai
Total Metals Analysis by ICPMS	ICP/MS	7800742	N/A	2022/01/26	Azita Fazaeli
Total Ammonia-N	LACH/NH4	7748274	N/A	2021/11/27	Amanpreet Sappal
Nitrate & Nitrite as Nitrogen in Water	LACH	7748877	N/A	2021/11/26	Chandra Nandlal
pH	AT	7751116	2021/11/28	2021/11/29	Surinder Rai
Orthophosphate	KONE	7725617	N/A	2021/11/29	Avneet Kour Sudan
Sat. pH and Langelier Index (@ 20C)	CALC	7724806	N/A	2022/01/26	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	7724808	N/A	2022/01/26	Automated Statchk
Sulphate by Automated Colourimetry	KONE	7725015	N/A	2021/11/26	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	7724807	N/A	2022/01/26	Automated Statchk

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10

Stantec Consulting Ltd
Client Project #: 160961457
Site Location: TIKAL
Sampler Initials: RD

TEST SUMMARY

Bureau Veritas ID: RHD459
Sample ID: FIELD DUP1
Matrix: Water

Collected: 2021/11/08
Shipped:
Received: 2021/11/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Organic Carbon (TOC)	TOCV/NDIR	7812398	N/A	2022/02/02	Anna-Kay Gooden
Total Phosphorus (Colourimetric)	LACH/P	7812399	2022/02/02	2022/02/02	Shivani Shivani
Turbidity	AT	7799231	N/A	2022/01/28	Neil Dassanayake

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	3.7°C

Turbidity, Metals, TOC and total phosphorus analyzed past hold time for samples SW21-01, SW21-02 and Field DUP1 with client's consent.

Results relate only to the items tested.

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

QUALITY ASSURANCE REPORT

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7732216	1,4-Difluorobenzene	2021/11/29	98	70 - 130	97	70 - 130	103	%				
7732216	4-Bromofluorobenzene	2021/11/29	102	70 - 130	108	70 - 130	96	%				
7732216	D10-o-Xylene	2021/11/29	92	70 - 130	100	70 - 130	102	%				
7732216	D4-1,2-Dichloroethane	2021/11/29	100	70 - 130	95	70 - 130	107	%				
7736282	o-Terphenyl	2021/11/26	95	60 - 130	80	60 - 130	87	%				
7716064	Conductivity	2021/11/29			100	85 - 115	<1.0	umho/cm	0.38	25		
7716090	Alkalinity (Total as CaCO3)	2021/11/29			94	85 - 115	<1.0	mg/L				
7722104	Dissolved Chloride (Cl-)	2021/11/29	115	80 - 120	103	80 - 120	<1.0	mg/L	4.1	20		
7725015	Dissolved Sulphate (SO4)	2021/11/26			106	80 - 120	<1.0	mg/L				
7725026	Dissolved Chloride (Cl-)	2021/11/26			102	80 - 120	<1.0	mg/L				
7725617	Orthophosphate (P)	2021/11/29	NC	75 - 125	101	80 - 120	<0.010	mg/L	1.0	25		
7725667	Orthophosphate (P)	2021/11/29	120	75 - 125	101	80 - 120	<0.010	mg/L	4.9	25		
7725678	Dissolved Sulphate (SO4)	2021/11/29	133 (1)	75 - 125	105	80 - 120	<1.0	mg/L	NC	20		
7727106	Dissolved Organic Carbon	2021/11/26	97	80 - 120	95	80 - 120	<0.40	mg/L	1.2	20		
7732216	Benzene	2021/11/29	113	50 - 140	104	50 - 140	<0.20	ug/L	NC	30		
7732216	Ethylbenzene	2021/11/29	119	50 - 140	110	50 - 140	<0.20	ug/L	NC	30		
7732216	F1 (C6-C10) - BTEX	2021/11/29					<25	ug/L	NC	30		
7732216	F1 (C6-C10)	2021/11/29	95	60 - 140	89	60 - 140	<25	ug/L	NC	30		
7732216	o-Xylene	2021/11/29	117	50 - 140	107	50 - 140	<0.20	ug/L	NC	30		
7732216	p+m-Xylene	2021/11/29	117	50 - 140	108	50 - 140	<0.40	ug/L	NC	30		
7732216	Toluene	2021/11/29	108	50 - 140	97	50 - 140	<0.20	ug/L	NC	30		
7732216	Total Xylenes	2021/11/29					<0.40	ug/L	NC	30		
7736282	F2 (C10-C16 Hydrocarbons)	2021/11/27	116	60 - 130	101	60 - 130	<100	ug/L	NC	30		
7736282	F3 (C16-C34 Hydrocarbons)	2021/11/27	119	60 - 130	105	60 - 130	<200	ug/L	NC	30		
7736282	F4 (C34-C50 Hydrocarbons)	2021/11/27	123	60 - 130	105	60 - 130	<200	ug/L	NC	30		
7748274	Total Ammonia-N	2021/11/27	94	75 - 125	98	80 - 120	<0.050	mg/L	1.2	20		
7748877	Nitrate (N)	2021/11/26	96	80 - 120	103	80 - 120	<0.10	mg/L	NC	20		
7748877	Nitrite (N)	2021/11/26	102	80 - 120	107	80 - 120	<0.010	mg/L	NC	20		
7751116	pH	2021/11/29			101	98 - 103			0.096	N/A		
7767702	Dissolved Aluminum (Al)	2022/01/07	106	80 - 120	101	80 - 120	<0.0049	mg/L	NC	20		

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7767702	Dissolved Antimony (Sb)	2022/01/07	NC	80 - 120	101	80 - 120	<0.00050	mg/L	1.4	20		
7767702	Dissolved Arsenic (As)	2022/01/07	NC	80 - 120	100	80 - 120	<0.0010	mg/L	0.96	20		
7767702	Dissolved Barium (Ba)	2022/01/07	107	80 - 120	101	80 - 120	<0.0020	mg/L	2.0	20		
7767702	Dissolved Beryllium (Be)	2022/01/07	114	80 - 120	96	80 - 120	<0.00040	mg/L	NC	20		
7767702	Dissolved Boron (B)	2022/01/07	104	80 - 120	91	80 - 120	<0.010	mg/L	0.039	20		
7767702	Dissolved Cadmium (Cd)	2022/01/07	105	80 - 120	100	80 - 120	<0.000090	mg/L	NC	20		
7767702	Dissolved Calcium (Ca)	2022/01/07	NC	80 - 120	101	80 - 120	<0.20	mg/L	1.0	20		
7767702	Dissolved Chromium (Cr)	2022/01/07	98	80 - 120	95	80 - 120	<0.0050	mg/L	NC	20		
7767702	Dissolved Cobalt (Co)	2022/01/07	100	80 - 120	99	80 - 120	<0.00050	mg/L	1.1	20		
7767702	Dissolved Copper (Cu)	2022/01/07	106	80 - 120	102	80 - 120	<0.00090	mg/L	1.9	20		
7767702	Dissolved Iron (Fe)	2022/01/07	104	80 - 120	101	80 - 120	<0.10	mg/L	NC	20		
7767702	Dissolved Lead (Pb)	2022/01/07	98	80 - 120	95	80 - 120	<0.00050	mg/L	NC	20		
7767702	Dissolved Magnesium (Mg)	2022/01/07	102	80 - 120	102	80 - 120	<0.050	mg/L	0.00026	20		
7767702	Dissolved Manganese (Mn)	2022/01/07	103	80 - 120	99	80 - 120	<0.0020	mg/L	4.9	20		
7767702	Dissolved Molybdenum (Mo)	2022/01/07	108	80 - 120	102	80 - 120	<0.00050	mg/L	1.4	20		
7767702	Dissolved Nickel (Ni)	2022/01/07	96	80 - 120	95	80 - 120	<0.0010	mg/L	1.2	20		
7767702	Dissolved Phosphorus (P)	2022/01/07	116	80 - 120	120	80 - 120	<0.10	mg/L	NC	20		
7767702	Dissolved Potassium (K)	2022/01/07	107	80 - 120	103	80 - 120	<0.20	mg/L	0.90	20		
7767702	Dissolved Selenium (Se)	2022/01/07	103	80 - 120	97	80 - 120	<0.0020	mg/L	NC	20		
7767702	Dissolved Silicon (Si)	2022/01/07	102	80 - 120	99	80 - 120	<0.050	mg/L	0.29	20		
7767702	Dissolved Silver (Ag)	2022/01/07	104	80 - 120	101	80 - 120	<0.000090	mg/L	NC	20		
7767702	Dissolved Sodium (Na)	2022/01/07	103	80 - 120	101	80 - 120	<0.10	mg/L	1.4	20		
7767702	Dissolved Strontium (Sr)	2022/01/07	100	80 - 120	97	80 - 120	<0.0010	mg/L	2.4	20		
7767702	Dissolved Thallium (Tl)	2022/01/07	100	80 - 120	95	80 - 120	<0.000050	mg/L	NC	20		
7767702	Dissolved Titanium (Ti)	2022/01/07	100	80 - 120	97	80 - 120	<0.0050	mg/L	NC	20		
7767702	Dissolved Uranium (U)	2022/01/07	98	80 - 120	93	80 - 120	<0.00010	mg/L	0.34	20		
7767702	Dissolved Vanadium (V)	2022/01/07	101	80 - 120	97	80 - 120	<0.00050	mg/L	4.1	20		
7767702	Dissolved Zinc (Zn)	2022/01/07	101	80 - 120	98	80 - 120	<0.0050	mg/L	2.7	20		
7799018	Dissolved Calcium (Ca)	2022/01/26	NC	80 - 120	100	80 - 120	<0.05	mg/L	1.3	25		
7799018	Dissolved Magnesium (Mg)	2022/01/26	NC	80 - 120	95	80 - 120	<0.05	mg/L	0.69	25		
7799018	Dissolved Potassium (K)	2022/01/26	96	80 - 120	98	80 - 120	<1	mg/L	1.4	25		

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7799018	Dissolved Sodium (Na)	2022/01/26	NC	80 - 120	97	80 - 120	<0.5	mg/L	0.86	25		
7799231	Turbidity	2022/01/28			93	85 - 115	<0.1	NTU	5.0	20		
7800742	Total Aluminum (Al)	2022/01/26	101	80 - 120	102	80 - 120	<0.0049	mg/L	0.11	20		
7800742	Total Antimony (Sb)	2022/01/26	103	80 - 120	100	80 - 120	<0.00050	mg/L	NC	20		
7800742	Total Arsenic (As)	2022/01/26	101	80 - 120	101	80 - 120	<0.0010	mg/L	NC	20		
7800742	Total Barium (Ba)	2022/01/26	100	80 - 120	99	80 - 120	<0.0020	mg/L	0.73	20		
7800742	Total Beryllium (Be)	2022/01/26	101	80 - 120	101	80 - 120	<0.00040	mg/L	NC	20		
7800742	Total Boron (B)	2022/01/26	99	80 - 120	101	80 - 120	<0.010	mg/L	4.0	20		
7800742	Total Cadmium (Cd)	2022/01/26	102	80 - 120	100	80 - 120	<0.000090	mg/L	NC	20		
7800742	Total Calcium (Ca)	2022/01/26	NC	80 - 120	98	80 - 120	<0.20	mg/L	0.95	20		
7800742	Total Chromium (Cr)	2022/01/26	97	80 - 120	99	80 - 120	<0.0050	mg/L	NC	20		
7800742	Total Cobalt (Co)	2022/01/26	96	80 - 120	97	80 - 120	<0.00050	mg/L	NC	20		
7800742	Total Copper (Cu)	2022/01/26	99	80 - 120	97	80 - 120	<0.00090	mg/L	NC	20		
7800742	Total Iron (Fe)	2022/01/26	97	80 - 120	97	80 - 120	<0.10	mg/L	NC	20		
7800742	Total Lead (Pb)	2022/01/26	94	80 - 120	95	80 - 120	<0.00050	mg/L	NC	20		
7800742	Total Magnesium (Mg)	2022/01/26	NC	80 - 120	100	80 - 120	<0.050	mg/L	1.9	20		
7800742	Total Manganese (Mn)	2022/01/26	99	80 - 120	100	80 - 120	<0.0020	mg/L	3.2	20		
7800742	Total Molybdenum (Mo)	2022/01/26	101	80 - 120	98	80 - 120	<0.00050	mg/L	4.7	20		
7800742	Total Nickel (Ni)	2022/01/26	95	80 - 120	96	80 - 120	<0.0010	mg/L	NC	20		
7800742	Total Potassium (K)	2022/01/26	101	80 - 120	100	80 - 120	<0.20	mg/L	0.24	20		
7800742	Total Selenium (Se)	2022/01/26	100	80 - 120	100	80 - 120	<0.0020	mg/L	NC	20		
7800742	Total Silicon (Si)	2022/01/26	99	80 - 120	98	80 - 120	<0.050	mg/L	1.9	20		
7800742	Total Silver (Ag)	2022/01/26	99	80 - 120	98	80 - 120	<0.000090	mg/L	NC	20		
7800742	Total Sodium (Na)	2022/01/26	98	80 - 120	100	80 - 120	<0.10	mg/L	2.0	20		
7800742	Total Strontium (Sr)	2022/01/26	95	80 - 120	98	80 - 120	<0.0010	mg/L	1.8	20		
7800742	Total Thallium (Tl)	2022/01/26	94	80 - 120	95	80 - 120	<0.000050	mg/L	NC	20		
7800742	Total Titanium (Ti)	2022/01/26	96	80 - 120	99	80 - 120	<0.0050	mg/L	NC	20		
7800742	Total Tungsten (W)	2022/01/26	98	80 - 120	98	80 - 120	<0.0010	mg/L	NC	20		
7800742	Total Uranium (U)	2022/01/26	100	80 - 120	102	80 - 120	<0.00010	mg/L	4.1	20		
7800742	Total Vanadium (V)	2022/01/26	99	80 - 120	99	80 - 120	<0.00050	mg/L	NC	20		
7800742	Total Zinc (Zn)	2022/01/26	98	80 - 120	101	80 - 120	<0.0050	mg/L	0.86	20		

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7800742	Total Zirconium (Zr)	2022/01/26	102	80 - 120	99	80 - 120	<0.0010	mg/L	NC	20		
7812398	Total Organic Carbon (TOC)	2022/02/02	97	80 - 120	96	80 - 120	<0.40	mg/L	0.025	20		
7812399	Total Phosphorus	2022/02/02	104	80 - 120	100	80 - 120	<0.004	mg/L	0.92	20	100	80 - 120

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10

Stantec Consulting Ltd
Client Project #: 160961457
Site Location: TIKAL
Sampler Initials: RD

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Anastassia Hamanov, Scientific Specialist

Brad Newman, B.Sc., C.Chem., Scientific Service Specialist

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

www.BVNA.com

6740 Campobello Road, Mississauga, Ontario L5N 2L8
Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266

CHAIN OF CUSTODY RECORD

ENV COC - 00014v2

19-Nov-21 16:23
Ronklin Gracian
C1Y2396

Invoice Information	Invoice to (requires report) ☐	Report Information (if differs from invoice)		Project Information		
Company:	Stantec Consulting	Company:		Quotation #:	C01624	
Contact Name:	Accounts Payable	Contact Name:		P.O. #/ AFE#:		
Street Address:		Street Address:		Project #:	160961457	
City:	Prov: Postal Code:	City:	Prov: Postal Code:	Site #:	Tikal	KSE ENV-414
Phone:		Phone:		Site Location:		Rush Confirmation #:
Email:	SAPinvoices@stantec.com	Email:	aaron.workentin@stantec.com	Site Location Province:		
Copies:		Copies:		Sampled By:	Ryan D	

Regulatory Criteria

REG 153: ☐ Table 1 ☐ Table 2 ☐ Table 3 ☐ Table ____ ☐ Res/Park ☐ Ind/Comm ☐ Agri/other ☐ Med/Fine ☐ Course ☐ For RSC

OTHER: ☐ CCME ☐ Reg 558* *min 3 day TAT ☐ MISA ☒ PWQO ☐ Reg 406, Table: ____ ☐ Sanitary Sewer Bylaw ☐ Storm Sewer Bylaw ☐ Municipality ☒ Other: SDWS

Include Criteria on Certificate of Analysis (check if yes): ☐

SAMPLES MUST BE KEPT COOL (<10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS

	Sample Identification	Date Sampled YY	MM	DD	Time (24hr) HH	MM	Matrix	FIELD FILTERED	FIELD PRESERVED	LAB FILTRATION REQUIRED	BTEX/F1	F2 - F4	VOCs	Reg 153 metals and Inorganics	Reg 153 ICPMS metals	Reg 153 metals (Hg, Cr VI, ICPMS metals, HWS - B)	RCAP Comp. Reg 153 PHCs, BTEX, F1-F4											# OF CONTAINERS SUBMITTED	HOLD - DO NOT ANALYZE	Comments
								1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
1	DP21-01	21	11	19	9	00	GW	X									X											4		SDWS
2	DP21-02		11	19	8	43		X									X		3									4		
3	DP21-03		11	19	8	22		X									X											4		
4	DP21-04		11	19	8	07		X									X											4		
5	SW21-01		11	18	13	00	SW										X	X										8		PWQO
6	SW21-02		11	18	14	00	SW										X	X										8		
7	FIELD DUP1		11	18	17	00	SW										X	X										8		
8																														
9																														
10																														
11																														
12																														

*UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS AND CONDITIONS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVNA.COM/TERMS-AND-CONDITIONS OR BY CALLING THE LABORATORY LISTED ABOVE TO OBTAIN A COPY.

LAB USE ONLY	Yes	No	°C				LAB USE ONLY	Yes	No	°C				LAB USE ONLY	Yes	No	°C				Temperature reading by:
Seal present							Seal present							Seal present							
Seal intact							Seal intact							Seal intact							
Cooling media present				6	4	1	Cooling media present				1	1	1	Cooling media present				1	2	3	
				1	2	3					1	2	3								

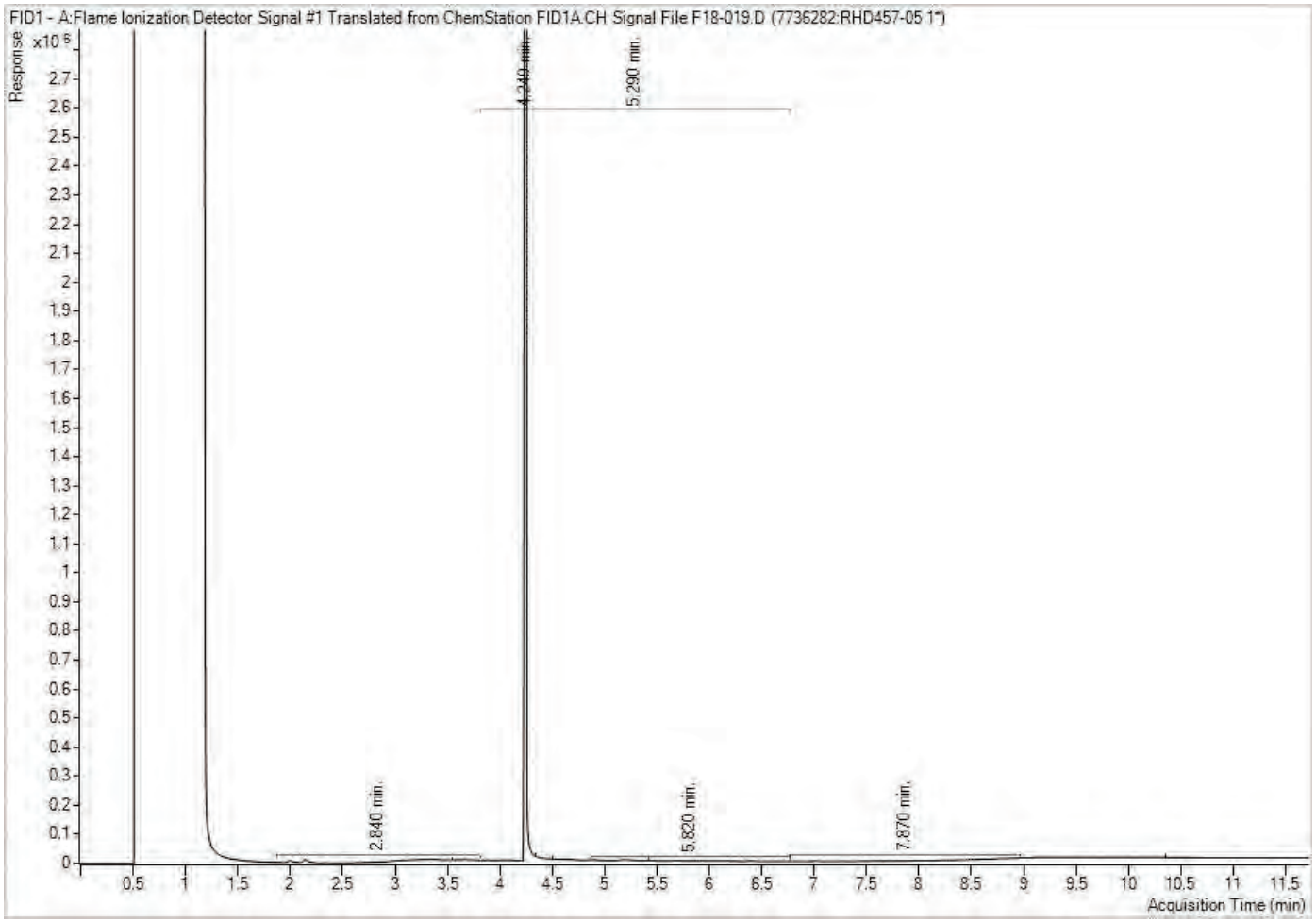
	Relinquished by: (Signature/ Print)	Date YY	MM	DD	Time HH	MM	Received by: (Signature/ Print)	Date YY	MM	DD	Time HH	MM	Special instructions
1		21	11	19	16	20	Sarah Webster	2021	11	19	16	23	
2													

Lm & DIPIKA SINGH 2021/11/19 7:49 WB# 421211

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10
Bureau Veritas Sample: RHD457

Stantec Consulting Ltd
Client Project #: 160961457
Project name: TIKAL
Client ID: SW21-01

Petroleum Hydrocarbons F2-F4 in Water Chromatogram

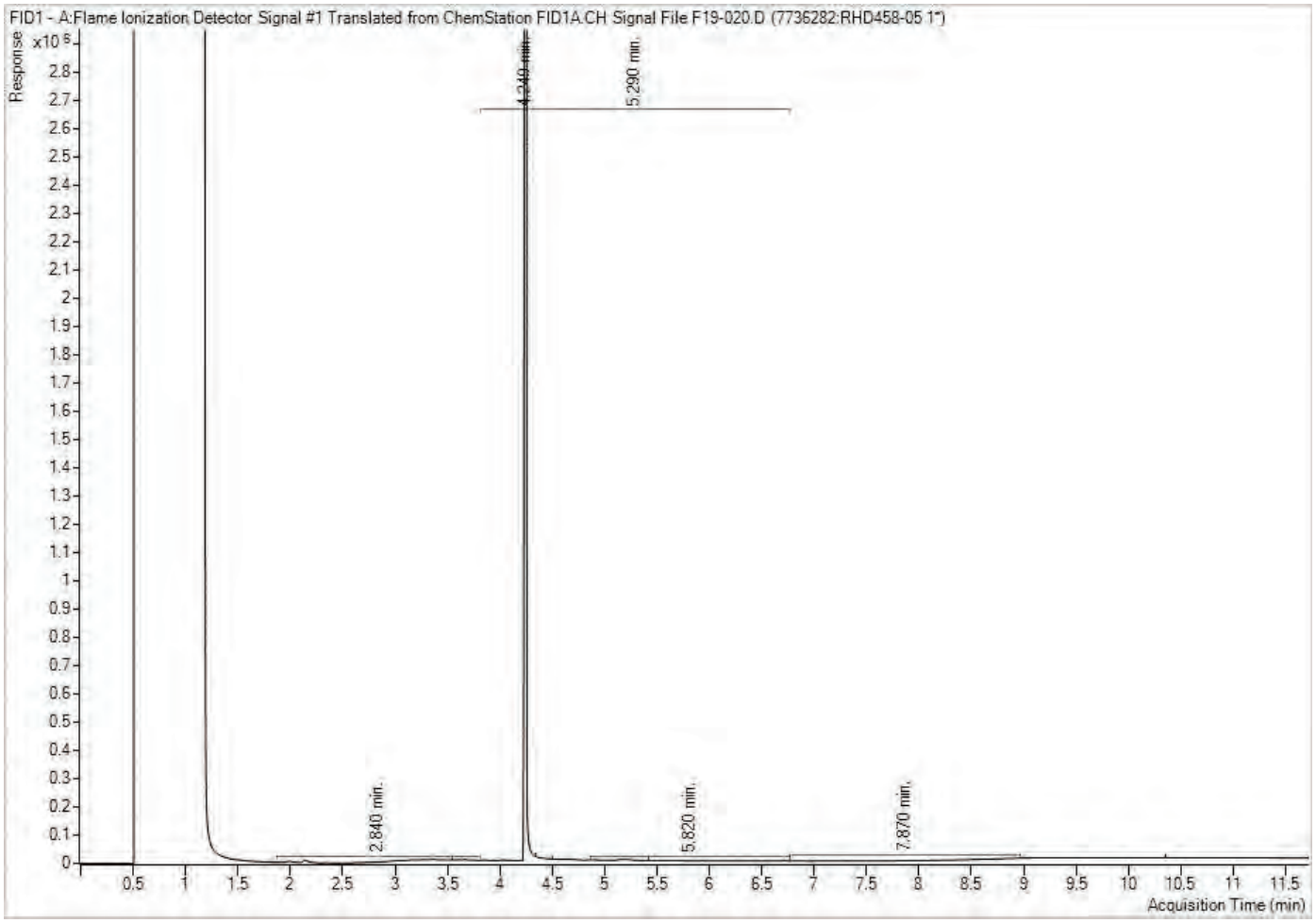


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10
Bureau Veritas Sample: RHD458

Stantec Consulting Ltd
Client Project #: 160961457
Project name: TIKAL
Client ID: SW21-02

Petroleum Hydrocarbons F2-F4 in Water Chromatogram

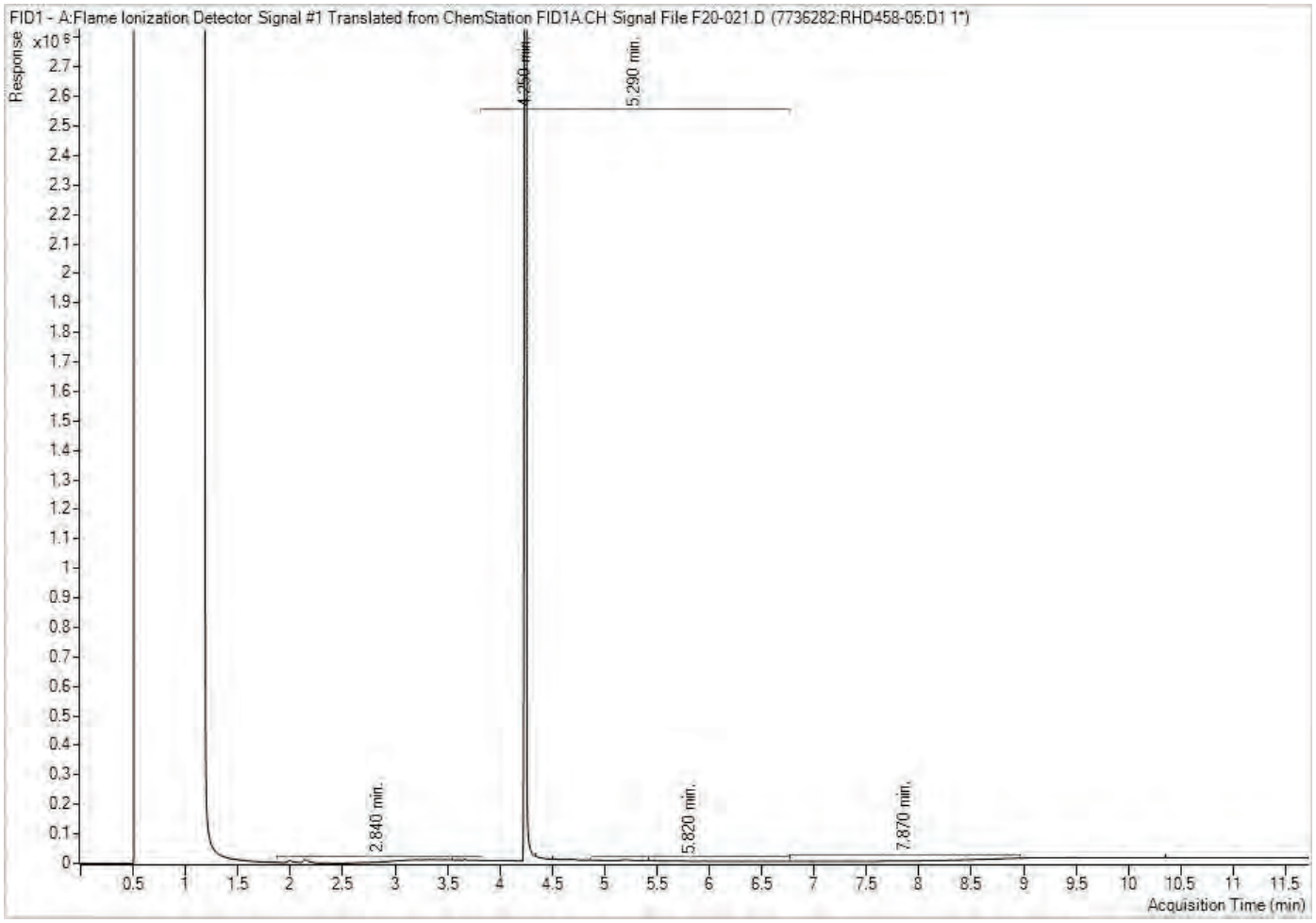


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10
Bureau Veritas Sample: RHD458 Lab-Dup

Stantec Consulting Ltd
Client Project #: 160961457
Project name: TIKAL
Client ID: SW21-02

Petroleum Hydrocarbons F2-F4 in Water Chromatogram

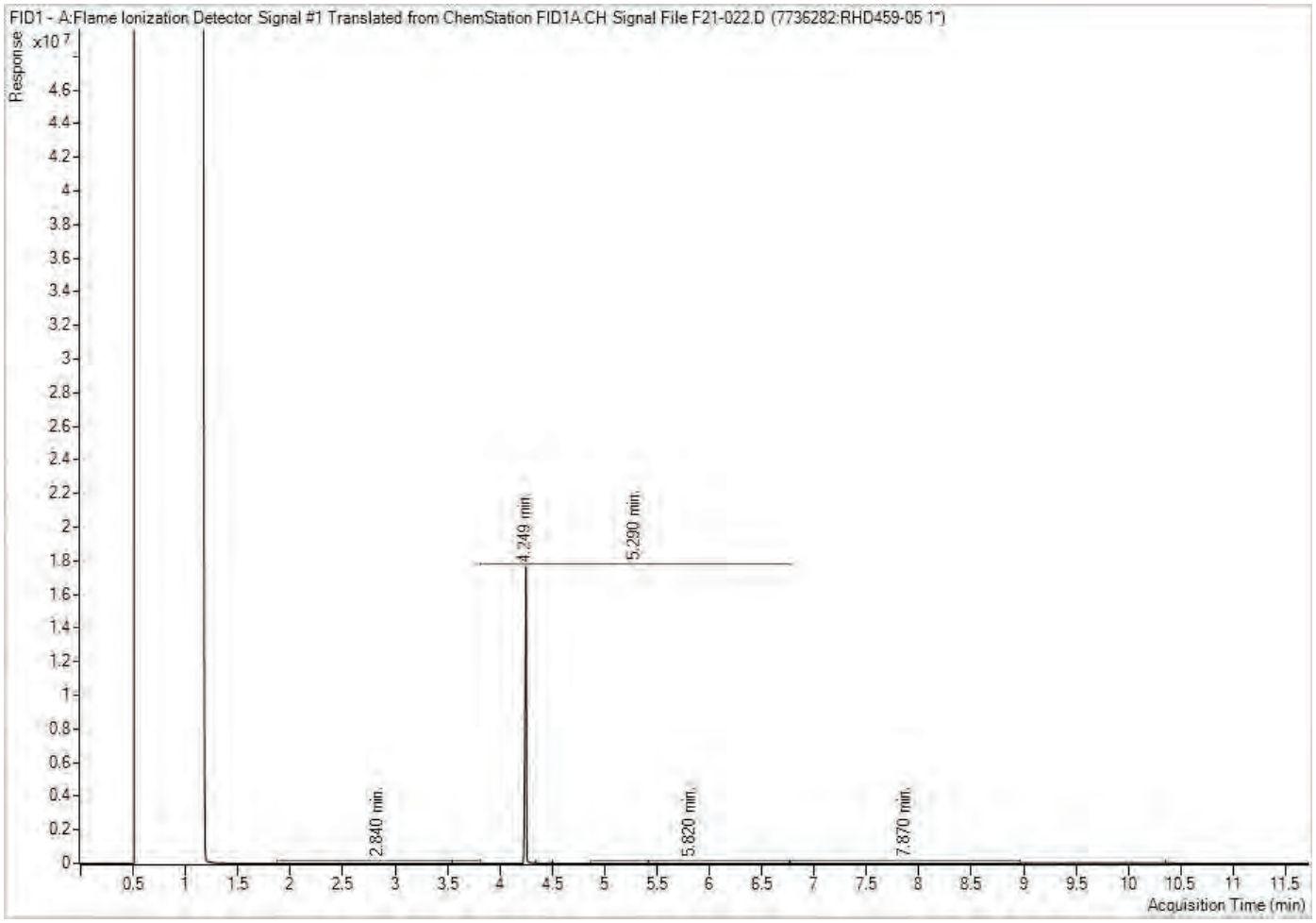


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Bureau Veritas Job #: C1Y2396
Report Date: 2022/02/10
Bureau Veritas Sample: RHD459

Stantec Consulting Ltd
Client Project #: 160961457
Project name: TIKAL
Client ID: FIELD DUP1

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Appendix F

Water Balance, Streamflow Analysis and Source Protection Mapping

TABLE F1
PRE-DEVELOPMENT MONTHLY WATER BALANCE

Monthly Water Balance Analysis - Thornthwaite and Mather model

Proposed Anthony Aggregate Pit Site, 4454 Victoria Road South, Puslinch, Ontario

Total Area Considered (ha) 8.77

Land Description Factors	Pre-Development Extraction Footprint								
Topography	0.18								
Soils	0.40								
Cover	0.20								
Sum (Infiltration Factor)	0.78								
Soil Moisture Capacity (mm)	75								
Subcatchment Area Considered (ha)	8.77								
Impervious Coefficient	0.00								
Impervious Area (ha)	0.00								0.00
Remaining Pervious Area (ha)	8.77								
Total Pervious Site Area (ha)	8.77								8.77
Percentage of Total Site Area	100%								100%

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Climate Data (Region of Waterloo International Airport Climate Station - 6144239, Ontario via Environment Canada Website - Climate Normals from 1991-2020)													
Average Daily Temperature (°C)	-6.3	-5.9	-0.8	5.9	12.6	17.8	20.2	19.1	15.2	8.8	2.6	-2.8	**7.2**
Precipitation (mm)	66	46	57	81	80	81	96	67	75	71	75	55	**851**
Evapotranspiration Analysis (Pre-Development Extraction Footprint)													
Heat Index	0.0	0.0	0.0	1.3	4.1	6.8	8.3	7.6	5.4	2.4	0.4	0.0	**36**
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	27.0	60.7	87.8	100.5	94.7	74.2	41.4	11.2	0.0	**497**
Potential Evapotranspiration Adjusting Factor for Latitude	0.81	0.92	1.06	1.18	1.27	1.29	1.22	1.11	0.98	0.86	0.76	0.74	
Adjusted Potential Evapotranspiration (mm)	0	0	0	32	77	113	123	105	73	36	9	0	**567**
PET (Malstrom, 1969) (mm/month)	0	0	0	32	77	113	123	105	73	36	9	0	**567**
Precipitation - PET (mm)	66	46	57	49	3	-33	-26	-38	3	35	66	55	**284**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-33	-59	-97	-88	-19	0	0	
Storage (S)	75	75	75	75	75	48	34	21	23	59	75	75	
Change in Storage	0	0	0	0	0	-27	-14	-14	3	35	16	0	
Actual Evapotranspiration (mm)	**0**	**0**	**0**	**32**	**77**	**107**	**111**	**81**	**73**	**36**	**9**	**0**	**524**
Recharge/Runoff Analysis													
Water Surplus (mm)	66	46	57	49	3	0	0	0	0	0	50	55	**327**
Potential Infiltration (I)	52	36	44	38	2	0	0	0	0	0	39	43	**255**
Potential Direct Surface Water Runoff (R)	**15**	**10**	**13**	**11**	**1**	**0**	**0**	**0**	**0**	**0**	**11**	**12**	**72**
Infiltration (mm)	**0**	**0**	**0**	**213**	**2**	**0**	**0**	**0**	**0**	**0**	**39**	**0**	**255**
Pervious Evapotranspiration (m^3)	0	0	0	2793	6760	9387	9698	7078	6374	3120	749	0	45959
Pervious Runoff (m^3)	1279	889	1100	952	60	0	0	0	0	0	962	1059	6302
Pervious Infiltration (m^3)	0	0	0	18720	213	0	0	0	0	0	3412	0	22345
Impervious Evapotranspiration (mm)	7	5	6	8	8	8	10	7	8	7	7	5	85
Impervious Runoff (mm)	60	41	51	73	72	72	87	60	68	64	67	49	766
Volumetric Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	0

Pre-Development Infiltration	22,345	m^3/yr	255	mm/yr	61	m^3/day

TABLE F2
POST-DEVELOPMENT MONTHLY WATER BALANCE

Monthly Water Balance Analysis - Thornthwaite and Mather model

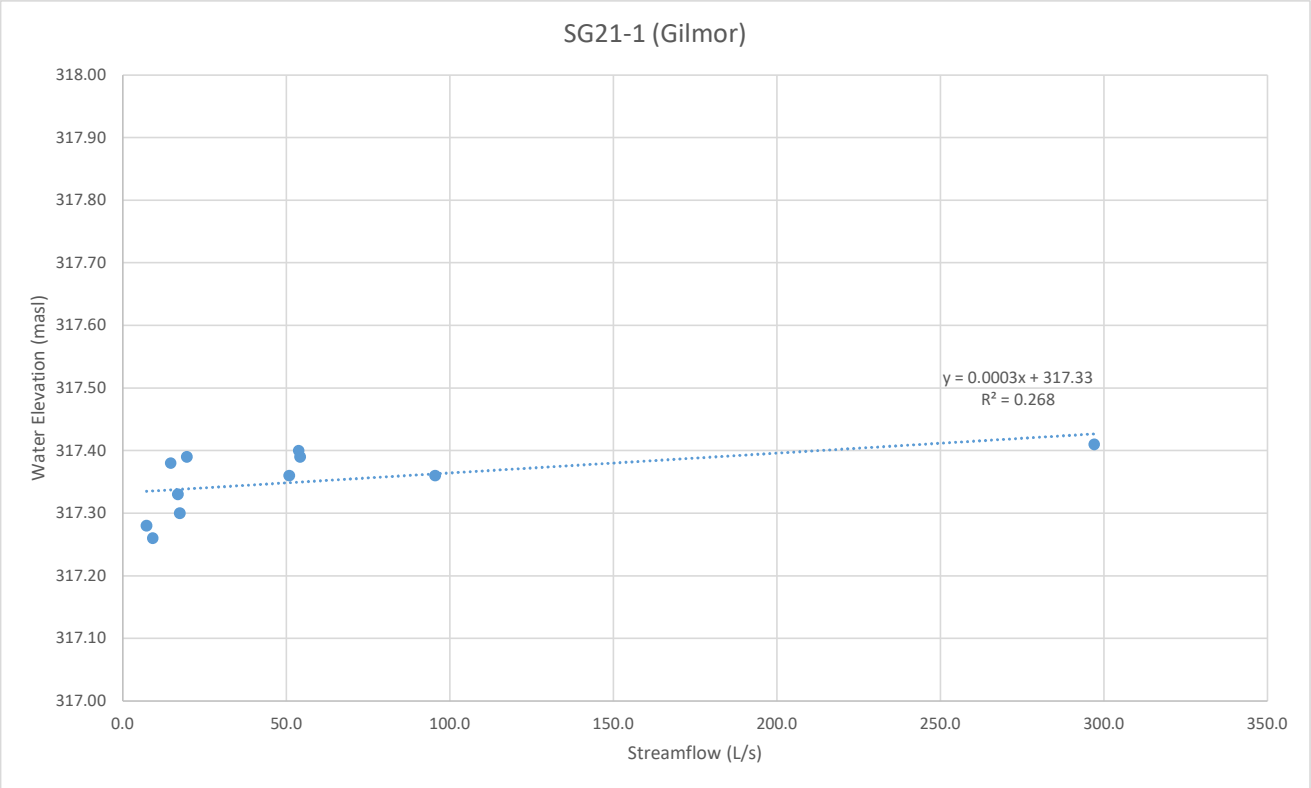
Proposed Anthony Aggregate Pit, 4454 Victoria Road South, Puslinch, Ontario

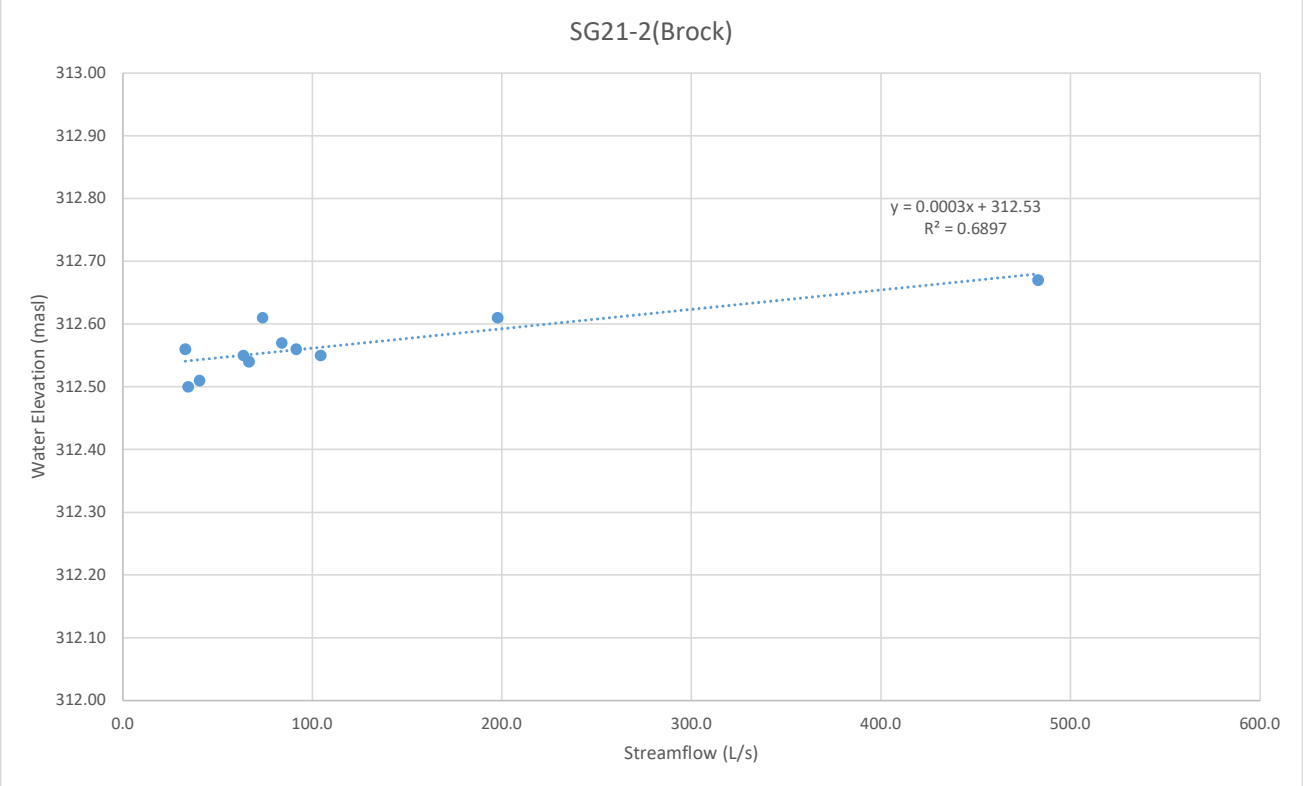
Total Site Area (ha) 8.77

Land Description Factors	Non-Ponded Areas	Ponded Areas
Topography	0.18	
Soils	0.40	
Cover	0.20	
Sum (Infiltration Factor)	0.78	
Soil Moisture Capacity (mm)	75	
Subcatchment Area (ha)	4.20	4.57
Impervious Coefficient	0.00	
Impervious Area (ha)	0.00	
Remaining Pervious Area (ha)	4.20	
Total Pervious Site Area (ha)	4.20	
Percentage of Total Site Area	48%	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Climate Data (Region of Waterloo International Airport Climate Station - 6144239, Ontario via Environment Canada Website - Climate Normals from 1991-2020)													
Average Daily Temperature (°C)	-6.3	-5.9	-0.8	5.9	12.6	17.8	20.2	19.1	15.2	8.8	2.6	-2.8	**7.2**
Precipitation (mm)	66	46	57	81	80	81	96	67	75	71	75	55	**851**
Evapotranspiration Analysis (Pre-Development Extraction Footprint)													
Heat Index	0.0	0.0	0.0	1.3	4.1	6.8	8.3	7.6	5.4	2.4	0.4	0.0	**36**
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	27.0	60.7	87.8	100.5	94.7	74.2	41.4	11.2	0.0	**497**
Potential Evapotranspiration Adjusting Factor for Latitude	0.81	0.92	1.06	1.18	1.27	1.29	1.22	1.11	0.98	0.86	0.76	0.74	
Adjusted Potential Evapotranspiration (mm)	0	0	0	32	77	113	123	105	73	36	9	0	**567**
PET (Malstrom, 1969) (mm/month)	0	0	0	32	77	113	123	105	73	36	9	0	**567**
Precipitation - PET (mm)	66	46	57	49	3	-33	-26	-38	3	35	66	55	**284**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-33	-59	-97	-88	-19	0	0	
Storage (S)	75	75	75	75	75	48	34	21	23	59	75	75	
Change in Storage	0	0	0	0	0	-27	-14	-14	3	35	16	0	
Actual Evapotranspiration (mm)	**0**	**0**	**0**	**32**	**77**	**107**	**111**	**81**	**73**	**36**	**9**	**0**	**524**
Recharge/Runoff Analysis													
Water Surplus (mm)	66	46	57	49	3	0	0	0	0	0	50	55	**327**
Potential Infiltration (I)	52	36	44	38	2	0	0	0	0	0	39	43	**255**
Potential Direct Surface Water Runoff (R)	**15**	**10**	**13**	**11**	**1**	**0**	**0**	**0**	**0**	**0**	**11**	**12**	**72**
Infiltration (mm)	**0**	**0**	**0**	**213**	**2**	**0**	**0**	**0**	**0**	**0**	**39**	**0**	**255**
Pervious Evapotranspiration (m^3)	0	0	0	1337	3237	4495	4644	3390	3053	1494	359	0	22010
Pervious Runoff (m^3)	613	426	527	456	29	0	0	0	0	0	461	507	3018
Pervious Infiltration (m^3)	0	0	0	8965	102	0	0	0	0	0	1634	0	10701
Impervious Evapotranspiration (mm)	3	2	3	4	4	4	5	4	4	4	4	3	45
Impervious Runoff (mm)	63	44	54	77	76	76	91	64	71	67	71	52	806
Volumetric Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	0

Pre-Development Infiltration	**Non-Ponded Area**	**10,701**	**m^3/yr**	**122**	**mm/yr**	**29**	**m^3/day**
	Ponded Area	**46**	**m^3/yr**	**1**	**mm/yr**	**0**	**m^3/day**
	Total	**10,747**	**m^3/yr**	**123**	**mm/yr**	**29**	**m^3/day**
Pre-Development Infiltration		**22,345**	**m^3/yr**	**255**	**mm/yr**	**61**	**m^3/day**
Infiltration Deficit		**11,598**	**m^3/yr**	**132**	**mm/yr**	**32**	**m^3/day**





Client/Project

Hydrogeological Assessment Level I and II Report
For Proposed Anthony Aggregate Pit,
4454 Victoria Road South, Puslinch, ON

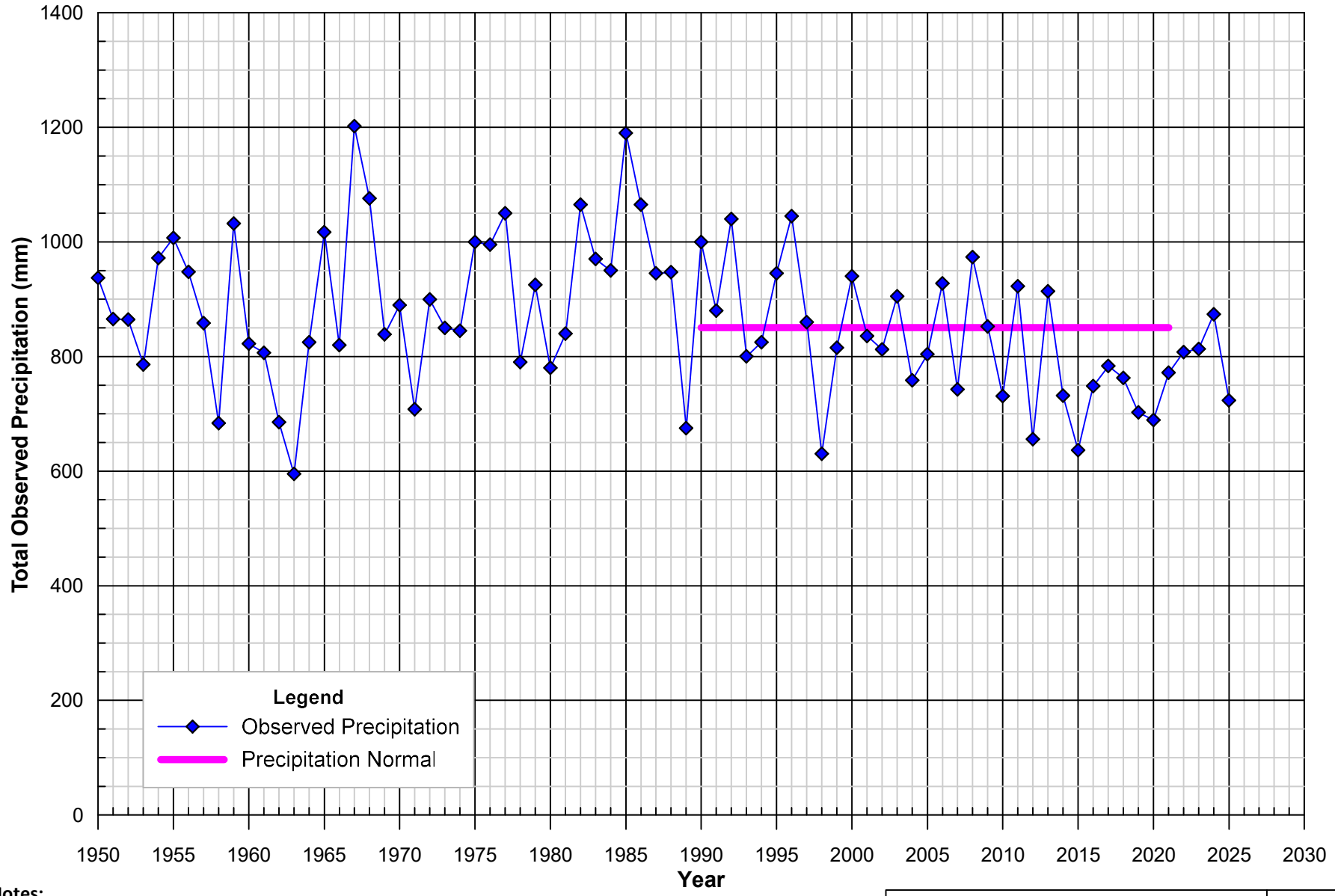
Figure No.

F1

Title

Streamflow Analysis

Stantec



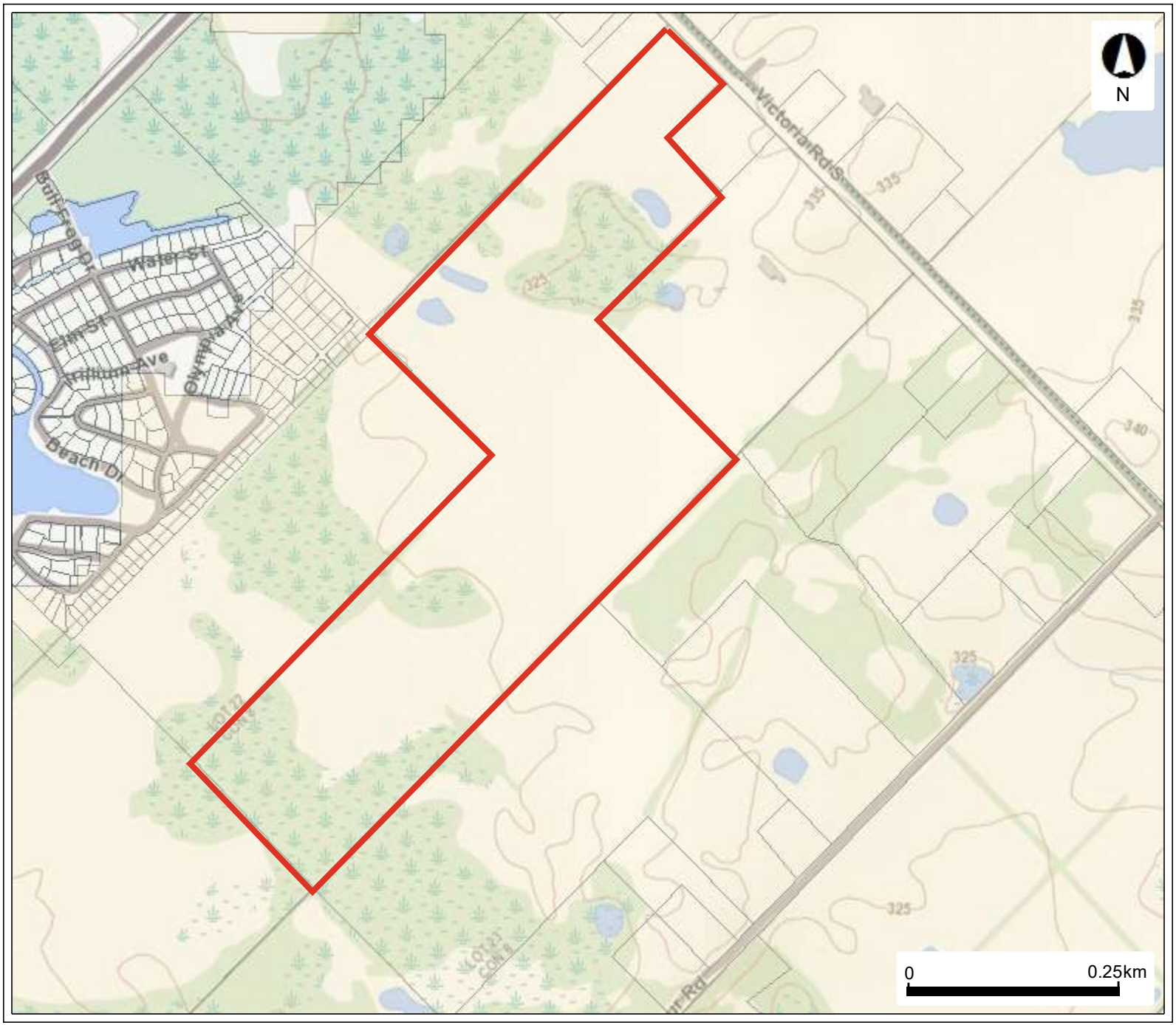
Notes:

1. Annual precipitation totals reflect the following data sources:
Shand Dam, Fergus (6142400) from 1950 to 1970, 2007 and 2022
Region of Waterloo Airport (6149387, 6149388, 6144239) from 1971 through 2026, except 2007 and 2022

2. Precipitation normal data provided by Environment Canada for Region of Waterloo Airport

Historic Precipitation Data		Stantec
DRAWN: AW	APPROVED: SMD	DATE: January 2026
PROJECT NUMBER: 160961457		FIGURE: F3

Figure F-4: Source Protection Mapping



Legend

Significant Groundwater Recharge Area
- N/A
- 0
- 2
- 4
- 6

Highly Vulnerable Aquifers

WHPA-E

Wellhead Protection Area
- A
- B
- C
- C1
- D
- F

Assessment Parcel

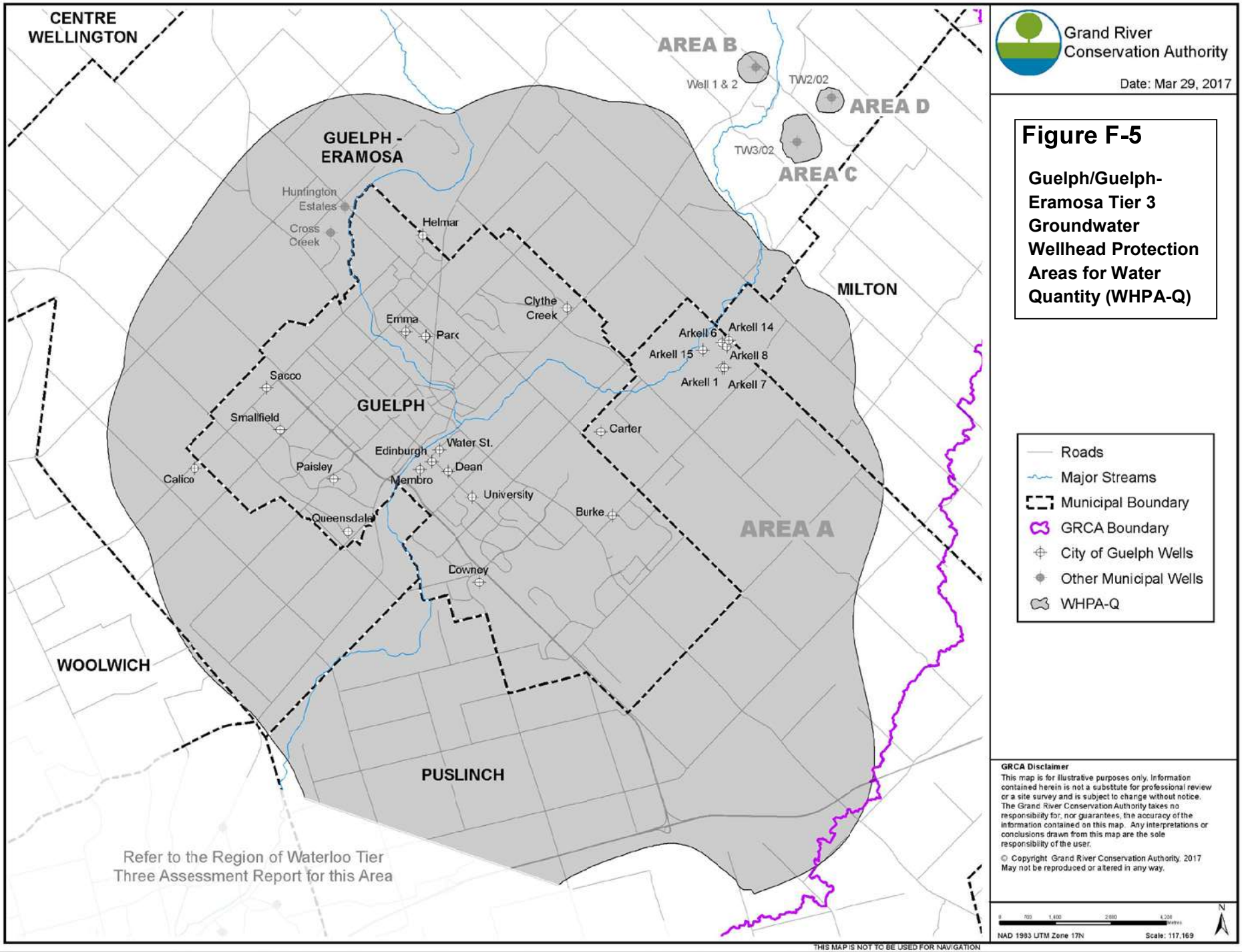
This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Environment, Conservation and Parks (MECP) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

Ontario

© King's Printer for Ontario and its licensors, 2024

May Not be Reproduced without Permission.
THIS IS NOT A PLAN OF SURVEY.

Map Created: 12/30/2024
Map Center: 43.47946 N, -80.13322 W



Grand River Conservation Authority

Date: Mar 29, 2017

Figure F-5

Guelph/Guelph-Eramosa Tier 3 Groundwater Wellhead Protection Areas for Water Quantity (WHPA-Q)

GRCA Disclaimer

This map is for illustrative purposes only. Information contained herein is not a substitute for professional review or a site survey and is subject to change without notice. The Grand River Conservation Authority takes no responsibility for, nor guarantees, the accuracy of the information contained on this map. Any interpretations or conclusions drawn from this map are the sole responsibility of the user.

© Copyright Grand River Conservation Authority, 2017
May not be reproduced or altered in any way.

NAD 1983 UTM Zone 17N

Scale: 117,169

Appendix G

Groundwater Model Memorandum

Stantec

Memo

To:	Stephen May, Lands Manager -West CBM Aggregates	From:	Rick Reinke, Stephen Di Biase Stantec
Project/File:	160961457	Date:	February 6, 2026

CBM Aggregates, a division of division of St. Mary's Cement Inc,. (CBM) retained Stantec Consulting Ltd. (Stantec) to conduct a groundwater modeling and thermal transport study for the new proposed Anthony Aggregate Pit, located in the Township of Puslinch, near Aberfoyle, Ontario. A three-dimensional numerical groundwater flow and thermal transport model has been developed to evaluate potential water table drawdown and thermal impacts of the proposed Anthony Pit. This Technical Memorandum describes the construction and calibration of the model and the results of a predictive simulation to estimate potential thermal impacts due to the interaction of groundwater and the post-closure pit ponds.

1 Model Construction

A steady-state groundwater flow model was constructed using the USGS modular groundwater flow modeling code, MODFLOW, and transient thermal transport was simulated using the MT3D solute transport code coupled to the MODFLOW flow model. The local surface water catchment was used to define the extent of the model domain (Figure 1). Three model layers were used to represent the local geology based on a conceptual model developed by Stantec (Stantec, 2026) – Layer 1 representing unconsolidated overburden, Layer 2 representing silty clay deposits, and Layer 3 representing bedrock.

1.1 Hydrogeologic Parameters

Initial conductivity values were assigned based on limited site-specific data as described in the conceptual model report (Stantec, 2022). Hydraulic conductivity in model Layer 1 was assigned based on surficial geologic zones as shown in Figure 2 and Table 1. Layer 2 and Layer 3 were assigned a single hydraulic conductivity zone per layer. These initial parameter values were varied during model calibration but kept within expected ranges. Final calibrated values are also presented in Table 1. Vertical anisotropy was assigned a ratio of Kh:Kv = 10.

The values for specific storage, specific yield, and porosity assigned to each model layer are shown in Table 2. These were estimated based on the conceptual model and literature values (Fetter, 2001).

Areal recharge representing the amount of annual precipitation that infiltrates to the groundwater table was assigned an initial value of 365 mm/year based on the site conceptual model (Stantec, 2026). Areal recharge was reduced to 296 mm/year during model calibration. Evapotranspiration (ET) was set to 490 mm/year based on literature values for the region. ET extinction depth was set to 1 meter.

Reference: Technical Memorandum - Proposed Anthony Aggregate Pit Groundwater Flow and Thermal Transport Modeling

		Initial Model Kx (m/s)	Calibrated Model Kx after PEST (m/s)
Layer1	Organic deposits	5.00E-05	1.90E-05
	Glaciofluvial deposits (Gravelly deposits)	5.00E-05	1.50E-05
	Ice-contact stratified deposits	5.00E-05	1.67E-05
	Stone-poor, carbonate-derived silty to sandy till	5.00E-05	1.10E-04
Layer2	Silty Clay	1.00E-06	1.00E-06
Layer3	Bedrock	1.00E-07	4.00E-08

Table 1. Model hydraulic conductivity.

Model Layer	Specific yield, Sy dimensionless	Specific storage, Ss 1/d	Porosity dimensionless
1	0.15	0.02	0.3
2	0.05	0.001	0.05
3	0.02	1×10^{-5}	0.02

Table 2. Model storage parameters.

Reference: Technical Memorandum - Proposed Anthony Aggregate Pit Groundwater Flow and Thermal Transport Modeling

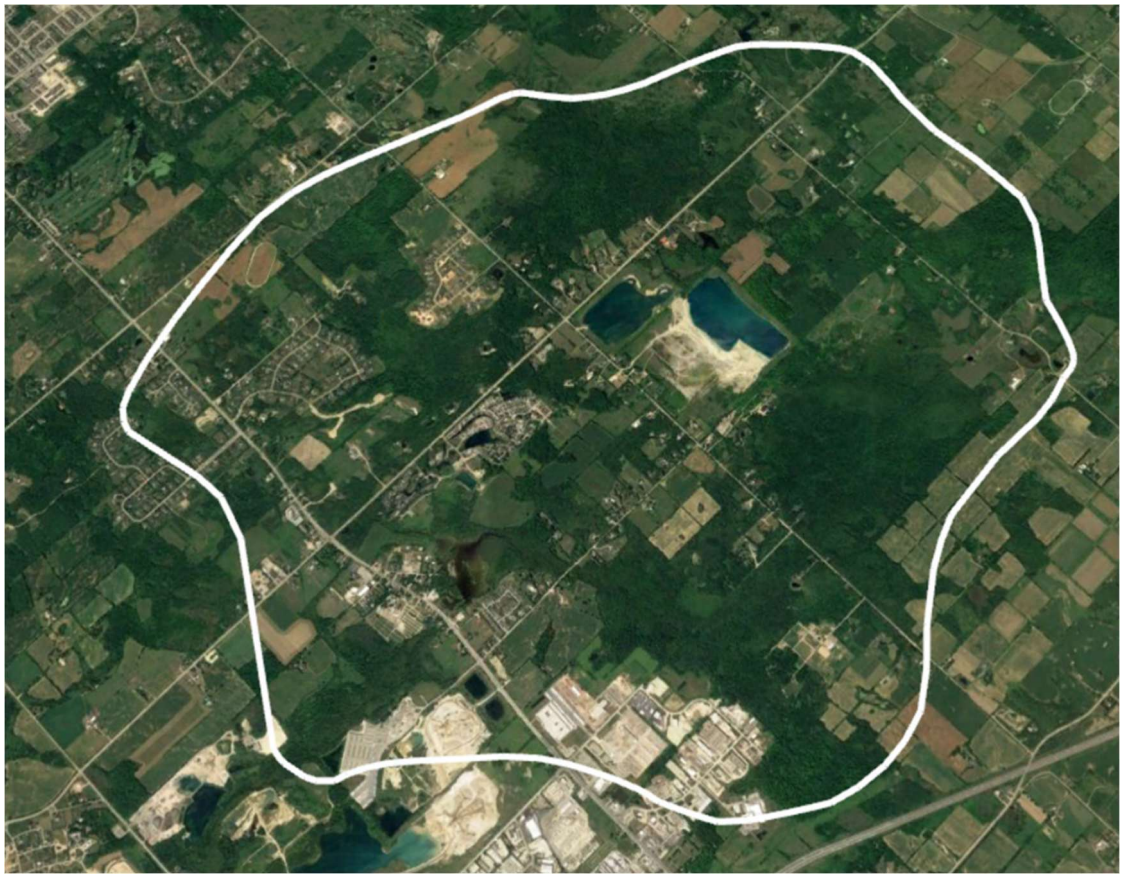
- 

Figure 1. Local catchment scale model domain.

Reference: Technical Memorandum - Proposed Anthony Aggregate Pit Groundwater Flow and Thermal Transport Modeling

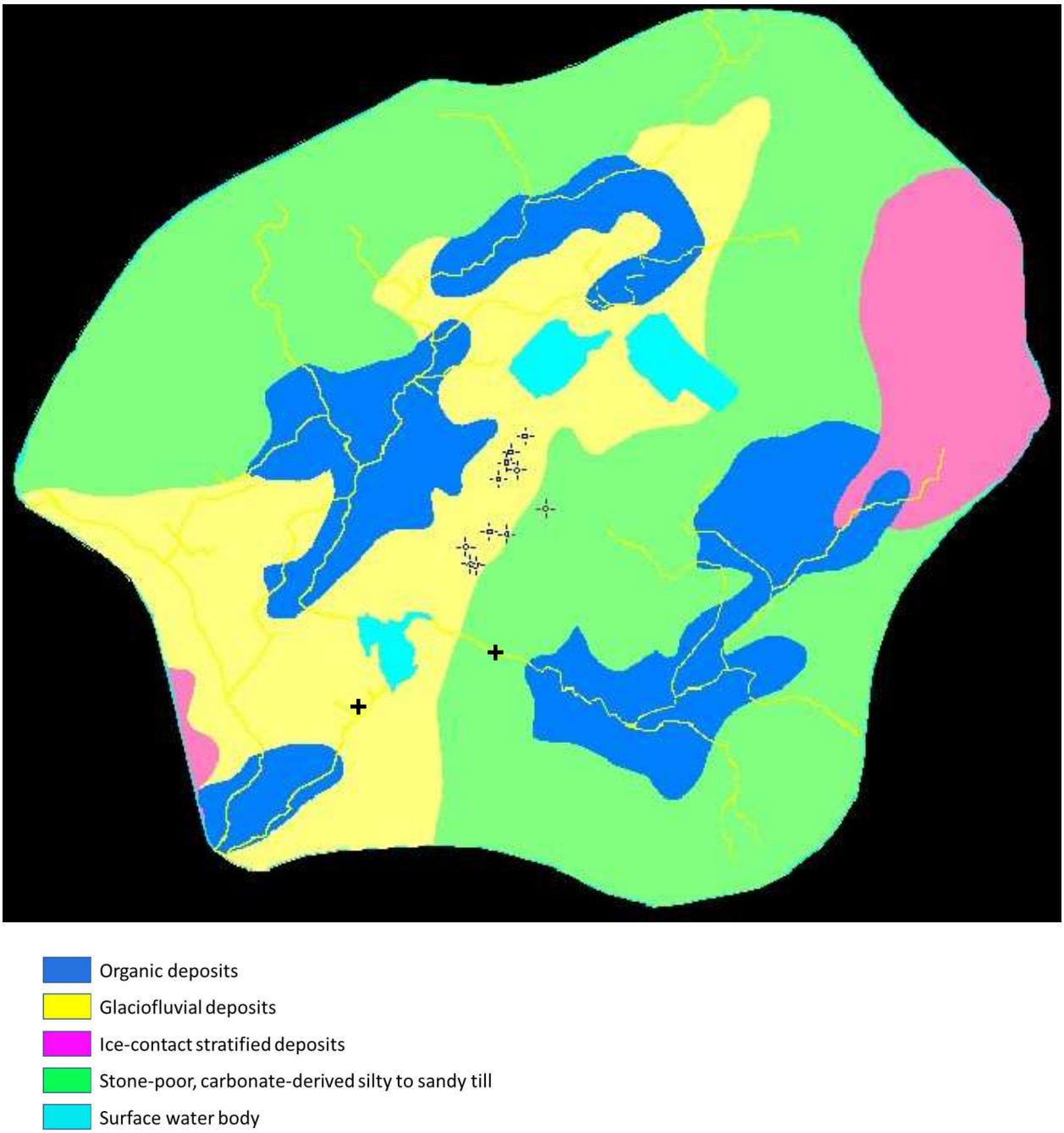


Figure 2. Overburden hydraulic conductivity zones.

1.2 Hydrogeologic Boundary Conditions

General Head Boundary (GHB) conditions were assigned to represent surface water bodies. Natural surface water bodies were assigned heads based on local topography, the proposed north pond at the Anthony Pit site was assigned a head of 321.7 meters, AMSL and the south pit was assigned a head value of 320.7 meters, AMSL.

An estimate of the regional potentiometric surface was developed based on available local and surrounding water level measurements, stream elevations, and estimated depths to water at local surface divides. The potentiometric heads where this surface intersects the model boundary were assigned to GHBs on the model boundary to simulate regional groundwater flow.

Drain boundary conditions were assigned to represent surface water stream drainages with drain elevation set to 0.5 meters below topography and drain conductance based on an assumed stream width of 1m over the length of the model cell with a streambed thickness of 1m and hydraulic conductivity of the streambed material of 100 m/d.

General Head and Drain Boundaries are shown on Figure 3.

1.3 Model Calibration

Model calibration is the process of adjusting model parameters and boundary conditions to obtain a match between field measurements and simulated values at specific calibration target locations. Hydraulic conductivity, recharge, and ET were optimized using the automated Parameter Estimation program, PEST, to obtain a best fit of the simulated water level elevations to measured values at the calibration target locations.

The flow model was calibrated to current pre-mining conditions. Water level elevations measured at eleven wells and piezometers in the area surrounding the proposed Anthony Pit were chosen as primary calibration targets. Water level elevations reported at 42 addition locations in the regional provincial groundwater database were used as secondary calibration targets. In addition, predicted model flows were compared to measured flows at two surface water monitoring stations on Aberfoyle Creek. Calibration target locations are shown on Figure 4

Final calibrated hydraulic parameters are shown in Table 1. The calibrated modeled potentiometric surface is shown on Figure 3.

Reference: Technical Memorandum - Proposed Anthony Aggregate Pit Groundwater Flow and Thermal Transport Modeling

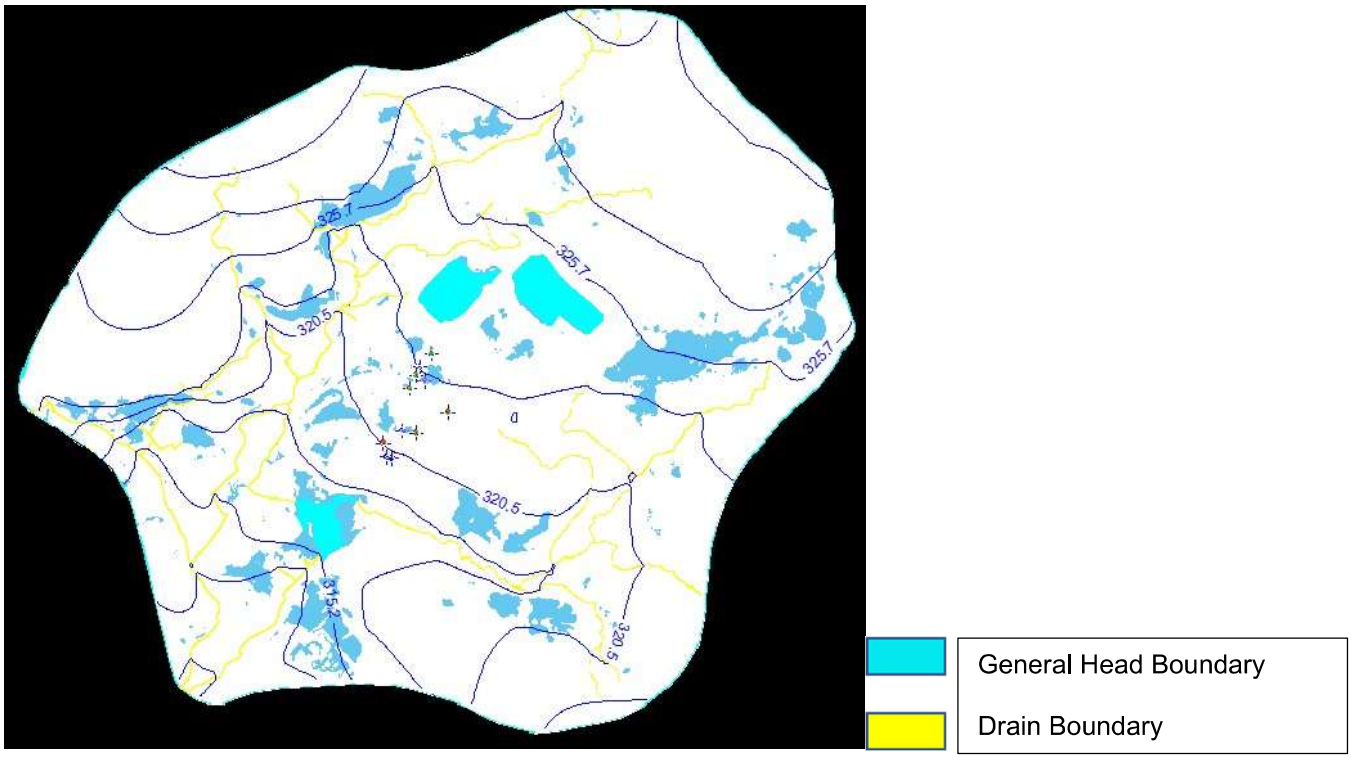


Figure 3. Simulated potentiometric surface, boundary conditions, and primary calibration target locations.

Reference: Technical Memorandum - Proposed Anthony Aggregate Pit Groundwater Flow and Thermal Transport Modeling

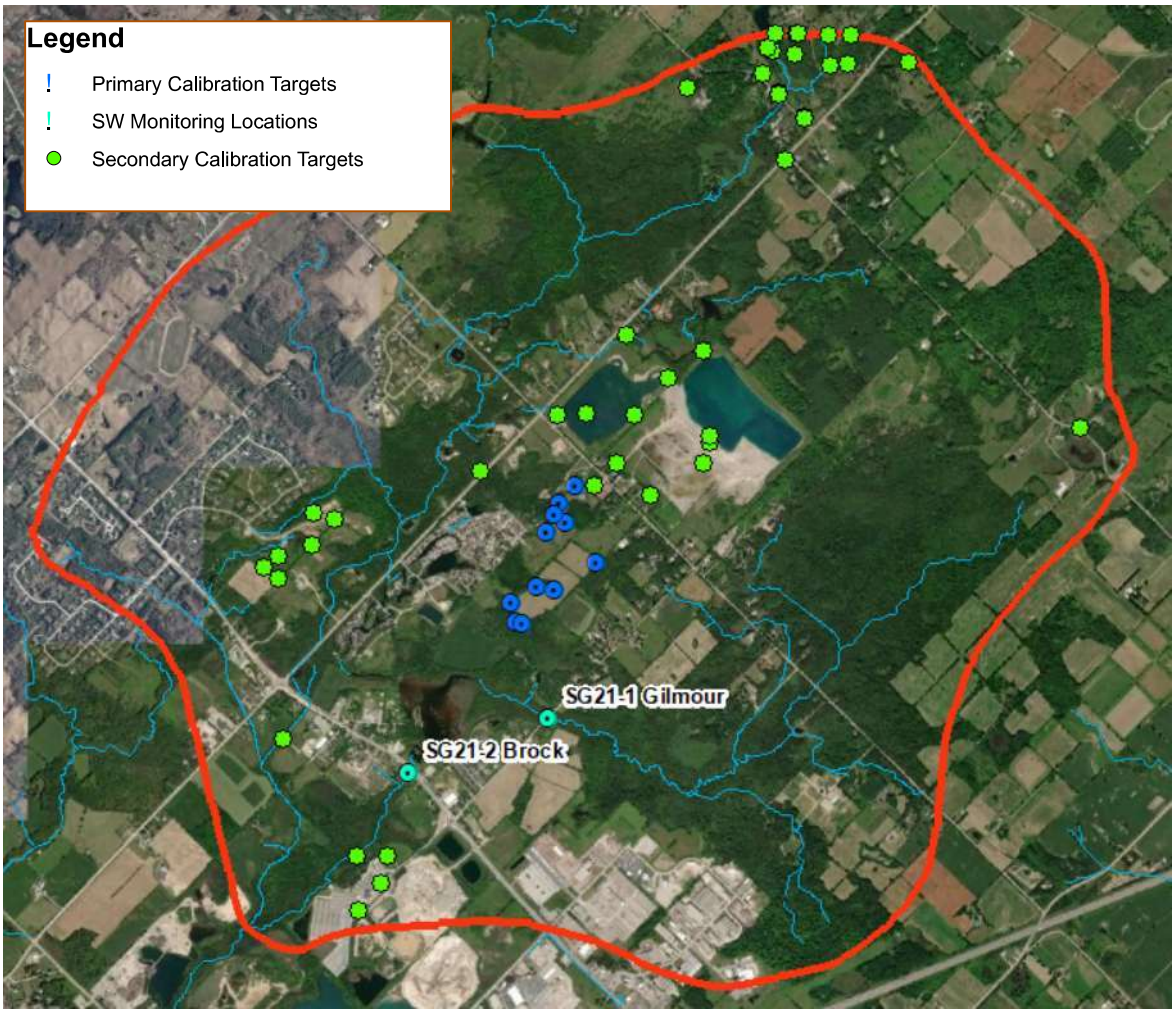


Figure 4. Primary and secondary calibration target locations.

Plots of simulated (modeled) versus observed (measured) groundwater elevations for the primary calibration targets are shown on Figure 5 and for the primary and secondary calibration targets on Figure 6. A line with a slope of 1 (i.e. simulated head = observed head) is shown for comparison. Calibration points plotting above this line, or positive residuals, indicate that modeled head is greater than the measured values at those locations, and, conversely, negative residuals where modeled head is less than the measured value plot below this line. These figures show that there is generally an even distribution of positive and negative residuals over the range of observed values indicating there is no bias toward overprediction or underprediction in the model calibration.

Statistical measures of model calibration are presented in Table 3. These measures include the standard error of the estimate and the root mean squared (RMS) error. In evaluating the fit between the observed and the simulated water levels, the RMS error is usually regarded as the best measure (Anderson and Woessner 1991). The RMS error is essentially a standard deviation calculated as the average of the squared differences between the measured and the simulated water levels. If the ratio of the RMS error to the total water level differential over the model area is small (e.g., less than 10%; Spitz and Moreno 1996), then the errors are only a small part of the overall hydraulic response of the model. In this simulation, the ratio of the RMS errors to the total water level differential (9.8% for the primary calibration targets and 6.9% for primary and secondary calibration targets) are less 10% indicating an acceptable model calibration.

Model calibration to surface water flows was assessed by comparing model simulated groundwater baseflow rates to measured values at two surface water monitoring stations, SG21-1 (Gilmor) and SG21-2 (Brock) on Aberfoyle Creek. Table 4 shows the measured flows at these stations on April 5, 2022 representing the spring runoff period and on June 1, 2022 representing a lower flow period. Model simulated flows are between the high and low measurements at these locations indicating a reasonable representation of groundwater/surface interaction.

Reference: Technical Memorandum - Proposed Anthony Aggregate Pit Groundwater Flow and Thermal Transport Modeling

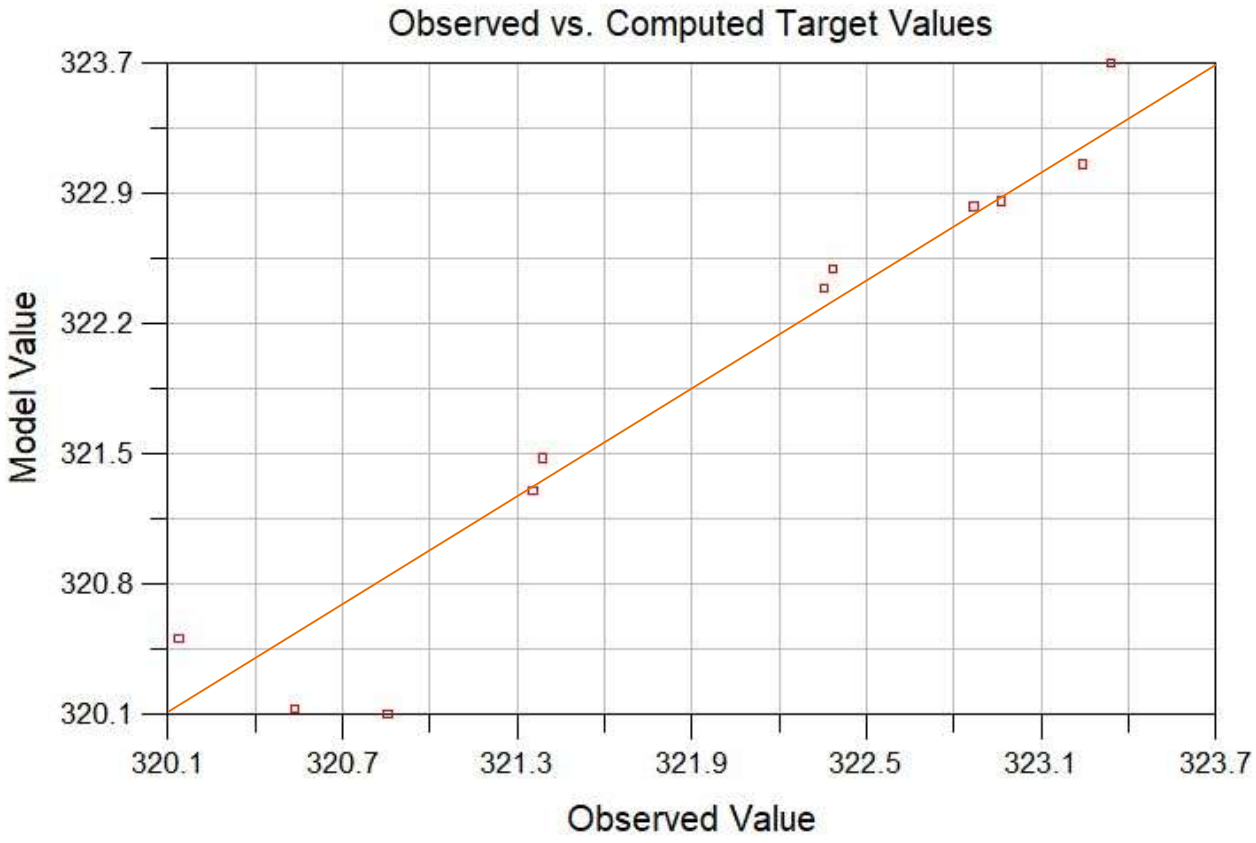


Figure 5. Modeled vs. Observed Heads – Primary Calibration Targets.

Reference: Technical Memorandum - Proposed Anthony Aggregate Pit Groundwater Flow and Thermal Transport Modeling

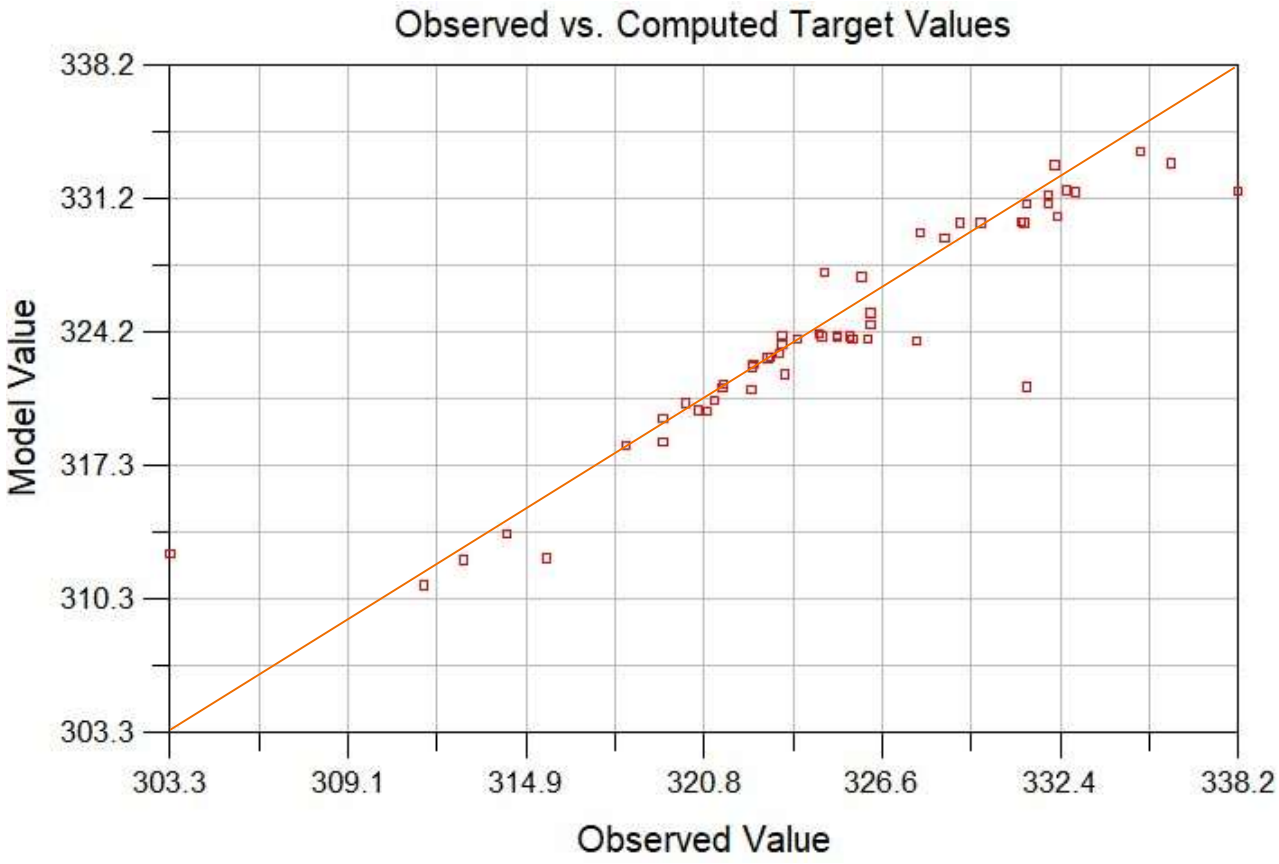


Figure 6. Modeled vs. Observed Heads – Primary and Secondary Calibration Targets.

Reference: Technical Memorandum - Proposed Anthony Aggregate Pit Groundwater Flow and Thermal Transport Modeling

Calibration Parameter	Primary Calibration Targets	Primary and Secondary Calibration Targets
Residual Mean	0.01m	0.65m
Residual Standard Deviation	0.31m	2.33m
Absolute Residual Mean	0.22m	1.39m
Residual Sum of Squares	1.05	311
RMS Error	0.31m	2.42m
Minimum Residual	-0.38m	-9.33m
Maximum Residual	0.74m	9.93m
Range of Observations	3.16m	34.90m
Scaled Residual Std. Dev.	0.098	0.067
Scaled Residual Abs. Mean	0.071	0.040
Scaled RMS Error	0.098	0.069
Number of Observations	11	53

Table 3. Model calibration statistics.

	Streamflow (L/s)											
Monitoring Station	Apr-22	Jun-22	Jul-22	Sep-22	Mar-23	Jul-23	Dec-23	May-24	Jul-24	Sep-24	Nov-24	Simulated
SG21-1 (Gilmor)	95.6	17.4	7.3	9.2	297.0	16.9	53.8	50.9	54.2	14.7	19.6	59.0
SG21-2 (Brock)	197.8	66.6	40.5	34.6	483.0	73.8	91.5	84.0	104.5	33.0	63.8	128.0

Table 4. Measure vs Simulated Streamflows.

2 Predictive Simulation – Groundwater Flow

The calibrated flow model was used to simulate how groundwater would respond to the creation of the two proposed pit ponds at the Anthony Pit site. The updated model containing the proposed pit ponds at the Anthony Pit site was created with the same boundary conditions and hydrogeologic parameters as the calibrated pre-mining steady state model with the addition of the two pit ponds. The pit ponds were simulated in the model using the MODFLOW General Head Boundary Package. The north most pit pond was assigned a specified head of 321.7 m and the southern pit pond was assigned a specific head of 320.7 m. Boundary conductance was set to 500 m/day. The newly added pit ponds can be seen represented in Figure 7.

The updated model was run in steady-state mode, and the results were compared with the results from the pre-mining steady-state model to estimate the potential drawdown in groundwater levels due to the presence of the proposed pit ponds.

Figure 8 shows simulated drawdown, or change in groundwater levels, due the addition of the proposed pit ponds at the Anthony Pit site. The estimated drawdown extents, as indicated by the 0.1 m drawdown contour in Figure 7, are approximately 360 meters to the southeast, about 0 meters to the southwest, about 150 meters to the northwest, and about 550 meters to the northeast.

Reference: Technical Memorandum - Proposed Anthony Aggregate Pit Groundwater Flow and Thermal Transport Modeling

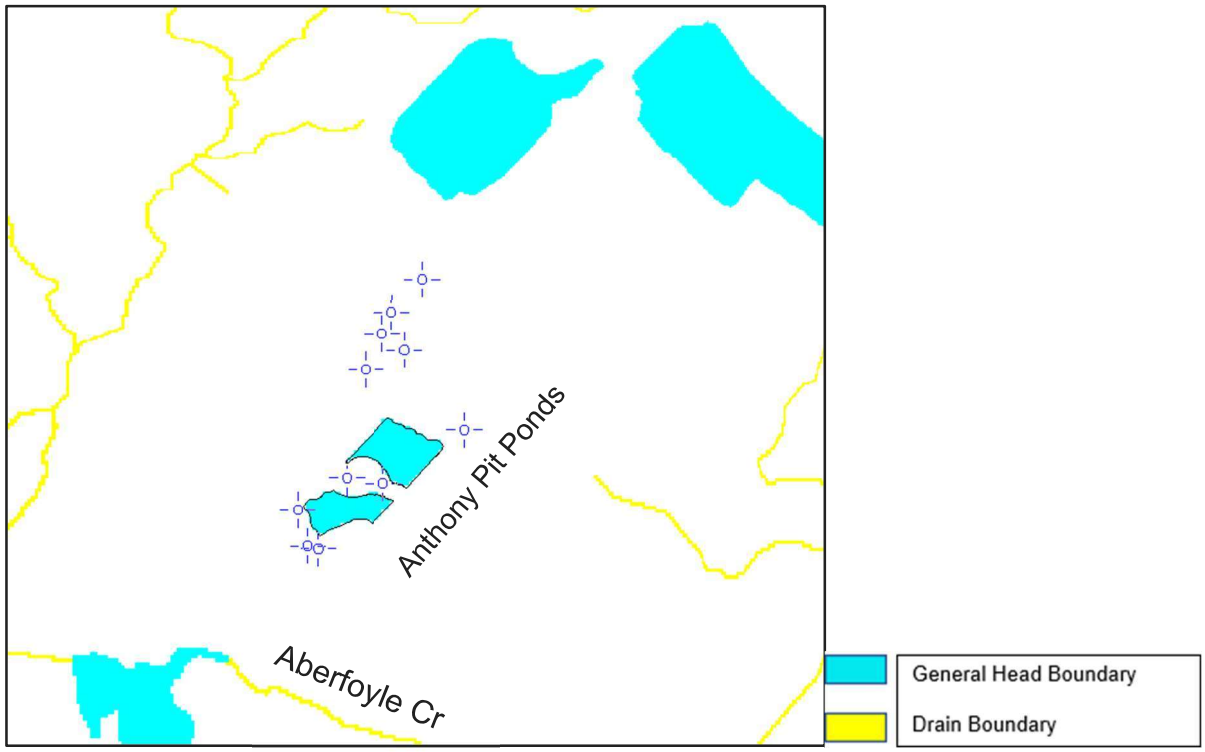


Figure 7. Boundary conditions of newly added Anthony Pit Ponds.

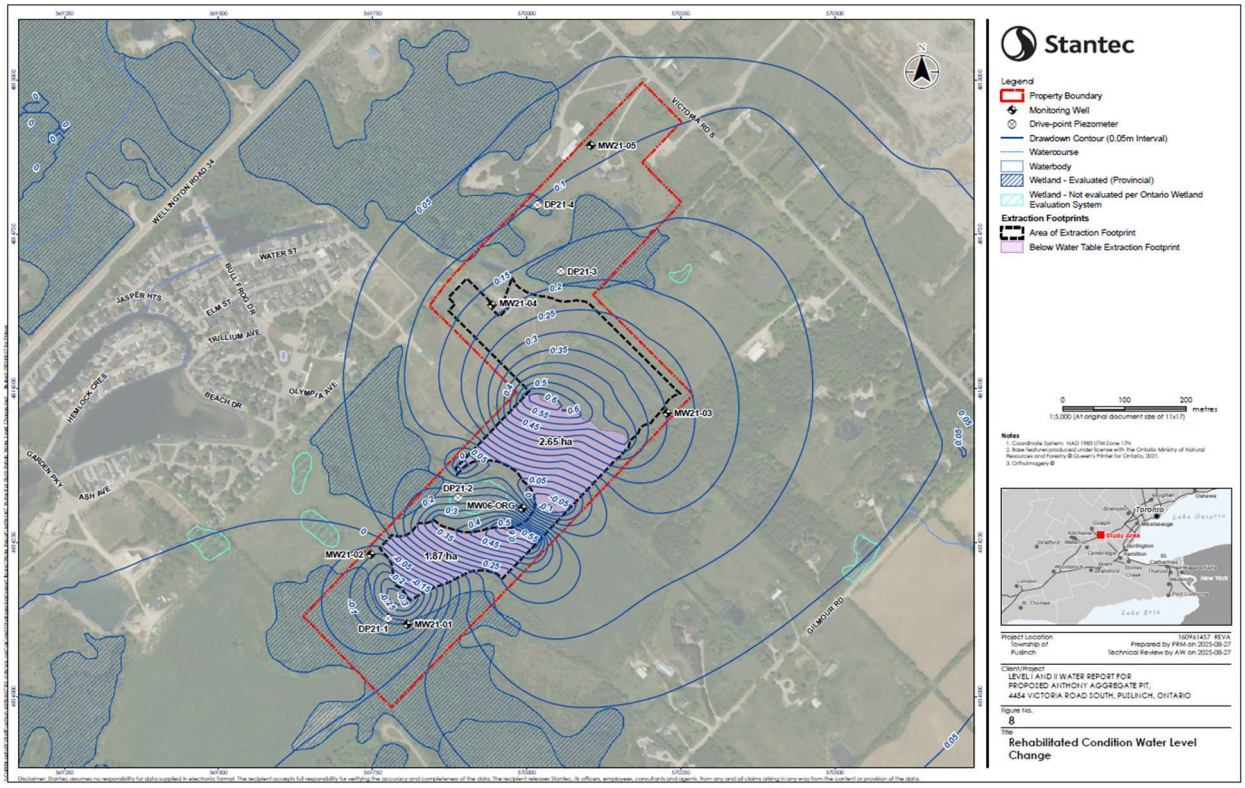


Figure 8. Simulated drawdown due to the addition of the Anthony Pit Ponds

3 Predictive Simulation - Heat Transport

The calibrated flow model was used as a basis for thermal transport predictions using the solute transport code MT3D-MS. A predictive thermal transport simulation was run with conservative assumptions to estimate potential changes in groundwater temperature due to the presence of the proposed pit ponds at the Anthony Pit site formed after mining concludes.

Heat transport in an aquifer is generally governed by heat convection along with the fluid phase, heat conduction and dispersion through the fluid and aquifer sediment, and heat exchange between the aqueous phase and the aquifer sediment. Based on the analogy between solute transport and heat transport equations, variables for the MT3D solute transport simulator can be re-interpreted for heat transport. The solute concentration is replaced by the temperature in Kelvin degrees. The distribution coefficient K_d for solute transport is replaced by the thermal distribution. The molecular diffusion in solute transport can be

represented by the thermal conduction in heat transport. This thermal conduction term is referred to as the bulk thermal diffusivity. Additional information on using solute transport simulation for heat transport modeling can be found in Hecht-Mendez, et.al. (2010) and Zheng (2010). Thermal transport parameters used in the predictive simulations are shown in Table 6.

The groundwater flow and thermal transport model was run to assess potential thermal impacts of the post extraction pit ponds. Solar radiation will warm the proposed pit ponds during the summer months leading to potential warming as groundwater flows through the warmer pit ponds and may eventually discharge to downgradient streams. The predictive model simulates a case where the pit ponds temperature is a constant 6^{O} C above ambient groundwater temperature. In actuality, the pit ponds temperature will fluctuate seasonally where the pit ponds temperature may be below ambient groundwater temperature during the winter months and only above the ambient groundwater temperature during the summer months. Therefore, these predictions should be considered conservative.

The transient thermal transport simulation was run for a period of 100 years. Figures 9 through 12 show the simulated shallow groundwater temperature above ambient after 10, 25, 50, and 100 years. As shown in the figures, warmer water from the proposed pit ponds at the Anthony Pit site moves downgradient via the transport processes of advection, thermal conduction, heat dispersion, and heat diffusion to the south toward Aberfoyle Creek. Groundwater slightly above ambient temperature begins to reach Aberfoyle Creek after about 10 years into the simulation (Figure 9).

After 25 years, the model results indicate groundwater approximately 2^{O}C above ambient groundwater temperature is discharging to Aberfoyle Creek (Figure 10). As the simulation continues, at 50 (Figure 11) and 100 (Figure 12) years the area of groundwater discharge to Aberfoyle Creek above ambient groundwater temperature apers to remain relatively constant after 25 years, and the maximum temperature discharging to Aberfoyle Creek remains approximately 2^{O}C above ambient. It should be noted that this does not represent all groundwater discharging to Aberfoyle Creek over this stream reach. Groundwater is also discharging to Aberfoyle Creek from south and from below which will in effect dilute the overall groundwater discharge temperature over this reach.

Variable	Value	Units
Overburden Porosity, n	0.3	-
Fractured Bedrock Porosity, n	0.05	-
Competent Bedrock Porosity, n	0.02	-
Thermal Distribution Factor, K_d	2.1×10^{-4}	m^3/kg
Dry Bulk Density, ρ_b	1,961	Kg/m^3
Thermal Diffusivity, D_h	0.16	m^2/d
Ambient Aquifer Temperature, T_b	281.15	K
Average Annual Temperature of Pit Ponds, T_{PL}	287.15	K
Longitudinal Dispersivity, α	0.5	m
Transverse Horizontal Dispersivity, α_T	0.5	m
Transverse Vertical Dispersivity, α_v	0.5	m

Table 6. Thermal Transport Parameters.

Reference: **Technical Memorandum - Proposed Anthony Aggregate Pit Groundwater Flow and Thermal Transport Modeling**

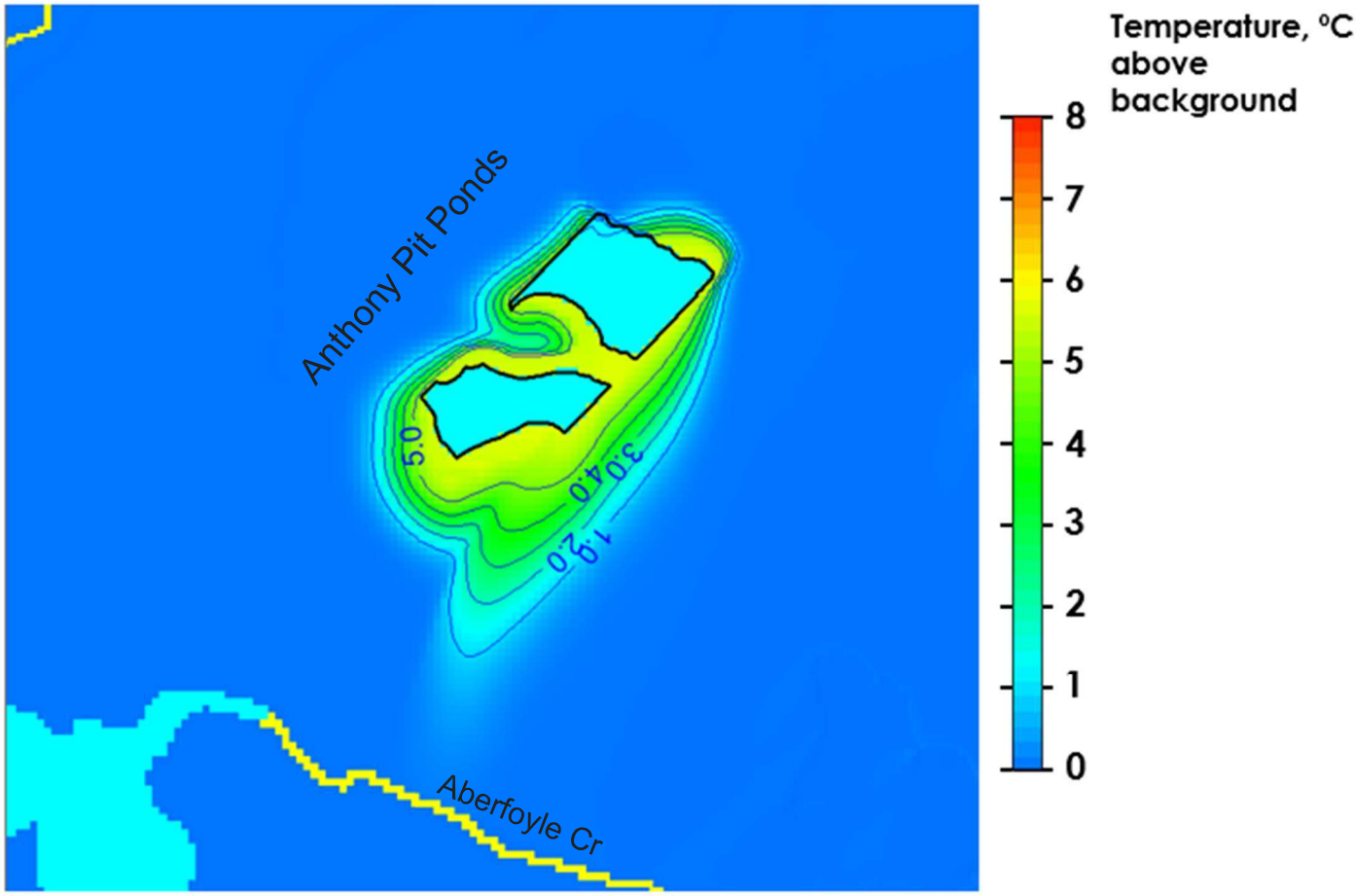


Figure 9. Predictive simulation results – groundwater temperature above ambient after 10 years (C.I. = 1°C).

Reference: Technical Memorandum - Proposed Anthony Aggregate Pit Groundwater Flow and Thermal Transport Modeling

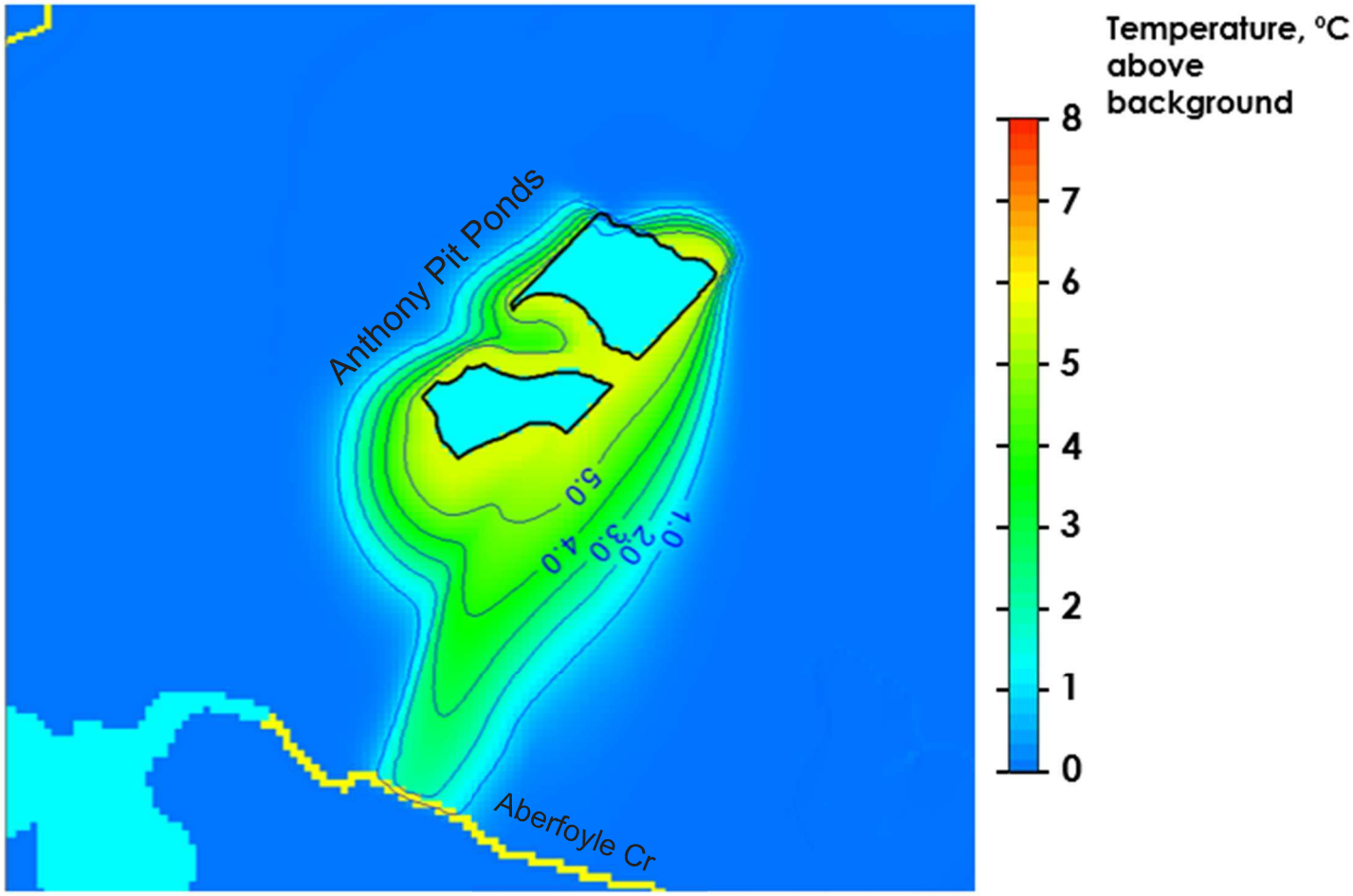


Figure 10. Predictive simulation results – groundwater temperature above ambient after 25 years (C.I. = 1°C).

Reference: **Technical Memorandum - Proposed Anthony Aggregate Pit Groundwater Flow and Thermal Transport Modeling**

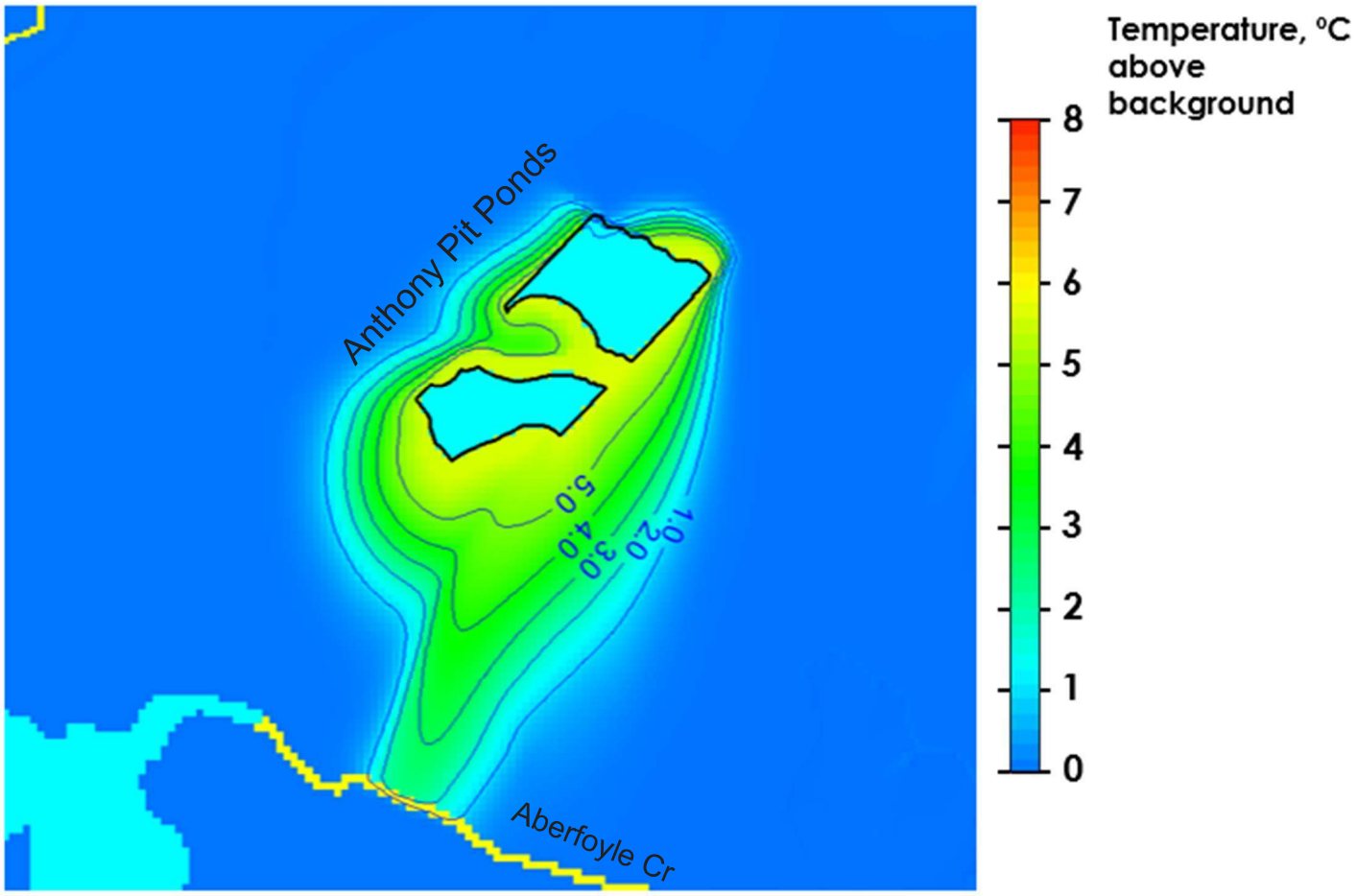


Figure 11. Predictive simulation results – groundwater temperature above ambient after 50 years (C.I. = 1°C).

Reference: **Technical Memorandum - Proposed Anthony Aggregate Pit Groundwater Flow and Thermal Transport Modeling**

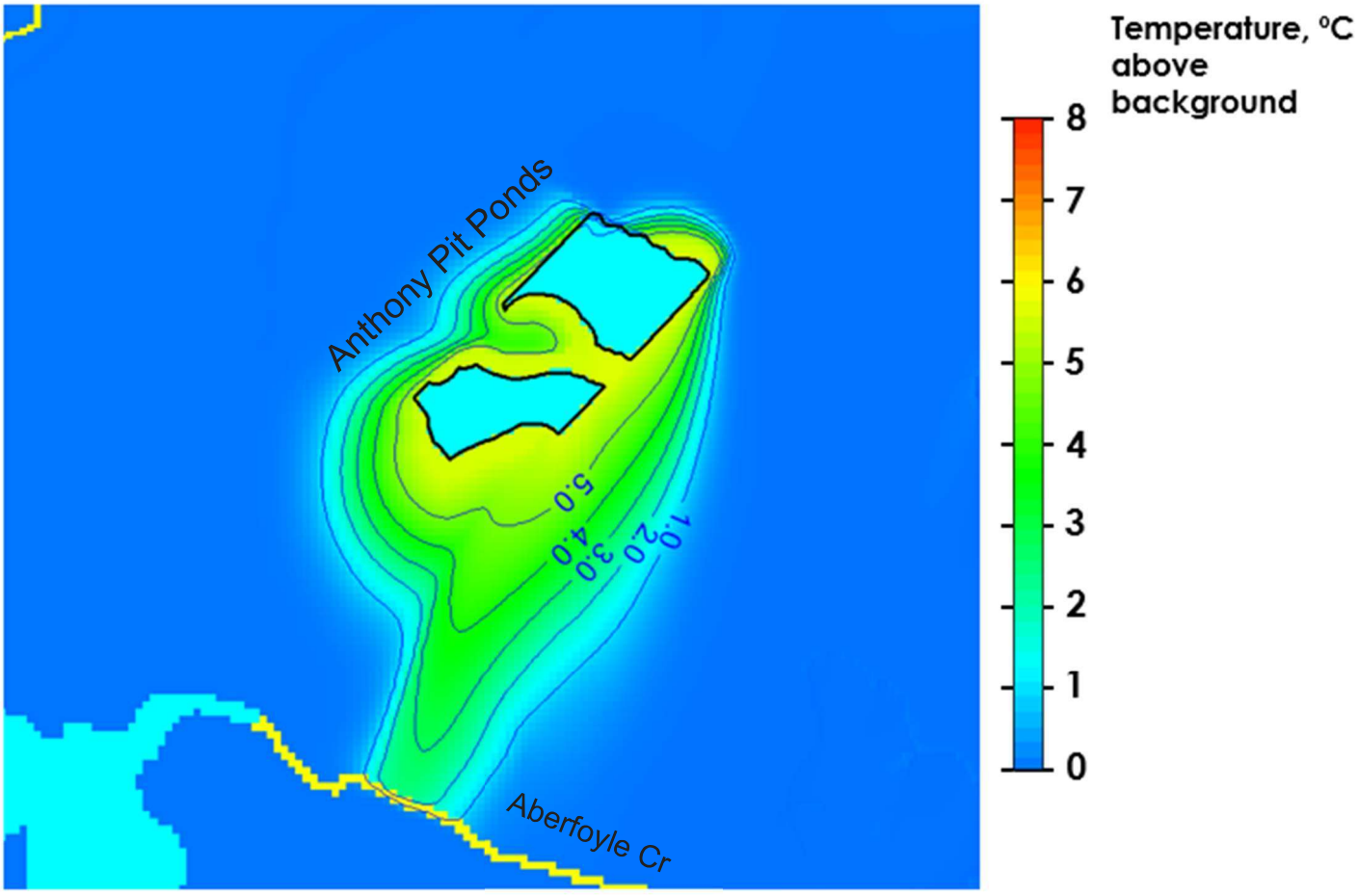


Figure 12. Predictive simulation results – groundwater temperature above ambient after 100 years (C.I. = 1°C).

4 Summary and Conclusions

A three-dimensional steady-state groundwater flow model and a transient thermal transport model were constructed to simulate and assess potential effects of drawdown and elevated groundwater temperature in the proposed pit ponds at the Anthony Pit site on local groundwater and surface water. A conservative simulation with a constant pit pond temperature of 6^{O}C above the ambient groundwater temperature was run over a 100-year duration.

The flow model was used to estimate the expected area of drawdown from the proposed pit ponds. The estimated drawdown extents, as indicated by the 0.1 m drawdown contour, are approximately 360 meters to the southeast, about 0 meters to the southwest, about 150 meters to the northwest, and about 550 meters to the northeast.

The thermal transport model indicates that groundwater with a temperature slightly above ambient begins discharging to a localized section of Aberfoyle Creek after approximately 10 years, and that the maximum temperature increase for any of groundwater discharge to Aberfoyle Creek during the 100-year simulation is approximately 2^{O}C above the ambient groundwater temperature with the majority of the groundwater discharge not having any increase above ambient groundwater temperatures.

It should be noted that this estimated temperature increase only represents the portion of groundwater discharge originating from the Anthony Pit ponds and does not represent all groundwater discharging to Aberfoyle Creek over this stream reach. Groundwater is also discharging to Aberfoyle Creek from south and from below which will in effect dilute the overall groundwater discharge temperature over this reach.

A less conservative case could be simulated by the thermal transport model with the pit pond temperature changing seasonally.

5 References

Anderson, M.P., and W.W. Woessner, 1992. Applied Groundwater Modeling – Simulation of Flow and Advective Transport. Academic Press, Inc.

Fetter, C.W., 2001. Applied Hydrogeology, Fourth Edition. Prentice-Hall, New Jersey.

Hecht-Mendez, J., N. Molina-Giraldo, P. Blum, and P. Bayer, 2010. Evaluating MT3DMS for Heat Transport Simulation of Closed Geothermal Systems, Groundwater, Vol. 8, No. 5, pp.741-756.

Stantec, 2026. Level I and Level II Water Report for Proposed Anthony Aggregate Pit 4454 Victoria Road South, Puslinch, Ontario.

Zheng, C., 2010. MT3DMS v5.3 Supplemental User's Guide, Technical Report February 2010, U.S. Army Corps of Engineers.

Reference: Technical Memorandum - Proposed Anthony Aggregate Pit Groundwater Flow and Thermal Transport Modeling

Sincerely,

STANTEC CONSULTING SERVICES INC.

Reinke, Rick
Digitally signed by Reinke, Rick
Date: 2026.02.06 08:38:10 -07'00'

Rick Reinke P.Geo., P.Geoph.
Principal Hydrogeologist
Mobile: 720-201-9754
rick.reinke@stantec.com

PROFESSIONAL GEOSCIENTIST
STEPHEN M. DI BIASE
PRACTISING MEMBER
1203
ONTARIO

Stephen Di Biase
2026.02.06 09:47:22 -05'00'

Stephen Di Biase P.Geo.
Senior Hydrogeologist
Mobile: 647-282-0563
stephen.dibiase@stantec.com

Appendix H

Project Team Curriculum Vitae

Stephen Di Biase M.Sc., P.Geo.

Senior Hydrogeologist

26 years of experience · Markham, Ontario

Stephen Di Biase is a Senior Hydrogeologist with the Environmental Services division. His 25 years of experience includes hydrogeological investigations in support of large-scale groundwater supply and dewatering projects. He brings extensive knowledge of groundwater exploration, drainage basin surveys, water balance calculations, aquifer mapping, GUDI assessments and development constraint mapping for projects located near sensitive wetlands, headwaters and kettle lake complexes in the vicinity of glacial moraines and the Niagara Escarpment.

EDUCATION

B.Sc. Earth Sciences, University of Waterloo, Waterloo, Ontario, 1999

M.Sc. Hydrogeology, University of Toronto, Toronto, Ontario, 2005

CERTIFICATIONS & TRAINING

Construction Dewatering and Groundwater Control (National Groundwater Assoc.), Waterloo, Ontario, 2005

Project Management (Golder Associates Internal Training Course), Markham, Ontario, 2005

Contracts and Liability (Golder Associates Internal Training Course), Markham, Ontario, 2004

Project Management, Queen's University School of Business, Ontario, 2001

Field Methods in Hydrogeology, University of Waterloo, Ontario, 2001

Ontario Ministry of Transportation Approved for Medium Complexity Hydrogeological Projects, Markham, Ontario, Canada, 2023

MEMBERSHIPS

Member, National Ground Water Association

Member, Ontario Ground Water Association

Canadian National Chapter, International Association of Hydrogeologists

Hydrogeologist, Professional Geoscientists Ontario

PROJECT EXPERIENCE

GROUNDWATER SUPPLY / WELLS

New Well Exploration Program | Township of Centre Wellington | Elora, ON, Canada | 2021 - | Project Manager

Construction of pilot test wells in four target areas surrounding the communities of Elora and Fergus. Field studies include bedrock coring, geophysical logging, packer testing, 7-day pumping tests, groundwater quality analysis and evaluation GUDI conditions.

Logan Well Feasibility Assessment | City of Guelph | Guelph, ON, Canada | 2021 - | Project Manager

Reconstruction and performance testing of a 306 mm diameter municipal test well. This project included management of drilling contractor, supporting permitting applications and supervision of a 3-day performance test. A feasibility study is being undertaken to determine if the Logan Well will be a viable groundwater supply source for the City of Guelph. Field study and reporting includes an assessment of GUDI conditions and effects of groundwater pumping on local environmental receptors.

Craighurst Groundwater Supply Investigation | Craighurst Partnership Limited | Craighurst, ON, Canada | 2020 - 2022 | Project Manager

Hydrogeology task manager responsible for developing a new groundwater supply source for the community of Craighurst. This project included the construction and performance testing of a new 306 mm diameter test production well at 36 L/s. Stantec's responsibilities for this study included contract tendering and administration, development of a groundwater monitoring network, securing provincial permits to take water, supervision of a 30-day performance test and a GUDI assessment of the new well.

Groundwater Supply Class Environmental Assessment | Town of Orangeville | Orangeville, Ontario, Canada | 2018 - 2022 | Project Manager

Project Manager for the Town of Orangeville Groundwater Supply Class Environmental Assessment. This project included the construction and performance testing of a new test production well along the Town's northeastern boundary. The field investigation included: installation of 1 cored bedrock borehole, downhole geophysical logging of 6 test wells, reconstruction of 3 open bedrock boreholes with multi-level monitoring well nests and a 30-day groundwater pumping test at 3,629 m3/day. The effects of groundwater pumping were monitored at a total of 34 locations, including 16 monitoring well nests, 3 surface water stations, 5 wetland piezometers and 10 private wells.

Guelph Water Supply Master Plan* | City of Guelph | Guelph, Ontario | 2013 - 2014 | Task Manager

Hydrogeology Task Manager responsible for the assessment of existing production well capacities. This project included a modelling analysis to assess the performance and effects of municipal well operation during conditions of drought and unforeseen well shut-downs.

Waterloo North Water Supply Class Environmental Assessment* | Region of Waterloo | Waterloo, Ontario | 2008 - 2010 | Task Manager

Hydrogeology task manager for the Waterloo North Water Supply Class Environmental Assessment. This project included the construction of a new test production well and performance testing of three test production wells within the Waterloo North Study Area. Golder's role in the Waterloo North Class EA includes management of the drilling and performance testing contracts, supporting the RMOW applications for access agreements, municipal sewer use permitting, MOE PTTWs, supervision of a 42-day performance test and preparation of an Environmental Study report supporting the test production wells through the EA process.

Southwest Quadrant Water Supply Class Environmental Assessment* | City of Guelph | Guelph, Ontario | 2008 - 2012 | Task Manager

Hydrogeology task manager for the City of Guelph Southwest Quadrant Water Supply Class Environmental Assessment. This project included the construction and performance testing of two new (15 inch diameter) test production wells in the City of Guelph. Performance testing of the new wells required a combined pumping rate of 134 L/s, a 3 km diversion of pumped groundwater, municipal sewer use permits, an Ontario Ministry of Environment Permit To Take Water, access agreements, an extensive groundwater and surface water monitoring program (including approximately 70 groundwater monitoring wells, 10 surface water monitoring stations and two private wells). A challenge during this complicated testing program was ensuring that performance testing of the new production wells did not adversely affect the operation of the existing municipal water supply system or impact surface water flow conditions in the receiving water courses.

Preliminary Design for Stage 2 Expansion of Aquifer Storage and Recovery (ASR) System * | Region of Waterloo | Kitchener, Ontario | 2008 - 2014 | Task Manager

Hydrogeology task manager supporting the preliminary design of the Stage 2 Expansion for the Regional of Waterloo Aquifer Storage and Recovery System. This project included the construction and performance assessment of six test wells at the Mannheim Water Treatment Plant. Groundwater modelling analysis was undertaken to develop a preliminary design plan that would optimize the performance of the expanded system.

Prospect Park Groundwater Supply Study* | Region of Halton | Acton, Ontario | 2011 - 2012 | Project Manager

Project Manager for the Region of Halton Prospect Park Groundwater Supply Study. This project included the analysis of data collected from the Prospect Park Well Field over a 5 year period to assess the potential to develop additional groundwater supply.

Baden-New Hamburg Water Supply Master Plan* | Regional Municipality of Waterloo | New Hamburg and Baden, Ontario | 2008 - 2010 | Task Manager

Hydrogeology Task Manager responsible for the assessment of existing production capacity of three well fields in proximity to the communities of Baden and New Hamburg.

Groundwater Supply Class Environmental Assessment* | Town of Shelburne | Shelburne, Ontario | 2009 - 2012 | Task Manager

Hydrogeology Task Manager responsible for the installation and performance testing of a new groundwater supply well in proximity to the Town of Shelburne. This project included negotiations with the Ontario Ministry of Environment regarding inter-basin transfer within the Great Lakes catchment area and a 72-hour groundwater pumping test. Golder completed an Environmental Study Report to satisfy a Federal Environmental Assessment process as well as a Provincial Class Environmental Assessment.

Aquafarms 93* | Ice River Springs | Feversham, Ontario | 2007 - 2009 | Project Manager

Carried out the field study and reporting requirements of a hydrogeological impact assessment for a commercial water supply operation. This project included aquifer performance testing, geophysical testing of water supply wells, monitoring of local domestic wells, and co-ordination of groundwater, surface water and ecological field studies.

Dagmar Ski Resort* | Dagmar Ski Resort | Glen Major, Ontario | 2003 - 2004 | Hydrogeologist

Evaluated the potential yield and hydrogeologic impact of two high-capacity water supply wells completed in the Oak Ridges Moraine Aquifer to support an application for a PTTW for the resort snow-making system.

DEWATERING AND PUMPING SYSTEMS

Toronto-York Spadina Subway Extension (TYSSE)* | Toronto Transit Commission | Toronto, Ontario, Canada | Hydrogeologist

Hydrogeologist for the Principal Engineering Consultant of the Toronto-York Spadina Subway Extension. This project included hydrogeology investigation and dewatering assessment at 6 proposed subway stations and 25 associated subsurface structures. Responsibilities included preparation of tender contract documents and specifications.

** denotes projects completed with other firms*

Eglinton Crosstown Light Rail Transit* | Toronto, Ontario | Hydrogeologist

Hydrogeologist responsible for preparation of dewatering assessment supporting the design of the Yonge and Allen Road Stations of the proposed Eglinton Crosstown Light Rail Transit.

Bayview Avenue Widening* | The Miller Group | Richmond Hill, Ontario | 2016 - 2018 | Project Manager

Installed forty (40) 152 mm diameter pressure relief wells to depressurize a confined aquifer and facilitate the construction of a regional sewer main.

Steeles Avenue Widening* | Fermar Paving Ltd. | Hornby, Ontario, Canada | 2016 - 2017 | Project Manager

Installed eight (8) 150 mm diameter pressure relief wells to depressurize a confined aquifer and facilitate the construction of bridge footings across water courses.

Nuclear Waste Management Organization* | Fox Construction Services | Darlington Nuclear Site , Ontario | Project Manager

Designed and installed dewatering system in support of upgrades at the Darlington Nuclear Plant

AGGREGATE SERVICES

Nelson Quarry Extension* | Nelson Aggregate Co | Burlington, ON, Canada | 2006 - 2011 | Project Hydrogeologist

Hydrogeologist responsible for the development of a field investigation to establish the potential impact of a proposed Quarry extension plan on locally significant environmental features. This field study required liaison with MOE officials, coordination of multi-disciplinary environmental investigations, procurement of testing permits and aquifer performance testing.

Lafarge Canada Inc.* | Lafarge Canada Inc. | Dundas, Ontario | 2008 - 2010 | Hydrogeologist

Hydrogeologist responsible for the development of a field investigation to establish the potential impact of a proposed Quarry extension plan on locally significant environmental features. This field study required liaison with MOE officials, coordination of multi-disciplinary environmental investigations, procurement of testing permits and aquifer performance testing.

Aaron Warkentin P. Eng.

Senior Hydrogeologist, Associate

23 years of experience · Waterloo, Ontario

Aaron is a results-oriented professional and project manager with over 20 years of consulting experience focusing on hydrogeological investigations, landfill compliance and mine/aggregate licensing monitoring and reporting, environmental impact assessment studies, hydrogeological permitting and compliance, and water resources engineering. Aaron possesses a sound understanding and is proficient in the application of hydrogeological principles and field techniques.

Aaron processes strong project management skills and has acted as project manager and/or project hydrogeologist for numerous projects involving water supply evaluations, groundwater management studies, large-scale multi-year monitoring programs, hydrogeological permitting and compliance, groundwater monitoring and hydrogeological impact investigations for construction development projects, landfill, mining and aggregate monitoring, licensing and compliance, throughout Ontario. Aaron is skilled in the analysis and interpretation of aquifer performance testing data, characterization and logging of geologic formations, evaluating groundwater-surface water interactions, developing groundwater and contaminant models, and has a working knowledge of groundwater protection legislation in Ontario.

Aaron has a strong working knowledge of the Earthsoft EQuIS data management system and portal development applications through project managing the develop of these types of custom knowledge management portal solutions. Aaron has extensive experience working on projects in support of proposed construction development and dewatering, including design and implementation of baseline and long-term groundwater monitoring program

EDUCATION

B.A.Sc., University of Waterloo Environmental (Civil) Engineering, Waterloo, Ontario, Canada, 2003

REGISTRATIONS

Professional Engineer #100144791, Professional Engineers Ontario, June 14, 2010

PROJECT EXPERIENCE

HYDROGEOLOGY

Cambridge East and Waterloo North Groundwater and Surface Water Monitoring Programs | Regional Municipality of Waterloo | Cambridge, Ontario | 2021-2023 | Project Hydrogeologist

Per the Region's Water Supply Master Plan and Class EA recommendations additional groundwater and surface water monitors were installed to be included in monitoring programs for the subject areas. Aaron acted as project hydrogeologist and assisted coordination of monitoring well construction and piezometer installations for the Region's Cambridge East and Waterloo North Groundwater and Surface Water Monitoring Program. Coordinated well geophysics and rehabilitation activities. An adaptive management plan is to be developed to document response related to future increased pumping.

Hydrogeologic Assessment, South Strasburg Trunk Sanitary Sewer | City of Kitchener | Kitchener, Ontario | 2017-2021 | Project Hydrogeologist

As part of the detailed design and construction of the South and Middle Strasburg Trunk Sanitary Sewer, Aaron acted as Project Hydrogeologist to prepare the required Hydrogeologic Assessments in support of PTTW and EASR applications for construction dewatering. The assessments detailed expected dewatering locations and volumes, discharge locations, and monitoring as required. Aaron also assisted in preparation of a wetland hydrogeological assessment as required by local conservation authority.

Eagles Nest Golf Course Irrigation Well Supply Assessment | Vaughan, Ontario | 2016-2017 | Project Manager / Project Hydrogeologist

Coordinated and completed new irrigation well installation at golf course, located within secondary buffer area of Keele Valley Landfill. Completion of a hydrogeologic investigation in support of a short term testing under a permit to take water for the irrigation well. Testing included a 72-hour pumping test and water level monitoring within adjacent monitoring wells. Coordinated and attended meetings with the Agencies (City of Toronto and MECP). Completed Permit to Take Water application for the short term pumping test.

Malahide Well Supply Assessment | IGPC | Aylmer, Ontario | 2017 | Project Hydrogeologist

Aaron acted as project hydrogeologist and assisted in a due-diligence assessment of the inactive Malahide Township well as a potential future water supply source for IGPC, Aylmer, ON. Coordinated well rehabilitation activities, and completion of a hydrogeologic investigation in support of a short term testing under a permit to take water for the Malahide Township supply well. Testing included a 24-hour pumping test and water level monitoring within adjacent monitoring wells. Aaron completed MECP permitting requirements for the project.

Greensville Backup Water Supply Project | City of Hamilton | Hamilton, Ontario | 2014 | Project Hydrogeologist

Aaron acted as project hydrogeologist in coordination and completion of production well drilling in bedrock near to the Niagara escarpment, 48-hour pumping tests, groundwater and surface water monitoring, coordination with City of Hamilton and Agencies, and hydrogeological assessment report preparation for permitting.

Fourth Line Well Field Hydrogeological Impact Assessment | Regional Municipality of Halton | Acton, Ontario | 2013-2014 | Project Hydrogeologist

The Region of Halton undertook a study to investigate the potential of expanding the taking from the Fourth Line well field by including a test well. The scope of work was to assess the impacts of increasing the daily taking from the well field above the then existing permitted rate. The environmental impact assessment included assessment of results of a comprehensive well pumping test to determine impacts to groundwater users, and an ecological review of nearby terrestrial and aquatic habitat to determine impacts to natural features. Aaron acted as project hydrogeologist and assisted in completion of the environmental impact assessment for the Region of Halton. Aaron completed background data review, analysis of pumping test data, and groundwater and surface water impact assessment report preparation.

Joe Sams Leisure Park Irrigation Supply Project | City of Hamilton | Waterdown, Ontario | 2011-2013 | Project Hydrogeologist

A water supply evaluation was completed for Joe Sam's Leisure Park within the City of Hamilton and confirmed the need for additional supply to meet sports field irrigation demands. Test drilling was completed in 2011 and an additional groundwater supply well was installed within the bedrock aquifer. Aaron acted as project hydrogeologist and assisted in a hydrogeologic investigation completed in support of a long-term permit to take water including a pumping test and water groundwater and surface water level monitoring.

Water Supply Assessment | City of Hamilton | Waterdown, Ontario | 2011-2013 | Project Hydrogeologist

In 2011, a water supply evaluation was completed for Joe Sam's Leisure Park within the City of Hamilton and confirmed the need for additional supply to meet sports field irrigation demands. Test drilling was completed in 2011 and an additional groundwater supply well was installed within the bedrock aquifer. Aaron acted as project hydrogeologist and assisted in a hydrogeologic investigation completed in support of a long-term permit to take water including a pumping test and water groundwater and surface water level monitoring.

PTTW Applications and Monitoring for Development Sites | Various, Ontario | 2012-present | Project Hydrogeologist / Permitting Coordinator

Aaron acted as Project Hydrogeologist and/or Permitting Coordinator to prepare groundwater permit to take water or environmental activity and sector registry permitting for water takings required as part of construction dewatering for various development projects in Ontario. Projects have included coordination of drilling and well monitoring, analysis of data to determine required permitting approach. The site conditions have ranged from industrial, commercial areas to residential areas, agricultural fields or shallow bedrock. As part of each application, an assessment of hydrogeological conditions was completed to evaluate construction dewatering requirements and evaluate potential interference concerns and mitigation measures. Water quality was reviewed, and discharge locations and a discharge plan determined. Consultation with clients and Agencies as required.

Pond Decommissioning | London, Ontario | Hydrogeologist

Assisted in preparation of MOECC Permit to Take Water reporting and application for dewatering during pond decommissioning in London, Ontario.

Fourth Line Well Field Hydrogeological Impact Assessment | Regional Municipality of Halton | Acton, Ontario | 2013-2014 | Project Hydrogeologist

The Region of Halton undertook a study to investigate the potential of expanding the taking from the Fourth Line well field by including a test well. The scope of work was to assess the impacts of increasing the daily taking from the well field above the then existing permitted rate. The environmental impact assessment included assessment of results of a comprehensive well pumping test to determine impacts to groundwater users, and an ecological review of nearby terrestrial and aquatic habitat to determine impacts to natural features. Aaron acted as project hydrogeologist and assisted in completion of the environmental impact assessment for the Region of Halton. Aaron completed background data review, analysis of pumping test data, and groundwater and surface water impact assessment report preparation.

Hespeler Waste Water Treatment Upgrades | Cambridge, Ontario | Project Hydrogeologist

Coordination of monitoring well testing for Region of Waterloo WWTP construction upgrades project, completed MOECC Permit to Take Water reporting and application.

MINING

Bissett Creek Mine Project | Northern Graphite Corporation | Ottawa, Ontario, Canada | 2018-2021 | Project Hydrogeologist

As part of the development of an open pit mine to access the graphite deposit, Aaron acted as Project Hydrogeologist to prepare the required Hydrogeologic Assessments in support of the PTTW application to facilitate the dewatering of the open pit. The assessments characterized groundwater flow and quality in relation to the open pit, detailed expected dewatering locations and volumes, discharge locations, assessment of potential effects of dewatering on the environment, and monitoring as required.

Greenstone Gold Mine Project | Equinox Gold Greenstone Mine | Geraldton, Ontario, Canada | 2024-Present | Project Manager

Aaron acted as project manager and assisted in coordination of work between multiple disciplines and consultants including hydrogeology, geochemistry, hydrology, terrestrial and aquatics as well as process, treatment plant, and mine engineers. Coordinated with discipline leads to complete agency monitoring and reporting requirements for the open pit mine. Groundwater Conceptual Modelling Hemlo Mine Property Expansion | Barrick Gold Corporation | Hemlo, Ontario, Canada | 2024-Present | Project Manager Aaron acted as project manager and assisted in coordination of work for a conceptual groundwater modelling for a feasibility study of the mine expansion project and intended to assist in permitting requirements.

OIL AND GAS PIPELINES

Hamilton to Milton Pipeline Project | Hamilton/Milton, Ontario | Project Hydrogeologist

Coordination of monitoring well testing and sampling for Union Gas pipeline installation near Milton, ON, attended and presented at meetings with Agencies, completed MOECC Permit to Take Water application and supporting hydrogeological assessment report preparation.

Brantford to Kirkwall Pipeline Project | Hamilton, Ontario | Project Hydrogeologist

Coordination of monitoring well drilling and sampling for Union Gas pipeline installation near Hamilton, ON, completed MOECC Permit to Take Water application and supporting hydrogeological assessment report preparation.

Thunder Bay Pipeline Project | Thunder Bay, Ontario | Project Hydrogeologist

Union Gas pipeline replacement/installation near Thunder Bay, ON, completed MOECC Permit to take Water application and supporting hydrogeological assessment report preparation.

Nanticoke Meter Station | Ancaster, Ontario | Project Hydrogeologist

Coordination of monitoring well testing for TransCanada Pipelines Limited meter station construction project, completed MOECC Environmental Activity and Sector Registry reporting and registration.

PTTW Applications and Monitoring | Various, Ontario | Hydrogeologist / Project Manager

Assisted in preparation of groundwater permit to take water applications for water takings required as part of construction dewatering and pipeline installation. The site conditions have ranged from industrial, commercial areas to residential areas, agricultural fields or shallow bedrock and have crossed creeks, rivers and lakes. As part of each application, an assessment of hydrogeological conditions was completed to evaluate construction dewatering requirements and evaluate potential interference concerns and mitigation measures. Water quality was reviewed and discharge locations considered.

Hydrogeological Report and EASR Application | Toronto, Ontario | Hydrogeologist

For Enbridge Gas Distribution (EGD) sites including Keele St. and Ashtonbee Stations, Assisted in the completion of hydrogeological assessments and Permit To Take Water application / Environmental Activity and Sector Registry (EASR) registration in support of construction dewatering. The hydrogeological review detailed available site conditions, proposed construction activity, dewatering estimates and discharge options. Potential interference concerns were evaluated and mitigation measures recommended.

Trans Mountain Expansion Project Knowledge Management Portal | Trans Mountain Corporation | Calgary, Alberta, Canada | 2021-Present | Project Manager

To facilitate data transfer, storage, and assessment Stantec assisted Trans Mountain in development of a knowledge management portal for the project. Aaron acted as project manager for the knowledge management portal development, coordinating with the various stakeholders, including 3rd party consultants and Stantec personnel. Aaron oversees and coordinates the development of the portal system and database to provide digital custom solutions for data transfer and visualization.

Rick Reinke PGeo, PGeoph

Geophysicist – Senior Water Resources Modeler

39 years of experience · Denver, Colorado

Rick has over 37 years of professional experience, with expertise in the mining industry, oil and gas operations and groundwater consulting. He currently specializes in hydrologic modeling, hydrogeologic field investigations, and well test analysis and interpretation. Rick's groundwater modeling experience includes coal bed methane (CBM) studies, coal mine and overburden dewatering, groundwater resource development, contaminant transport, unsaturated zone flow, finite element modeling, density-dependent flow and dual-domain mass transport, and integrated groundwater and surface water modeling. Rick has also managed and implemented numerous field programs, including a variety of drilling and site investigation operations, well installations, well stimulation, hydraulic testing, soil and water sampling at CERCLA and RCRA sites, geophysical investigations, coal bed methane pilot studies, water supply investigations, coal mine and overburden dewatering, and environmental site investigations.

EDUCATION

BS Applied Geophysics, Michigan Technological University, Houghton, Michigan, 1986

MS Geophysics, University of Wyoming, Laramie, Wyoming, 1991

MS Geology, Western Michigan University, Kalamazoo, Michigan, 1994

REGISTRATIONS

Professional Geophysicist, Association of Professional Engineers and Geoscientists of Alberta

Professional Geoscientist, Association of Professional Engineers and Geoscientists of Alberta

MEMBERSHIPS

Member, National Ground Water Association

PROJECT EXPERIENCE

GROUNDWATER MODELING

Aquifer Storage and Recovery (ASR) Well Program | South Florida Water Management District | Okeechobee, Florida | Groundwater Modeling Lead

With a planned total capacity of 275 MGD, the Lake Okeechobee Watershed Restoration Project ASR Program is currently one of the largest aquifer storage and recovery projects in the world. It involves the construction of 55 ASR wells—each capable of pumping 5 MGD—at eight sites throughout the Lake Okeechobee watershed. Stantec was selected to evaluate the potential for developing these sites to support the construction of ten ASR well pairs. Rick is serving as the groundwater modeling lead for local-scale ASR model of the C-38N and C-38S sites. In this capacity, he is overseeing the development of a groundwater model using the SEAWAT code to evaluate ASR injection and recovery scenarios at each site.

Springtree Wellfield Modeling | City of Sunrise | Sunrise, Florida | Groundwater Modeler

The City of Sunrise operates sixteen Biscayne Aquifer water supply wells at the Springtree wellfield. Because eight wells have low specific capacity, the City needs to add additional wells to increase the capacity and reliability of the wellfield and provide rotational capacity for the rehabilitation or replacement of some existing wells. Rick conducted a 2-D modeling assessment to assess the impact of adding wells on the City's water use allocation permit.

Lower Tamiami Groundwater Flow Model | Bonita Springs Utilities (City of Bonita Springs) | Bonita Springs, Florida

Rick provided senior review and modeling support for the City of Bonita Springs' Lower Tamiami Groundwater Flow Model. His responsibilities included responding to information requests from SFMWD.

Potash Brine Feasibility Study, Lake Mackay, Australia, Agrimin | Project Manager

Managed development of density-dependent groundwater flow and dual-domain mass transport model of Lake Mackay, Australia to evaluate brine extraction from unconfined dry lakebed sediments. Model was used to develop mine plan and estimate reserves for mine definitive feasibility study. Performed gap analysis of PFS data and supported client on hydrogeology field and lab data acquisition program to bring project to DFS level. Competent Person (CP) for the hydrogeology and reserves sections of the JORC Technical Report and DFS Report for the project.

Potash Brine Feasibility Study, Sevier Lake, Utah, Crystal Peak Minerals | Project Manager

Managed development of density-dependent groundwater flow and dual-domain mass transport model of Sevier Playa, Utah to evaluate brine extraction from playa sediments. Model was used to develop mine plan and estimate reserves for mine feasibility study. Qualified Person (QP) for the hydrogeology and reserves sections of the NI43-101 Technical Report and FS Report for the project.

Navajo Mine Extension Project, Farmington, New Mexico, BHP | Groundwater Modeler

Developed saturated-unsaturated groundwater flow and transport model using FEFLOW to assess the effects of pit drainage and re-saturation of mine backfill as well as long-term effects of mine spoils and coal combustion byproducts on groundwater quality.

Site-Wide Water Balance Hydrologic Model, Rocky Flats Environmental Technology Site, Jefferson County, Colorado, US Department of Energy | Groundwater Modeler

Groundwater modeler for Site-Wide Water Balance (SWWB) hydrologic modeling project using the MikeSHE integrated modeling code at the Rocky Flats Environmental Technology site in Jefferson County, Colorado. Responsibilities included assisting lead modeler in developing the SWWB and presenting project plans and progress to client and stakeholder groups including DOE, EPA, CDPHE, the State Engineer's office, cities, counties, and citizen groups.

3M Project, San Juan Basin, Colorado, Colorado Oil & Gas Conservation Commission | Groundwater Modeler

Developed a groundwater model of the Fruitland Formation, San Juan Basin, Colorado and New Mexico. The hydrologic model was used to define pre-CBM production pressures and groundwater flows, including discharge to streams, to test various conceptual models of internal barriers and baffles, and to provide starting conditions for a transient reservoir model. Model development integrated formation permeabilities and porosities (determined from reservoir modeling), multiple recharge assessment techniques, stable isotope chemistry (and interpreted recharge temperatures), and major-ion groundwater chemistry.

Redfield Project, Denver, Colorado, Brown Retail Group | Groundwater Modeler

Developed groundwater model to assess the performance of a hydraulic containment system at the contaminated Redfield industrial site. The model was used to optimize injection well locations and injection rates of remediation system. Developed a separate groundwater transport model for optimization of an enhanced bioremediation system.

HYDROGEOLOGY

Grosmont Well Testing Program, Wabasca, Alberta, Canada, Shell Canada | Project Manager

Managed a large scale well testing program over four winter field seasons for a major oil and gas developer in northern Alberta. Work included over fifty single well production and injection tests with straddle packers in open holes and through perforated and cased wells; multi-well interference testing; and a production test in a horizontal well.

Coal Bed Methane Pilot Studies and Discharge Water Management, Powder River Basin Coal Bed Methane Operations, Gillette, Wyoming, Devon Energy | Project Manager

Managed two CBM pilot studies in the Powder River Basin of Wyoming. Conducted well testing programs to evaluate the effects of complex geology and coal anisotropy on coal depressurization during CBM production. The pilot consisted of several multi-well aquifer tests to evaluate coal permeability, aquifer storage properties, dissolved methane content, and groundwater quality of CBM production water. Analyzed and interpreted data and reported on results. Discharge water management for CBM field in the Powder River Basin, Wyoming. Permitted various water discharge management options including discharge to surface water drainages and containment in small reservoirs. Work also included assuring client remained in compliance with various State and Federal regulations.

Naarin Sukhait and Tsagaan Tolgoi Mines, South Gobi Province, Mongolia, Ivanhoe Mines | Project Manager

Managed a field investigation and mine dewatering study for two proposed open pit coal mines in South Gobi Province, Mongolia. Oversaw drilling and well installation and conducted well testing programs for water supply investigation and dewatering evaluation at two proposed mine pit locations. Incorporated results of field investigations into numerical groundwater model to determine anticipated pit inflows and to evaluate various dewatering strategies.

Smith Ranch-Highlands Uranium Operations, Douglas, Wyoming, Cameco Resources | Project Manager

Managed well testing program, data analysis and reporting for in-situ leaching (ISL) uranium mine. Oversaw development of a groundwater flow and particle tracking model using to evaluate a restoration plan for an in-situ leaching (ISL) uranium mine in the Powder River Basin, Wyoming. Model results were submitted to regulatory agencies as part of the application for approval of the mine unit restoration plan.

Chemical Manufacturing Facilities - Environmental Investigation and Groundwater Monitoring Program, Lake Charles, Louisiana, Bayport and Channelview, Texas, ARCO Chemical Company | Project Manager

Project manager for environmental investigation and groundwater monitoring programs at various CERCLA and RCRA sites. Duties included coordinating drilling and sampling operations, report preparation, and ensuring compliance with Federal and State regulations. Provided technical oversight of monitoring well drilling and installation.

Turtle Bayou Superfund Site, Crosby, Texas, ARCO Chemical Company | Hydrogeologist

Coordinated drilling and sampling operations, prepared report, and ensured compliance with Federal and State regulations. Provided technical oversight of well drilling and installation to monitoring the effectiveness of SVE and ISB remediation systems.

Elk Mountain Project, Elk Mountain, Wyoming, Shell Unconventional Resource Evaluation | Project Manager

Hydrogeology field manager for coal to liquids pilot study and field investigation in the Carbon Basin, Wyoming. Installed and conducted aquifer tests on several baseline monitoring wells. Conducted quarterly groundwater sampling. Incorporated field data in numerical groundwater model of the project area.

Yucca Mountain Project, Nevada, Nye County Nuclear Waste Repository Project Office | Principal Investigator

Managed and implemented several hydrogeologic investigations and monitoring programs for a local stakeholder of the proposed Yucca Mountain Nuclear Waste Repository.

PUBLICATIONS & WHITEPAPERS

Co-authored with A.O'Hayre, B.Musslewhite, D.Place, Application of Saturated-Unsaturated Groundwater Flow Model to Simulate the Probable Hydrologic Consequences of Mining at the Navajo Mine Extension Project, New Mexico. *National Meeting of the American Society of Mining and Reclamation, Billings, Montana*, 2009.

Co-authored with P.Vaca, J.Klenke, M.Hausner, and L.Kryder, Distributed Temperature Perturbation Sensing (DTPS) Measurements in Valley Fill Aquifer (VFA) Wells under Pumping Conditions at Nye County EWDP Site 22, Part Two – Data analysis and Modeling. *Devil's Hole Symposium. Death Valley, California*, 2012.

Overview of Nye County Gravity Fault Well Testing Program, Amargosa Valley, Nevada. . *Devil's Hole Symposium. Death Valley, California*, 2014.

Mark Hausner, Levi Kryder, John Klenke, Richard Reinke, and Scott Tyler. Interpreting Variations in Groundwater Flows from Repeated Distributed Thermal Perturbation Tests. *Groundwater, Vol. 54, No.4*, 2016.

With every community, we redefine what's possible.

Stantec is a global leader in sustainable architecture, engineering, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.